CANOES OF OCEANIA

By

A. C. HADDON and JAMES HORNELL

VOLUME I

THE CANOES OF POLYNESIA, FIJI, AND MICRONESIA

By James Hornell

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(A Synopsis)

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VOLUME I. THE CANOES OF POLYNESIA, FIJI, AND MICRONESIA

By James Hornell

INTRODUCTION*

The basis of the present work consists of data gathered during a voyage to the Pacific during the years 1924 and 1925. For the privilege of thus becoming acquainted at first hand with the distribution and constructional details of the sea craft of indigenous type which survive in this island world, I have to acknowledge deep indebtedness to two organizations. The St. George Expedition to the South Sea is one; the Percy Sladen Trust, the other. The St. George Expedition was the means of enabling me to visit the Marquesas, the Tuamotus, and the Society Islands, while the grant generously made by the Percy Sladen Trustees permitted me to make a fairly exhaustive study of the canoes of Samoa, Tonga, and Fiji and to collect much valuable information bearing upon the history and present condition of related craft in other localities of the area.

During the investigation attention was focused in particular upon the comparative study of outrigger attachment as it differed in the various island groups together with a detailed examination of the geographical distribution and variation in design of the double canoes used for voyaging between the islands in former times. Without the transport facilities afforded by the employment of double canoes, Polynesian migration and settlement could never have attained the dimensions which they did, as evidenced by the widespread distribution of this people from Hawaii in the north to New Zealand in the south, from the outposts scattered on the fringe of Melanesia on the west to far-away Easter Island on the east.

Another subject that received special attention concerned the extent and character of the knowledge formerly possessed by the South Sea peoples of the art and practice of navigation. Their skill as deep-sea sailors has usually been greatly underestimated, particularly by the early circumnavigators whose labors might well have been more fruitful and successful had they appreciated at its full worth the comparatively extensive knowledge of the seaways of the Pacific possessed by certain of the Polynesian islanders.

Today conditions are so changed by long-continued contact with what is termed "white civilization", represented by explorers, missionaries, whalers, traders and globe-trotters, that the maritime activities of the past are represented in shadowy, vague, and uncertain outlines. An immense amount of labor became necessary before a true appreciation could be attained of the characteristics and details of the sea-going craft of the islands as they existed when Magellan, de Quiros, Schouten, Tasman, Cook, Bougainville, and the rest of the great galaxy of early Pacific navigators sailed among the archipelagoes. Every one of the stories written by or about the many South Sea voyagers of the past had to be read, sifted, and compared. Too often the descriptions are tantalizingly vague concerning the

* In conformity with Museum editorial practice, the spellings of English words have been modified to American spellings as given in Webster's New International Dictionary.—Editor.

features to which we attach the greatest importance; sometimes there are obvious errors of statement, or of interpretation. Fortunately several of the early recorders were men of keen observation upon whose accounts reliance can be placed with confidence. Of these, Cook was preëminent and it is unfortunate that the artists who accompanied him and other eighteenth century navigators seldom did justice to their opportunities. Apart from a number of outstanding exceptions the level of illustration met with in publications prior to the nineteenth century was notably low and unreliable, even when the artists accompanied the expeditions. Illustrations appear to have been worked up frequently from imperfect field sketches, eked out from memory and with little attention to technical detail. Worse still, engravings were not infrequently made in Europe by artists who had to rely largely upon their imagination when instructed to illustrate the text of the stories of returned voyagers.

Hence, in addition to the labor entailed in reading through the vast bulk of literature dealing with the Pacific in order to extract all pertinent notices of canoe construction, much time had to be spent in elucidating the real meaning of these passages and in sifting the wheat from the chaff, of which there is often an inordinate amount. Museum collections had also to be ransacked and here, too, difficulties abound for it is seldom that actual canoes are included in the exhibits; although models from certain island groups are numerous enough, few are made to scale and many omit or distort important features. Fortunately the knowledge of the details of the native craft that survive, which I gained during my travels, proved invaluable in the task of eliminating error and checking misstatements—indeed a satisfactory treatment of the subject would otherwise have been impossible.

The foremost aim of my work has been to collect, correlate, and arrange all the known and available details of canoe construction as it is or was characteristic of each island group in order that the student of racial migration may have all the help possible from this source. Such deductions as follow from this study of Pacific canoes are, of themselves, insufficient to enable us to solve distributional and dispersal problems; all other elements of human culture characteristic of the islanders must be taken into account before valid conclusions become possible. However, such limited and tentative conclusions as are within our power to deal with are given attention in the General Survey which Dr. Haddon and I contribute jointly to another section of this report (volume III).

In the body of the following account of the canoes of Polynesia, Fiji, and Micronesia, due acknowledgment is made as far as possible to those who have given generously of help and advice. I cannot, however, refrain from placing on special record my deep gratitude for the invaluable help received from all members of the staff of Bernice P. Bishop Museum—from the Director, Dr. Herbert E. Gregory, from Dr. E. S. Craighill Handy, Dr. P. H. Buck, Mr. Kenneth P. Emory, Mr. E. G. Burrows, and others, nor must I omit to express thanks to Miss E. C. Anderson for the sympathetic understanding which she brought to the task of editing the voluminous manuscript entrusted to her care. In order to obviate the great delay in publication which otherwise would be inevitable, Miss Anderson and Dr. Buck have kindly undertaken the laborious and responsible task of revising the final proofs for the press and for this I am most grateful.

The late Mr. Elsdon Best, New Zealand's foremost authority on all that pertains to Maori ethnology, took a lively interest in my investigations. The late Professor Roland B. Dixon was another most helpful friend and to him I am indebted for valuable information and photographs. Yet another friend who has

passed away and whose unique knowledge of Micronesia was placed unreservedly at my service was Dr. Paul Hambruch of the Hamburg Museum für Volkerkunde.

To Mr. D. G. Kennedy, District Commissioner in the Ellice Islands, I owe thanks for placing a fund of information concerning the canoes of that area at my disposal and for the use of an important series of drawings and photographs. Others to whom I am indebted for valuable help include Mr. H. J. Braunholtz of the Ethnological Department, British Museum; the Director of the Australian Museum; Monsieur Th. Delachaux, Neuchatel; Dr. H. D. Skinner, Otago; Mr. Lawrence W. Jenkins, Peabody Museum, Salem, Mass.; Mr. A. M. Hocart; and Mr. Kingsley Roth, District Commissioner, Fiji. In the islands everybody gave most willingly of any information they possessed. To name a few only of those who helped, I owe particular thanks to Monsieur G. LeBronnec of Atuona and the Chief of Hakaui, both in the Marquesas Islands; Ratu Popi E. Senilole of Mbau in Fiji; and the Prince Consort in Tonga.

Most helpful of all has been Dr. A. C. Haddon, F.R.S. Without his constant encouragement and advice I should never have been able to accomplish the present task. I cannot find words in which to express adequately the debt of gratitude which I owe him; he was so kind as to read through the whole of what I have written and his wise criticism has been of inestimable value on innumerable occasions.

March 21, 1936.

POLYNESIA AND FIJI

HAWAII

SOURCES OF INFORMATION

Although Hawaii may have been sighted by Juan Gaetano in the sixteenth century, no information concerning the material culture was recorded until Captain James Cook in 1778 and 1779 landed on the larger islands. Fortunately a fairly detailed description of the sea craft used by the islanders at that period is given in the journal kept by Samwell (1899)*, the surgeon of the *Discovery*. This is usefully supplemented by three sketches by Webber, the artist who accompanied Cook on his third voyage. Two of the sketches are reproduced here (figs. 1, 2). The third, a view of Kealakekua Bay in Hawaii, where Cook was murdered, shows two double canoes under sail and a fleet of single outriggers.

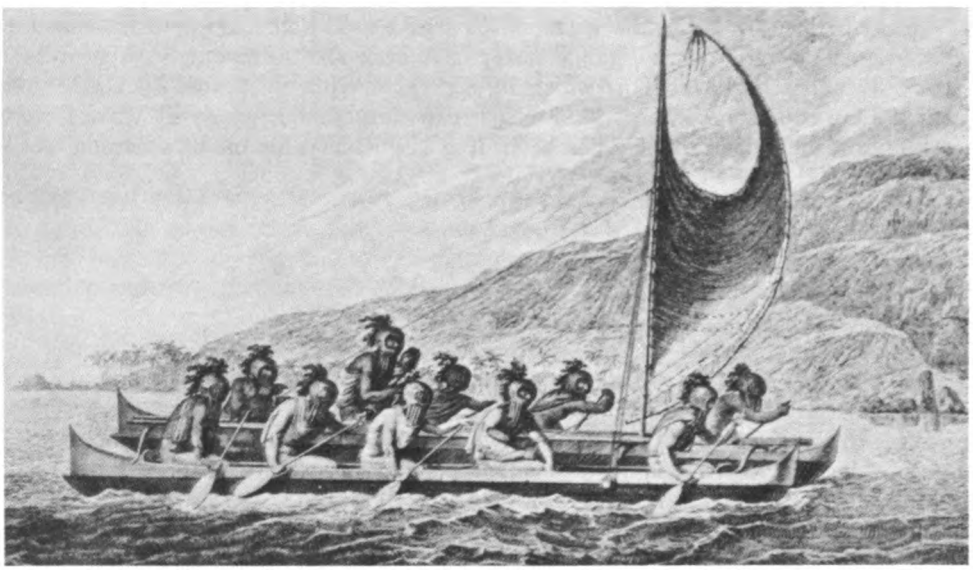


FIGURE 1.—Hawaiian double canoe (drawn in 1778 or 1779 by J. Webber during Captain James Cook's third voyage): horizontal deck platform (*pola*) resting upon connecting booms (*iako*) occupies most of space between the hulls; end booms attached upon end deckings; mast stepped above second and stoutest *iako* midway between the equal-sided hulls; form of sail and coloring of dark underbody and light-hued superstructure correctly rendered.

From these sources, from the descriptions given by Freycinet and Arago, who in the *Uranie* and *Physicienne* visited Hawaii in 1819, and particularly from the detailed description and scaled drawings which appear in the monumental monograph on extra-European ships and canoes by Admiral Paris (1841), one is able to obtain an unusually clear understanding of the construction of the two classes of sea craft used by the Hawaiians—the double canoe and the single outrigger. The outrigger canoes still in common use in the islands continue to be constructed on the same fundamental design as were those employed in vast numbers at the time of Cook's discovery of the islands. Double canoes such as were then used are today non-existent, although a makeshift and temporary imitation is occasionally attained by lashing straight poles athwart the hulls of two outrigger canoes from which the outrigger frames have been removed. Some of these, as seen in a photograph taken

*Reference to the Bibliography (p. 446) is made by date of publication.

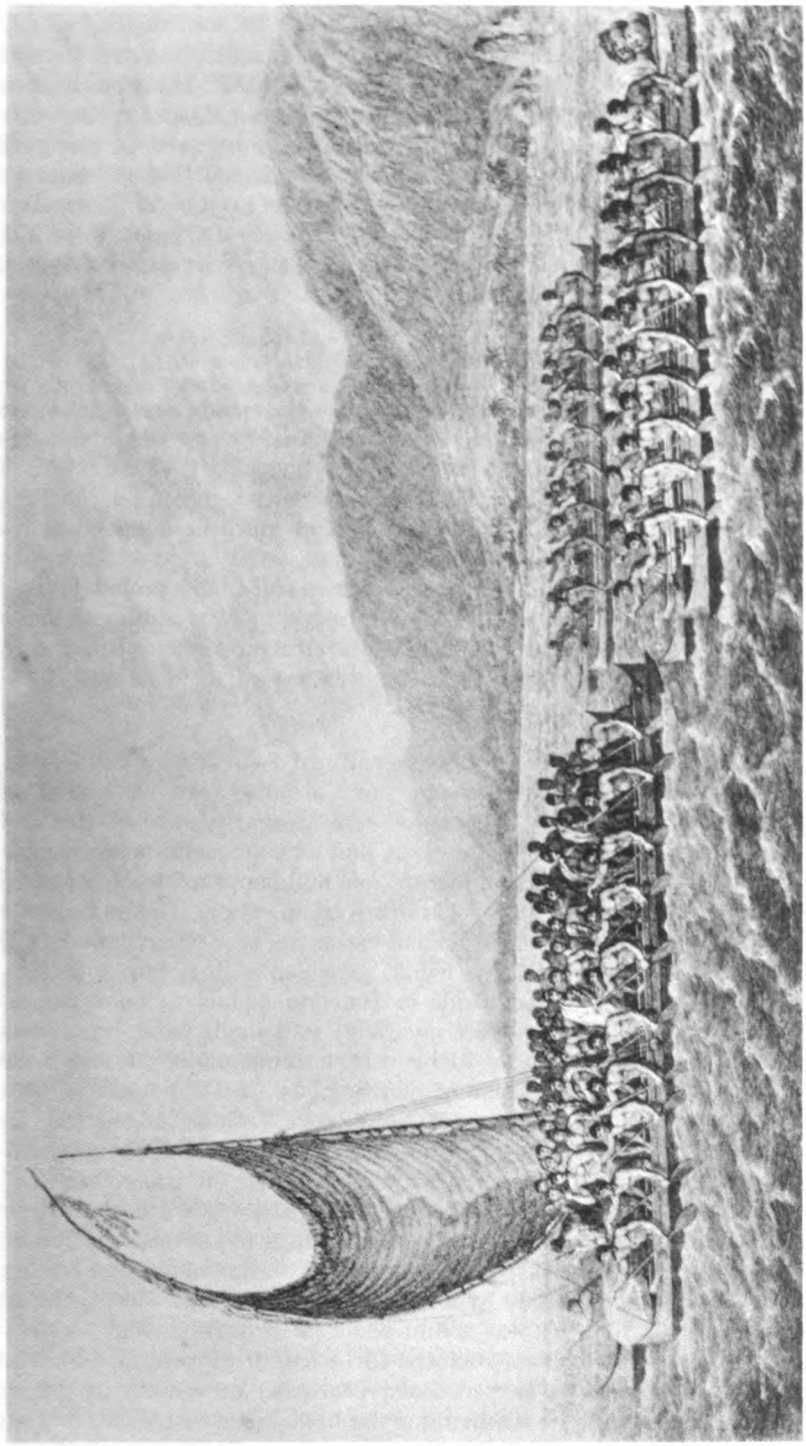


FIGURE 2.—"Tereoboo, King of Owyhee, bringing presents to Captain Cook" (drawn by J. Webber): end booms pass through the wash-strakes, a detail due probably to large size; deck platform horizontal; great carrying capacity indicated.

about 1890, are even equipped for sailing, having a mast stepped in a shoe placed upon the fore boom, midway between the hulls.

Before beginning the following description of Hawaiian canoes I wish to express my warm appreciation of the courtesy of Mr. V. S. K. Houston of Hawaii. He had prepared a detailed account of the Hawaiian double canoe, but this he withdrew from publication when he learned that I was engaged on the present monograph. He also most generously placed at my disposal all the data which he had collected. I am therefore glad of this opportunity to record my sincere thanks to Mr. Houston and also to Dr. Herbert E. Gregory, Director of Bernice P. Bishop Museum, who has afforded invaluable help in the preparation of this section.

DOUBLE CANOES

History

Even in the early part of the nineteenth century the number of double canoes (*wa'a kaulua*) possessed by the king and the great chiefs was considerable. Such good sea boats were they considered, that when Kamehameha I, who died in 1819, contemplated the conquest of Tahiti, his chief reliance was upon a large fleet of double canoes which he had built and acquired and in which he intended to transport a large number of fighting men (Simpson, 1847, vol. 2, p. 71). Malo (1903, p. 174) mentions that in the time of this ambitious ruler, and probably for this contemplated invasion of Tahiti, an attempt was made to gain additional size and carrying capacity by combining three hulls into one structure, thus forming a triple canoe (*pu-kolu*). So far as is known the result was not satisfactory.

Hulls

The ordinary double canoe consisted typically of two similar hulls disposed parallel with one another and connected at a short distance apart by several stout, transversely placed booms (*iako*). The hulls were as nearly equal in size and as nearly counterparts of each other as the canoe builder's art could make them with the timber available (fig. 8). When, however, one hull happened to be longer than its fellow, the craft was termed *ku-e-e* (Malo, 1903, p. 174). The starboard hull was designated *akea*, the port one *ama*. Each had as its base or underbody a slab-sided dugout hewn from a single tree trunk, provided with a few spreaders or pseudoframes tied to cleats on the inside to function mainly as boom supports. These Hawaiian canoe underbodies were invariably in a single piece, however long they might be. They do not appear to have been compounded of two sections connected end to end by some form of jointing, as was the common custom in the Society Islands, the Marquesas, and New Zealand whenever one tree trunk was insufficient for the length desired. The vertical sides passed abruptly at the curved bilges into a rounded bottom nearly semicircular in transverse section, destitute of keel, and with strong longitudinal curvature toward each extremity, where it was brought to a sharp point; even at the ends this underbody remained nearly horizontal along its upper aspect, and whatever sheer the finished hull eventually possessed was given it mainly by a rise in the washstrakes toward the ends.

The main washstrake (*mo'o*) was a thin plank, 6 to 8 inches high, sewn vertically upon each edge of the dugout except for a length of several feet at each end, where it was replaced by a shaped board (*ka laau*) carved out of the solid. This terminal modification of the washstrake, the homologue of half an end piece, in its proximal portion was vertical and constituted a continuation of the main washstrake. The distal portion, after rising vertically to a gradually increasing height above the main strake in order to impart a gentle sheer to the ends of the

hull, curved inward above till it met horizontally its fellow from the opposite side. This median junction of the inner edges of the opposing end-piece sections was continued for a distance ranging from 1 to 2 feet to a termination above the extremity of the underbody, where the terminal edges of the two were brought together vertically at an acute angle in the median line, forming thereby a sharp, wedge-shaped stem and stern. Both the horizontal and vertical junctions were secured by neat sennit sewing. Cook's description (1784, vol. 2, pp. 243-44) is excellent: "The extremities both at head and stern, are a little raised and both are made sharp, somewhat like a wedge; but they flatten more abruptly, so that the two side boards join each other, side by side, for more than a foot." The account given by Paris (1841, p. 139) also deserves to be quoted:

> [The sides] are heightened by one or two weather boards with double scarfs, secured by double lashings, barely visible, which are connected by a board athwartships near the bow. At the stern the sides join through being bent or shaped like the bow piece, and they fit one against the other, rising to a point widened a little at the top [fig. 3]. Near the bow is a cover, of two pieces joined to the canoe, similar to the stern pieces, the two halves being joined to each other by very delicate flat lashings. These end pieces, which can certainly not have been given these shaped forms except by working in solid wood, are of such perfect workmanship as is seldom to be found in work of this character.

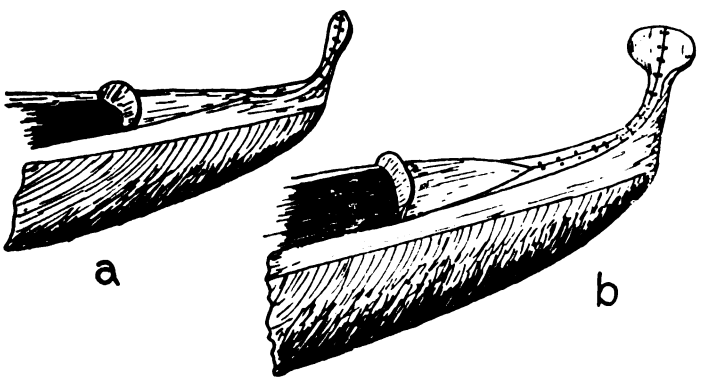


FIGURE 3.—Fore ends of two Hawaiian canoes: *a*, ordinary form of curved terminal (*manu*); *b*, broader terminal of *lele-iwi* canoe (after Malo, 1903).

The extremity at each end was fashioned into a short, upturned point (*manu*), appearing acute when viewed laterally but distinctly spatulate when seen end on (fig. 3). That at the head was sometimes the larger; when unusually broad, the canoe was termed a *lele-iwi* and was used principally for display (Malo, 1903, p. 178).

At the head the bipartite end piece extended to the extreme fore end of the underbody; at the stern it ended a couple of inches or so short of the after extremity of the dugout underbody, which therefore showed as an acutely pointed miniature ram projecting aft. Otherwise the two extremities were similar.

The arched-in form of each end of the canoe was obtained by hewing the bipartite end piece from two solid blocks, each shaped in section into the quadrant of a circle. Today, with imported timber cheap and easily worked with the aid of steel tools in place of stone adzes, this method of construction has been abandoned in the making of fishing canoes in favor of one in which the whole miniature whaleback is fashioned in a single piece, either nailed or screwed on at its junction with the underbody, which still continues to be a dugout.

For a short distance abaft the conjoined halves of the fore end piece the canoe was further closed in by a triangular length of horizontal planking forming a short fore deck. In canoes heightened by the addition of a single strake, two low curved and sharp ridges, one arising from each side of the after edge of this fore decking and carved out of the same block of wood, passed forward a short distance, converging anteriorly to form a weak breakwater on the after side of the decking. In large canoes where further freeboard was obtained for the open waist by adding one or even two narrow strakes upon the edges of the main strake, the shaped breakwater was replaced by straight transverse planks joining the ends of the additional strakes at both the forward and the after end of the waist.

At the seam between the washstrake and the underbody an overlapped joint was made by recessing the lower edge of the strake plank on its inner side to about half its thickness, the joint being afterwards secured by neat stitching scarcely traceable on the exterior. Alternatively the outer edge of the underbody was similarly recessed in addition, forming a double scarf joint. The sennit braid used for lashing was passed from the interior through a hole bored transversely through the side of the underbody immediately below the upper margin; it was then continued through another hole bored obliquely upward and inward from a point on the lower edge of the washstrake above. Several turns having been made through the two holes, the braid was carried along on the inner side of the hull, from the upper hole in the pair just joined, to the lower hole in the adjoining pair. Figure 4 makes clear this unusual method of joining opposed edges so that the lower edge of the added plank overlapped and concealed the joint it made with the underbody or with a lower plank. When one or two additional strakes were present, each was fitted to the one below in the same manner in which the first strake was attached to the underbody.

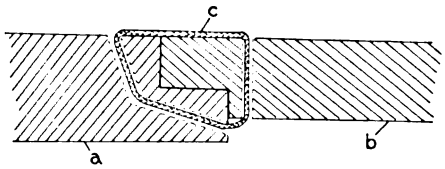


FIGURE 4.—Hawaiian method of sewing overlapping lower margin of washstrake (*a*) to edge of dugout underbody (*b*); parallel broken lines indicate course of perforations through which sennit lashing (*c*) is passed; inner side at top.

In Manihiki canoes the same peculiar method of protecting the main seam is employed, but with greater refinement. Buck (1911, p. 92) mentions a somewhat related device as being present in the larger canoes on Niue, but this is doubtful as it is based upon a native's unsupported statement, at variance with all other sources of information.

BOOMS AND ATTACHMENTS

The booms connecting the two hulls varied in number with the size of the vessel. Webber's sketches (Cook, 1784) show them as either three or four, but in a canoe figured by Paris (1841, pl. 127, figs. 1, 2) six are shown, and in the gigantic craft which are reputed to have carried from 80 to 140 men (Best, 1925, p. 235) it is probable that an even greater number were required to assure the requisite rigidity. These booms were lashed to the hull in a most curious and unusual manner. Wherever a boom crossed the gunwales, a curved spreader (*wae wa'a*), either angular U-shaped or else bow-shaped, was inserted, arms upward, transversely within the hull, the end of each upturned arm butting against the lower side of the boom; laterally each lower corner or angle rested against a projecting horizontal

comb cleat (*pepeiao*) on the inner side of the underbody, left at the time the interior was hewn out. Usually at each side at the turn of the curve a notch was made into which the edge of a cleat fitted, as shown by some old spreaders in Bernice P. Bishop Museum (fig. 15).

Each spreader was made fast to these two cleats, one on each side, by lashing passed through holes bored vertically therein:

> The boom was lashed to the spreader by many turns of strong sennit arranged according to one of several systems. Further strength was secured by sennit lashing passed on each side of the hull through two holes in the strake on which the boom rested and then carried around the boom, returning through the two holes to make a turn around the adjoining upturned limb of the U spreader; the procedure was repeated until this accessory lashing was deemed strong enough.

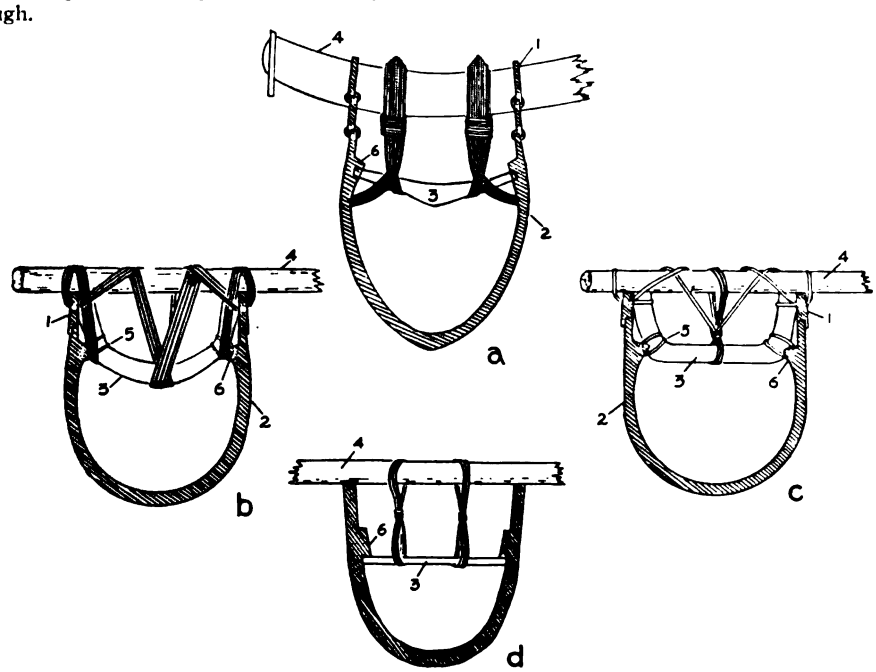


FIGURE 5.—Three Hawaiian methods of lashing booms to hulls and to U spreaders, with Indonesian method for comparison: *a*, by means of two great collar lashings, appears to have been employed in double canoes (after Paris, 1841, pl. 127, fig. 4); *b*, method seen in an outrigger canoe which belonged to Kamehameha V; *c*, method used in small fishing outriggers of present day; *d*, arrangement of lashings commonly employed in Indonesian outrigger canoes, spreader a straight bar (after Hornell, 1920, figs. 36, 41, 52); 1, washstrake; 2, dugout underbody; 3, spreader; 4, boom; 5, lashings attaching spreader to side cleats (6).

It is remarkable that the basal region of the spreader neither rested upon nor reached to the bottom of the dugout. It was a fitting utilized mainly to provide a purchase for the boom lashings and so to relieve and distribute the great strain on the washstrakes which would have resulted in these exceptionally large and heavy canoes had the booms been lashed directly as is customary in small canoes; in addition, these spreaders gave support to the sides of the canoe, and it is probable that they represent true frames which have degenerated and now subserve a new purpose.

The form, arrangement, and lashing of the spreaders used in a large double canoe belonging to King Kamehameha, described and figured by Paris (1841, p. 139, pl. 127, fig. 4), differ greatly from the description given above, which is based upon the information afforded by authentic old models and on what is known of

the spreaders in outrigger canoes still in use in the islands. According to Paris the only lashing of each boom to its spreader was by two massive connecting collar lashings (fig. 5, *a*), an arrangement much simpler than either of the more common ones described hereafter for outrigger canoes. The course of the outer branch of each of his two great bunches of lashings ends obscurely in his figure, with no apparent continuation or attachment, due probably to a mistake on the part of the engraver. Paris shows no accessory lashings, nor does he show the spreader attached by lashing to horizontal cleats on the sides of the hull; instead, he shows it reduced to a slightly curved brace or strut having the ends inserted under the side cleats or in notches therein. In his text Paris specifically states that the spreaders were fitted into "horizontal grooves worked in the strengthening projections left on each side," an arrangement known only from this account.

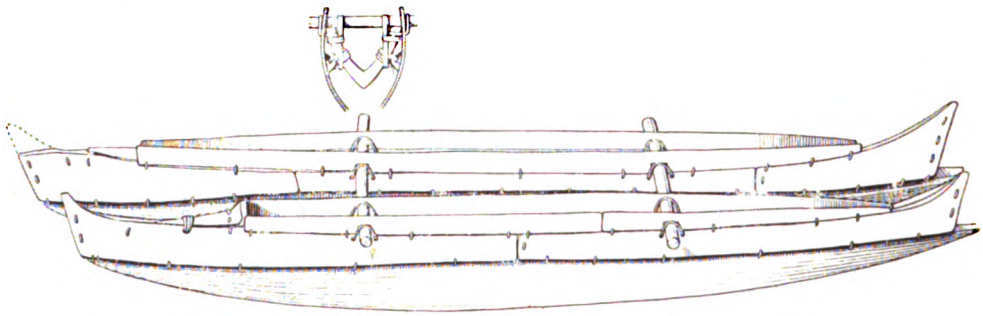


FIGURE 6.—Double canoe model brought from Hawaii by Vancouver (British Museum), cross section of one hull shows U spreader lashed to comb cleat on each side of hull; straight booms appear to have been characteristic of the ancient type.

In Indonesia a device on the same principle as that described and figured by Paris is frequently employed to secure the booms (Hornell, 1920, figs. 41, 52). In this a stout thwart bar is jammed beneath two lateral cleats projecting low down on opposite sides of the dugout hull (fig. 5). To each of the bars a boom is lashed by two collar lashings, much weaker but otherwise similar in technique to the Hawaiian ones described by Paris.

The departure from the normal form and arrangement of the spreader, noted above, must have been seen during the visit of Paris to Hawaii in 1839. It is possibly one of the innovations tried out during the transition period when the native culture of the islands was being rapidly modified by increasing contact with the outside world.

The ends of the boom nearest the head and those of the one nearest the stern rested upon the short covered-in region present at each extremity. The ends of the others, in canoes furnished with a single strake, rested directly upon the upper edge of this washstrake; in those with two strakes they passed through the upper one or partly through both and rested on the upper part of the lower. The two hulls, according to Paris, were set "very close to one another and do not, as a consequence, work as much as others [in which the space between the hulls is considerable] and are easy in their movements."

According to Malo (1903, p. 173) the booms used in ancient times were straight, as in the double canoes of all other Polynesian islands. This, Malo says, continued to be true till the time of Keawe II, who flourished about the last quarter of the seventeenth century, when one Kanuha invented the curved *iako* which thenceforward became characteristic of the Hawaiian type of double canoe. This

change enabled passengers and cargo to be carried in greater security, owing to the higher level at which the deck platform could be laid.

Malo's statement is apparently confirmed by a fine model now in the British Museum which was brought home by Vancouver. This, typical in hull form, is fitted with two perfectly straight booms which pierce the washstrakes; no platform (*pola*) is present (fig. 6). It is not certain, however, whether this model represents a late survival of the older method or an extemporization out of two outrigger hulls, in the same way in which at the present day two such hulls are sometimes transformed temporarily into a rude type of double canoe in order to transport some exceptionally heavy or bulky article. Such a canoe was used when the stone to cover the birthplace of Kamehameha II was carried to Napuhu. Normally

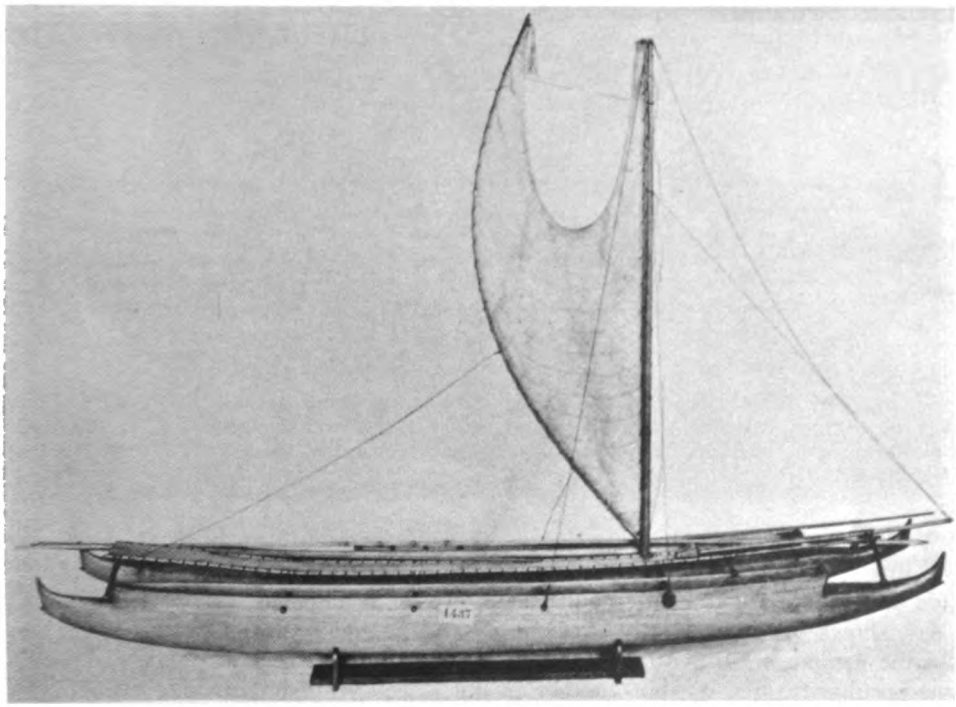


FIGURE 7.—Hawaiian double canoe model (Musée de Marine, Louvre, Paris) made in France under supervision of Admiral F. E. Paris, the most handsome model in existence; several mistakes in construction.

each boom was strongly arched in the middle region where it spanned the interval between the hulls, and the outer portions crossing the waists of the two hulls were straight. Each end boom was usually bowed slightly higher than the others, whereas the second from the fore end was stouter and wider than its fellows and carried the socket in which the mast was stepped. It must have been difficult to obtain naturally grown timber from which to form these peculiarly arched beams; the shape is one seldom found in the stout branches of ordinary trees. Fortunately, in the hau (*Hibiscus tiliaceus*) the Pacific islanders have a common tree with such a tortuous habit of growth as to provide branches of almost any desired curve.

PLATFORM

Supported upon the arched backs of the booms, a narrow, light platform (*pola*) formed either of "slight poles" laid longitudinally and lashed side by side (Ellis,

1826, p. 314) or of a broad plank with a stout pole attached at each side (Paris, 1841, p. 140) was built longitudinally over the rather narrow space between the hulls and at a height of at least 2 feet above the gunwales (Ellis, 1826, p. 314). On this platform clustered a crowd of warriors when the double canoe was sent forth to do battle with the enemy, the open waist of each hull being reserved for the paddlers; passengers and cargo were similarly carried thereon when the vessel was engaged in peaceful pursuits or on exploring voyages.

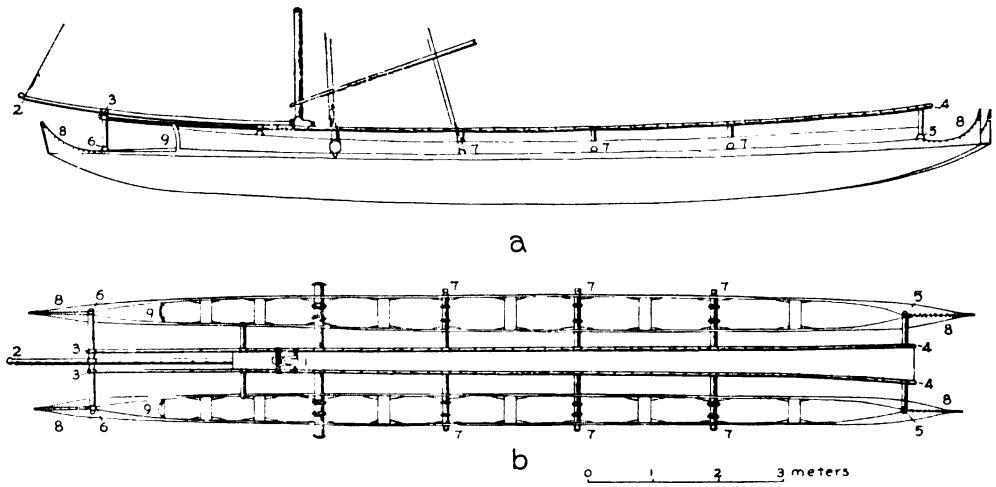


FIGURE 8.—Double canoe of King Kamehameha, after drawings made in 1839 by Paris (1841, pl. 127): *a*, side view; *b*, deck plan; 1, mast shoe; 2, end of bowsprit; 3, 4, side rails of platform; 5, 6, outermost crossboom at each end; 7, principal crossbooms; 8, end covers; 9, breakwater.

Webber's drawing (figs. 1, 2) show this platform as maintained at the same level throughout its length. Paris in his plate (1841, pl. 127) and in a beautifully made but not wholly accurate model in the Musée de Marine, Louvre, Paris (figs. 7, 8)[1], shows the ends slightly curved upward, the end booms being rather higher than the median ones. An old model in the Horniman Museum, London, has the same peculiarity (fig. 9), but another in the Royal Scottish Museum, Edinburgh, shows all the boom arches to reach approximately the same horizontal height.

[1] The Hawaiian figures given by Paris differ from other drawings and descriptions in several particulars. For instance, the mast is shown as stepped on the *pola* a little forward of the second and most massive cross boom, instead of immediately over this boom. All his figures, with the doubtful exception of one (1841, pl. 127), depict both ends of each hull as exactly similar, with the projection of the dugout underbody brought to a sharp, free point extending beyond the distal extremity of the curved-in bipartite end pieces, instead of restricted to the stern of each hull. He even goes so far as to alter his copy of Webber's figure of a double canoe under sail (fig. 2) to agree with his own drawings (Paris, 1841, pl. 127, fig. 14). Paris takes other liberties. Webber (perhaps wrongly) in the same sketch shows a forestay with a branch going in sheet fashion to a point at about midlength of the boom. Paris (1841, pl. 127, fig. 14) extends this branch backward as a vertiable sheet and alters Webber's forestay into a rope running from the head of one hull to a point near the end of the sheet.

The construction of the Louvre model made under the supervision of Paris repeats the structural divergences here noted. In addition, the model has the curved-in bipartite end pieces in one with the underbody at both ends, a peculiarity never seen in any Hawaiian canoe, ancient or modern.

In all Webber's plates, which agree with other sources of information, the mast is stepped immediately above the second boom from the head, which was made especially stout for the purpose. In the figure and model by Paris this extra strength is seen in the second boom (fig. 8) but the mast is stepped well in front of it, a position which renders the special strength of this boom unnecessary.

Another divergence difficult of reconciliation (Paris, 1841, pl. 127, fig. 4) is the sewing of the seams, shown to be unconcealed on the outer side, whereas a distinguishing and invariable feature of Hawaiian canoe design is the concealment of the stitches on the outside (fig. 5, *b* and *c*).

Notable instances of the carelessness of the engraver or of the inaccuracy of the sketches supplied to him are found in the perforated cleats (Paris, 1841, pl. 121, fig. 14), shown vertical instead of horizontal, and in the copies of Cook's scaled drawings of a Tongan double canoe and of Anson's "flying proa." These and other discrepancies shake confidence in the scrupulous fidelity of the figures a great pity, for otherwise this work is the finest of its kind in existence.

What advantage a curved platform could have to counterbalance the discomfort it would entail upon a crowd of people standing or sitting upon it is difficult to imagine. In one of Webber's plates (fig. 2) not less than 38 men are seen crowded upon the platform of a double canoe, together with some bulky goods as presents.

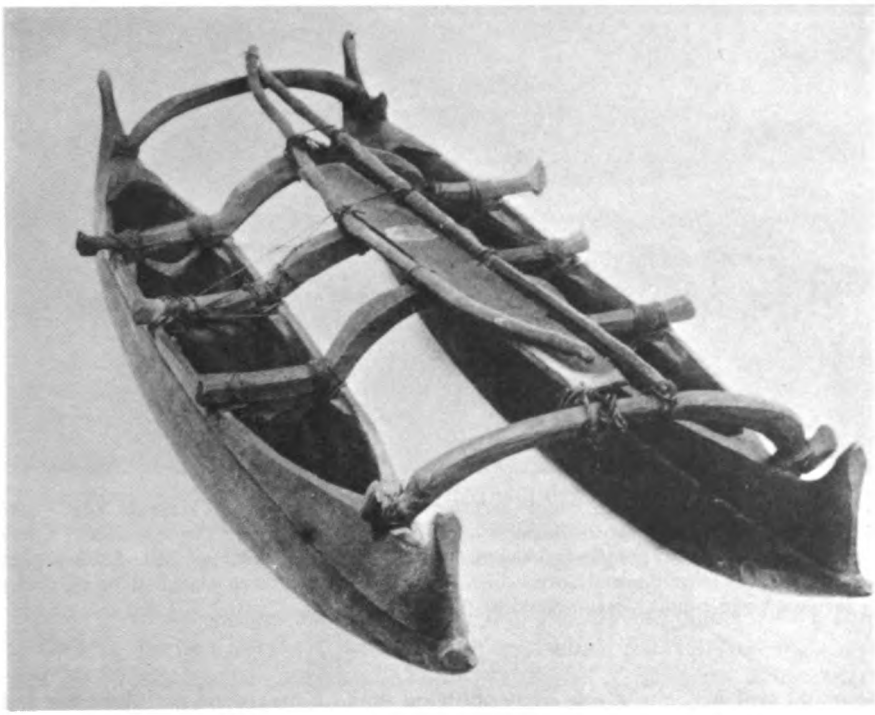


FIGURE 9.—Model of Hawaiian double canoe seen stern on (Horniman Museum, London); platform (*pola*) shown as plank bordered on each side by pole; pseudo-frame lashed below each of the three median booms.

Ellis (1826, p. 314) states that this platform "provided a comfortable seat and also kept our packages above the spray of the sea." Bingham (1849, p. 82) amplifies this when describing the visit of some chiefs to the ship on which he was traveling:

> Our distinguished guests . . . returned to the shore on their state vehicle—their double canoe, seated on a light narrow scaffolding which rested on the semi-elliptical timbers by which two large parallel canoes, each neatly carved from a tree, are yoked together, 5 or 6 feet apart. . . . The favored passengers on a Hawaiian double canoe sit 3 or 4 feet above the surface of the water, while the rowers sit on thwarts in the canoe . . . with their faces forward.

In an elegant model in the Hamburg Museum the usual plank *pola* is replaced by zigzag lacing of cord (fig. 10).

MAT COVER

To prevent swamping during heavy weather, a mat cover (*pa-u*) was fitted over the entire open region of each canoe hull, but in order to enable the crew to continue paddling, a number of large holes were made in it, through one of which each paddler thrust his head and body in manner analogous to that of the Eskimo in his kayak. Under ordinary conditions only the waist of the craft where the baggage and cargo were stowed was covered in this way. Emerson (Malo, 1903, p. 179) describes the way of fastening the *pa-u:*

A number of holes, called *holo*, were made in the upper edge of the canoe. By means of small cords passed through these holes a line, called *alihi pa-u*, was lashed in place. Through the loops of this *alihi* was run a line that criss-crossed from one side to the other and held the *pa-u* or mat in place. This last line was called a *haunu*.

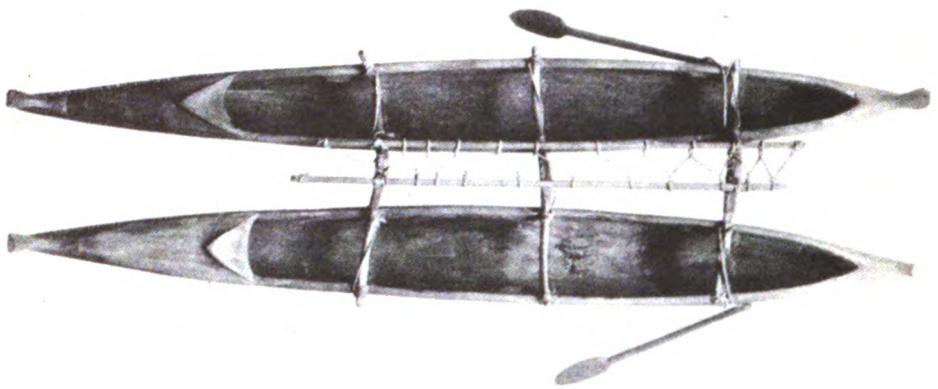


FIGURE 10.—Model of double canoe 38.5 cm long from Hawaii (Museum für Volkerkunde, Hamburg): hulls of unusual elegance and good proportion but otherwise model inferior to that shown in figure 9; pseudo-frames missing and original lashings have been replaced improperly; platform is of unusual form—instead of planking between marginal poles, there is a zigzag lacing on which bulky cargo could be carried.

PADDLING

The usual and favorite mode of propulsion was by means of paddles; the hulls were primarily designed to accommodate a maximum of paddlers, who were seated upon thwarts. Freycinet (1829, vol. 2, pt. 1, p. 615) records that the paddlers in each hull paddled alternately on the port side and on the starboard, those in one hull paddling on the port side while those in the other paddled on the starboard, changing over at intervals. The central platform was sufficiently raised and narrow to permit of this. To regulate the order of paddling, a man in the bows acted as stroke, striking three blows in succession against the side with his paddle whenever he judged it time to change over. On the third blow the paddlers executed the maneuver with precision. Bingham's account (1849, p. 83) of the system of paddling is similar.

Freycinet, the only observer who records two methods of steering, describes them thus: "Usually a man placed in the stern of each canoe steers with a long paddle; we have sometimes seen, however, a rudder (*gouvernail*) set up in the center of the space between the hulls [at the aft end of the median platform]." He adds that the islanders preferred to impel their canoes by paddling rather than by sailing, the former method being for them "much more expeditious." He characterizes their sail as small compared with the dimensions of the canoe (1829, pp. 614, 615): "It had particularly very little hoist (*guindant*) and it appeared to us that the islanders made use of it only when the wind was right abaft or on the quarter".

Manned by a well-trained crew, these great canoes had a wonderful turn of speed that could be kept up for long stretches. Turnbull (1813, p. 232) states that "these canoes are so well calculated for speed that we have seen the natives work

them along, with their short paddles, at the rate of 11 or 12 miles an hour and fairly run them under water." Simpson (1847, vol. 2, p. 70) also remarks that "in speed, as well as in security, the double canoes are vastly superior to the single".

Paddles

The ordinary paddles averaged 5 feet in length. As seen in a fine example in Bernice P. Bishop Museum (fig. 11, *a*), the loom is straight and is circular in transverse section except at the proximal end, where it is slightly elliptical. No hand grip is present.

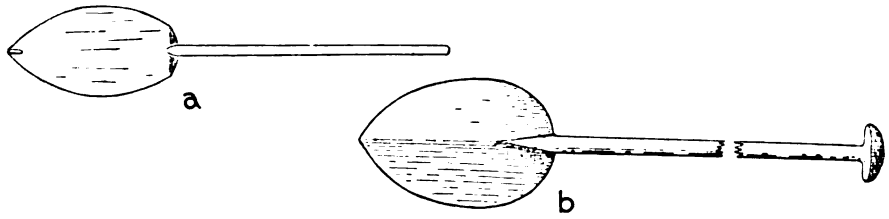


Figure 11.—Hawaiian paddles: *a*, old form with short rib carved in relief upon one side of blade below tip (Bernice P. Bishop Museum); *b*, crutched steering paddle (after Choris).

The blade of a typical paddle is short, broad, and approximately ovate in shape, the broad end proximal. Except close to its junction with the shaft, where, in cross section, it has the form of a narrow elongated diamond, the blade is weakly plano-convex, the forward or upper side being very slightly convex, the hinder one flat.

Many of these paddles were tipped on one side of the blade with a short rib or thickening (*io* or *upe*)—1.5 inch long in the example figured (fig. 11, *a*)—which served no known useful purpose. Linton (1923, p. 318) gives it as present on either side, but this is contrary to the statement in the Bernice P. Bishop Museum Handbook (1915, pt. 1, p. 16) and to the form of the example figured, in which the rib is present only on the face or anterior side. This thickening of the tip of the blade is also found in certain Micronesian paddles, notably in those of the Truk Islands in the central Carolines; in these the tip is slightly elongate and is thickened equally on each side for rather more than 2 inches from the end. It seems probable that both have had a common origin and represent an early or primitive stage in the evolution of the Tuamotuan, Marquesan, and Mangarevan beak-ended paddles.

A typical paddle in Bernice P. Bishop Museum has the following dimensions:

Length over all 60⅛ inches; length of shaft 37⅞ inches; diameter of shaft at mid length, 1⅝ by 1 11/32 inches, at the proximal end 1 by 1 5/32 inches; length of blade 22¼ inches, extreme width 11 3/16 inches, thickness at center 11/32 inch, at the sides 3/32 inch; length of rib or ridge on the face of the tip 1½ inch, width 5/16 inch, thickness of tip 6/16 inch.

The steering paddles were of the same general form as those used for propulsion but were proportionately larger in their dimensions. They also differed in having a straight crutch-shaped hand grip, as figured by Choris (1822, pl. 13) and confirmed by a fine example in the British Museum. (See fig. 11, *b*.) Neither the ordinary nor the steering paddles were ornamented in any way.

The double canoe was the craft employed mainly, if not exclusively, in deep-sea voyaging. It possessed distinct advantages over the single outrigger because of the greater comfort it afforded the paddlers, due to the greater beam of the hulls, and because of the opportunity which the median platform provided for carrying an ample supply of provisions as well as passengers. It was also considered the safer craft in rough weather.

Mast and Sail

The double canoe was always equipped to carry sail. The position and manner of stepping the mast (*kia* or *pou*) are involved in confusion. Malo (1903, p. 174) states that the mast was set up in the starboard hull (*ekea*), whereas Simpson (1847, vol. 2, p. 70) describes it as "planted between the two parts," meaning the two hulls. Paris gives the latter position, his figures and the model he had made for the Louvre collection showing the mast as stepped in a socket upon the *pola*, a little forward of the second *iako* (figs. 7, 8). Ellis (1826, p. 315) says the mast has "generally a notch cut at the lower end and is placed on one of the cross pieces, to which it is tied". Webber's figures (Cook, 1784) confirm those of Paris, except that here the step upon the *pola* appears to be immediately above the second *iako*, a position more suitable to meet the strain involved. The conclusion most probable is that the mast was stepped in the starboard or weather hull in small double canoes without a *pola*, where a notched heel would enable it to fit upon the second *iako*, whereas in larger vessels it was stepped in a socket or shoe upon the *pola* but immediately above the second *iako*.

As seen in Webber's fine sketch of a double canoe (fig. 1), the sail (*la*) was trilateral in shape and placed apex downward. One of the two long sides was laced or tied to the vertical mast, the other to an upwardly curving slender spar, the boomsprit. The lower end of this spar was secured to the mast close to its foot, and the upper end was bent in toward the masthead by means of a cord. This gave the free margin a deeply crescentic form resembling superficially the crab-claw sail of the Santa Cruz canoe and of the *lakatoi* of New Guinea. The material used was lauhala matting. All figures agree in showing a pendant made of streamers of bark cloth (tapa) flying from the upper end of the boom sprit. Samwell (1890, p. 262) states that a bunch of black feathers also decorated the masthead. A back stay and a pair of shrouds on each side appear to have been used to secure the mast in position. Paris in his figure and model adds two fore stays attached below to the outer end of a slender bowsprit, butted at its after end against the mast shoe. No sign of this is found in Webber's drawings and it is probably an innovation inspired by European usage. The mat sail was made in strips sewn together horizontally between the sides lashed respectively to mast and boom sprit.

The forward position of the single mast precluded these craft from sailing otherwise than with the heads directed forward.

With the rapid increase of contact with white men, the superiority of the European sprit sail was early recognized. Paris (1841, p. 141) records that when he was in the islands in 1830 the old rig was replaced by

> . . . a spritsail of cotton cloth. . . . The sail area is considerable, as one may judge from the height of the mast (8.3 meters), as well as the length of the bowsprit and boom (7.5 meters). The canoe is handled in the same way as our own boats, because this canoe differs from others in that both sides [hulls] are similar, and may be alternately to windward or to leeward, whereas in Tonga the smaller one acts as an outrigger.

But even thus modified and improved, the double canoe could not hold its own and the Hawaiians soon afterwards abandoned it entirely in favor of the schooner type of sailing craft.

Materials

The timber usually employed in making the dugout underbodies of ordinary canoes was the koa (*Acacia koa*), a hard wood which has been marketed as "Hawaiian mahogany"; but whenever it was possible to procure them, trunks of Oregon pine were preferred for their greater size. These were not infrequently cast up on the shores of the islands, particularly of Niihau and Kauai. Brigham (1900,

p. 12) records having seen in 1864 "dozens of such logs, some of great size, along the shores of Niihau". This flotsam from the west coast of North America was eagerly sought for and any exceptionally fine trunk was hoarded by the local chief for the construction of a specially large double canoe; the difficulty was to obtain a companion of equal size. Vancouver (1798, vol. 2, p. 219) records that the chief Taio kept one gigantic trunk unworked for a long time in the hope of finding another to match it. Disappointed in this, eventually with great reluctance he utilized it for the hull of one of the largest outrigger canoes ever made in the islands, 61.5 feet in length and of depth and beam proportionate.

Great skill and an infinity of patience were exercised in the fashioning of these hulls. The surface of the underbody was carefully rubbed down with pumice and then wrought to a wonderful degree of polish, after being painted black. Emerson (Malo, 1903, p. 177) notes:

> This Hawaiian paint had almost the quality of a lacquer. Its ingredients were the juice of a certain *Euphorbia*, the juice of the inner bark of the *kukui* tree, the juice of the banana tree, together with charcoal made from the leaf of the *Pandanus*. A dressing of oil from the nut of the *kukui* was finally added to give a finish. I can vouch for it as an excellent covering for wood.

The washstrakes, by way of contrast, were kept either their original light hue or else were stained yellow, a color scheme retained by the descendants of these old Hawaiians for the hulls of present-day fishing outriggers, which, apart from the degenerate roughness of their build, are virtual replicas of the old-time canoes.

The washstrakes (*mo'o*) were cut from the wood of the breadfruit tree (*ulu, Artocarpus incisa*), the booms (*iako*) from branches of hau (*Hibiscus tiliaceus*), and the paddles (*hoe*) were hewn out of native hardwood, usually koa (*Acacia koa*).

Dimensions

In the account of Cook's third voyage (1784, vol. 3, p. 148), the size of the largest double canoe of Owhyhee (Hawaii), as actually measured, is given as 70 feet long, 12 feet broad, and 3.5 feet deep; the breadth given is the over-all width of the double structure. The beam of each hull in such a vessel would not be less than 2 feet.

These dimensions were occasionally exceeded; it is on record that an old wrecked canoe on the coast of Hawaii was 108 feet long. There was also a certain canoe of Oahu of the eighteenth century reputed to have carried from 120 to 140 men (Best, 1925, p. 235). The usual dimensions were much smaller than these. Those of one of average size as scaled off and converted from Paris (1841) are as follows:

	METERS	FEET
Length over all, right hull	14.50	47.50
Length over all, left hull	14.28	46.83
Maximum breadth, right hull	0.57	1.87
Maximum breadth, left hull	0.50	1.64
Maximum breadth across both hulls	2.01	6.59
Length of main boom	2.40	7.87
Greatest depth	0.98	3.21
Depth from lowest point of bottom to top of forward breakwater	1.30	4.26
Minimum distance between hulls	0.94	3.08
Length of platform	10.43	32.21
Width of platform, forward	0.36	1.18
Width of platform aft	0.60	1.96
Number of paddlers' thwarts in each hull	6	

OUTRIGGER CANOES

Historical References

The immense number of canoes (*wa'a*) possessed by the Hawaiians greatly impressed the earlier voyagers, and at the same time the perfection of workmanship characterizing them compelled expressions of the deepest admiration. Ledyard (1783, p. 103), who was one of the ship's company in the *Resolution* when Cook first anchored in Kealakekua Bay, says of the assembly of the islanders on that occasion that two officers ordered by Cook to number the canoes surrounding the ships both exceeded ". . . 3,000 in their count; filled with men, women, and children the number afloat was at least 15,000, besides those who were swimming and sustaining themselves on floats".

These floats appear to have been surfboards, for Turnbull (1813, p. 232) describes them as "thin feather-edged slices of wood."

On another occasion, January 16, 1779, when Cook's ships were again anchored in the bay, it was recorded in the official account (1784, vol. 2, p. 548): "Canoes now began to arrive from all parts; so that before 10 o'clock, there were not fewer than 1,000 about the two ships, most of them crowded with people and well laden with hogs and other productions of the island".

Even as late as the time of Kamehameha I, their number continued little if at all diminished, for Arago (1823, pt. 2, p. 105), who was on the *Uranie* during her stay in the islands in 1819, remarks: "The number of his [the king's] canoes was immense; we see more of them here in a paltry village than you would find in all the Mariannes". Again (1823, pt. 2, pp. 65, 66; Souvenirs, vol. 2, p. 48) Arago describes seeing on the shores of Kealakekua Bay

> . . . some sheds which shelter from the rain and wind a prodigious number of canoes, both single and double, remarkably handsome and well finished . . . our cabinet-makers do not polish the most costly furniture better; and without planes or any of the tools employed by our workmen, those of Owhyhee are capable of competing with the best artisans in Europe. The underbody of their boats, as far as the thwarts, is painted black, and polished till it becomes very bright, by means of the juice of a yellow flower which is found all over the island.

Freycinet (1829, vol. 2, pt. 1, p. 614) was equally enthusiastic.

In the days while yet the native population was large and possessed the land, outrigger canoes (*wa'a kaukahi*) formed the vast majority of the sea craft thus eulogized. They were of the same design as those still surviving as fishing canoes among their vanishing and impoverished descendants, differing only in dimensions and in the quality of their construction and finish. Those of the present day are built with much less care in spite of the more efficient tools now available to their builders. Ellis (1826, p. 315) gives a good general description:

> The canoes of the Sandwich Islands appear eminently calculated for swiftness, being long, narrow, generally light, and drawing but little water. A canoe is always made out of a single tree; some of them are upwards of 70 feet long, 1 or 2 feet wide, and sometimes more than 3 feet deep, though they are seldom in length more than 50 feet. The body of the canoe is generally covered with a black paint, made by the natives with various earthy and vegetable materials, in which the bark, oil, and burnt nuts of the *kukui* tree form the principal ingredients. On the upper edge of the canoe is sewed, in a remarkably neat manner, a small strip of hard white wood, from 6 to 8 inches in width, according to the size and length of the canoe. All the canoes of these islands are remarkably strong and neatly made; and though not so large as those of New Zealand, the Society Islands, or some of the other islands to the southward, are certainly better made and would probably paddle or sail faster than any of them. One man will sometimes paddle a single canoe faster than a boat's crew could row a whaleboat. Their tackling is simple and convenient; the mast generally has a notch cut at the lower end, and is placed on one of the cross pieces to which it is tied; the sails they now use are made of mats and cut in imitation of the sprit sails of foreign boats, which, they say, they find much better

than the kind of sail they had when first visited by foreigners. When sailing with a fresh breeze, the ropes from the lower corners of the sails are always loosened and held in the hands of persons whose only business it is to keep them properly trimmed. Their paddles, which are large and strong, are generally 4 or 5 feet long, have an oval-shaped blade and round handle, and are made of the same hard and heavy wood employed in building their canoes. They are not handsome and their weight must make paddling very laborious. Neither the canoes nor paddles of the Sandwich Islanders are carved, like those of many islands in the Pacific. Their canoes are, nevertheless, neat and sometimes handsome.

Construction

The canoes were equipped with a single outrigger, fitted always upon the port side. The hull was constructed in the same manner and of the same materials as the hulls of double canoes. The ends were of the same peculiarly neat fashion and finish as those the double canoes had in former days, but at the present time this method of construction is found too troublesome and the washstrakes merge at either extremity respectively into solid bow and stern end pieces, the whole of each hewn out of a single block of wood, instead of two equal halves joined together along the median line. Another deviation from the old design is the fastening of the washstrakes to the underbody by nailing instead of by sewing; in the modern method the lower edge of the washstrake still overlaps the outer edge of the underbody, but attachment is effected by driving nails through the overlap from the outside and then clinching them on the inner side.

Outrigger Frame and U Spreaders

The outrigger frame consists of two booms (*iako*) attached directly to a float (*ama*) of the light wood of the *wiliwili* (*Erythrina monosperma*). In present-day canoes the booms may be either cylindrical or, in the better canoes, adzed to a rectangular section. Paris says they were finished to an eight-sided shape and polished. The inner ends lie across the hull and rest directly upon the upper edges of the single strake added to the sides of the underbody in outrigger canoes of ordinary size. A U-shaped fitting (*wae wa'a*) similar to that placed within the hull in double canoes is employed here for the same purposes. The system of lashing in ordinary use at the present time consists of a central sennit or cord attachment stretching between the boom and the base of the U spreader in the form of three sets of cords radiating upward to the boom from the median point in the base of the spreader (fig. 5, *c*); each of the lateral cords, which pass obliquely downward after passing over the boom, is carried through one of two holes in the washstrake adjacent and makes a turn around the boom outboard before returning through a second hole to repeat its former course in a reverse direction. An alternative system of lashing is that seen in a fine fishing canoe which belonged to Kamehameha V, now in the Bernice P. Bishop Museum.

The U spreader is deeply notched at each angle to receive the angular edge of the perforated comb cleat projecting from the inner side of the underbody on each side. Two sets of lashings are present; the first, of thin twine, is passed several times through the hole in the cleat on one side and around the adjacent angle of the U spreader and then made fast; similar treatment is given on the opposite side. The second and major set of lashings serves to secure the boom both to the spreader and to the sides of the canoe. Here the material is stout sennit. Its course takes the form of a series of V's (figs. 12; 5, *b*).

A still more elaborate method of lashing (*kaholo* or *luukia*) Malo (1903, p. 174) says was reserved for the canoes of royalty and was "regarded as being in the highest degree sacred, and to climb upon the canoe, or to intrude at the time when one of these fastenings was being done, was to bring down on one the punishment of death". Emerson in a note (Malo, 1903, p. 178) says the *luukia*, or in full the

pa'u o Luukia, lashing was a highly decorative lashing, named after a famous beauty who sought to defend herself against the approaches of a royal lover "by wearing about her loins some sort of woven corset or *pa-u.* Hence the term *pa'u o Luukia,* corset or skirt of Luukia, applied by the old salts, canoe-men, of the sixteenth century, to the most aesthetic and decorative style of canoe lashing employed".

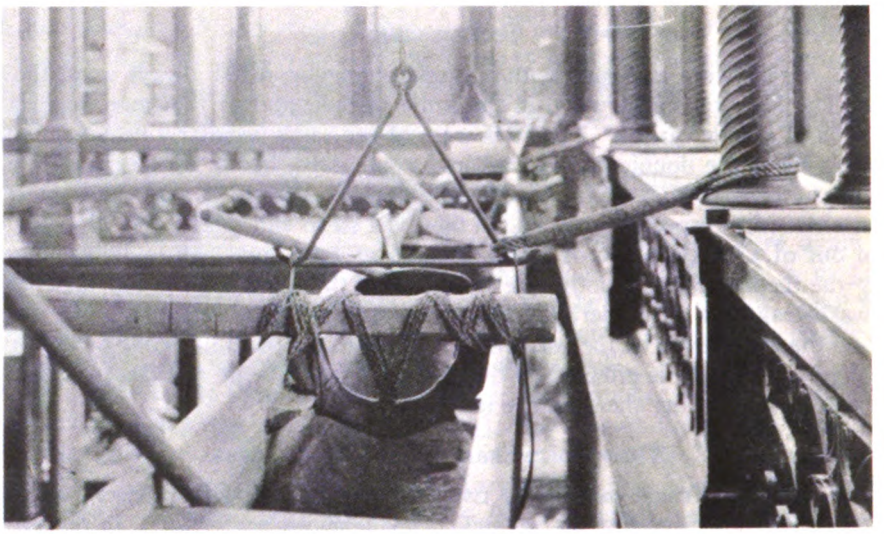


FIGURE 12.—Interior of fishing canoe of Kamehameha V, showing details of lashing of boom to washstrakes and pseudo-frame (Bernice P. Bishop Museum).

The inboard section of each boom is straight; outboard it rises in a flat arch slightly above the level of the gunwale and then curves downward nearly to what is the water line when the canoe is afloat. Here it meets the upper surface of the float, to which it is lashed by sennit passed several times around the float and the end of the boom, which may be either upcurved or notched on the upper side to render attachment more easy and secure. An alternative method is to pass several turns of lashing through two holes bored transversely in the float and around the

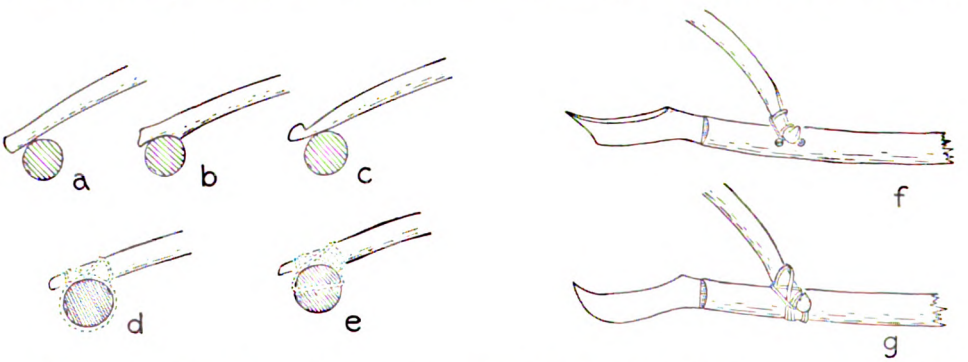


FIGURE 13.—Hawaiian outrigger attachments and float: *a, b, c,* three forms of boom ends; *d,* fastening of boom to float by passing lashing around float; *e,* fastening of boom to float by passing lashing through transverse perforation; *f, g,* two forms of carved fore end of float, believed to be conventional representation of a lizard's head; the two common forms of lashing boom to float also shown.

end of the boom; the end of the boom may be either notched, upturned, or plain—in the plain boom the under side is cut and shaped to fit conformably upon the surface of the float (fig. 13).

Float

The float (*ama*) is usually a cylindrical pole, sufficiently curved to raise the ends clear of the water while the median region between the booms remains awash. The after extremity in the canoes still in use is either truncate or brought to a sharp horizontal edge, whereas the fore end is carved into a conventionalized repreesntation of what Freycinet (1829, vol. 2, pt. 1, p. 613) says is a lizard's head (fig. 13, *f-g*); the sides of this region are sliced away, reducing it to a thin vertical board. This part and also a short section at the after end, sometimes cut into a rectangular form, are generally painted white at the present day.

According to certain old models, among them a very fine one in Bernice P. Bishop Museum (fig. 14), and to the figure given by Paris (1841, pl. 127, fig. 6), the form of the float had originally a still more pronounced curvature; in contrast with the floats now in use, the after end might even be attenuate and run to a fine point. Paris (1841 pt. 1, p. 141) remarks that this curvature created a compensatory effect by its action, as on entering and leaving the water progressively the resistance offered was neither so great nor so suddenly applied as it would be with a straight float; he adds that "this is also the only country where this action has been augmented to some extent by making the float laterally compressed in place of having it round". The fore boom is attached somewhat farther from the head of the canoe than is the after boom from the stern.

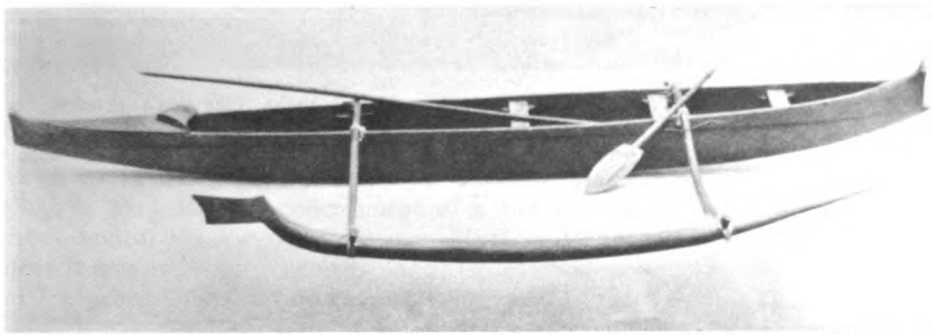


Figure 14.—Model of Hawaiian outrigger canoe; after end of float long and drawn out to acuminate point; "lizard head" fore end typical and still used in canoes of present day; paddle has typical broomstick handle and broadly ovate blade (Bernice P. Bishop Museum).

Fish-Spear Racks

In canoes used by fishermen, a notched rack (*ihu wa'a*), to hold fish spears and poles in place, was formerly lashed outboard, by sennit passed through holes in the ends, to each of the booms. Bernice P. Bishop Museum possesses a number of specimens of these racks and it is upon these that the following description is based:

The racks are of two forms, both carved from the solid. One of these has the form of a low, flattened arch, shaped above into three well-rounded rack grooves wherein the fishing rods and spears rested (fig. 15). Each end is perforated to permit of being lashed in place upon a boom. The finest of the museum examples, measuring 25 inches in length, has the outer part of one end carved into a small image in human form; enough remains at the other end to show that it had borne a counterpart image before it suffered damage. In the majority the ends are truncate and without ornamental carving.

The second form, represented by two examples, is much more crude. The rack grooves are more angular and deeper and less carefully carved. The larger example has three deep grooves, the smaller two. Both have solid bases, the smaller with a single and median perforation for lashing to the boom. The ends in each are rudely carved into the shape of hideous human heads, the tongue prominently shown but not protruded beyond the lips (fig. 16). In many present-day canoes fishing implements are rested in a forked branch tied upon a boom in the place where one of these ornamental racks was formerly lashed.

FIGURE 15.—Hawaiian fishing canoe: above, two rod racks (*ihu wa'a*); below, two spreaders or pseudo-frames (*wae wa'a*) which brace hull and to which booms are lashed; left, notch at each side which fits over angular edge of perforated cleat on inner side of hull, to which it is lashed (Bernice P. Bishop Museum).

FIGURE 16.—Crude rod racks (*ihu wa'a*) with ends carved (Bernice P. Bishop Museum).

DIMENSIONS

Hawaiian canoes as formerly constructed were extremely light, the thickness of the dugout underbody being between 1 and 1.5 inches and that of the washstrakes not above 1 inch. La Perouse (1797, vol. 2, p. 113) had one weighed which measured 24 feet long by 1 foot beam and about the same in depth, a fairly average size, and found it not to exceed 50 pounds in weight. According to the Bernice P. Bishop Museum Handbook (1915, pt. 1), the paddles used by women were much smaller than those of the men.

Light frames (ribs) are introduced in many modern canoes to give additional strength.

The hulls were of every size up to great vessels 60 to 70 feet in length with width and depth of more than 3 feet. The majority were, however, small, ranging from 15 to 24 feet in length, according to Samwell (1899). Rienzi (1836-37, vol. 2, p. 44) gives the average as 24 feet with a beam of 18 to 20 inches. Freycinet (1829, vol. 2, pt. 1, pp. 613, 614), who visited the islands in 1819, states that their hulls ranged from 12 to 50 feet in length and furnishes the detailed measurements of a medium-sized canoe as under:

	Meters		Meters
Length over all	11.376	Diameter of float at mid-length	0.284
Outside beam amidships	0.575	Height of washstrakes at middle	0.074
Depth from top of washstrake	0.566	Height of washstrakes at the point where they unite to form a miniature whaleback (sabot)	0.280
Length of outrigger boom	3.573		
Length of float	5.809	Thickness of washstrakes	0.029

The measurements of the fine fishing canoe of Kamehameha V preserved in Bernice P. Bishop Museum agree closely with the foregoing dimensions, being as follows:

Length over all	35.5 feet	Beam outside	23.0 inches
Depth outside	27.0 inches	Beam inside	17.5 inches
Depth inside	23.5 inches	Center of canoe to center of float	10.7 feet

Ornament

Carved ornament appears to have been seldom employed. Apart from the carved fishing racks already described, the only references are those of Samwell (1899, p. 262), that a wooden image of a god was carried at the stern of some canoes, and of the Bernice P. Bishop Museum Handbook (1915, pt. 1, p. 15), where it is stated that "often the pious fisherman placed at the bow a two-headed god," of which the Museum has two examples (nos. 3906, 3907).

Sail Rig

In those outriggers fitted for sailing, the old rig which was in use in Cook's time was an Oceanic sprit similar to that of the double canoe figured by Webber. (See fig. 1.) The mast was stepped upon the inboard part of the fore boom as was usual in Polynesian canoes. By 1839, when Paris visited Hawaii, the old type had disappeared and had been replaced (1841, p. 141) by

> . . . a [European] spritsail laced to a boom as well as to the mast. This latter, which is stepped in the bottom, is secured to the outrigger boom and stayed on each side by two shrouds, and also by a stay attached at the bow. All these spars are of ordinary wood, bamboo appearing to be very rare in these islands. The outrigger is placed to windward or to leeward according to the tack one is on; for these canoes, although their ends are nearly alike, do not go about like the others, but without changing their sailing rig, keep the outrigger to port whether it be to windward or leeward. They sail very well and of an evening when a fresh breeze brings them back from the fishing grounds, they slide over the water with rapidity and respond lightly to the swell of the waves. They are manned by 5 or 6 men and are steered by means of an ordinary paddle with which the canoes are also propelled very easily.

NAVIGATION

Little is known of the degree of skill in navigation possessed formerly by the Hawaiians. Malo (1903, p. 26) remarks that "the ancients are said to have been skilled in observing the stars, which served them as a mariners' compass in directing their course". He infers that this knowledge was received from Tahitian voy-

agers and settlers and states that the point of departure for Tahiti was at the western point of Kahoolawe (Rodman—1928—says it was the southern point) known to this day as Ke-ala-i-kahiki (The-route-to-Tahiti). Owing to the fact that intercourse with Tahiti is known to have existed at least as early as the twelfth century, it may be concluded that the Hawaiian science of navigation was identical in kind and extent with that of the Tahitians. Rodman (1928, p. 79) states:

> [The sailing instructions for a voyage to Tahiti] were to steer by the sun by day and by the stars by night, principally Polaris, on a course a little to the east of south. This at night would be accomplished by keeping Polaris several degrees to the left of a north and south course. Furthermore, when the celestial bodies might be obscured by clouds, knowing that the winds were generally easterly, they were to keep on the port tack; or keep the wind on the port side.

Rodman alleges that voyages between Hawaii and Tahiti were greatly facilitated by the use of a navigational instrument which he terms "the sacred calabash", whereby the pilot was able to fix his latitude with comparative accuracy, in much the same way as with a sextant. Whether any instrument for effecting this purpose was ever used is very doubtful, for Rodman's "sacred calabash" has been shown by J. F. G. Stokes (Rodman, 1928, note) to be in reality a royal traveling trunk made of wood, "in which were carried clothing and other valuables".

TECHNICAL TERMS

Technical terms in use in Hawaii for sea craft include the following:

Akea: starboard hull of double canoe.
Ama: float; port hull of double canoe.
Hoe: paddle.
Iako: boom.
Io or upe: ridged tip of paddle.
Iwi-kaele: dugout underbody.
Ka and ka-liu: bailer.
Kia or pou: mast.
La: sail.
Laau hope: end piece at stern.
Laau ihu: end piece at head.
Manu: carved up-turned point at each end of hull.
Mo'o: washstrake.
Oio: middle section of washstrake.
Pepeiao: comb cleat.
Pola: platform of a double canoe.
Pou or kia: mast.
Upe or io: ridged tip of paddle.
Wa'a: canoe (general term).
Wa'a kaukahi: outrigger canoe.
Wa'a kaulua: double canoe.

BONIN ISLANDS

In the Bonin (Ogasawara) Islands, situated between the Marianas and Japan, a single-outrigger canoe of neat appearance was in use till the beginning of the present century and may indeed survive now. The people who used this type of canoe were Polynesian in appearance, but till Japan effectively colonized the islands in recent years their speech was English.

The hull of the canoe (fig. 17) is a double-ended dugout. The ends are almost identical, curved, sharp, and capped above by short and pointed triangular end pieces sharply curved upward; weatherly qualities are given by a short, slightly arched deck at each end, butting against the after side of the small end piece. These canoes run to 30 feet in length, according to the information which accompanies the model, shown in figure 17.

The outrigger consists of two similarly shaped booms curving downward in their distal part to their insertion into the float at a distance outboard of about 8 feet. The pointed end of each is forced into a hole made in the ridged midline of the float and is further secured by a collar lashing to a peg inserted on the inner aspect of the float (fig. 18, *a*).

The proximal ends of the booms lie athwart the dugout hull and rest upon the gunwales. Crossing the hull a short distance immediately below each boom is a convexly bowed wooden thwart bar or boom brace; its ends pass through the sides and show on the outside a couple of inches below the gunwale. To this the inboard part of the boom is secured by two collar lashings (fig. 18, *b*). A method of attachment of the same type is found in the South Celebes (fig. 18, *c*) and in a varietal form is general throughout Indonesia (Hornell, 1920, pp. 66, 80, 88).

The float (fig. 17) is two-fifths of the length of the hull. The ends are pointed and the upper surface is ridged longitudinally; the sides and bottom are rounded as in the dugout hull. A curious feature is its compound construction; it consists of a basal part hollowed out in canoe fashion, and an upper part made of a long board broadly triangular in transverse section, fitting over the hollowed under part like the ridged cover of a sarcophagus. In the model shown in figure 17 the cover is glued on; whether the float is bipartite in full-sized canoes is not known.

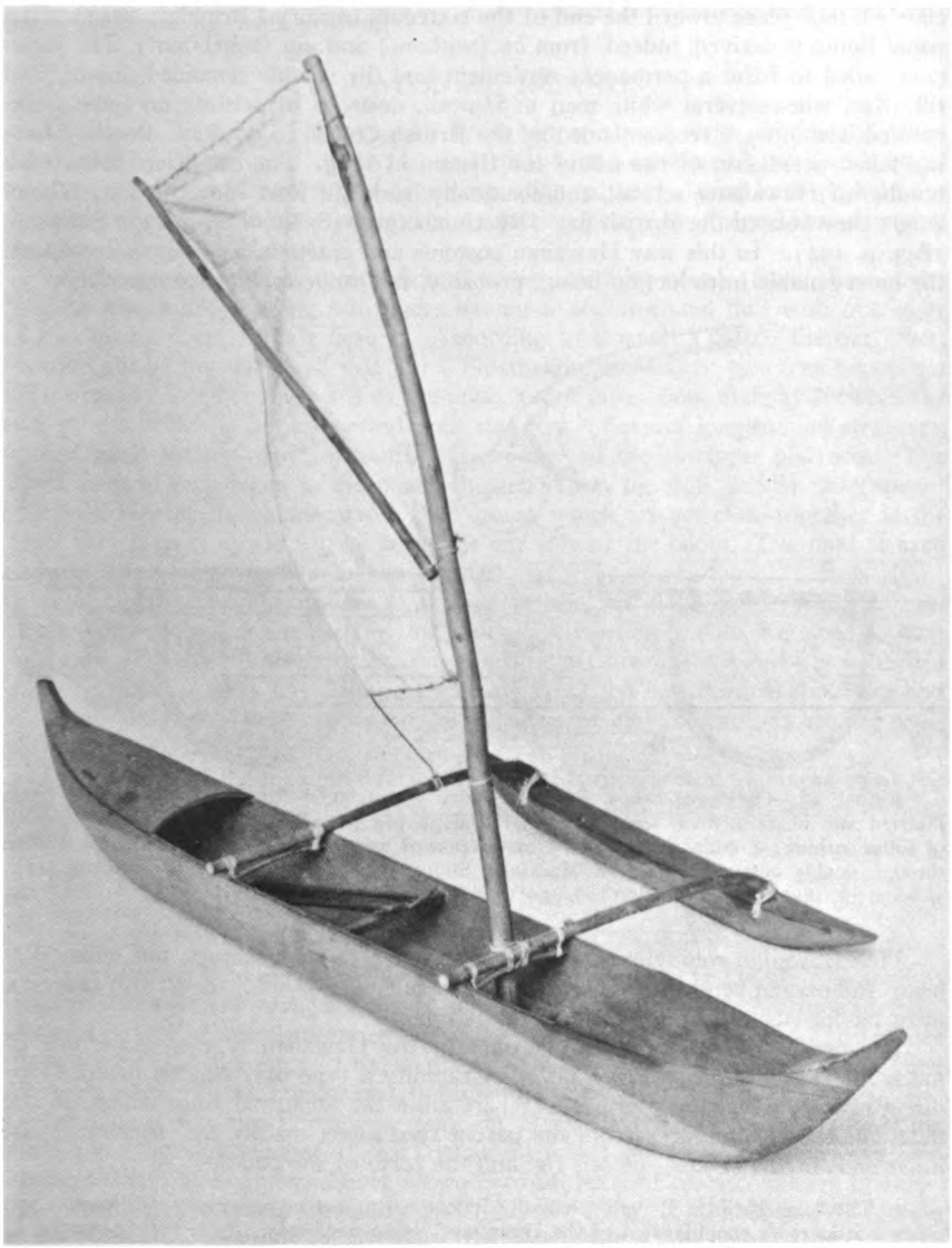


FIGURE 17.—Model of outrigger canoe from Bonin Islands (Science Museum, South Kensington, London): Hawaiian pseudo-frame replaced by cross brace of which ends perforate sides just under gunwale; European sprit sail; canoe body closely resembles that of Hawaii.

A mast rigged with a half spritsail is stepped in the bottom immediately abaft the fore boom, to which it is strongly lashed.

The design of both hull and outrigger approximates so closely to the Hawaiian that if the history of the colonization of the islands were not known various erroneous theories might be founded on this fact. It so happens, however, that the islands were uninhabited at the time of discovery by the Japanese, which, it is claimed, took place toward the end of the sixteenth century (Brinkley, 1910). The name Bonin is derived, indeed, from *bu* (without) and *nin* (inhabitant). The Japanese failed to form a permanent settlement and the islands remained uninhabited till 1830, when several white men in Hawaii, desirous of settling on some uninhabited island, were recommended by the British Consul to go there, Beechey having taken possession of the island for Britain in 1827. The colonizers collected a number of Hawaiians, set sail, and eventually landed at Port Lloyd, in Peel Island, where they hoisted the British flag (Ruschenberger, 1838, vol. 2, p. 297; Simpson, 1843, p. 124). In this way Hawaiian customs and crafts became implanted there, the most notable introduction being, probably, the canoe type above described.

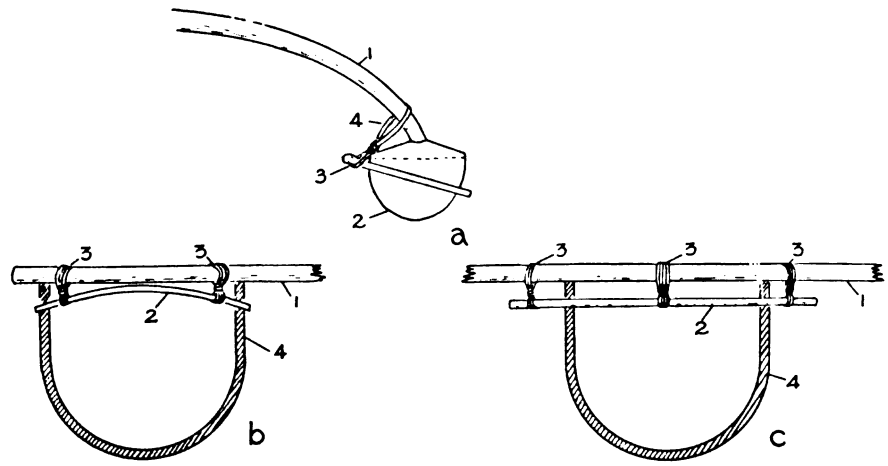


FIGURE 18.—Outrigger canoe, Bonin Islands. *a*, outrigger attachment: 1, end of boom inserted into float; 2, float, seen in cross section; 3, peg passed through float for attachment of collar lashing; 4, collar lashing. *b*, cross section of same canoe compared with *c*, a section through double outrigger canoe of Macassar, South Celebes (after Hornell, 1920, fig. 47): 1, boom; 2, thwart bar; 3, collar lashings; 4, dugout hull.

This Hawaiian colony existed till well into the present century, but today it is being submerged beneath the influx of thousands of Japanese, the British Government having abandoned its claim to the islands.

The main divergences of this variant of the Hawaiian type of canoe are of much interest, for they show with what rapidity a type may become modified by direct contact with other cultures. Apart from the abnormal construction of the float, the chief differences from the parent type affect mainly the lashings of the inner ends of the booms, the sail rig, and the form of the paddles:

1. The boom lashings, though essentially Indonesian in method as already mentioned, must yet be considered a simplification of the Hawaiian U-shaped spreader of the variety figured by Paris as employed in the royal double canoe in 1839 (fig. 5, *a*); in this the fitting is reduced to a slightly bowed spreader to which the boom is made fast by two massive collar lashings.

2. The half-sprit rig employed is a rough adaptation of the ordinary European sprit sail, the rig which the peripheral Polynesians have found it most easy to adopt when abandoning the

old Polynesian type of triangular sail which was tied to the mast. On the other hand, the Oceanic lateen, seen typically in Fiji, gave place to the boomed sail employed by schooners.

3. The paddles used are essentially of the Japanese sculling type, long-shafted and cross-handled, with the blade elongated and narrow.

European, Japanese, and possibly Indonesian sources have thus contributed to the modification of the original Hawaiian design from which the Bonin Islands outrigger canoe has been evolved.

EQUATORIAL ISLANDS

Christmas, Fanning, Palmyra, and Washington islands were uninhabited when discovered by Europeans. Stone and shell tools found on some of the islands attest to a former period of occupation (Fanning, 1834, p. 224) dating back probably to the time when these islands were used as halting places by Polynesians voyaging between Tahiti and Hawaii.

At the present time Fanning Island is occupied by people from the Gilbert Islands who employ sailing outriggers having a double-ended hull with outrigger of modified Gilbert Islands design. According to Burnett (1910), the outrigger, boomed out on the starboard side in his illustration, consists of two true booms set rather closely together, forward of the mast, and a false boom midway between the two others, which is not connected with the float. Several longitudinal stringers, spaced some distance apart, stiffen the framework of the outrigger platform. The attachment of each boom to the float (Burnett, 1910, fig. opp. p. xii) is by means of two divergent stanchions; from their bases, which are set close together in the float, they diverge upward to be lashed to one side of the boom. The float at each end extends a long way beyond the booms.

The rig remains Polynesian—a triangular sail, set apex down, with the heel of the yard stepped at the head of the canoe. A yard and boom are laced to each long side. The mast is stepped apparently a little aft of midships and has a marked rake forward. A side stay is shown running from the masthead to the outer end of the fore boom. These canoes can be sailed either end forward, as are the ordinary Gilbert Islands craft.

In the form of the outrigger attachment used here is seen a modification of the forked or Y attachment, a reversion to the use of two divergent sticks, without fusion of their lower ends.

MARQUESAS ISLANDS

AMBIGUITY IN EARLY RECORDS

Apart from a bald and probably misunderstood sentence in De Quiros' account of Mendaña's second voyage, there is no valid evidence that the Marquesans possessed any type of sea craft other than rafts, single outriggers, and double canoes at the time of the discovery of the southern islands by Mendaña in 1595 and of the northern islands by Marchand and Ingraham in 1791.

De Quiros was the Portuguese pilot on Mendaña's second voyage across the Pacific in 1595, and he alone of that company has left any record of what was seen during their sojourn in the islands. Two Spanish texts of his account are in existence; one given by Cristoval Suarez de Figueroa (1613) is an abbreviated version of the narrative, generally copied word for word; the other, complete, is by Don Justo Zaragoza (1876). As none of the English translations gives a sufficiently critical rendering of the chief passage which concerns the present subject, the Spanish text is given, together with a more literal and exact translation.

De Quiros (1876, vol. 1, cop. 6, p. 36) in describing his arrival in the bay of Omoa, in Fatuhiva, the most southerly island, wrote:

> De un puerto que está junto á un cerro ó picacho que queda á la parte del Leste, salieron setenta canoas pequeñas, no todas iguales, hechas de un palo, con unos contrapesos de cañas por cada bordo, al modo de postigos de galeras, que llegan hasta el agua en que escoran para no trastornarse, y bogando todas sus canaletes. En cada una los ménos que habian eran tres y en la más diez, unos á nado, y otros sobre palos, como cuatrocientos indios.

Translated, this reads:

> From a harbor under a peaked hill which lies on the eastern side, there came out 70 small canoes, not all the same size, each made out of a tree trunk, with counterpoises of canes on each side, after the manner of the outboard rowing galleries of galleys, which reached down to the water on which they rested to prevent capsizing; all rowing with their paddles. In any one the least number would be 3 [men], and in the largest 10; some were swimming and others on logs [? rude catamarans]. Altogether there would be some 400 natives.

The significance of this passage lies in its reference to what authorities have hitherto considered to indicate canoes fitted with double outriggers, from the phrase beginning "contrapesos de cañas", translated by Markham (1904) as "outriggers of cane on each side after the manner of the gunwales of galleys". The rendering of *postigos de galeras* as "gunwales of galleys" is faulty and meaningless. What De Quiros meant is clear enough: in the larger galleys of his day a horizontal platform (in Italian, *posticcio* or *aposticcio*) running the whole length of the waist of the vessel projected outboard on each side to afford greater leverage for the galley slaves when plying the great sweeps which formed the primary means of propulsion.

Does this fit the description of the device as a form of the double outrigger such as is common in Indonesia? Were we not obsessed by the idea of outriggers, the description would convey rather the vision of a bundle of reeds or canes lashed outboard below the gunwale of the canoe on each side. The craft mentioned were specifically described as very small (*canoas pequeñas*). Now in dugouts such as these were, the freeboard would be only a few inches; a bundle of canes or two or three bamboos lashed to each side would reach to the water, as described by De Quiros, and would be exactly comparable in position to the outboard galleries of a galley, which are actually termed "outriggers" by some writers (Tarn, 1933). This is a method of preventing the capsizing of narrow, unstable canoes in Burma, Siam, the Philippine Islands, and the Solomons (Guppy, 1887, p. 149). The same principle has also been adopted on the Colombian coast of South America, probably introduced by the Spaniards (Hornell, 1928).

The employment of the word *cañas* (literally "canes" or "reeds") is particularly significant, for no such material, not even bamboo, is employed in Polynesia to form outrigger floats, which surely are the equivalents of *contrapesos* if applied to an outrigger canoe. The use of the plural is not without significance, as the float is invariably a single log in Polynesia, whereas in the Philippine Islands, already in the possession of the Spaniards at the time of Mendaña's expedition, compound floats made up of two to five bamboos lashed together are part of the normal equipment of the larger vessels furnished with double outriggers belonging to that locality (Hornell, 1920, p. 76). This, in conjunction with the error of fact in the description by De Quiros of Marquesan methods of canoe carpentry, noted by Linton (1923, p. 347), suggests the probability of an actual mistake by De Quiros in writing up his recollections concerning Marquesan outrigger canoes, whereby he confused Philippine outrigger construction with what he had seen in the Marquesas.

A passing expression used by Porter, who visited the islands in 1813, is held by some to furnish corroboration of the former existence there of the double out-

rigger. Porter (1822, vol. 2, p. 73), in describing the method of rowing in Nukuhiva, says the fishing canoes "are managed with paddles more resembling an oar, and are in some measure used as such, but in a perpendicular position, the fulcrum resting on the outriggers projecting from each side".

Every other voyager who touched at the Marquesas from Cook (1775) onward, describes and figures single outriggers only. The explanation of the seeming contradiction in Porter's account appears to be that the single Marquesan outrigger was and is characterized by the projection of the proximal ends of the outrigger booms some distance outboard on the side opposite that on which the float is attached; this is clearly shown in Hodges' figure (Cook, 1777, vol. 1, pl. 33) as well as in the accompanying photograph (fig. 27) of a canoe taken in 1925. This projection on the off side is sufficient to permit of its use as the fulcrum for an oarlike paddle equally with the full length of the boom on the float side. Besides, unless the fulcrum be against or on the side of the canoe, paddles (sculls) could not be used in a perpendicular position.

Judging by the use to which it is put in the sailing outriggers of the Society Islands at the present time, the offside outboard projection of the booms seems to have been provided primarily as a purchase for a mast stay or shroud. Even in double canoes the booms projected outboard of each hull to a notable extent, as seen in K. von den Steinen's photograph of a double canoe at Hanavave (1928, vol. 3, pl. a 0, fig. 4). If this projection be considered as vestigial in the single outrigger and as denoting the former presence of a second float (double outrigger type), one would have to infer some vestigial reason for its presence also in the double canoe, whereas a sufficient reason is that given above, namely, to provide points of attachment for mast shrouds at a suitable distance outboard.

From these considerations it may be concluded that neither can De Quiros' passage be considered as conclusive of the former occurrence of double outriggers in the Marquesas, nor can Porter's reference be taken as having a similar import, or as confirming it.

In 1775 when Cook visited the southern islands, and in the period covered by the next few decades, constant reference is made to the use by the islanders of both single outriggers and double canoes and of their being paddled in the usual fashion by short paddles used by men in a sitting position; what Porter saw was probably some exceptional form of sculling akin to that practiced by Fijians.

OUTRIGGER CANOES

Outrigger canoes were the craft employed ordinarily in warfare and in fishing. As a consequence, the vessels used for these purposes differed considerably in construction and size.

War Canoes

De Quiros noted the larger craft during the stay of Mendaña's ships in Resolution Bay, Tahuata Island. Markham (1904) has not done full justice to De Quiros' description in his rendering of this passage, hence an amended translation, slightly expanded after a consultation of both Spanish texts, is given:

> Outside the village they had some very long and well-built canoes made from a single log into the form of an underbody (*quilla*)[2], prow, and poop, [the sides] heightened with planks strongly attached with cord made from coconut fiber. In each there was room for 30 or 40 Indian rowers. They gave us to understand, when they were asked by means of signs, that they went in these [large canoes] to other islands. They work with adzes which they make of thick fish bones or shells. They sharpen them upon stones which they have for this purpose.

[2] Compare the use on the northeast coast of England of the word "keel" for a local type of barge and the old British application of the term to the "longships" of the Norsemen and Saxons.

As will be seen from particulars culled from subsequent writers who had greater opportunities for observation, this is a concise and accurate description, except for one thing. Linton (1923, p. 347) suggests that De Quiros in writing up his experiences confused the Marquesas with some of the low coral islands which he had visited earlier in the voyage, when he says the Marquesans employed fishbone or shell adzes. There is no evidence favoring De Quiros' statement; every adze found in the Marquesas is of stone and native tradition knows of no other material for this purpose.

According to Porter's account (1822, vol. 2, pp. 13, 72), the war canoe ranged between 40 and 50 feet in length, 13 to 24 inches in beam, and 18 and 24 inches in depth. It was formed of a dugout underbody to which were attached ornamental bow and stern pieces. To get greater freeboard, a washstrake was sewn upon each edge of the dugout and sewn at each extremity to the proximal section of the ornamental end pieces.

The washstrakes, which were 12 to 18 inches deep, were furnished with a narrow flange projecting outward along the upper edge of each, forming a narrow gunwale. Linton (1923, p. 306) describes each end of either washstrake as cut away below in a long curve at its beveled and overlapping junction with the sides of the end pieces. The upper margins of the extremities of the two washstrakes were closed in transversely at each end by a vertical flange forming a low breakwater athwart the proximal section of each end piece of which it formed a part as described below; all these parts were secured together by sennit lashings passed through triangular holes in the edges.

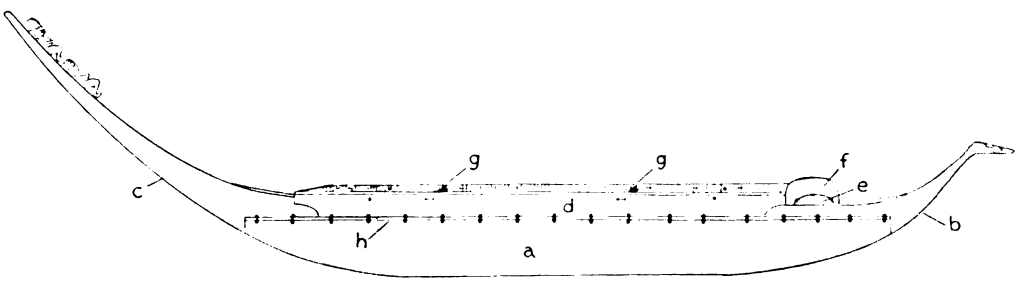


FIGURE 19.—Marquesan canoe hull: *a*, underbody; *b*, fore end piece with human face carved on expanded extremity; *c*, after end piece bearing two recumbent tiki figures; *d*, washstrake; *e*, transverse breakwater, in one with fore end piece; *f*, supplementary breakwater, lashed upon *e*; *g*, *g*, two bulkhead frames; *h*, batten covering side seam; feathers generally caught under each lashing; tips directed aft.

Long pads of broadly plaited three-strand rough sennit were placed within the seam between the underbody and the washstrakes and end pieces, the joint protected by a narrow covering strip of bamboo or soft wood, sewn over it on both the inner and the outer side. The outer of these covering battens was painted black and decorated at each lashing with tufts of white feathers with the plumes directed toward the stern, the quills being caught under two or three of the sennit loops of the sennit lashing. This mode of decorating the outer battens is precisely similar to the New Zealand custom.

When all the attachments had been made, the lashing holes were calked with coconut fiber beaten in with the aid of a pointed stick and a wooden mallet.

The ornamental prow piece was carved out of the solid; in canoes of average size and type it measured from 12 to 16 feet in length, whereof 6 feet or more would rest upon the beveled edges of the forward region of the underbody. This

after section, which fitted between the forward ends of the washstrakes, formed a short end cover, flat on the upper surface, and vertical-sided but deeply hollowed beneath, making it comparable with the end covers of Fijian canoes. Across the distal end of the flat upper surface of this after section there rose a low transverse ridge, the breakwater, upon which was usually lashed, vertically, an arched plank forming a supplementary breakwater to keep water from entering the waist when the canoe was pounding through rough seas. This supplementary breakwater had the form of a violin bridge; it was lashed at the center to the basal breakwater ridge and at the sides to the ends of the two washstrakes (fig. 19).

A deep heel-like vertical projection from the under surface of the prow piece fitted over the truncated fore end of the underbody to avoid a break in the curve line up from the bottom.

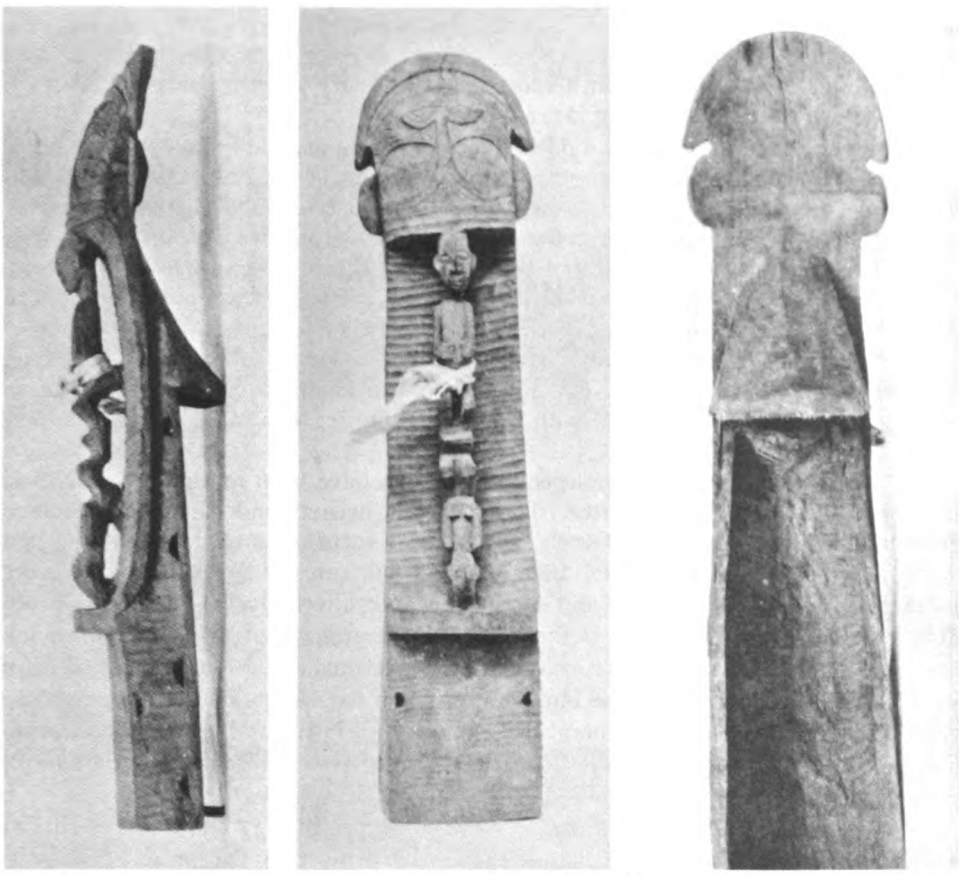


FIGURE 20.—Bow piece of an old Marquesan model, side, top, and bottom views (after Linton, 1923).

In front of the breakwater the upper surface of the prow piece in the ordinary type continued flat and horizontal (fig. 20). It projected a varying distance beyond the end of the underbody—from 6 to 10 feet in large canoes. For the greater part of its length it equaled in width the end of the dugout hull to which it was lashed. Toward its distal end it narrowed slightly and then expanded into a short and broadly spathulate figurehead, the forward margin being bowed horizontally.

The upper surface, somewhat convex, was carved into a representation of a flat human face with the usual conventionally grotesque features given by the Marquesans to their tiki figures. As the upper surface of the figurehead was either horizontal or slightly bent downward, the ugly face gazed upward or slightly forward (fig. 20).

A second type of prow piece appears to have been employed, but almost the only evidence regarding it must be drawn from the conventionalized models being made at the present day in Fatuhiva and from older and more reliable ones found in various museums, notably in that of Neuchâtel. In this type the distal section, instead of being horizontal, rises upward in a curve of varying length and abruptness. In the models made in recent years, it rises at an abrupt angle and passes into a nearly vertical "neck" which ends in a forwardly directed terminal "head," expanded horizontally but showing a bird's-head outline when viewed from the side (fig. 19). In older models, the inclination of the neck is much less marked, the angle of elevation varying between 15 and 45 degrees from the horizontal; all agree in having this neck region, though it may be very short in some; in others it may be thrice as long. (See fig. 21, *b, c.*)

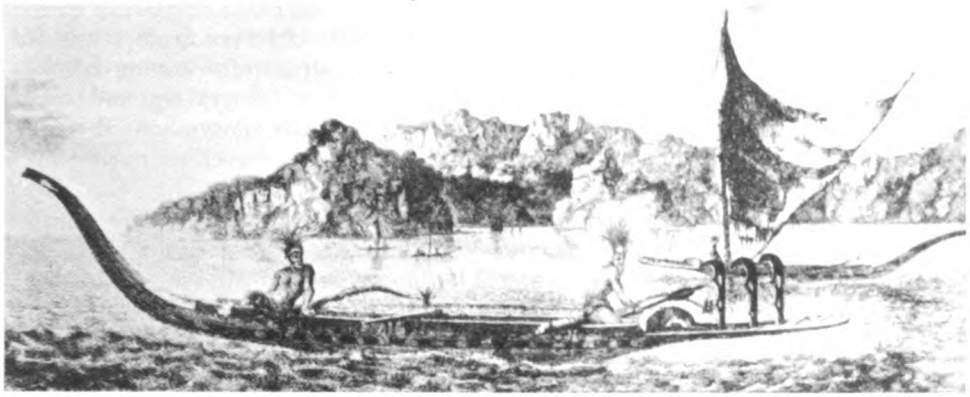
Apart from the evidence of models, there is the undisputable fact that the prow pieces of the double canoe photographed by Christian in 1894 at Hakaui in Nukuhiva show the same feature most distinctly. Curiously enough the angular elevation of the long necks of these prow pieces appears from the photograph (Christian, 1910, p. 180) to have differed the one from the other to some small extent. Both are long and swanlike in side view, ending in the characteristic bird's-head terminal, with human features carved on the upper surface.

Corroboration is also afforded by the figure of a double canoe given by K. von den Steinen (1925-28, vol. 3, fig. 4), which was photographed at Hanavave in Fatuhiva. It is almost identical with Christian's figure, both hulls having similarly curved heads.

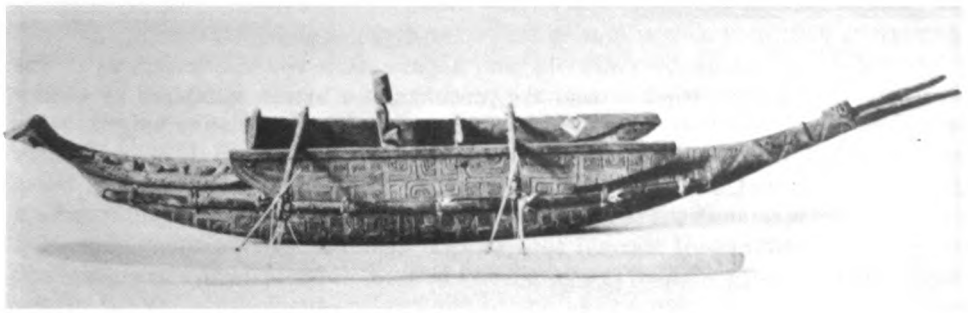
As models showing this swan-neck prow piece have been brought from Nukuhiva as well as from Fatuhiva, the islands where Christian and K. von den Steinen respectively saw actual canoes with similar head form, it is evident that the two varieties of prow, the horizontal and the upcurved, can not be explained as being local types, say of the northern and southern islands alternatively. It is more probable that the upcurved head was the distinctive figurehead of a type of canoe not commonly in use, but the one considered by model makers as the highest or most important creation of the canoe builder's art; this would mark it as the one to be copied rather than those in general use—those with horizontal prows. It is probable that the swan-neck type was the prerogative of powerful chiefs, as the double canoe at Hakaui certainly was.

A figure illustrating Cook's second voyage (1777, pl. 33) shows three similar upright ornaments, set in line ahead, upon the projecting flat prow of an outrigger canoe (fig. 21, *a*). Each is curved backward, scimitar-like, at the top, and has two pointed projections on the after side of the shaft. In this connection must be mentioned an observation of C. S. Stewart of the *Vincennes* (1831, vol. 1, p. 243), who, describing a canoe 20 feet long, says: "The low prow, almost on a level with the water line, projected horizontally several feet before the body of the canoe, and terminated in a flat figurehead carved into a hideous face. Between this and the bow, three green coconut leaves, 4 or 5 feet high, were fastened erectly."

D'Urville (1834-35, vol. 1, p. 486) mentions the same custom but gives the number of coconut leaves as "three or four" and the height as 5 or 6 feet.



a



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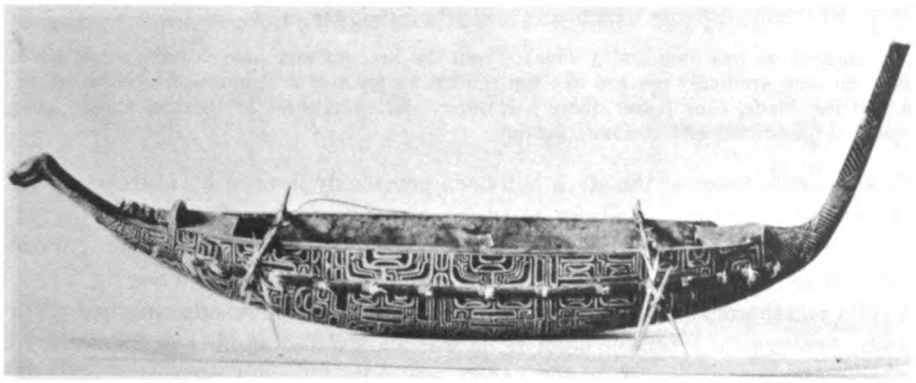


c

FIGURE 21.—Marquesan outrigger canoes: *a*, canoe drawn by Hodges in 1774 at Vaitahu, Tahuata (Cook, 1777, vol. 1, pl. 33), only sketch extant of an old type of outrigger canoe under sail; *b*, *c*, old models (Neuchâtel Museum), differing considerably and probably from different localities, stanchion attachment present in both but in imperfect condition; apart from differences in the two ends underbody in *c* deeper than in *b*, which involves differences in proportions and shape of washstrake and breakwater; bulkhead amidships in *b*, and incised patterns different from and of finer execution than in *c*; improbable that underbodies of canoes were ornamented with incised patterns as shown in these models.

A view of Taiohae (Madisonville), Nukuhiva, in Porter's Journal (1822 ed., vol. 2, opp. p. 15), corroborates this evidence, for in the foreground is a canoe with a low bow whereon stand two conspicuous, tall pinnate leaves, unmistakably of the coconut palm. The probability seems to be that Cook's engraver made a mistake in his work, interpreting the original sketch of three gracefully waving coconut leaves by similarly curved ornamental wooden uprights. Engravers and copyists have perpetrated worse blunders than this. Two similar canoes figured on the same plate are without these peculiar ornaments, which are, therefore, not integral parts of the design.

The underbody at the stern end curved up from the bottom rather more sharply than at the forward end, and was continued into a long sweeping terminal curve by what Porter (1822, vol. 2, p. 13) described as "a slender projection in the form of a sleigh runner". This stern piece in its various parts was comparable with the swan-neck form of prow piece, except that its distal section beyond the end of the underbody was much longer. The proximal section, resting upon the underbody, was much longer than the corresponding region of the prow piece and like it was hollowed deeply beneath; the upper side rounded in above to a well-marked median ridge. The general structure, apart from the upcurved extremity, again suggests comparison with the hollowed-out end cover or decking of Fijian design.

A model, now about 60 years old, and apparently a votive offering, as it was found suspended in a little box near the precincts of a marae, is figured by Caillot (1909, pl. 89). The upcurved stern projection is of great relative length, being one third the total length of the hull; it is remarkable for having three tiki figures carved in the round, recumbent on its upper surface. The float is missing, but a number of stick connectives still remain bound to the two booms, proving it to be a genuine representation of the old type of outrigger canoe. Another figure of a model canoe given by Caillot (1909, pl. 88) is much inferior in workmanship and is spurious in that the connectives are of the modern plank form instead of the stanchion type shown in the other.

In some canoes the stern piece appears to have been double, for Stewart (1831, vol. 1, p. 244) says of one which was a single outrigger, and

> . . . perhaps 20 feet long and 3 wide. From the keel on each side, a light round timber extended, curving gradually upward like the runners in front of a sleigh, and terminating in a broad flattened blade, 6 or 8 feet above the water. Between these at the top, a rude image of a god was suspended in a reclining posture.

This bipartite form of the stern had been previously noticed by Marchand, who discovered the northern islands in 1791, his remarks (1798-1800, vol. 1, p. 131) being: "L'arrière est formé par deux planches de quatre pouces de hauteur, posée de champ et se relevant sous la figure d'une S allongée et couchée." (See fig. 21, *b*.)

A high rectangular platform was erected either in the bows or amidships (Porter, 1822, vol. 2, p. 72) for the chief if he was aboard and another at the stern for the steersman. According to Porter (1882, vol. 2, p. 72) and Stewart (1831, vol. 1, p. 245), when the canoes were on warlike expeditions or ceremonial visits, cords closely hung with tufts of human hair, the trophies of victorious conflicts with enemies, stretched from the summit of the high curving stern to the two after corners of the steersman's seat, which was further decorated with white cloth and a fringe of palm leaves. A model in the Peabody Museum, Salem, Massachusetts, dating from 1817, still shows the fringed stern cords as thus described (fig. 22). Stewart (1831, vol. 1, p. 327) also records that a skull was lashed on each corner of the stern platform.

The crew sat on thwarts, which, in a well-preserved but incomplete underbody at Hakaui, had rested upon cleats or bosses left below the edge of the dugout when it was hewn out; these had been carved into the form of squat human figures of the tiki type. A complete underbody lying alongside of it had none of these bosses and it is uncertain how, in it, the thwarts had been supported.

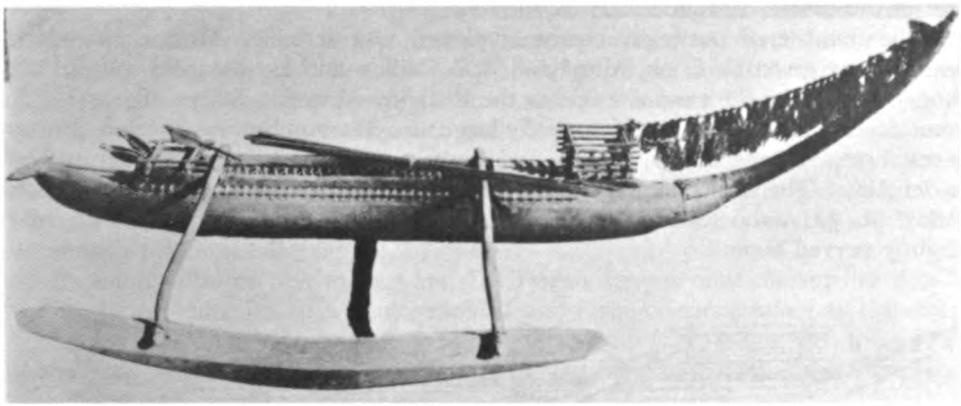


FIGURE 22.—Oldest known model of outrigger canoe from the Marquesas, obtained in 1817 and unique in having the two booms attached directly to float as in Hawaiian attachment (Peabody Museum, Salem, Massachusetts).

According to Porter (1822, vol. 2, p. 13), three transverse wooden bulkheads "placed in the manner of partitions" divided the interior (hold) into four sections, performing the function of timbers to keep the sides from closing in. These bulkheads are also commonly shown in models, the upper edge cut flush with the gunwales. As seen in one model (Cranmore Ethnographical Museum, Chislehurst), their only attachment to the hull of the canoe consists of a sennit lashing on each side passed through a pair of holes in the washstrake, just below its upper edge,

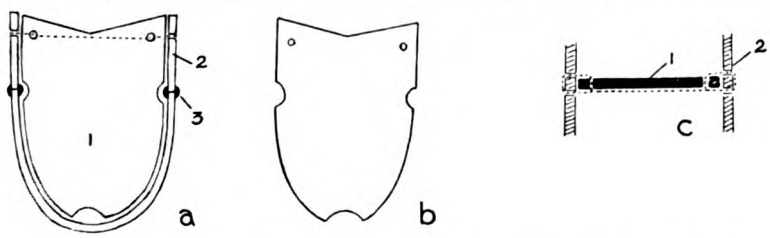


FIGURE 23.—Bulkhead frame of Marquesan canoe. *a*, cross section of hull: 1, frame in position, secured to sides by lashing to washstrake (2); 3, seam between washstrake and underbody protected within and without by a batten; bulkhead notched at base for passage of bilge water. *b*, bulkhead removed. *c*, horizontal section showing course of lashing by dotted lines: 1, bulkhead, perforated at each side by single hole; 2, washstrake with paired holes. (From a model in the Cranmore Ethnological Museum).

and through a single hole in the adjoining top corner of the partition. After securing one side in this way the sennit is carried across to the other side and the single stitch repeated, securing the partition to the washstrake. The lateral edges of the partition (fig. 23) lie close against the inner sides of the hull, with a notch cut in each edge to fit over the projection inward of the batten covering the washstrake

seam; another and larger notch is present in the bottom edge to allow the free flow of bilge water from one compartment to another. The purpose of these partitions is to stiffen the hull against stresses which might otherwise cause the collapse of the comparatively thin sides.

Nowhere else in Polynesia are such partitions found, but one of similar form is shown by Paris (1841, pl. 106) in a sectional figure of a canoe belonging to Satawal in the central Carolines.

The number of outrigger booms employed was variable. Most commonly it was two, as given by Cook, Marchand, and Caillot, and as shown by various old models, including the exquisite one in the Peabody Museum, Salem (fig. 23). In some canoes, probably those of specially large size, the number was greater. Porter gives three, "from the bow, middle, and stern", in canoes "generally about 40 feet in length". The same number is shown in a canoe figured by D'Urville (1846, Atlas, pl. 52), who also illustrates one (1834, vol. 1, pl. 61, fig. 2) with four slightly curved booms.

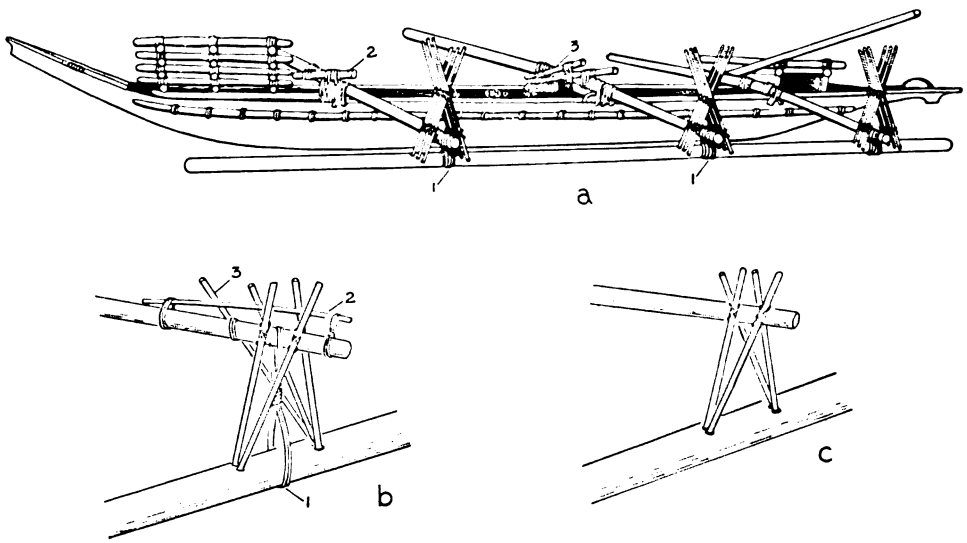


FIGURE 24.—Ancient method of Marquesan outrigger attachment. *a*, Nukuhiva canoe (slightly modified from D'Urville, 1846, pl. 52, fig. 1), remarkable for low level at which booms are attached; number of paired stanchion connectives difficult to make out in original drawing, but probably three pairs to each boom: 1, vertical sennit brace around float supplementing each attachment; 2, 3, Spanish windlass. *b*, old form of attachment (after K. von den Steinen, 1928, vol. 3, α o, fig. 3): 1, sennit brace; 2, tension rod passing over axils of two overcrossed stanchions; 3, single supplementary stanchion apparently present. *c*, ordinary form of attachment in old models, no suspensory brace present; probably the makers omitted it to save trouble.

The inner ends of the booms were fitted athwart the hull, resting either directly upon the gunwales, or upon comb cleats fitted thereon, and made fast by lashings passed through paired holes in the washstrake below. These lashings were kept taut by the use of short rods employed in the same manner as the Spanish windlass. By this arrangement the booms could be removed or replaced instantly, without the trouble of remaking the lashings. This implement is shown both in D'Urville's sketch of an outrigger canoe (fig. 24, *a*) and by K. von den Steinen (1928, vol. 3, pl. α o, fig. 4) in an illustration of a double canoe.

With the disappearance of the war canoe and the introduction of a new type of outrigger attachment some half century ago, remembrance of the earlier form of boom and method of attaching the float to the boom has been lost in the islands. Models now being made in Fatuhiva, purporting to represent the old-time type of war canoe, are fitted with two straight booms connected to the float by means of the barrel-stave connective as used in the present-day fishing canoes. The only reliable information regarding the type thus displaced is that derived from old models in museums and a few contemporary illustrations, notably the one in D'Urville's "Voyage au Pole sud" (1846), though even this is deficient in detail (fig. 24). From these it is seen that the connectives consisted normally of 2, 3, or even 4 pairs of straight stanchions to each boom; they were set obliquely, 2 or 3 on each side of the boom. The lower ends of those on the same side were inserted close together into the upper surface of the float; their upper ends diverged, crossing and interdigitating with their opposite numbers above the boom, to which they were lashed with sennit (fig. 24, *c*).

Probably both the best models and D'Urville's figures omit the smaller details, for in the reproduction of a photograph of an outrigger canoe taken at Hanavave by K. von den Steinen (1928, vol. 3. pl. α o, fig. 3) a tension rod is seen to be fitted in the upper axils of two pairs of overcrossed stanchions, together with an unpaired stanchion and a cord or sennit brace, as shown in figure 24, *b*.

The only other illustration of the Marquesan attachment to be noted is that of a Nukuhivan outrigger given by Langsdorff (1812), which is copied by K. von den Steinen. The drawing of this fitting, though not definite, as no perspective view is given, indicates that not more than two stanchions were employed, one on each side of the boom, both placed vertically. No cord brace is shown. This arrangement introduces a type of attachment at variance with all other information and leaves doubt as to the accuracy of the representation, especially as in another plate (Langsdorff, 1813, vol. 1, p. 88) a small figure of an outrigger canoe appears in which the float is shown as tied directly to the booms.

The outrigger booms appear to have been both curved and straight. Many old models show them as straight, but in Cook's figure (1777, pl. 33) they are strongly curved, the ends bent down till they reach close to the surface of the water and immediately over the float, to which they are connected by several stanchions. D'Urville's figure of a four-boomed canoe (1834, vol. 1, pl. 61), a poorly executed sketch, also shows them somewhat curved.

In a finer figure (D'Urville, 1846, pl. 52) the booms appear straight, but this must be a defect in the drawing, for the boom ends, as shown, almost touch the float, which would be impossible unless the boom curved downward owing to the considerable vertical distance separating the gunwale of the canoe from the surface of the water in which the float is immersed in large part. The stanchions are shown inserted so close to the axis of the boom as to cross and interdigitate at a relatively considerable height above it; they are lashed to the sides of the boom quite low down, and again to one another at the point of interdigitation.

A vertical sennit brace lashing, passed around both, appears also to have connected the boom and float a very short distance apart (fig. 24, *a*, 1). This method of attachment, which brings the distal end of the boom almost down upon the float, could only be arranged if the boom were curved downward toward its distal extremity.

If the booms in some canoes were straight, as testified by several old models (Neuchâtel and Hamburg Museums), this was a variation of minor importance

and of easy and natural genesis; it required nothing more than some lengthening of the stanchions and the spacing farther apart on the long axis of the float of the group insertions of their bases in order to enable the boom to be lashed closer to the point of interdigitation and at a higher level (fig. 24, *c*).

It is probable that the original method of attachment was direct, the stanchion attachment being a modification brought about by contact with a foreign culture—hence the combination of curved boom and stanchion attachment. Direct attachment appears, indeed, not to have died out entirely until quite recent times, for the beautiful old model in the Peabody Museum, Salem, shows each of the two curved booms to be attached directly to the float by cord lashing passed several times through a V-shaped perforation in the ridged upper surface (fig. 22). This is the only instance of this method known from the Marquesas, apart from that doubtfully recorded in Langsdorff's engraving, but as it is the charactertistic system of attachment in Hawaii to the north and in Napuka in the Tuamotus, the nearest land to the south, colonized according to tradition from the Marquesas, it is probably the method that was employed by the ancestors of the present Marquesans prior to admixture with a foreign stock.

The float, as seen in the Peabody Museum model, is about two thirds the overall length of the hull and end pieces; the lower side is strongly bowed longitudinally, the upper with a well-developed median ridge; the ends are rounded and sharp horizontally.

These war canoes were on occasion converted into the double form by booms laid over both and lashed to the gunwales.

Mast and Sail

Were it not for an illustration of a number of sailing canoes seen by Cook at Resolution Bay, Tahuata, in 1774 (fig. 21) and a remark by Porter, we should know no details of the Marquesan sail rig. As it is, Cook's plate shows it to have been almost identical with that of Hawaii. The sail, made of matting, was triangular and set apex downward. Its two long sides were laced or tied respectively to a mast stepped vertically, and to a spritlike boom tilted at a very high angle from the horizontal, so giving it the appearance of an inverted shoulder-of-mutton sail, as stated by Porter (1822, vol. 2, p. 73). The mast was stepped forward of midships. Cook's artist shows two weather shrouds that appear to be led to one of the outrigger booms, and another on the lee side, attached below to the outboard projection of the butt of the same boom. Also a forestay leads to a point on the flat headboard and a guy is attached near the outer end of the yard.

Ownership

The separate parts making up the canoe and even each paddle had their separate proprietor. Porter (1892, vol. 2, p. 72) records that

> . . . to one belongs the pieces projecting from the stern, to another the part forming the bow. The pieces forming the sides belong to different persons, and when a canoe is taken to pieces the whole is scattered throughout the valley and divided, perhaps, among 20 families. Each has the right of disposing of the part belonging to him, and when she is to be set up everyone brings his piece, with the materials for securing it. The setting up of a war canoe goes on with the same order and regularity as all other operations. These canoes are owned only among the wealthy and respectable families, and are rarely used but for the purposes of war or for pleasure, or when the chief persons of one tribe make a visit to another.

Fishing Canoes

There were two quite distinct types of fishing canoe, one in which the hull was very beamy and deep, the other consisting of small dugouts without washstrakes.

The only authority to describe the first type is Porter. Curiously enough, none of the older people of the islands know anything about these great fishing canoes, although they are conversant with many of the details of war canoes, single and double, in spite of never having seen any. Porter (1822, vol. 2, p. 73) describes fishing canoes seen in Nukuhiva as

> . . . vessels of a larger and fuller construction [than the war canoes], many of them being 6 feet in width, and of an equal depth. They are managed with paddles more resembling an oar, and are, in some measure, used as such, but in a perpendicular position, the fulcrum resting on the outriggers projecting from each side. With these they proceed to the small bays on the coast, where they fish with the scoop net, and with the hook and line.

Previously, at Uapou, Porter (1822, vol. 2, pp. 13-14) had seen "the frames of boats of a different construction [from the ordinary type of outrigger] set up shorter and wider than the [war] canoes and in shape somewhat similar to the common whaleboat".

These northern islands were discovered in 1791, the year when British whaling attained its maximum in the South Sea—75 London ships were then engaged in this fishery (Lydekker, 1911)—and as the neighboring seas were a famous locality for the cachalot whale, the islands were frequently visited by whaling ships during the long interval of 22 years between that year and Admiral Porter's raiding cruise in 1813 against British whalers in the Pacific. For this reason, even apart from the probability that the whalers, according to their custom elsewhere, recruited extra whaling hands in the northern Marquesas, it appears likely that the beamy fishing boats of whaleboat design described by Porter were nothing but rude copies of the European model, just as the *vaka poti* of the present day is admittedly constructed on European lines. Apart from Porter's scanty notice, we have no confirmation or description from any other source.

The small harbor craft used in ordinary fishing and in inshore work was a simple dugout, without washstrake or end pieces. It had two booms (*kiato*) attached to the float (*ama*) by stanchion connectives (*tiatia*). It has been described as extinct for many years past, but I was fortunate to see one, probably the last remaining, at Hakaui in 1925. It was a small one-man dugout, with two straight booms each attached to the float by two stick stanchions crossing above the boom to which they were lashed. One stick in each pair was vertical, the other obliquely disposed on the aft side of the fore boom and on the fore side of the after boom.

Ornament

Various forms of ornament and decoration have already been mentioned incidentally—the tiki images at the stern and on the thwart seatings, the grotesquely carved face used as a figurehead, the painting and feather decoration of the battens covering the side seam, the use of festoons of human hair at the stern and of coconut leaves on the prow. Another bizarre custom was to affix skulls of enemies slain in battle upon the fore end piece (Fanning, 1833, pp. 129, 146). Dumoulin and Desgraz (1843, p. 282) also record this decoration, and add:

> These skulls, bleached by time, are curiously ornamented; a piece of mother-of-pearl on which a black pupil is painted is inserted into each orbit; a false nose of wood is fitted into the nasal cavity and below the zygomatic arch; on each side of the jaws the long tusk of a boar curves upwards. Tufts of hair, black or gray, are hung upon these relics, which bear witness to the bravery of him who possesses them.

The prow piece, in common with the stern piece, was occasionally ornamented with tiki figures along the middle line (fig. 20).

The custom of decorating the prow with three or four erect coconut leaves is probably of significance similar to that recorded by Gill (1880, p. 104), who states that the fishermen of Mangaia in the Cook Islands would never go to sea at the beginning of the fishing season without first placing in the bows of their canoes a palm frond representing their tutelary deity Mokoiro. This is one more of the numerous links connecting the Marquesas with the Cook Islands and thence with New Zealand.

Besides these decorations, there seems to have been much incised carving on the end pieces and upon the washstrakes of valuable canoes, the patterns being generally angular-geometric and less commonly curvilinear as used in tattooing. Modern canoe models are misleading in the profusion of carving with which every part is covered, even to the bottom.

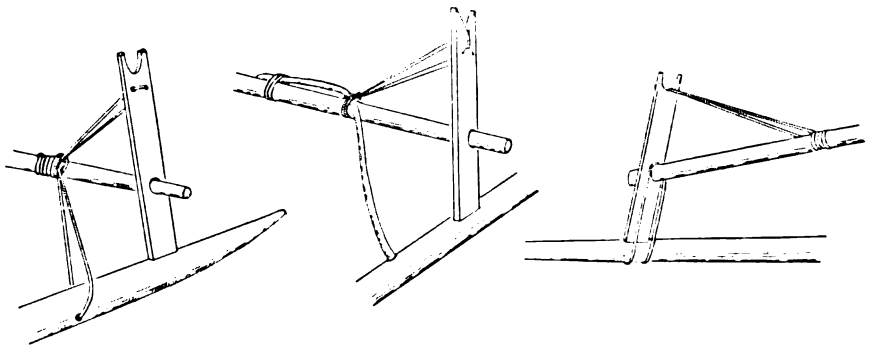


FIGURE 25.—Outrigger attachments in modern Marquesan canoes; single plank connective replaces several pairs of overcrossed stanchions.

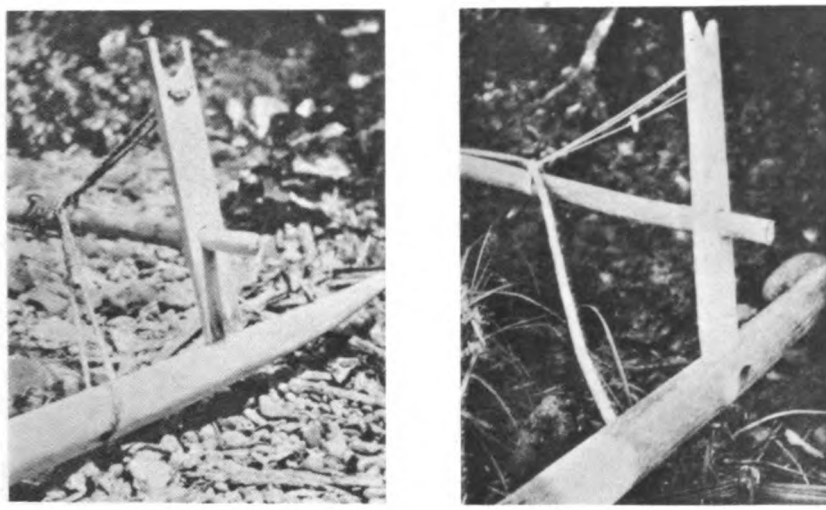
MODERN CANOES

The present-day outrigger canoes in use in the Marquesas are the result of miscegenation, hybridized offspring of the old native single outrigger, the European whaleboat, and quite possibly the East African double outrigger. Their chief claim to notice lies in the striking example they afford of the rapidity with which new designs and appliances of obvious superiority to the old ones may be adopted by native communities and rapidly disseminated, extirpating indigenous equivalents. They consist of small fishing dugouts (*vaka*) and larger clinker-built, double-ended planked boats (*vaka poti*); both are provided with single outriggers.

The *vaka* are all of small size, 12 to 18 feet in length with a beam of 12 to 18 inches and a depth approximately the same. The two ends are similar, curved up from the bottom into a short straight cutwater. The dugout underbody is slab-sided, and the bottom, rounded transversely, is straight for most of its length. Narrow washstrakes give additional freeboard. Each consists of a thin plank, 4 to 6 inches deep and 0.5 inch thick, nailed by its lower edge, clinker fashion, against the outside of the edge of the dugout. The ends are bent inward at each extremity of the canoe, where they are sawed off obliquely and nailed together. There is no end piece of any sort, the washstrakes extending continuously the whole length of the hull without appreciable sheer. In the better-made *vaka* a very short triangular decking board is inserted at each end, resting upon the edges of the dugout underbody.

The outrigger device is formed of two straight booms, usually of hau (*Hibiscus tiliaceus*), each joined to the float by means of a vertical or slightly inclined plank

connective; in many canoes a barrel stave is employed for this purpose, and so far as can be learned this was its original form when this method was introduced 40 or 50 years ago by a mulatto who had settled in Hivaoa. The lower end is inserted into a slot in the float. A hole cut about the middle or a little below that point admits the distal end of the outrigger boom, which is usually thinned down or shouldered to prevent it from slipping too far through the hole. The connection is secured by a sennit brace passed in varying manner from a point on the boom about a foot inward from the distal end, through holes or a notch in the upper part of the plank connective (fig. 25). There is usually a side brace of sennit or sometimes of withy between the point at which the first brace is lashed to the boom and another point on the float a foot or thereabouts on one side of the insertion of the plank connective. A notch, semicircular or angular, is cut in the upper end of the connecting plank or stave, as a rest for the owner's fish spear[3]. (See fig. 26.)



a *b*

FIGURE 26.—Modern Marquesan methods of attaching float to booms by board connective: *a*, supplemented by sennit brace passing through transverse hole in float; *b*, bent withy used, lower end inserted into float, upper end tied to boom (from photographs taken in Hivaoa in 1925).

The float is cylindrical and may be pointed at one or at both ends.

The booms are lashed athwart the canoe two or three feet from the respective end, separated by a rather unusually long interval. To attach each boom to the body of the canoe, two holes are bored below the gunwale, one on each side and opposite one another in the position they would have if the boom were to be lashed down upon the gunwale in the usual Polynesian fashion. Through these holes hardwood pegs several inches long are driven half way, and it is to these that the booms are lashed. In some canoes, instead of these short pegs, a single long rod is passed from side to side through a hole in each washstrake and to this the boom is lashed at each side; this method is also found in Indonesia (Hornell, 1920, p. 88).

[3] On the coast of East Africa, in Kenya, Tanganyika, and Zanzibar, double-outrigger canoes are in use with attachments of closely related type, of which descriptions have been given by Haddon (Man, 1918, nos. 29, 68) and Hornell (Man, 1919, no. 55; Man, 1920, no. 67). It is therefore not unlikely that the mulatto or negro who is credited with the introduction of the current method into the Marquesas may have come from East Africa.

The *vaka poti* is a larger edition of the same type, with additions adopted from the European whaleboat (fig. 27). It runs from 20 to 26 feet in length with a beam of from 2 to 3 feet and a depth of about 2.5 feet. The hull varies considerably. In some it consists of a well-formed dugout underbody on which a wide washstrake is fitted in clinker style, with an outer beading along the upper edge and commonly a low fore weatherboard at each end. In the majority the dugout underbody is reduced to a median strip a few inches wide, convex without, channeled within. Slightly curved stem and stern posts are bolted onto the ends of this keel, and a few light frames are added in European style. The sides are clinker-built, of several overlapping strakes of imported deal planking. At the ends these are bent inward and nailed into grooves in the stem and stern posts. A short decking is provided at each end, sunk some inches below the gunwales, as are also three thwarts which brace the sides of the hull, the forward one being pierced to receive the mast.

FIGURE 27.—Modern outrigger canoe (*vaka-poti*); differs from old type in being partially plank-built with short deck at each end and board connective replacing overcrossed stanchions (photographed in 1925 in Hivaoa, Marquesas).

The outrigger is similar in design to that of the smaller dugout fishing canoes.

A curious peculiarity of the Marquesan outrigger canoes, both those now existing and those formerly in use, is that the outrigger is commonly on the starboard side, the converse of the usual practice in other Polynesian islands. Even where the two ends are identical, they are paddled generally with the outrigger on the right of the paddlers. The same custom prevails characteristically in Napuka, which is reputed to have been colonized by Marquesans; it is also common in the eastern Tuamotus, where, too, little difference is made between the head and the stern in shape.

Linton (1923, p. 300) writes that a *vaka poti* is provided with short oars of ordinary European form and "a leg-of-mutton sail of canvas like that commonly used on ship's boats; when not in use the sail is stored under the short deck at one end of the boat, while the poles which serve as mast and boom are lashed along the crosspieces of the outrigger. . . . The natives do not seem to understand tacking, and never sail except with a following of wind." The *vaka poti,* according to Linton, are not used for interisland travel.

DOUBLE CANOES

Porter (1822, vol. 2, pp. 72, 73) recorded:

> The canoes used for the purpose of navigating from one island to another, a navigation very common, are similar in their construction to the larger kind of fishing canoes, and are secured together by beams lashed across. These are called double canoes, and are furnished with a triangular sail made of a mat, similar to that generally called a shoulder-of-mutton sail, but placed in an inverted position, the hypotenuse forming the foot of the sail, to which is secured a boom. These are also worked during a calm with paddles, and appear capable of resisting the sea for a long time. The canoes formed for the sole purpose of going in search of new lands are of still larger construction, and are rigged in the same manner. [See fig. 28.]

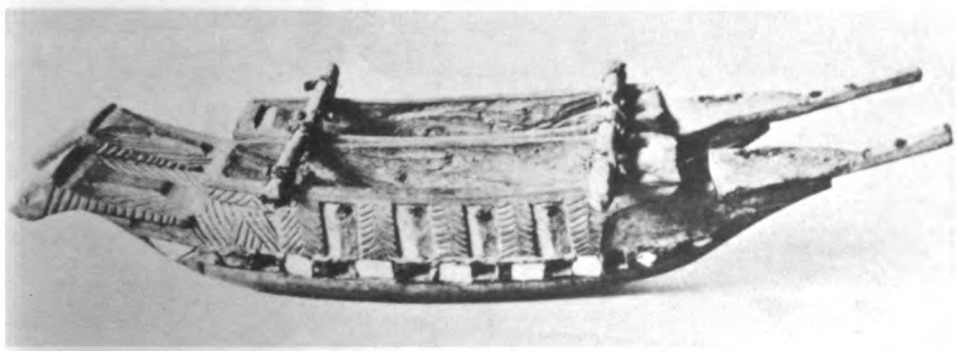


FIGURE 28.—Old model of Marquesan double canoe (Neuchâtel Museum), probably only one of its kind in existence; discontinuous line of shell inlay along washstrake seam, a feature not recorded by any writer; underbody correctly shown without incised ornamentation.

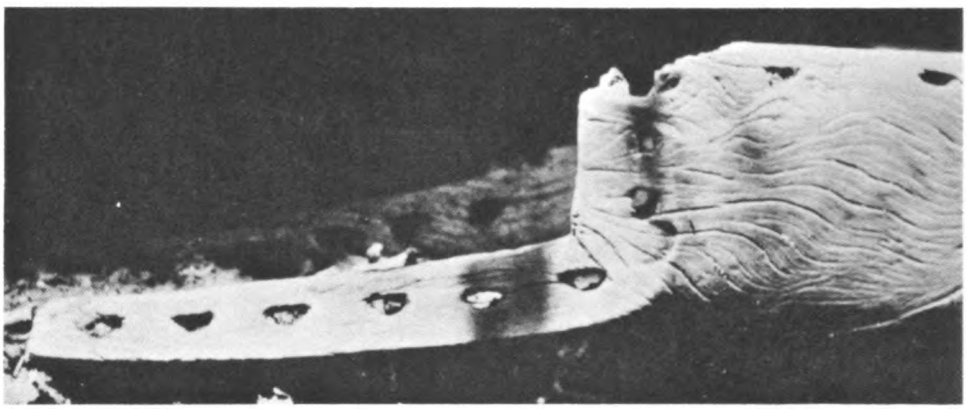
The pressure of periodical overpopulation and the resultant tribal warfare were the usual impelling factors in voyages of discovery. It was traditional knowledge that other island groups existed. Whenever a family or clan or tribe found their enemies too powerful, emigration, perilous though it was, offered the only alternative to slavery and death. The last preparation in Nukuhiva for one of these ventures is probably that related by Porter (1822, vol. 2, p. 51):

> Temaa Tipee and his whole tribe, about two years ago [1811], had many large double canoes constructed for the purpose of abandoning their valley and proceeding in search of other islands, under the apprehension that they would be driven off their land by other tribes. But peace took place, the canoes were taken to pieces, and are now carefully deposited in a house, constructed for the purpose, where they may be kept in a state of preservation to guard against future contingencies.

Love of adventure and of renown were other motives that influenced men from time to time to organize similar expeditions. Within historic times none returned to tell of success, but this did not deter other adventurers from seeking new homes in the unkonwn; Porter (1822, vol. 2, p. 52) writes that the priests who had predicted success, a few days after the departure of the canoes would go "lurking to the houses" and in a squeaking, affected voice, inform the people that their friends had found a land abounding in breadfruit, hogs, coconuts, and everything that could be desired, and invite others to follow them.

Two decaying double-canoe underbodies, the last surviving, were seen in Hakaui Valley, Nukuhiva, in 1925, and I obtained permission from the tribal chief to remove the end portions of the sounder one for the British Museum, where they now are. The wood used in both was *tamanu* (*Calophyllum inophyllum*). Tool

marks had been obliterated, and the surface, both inside and out, rubbed down to perfect smoothness. The longer underbody only was complete; the length was 40 feet 6 inches, the extreme breadth 4 feet, tapering at the ends, which are similar, to 2.5 feet. So old are these remains that local tradition about them is vague and unreliable. Some hold that they had been separate war canoes, each provided with an outrigger, but from the evidence of the photograph given by Christian (1910, p. 180), which shows the two hulls ranged side by side with three cross booms in position, it seems certain that they were used also in the double form, even if their normal use was with the outrigger.



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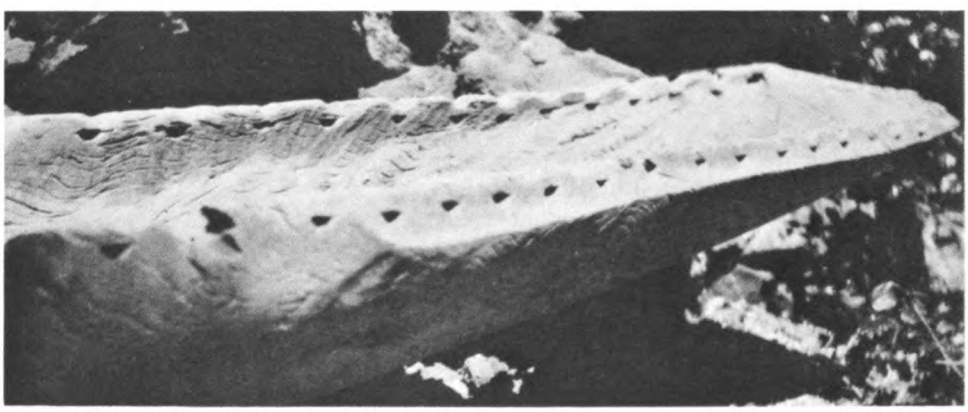


b

FIGURE 29.—After section of one of two Marquesan hulls formerly used as a double war canoe: *a*, forward end, showing the after part of a great mortise-and-tenon joint employed in joining the two underbody sections, end to end, to form hull of length required; *b*, stern end, showing triangular lashing holes along sides and beveled margin of aftermost part, to which curved end piece was lashed (photographed in 1925 at Hakaui, Nukuhiva).

The shorter and incomplete underbody was the better preserved, as well as the more interesting (fig. 29); it showed clearly the method employed to obtain the requisite length when a trunk of sufficient length and girth was not obtainable to make the underbody in a single piece.

Only the main section remained, the shorter additional forward section having disappeared, together with the ornamental end pieces, washstrakes, and thwarts. It measured over all barely 35 feet, with a maximum beam of 3 feet 4 inches, diminishing to 1 foot 6 inches at the stern; the maximum depth outside was 1 foot 9 inches. The hollowed interior was distinctly trough-shaped, the sides vertical, the bottom flat with the angles, inside and outside, rounded. The bottom was nearly 3 inches thick, and at some distance from the end (stern) began to slope gradually upward, rounding in at the same time.

The upper edge was horizontal and flat except for the last 6 feet of the stern where it was beveled and thickened to form a projecting angular ridge suitable for the seating of the ornamental stern piece. Along the whole length of the edge and stern ridge was a series of triangular slots, through which the sennit lashing was passed when sewing on the washstrake and end piece (fig. 29, *b*). The other end, to which a lengthening piece had been joined when the canoe was in a complete condition, showed plainly the method which had been employed. It had been cut back on the sides and fashioned in such a manner that a great tongue-shaped continuation of the bottom projected about 2 feet as a massive tenon, which had fitted into a corresponding slot or mortise in the missing section used for lengthening (fig. 29, *a*). The end of the tenon was cut square across; its sides sloped backward and upward to within 8 inches of the upper edge of the underbody, ending there in a vertical cut. The edges of the joint were beveled and perforated at intervals of 5 to 6 inches by triangular holes for lashings. The method of joining two sections of an underbody, indicated here, is identical with that followed in New Zealand as illustrated by Best (1925, fig. 33), except that the short vertical cut from the upper edge is replaced by an oblique one in the Maori method (fig. 131).

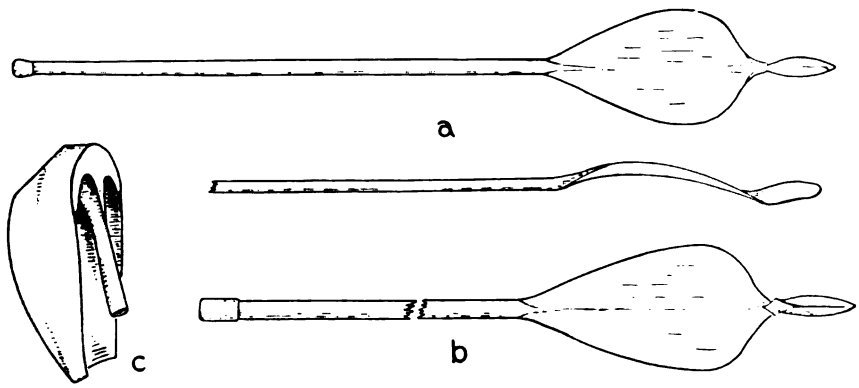


FIGURE 30.—Marquesan paddles and bailer: *a*, face and side views of ordinary paddle (British Museum); *b*, face view of steering paddle (after K. von den Steinen, 1928); *c*, bailer of typical form (after Handy, 1923).

PADDLES

With the exception of the peculiar form of oarlike paddle or scull mentioned by Porter as in use in Nukuhiva on beamy fishing canoes which he alone seems to have seen, the Marquesan canoes were propelled, when not under sail, by paddlers sitting double-banked in large canoes, or singly in small ones. The paddles used were beautifully carved out of a block of hard rosewood; the loom was slender and plain with a small cylindrical hand grip at the top, the blade a broad oval widening a little toward the farther end, where the tip was elongated into a stout knob of beaked shape characteristic of and peculiar to the islands (fig. 30).

A terminal beak of nearly the same shape forms the tip of the old Mangarevan paddle and both appear homologous with the angled tip of the Tuamotuan paddle and with the slender "finger" given off from the center of the rounded distal end of the Easter Island dancing paddle, as also of the rib thickening of the point seen in some old Hawaiian and Cook Islands paddles and in some characteristic of New Zealand and certain central Caroline islands.

The average length of the Marquesan paddle was 5 feet, whereof the blade accounted for 12 to 15 inches, with a maximum width of 6 to 7 inches. The side of the blade turned toward the paddler was convex, the other concave.

The paddles of ordinary canoes seldom had other ornament than their own elegant design; in an exceptional example in the British Museum two tiny tiki heads in high relief are carved on the farther part of the convex side of the blade. Conversely, the hand grip and the blade of paddles belonging to war canoes of great chiefs were usually profusely covered with carving; the grip was worked into the semblance of either two small tiki figures (fig. 31) or of two heads similarly arranged, and the blades were covered with incised patterns, mainly curvilinear. Details are given by Linton (1923, pp. 315-316), who also enumerates the various uses which the terminal knob (fig. 30) is alleged to have served—the real use remains uncertain.

FIGURE 31.—Finely carved grip of Marquesan paddle (British Museum).

BAILERS

Bailers (*tata*) of typical Oceanic form are used and in former times were ornamented with carving. The scoop part is wide and the bottom flattened (fig. 30, *c*). K. von den Steinen (1928, vol. 3, pl. α 0, fig. 9) figures an exceptional sugar-scoop form in Stuttgart Museum with the grip formed by a wide slot cut horizontally in a backward extension of the butt end of the scoop.

RAFTS

A catamaran seen on a stream in the historic Taipi Valley in 1925 consisted of three long banana stems pegged together with hardwood rods, passed from side to side (fig. 32). The fore end was cut to a sharp wedge point by long sloped cuts from each side; the after end was truncate. A box formed a seat, and the little craft was propelled by an oar-shaped paddle. Porter (1822, vol. 2, p. 74) records the occasional use of "a kind of catamaran which they construct in a few minutes, and a kind of surfboard, similar to that of the natives of the Sandwich Islands".

De Quiros (1876, vol. 1, cap. 6, p. 36) probably refers to this primitive form of catamaran when he states that some of the natives of Fatuhiva came off to the ships upon logs (*sobre palos*).

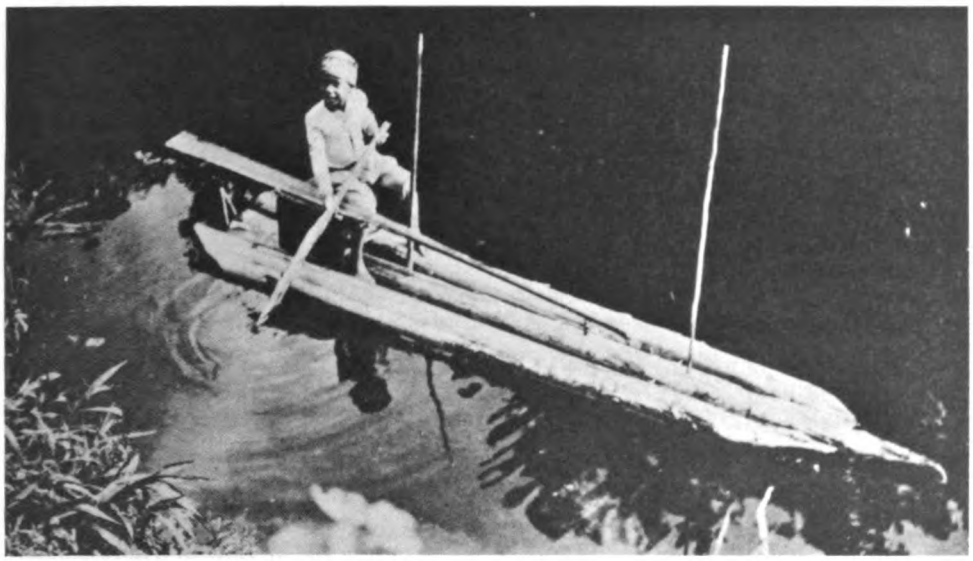


FIGURE 32.—Catamaran made of three banana stalks skewered together (photographed in 1925 in Taipi Valley, Nukuhiva).

The occasional use of sea-going rafts is suggested by several traditions. Handy (1923, p. 20) records the story of a number of people who, defeated in battle, departed from Hanapaoa on a bamboo raft and "reached Takaroa in the Tuamotus". He also mentions a legend that the tribe called Fitinui, which lived in the upland valley of Meae Topa Iho in Hivaoa, being overwhelmed in battle, "built rafts of great packs of bamboos tied together. On these they departed from Hivaoa expecting to take refuge on Tahuata. But a contrary wind arose and they were driven southward". A local belief is current that they landed on Napuka, but Handy says that the culture and dialect of the Napukans give no suggestion of close relationship to the Marquesans.

TECHNICAL TERMS

(DORDILLON, 1904)

A, ka: sail.
Ama: outrigger float.
Auau, pihao: fore end piece (prow).
Hoa, tiatia: stanchion connectives.
Hoe, tohua: paddle.
Hope, hopetau: after end piece.
Ka, a: sail.
Kapekape, uki, ui: steering paddle.
Kiato: outrigger boom.
Pihao, auau: fore end piece (prow).
Tata: bailer.
Tia: mast.
Tiatia, hoa: stanchion connectives.
Tohua, hoe: paddle.
Ui, uki, kapekape: steering paddle.
Vaa, vaka: canoe.
Vaa houua, vaka touua: double canoe.

The dialect spoken in the northern islands of the Marquesas differs considerably from that in the southern, hence the presence of synonyms in the above list.

CONCLUSIONS

In reviewing the ancient forms of Marquesan canoes, striking resemblances with those of New Zealand become apparent. The more noteworthy are:

1. The general and particular agreement in the form and the disposition of the parts. Both had normally a flat projecting prow, ending in a sculptured figurehead, a high upstanding stern piece, and a hull of three separate parts—a dugout underbody and a single washstrake on each side—the whole forming a typical five-part canoe.
2. The figurehead in each carved into the representation of a forbidding human face.
3. The use of a great mortise and tenon joint in hulls lengthened by the addition of one or more extra sections.
4. The employment of broader hulls for double canoes than was the custom in Polynesia, with the concurrent suppression of the large built-over platform employed in the double canoes of Tonga, Samoa, Tahiti, and even Hawaii. As a consequence of the broader hulls, paddlers were double-banked in the larger Marquesan and Maori canoes.
5. The use of stanchion connectives.
6. The high level of development and artistic feeling shown in the carving and ornamentation of the canoes, paddles, and bailers of both localities, and an underlying affinity in the motives employed.
7. The custom of carrying trophies of dead enemies on the prows—in the Marquesas the skulls (Fanning, 1833, pp. 129, 146), in New Zealand the hearts (Forster, according to Best, 1925, p. 29).

Other branches of Marquesan culture indicate similar affinity with that of the Maori, much closer indeed than of either with Tahiti, in spite of the traditional tracing of the bulk of Maori blood to a Tahitian origin. This general approximation of Maori and Marquesan cultures becomes significant in view of Handy's conclusion (1922, p. 206) that "there are strongly present in the Marquesas cultural elements which are not truly Polynesian, the sources of which must be sought beyond the western limits of this cultural area". This implies that the Maori and Marquesan sections came under strong foreign cultural influence by contact and some degree of racial intermixture subsequent to separation from the proto-Polynesian stock.

On the other hand, the peculiarities of the Marquesan paddles point to close relationship with eastern Polynesia, for although the blade of the Maori paddle appears to be related rather to forms common in Micronesia and Melanesia, the affinities of the Marquesas are definitely with the Tuamotus, Mangareva, and Easter Island. The stout beak or knob which tips the blade and the curved shape of the blade itself are paralleled in the paddles of Mangareva and the Tuamotus, and these beaked tips appear, in turn, to be homologous with the slender "finger" given off from the rounded distal end of the Eastern Island "dancing paddle." Probably the rib thickening seen at the tip of some old Hawaiian paddles is a primitive or possibly a degenerate form of the same feature; in spite of the utterly different form of the Maori paddle blade there may even here be relationship, for in some New Zealand paddles the tip of the blade assumes a bulbous form but always remains minute in size.

TUAMOTU ARCHIPELAGO

HISTORICAL REFERENCES

Owing partly to the dangers attendant upon navigation among the low atolls of the Tuamotu Achipelago and partly to the meager trading opportunties offered, these widely scattered islands were among those least visited by white men in the Pacific until comparatively recent times, when, unfortunately, the old types of sea craft had been replaced in many islands by the European schooner or by Tahi-

tian canoe models built commonly of foreign timber. Thus it is that there are few sources of information for the reconstruction of a satisfactorily detailed account of the structure of ancient types. The best materials are to be found in the accounts and figures given by Admiral Paris of the large double canoes (*pahi*) from the Tuamotus seen by him at Tahiti and those by Commodore Wilkes of similar but smaller vessels, together with such details as may be learned from examination of the small single outriggers of ancient form surviving in far-out islands having infrequent communication with the "outside world"—represented by Tahiti and the neighboring isles. Several small canoe hulls and a few exceptionally good native-made models in various museums afford further invaluable help.

Outstanding characteristics of the old island craft, both large and small, differentiating them from the ordinary canoes of the Society Islands, were the sharpness of the bottom, due to the presence of a primitive keel formed of a narrow longitudinal timber, usually channeled above, and the use in the building up of the sides of many short lengths of plank of irregular shape; strengthening ribs were present in the larger vesesls. Most of those who have paid attention to the construction of Tuamotuan canoes mention these characteristics specifically and they agree consistently in acknowledging the admirable way in which the hulls were put together, made as they were of a large number of small pieces of wood skilfully sewn together.

The first to notice the excellent build of these canoes, De Quiros, the earliest voyager to write an account of his experiences in the Tuamotus, records (1904, vol. 2, p. 336) how, in 1606, he saw come out from the low island named by him "Conversion de San Pablo" (which Wharton identifies as Anaa) a number of canoes "like galeots, not of one tree trunk, but very subtly contrived. Better could not have been made in Castille, with their mat sails very curious".

Forster (1777, vol. 2, p. 42), in referring to the canoes of Takaroa, remarks that "their canoes were very short, but stout, and pointed at both ends and had a sharp keel". A fine example of a small canoe agreeing in all particulars with this description, brought back by Wallis in 1767 from Nukutavake, is still in perfect preservation in the British Museum, and canoes of the same type are still found in the seldom-visited islands of the east-central section of the archipelago.

Conversely, the canoes of islands in frequent communication with Tahiti are now generally constructed after the Tahitian model, and have a rounded bottom and a dugout hull instead of one built up of plank patches—or, if partly of planks, these are cut from pine boards.

In the second half of the eighteenth century when contact with Europeans became frequent, the Tuamotuan type of large sailing vessel was much superior to that of the Society Islands and the design of the sails was already well on the way to develop into the Oceanic lateen, a form greatly in advance of the primitive triangular spritsail type in use in Hawaii, the Society Islands, and New Zealand at the time of their discovery.

OUTRIGGER CANOES

The result of the gradual increase of communication with Tahiti, now intensified by the appearance of the motor schooner, is that two main types of outrigger attachment exist, with, as is natural, numerous modifications of each which have arisen owing to special local conditions or to the differentiation that arises in communities long isolated, as are those in the outlying atolls. These two types may be termed respectively the indigenous and the Tahitian.

The Tahitian type is most prevalent in and characteristic of the northern and western islands where communication with Tahiti has been long-continued and frequent. The indigenous type on the contrary is to be found today only in those distant islands on the outer fringe of the archipelago where isolation, the difficulties of navigation, and the poverty of the islanders have perforce limited intercourse with the rich islands to the westward. Such islands are those of Napuka and Tepoto, farthest north, and those in the southeast region of the archipelago, represented by Tatakoto, Pukarua, Reao, Vahitahi, and Nukutavake.

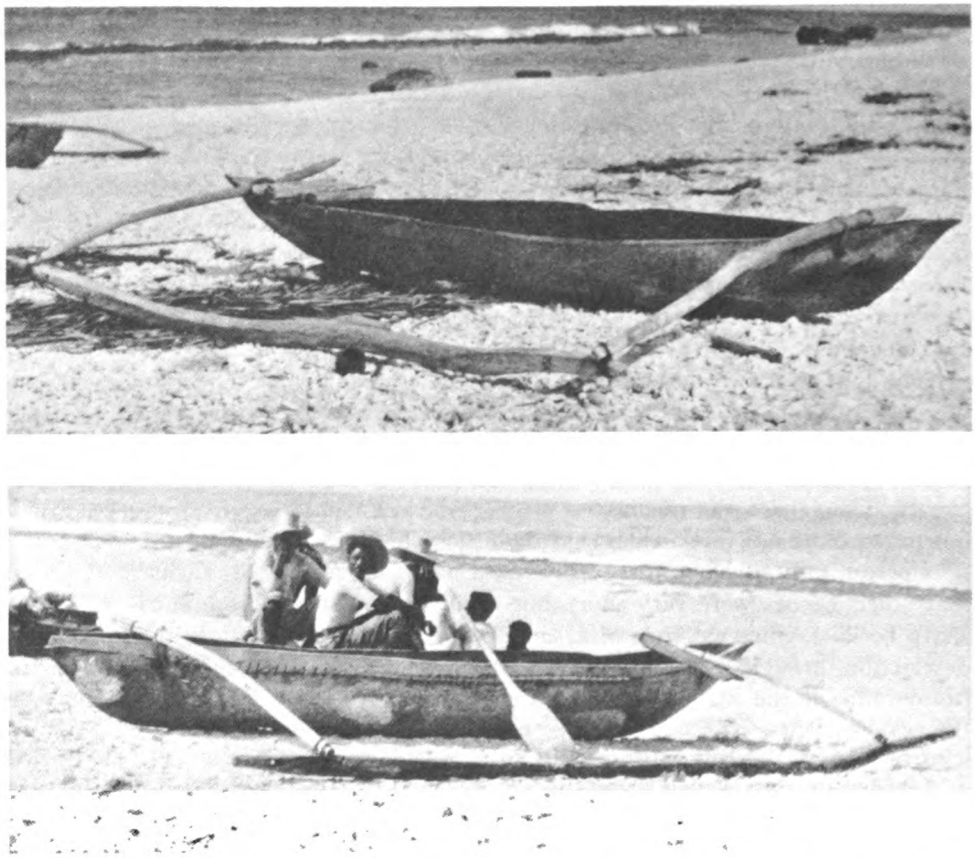


FIGURE 33.—Modern canoes of Napuka, common type, formed of dugout with sides raised when necessary by addition of sewed-on washstrake, without end pieces, keel, or inserted thwarts; booms attached to hulls close to ends and to float by direct lashing in Hawaiian manner (photographed in 1925).

LOCAL VARIATIONS

Although the local differences in the construction of the hull and the methods of outrigger attachment may be coordinated as varieties of one fundamental type, many of the islands have developed local charactertistics so emphatic that it is not possible to treat them as parts of a homogeneous unit or to give a generalized description that will serve for all, as can be done with safety for the sea craft of Samoa, Tonga, or Fiji. In closely set island groups, like those named, constant intercommunication between the various islands has resulted in the establishment of a common design, with local differences reduced to a minimum. In the widely

scattered Tuamotus, intercourse with and among the outlying islands is today irregular and infrequent and probably has always been so, with the result that certain islands developed widely different variations, particularly in the outrigger attachment. Hence it is necessary to take the principal islands or centers separately and describe the outstanding variations in design before attempting to synthetize the information recorded. The islands where the designs are simplest will first be taken, followed by those where the basic design has undergone further development or variation.

NAPUKA

A visit to Napuka in 1925 during the cruise of the *St. George* enabled me to study at first hand the construction of the primitive canoes still in ordinary use there.

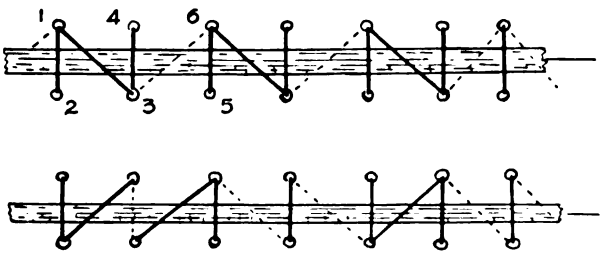


FIGURE 34.—Variations of the degenerate system of continuous stitching commonly employed in Napuka for sewing washstrake to underbody; stitches show only single turn of cord and are irregular in arrangement; coir twine is passed from inside through hole 1, down outside to 2, back inside to 1, and through it on to 3 outside; from 3, twine passes to 4 inside, back outside to 3, then obliquely on inside to 6; from 6 the process as detailed is continued by repetition; as sewing progresses a calking strip of coconut-leaf midrib is enclosed on each side under stitches and pressed tightly against seam made by junction of washstrake with dugout body; holes afterwards plugged with fragments of cloth. (Diagrammatic.)

Sixteen small outrigger canoes (*maota*) were seen, nine on the outer beach and seven in the lagoon, which, closed to canoe traffic from the sea, is of great economic importance to the islanders because of the prolific beds of a small species of the giant clam (*Tridacna*) found there; this mollusk is consumed in great numbers and the shallow parts of the lagoon are encumbered with many island-like "kitchen middens" composed of millions of its empty shells.

All the canoes seen were small dugouts, unprovided with mast and sail, propulsion being solely by paddles. The largest was 16 feet 4 inches long; the majority ranged from 14 to 15 feet. Most were one-man canoes provided with a single paddle. Even the largest canoe, though capable of carrying two passengers, was usually propelled by one paddle.

When the size of the tree permits, the hull is made in one piece, without the addition of washstrake or end piece. Few trees of kind and dimensions suitable for the purpose now grow on the island, so the sides of most of the home-hewn dugouts must be raised by means of pieces of board sewn on along the gunwales or upon the bows to form rude and primitive washstrakes. The underbody, having been hewn from a tree trunk, usually has one end deeper than the other. Both are pointed, distinguished in profile by the angle of curvature at which they meet the horizontal bottom. The end generally directed forward is shorter and more bowed beneath than the other, which rises from the bottom in a long and flatter curve (fig. 33).

Uniform regularity is seldom shown in the sewing of the washstrake sections (*tio*) to the edges of the dugout. Generally the stitches take the form of a series of capital N's both on the outside and the inside of the hull, with connecting diagonals (fig. 34).

A fore washboard is added to give sheer to the forward end of some canoes. This is made of two pieces of plank fitted together in V fashion at one end and sewn together through a single series of holes (fig. 35). In this particular the design shows direct relationship with the Hawaiian method of connecting the pair of curved boards which there replace the wash-strakes at each end of the hull.

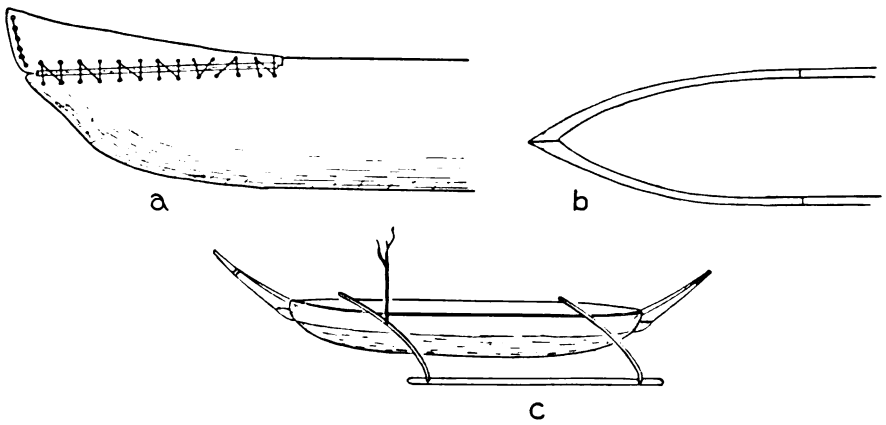


FIGURE 35.—Napuka canoe: *a*, side view, showing method of affixing bow washboard, lower edge sewn to gunwale of dugout, seam protected by covering batten, forward ends meeting in median line are sewn through (compare Hawaiian end pieces); *b*, view from above, showing bow washboards brought together at fore end; *c*, Napuka canoe (Wilkes, 1845, vol. 1), pointed end pieces in modern canoe absent or greatly reduced.

The outrigger is attached indifferently on either side. In the majority, contrary to Polynesian custom, it is, however, attached on the starboard side. Actually the two ends are so shaped that the canoe goes equally well in either direction. Usually the fore end of the float is somewhat sharp, but in some the difference between the two ends is inappreciable.

The outrigger booms (*kiato*) are two in number, lashed at their inner ends to the gunwales of the canoe with sennit or more commonly with coir twine passed through a single hole in the side. After securing a boom to one gunwale, the lashing is carried along the boom to a point midway between the gunwales. Here it is given one or sometimes two half-hitches around the boom before being carried along farther to make the second gunwale lashing. When there is any difference in the size of the booms, the fore boom is the stouter of the two.

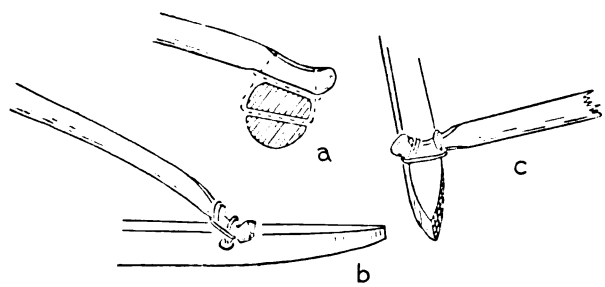


FIGURE 36.—Outrigger attachment, Napuka: *a*, side view of boom resting on float seen in cross section, lashing shown as broken line passing through hole in float and thence around boom; *b*, *c*, side and end views.

Normally each boom is attached directly to the float (*ama*) by a coir-cord lashing which passes through a hole cut transversely in the float; in some canoes the lashing is passed several times around the float instead of through a hole therein. After several vertical turns passing around or through the float and transversely across the boom, one or two circumferential turns between the boom and the float are made before the end is made fast by half-hitches (fig. 36).

The floats now used are of *purau*, imported ready-made from Papeete.

When required, loose thwarts (*koke*) are laid transversely upon the gunwales. In one canoe four stout stretchers crossed the interior of the hull just below the gunwales to prevent the collapse of the sides.

The hull in former days was adzed out of the trunk of the *tou* (*Cordia subcordata*), but after a cyclone had destroyed the remaining *tou* groves the canoe builders turned to the *puka* (*Pisonia ombrellifera*) (called *ngatae* in the western Tuamotus), although they recognized its inferiority. Mr. K. P. Emory (personal communication) mentions that a canoe made of *puka* will last only 2 years, whereas a *tou* canoe lasts 30 or 40 years. A native who is proud will import a *tou* canoe from Tahiti.

The dimensions of the largest canoe seen were: length over all 16 feet 4 inches, between booms 12 feet 8 inches; length of hull forward of fore boom 1 foot 8 inches, aft of after boom 2 feet; distance of float from hull 4 feet 3 inches; projection outboard of butt ends of booms 10 inches; beam outside at mid length 1 foot 8 inches, at after boom 1 foot 1 inch; greatest depth (which is amidships) 1 foot 5.5 inches; length of float 15 feet 9 inches, of paddle 5 feet 9 inches; length of blade 2 feet 3 inches.

In Napuka the canoes, owing it may be to the dangers of the reef and the lack of any navigable passage into the lagoon, have remained as small and as primitive as when the island was first visited. As long ago as 1839, Wilkes (1845, vol. 1, p. 319), who saw the island in that year, recorded that the many canoes that came off to the ship

> . . . were quite small, being only from 12 to 15 feet long. They generally contained two and sometimes three natives. Each canoe had an outrigger and a projecting point both before and behind, by which they got into them from the water. They are formed of strips of coconut wood sewed together. Two persons can carry them. Their paddles were curved backwards.

Wilkes is presumably in error regarding the timber employed. The coconut palm is never used in the Tuamotus for canoe planking.

Although none of the 16 canoes examined were referable to this design, one of the photographs kindly supplied by Mr. K. P. Emory, who visited the island in 1929 and 1930, shows that it still persists:

> The canoe represented is the finest now existing in the island; it measures 17 feet in length and was built in 1907 from pieces of canoes destroyed in the hurricane of that year. With the exception of the underbody, formed of two dugout sections sewn together end to end by means of a butt joint, in place of being wholly of short lengths of planking, it is identical with Wilkes' figure (fig. 35, *c*). The dugout sides are raised by two irregular strakes made up of short lengths of fairly broad planking sewn together. A narrow gunwale rail tops the sides, partially wanting on the off side. Pointed end pieces, triangular in section and slightly hollowed at the butt end, are sewn below to the dugout base and laterally to the side strakes. No breakwater is present such as is a feature of the higher-sided canoes to the southeast.
>
> The outrigger is similar to that of the more roughly made canoes already described, but the attachment is made more carefully; the distal end of each of the two booms is cut across obliquely in order to fit flat upon the horizontal upper surface of the float, which is rectangular in transverse section. To give security to the lashing, the upper surface of the boom end is heeled. The lashing, at present made of coir cord instead of sennit, passes through a transverse hole in the float, thence around the heel, back through the hole, and then around the shaft of the boom. After this course has been repeated four or five times, the lashing is finished off with several circumferential turns around those already made, in order to tighten and secure them in place.

That pointed end pieces are characteristic of the original Tuamotuan hull type is certain. Apart from Wilkes' figure and the evidence at hand from the Vahitahi and Reao areas, Emory in 1930 saw 10 such end pieces in houses and rubbish heaps in Napuka and brought away 5 of them.

The differences in the shape of the ends of the smaller Napuka canoes of the present day are seldom found in the eastern or outer Tuamotus and then are but little marked. On the other hand, these are typical of western Polynesian, where

the after end is normally pointed, whereas the fore end inclines to a shortness that in many canoes ends in the formation of a nearly vertical, sharp cutwater.

There can be no doubt that the changes in design in Napuka from the partially plank-built canoe to the dugout, sometimes quite without any trace of a washstrake, and from similar to dissimilar ends, are due to intercourse with Tahiti; this has given the inhabitants opportunity to obtain, by importation by the trading schooners that call from time to time to collect copra, dugout hulls larger than were formerly available. Such dugouts, hewn in Tahiti, are shaped more or less after the present Tahitian fashion, whereby in order to obtain the greatest length possible from the tree trunk, the upper and thinner part is formed into a lean and pointed stern, while the thick butt becomes the deeper opposite or head end.

The paddles in use today are roughly made and are modeled on the Tahitian design. The shaft is cylindrical and without hand grip, the blade shouldered and broadly oblong (fig. 37). Several examples of the ancient beaked type of paddle (*tipoka*) fortunately exist in the Bernice P. Bishop Museum collection; they and two others from Fagatau of identical shape confirm the accuracy of Wilkes' description. This paddle form appears to have been characteristic of the Tuamotus, and is undoubtedly akin to the more elaborate paddles of Mangareva and the Marquesas. (See fig. 37, *e*).

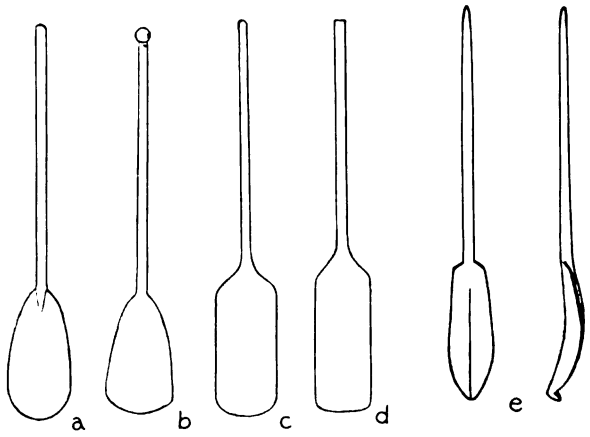
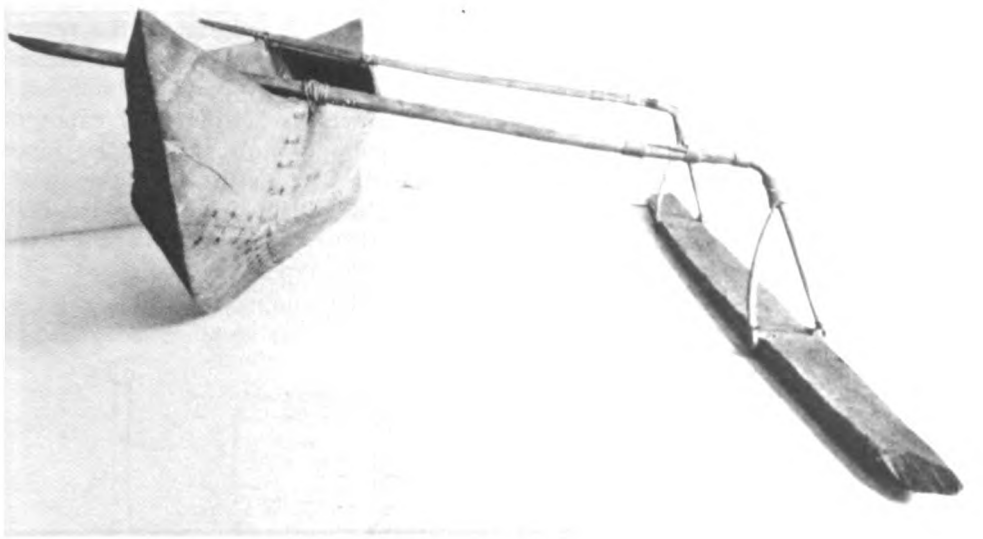


FIGURE 37.—Types of modern broad-bladed paddles: *a*, Tahiti; *b*, Rarotonga; *c*, Napuka; *d*, Rangiroa; *e*, front and profile views of old beaked paddle from Napuka (from a drawing by K. P. Emory).

TIKEI

The atoll of Tikei had canoes of the same type as those of Napuka; Choris (1822, pl. 12) figures one hollowed out of a tree trunk, with three booms lashed to the gunwale of the dugout hull and attached directly to the float, which, as usual in Tuamotuan outriggers, is nearly as long as the hull. Another common feature of Tuamotuan canoes is a tendency to employ multiple booms; this is a practice highly characteristic of Melanesian types and may be due to ancient influence from that quarter.

The booms are shown straight in Choris' figure, but this undoubtedly is an error, as they would not function properly if so fixed. Other figures by Choris are carelessly drawn and therefore such a detail as this, differing entirely from what is known of the construction in all the other islands, must be disregarded. The ends of the hull in his figure show sheer, each terminating in a blunt point.



a

b

FIGURE 38.—Canoes of Reao: *a*, model (no. 64867, Peabody Museum, Harvard University); *b*, large canoe of the ordinary type in use at present day, built up of "patched" sides upon a definite keel.

REAO AND PUKARUA

South and southeast of Tikei are the atolls of the archipelago engaged in constant traffic to and fro with Tahiti, and it is only in the far east of the central section of this island world, in Reao, Pukarua, and Tatakoto, that the ancient indigenous canoe type is found again. Seurat (1905, pp. 295-307) has published a fairly full description, with illustrations, of the present-day outrigger canoe of Reao, and Emory, who has visited the island more recently, has placed much material and several fine photographs at my disposal. These sources and the photographs of a unique model of a Reao canoe in the Peabody Museum, Harvard University (fig. 38, *a*), sent me by Professor Roland B. Dixon, indicate that the Reao canoes exhibit fundamental resemblances to the older type seen at Napuka, each being made up of a dugout base, with sides and pointed end pieces sewn on.

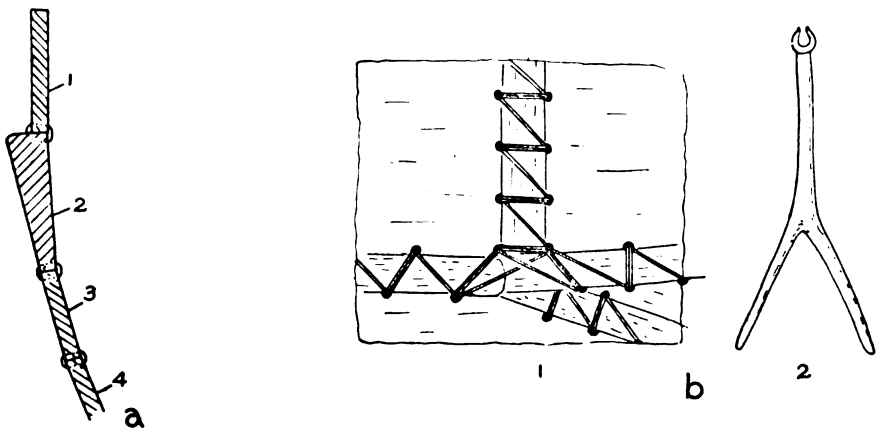


FIGURE 39.—Canoes of Reao and Tatakoto. *a*, upper strakes, in section: 1, washstrake secured to (*2*) shouldered strake (*roku*) by lashing passed through upper inner angle; 3, 4, lower strakes of ordinary form and lashing. *b*, battens and instrument for tightening lashings (after Seurat, 1905): 1, adjustment of battens on inner side of canoe at junction of four plank patches, holes plugged with coconut fiber, battens split midribs of coconut leaves; 2, forked lever (*keke*) for tightening lashings.

Differences in detail are considerable, due mainly to the difficulty on Reao and Pukarua of procuring timber of suitable size and shape. Hence the dugout underbody is here reduced to a deep and narrow keel-shaped structure, the bottom therefore sharp instead of rounding as in Napuka. The hull is equal-ended instead of having one end wider and deeper than the other. The sides are made up of more numerous strakes, and these in turn are formed of smaller and more numerous plank "patches" (fig. 38, *b*). The booms, instead of being curved and lashed directly to the float, are compound, each composed of a straight main section, with a down-turned, curved, or elbow terminal scarfed on (fig. 40). This last peculiarity must be considered merely a variety of the curved boom with direct attachment, so obviously is it a variation induced directly by environmental conditions—the lack of trees having branches of suitable size and strength.

The keel of all but the smallest canoes is V-channeled above. The number of the strakes depends upon the size of the canoe; small ones may have 2 only, larger ones 4 or even 5. These are made up of very short pieces of plank sewn together with sennit in the manner described in detail for Vahitahi. Usually the seams are not covered on the exterior, but this protection is invariably given on the inner side. A remarkable detail is the shape of the patches used in forming the strake next below the washstrake. This strake (*roku*) thickens gradually toward the upper edge till it is roughly twice as thick there as at the lower edge (fig. 39); this con-

stitutes it a strengthening wale and permits of setting back the washstrake some part of an inch. This peculiarity is common also to the canoes of Pukarua and Tatakoto. The end pieces are similar in form but smaller proportionately than those of the large Napuka canoe—stout, cone-shaped, and sharply pointed at the distal end; owing to their smaller size, a patch is usually interposed between the base of each and the end of the keel. They are also without any hollowing of the butt, due to the smallness of their size. In small canoes there is a single median thwart, in larger ones three, one median and the others near the ends. Their extremities are through-sewn to the sides of the hull.

The outrigger booms, commonly made from the wood of the coconut palm, are rectangular in cross section and either 2 or 3 in number according to the size of the canoe. The hull lashings of the booms pass through single holes below the gunwales and the butt ends project well outboard on the off side. The elbowed extension forms a slightly obtuse angle with the shaft, to which it is joined by a long splice secured by 1, 2, or 3 groups of sennit lashings.

The float is plank-shaped, broad but thin, with vertical sides. Each end extends considerably beyond the near-by boom and usually ends in a sharp transverse edge abreast or a little forward of the end of the hull; in many canoes the float is thus longer than the hull.

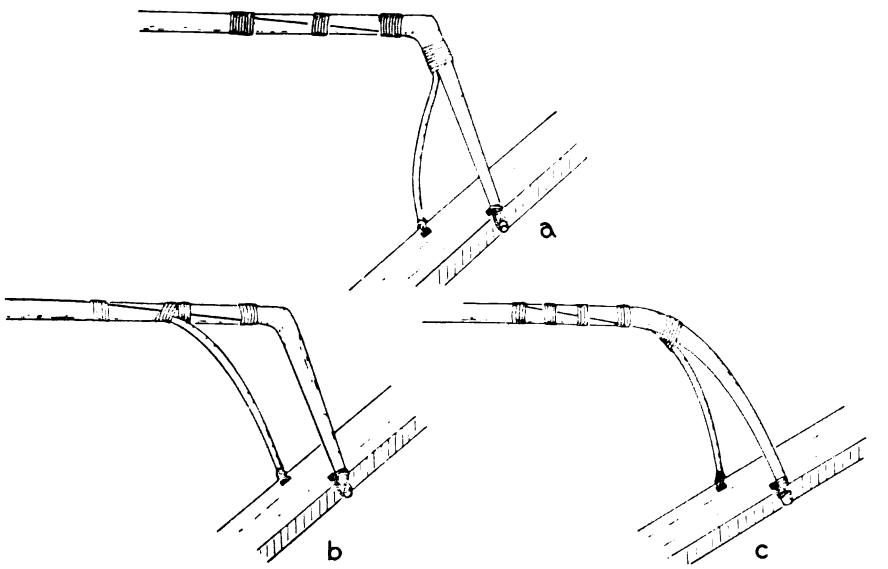


FIGURE 40.—Outrigger attachments of Reao and Tatakoto: *a*, *b*, varieties of Reao attachment (*b*, upper end of bracket withy lashed under scarf joint connecting boom with its angled extension); *c*, Tatakoto type from present-day fishing canoe, upper end of bracket withy lashed to downturned leg of boom extension (from photographs by K. P. Emory).

Attachment of the boom to the float is effected by lashing the down-turned end of each elbowed extension of the booms against the outer side of the flattened float, secured thereto by sennit lashing passed through a curved passage between a hole on the upper surface and one on the outer side (fig. 40). To reinforce the attachment a bent withy tied at the upper end either to the region of the boom splice or just below the elbow has its lower end lashed to the inner side of the float in the same manner in which the elbow extension is lashed against the outer side.

Seurat says that the dugout base was formerly hollowed out by means of an adz (*tokitoki*) made from a *Tridacna* shell, or else of basalt imported from Tahiti, hafted in an elbowed handle.[4] The planks required to form the side strakes were shaped by shell or stone axes

[4] Emory informs me that Seurat's statement applies only to the central area, where Tahitian adzes passed in trade as far east as Hao. It is incorrect for the Vahitahi, Reao, and Tatakoto areas, where no stone adzes are found. There is also discrepancy in the hull form between Seurat's figure of a Reao canoe and the photographs and descriptions supplied by Emory; in Seurat's figure there is no keel shown and the main part of the canoe consists of a deep-sided dugout, with a washstrake sewn to its edges. This is certainly not the construction proper to the design characteristic of the island.

a

b

FIGURE 41.—Tatakoto fishing canoe of present day: *a*, stern curves up characteristically, booms project outboard to considerable distance on off side; *b*, details of stern showing steersman's seat stretching between two curved bars which represent head rails of Vahitahi type, bailer without handle rests on thwart (photographs by K. P. Emory).

(*toki*) and measured usually about 90 cm (about 3 feet) long by 16 cm (about 6 inches) wide, united by sennit sewing. The holes in the opposed edges of the joints were pierced by means of a pump drill, armed with the caudal spine of a sting-ray. When sewing the planks together, a lath cut from the rachis of a coconut leaf is laid over the seam on the inside to render it water-tight (fig. 39).

The lashing is tightened with the aid of a Y-shaped levering implement (*keke*) (fig. 39, *b*) made of the tough *mikimiki* (*Pemphis acidula* Forster), of which the booms are also made. An identical implement was in use formerly in New Zealand for a similar purpose (Best, 1925, p. 79), in the Society Islands (Handy, 1932, p. 51), and in the lower Cook Islands (Buck, 1927, p. 261). Buck gives the only correct description in existence of the use of this implement.

The float is made of the light wood of *Guettarda speciosa*.

These canoes are usually propelled by a paddle, but Seurat mentions that large ones may have mast and sail. The dimensions of the one figured by Seurat are: length 2.45 meters, beam 0.50 meter, depth 0.45 meter.

VANAVANA

In Beechey's time (1826) the canoes of Vanavana (his "Barrow Island") were furnished with outriggers similar to those of "Clermont Tonnere", which was the name given by Duperrey to Reao. As recorded by Beechey (1831, 4th ed., vol. 1, p. 158), the largest was 18 feet long by 15 inches broad and was hollowed out of a tree trunk.

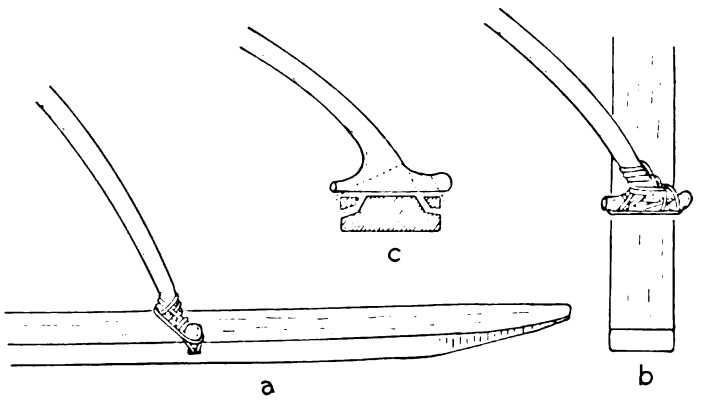


FIGURE 42.—Unusual form of outrigger attachment, Tatakoto canoe model (no. 64866, Peabody Museum, Harvard University): *a*, face view; *b*, side view; *c*, diagram showing course of sennit lashing through V perforations in upper edges of float.

TATAKOTO

Tatakoto has canoes closely resembling those of Reao and Pukarua in all respects save in the form of the hull ends. The Tatakoto canoes have a definite head and stern. The head is low and horizontal, terminating in a pointed end piece of the Reao type, whereas the after end of the stern end piece curves upward after the Cook Islands type seen in Mangaia, Atiu, and Mitiaro (fig. 41, *a*). Like the fore end piece, the basal region is partially hollowed out. The summit is truncate; typically it has a three-way perforation immediately below, and an unpaired rectangular opening on the front side communicating with two triangular paired slots, one on each lateral face.

Across the canoe at the place where the sides of the after end piece join the washstrakes, a slightly curved, stout seat is fitted for the steersman; the ends project some inches outboard on each side (fig. 41, *b*). To stabilize the end piece and the steersman's seat, a strong bow-shaped strut runs from gunwale level on each side immediately behind the after boom to a point halfway up the curved part of

the end piece, where it is made fast. Each end of the steersman's seat is let into a slot on the inner side of one of these lateral struts.

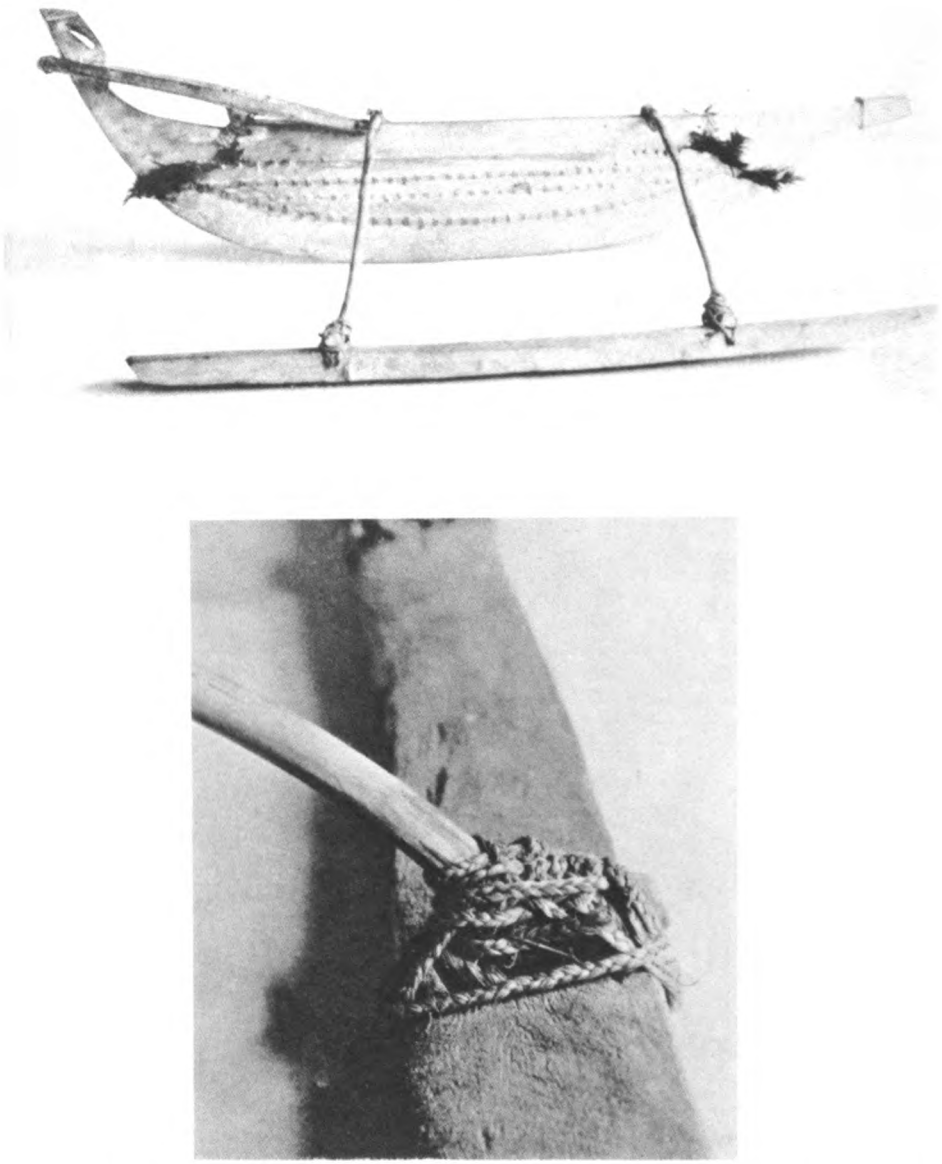


FIGURE 43.—Side view and details of outrigger attachment, Tatakoto model (no. 64856, Peabody Museum, Harvard University).

The outrigger—booms, float, and attachment—is typically similar to that of Reao (fig. 40, *c*), but in a beautifully made model collected by Agassiz in 1905 (Peabody Museum, Harvard University) the two booms are curved and attached

directly to the float as in the large Napuka canoe of antique build, except that the end of each boom has a projection on both the outer and the inner face to facilitate lashing through curved holes in the float (fig. 42). This pretty model shows the extremity of the fore end piece carved into a rectangular knob and tufts of black feathers caught under the lateral lashings binding the end pieces to the keel and sides (fig. 43). Another feature of interest is the serration of the projecting edge of the *roku* strake for a short distance from each end; the fore end of the *roku* has six triangular teeth, the after one five. Buck (1930, p. 374) records similar serrations at the two ends of the washstrake in certain Samoan canoes.

A model of the Tatakoto type in Bernice P. Bishop Museum shows both extremities with high, upcurved ends, equal in size and shape (fig. 44). No bow-shaped struts are present on the sides of either end piece, but a beautifully made fin-ended steering oar is pivoted in correct position at one end. The float of the outrigger has been lost, but the booms remain, two in number, curved for direct attachment as in the Peabody Museum model. Five thwarts are counter sunk in the gunwales, a feature unusual in Tuamotuan outrigger design.

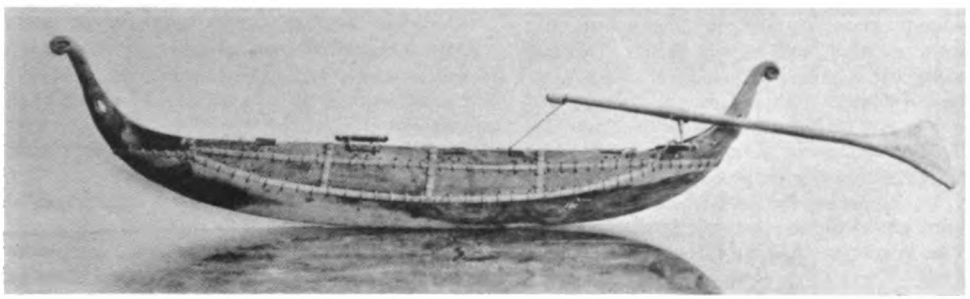


FIGURE 44.—Model of canoe labeled "Reao" but unmistakably of Tatakoto; European sail with which it was rigged is removed; outrigger has been lost; steering oar of old pattern, but curved-up head of canoe unknown from the Tuamotus except in this model (Young collection, Bernice P. Bishop Museum).

It is possible that it was a vessel of this type that Webber sketched at Tahiti, but failed to put a name to (fig. 82). This had long, upturned ends, a definite *roku* wale, and single outrigger with direct attachment, features foreign to Tahitian outrigger construction.

VAHITAHI AREA

Alexander's inference (1902, p. 765) that the material culture of Vahitahi, Nukutavake, Akiaki, and Vairaatea has undergone little change since contact was made with Europeans receives definite confirmation from the fact that a small canoe brought to England in 1767 by Wallis from Nukutavake is essentially of the same hull construction as canoes seen by Alexander at this island in 1899.

The canoe brought home by Captain Wallis is by far the oldest complete hull of a Polynesian canoe in existence. Fortunately it is still in perfect condition save for the loss of its outrigger and the head rails at each end. Today such an authentic relic of ancient canoe design is of great value, for too often much of the material available for the study of the old sea craft of Polynesia is meager, suspect, or obviously inaccurate. Even in regard to models, time and again I have been impressed with the need to exercise great caution in accepting their evidence on structural details. It is exceptional to find them made to anything approaching an accurate scale; their small size and the primitive tools used in their construction

preclude accurate detail. Generally there is a simplification of design and a suppression of features that are of importance to the ethnologist. Seldom were they made specifically as diminutive replicas of the actual workaday canoes; more often they were originally toy canoes used by the island lads and men in their water games. These toys in particular are characterized commonly by a reduction of parts, most marked in regard to the number of the outrigger booms; others, more carefully made, with a view to pleasing the eye of the white visitor, are less accurate than the toy canoes. Actual canoes, in the absence of photographs, are therefore invaluable as affording authentic information of structural design and detail in former days and as checks upon the modifications which their types may have undergone in recent years.

The Wallis canoe (fig. 45) makes it certain that a few remote islands in the eastern section of the Tuamotus retain today many archaic features lost in part or entirely by the islands to the northwest. As the only extant Polynesian canoe dating back to the eighteenth century, its construction deserves detailed description:

Like all those of the inshore and lagoon waters of the archipelago, the canoe is quite small, barely 12 feet 9 inches in length over all. For this length, the beam and height are notably great, 27 and 25 inches respectively. It is double-ended and carvel-built, all parts sewn together with sennit braid. The bottom is moderately rounded at the bilge but sharp along the middle line, owing to the presence of a prominent keel, narrow and deep. On this keel rounding sides are raised, built up of four main series of short lengths of planking sewn end to end to form fairly regular strakes. A short transverse breakwater at each end connects the top strake of the opposite sides, and an elongated and tapered end piece at each extremity keys together the ends of the keel, breakwater, and side strakes.

Lengthwise the keel is strongly crescentic, curving up steeply toward each end, where it joins the elongated end piece, which continues the crescentic curve at a slightly reduced angle. The middle section, 64 inches in length, is the longest. The end sections are each 24 inches long. These three sections are butted end to end and sewn together with sennit passed through holes bored at various angles through the opposed ends; on the upper side a narrow batten is inserted beneath the lashing to make the joint watertight.

The upper surface of the keel, averaging 3 inches in width, is flat and without sign of the channeling characteristic of the keels, according to reliable descriptions, of the ancient voyaging canoes (*pahi*) of the Tuamotus. Below the side planking sewn to the beveled edges of its upper surface the keel projects about 2 inches, thereby becoming of functional value in protecting the somewhat fragile side strakes from damage when the canoe was being launched or drawn ashore over the rough coral fringe of the beach.

The four strakes forming the sides, taken in order from the keel upward, may be termed respectively the garboard strake, the bilge strake, the wale strake, and the washstrake. The first two are formed of broad pieces of plank of unequal size and are sheered upward toward the ends, thereby becoming roughly parallel with the sheer of the keel. The "patches", or short lengths of plank in each strake, are mostly rectangular and oblong in shape, except the terminal ones, which are triangular in order to conform with the diminishing width and depth of the hull at each end. The garboard strake, on what I consider to be the starboard side, is made up of seven patches. The shorter bilge strake has only four. On the port side the individual patches in each strake, four in number, are longer than those on the starboard side.

The two upper strakes both run horizontally; as the two lower are sheered a horizontal line is obtained for the upper strakes by filling in the concavity above the bilge strake with a narrow adjusting half-strake curved along its lower edge and horizontal along the upper.

The wale strake is a peculiar feature, found, so far as I am aware, only in Tuamotuan canoes. It is the homologue of the strengthening wale (*roku*) in the canoes of Reao and Pukarua. Its form closely resembles that of the keel; in the large double canoe described by Paris (1841, pp. 135-136) the similarity is emphasized, as both are stated to be channeled on the inner side, with the outer side of the wale strake salient and rounded like the keel but in less degree. Here in this small canoe the wale strake is flat on the inner side and only slightly rounded and salient externally, except toward the ends where the rounding and slight projection is more pronounced. Each extremity of this strake is cut off obliquely on the lower side to allow it to fit into the acute angle formed by the junction of the upturned end of the keel with the base of the end piece, to both of which it is sewn. For about 2 inches from each end the

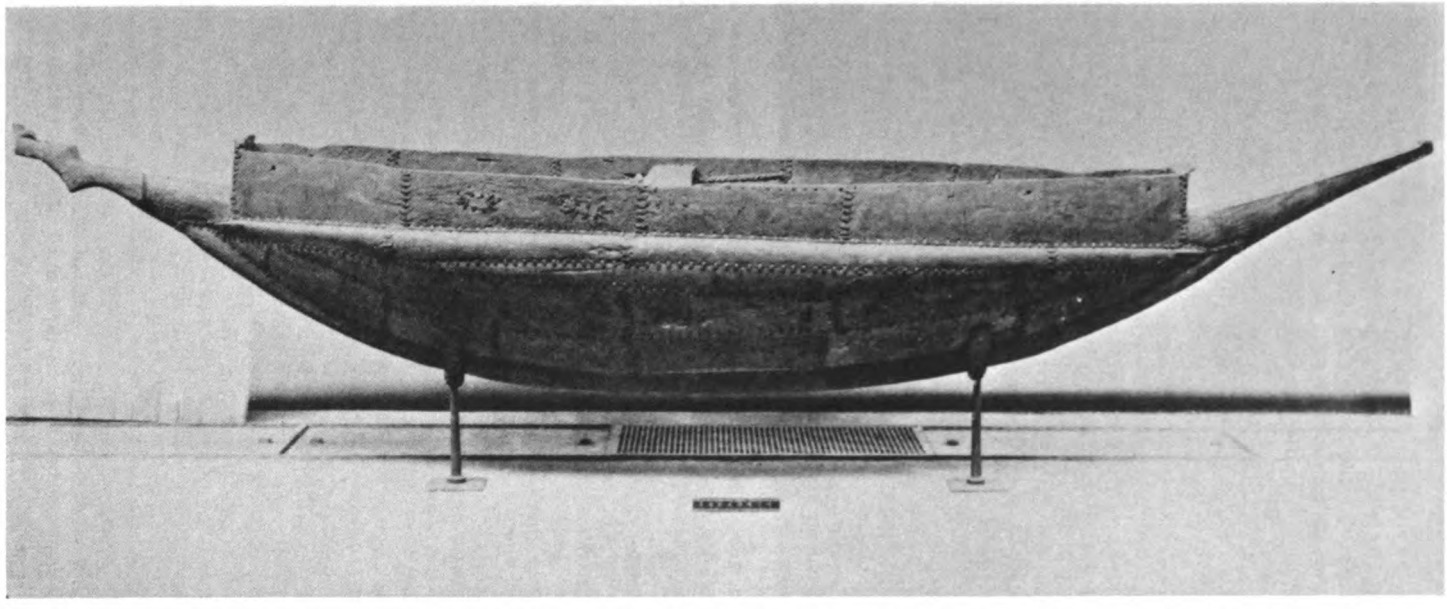


FIGURE 45.—Starboard view of canoe brought from Nukutavake in 1767 by Captain Wallis (British Museum), oldest Polynesian canoe in existence; note deep keel, sides built up of many "patches", keel-like rubbing strake, high washstrake, long end pieces, also slight setting back of washstrake and two large repair patches in one of the sections, small holes for lashing attachment of booms close to transverse breakwater at each end.

outer side is hewn into a sharp horizontal ridge, apparently to reinforce its strength and compensate for reduction in depth at this point. Three pieces butted end to end form this strake on one side, four on the other.

A deep washstrake completes the structure of the sides. The lower margin is horizontal, the upper sheered slightly toward each end, so although its depth is 5 inches amidships, the sheer increases it at each end to 7 inches. On the starboard side it is made up of four pieces of broad board; for the port side a sufficient supply of broad boards must have been lacking, for whereas the two forward ones are of the full depth, the after ones are in two tiers or half-strakes, each of three narrow strips.

The various strakes are sewn together edge to edge, and the individual patches end to end, with sennit passed through paired holes in the opposed edges; the lower edge of each garboard strake is similarly sewn to a beveled edge of the upper part of the keel.

The fore breakwater, bridging the gap between the converging ends of the two washstrakes, is lipped at the fore side of the upper margin; the after one is without a lip.

The fore end piece is hewn from the solid into a long and gracefully tapered blunt-ended projection, flat on the upper surface, rounded below. On the upper side, at the truncate distal end, is a low transverse terminal ridge. The wide butt is hollowed out and arched, the basal part partially cut away in order that the sides may be seated directly upon the forward extremities of the keel and wale strakes, to which they are attached by through sewing as in the other parts. The hinder end of each side of the arch is similarly attached to the lower part of the fore washstrake of the same side; the base of the breakwater is sewn upon the crown of the arch. This arrangement of the parts leaves a small recess at the base of the end piece, opening into the cavity of the hull. (See fig. 46, *b*.)

The after end piece is slightly shorter than the forward one and, unlike it, consists of two distinct sections. The proximal is a hollowed tapered butt similar in form and attachment to that of the fore end piece. The distal section, 14 inches long, is divided by a vertical, elongated slot into two lateral limbs which reunite at the extreme end. Both are carved into the peculiar jointed form seen in figure 45, with an angular spur or heel alternate on the upper and the lower side.

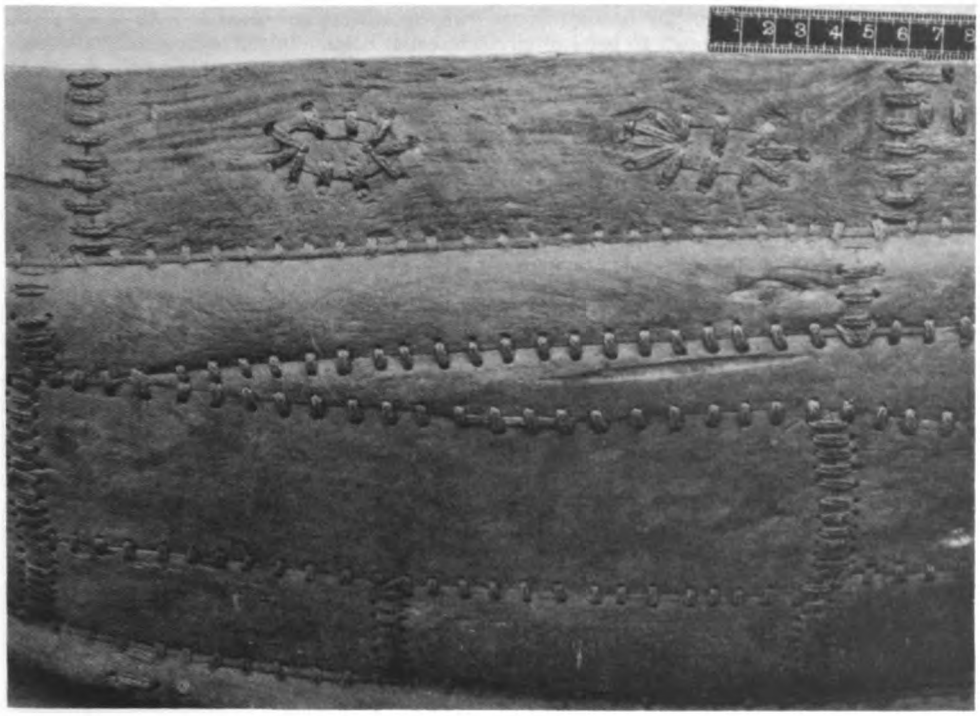
The only fitting is a stout, squared thwart, nearly amidships, through-sewn to the washstrakes rather above their mid height; the upper surface is a clear inch below the gunwale. No supporting cleat is provided, nor are there any ribs as in the large voyaging canoes of the archipelago.

The outrigger is missing, but the presence of a hole in the port washstrake 3 or 4 inches from each end, directly opposite similarly bored holes in the starboard washstrake, indicates that a two-boom outrigger has been used, the number most common in small canoes of this archipelago at the present time. In the slight concavity in the gunwale above the after lashing hole on the port side the boom would rest when in position. The proximity of the booms to the ends of the hull is an ordinary and characteristic feature of small Tuamotuan canoes; it is a practical convenience in a one-man canoe, as the man, seated amidships, can wield his paddle on either side without being cramped in action by a too-near boom.

Another pair of opposed holes is also present in the washstrakes 9 inches abaft the fore-boom holes; these were probably used in the lashing of a head rail on each side at this end, in manner similar to that seen in the canoes of the present day. The head rails at the other end were probably lashed on at their inner ends by the same lashing that secured the outrigger boom to the gunwales at the same end. The outer ends of each pair of head rails would be lashed to the outer extremity of the end piece to which they pertained.

The sewing together of the various parts is carefully done by through turns of beautifully made three-ply sennit, still in perfect condition though more than a century old. The sewing is continuous, carried along obliquely from one pair of holes to another. This gives a sharply zigzag pattern on the inner side, whereas on the outer side straight bands of sennit are alone seen, connecting the units of each pair of holes. The seams between the different strakes show two turns of sennit on the outside, with a single one on the inner, connecting by a single obliquely running braid with the next pair. On the vertical joints where play is most liable to occasion a leak, an extra turn of sennit is added to afford additional strength.

Apart from the employment of many short pieces of plank of irregular size and shape, the presence of inserted repair patches even on these small pieces is evidence of the scarcity of large timber suitable for canoe construction on the island. Two of these repairs occur in adjoining patches of the bilge strake; they are little more than plugged holes, the inserted squares of wood sewn in place by two and by three stitches respectively (fig. 46, *b*). Two others are oval patches, each about 3.5 inches long, inserted in a section of the starboard wash-



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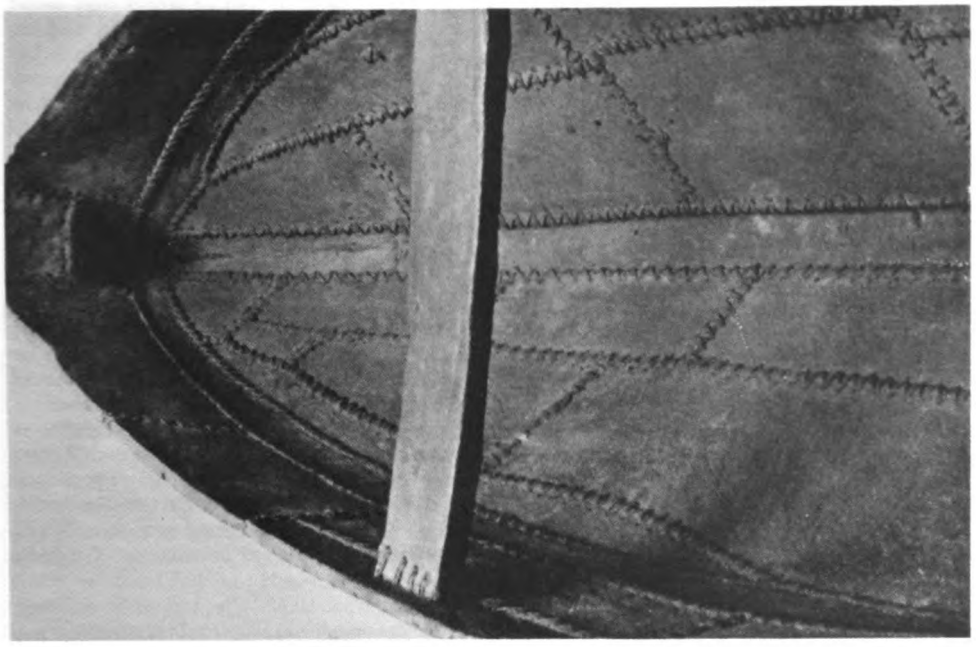


b

FIGURE 46.—Details of old Nukutavake canoe shown in figure 45: *a*, section of starboard side showing method of sewing planks together with sennit, two inserted patches in washstrake, at bottom a butt joint in keel; *b*, interior, looking forward; note narrow keel, batten-covered seams, stout thwart, recess at bows in butt end of fore end piece, and two small wood-plugged holes on right side, one immediately in front of thwart, the other just abaft it.

strake (fig. 46, *a*). In one, the broader of the two, 10 stitches are used to hold it in place, the sennit being passed through 10 pairs of circumferential holes. In the other patch, although the number of stitches is increased to 12, 3 holes only are made in the inserted patch, owing to its narrowness—barely 1.5 inches wide. Through these 3 holes, 6, 2 and 4 stitches pass respectively from 12 holes bored at regular intervals around the margin of the aperture thus repaired.

Further evidence of need for economy in the use of available timber is afforded by the presence of at least one plank showing positive sign of prior use in an older canoe. This particular piece, part of the starboard washstrake, has a row of holes, some intact and others broken down, along its free edge, now become a section of the gunwale of the canoe.

Every seam, whether horizontal or vertical, is closed on the interior side of the hull by means of a narrow batten of coconut-leaf midrib inserted under the stitches. On the exterior only the seam on either side of the keel and that between the washstrake and the wale strake are similarly protected.

All holes used in sewing the various parts together are tightly plugged with coconut fiber driven in from the inner aspect except those along the lower side of the keel and garboard strake seam and of the washstrake seam; in these places the plugs are inserted from the exterior.

Only on the end pieces, which have been hewn out of the solid, are adz marks visible. Everywhere else the surface has been carefully rubbed down and made smooth.

A considerable number of slight grooves in the outer edge of the port gunwale extend for some 15 inches both forward and aft of the thwart fitted amidships. These are friction furrows made by hand lines used in fishing and show to what use this canoe was put while in the hands of its island owner 169 years ago.

For the fine photographs which illustrate the construction of this oldest example of a complete Polynesian canoe I have to thank the courtesy of the Ethnographical Department of the British Museum and in particular Mr. H. J. Braunholtz, who had the canoe photographed at the cost of considerable time and trouble.

A canoe hull from Vahitahi (Bernice P. Bishop Museum), collected in 1915, shows the design to have remained almost unaltered:

The hull is nearly of the same dimensions as that of the canoe collected by Captain Wallis. What minor differences are found are due in the main to the employment of larger and better planking. The hull of *tou*, obtained from Akiaki 25 miles to the west, is double-ended and has a deep keel, again in three sections. The sides are lower and of simpler construction; they consist of two deep and quite regularly alined horizontal strakes finished off with a gunwale rail practically without sheer which may be taken as the equivalent of a washstrake. Above the garboard strake each end is closed in by a deep transverse breakwater, with the keel prolonged upward at an acute angle from the vertical into a pointed end piece functioning as a cutwater.

In only two important details does the design differ from that of the canoe collected by Wallis. A head rail, a continuation of the gunwale rail, extends on each side about 18 inches beyond each breakwater, joining its neighbor from the opposite side at the bluntly pointed extremity of the end piece. The other difference is the absence of the narrow wale strake (*roku*).

The outrigger consists of three elbowed booms, the ends lashed directly to the float. Each has a straight shaft giving off at the distal end a slightly curved, down-turned branch at an angle of about 45 degrees from the vertical; a small knob similar to what is characteristic of Rimatara in the Australs (fig. 106, *c*) projects horizontally beyond the point of branching. The curved branch at its lower end is notched on the outer or upper side for convenience of lashing it to the float. A pair of long withy braces of *Suriana* were supplied for each boom; they are sharply pointed at one end, evidently intended to be driven into the float. The booms and float, which are all circular in cross section, had evidently been freshly cut for this canoe but had never been assembled. The braces were probably intended to be fitted one on each side of the boom elbow terminal in a way similar to the fitting of the curved connectives of modern Rapa canoes.

NUKUTAVAKE

The present-day canoes of Nukutavake, which Emory states are today similar to those of Vahitahi (April 28, 1932, personal communication), are well described by Alexander (1902, pp. 765-767), who visited the island in 1899 during the cruise of the *Albatross*. Alexander remarks that everything connected with the people of this island had the appearance of having undergone little change through the

introduction of modern things. As nearly as could be learned, no white men had ever lived among them.

The largest canoe seen by Alexander was 17 feet in length, 3.75 feet in beam, and 2.5 feet in depth. It was very sharp on the bottom, with a great deal of dead rise. In others, wider in proportion to the length, the bilge was more rounding. The region corresponding to the keel and garboard strake was hewn from one piece [a characteristic distinguishing them from the Reao type, in which a distinct keel is normally present, separate from the garboard strake]. On its edges sides were raised, made of many short lengths of planking, frequently irregular in form, sewn together with sennit and roughly arranged in strakes. A deep breakwater connected the upper strakes at each end. The seams were covered with bamboo strips and between the planks were calkings of gum and narrow strips of lauhala. The longest plank was used to form the gunwale strake. Head and stern were alike. On each side at each end a head rail extended forward beyond the breakwater about 2.5 feet; to the inner ends of these head rails the forward and after booms were fastened respectively. From the keel an end piece ran up to connect with the pair of head rails, giving strength and adding considerably to the general appearance. This end piece was made of one piece of wood and was neatly fitted and sewn at its base to the keel, breakwater, and side planks and at its outer extremity to the converged ends of the two head rails. As a result of this construction, each end of the canoe had the form of a tripartite open frame, projecting horizontally beyond the breakwater. Athwart the end functioning as the stern was a prominent cleat for making fast the sheet and against which the steering oar was placed when the craft plied through the surf and in narrow passages. Two cross braces, one forward and one aft, answered as thwarts. On one canoe a temporary bowsprit was rigged, the heel fastened underneath the forward outrigger boom. The more beamy canoes had two sets of floor timbers, one set 3 feet from the bow, the other 6 feet from the stern. One canoe, 14 feet long but only 2 feet wide, had no timbers. In the largest canoe was a mast step, the mast partner situated just aft of the forward boom and fitted to the gunwales. No masts or sails were seen.

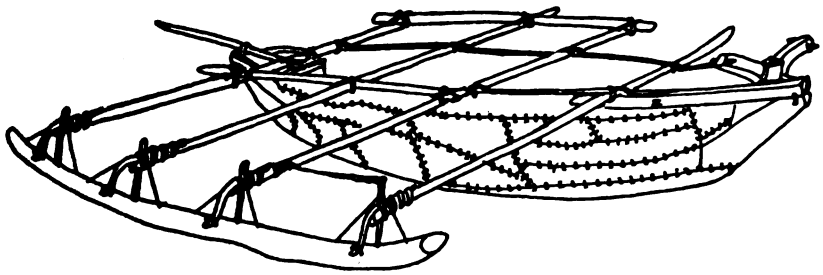


FIGURE 47.—Outrigger canoe of Nukutavake, stern to right; in this canoe the float is cylindrical (after Alexander, 1902).

The outrigger of the largest canoe consisted of four straight booms projecting 9 feet outboard on the port side, at which distance they were attached indirectly to an unusually long float, 19 feet long (fig. 47). Of the smaller canoes some had 4 booms, others 3 only.

The float, always long, varied greatly in shape. In the largest canoe it was rectangular in section, 12 inches wide, and 8 inches deep and turned up slightly at each end. In the smaller ones it was cylindrical, more curved at the ends, whereof the forward one was round-pointed, the after one truncate.

The connectives of each boom consisted primarily of a curved and down-turned extension, spliced to the outer end of the boom as already noted for the canoes of Reao and Tatakoto. Its lower or distal end was lashed in the Reao manner to the outer side of the float. The supplementary parts (fig. 48) show considerable modification of the Reao design. Instead of a bent withy attached distally to the inner side of the float and proximally to the spliced region of the boom, there was a vertical stanchion, 20 inches long, passed through a hole in the end of the boom, its lower end inserted into the upper surface of the float. The upper end of the stanchion projected some inches above the boom, to which it was seized with sennit. Two sennit stays braced it fore and aft, one passing from each side of its head to points on the float respectively a few inches forward and aft of the stanchion.

The booms were lashed upon the gunwales at the places where the inner ends of the head rails overlapped them laterally, and projected outboard 3 feet on the off side; a stringer pole connected their extremities on this side.

According to Alexander (1902) these canoes showed original design and workmanship of a superior quality: "All canoes examined at other islands were crude compared with these."

The vertical stanchion employed as a subsidiary connective in this isolated community is a peculiarity seen also in Fakaravan outriggers (fig. 53, *a*), which in other respects approach the Tahitian design.

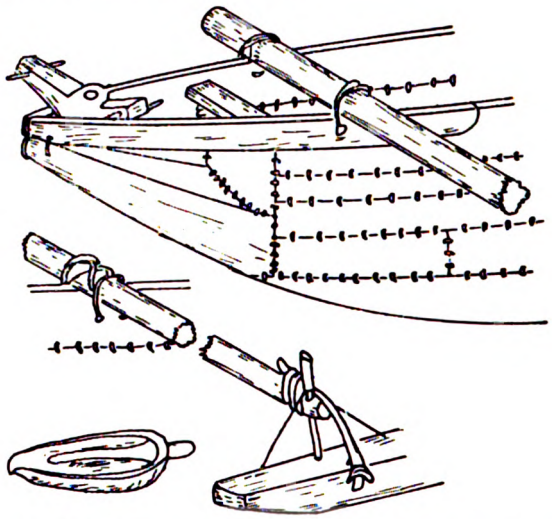


FIGURE 48.—Details of Nukutavake canoe: stern shows steering cleat with two belaying pins athwart head rails just forward of their junction with pointed extremity of after end pieces; lashing of boom to gunwale; outrigger attachment; bailer of Oceanic form with outer heel at base of internal handle (after Alexander, 1902).

The presence of a stern cleat with horns for making fast the sheet, but used primarily as a fulcrum for the steering oar, is a remarkable and unique feature in eastern Polynesian canoes (figs. 47, 48). It does not seem to be an adaptation from a European model; rather does it seem to connect with the related fitting seen in some Micronesian and Indonesian types. The habitual use of sail when at sea is indicated, and this is confirmed by a passage in Hall and Nordhoff (1921, p. 321), where it is stated that a white man living on Pinaki, about nine miles to the northwest and then uninhabited by Tuamotuans, informed one of the authors (1920) that the Nukutavakians "often came over in sailing canoes—a dozen or two at a time if the wind favored; and they would stay until it shifted back to the southeast".

Large sailing canoes without outriggers, similar to those of Vahitahi, were also used here until recent years. The last one was seen by Emory in 1930, rotting on the beach. It was made of timber from Akiaki and probably was built there.

MAKEMO

Makemo, although well within the radius of Tahitian influence, has nevertheless a form of canoe which constitutes a distinct link between the indigenous and the Tahitian types. In this, according to Alexander (1902, pp. 759, 760), who visited the island in 1899, the hull is of the Tahitian pattern, having a vertical cut-

water "with a sort of billet-head projecting outboard; stern raking; bottom straight fore and aft and flat thwartships". The underbody was a hardwood dugout with the sides curved inward toward the gunwale, on which was sewn a deep vertical washstrake of soft wood. The billet-head referred to is a blunt projection from the fore upper corner of a massive end piece rectangular in side view but winged behind to join on to the ends of the two washstrakes.

The outrigger consisted of three booms, the foremost of which had a tripartite branching at the distal end. Two of the branches slanted downward to be attached directly to the float, connected by lashing passed through two closely set holes in its outer edge; the third projected horizontally and was bound to the float by a vertical cord brace (fig. 49). The two other booms were curved poles lashed directly to the upper surface of the cylindrical float. The ends of the three booms projected some distance outboard on the offside of the hull. All rested upon the upper edges of the washstrakes and were seized thereto by sennit passed through holes just below. Three thwarts were tied upon the gunwales, one median, the others near the ends.

FIGURE 49.—Outrigger of Makemo, peculiar form of attachment is present: foremost boom has a trifid end, of which two branches inserted into float, third horizontal and connected with float by vertical sennit brace; the two other booms curved with distal ends attached directly to float (photographed in 1901, U. S. National Museum).

Between the underbody and the washstrake a strip of lauhala was inserted; the seam was then covered both on the outside and on the inside of the canoe with a narrow lath of bamboo and the whole drawn tight by being laced over with coir cord, but the outer batten (fig. 49) was discontinuous, an unusual detail of technique.

The largest of these Makemo canoes was 17 feet long with a depth of 18 inches and a beam at the widest part of the underbody of 14 inches. The bottom, having to endure rough treatment when dragged over the reef, was left of considerable thickness; in this canoe it was 1.5 inch thick.

Alexander remarked upon the deterioration manifest in the standard of canoe-building at Makemo and elsewhere in the islands as compared with former times:

"In place of neatly finished outriggers seized together with coir sennit, many are now poorly made and fastened together with nails and pieces of wire; while the large sailing canoes have been supplanted by sloop-rigged boats".

Ancestry of the Indigenous Type

A consideration of the peculiar restrictions imposed upon canoe design by the conditions of the environment leads to the conclusion that the fundamental or primitive type of the outrigger canoes of the Tuamotu Archipelago was that of the five-part canoe with direct outrigger attachment, in spite of the fact that the hulls were usually made up of a great number of small pieces. These, upon analysis, resolve themselves into five series making up respectively a dugout base, two side strakes, and two end pieces. The multiplicity of pieces used in forming the base and the sides is not a character adopted through preference or for any particular technical advantage it confers; it results directly and solely from the lack of timber large enough to be hewn into a dugout underbody and into long and broad planks for conversion into deep washstrakes. The construction of the canoes of Makemo and Napuka shows how reversion to the original type takes place when suitable material is available.

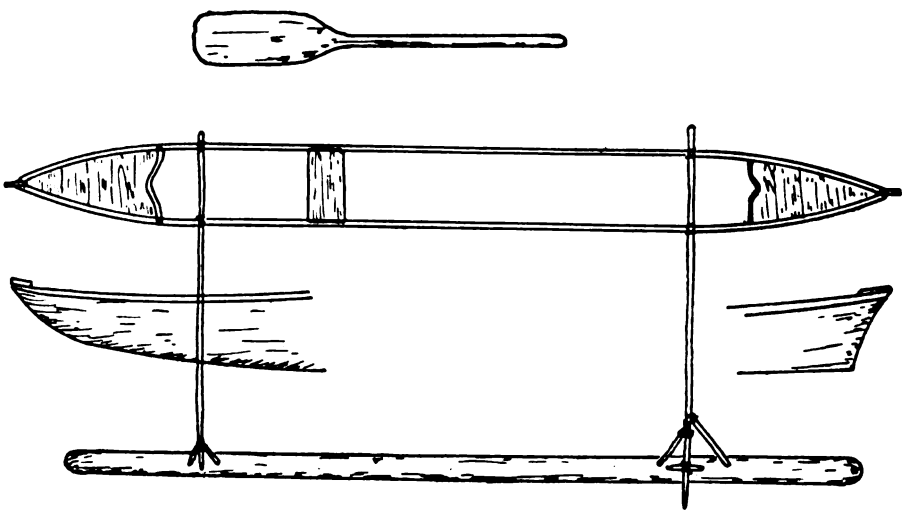


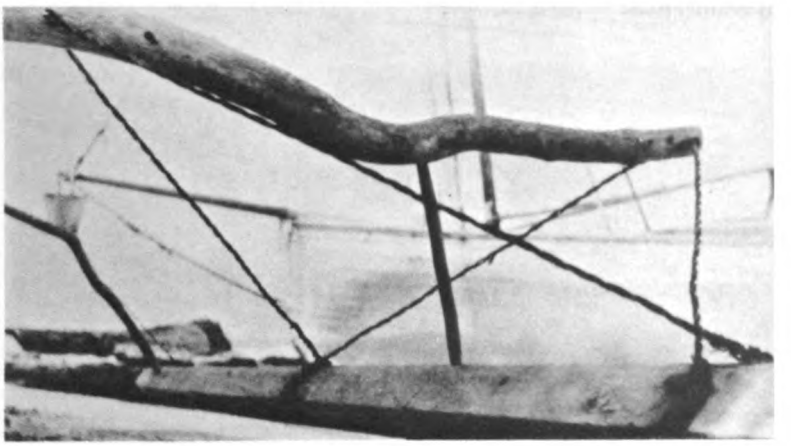
Figure 50.—Outrigger canoe and paddle of Rangiroa: stern to left; outrigger is copy of Tahitian type with slight modifications (after Alexander, 1902).

Similarly, although compound booms characterize the full-sized canoes of Tatakoto, the use of one-piece booms in models from that island goes far to prove that deviation from the one-piece boom is due directly to difficulty in finding curved branches of sufficient strength and suppleness for the purpose. The straight-limbed wood used for the horizontal section in the Reao and Tatakoto area has brittle branches, whereas *Suriana* is a wood small in girth but exceedingly supple and strong, hence the combination of a curved terminal with a straight horizontal boom.

The Easter Island outrigger canoe as figured by La Perouse (fig. 66) appears to have been closely related to the Tuamotuan type, which also has affinity with the pre-Tahitian type that formerly existed in certain of the Austral Islands, and particularly in Rimatara.

Tahitian Influence

The type of outrigger canoe used in the Society Islands, with many local and individual variations, is found in general use throughout the atolls of the northwestern section of the Tuamotus; these islands, from their geographical situation and massed numbers, have long been in frequent and intimate intercourse with Tahiti. Indeed, the founder of the Pomare dynasty was a chief from Fakarava. The canoes of Makatea and Niau (Friederici), Rangiroa (Alexander), Anaa (Pallander), and Fakarava (Hornell) are representative of this region.



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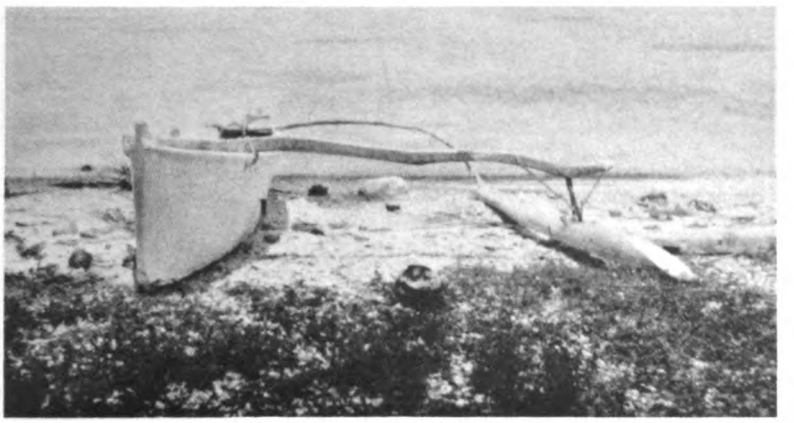

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Figure 51.—Modern plank-built outrigger canoe of Fakarava: *a*, typical modern form of outrigger attachment, fore-boom attachment a vertical stanchion connective braced by two pairs of converging stays (of wire in one canoe, of cord in another), after boom inserted into float; b, view showing oversliced fore end of float and form of fore-boom attachment consisting of a median, forked, and vertical stanchion supported by an outer and an inner cord stay made fast to pegs in float, unusual (photographed in 1925).

According to the authorities respectively named, the canoes of Makatea, Rangiroa (fig. 50), and Anaa are precisely similar to the Tahitian type, characterized by a dugout hull, with a slightly concave vertical cutwater, a pointed stern, and with

two dissimilar booms whereof the fore one is stout, slightly recurved, and connected to the float by a number of slanting stick stanchions and the after one slender, flexible, strongly bowed, and attached directly to the float. Turnbull (1813, p. 263) who visited Makatea in 1803, found the canoes "superior in point of execution to those of Otaheite, being ornamented with a profusion of carved work". This was probably due to the harder quality of timber available; according to Emory, Makatea was the only island in the Tuamotus where *tamanu* grew originally. The canoes of Niau, according to Friederici (1912, p. 314), differ from the Tahitian type in possessing straight fore booms, but the usual Tahitian design of stanchion connectives is used.

FIGURE 52.—Modern sailing outrigger of Fakarava; European rig has been adopted but outrigger is normal (photographed in 1925).

The outrigger craft of Fakarava are numerous and, though undoubtedly variations upon a Tahitian model, the modifications are worth recording. A considerable number of two-boom single outriggers having a standing mast and shrouds, and rigged with a jib, fore sail, and boomed sprit sail of European type, were seen during a visit to the island in 1925, as well as numerous paddling canoes.

The form of the outrigger is variable within definite limits, affecting particularly the details of the fore-boom attachment (fig. 51). All outriggers are fitted on the port side.

The fore boom is always stout, rigid, and generally with less curvature than is seen in Tahiti; in the sailing canoe it is nearly straight on the outrigger side. Not uncommonly it is made of a squared timber. In the sailing outriggers it projects a considerable distance outboard on the off or starboard side in order to give a purchase for the attachment of a long balance spar to which several shrouds are led (fig. 52). Where the end of the fore boom projects over the float it is primarily supported at the correct height by a vertical stanchion, whereof the ends are inserted respectively into the lower side of the boom and the upper surface of the float (fig. 53, *a, b*); in some canoes it is doubled (fig. 53, *d*), and in a few it is forked at the lower end to give increased rigidity. It is also braced by four or five obliquely running cords; two of these, on each side, pass obliquely upward from the float, one outward to the projecting end

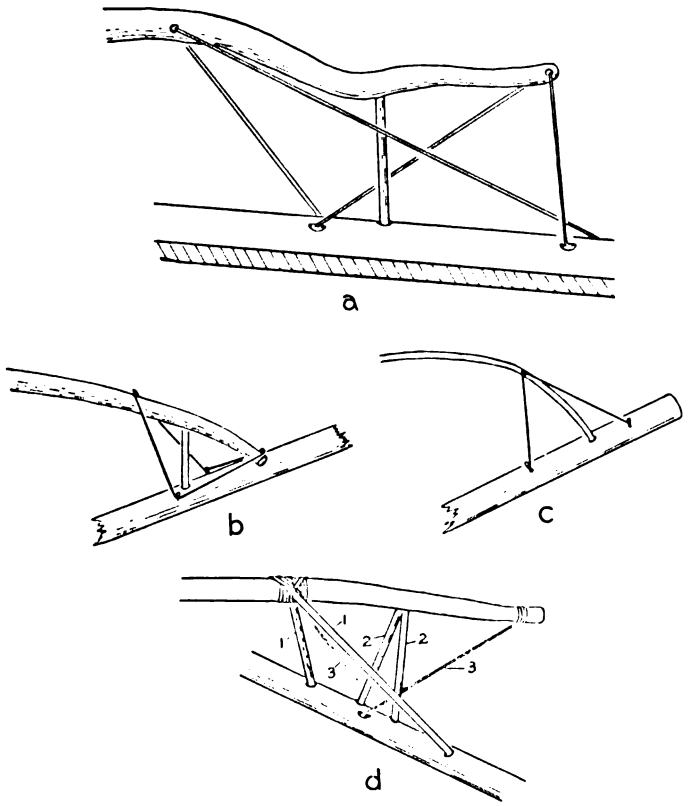


FIGURE 53.—Outrigger attachments, Fakarava. *a*, typical fore-boom attachment, one vertical stanchion and two pairs of sennit or cord braces through V-shaped perforations in ridged upper surface of float. *b*, degenerate variety of typical form: sennit, cord, or wire braces held in position by nails and staples instead of passing through perforations in float. *c*, typical aft-boom attachment, inserted end of aft boom braced by two side stays of sennit, cord, or wire. *d*, non-typical attachment of fore boom: 1, pair of oblique stanchions; 2, median pair in inverted V form; 3, outer and inner cord brace.

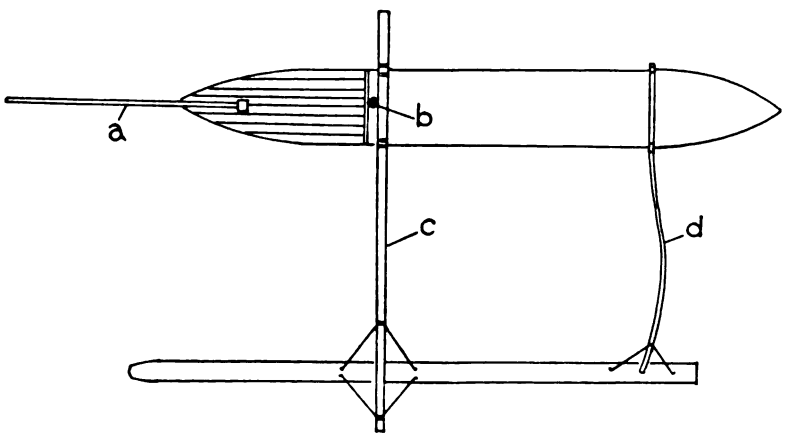


FIGURE 54.—Plan of modern sailing outrigger, Fakarava, rigged as a cutter with mainsail, foresail, and jib: *a*, bowsprit; *b*, mast; *c*, fore boom; *d*, aft boom. (After canoe seen in 1925.)

of the boom and the other inward toward the hull (fig. 53, *a*, *b*). The fifth or unpaired brace when present runs outward from the base of the vertical stanchion to the extremity of the boom.

In one attachment a couple of additional braces were noted, one running aft and downward from the boom to attachment to the float, the other forward and downward. All these braces may be lashed at the lower ends either to wooden pegs or to nails or staples driven into the float, or they may be passed through holes bored transversely through the upper part of the float.

The slender after boom is always arched and flexible as in Tahiti (fig. 53, *c*). The distal end is normally inserted directly into the float and is strengthened on both the fore and the after side by a cord or sennit brace attached by pegs, nails, or staples to the float. In some, steel wire is used in place of cord or sennit—a modern innovation, as is the common use of wire for the fore-boom braces.

The float is very like that of Tahiti, being long, straight, and bluntly pointed at the fore end, which extends nearly to a level with the head; the after end is roundly truncate a short distance abaft the after attachment. In most canoes it is cylindrical; in a few it is axially ridged on the upper side.

The form and function of the balance spar are the same as in the Society Islands.

All the larger canoes are decked in forward of the fore boom (fig. 54) and in some the space aft of the after boom is likewise covered in. The hull in all is very deep and narrow in proportion to the length; in those built up of planks the bottom is flat (fig. 52).

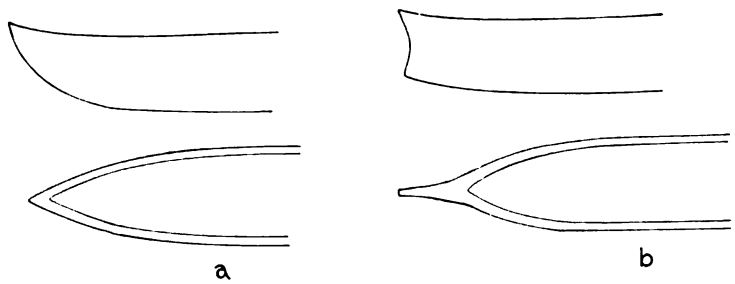


FIGURE 55.—Fore ends of dugout canoes, side view and plans: *a*, Fakarava; *b*, Tahiti, has more dead wood in stem.

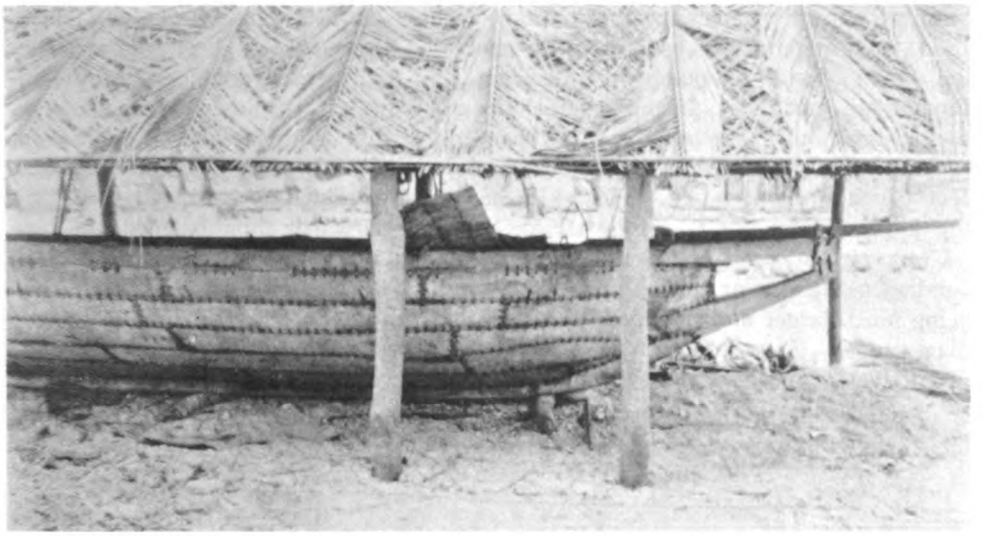
The Fakaravan type of outrigger canoe is certainly derived from the Tahitian. There are, however, considerable modifications introduced, the principal being: 1, the substitution of sennit, cord, or wire braces for obliquely set stanchion connectives; 2, the use of a vertical stanchion connective; 3, the adoption of a straight vertical cutwater or else of one convexly curved, with the stern more or less bowed. In Tahiti the cutwater is slightly but distinctly concave vertically and the stern runs fine to a sharp point. The fore end has a lot of dead wood in the Tahitian type, but not in that of Fakarava (fig. 55).

The dimensions of a typical Fakaravan sailing outrigger are:

Length of hull, over all, 19 feet; length of hull forward of fore boom 6 feet 6 inches; length of float 18 feet 9 inches; length of float forward of fore boom 9 feet 4 inches; distance outboard of float 7 feet; beam 1 foot 6 inches; depth 1 foot 9 inches; height of boom above float 1 foot 6 inches; distance between booms 8 feet 5 inches.

VOYAGING CANOES WITHOUT OUTRIGGERS

Mr. K. P. Emory, who has generously supplied me with numerous details and photographs of Tuamotuan canoes, in 1930 found four large voyaging canoes for use without outriggers still existing in the Vahitahi area. Two in perfect condition were at Vahitahi, one at Nukutavake, rotting away, and a fourth beginning to decay at Akiaki; the last of these is now at the Papeete Museum. (See fig. 56.)



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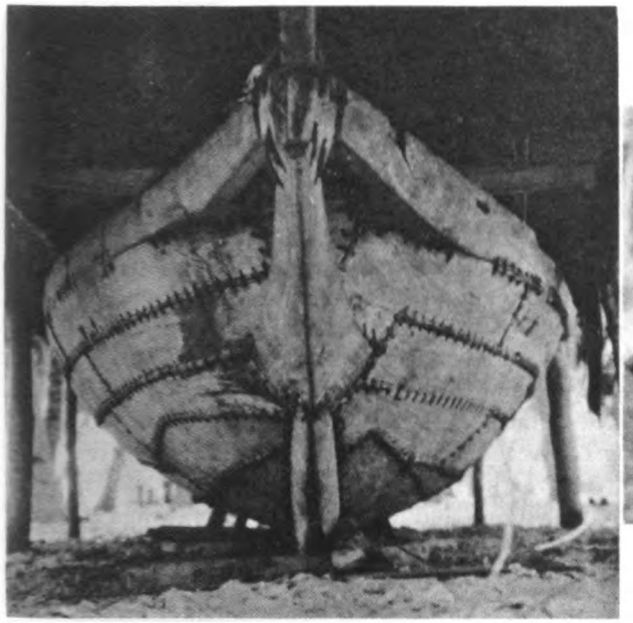

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FIGURE 56.—Vahitahi sea-going vessel, one of the last voyaging canoes in the Tuamotus: *a*, side view, beam has been increased so greatly that canoe is sailed without outrigger, structure shows direct development, by addition of more strakes and of massive head rail on each side of upwardly directed end piece, from type of outrigger canoe seen in figure 45; *b*, end view showing characteristic head fittings peculiar to the Tuamotus, head rail on each bow extends outward to meet free extremity of end piece, which also forms cutwater; *c*, stern, heavy steering oar pivoted upon cross bar lashed athwart the two headrails (photographed by K. P. Emory in 1930).

The dimensions of the better of the two Vahitahi canoes are: length 28 feet, beam at gunwale 7 feet, height 3 feet 5 inches. It is a single hull, built about 1880. Old material was used in its construction; the end pieces, keel, and many of the pieces of side planking were derived from a discarded double canoe of the famous old *pahi* type. In the general lines of its design it follows closely those of the old type, but in the proportion of beam to length it is much wider, being as one to four. The Akiaki hull is still beamier, for to a length of 29 feet the beam is 8 feet 3 inches, depth 3 feet. This extra beam was obtained by raising the sides by the addition of one or two extra strakes, inclined outward; thus widened, the vessel was enabled to sail without the adventitious aid of an outrigger. The design is fundamentally similar to that of the small hull in Bernice P. Bishop Museum, but being much larger and intended for sail, it has fittings not necessary in small paddling canoes. These consist of V-shaped ribs, a mast, a bowsprit, and a heavy long-eared steering cleat set transversely at the functional stern.

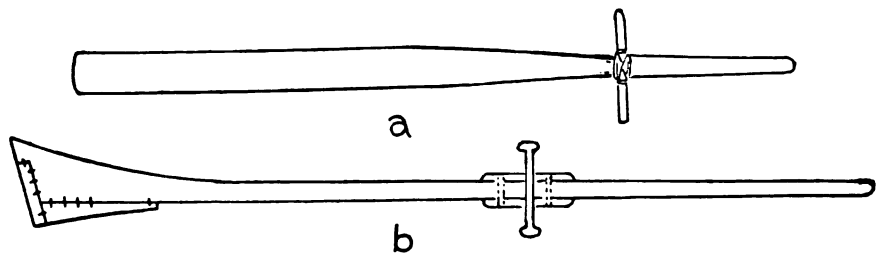


FIGURE 57.—Steering oars of Tuamotuan double canoes: *a*, from the last surviving *pahi* at Vahitahi in 1930 (photographed by K. P. Emory in 1930); *b*, ancient type (after Duperrey, 1829).

Although this vessel is an adaptation of material from old hulls to a modified whale-boat design, the steering method (fig. 56, *c*) is of great value as elucidating that formerly in use in the twin hulls of the *pahi* (fig. 57, *b*). The steering fitting has an oarlike form, the blade long and broad and nearly parallel-sided. At the point where the blade narrows into the stout cylindrical handle a short cross bar is lashed on (fig. 57, *a*). One end is pointed and fits into a vertical hole in the heavy steering cleat; a strong braid made from aerial root fibers of hala (*Pandanus*), attached to one horn of the cleat, is led to the opposite end of the cross bar, made fast there by half-hitches, and then led to the second horn of the cleat, where it is belayed. Thus confined, the steering oar is admirably steadied and thereby gives the steersman greatly increased control over its movements. This undoubtedly is the same method as that recorded by both Paris and Wilkes in their drawings of the double canoes existing in the first half of the last century.

The mast was stepped well forward, probably against the cross piece in front of which the bowsprit was made fast. Emory did not see it in position, but from the analogy of a large sailing canoe seen at Reao, considers that it was probably stepped similarly—that is, in a movable shoe block, fitting in the channeled surface of the keel. This canoe made an interisland trip in 1930 carrying about 30 passengers.

BAILERS

The Tuamotuan bailer (*tata*) is of typical Oceanic form, varying in width according to the breadth of the hull in the bottom; in small canoes half a coconut shell is often used for this purpose.

DOUBLE CANOES

To reconstruct a detailed picture of the double canoes of the Tuamotus with any precision is extremely difficult. Many references are made to them by the early voyagers, but confusion has arisen from the fact that the majority of these notes were made in Tahiti and Raiatea and not actually in the Tuamotus themselves. Tahiti was then, as now, the hub of the universe for the people of the Tuamotus. Ellis (1829, vol. 1, p. 181) says: "The natives of the eastern isles frequently come down to the Society Islands in large double canoes, which the Tahitians dignify with the name of *pahi*, the term for a ship". As the Tuamotuan craft were better sea boats than their own, the greater chiefs in the Society Islands may occasionally have acquired some for incorporation in their own war fleets and for expeditions to far-off islands.

Cook when in Tahiti in 1769 remarked (1893, p. 98), "They have some few other canoes, or *pahees* as they call them, which differ from those above described, but of these I saw but six upon the whole island and was told they were not built here." One of these double canoes he described as being composed of two hulls of equal length—76 feet—and added that they were

> . . . sharp and narrow at both ends and broad in the middle; the bottom is likewise sharp, inclining to a wedge, yet bulges out very much and rounds in again quick just below the gunwale. They are built of several pieces of thick plank and put together as the others [those of Tahiti] are, only these have timbers in the inside which the others have not. They have high curved sterns; the head also curves a little; and both are ornamented with the image of a man carved in wood.

The great Tahitian canoes are stated by Best (1925, p. 129) on Cook's evidence to have been obtained from the Tuamotus. Some few may have been, but the usual practice in the early days of European intercourse was undoubtedly to build them in the Society Islands and chiefly in Raiatea, with the help or under the direction of shipwrights brought from the Tuamotus. Moerenhout (1837, vol. 1, p. 159) states so definitely: "At Tahiti they make use of the same kind of vessel for voyaging, but are under the necessity of employing some natives of the Low Islands [Tuamotus] for their construction."

Again, according to writers who actually voyaged among the Tuamotus, none of the Tuamotuan double canoes had a "high curved stern, with the head also curved a little" as described by Cook. The only reliable figures of this long-extinct type—those of Duperrey, Paris, and Wilkes—and the few authentic models in existence, show hulls with little or no sheer and quite without any high or curved stern. It may therefore be concluded that the Tahitian *pahi* at the time the islands were first visited by Europeans was a vessel constructed with the help of Tuamotuan natives after the Tuamotuan design but modified in the form of their extremities and other respects to conform with Tahitian taste. Banks (1896, p. 115) writes that he saw *pahi* being built by foreign workmen during his visit to Raiatea. The builders of these vessels had the great advantage of having at their command in the Society Islands planks of greater length and width than were available in the Tuamotus, where the only suitable timber available was of such small dimensions that planks in good running lengths could seldom be procured for the construction of the hull.

That the home-built Tuamotuan double canoes, although made of inferior timber, were finely built vessels fit for long voyages is emphasized by Ellis (1832-36, vol. 3, p. 305) who, writing about 1828, states:

> They [the Tuamotuans] formerly built better vessels than any other nation in the eastern part of the ocean, and they were more daring and successful navigators than the more favoured

and civilized tribes which they occasionally visit. Their canoes . . . are still superior to any in this part of the Pacific.

The vagueness of the term *pahi,* which the Tahitians applied to any large vessel in the same loose manner in which we ourselves employ the word "ship," has largely invalidated the great majority of the accounts left by the early voyagers to Tahiti, where the Tuamotuan double canoe was first seen by Europeans. The descriptions given by them are usually loosely worded and, with scarcely any exception, give no information concerning what island or section of the archipelago the vessel described actually belonged to.

There is no doubt that the typical double canoe of the Tuamotus was a vessel very different from that ordinarily employed in the Society Islands. The first valid description traceable is that of Commodore Byron, who visited Takapoto and Takaroa (King George's Islands) at the north end of the archipelago in 1765 and who wrote (Hawkesworth, 1773, vol. 1, p. 100) as follows:

Our boats then returned and brought off the two canoes which they had pursued. One of them was 32 feet long, and the other somewhat less, but they were both of a very curious construction and must have cost those who made them infinite labor. They consisted of planks exceedingly well wrought, and in many places adorned with carving; these planks were sewed together, and over every seam there was a strip of tortoise shell, very artificially fastened, to keep out the weather: their bottoms were as sharp as a wedge, and they were very narrow; and therefore two of them were joined laterally together by a couple of strong spars, so that there was a space of about 6 or 8 feet between them: a mast was hoisted in each of them, and the sail was spread between the masts: the sail which I preserved, and which is now in my possession, is made of matting, and is as neat a piece of work as ever I saw: their paddles were very curious, and their cordage was as good and as well laid as any in England, though it appeared to be made of the outer covering of the coconut. When these vessels sail several men sit upon the spars which hold the canoes together.

Wallis (Hawkesworth, 1773, vol. 1, pp. 426-428) two years later (1767) saw seven of these double canoes at Nukutavake (Queen Charlotte Island),

. . . with two stout masts in each . . . The canoes appeared to be about 30 feet long, 4 feet broad, and 3.5 deep. Two of these being brought alongside of each other, were fastened together at a distance of about 3 feet asunder by cross-beams passing from the larboard gunwale of one to the starboard gunwale of the other, in the middle and near to each end . . . They saw several canoes building, which are formed of planks, sewed together, and fastened to several small timbers that pass transversely along [across] the bottom and up the sides.

Moerenhout (1837, p. 158), whose acquaintance with the Tuamotus was more intimate and detailed than that of any other early writers, gives further useful information which in translation is as follows:

From time immemorial the people of the Dangerous [Tuamotu] Archipelago have had the reputation of being the most daring navigators of these seas by means of their great canoes which often are more than a hundred feet in length and in construction follow a plan which makes them resemble closely our own ships, for they have a keel and an interior framing whereof the members control the shape of the hull. . . . It is in such canoes that they make journeys in these waters to a distance of several degrees; but as they are too narrow for their length and for their depth, they connect two of them together; then by means of a median platform, they obtain a width equal to at least one third of their length. They are sharp at the two extremities and they do not make them tack in order to change the direction; they turn the sail and move the steering oar to the other end. The Tahitians employed the same kind of vessels for voyaging; in order to build them, they had need of the help of men from the low islands. They called these canoes *pahi,* the name by which today they designate our ships.

Moerenhout (1837, p. 180) states that he had seen canoes of the Tuamotus of different sizes, but that the largest were the *pahi* (double canoes) in which they made their long voyages. He adds that they were "immense vessels, one of which

measured 75 feet long by 28 feet in breadth", a shorter length than that given in his previous description. The beam mentioned is obviously the over-all breadth of the two hulls when joined together. Moerenhout notes that the keel was seldom in one piece.

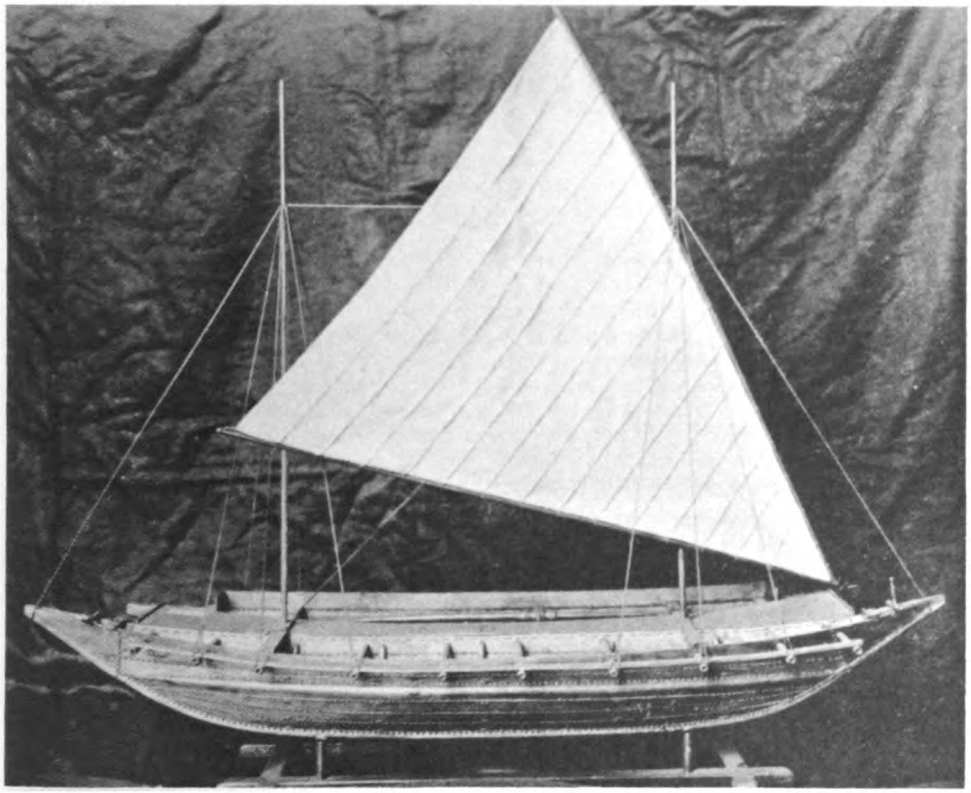


FIGURE 58.—Tuamotuan double canoe, model made under the supervision of Admiral F. E. Paris (Musée de Marine, Louvre, Paris, no. 1451).

Such particulars give only a very general and quite inadequate conception of these curious craft and it is fortunate that they survived long enough into the nineteenth century to be seen by two seamen of keen observation, Admiral Paris and Commodore Wilkes. Paris was particularly interested in recording the details of the sea craft of primitive peoples; he made a special study of this subject and in his monumental work on extra-European naval construction has left the only clear and full account of the double canoes of the Tuamotus that exists. At the same time, it must be remembered that there must have been considerable variation in the build in different islands in the far-flung archipelago, extending 900 miles northwest to southeast. Paris unfortunately does not give the island to which the canoe belonged and though the description of the hulls agrees in regard to the main features with those of Byron and Wilkes, that of the rig differs considerably in all three.

Paris (1841, pp. 135, 136), who, according to the label upon a model (fig. 58) in the Musée de Marine, Louvre, measured the original of this exhibit in 1839, writes as follows:

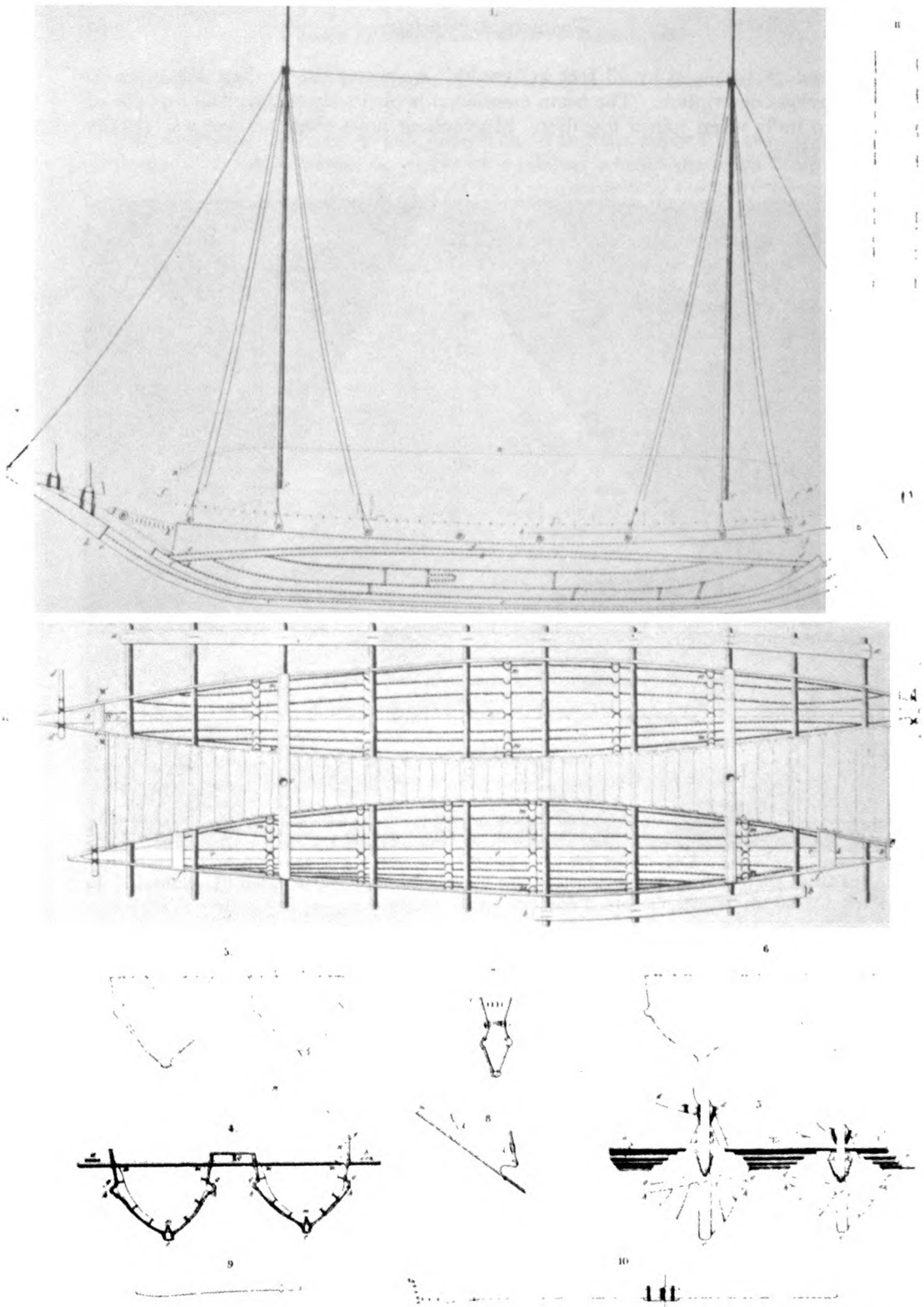


FIGURE 59.—Details of construction of double-canoe model shown in figure 58: 1, 2, side view and plan; 3, end view, showing steering fittings; 4, cross section amidships; 5, 6, body sections; 7, cross section of larger hull near end; 8, end piece in longitudinal section, joining keel and breakwater; 9, ordinary paddle; 10, steering oar; 11, ladder mast (after Paris, 1841)

The people of the Paumotus [Tuamotus] are often seen among the Tahitians, from whom they are easily distinguished by their vigor and their more determined air; they continue to arrive in large double canoes, rather roughly constructed, made as they are from the wood of the coconut palm. [To follow description see fig. 59, in which the original figure numbering and lettering are retained for convenience of reference.] The hull of each canoe has for its base a keel bent upward toward its ends and hollowed out [channeled] on the upper side (fig. 4) in such manner that its edges are not thicker than the side planks which are sewn to it, and which are then united together as high as the piece (*h-h*) forming the bilge on each side; the latter, sewn to the keel at each end, is also hollowed out on the inner side and, bent upon itself, has joined to it the upper strakes of the hull, to which it is sewn along the line (*g-g-g*) which runs from one end to the other. To its lower edge (*h-h*) is attached the upper edge of the lower planking, disposed as seen in figure 4. The sewing, rather coarse, is formed of narrow braids of sennit, without diagonals, passing through the planks already held in position by wooden pegs *à pointes perdues*, and compressing pads of coir fiber on both the outer and inner sides. The planks are maintained in position, in addition, by frames (*m*), to which each is fastened by lashings; when these are not in a single piece the component sections, fitted one upon the other, are tied securely together. The upper planks have their ends attached to a transverse piece (figs. 2, 7, *i-i*), which, filling up the interval which separates them, is sewn on the lower side to the solid [end] piece (figs. 1, 2, *k-k*), which forms a continuation of the keel, and is itself united to two planks [head rails], *oi* and *oi* (fig. 2) attached on each of its sides, and rather narrow, for there remains a space between them and the prolongation of the keel; in the smaller hull one of the connecting booms passes through this terminal space; all the other booms pass through the top strake, to which they are united only by wooden pins on the outer and inner sides; these booms are made from trunks of the coconut palm, of which the interior, soft and spongy, dries and is easily hollowed out; their outboard portions support some planks (*a-a*, *b-b*), on which the crew can walk. These canoes are far from being symmetric, as indicated by the plan and vertical sections (figs. 2, 5, 6), which have been made with the greatest accuracy to scale from measurements made in decimeters. . . . The connection of the two hulls is strengthened by a platform almost as long as the smaller hull, formed of planks attached marginally to the two gunwales and supported by a plank (*o*) [running longitudinally], placed upon the booms [midway between the hulls]. The extremities of the platform are finished off by low transverse coamings. A stout plank crosses the platform at some distance from each end and extends on either side far enough to rest upon the outer gunwale of each hull. Each of these transverse planks has a boss amidships in which is a cavity which serves for the stepping of a mast. There are two masts and each is supported on either side by three shrouds secured to the outboard ends of the three nearest booms; in addition, each has a stay [to the adjacent end of the larger hull], as well as a cord connecting the two masts.

Paris states that he noticed a different rig on a canoe seen at a distance. This had also two masts, but each appeared double and united at the top in the form of a crane; probably what he saw was a canoe having the peculiar standing rigging described by Ellis (1829, vol. 1, p. 181), in which " a kind of ladder or wooden shroud extends from the side to the head of the mast", of which there were two. A similar rig is figured by Wilkes (1845, vol. 1, p. 327), and this when seen "from afar" would give the cranelike appearance mentioned by Paris (fig. 60).

Paris (1841) did not see the sails of these canoes, but states that, from the descriptions given him by the natives, each canoe had but a single sail which the crew hoisted on one or the other mast according to the tack they were on:

It is triangular, with two equal-sized yards, of a length a little less than that of the smaller hull, on the fore end whereof its lower angle is stepped; it is of matting exactly similar to that of Tongatabu. The natives told us also that when the wind blows very violently or when the sky, obscured by clouds, denies them all means of directing their course, it is necessary often to wait a long time with the sail down and that it was very wearisome to bale out the water that came aboard or entered by the seams.

Some additional information concerning these curious double canoes is furnished by Commodore Wilkes, who visited the archipelago in 1839, a few years later than the date of the sojourn of Paris in Tahiti. His references are disappointingly brief and incomplete, but fortunately the two illustrations of different

types which accompany them give additional information. The first of these (fig. 60) he describes as follows (1845, vol. 1, p. 327):

> They [the hulls] are 35 feet long and 4.5 feet wide, connected together by a strong framework, on which is placed a deck, and a temporary mat hut is erected on their voyages. Every part is neatly put together, and well-secured with twine and sennit. . . . They have two masts, supported by vines instead of ropes, and are enabled to spread large mat sails; they steer with a large oar. After examining them, one can easily account for the long voyages which the natives have been sometimes able to accomplish.

The *Porpoise* (Wilkes, 1845, vol. 4, p. 271) when making for Aratica met

> . . . a large double canoe, with two mat-sails, which proved to be from Anaa, and bound to Aratica; there were 16 persons on board, men, women, and children. . . . They had left Anaa, a distance of 130 miles to the southward, the morning before. The canoe was a dull sailer. . . . She reached the entrance to the lagoon during the day.

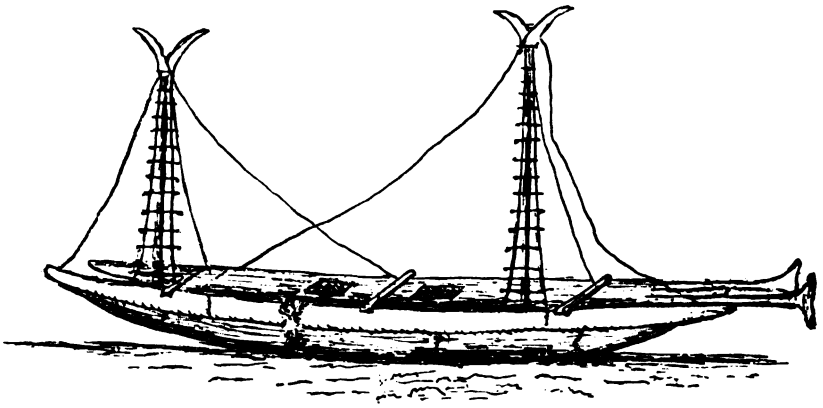


FIGURE 60.—Two-masted double canoe of Anaa (after Wilkes, 1845, vol. 1, p. 327).

Corney (1915, vol. 2, p. 117) says of the people of Anaa:

> [They] were in fact sea rovers, and frequently raided the smaller islands of the Tuamotu group, being strong enough and feared enough to obtain what they wished for by force rather than by barter or peaceable commerce. Their pre-eminence arose mainly, no doubt, from the greater productiveness of their atoll, owing to its size and the nature of the soil on it. . . . They had also the best supply of timber, built larger and more seaworthy canoes than their neighbours, and ventured farther afield, not only to Tahiti (which they once designed to conquer, and did actually invade, but consented, after a parley, not to molest), but even to the windward atolls of Hao, Vairaatea, and Nukutavake.

The canoe to which Wilkes' description refers (fig. 60) differs very greatly from that of Paris, but on a subsequent page (1845, vol. 1, p. 345) he gives as a tailpiece a woodcut of a "trading double canoe" (fig. 61) which, after allowance is made for the smallness and sketchiness of the drawing, affords convincing corroboration of the general accuracy of Paris' detailed figures. The only allusion to this figure by Wilkes is:

> The natives themselves [no particular island is mentioned, but the reference is generally to Anaa] carry on a small trade in their double canoes which, it will be seen by the woodcut below, have already undergone some modifications [in the type of rigging] from that already given on a previous page [327], as formerly in use.

The differences between this figure of Wilkes (fig. 61) and those of Paris are confined to details; the number of connecting booms in Wilkes' sketch are eight only, as against the ten shown by Paris, and no stay connecting the mastheads is shown by Wilkes. In Paris' figure and in the second of Wilkes' woodcuts, pole masts are depicted, stepped vertically, but in Wilkes' first figure each terminates in

a heavy two-horned crutch through the base of which a halyard was rove; this kind of masthead is probably homologous with the crescentic form seen in Fijian canoes.

The hulls of a double canoe seen by a colleague of Paris, Monsieur Lottin, and figured by Duperrey (1827, pl. 47), painted all over in small squares of red and white, 30 centimeters square, were of the following principal dimensions; length from head to head 14.50 meters, beam of each hull 1.05 meter, depth of each hull 1.40 meter, length of masts 5.80 meters. Lottin noted that neither of the two masts, made of bamboo, was stepped in a cupped boss or shoe as in the other canoes seen, but was held in position by means of a fork, "posée à plat". At each node in the bamboo mast a hole was chopped, "without a doubt for climbing it easily". Lottin adds that "at 0.15 to 0.20 meter from the mast, there was a rod of the same length parallel and joined to it by short cross bars which give it the air of a ladder".

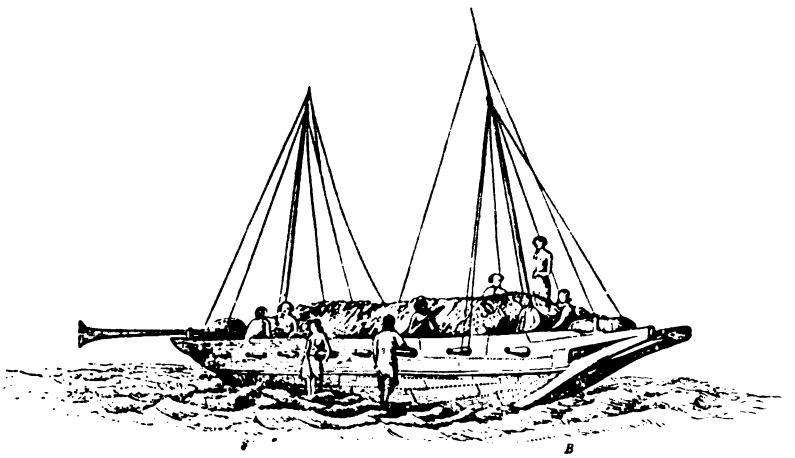


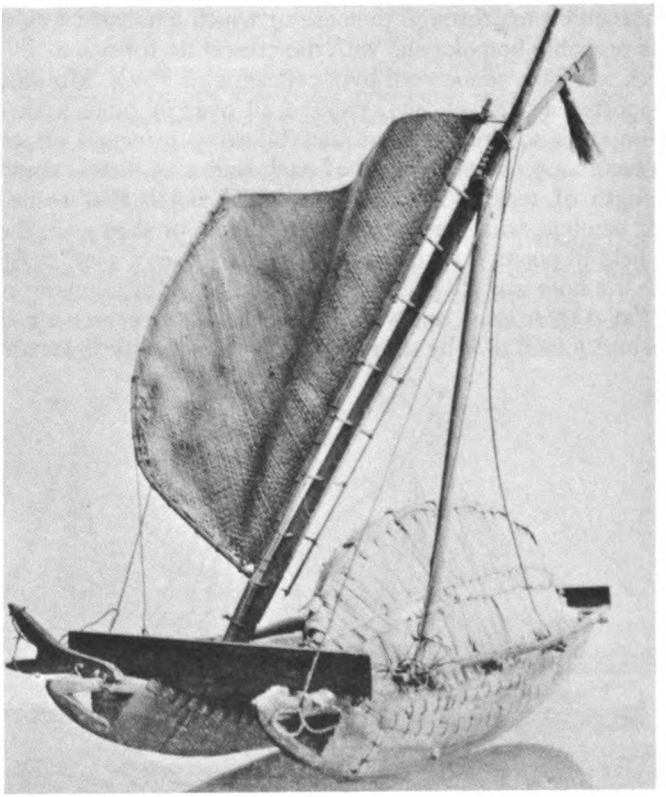
FIGURE 61.—"A trading double canoe" of the Tuamotus, of a later type than that seen in figure 60 (after Wilkes, 1845, vol. 1, p. 345).

These double canoes (Ellis, 1829, vol. 1, p. 181) had usually "a permanent covered residence for the crew", a shelter which, according to Duperrey's figure (1827, pl. 47) and Lottin's description as quoted by Paris, was of lauhala matting, about 0.72 meter high, in the form of a quarter cylinder running the whole length of the windward hull, the ends curved; two or three doors opened on the vertical side "turned away from the wind".

The steering oar employed was of remarkable size and power. The loom was long and cylindrical, the blade rather short, widening toward the outer end into a fish-tail form (fig. 57, *b*).

There appear to have been two methods of suspension. In the one figured by Paris (fig. 59) the long loom of the oar was transfixed at a considerable distance from the proximal end by a short crossbar, knobbed at each end. By it the oar was slung from a vertical peg fitted on the off side of a strong bar lashed athwart the extreme end of the functional stern of the leeward hull. As the vessel could sail either end forward, the fitting was duplicated at the opposite extremity of the same hull, the steering oar being transferred thereto on changing tack.

The second method is illustrated in the Fagatau (Fangatau) model in Bernice P. Bishop Museum (fig. 62). The crossbar is replaced by a shouldered thickening which fits against the inboard side of a horizontally disposed crutch lashed across the end of the hull.



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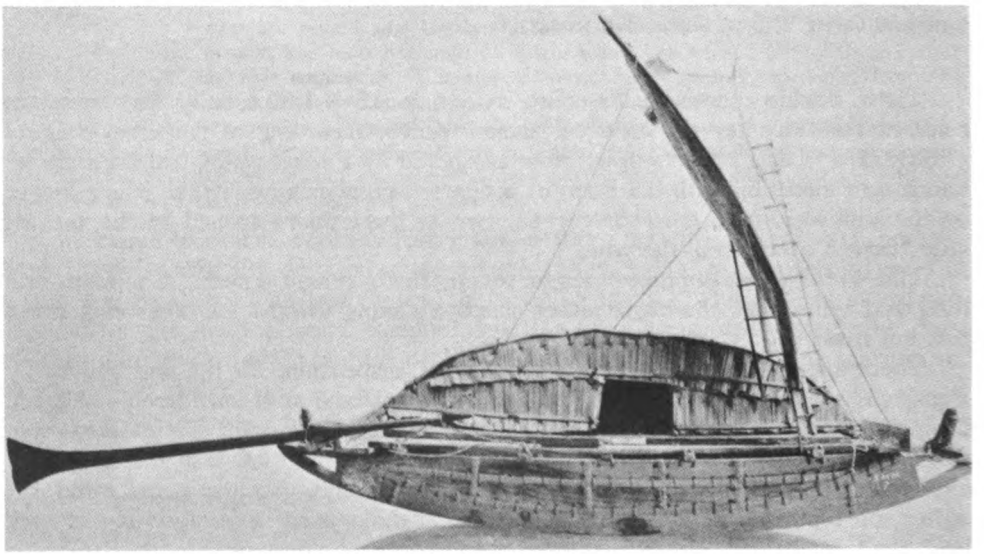


b

FIGURE 62.—Model of two-masted double voyaging canoe from Fagatau, "made about 1854" (Bernice P. Bishop Museum, no. 3474): *a*, view from fore end; *b*, lee side showing front of shelter or deck cabin, steering oar in position, and doorway of deck cabin open; second mast, not shown, similar to first and occupies same relative position at opposite end.

The first of these two types survives in a simplified form in the sailing boats without outriggers belonging to the Vahitahi area; in these the broad fin end of the old design has given place to an elongated oar-shaped blade, and the bar fitted across the loom, instead of being slung from a vertical peg, functions as crossbar and peg combined, one end of the bar being pivoted in a hole at the center of an eared cleat set transversely across the stern and supported by side braces connecting the ears of the cleat with the upper end of the crossbar (fig. 56, *c*).

Whether a steering oar was sometimes used simultaneously in each hull is uncertain. In figure 61 a single steering oar only is shown and the same inference results from an examination of Paris' drawings and the Fagatau model (fig. 62); in figure 60, however, two steering oars are conspicuous, projecting horizontally over the sterns of both hulls like two great buffers.

The dimensions of a steering oar as given by Paris are: length over all 5.80 meters, length of part beyond crossbar 3.25 meters, width of expanded end of blade 1.03 meter.

When the wind did not serve, short paddles 2.20 meters long were used. These (fig. 59, no. 9) had a spathulate blade, and there was a short crossbar near the proximal end.

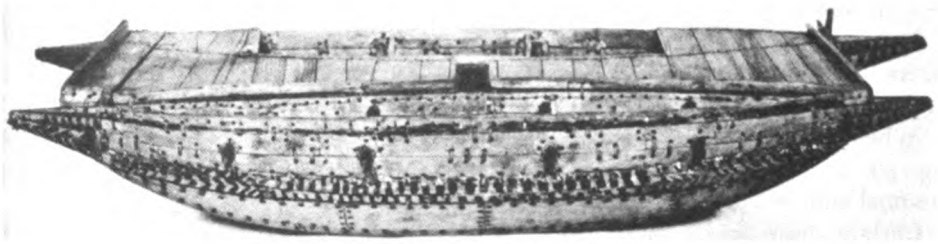
Certain discrepancies are found when comparing the foregoing accounts; of these the more important concern the form of the mast, sail, and rigging. Byron (Hawkesworth, vol. 1, p. 100) states that a mast was stepped in each hull and the sail spread between. Paris, on the contrary, figures and describes the two masts as vertical poles stepped tandemwise in the middle line between the two hulls, and the sail as triangular, the long sides bounded by two yards. Wilkes also figures the masts as tandem, but it is not clear from his sketch exactly where they are stepped, and his description makes no mention of this point. In the first of his two sketches (fig. 60), which he considers to represent the older type, he shows each masthead in the form of a wide shallow crutch, whereas in the second (fig. 61) he figures them as plain poles as Paris does. The mast described by Lottin is in a class by itself, being of biped form with a wooden ladder affixed to the side of the main spar.

Wilkes figures ratlines on the shrouds in one woodcut (fig. 60) and Ellis (1829, vol. 1, p. 181) confirms this.

Meager as all accounts are, with the exception of that of Paris, it is evident that there was considerable variation in the rig of these vessels, a conclusion consistent with the great extent of the archipelago and the comparative isolation in which many of the island communities lived, which would here and there work out local variations of the basic or primitive rig exactly as fishing boats in different British ports vary considerably in their rig and hull form. It seems probable, however, that certain details were innovations adopted by the islanders subsequent to the exploration of the archipelago by English and French navigators in the second half of the eighteenth century, from whom Paris, Wilkes, and Ellis were divided by more than half a century. Hence it is almost certain that the use of ratlines was a rude adaptation of the form of standing rigging employed for foreign ships. To a similar origin may be referred the substitution of pole masts for crutch-headed ones.

So far as I am aware, the best native-made models of these vessels in existence are a well-proportioned pair of hulls, without masts and other fittings, in the Royal Scottish Museum, Edinburgh (no. 1895, 357), and a fully-rigged example in Bernice P. Bishop Museum.

The Scottish model agrees in every essential detail with the figure given by Duperrey (1827, pl. 47) and with the hulls figured by Wilkes. It also corroborates the accuracy of Paris' description of the hulls, apart from minor details. This model (fig. 63) consists of two plank-built hulls of unequal length, connected by six booms, their ends projecting considerably beyond the outer side of each hull. The larger hull measures 28.5 inches in length, the smaller 25.5 inches; their width amidships is practically the same, about 4 inches, and the space between them, covered by decking, ranges from about 3 inches amidships to about 8 at each end. To describe the model in full detail would be in great part to recapitulate Paris' de-



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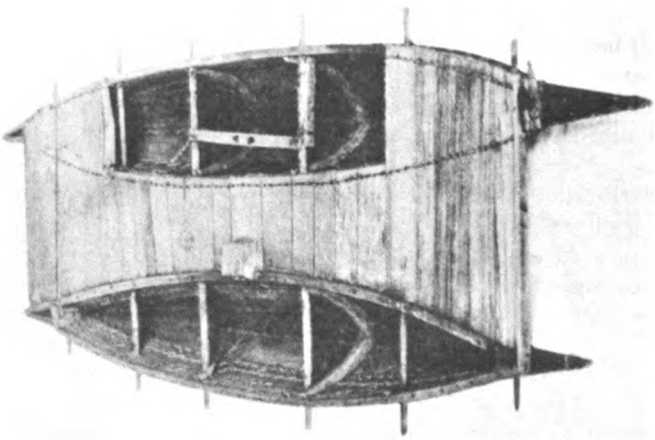

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FIGURE 63.—Old model of double canoe from the Tuamotus (Royal Scottish Museum, Edinburgh, no. 1895, 357), probably the best native-made model in existence, corroborates in most details the general accuracy of the Paris model but is more decked in: *a*, side view, narrow rubbing strake, not channeled, ornamented with many small checkers and chevrons in black paint; *b*, top view, three of original transverse frames remain and cleat at one end of larger hull would serve for making fast sheet or as pivot for steering paddle; outboard projection of booms typical; hollow boss, open on one side, seen amidships on deck platform, is probably form of mast shoe.

scription. The following features and differences require, however, to be particularized:

The keel in the smaller hull alone is channeled above; in the larger one, the upper surface of the keel is flat. Each is composed of four sections lashed end to end.

Four strakes form each side. Of these the garboard strake is the broadest, made up of several pieces of irregular length sewn end to end. Above this runs a very narrow wale strake painted with the same curious checkered pattern that in Lottin's canoe covered the whole exterior. Paris describes this strake as channeled on the inner side, in similar fashion to the keel; in the model it is merely a plain strip of planking and is only very slightly curved on the inner side; on the exterior it is strongly shouldered, whereby it is considerably thickened for the purpose of stiffening the hull longitudinally. It is apparently the equivalent of the thickened upper strake (*roku*) in the outrigger canoes of Reao and Tatakoto. Above are two somewhat wider strakes, of which the upper is the washstrake. Covering the edge of the washstrake of the outer side of the small hull is a narrow gunwale rail, attached both by means of vertically inserted trenails and by sewing with sennit; along the inner side of the hull a similar strip is found, but here it lies upon and covers the ends of the transverse planking of the deck platform. The larger hull is without this covering rail.

The ends of each hull are similar. An elongated triangular solid end piece, forming a slanting cutwater, closes the meeting place of the keel with the converging ends of all the strakes excepting the washstrake. Above it, a head rail consisting of a hornlike horizontal projection from the washstrake on each side passes forward, converging to form the upper part of the pointed stem, of which the lower part is formed by the pointed end of the small end piece. These parts are firmly lashed together at the extreme outer end. Between the head rails and the end piece beneath is a narrow slot through which, in the smaller hull, the outermost boom passes as mentioned by Paris. All the other booms pass through the lower part of the washstrakes and are bound to the sides by a curious X form of lashing which binds them above to the washstrake and below to the wale strake, skipping in its course the broad strake between these two. The end booms in the smaller hull appear to be kept in position without lashing by being nipped between the end piece and the head rails.

Each hull was originally strengthened by two V-shaped transverse frames, each formed of two curved ribs. They are attached to the hull alongside the two median booms but are not lashed to them. In the larger hull the ribs of each frame are separate like those of the Gilbert Islands canoes and do not join below; each is sewn directly to the hull planking at two points—at the upper end and at an intermediate point between the two extremities. The upper lashing passes around the inner side of the rib and through a perforation to the outside of the hull and then back through another; the lower lashing passes through a hole made from side to side through the rib and then through the hull planking as in the other lashing. In the smaller hull, of the original two frames only one remains, but here the two ribs join above the keel, having been shaped out of a forked branch (or hewn from the solid) to form a complete V; the down-turned apex is channeled to permit of the free passage of bilge water.

The deck platform fills in all the space between the hulls except at the extreme ends. It also covers in that part of the larger hull which lies between the endmost and the second boom at each end. The smaller hull is open throughout its length. The stitching of the platform planks to the gunwales is done in a most unusual manner. The sennit is first passed down a vertical hole in a plank, through a transverse one in the washstrake beneath, then on to a second hole in the washstrake, through it, and finally up to the surface through the first or commencing hole in the platform planking; from this point the procedure is a repetition of that described, the sennit being first passed along to the hole in the planking next in order to the one at which the stitching was commenced.

The planks forming each hull are sewn together in the manner usual in Tuamotuan canoes, each hole being plugged afterward by means of a tapered wooden peg driven firmly in. All the seams are unprotected on the exterior, but within the hull they are covered by narrow battens held in place by the seam stitches.

No mast is present nor is there any recognizable mast step; there is, however, a curious hollow block in one piece with the midships plank of the deck platform and immediately outboard of the inner gunwale of the smaller hull. On its outer face—that turned toward the small hull—it is open and this opening is obviously intended to receive the end of a stout squared block or spar. Abreast of it in the larger hull is a short fore-and-aft bar tied by the ends athwart the two median booms; at mid-length are two paired holes. What these structures are would be a mystery were it not for Lottin's reference to the mast of a double canoe which was not stepped in the ordinary manner but "was held in position by means of a kind of

fork, lying flat", which I assumed to be a rude kind of tabernacle. This statement makes it seem probable that the mast was stepped in a socket in a stout bar lashed athwart the smaller hull with its inner end inserted in the open side of the hollow block on the platform. The holes in the fore-and-aft bar in the larger hull would then serve to step the forked ends of the mast shore described below as present in the Bishop Museum model, which is rigged with the biped mast characteristic of one type (? the older) of Tuamotuan rig.

Just abaft the last boom in the larger hull is a thwart bar or cleat projecting outboard on the outer side; from the center of the bar rises a short vertical peg. These fittings are adjuncts to the great steering oar common to all large Tuamotuan vessels. A similar steering cleat is characteristic of Micronesian canoes.

The original coloring, less extensive but similar in pattern to that described by Lottin, differs somewhat on the two hulls. That on the larger or starboard hull (judging from the position of the steering cleat) is of regular brown and whitish checkers both on the sides of the pointed end pieces and along the whole length of the wale strake (*roku*); on the smaller hull only the long median section of the wale strake is painted—in a pattern of two rows of checker squares. A considerable length of this strake at each extremity and the two pointed ends of the hull are ornamented with bold brown chevrons. In the checkers only the dark squares are painted; the "white" of the others is the natural light coloring of the wood itself.

The second native-made model of a double canoe, that in Bernice P. Bishop Museum (fig. 62), has a hull of the same general form but less well proportioned than the Edinburgh one; the deck fittings, mast, and rigging are present and in good condition. The model came from Fagatau, a low island about 100 miles south of Napuka. It purports to have been made about 1854 and to be a model of a vessel that then existed, 60 feet long and capable of carrying as many as 60 passengers (K. P. Emory, personal communication).

Two masts of identical form are present, each with its own mat sail; one mast only is shown in the photograph (fig. 62) to avoid overcrowding the detail. The one set up is stepped on the platform between the hulls, fairly close to one end. The second one occupies, when set up, the same relative position at the opposite end of the vessel. Each has the appearance of a sheer mast and consists of a stout squared spar, the mast proper, inclined sharply toward the weather hull, and of a long, nearly vertical strut or shore, lashed at its upper end to the mast near the top, thus giving the mast its distinctive inverted V appearance. The heel of the larger spar is cut off obliquely to fit into an angular notch in the decking above the foremost cross boom, close to the inner gunwale of the leeward hull. The shoring spar has its lower end forked to straddle the outboard end of the same cross boom upon the weather side. A stringer is lashed athwart the projecting outboard ends of the cross booms on this side and serves to prevent the forked end of the shore from slipping.

Fitted to the stouter spar is a ladderlike structure provided with eight rungs set at regular intervals. Each rung passes through a fore-and-aft perforation in the spar in such manner that the spar appears to run up through the center of the ladder fitting.

To the upper end of the mast is lashed a forked Y-shaped "truck" having a hole in the short shank through which the single halyard is rove. To one limb of the fork two ornaments are tied. One is a fan-shaped object of pearl shell, serrated along the curved outer edge; the other, tied below the first, is a tassel of stiff coconut fibers.

The arrangement of the parts thus described explains and confirms the reference by Ellis and Lottin to the existence of a ladderlike type of mast and also the account by Paris of a canoe seen from afar with two masts appearing double and united at the top in the form of a crane.

The sails of this model are subtriangular in shape, the after margin curved, the fore side straight, as is also the shorter upper edge, the inverted base of the triangle. The curved after side is tied by a series of half-hitches to a light pole, the boom sprit. The fore side or luff is caught between the two halves of a split pole, representing the yard, to which it is secured in the same manner. The lower end of the sprit lies loosely against the yard some distance above its foot, which is confined against the lower part of the mast by a sennit grommet, kept from slipping by a notch in the mast.

The halyard, rove through the crutch topmast, is made fast to the outer end of the yard. This arrangement, combined with the restraint imposed upon the tack of the sail through the yard being tied to the foot of the mast, is much inferior to that found in Fiji and Micronesia, where the yard is slung from a point well down from the outer end, and where its foot is free.

A weather shroud and a forestay are present, together with two sheets to control the movements of the sprit.

The rig of this model has no parallel anywhere and contradicts that shown by Paris in his model (fig. 58). In its form the sail approaches that formerly in use in the Society Islands and in Hawaii, but there the fore margin of the sail was tied directly to the mast. By freeing the fore margin from the mast and providing a yard, governed by a halyard and sheets, the Oceanic lateen is approached; but as the foot of the yard is lashed to the mast, the sail can not be handled in a comparable manner. Were it not for distributional reasons, the type of sail might be regarded as an ancestral form of the Oceanic lateen; it seems rather to be a tentative move in a process of convergence from a different origin.

The model shows the weather hull to be almost entirely covered in with lauhala sheets to form a long low hut, exactly as described by Lottin, but with only a single doorway set at midlength on the lee side. The steering oar is of unusual shape, being shouldered at the point where a crossbar is fitted in the typical form.

SUMMARY

In spite of the great area over which the atolls of the Tuamotus are scattered, the canoe designs evidently differed but slightly in essentials. Just as the old type of paddling canoe of Napuka in the far north resembles that of Reao and Nukutavake in the southeast, so Wilkes' sketches prove that the double canoes of Anaa were identical with those of the distant Vahitahi area.

The hulls were either equal in dimensions, or if there was inequality the disparity was small. Each was keeled, the keel channeled in U or in V shape on the upper side. Each garboard strake was sewed upon one of the edges of this keel with several narrow strakes above to complete the sides; notable among these was a narrow and slightly salient wale strake, the equivalent of the *roku* of outrigger hulls. Timbers secured the strakes in position, the ribs being tied directly to the strakes by sennit passed through holes bored therein, without the intervention of strake cleats in the rudimentary fashion of Hawaiian canoes or in the fully developed Solomon Islands type and the somewhat different Fijian one.

The ends of both hulls were low, showing little or no difference. Each terminated in a pointed end piece, forming the upper part of a raked cutwater, and was strengthened by a stout head rail on each side, with a characteristic open-sided triangular figurehead as the result. These ends were neither elevated nor differentiated and were without carved ornament, thereby differing characteristically from the Tahitian type but agreeing with that of Hawaii.

A platform bridged the space between the two hulls, supported at the sides upon the inner gunwale of each, and medially by a longitudinal beam resting upon the connecting cross booms. These cross booms were straight and not arched as in the Hawaiian type; they passed through the uppermost strakes and projected a foot or more beyond the outer gunwale of each hull. In large canoes these outboard ends were even longer and sometimes served to support a plank or a spar running the greater part of the length of the hull, used probably when the crew were poling or paddling their craft. A lean-to shelter made of lauhala mats over the weather hull—the smaller hull, if there was any difference in size—gave some protection to the crew and passengers, and there was either in addition or alternatively a low weatherboard or dashboard raised on the same side of this hull to afford some protection from the lop of the waves.

The rig was characteristically two-masted, but, to judge from the Edinburgh model, these canoes were sometimes rigged with a single mast, stepped amidships. The sail was sub-triangular, the long sides bounded by a yard and boomsprit respectively, and was set apex downward. When two masts were present, the usual custom, they were stepped on the platform between the hulls, each at approximately the same distance from its respective end. In some instances the masts were plain poles; in others they had the more primitive and typical crutch-shaped masthead. Permanent shrouds secured the masts in position, the lower ends made fast to the outboard ends of the nearest cross booms of the hull. Stays ran from each masthead to the adjacent end of the main hull.

A biped mast of peculiar ladderlike form was the typical rig of the canoes of some at least of the islands. Duperrey's figure and Lottin's description as quoted by Paris are confirmed by the presence of just such a strange ladder mast figured by Cooke (1777, vol. 1, pl. 53) and still more conclusively by the mast fittings of the Fagatau model in Bernice P. Bishop Museum.

The hulls being double-ended and similar in form, the vessel was able to sail either end forward. To put about, the sail was either swung round to the other side of the mast (Moerenhout) or else reset on the companion mast at the other end of the vessel (Paris), the long steering oar being transferred to the end which previously had functioned as the forward region of the craft. The same hull was normally kept on the weather side. If there was any difference in length, this weather hull was the shorter; on it was the lauhala hut shelter for the crew and passengers.

The hulls of the Tuamotuan double canoe in certain of their features approach the Hawaiian type somewhat closely. Both are characterized by the same general and primitive form, the ends practically without sheer and the waist undecked, with the deck platform restricted to the space between the hulls. The differences that exist are, in the main, accounted for by differences of environment—the differences in the natural resources of the two archipelagoes. In Hawaii, large tree trunks were available, either grown there or drifted from the American coast, and dugout hulls without keels and requiring little or no strengthening by means of ribs were the natural expression of local canoe-building art. In the Tuamotus, lack of large timber led to the building of hulls made up of short lengths which had to be timbered inside and furnished with a keel to render them sufficiently rigid. Other differences are comparable with the variations common among the fishing boats of any single country possessing a lengthy coast line and considerable differences in local physical features.

On the other hand, there is no doubt that the rig of these Tuamotuan double canoes differed greatly from that in use in Hawaii and the Society Islands. In both these localities the vertical fore side of a triangular sail set apex downward was tied or otherwise attached to the mast itself. In the Tuamotus the sail, still triangular but provided with yard and sprit along the two long sides, had progressed well on the way to become a lateen and was slung from the mast by a halyard and not tied or laced thereto.

From the Fijian design the rig differed strikingly in that the masts were two in number and not single, and in being permanently fixed in position instead of capable of being raked at will toward either end of the hull. It is noteworthy that the rig of the elaborately ornamented double canoes of Manihiki and Rakahanga approached more closely the Tuamotuan design than any other. The two masts were commonly stepped tandem fashion, and the sail form was almost identical, with the yard prolonged below the tack into a long heel.

The crutch or Y shape of the masthead truck was widely distributed, extending from the Tuamotus through Manihiki, Samoa, and Tonga, to Fiji, but was missing in the Society Islands.

The terms applied to the twin hulls appear to have been closely related to those of the rest of Polynesia. At Tatakoto, Emory found that the weather hull was remembered under the name *kuama,* that of the lee hull as *katea.*

MANGAREVA

CATAMARANS

When Mangareva (Gambier Islands), a small group of high islands, was discovered, the inhabitants had no better means of traversing the wide, shallow encircling lagoon than a large sailing catamaran. No clearer description has ever been given than that by Captain Beechey (1831, vol. 1, p. 105), of the *Blossom,* who visited Mangareva in 1825, the first white man to set foot on their shores. As the *Blossom* neared the islands

. . . several small vessels under sail were observed bearing down to us. When they approached we found they were large katamarans or rafts, carrying from 16 to 20 men each. At first several of them were fastened together and constituted a large platform, capable of holding nearly 100 persons; but before they came near enough to communicate, they separated, furled their sails, and took to their paddles, of which there were about 12 to each raft [fig. 64]. We were much pleased with the manner of lowering their matting sail, diverging on different courses, and working their paddles, in the use of which they had great power, and were well skilled, plying them together, or, to use a nautical phrase, keeping stroke. They had no other weapons but long poles.

Beechey (1831, vol. 1, p. 143) supplements this first impression by details of the structure of the catamarans:

Contrary to the general custom, no canoes were seen at Gambier Islands, but rafts or katamarans are used instead. They are from 40 to 50 feet in length, and will contain upwards of 20 persons. They consist of the trunks of trees fastened together by rope and cross beams: Upon this a triangular sail is hoisted, supported by two poles from each end; but it is only used when the wind is very favorable, at which time, if two or three katamarans happen to be going the same way, they fasten on and perform their voyage together. At other times they use very large paddles made of a dark hard wood, capable of a good polish, and neatly executed. Some of them had a hand or a foot carved at the extremity of the handles, very well finished. They are about 5.5 feet in length, including 2 feet 8 inches of blade, which is about a foot in width, curved and finished with a small point or nail at the extremity [fig. 65]. In shallow water they make use of long poles for punting, in preference to their paddles.

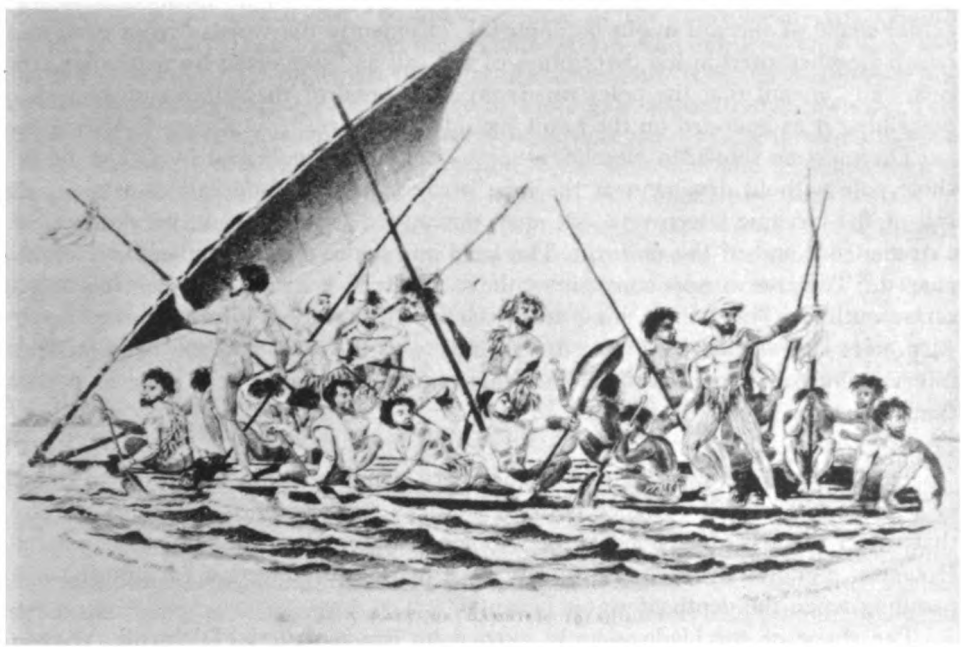


FIGURE 64.—Large catamaran of Mangareva under sail, sketched in 1826 (from Beechey, 1831, vol. 1).

Both D'Urville (1834-35, vol. 1, p. 517) and Moerenhout (1837, vol. 1, p. 109) confirm Beechey's description of the Mangarevan custom of joining several rafts together to form a spacious platform. D'Urville says that five or six were usually thus arranged, capable of carrying 80 or 100 men and that each individual raft was manned by a crew of 12 or 15. Moerenhout mentions that this joining up was customary "when going before the wind". He adds that some rafts, presumably invididual ones, could carry as many as 40 people.

Beechey's fine plate (fig. 64) of one of these catamarans makes clear several details. It is difficult to make out the number of logs forming the platform; it is, however, an odd number as in India. In the illustration there appear to be either five or seven; Moerenhout (1837, vol. 1, p. 109) gives the number as three, but perhaps this refers to small catamarans, as it is impossible that 40 persons could be supported upon three logs. The fore ends are pointed, or rather, wedge-shaped; logs in the center project somewhat farther than those of the more lateral, the median one being the longest. The after end is truncate, the logs finishing level with one another. Two cross beams, one toward each end, are lashed across the basal fore-and-aft logs.

On these catamarans the Mangarevans were accustomed to visit Temoe, nearly 30 miles distant (Moerenhout, 1837, vol. 1, p. 110). Though uninhabited at a recent date (Brigham, 1900, p. 156), there are many stone-built maraes there, and Best (1923, p. 14) mentions that Temoe was settled by a party of refugees from Mangareva about 150 years ago.

MAST AND SAIL

Were Beechey's description not made clear by his engraving and this in turn not corroborated by D'Urville's explicit statement (1834-35, vol. 1, p. 517) that the "long sail was attached to two 'antennae' and supported by an inclined mast", the actual shape of the sail might be doubtful. Evidently the words "from each end" which Beechey used in his description of the sail as "supported by two poles from each end", meant that the poles ran from end to end of the sail, a clumsy way of describing it as bounded on the two long sides by spars.

The mast as shown in Beechey's engraving and as described by D'Urville is a short pole without ornament at the top; it rakes forward and carries a triangular sail of the Oceanic lateen type, set apex downward with the tack tied down at the extreme fore end of the plaform. The yard and boom are of bamboo, both lightly curved. The free or upper margin of the sail—the base of the triangle—has a crescentic outline. The sail is slung from the masthead, about three-quarters up the yard. Its lateral margins are tied respectively to the yard and the boom at short intervals by paired cords whose fluttering ends are left long and serve as decorations along the boom.

PADDLES

The long paddles were used in the ordinary sitting position, according to Beechey's plate, which is at variance with Friederici's statement (1913, vol. 3, p. 162) that "after the loss of their boats, they took to paddling, standing upon their rafts". However, as noted above, the people show a marked predilection for punting over paddling when the depth of water permits.

The shape of the blade is aptly likened by Roquemaurel (D'Urville, 1842-46, vol. 3, p. 400) to that of a banana leaf; in dimensions it exceeds every other paddle blade in Oceania apart from steering paddles. As shown in Beechey's figure, the hand grip is fashioned into a backwardly curved knob, carved, as Beechey says, into the form of a hand or a foot, and a paddle in the Bernice P. Bishop Museum has a hand carved in this position. In a paddle in the British Museum (fig. 65) this is lacking.

Examination of the same paddle indicates that the "nail" at the tip of the blade is a feature homologous with the larger and stouter terminal "beak" characteristic of the Marquesan paddle. The same feature is present in a modified form in the old Tuamotuan paddle, and the terminal "finger" on the Easter Island dancing pad-

dle (fig. 67, *a*) is probably a vestigial relic of a similar peculiarity. To the same category appear to belong the ridged tips of some Hawaiian paddles and the enlarged tips occasionally seen on Maori ones.

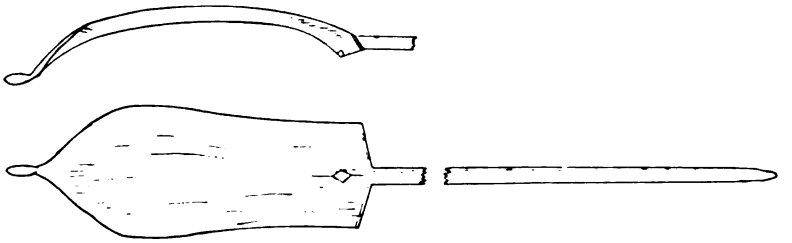


FIGURE 65.—Face and side views of Mangarevan paddle (British Museum) showing characteristic "nail" at tip of blade.

COMPARISONS

On the evidence of the similarity of the language and of certain of the legends of the Mangarevans with those of the Rarotongans, Seurat (1905, *b*, p. 483) concludes that their ancestors came from this island, which in turn appears to have been colonized at a very early period by people of the Marquesan type (Smith, 1921a, pp. 213, 232)—Polynesians tinged with Melanesian culture—who were submerged at a later date under an influx of Samoans and Tongans. However this may be, and the remarkable resemblance of the highly specialized Marquesan paddle to that of Mangareva can not be overlooked, there can be little question that the Mangarevans are much more closely related to the Samoans and Tongans than to the people of the Society Islands or to those of the Tuamotus, notwithstanding their proximity to the Tuamotus. Apart from this, the structure, rig, and nomenclature of the Mangarevan catamaran all combine to point to the conclusion that it is derived directly from a type of craft akin to the double canoe used in Tonga and Samoa before the Fijian *ndrua* type displaced it. We have only to look at Le Maire and Schouten's figure of a Tongan *tongiaki* encountered near Tafahi or at that by Hodges in Cook (1777, pl. 42), to see how easily this type of vessel might degenerate into a Mangarevan catamaran were the great deck platform strengthened by cross beams and the two hulls discarded.

The Mangarevan term for catamaran as given Seurat (1905, *b*, p. 483) is *paepae*, a word widely employed in Oceania for a sea-going craft. In the Chatham Islands it was applied to the largest of the boat rafts in which the Moriori formerly crossed wide stretches of open sea (Shand, 1911, p. 86). It is also used in Ongtong Java and Nukumanu, off the Solomons, in the sense of "sea-going vessel" under the forms *pepe'au* and *pepekau* respectively (Sarfert and Damm, 1929, pp. 196-201). In Marquesan a house platform is a *paepae*; in Polynesia the favorite sea-going vessel in former times consisted essentially of a large and roomy platform supported either upon a pair of canoes used merely as floats and not usually as living quarters, or upon a canoe and a float, as suggested by Friederici (1912, vol. 2, p. 247). Friederici, quoting from an "Essai de Grammaire de la langue des Îles Gambier" (Paris, 1908), gives *kiatu* as the Mangarevan term for a raft and infers that "this shows clearly that the outrigger frame [of an outrigger canoe] with its lattice work has degenerated into a raft which retains the Polynesian name for the booms of an outrigger, namely *kiato*". This derivation of the Mangarevan catamaran from an outrigger appears to me much less probable than from a double canoe such as the Tongan *tongiaki*, for the reasons I have already stated. The term

kiatu presents no difficulty; it is applied indifferently by Polynesians to the booms of their double canoes and to those of outrigger canoes.

It appears doubtful whether the two terms *kiatu* and *paepae* are merely synonyms or whether they stand respectively for different sizes or classes of rafts. The grammar quoted gives *kiatu* as "nom d'un grand radeau" (Tragear—1899—gives *kiato,* with the same meaning), so one of the words may stand for a specially large raft, perhaps a composite one formed by joining together several ordinary rafts, with the other term used for the small or individual raft. In Tahitian, according to information supplied by K. P. Emory, *paepae* signifies a raft of any sort, so it might be inferred that the Mangarevan *paepae* is the more generalized term, with *kiatu* standing for a raft of special size or construction, were it not for the uses of *paepae* in the sense of a sea-going vessel as contrasted with other terms designating small lagoon or inshore types.

The custom of joining catamarans when sailing is also found in southern India, where, on the Tinnevelly coast lying opposite Ceylon, the specialized boat catamarans of the locality are commonly joined in pairs when sailing to or from the fishing grounds (Hornell, 1902, p. 154).

According to D'Urville (1842-46, vol. 3, p. 400) the Mangarevans were not wholly without true canoes at the time of his visit, for he says: "Only a small number of very roughly constructed pirogues are found among them." He neither figures nor describes them.

Tregear (1899) gives two words referable to a dugout canoe, *vaka* and *kamiha*. The former he defines as "a canoe, a raft", synonyms suggestive again of the transformation locally of canoes into rafts. The meaning of the other term, *kamiha,* is given as "the trunk of a tree hollowed out as the outrigger of a canoe". As it stands this definition is meaningless, but it is probable that "a dugout canoe fitted with an outrigger" is intended, an inference confirmed by the fact that *kamia* is the term applied to a small outrigger canoe in Rapa at the present day (Stokes, J. F. G., Manuscript on Rapa, Bernice P. Bishop Museum).

MODERN CANOES

At the present day some small outrigger dugout canoes are in use. From a model given by Mrs. S. Routledge to the Pitt-Rivers Museum, Oxford, the design is seen to be Tahitian, modified apparently by influence from Rapa. The fore end of the dugout hull is deep, concave vertically, and sharp; the stern runs fine to a blunt point, curving up from the bottom. The float and the two booms are of Tahitian type, the fore boom stout and curved, the after one deeply bowed and slender and directly attached. The attachment of the fore boom consists of a pair of curved stick connectives adpressed above to the sides of the boom as in Rapa and made fast by diamond-pattern lashing. This attachment is reinforced by a third and median curved stick connective, the lower end inserted into the float, the upper lashed along the side of the boom inside the attachment of the paired connectives, after the fashion of the units of the inner pair in the Rapa type.

EASTER ISLAND

HISTORICAL REFERENCES

When Roggeveen discovered Easter Island (Rapa-nui) in 1722, the inhabitants possessed " a great many canoes . . . of poor and flimsy construction". Isolated on an inhospitable rock, without timber suitable for the purpose, the islanders were unable to construct any craft fit to enable them to renew relations with the mother islands to the west or to seek out a new home where nature was more kindly. The

memory of the great canoes that had brought their forefathers from out of the west had waned and little remained in the design of their canoes to give indication of what these adventurous craft had been.

Half a century later, in 1770, Gonzales (1908, p. 121) saw two only, and believed these were all that the islanders possessed. Cook, who followed three years later, records seeing "not more than three or four", and La Perouse (1798, vol. 1, p. 76) wrote in 1786: "I saw only three on this part of the island and I should not be surprised, if, in a short time, through the want of wood, there should not be one remaining". He adds that "they have, however, learned to do without them, for they swim so strongly that in the highest sea they go two leagues out from the shore".

Lisiansky, who visited the island in 1804 (1814, p. 58), did, indeed, fail to see any canoes, for of the many natives who came off to his ship every one swam off supporting himself upon what Lisiansky terms a "rush mat". The wind during his stay off the island was boisterous and he mentions that the islanders had to swim through a tremendously heavy surf. D'Urville (1842, vol. 3, p. 162) also records the use of swimming supports; he recounts how Captain Rugg of the English schooner *The Friends* informed him that he had lain off Easter Island without being able to land, because of the southeast wind, and that "nine natives had come aboard his ship with single planks (*simples planches*) which served to sustain them in the water even to a distance of four or five miles". Roquemaurel (D'Urville, 1842, vol. 3, p. 387) adds that each of these men was stretched out on a single plank, a description which suggests that the support was something resembling a surfboard.

Possibly the islanders used these boards or mats because they feared to launch their frail canoes, for that they had some is certain; Choris saw two in 1816, and Beechey in 1825 noticed "three boats hauled up on the shore . . . but the natives did not attempt to launch them".

In comparatively recent times W. J. Thomson (1891, p. 474), who reports on a visit to Easter Island, states that when he was there no canoes (*vaka poe-poe*) were in use; the only evidence of their existence was "two very old ones found in a cave . . . and now serving as burial cases". He adds, "They were a patchwork of several kinds of wood sewed together, and though in an advanced stage of dry rot the material was sufficiently well preserved to prove that it never grew on Easter Island, but had been obtained from the drift-wood on the beach".

The canoes of Roggeveen's time were no better constructed. He writes (1908, p. 19):

> Their canoes are fitted together of a number of small boards and light frames, which they skilfully lace together with very fine laid twine made from the above-mentioned vegetable product, *piet*. But as they lack the knowledge and especially the material for caulking the great number of seams of their canoes and making them tight, they consequently leak a great deal, on account of which they are necessitated to spend half their time in baling. Their canoes are about 10 feet long, not counting the high and pointed stem and stern pieces. Their width is such that, with their legs packed close together, they can just sit in them so as to paddle ahead.

Roggeveen does not mention that the canoes had outriggers, but all who followed him, Gonzales, Cook, Forster, La Perouse, and Choris, refer to or picture this adjunct. Unfortunately these accounts do not agree in all particulars, and too many are indefinite through superficial observation. The sketches by Choris contradict the one given by La Perouse. All essential details available other than Roggeveen's regarding both the form of the hull and the design of the outrigger are contained in the following quotations:

1770.—One of Gonzales' officers (1908, p. 121) writes: "Their canoes are constructed of five extremely narrow boards (on account of there being no thick timber in the country) about a cuarta [roughly a span] in width; they are consequently so crank that they are provided with an outrigger to prevent them from capsizing. They are fitted together with wooden pegs in place of nails."

1774.—Cook (1777, vol. 1, pp. 292-293) describes the canoes as "very mean, and built of many pieces sewed together with small line. They are about 18 or 20 feet long [clearly an overstatement], head and stern curved or raised a little, are very narrow, and fitted with outriggers. They do not seem capable of carrying above four persons, and are by no means fit for any distant navigation. As small and as mean as these canoes were, it was a matter of wonder to us, where they got the wood to build them with. For in one of them was a board 6 or 7 feet long, 14 inches broad at one end, and 8 at the other; whereas we did not see a stick on the island that would have made a board half that size; nor indeed was there another piece in the whole canoe half so big."

1774.—The general size of the "patches" of which the canoes were made up is given by Forster (1777, vol. 1, p. 558) as not more than 4 or 5 inches wide and 2 or 3 feet long. He corrects Cook as to the length of the canoes, which he states was about 10 or 12 feet. Describing a canoe, he says: "Its head and stern were raised considerably, but its middle was very low. It had an outrigger or balancer made of three slender poles [? two booms and a float] and each of the men had a paddle of which the blade was likewise composed of several pieces."

1786.—In La Perouse (1798, vol. 1, p. 76) a figure of a canoe is given which shows a small two-ended canoe with upturned ends, as described by Roggeveen and Forster, but with the long terminal projections broad and rounded at the ends instead of being equally narrow for their whole length. A single outrigger is present, formed of two straight thin rods as booms, with a third, representing a float, resting upon them, but showing no visible attachment. This float is too thin to be of any utility. [See fig. 66, *a*]. In the text La Perouse gives the size of the component pieces of plank used in making the canoe as 4 or 5 feet long and very narrow. Four men were the most one of the canoes could carry—the number mentioned by Cook.

1825.—Beechey (1831, vol. 1, p. 40), who visited the island in 1825, contents himself with saying that three canoes were noticed hauled up on the shore, "resembling the drawing in Perouse's 'Voyage', but the natives did not attempt to launch them."

The only other reference of interest is a puzzling one made by Choris (1822, text and pl. 10, figs. 1, 2), who was aboard the *Rurik* when she touched at Easter Island in 1816.

The party of the *Rurik* remained "scarcely five minutes on the island" owing to the hostile attitude of the inhabitants. Choris had certainly little opportunity to note clearly the structure of the canoes, for the crews of the only two seen refused to come near and soon sheered off ("ils refusèrent de s'approcher, et bientôt rebroussèrent chemin"). Choris describes the canoes as "chétives, pourvues de balanciers, et portant chacune deux hommes". Sketches are given of both [fig. 66, *b, c*]; each end is shown to sheer sharply upward and to be prolonged at the same angle as a narrow projection, not unlike a slender bowsprit, for a foot or 15 inches. One of the canoes is provided with a double outrigger with short, slender, straight booms, to which is tied on each side an equally slender rod, the homologue of a float. The other canoe is depicted with a very short thin rod laid athwart it close to each extremity, to which the ends of a curved withy, bowed almost double, are attached; the arc is reflected over the terminal "bowsprit" to which it is shown as tied.

It is clear that the canoes used by the Easter Islanders were never more than 10 to 12 feet long, very narrow, the two ends sharp and similar in form, rising into rather high, pointed extremities, the whole resembling fairly closely the smaller canoes of the Tuamotus as they were when first seen by Europeans. The patched hull adds to the similarity.

The function and form of the outrigger are somewhat doubtful. Were it not for Choris there would be no hesitation in concluding that it was of the single type, with the float directly attached. Choris, however, saw something different and as his sketches are precise and represent two most dissimilar designs, means have to be sought to account for these apparent contradictions. A characteristic common

to the figures given by both La Perouse and Choris is the obvious unsuitability of the outriggers as depicted for service as a counterbalancing device. The rods which represent the floats in La Perouse's sketch (fig. 66, *a*) and in the first of those by Choris (fig. 66, *b*) are useless for this purpose, both because they are too slender and light and also because they do not reach to the water, as the booms to which they are directly attached are straight. The second sketch by Choris (fig. 66, *c*) shows a variation quite useless as a counterpoise device. If, then, these "outriggers" are useless for the purpose they ordinarily serve, they must either be fulfilling a new function, or else be attachments of vestigial and degenerative significance, conventionalized relics of something that had a definite purpose and utility in days that had become in these later years merely a dim tradition.

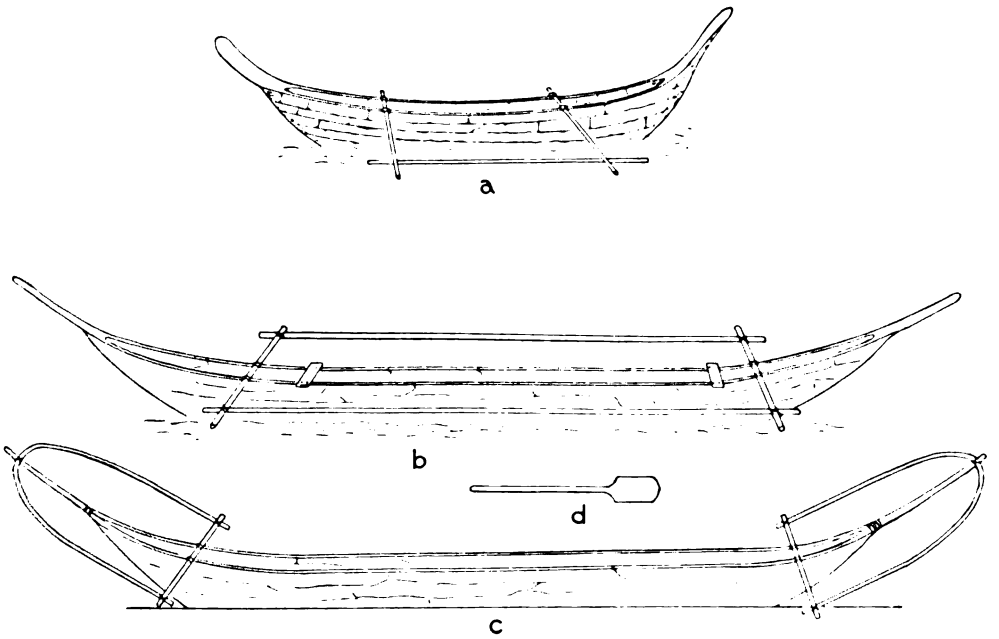


FIGURE 66.—Canoes of Easter Island: *a*, outrigger canoe, drawing dates from 1786 (after La Perouse); *b*, *c*, *d*, canoes and paddle, after Choris (1822-26), who visited the island in 1816.

The first of these hypotheses has little to support it; the islanders were too good swimmers to require a canoe attachment to which to cling, nor could such be of any use in hauling it ashore—these canoes were so small and light that beaching and landing presented no difficulties.

The conclusion is clear: either the sketches of La Perouse and Choris are inaccurate in respect of the form of the outrigger (straight booms and rodlike float), or at the time when Easter Island was discovered by Europeans the inhabitants no longer considered the outrigger as an essential adjunct to their canoes—its retention would then be the expression of that conservative spirit which adheres tenaciously to old customs for no apparent reason. A parallel to this is found in Madagascar, where the double outrigger, characteristic of Indonesia and normal to the design of the canoes of East Africa, not uncommonly becomes in effect a single one; the float on one side is large enough to be functional, but its equivalent on the other side of the canoe has been reduced to a thin rod connecting the

ends of the two booms, which commonly project on that side to a shorter distance than do their other extremities upon the functional side.

The weight of available evidence is in favor of the view that the original type of outrigger on Easter Island was single. The figures of Choris, even if correct, which is doubtful, can indicate nothing more than the variability frequently found when old customs cease to have any meaning and are on the point of extinction. That Choris was an unreliable artist is proved by comparison of others of his canoe figures with authentic examples from the same localities. For instance, his sketches of Hawaiian canoes are inaccurate in such important particulars as the uncovered ends of the double canoe and the lack of bowed spreaders under the booms in the outrigger canoe.

PADDLES AND SCULLS

The paddles employed to propel the frail canoes seen by early voyagers are pictured and described by Choris (1822-26, pl. 10) as having a broad, parallel-sided blade, sharply shouldered, and with the distal edge very slightly curved, the loom straight and without an enlarged hand grip.

It is probable that this form is as degenerate as that of the canoes themselves and that it departs equally far from the original design. Some approximation to the original design may be deduced from examination of a few ceremonial (? dancing) paddles, 7 to 8 feet long, which survived until recent years in the island; the design in all respects agrees with that of more numerous short ones (? models of the larger) carved from the same hard wood whereof cadaverous human figures are even yet manufactured by the islanders for sale to visitors.

The form has a superficial resemblance to that of the double paddle used by some Eskimos and certain South American Indians; the crutch or handle region has been shaped into an ornamental suboblong expansion approximately equal in area and weight to that of the ovate blade. In the full-sized paddles indications of human features are carved on one side in low relief, the resemblance in a few of the better-preserved ones being eked out with black and white paint (fig. 67, *c*). In the hardwood models the carving is limited to the representation of conventionalized eyebrows and the rudiment of a nose line (fig. 67, *a*).

The real blade is obovate in shape and without carving or painted ornament. From the center of the bluntly rounded distal margin a cylindrical, finger-shaped projection is given off, two to three inches long, with a slight annular swelling at midlength. Double-ended dancing (or ceremonial) paddles are also known from the Austral and Cook Islands.

How far this design resembles the ancient form of paddle it is impossible to determine. Probably the expanded handle greatly exaggerates an original crutch or hand grip in order to obtain balance when used in dancing. Conversely, the fingerlike projection, which may be considered the homologue of the terminal "claw" in Marquesan, Tuamotuan, and Mangarevan paddles, has probably suffered reduction. Fine examples of both the long and the short varieties of this peculiar type of paddle are represented in the collections of the British Museum and the Berlin Museum für Völkerkunde.

Thomson (1891, pl. 49) figures two remarkable appliances which he found in the possession of the Easter Islanders (fig. 67, *b*). He calls them "ancient scull oars", termed *mata kao* by the natives. Each has a long, narrow blade with a high median ridge along one face, giving the blade an inverted T form in transverse section. A long pole handle is attached to the back by lashing passed through a pair of holes in the blade. These oars were used, Thomson says, for steering and sculling very large canoes. They were "very old and were highly prized by the

islanders as the only specimens of the scull oar used by their ancestors". The blade of a third example, precisely similar in form, is possessed by the Berlin Museum für Völkerkunde.

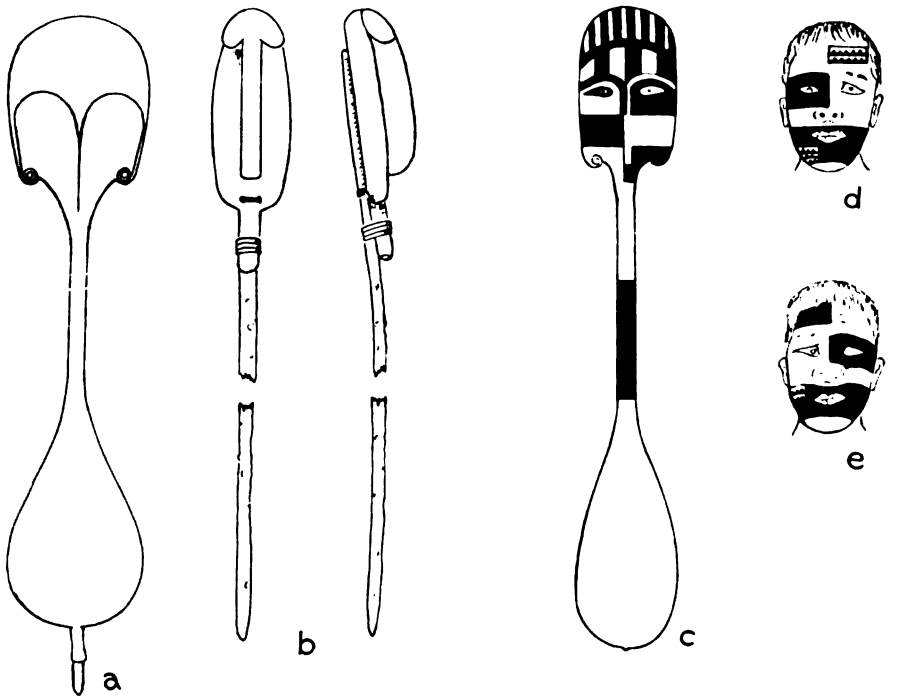


FIGURE 67.—Paddles from Easter Island: *a*, double-ended "dancing paddle" (British Museum); *b*, face and side views of "an ancient scull oar" (Berlin Museum für Völkerkunde); *c*, large ceremonial paddle with black and white checkered face painted on principal blade (after Thompson, 1891); *e*, tattooed faces of two Marquesans for comparison (after Handy, 1922).

AFFINITIES

If the ancient form of the Easter Island paddle blade be preserved even in part in that of the large ceremonial paddle above described, then the remarkable finger-like projection at the distal end assumes great comparative importance, for a related and apparently homologous feature is characteristic of the paddle blades formerly in use in the Tuamotus, the Marquesas Islands, and in Mangareva. In the Marquesas and in Mangareva, however, this projection is emphasized and is sufficiently large to be effective in use. In the Easter Island form it has assumed a vestigial form.

The existence of double-ended (? dancing) paddles in Easter Island and the Austral Islands is also significant of old-time relationship between these southeastern outliers of Polynesia.

One remarkable similarity is limited, so far as I am aware, to the identity in pattern of the painted decoration of a single Easter Island paddle with certain tattoo designs distinctive of Marquesan art (fig. 67, *c-e*). This paddle, figured by Thomson (1891, pl. 52), is described as a "double paddle, called *mata-kao-kao*". On the broadly oblong bladelike expansion of the grip end is a representation of a human face, painted in a fashion remarkably like one of the most striking of the

Marquesan tattoo face patterns (Handy, 1922, pl. 3, fig. 1). Another pattern of similar type is figured on the same plate (Handy, 1922, pl. 3, fig. 5), and K. von den Steinen (1928, vol. 2, figs. 53, 58) has also reproduced two faces tattooed in a like manner. Handy says that in one design figured (1922, pl. 3, fig. 1) the pattern had not been completed, but this is not likely to be the explanation of the reversal of the blocks of blue and white on the two halves of each face in all the other patterns.

These indications of Easter Island linkage with the Marquesas and Mangareva have to be considered both from the standpoint of tradition and in the light afforded by general conclusions regarding the sequence of racial colonization in southern and eastern Polynesia.

Rarotongan traditions related by Smith (1921, pp. 232, 245) tell of an early Marquesan settlement in Rarotonga and of the close relations between these islands, alleged to have been maintained by frequent voyages which later appear to have ended, coincident with a widspread cessation of extensive voyaging and migration. The same traditions include Easter Island among the many islands discovered during the great era of exploration associated with the name of Ui-te-Rangiora, who flourished about 650 A.D., according to the Rarotongan genealogies (Smith, 1921, p. 171). They also record the visit of Tangiia-nui, another famous navigator, to the island about the middle of the thirteenth century in the course of a voyage which embraced many of the islands lying between Fiji and Easter Island; this adventure ended in Rarotonga, where Tangiia decided to settle. Mangareva is on the direct route from Rarotonga to Easter Island and so it may have served as a friendly halting place where fresh supplies might be obtained. Mangareva appears to have been settled by Rarotongans (Seurat, 1905, *b*, p. 483); if so, the form of the Mangarevan paddle would suggest that it derived from the Marquesan section of the Rarotongan population before it was submerged or driven out by Samoan and Tahitian elements.

Traditional accounts, however, point to Easter Island as having been finally settled from Rapa-iti, the Rapa of the present day, at a period placed by Smith some 24 generations ago, or about 1300 A.D. (Best, 1923, p. 37), a computation based upon the genealogical tables of the Easter Islanders. As there is reason to believe that the people of Rapa are racially akin to the Rarotongans and Mangarevans, the Rapa settlement presents no difficulty in the acceptance of the broad conclusion that Marquesan culture reached Easter Island via Rarotonga and Mangareva.

The Easter Islanders' own traditions, apart from their genealogies, are vague and of little historical value. They are summarized by Thomson (1891, p. 474) to the effect that the island was settled by a chief called Hotu Metua, who

> . . . is said to have landed upon the island with 300 followers in two canoes, which are described in the traditions as 90 feet in length and 6 feet deep (draught of water). From the description of the boats and the representations found of them among mural paintings and sculpture in certain caves, the canoes of the original settlers were quite similar to the Fiji [?] war canoes. They were constructed of many pieces of wood neatly fitted together and held in place by thongs or lashings, high and sharp at both ends and balanced by an outrigger or small canoe.

The journey from the motherland is said to have lasted 120 days (Thomson, 1891, p. 526). The distance from Rapa to Easter Island is about 2500 miles. Considering that favorable winds from the northwest and west blow with considerable regularity south of the Tropic of Capricorn in the region traversed, an average speed of five knots might be maintained with ease, a rate which would enable the voyage to be performed within the space of three weeks. The distance to be traversed is actually only about 150 miles more than that from Tahiti to Hawaii, a

voyage which was frequently made in both directions in ancient times without undue danger or difficulty. The loneliness of Easter Island, the easternmost outlier of Polynesia, accentuates the connotation of difficulties one envisages for the adventurous men who settled the island, and for those who undoubtedly returned to the homeland to tell of their discovery.

Routledge (1919, p. 278) gives a variant of the legend. The coming of a double canoe is again indicated, but its arrival was preceded by that of six men who came to the island "each on a piece of wood". Later, two boats were seen approaching. The vessels were bound together, but as they came near the land the cord which united them was cut. The name of the one boat was *Otcka* and that of the other *Oua*.

This variant legend, coupled with the indications of Melanesian influence cited by Balfour (1917), furnishes strong reason to believe that the first inhabitants of Easter Island were either Melanesians or a mixed race in which the Melanesian element predominated; the traditions that they came on pieces of wood or in canoes bound together, which separated as they neared the land, suggest the query: Is this the survival of a dim recollection of the use of rafts by the first arrivals—rafts, maybe, of the type used in Mangareva, the inhabited island nearest to Easter Island (apart from Pitcairn), where the custom of tying two or more rafts together when sailing was the common practice?

The Routledge legend, suggesting a Melanesian occupation of the island prior to the Polynesian, fits in satisfactorily with the evidence of strong Melanesian influence in the Marquesas, Rarotonga, and elsewhere in southeastern Polynesia.

Whatever credence may be given to the traditional accounts of voyages to and from the island, it may be inferred that communication with the motherland ceased not later than the middle or end of the fourteenth century, when voyaging came to an end between Tahiti and Hawaii according to Smith (1921, p. 134) and probably also between Rarotonga and New Zealand. The difficulty of making a landfall, the smallness of Easter Island, its bleakness, and its lack of natural resources, militated against the continution of intercourse, but the main cause was surely the lack of suitable timber for the construction and repair of sea-going canoes, either from the natural absence of large trees on the island, or, if originally present, by gradual depletion of a supply not sufficient to meet all the needs of the islanders.

SOCIETY ISLANDS

TRADITIONAL AND HISTORICAL REFERENCES

The Society Islanders are justly credited with having been at one time the most enterprising of Polynesian voyagers. Following the account of the early history of New Zealand as given by Best (1925,, pp. 271-278), it was a Tahitian named Kupe, who, with Ngake or Ngahue, first discovered New Zealand not less than 40 generations ago; this, at 25 years to a generation, would place the event about the first quarter of the tenth century. Tradition says that the basal portion of Kupe's canoe was composed of three pieces or lengths, and that these were simply butted together and secured by lashing through holes bored in the opposite edges, a method identical with that described by Bougainville (1771, p. 221) as employed in Tahiti in 1768. Three lengths of hollowed tree trunks were also the usual number required in building large canoes in this island as recorded by Cook and Wilson; four lengths were exceptional and used only for specially long hulls.

Some eight to ten generations after Kupe's exploit (about 1125 A.D.), other Tahitians under Toi and Whatonga made a similar voyage to New Zealand. Some

genealogies would seem to place this date much earlier, even to 40 generations from 1900, or to about 900 A.D.; this, in turn, would automatically push back Kupe's voyage to about the beginning or the middle of the eighth century (Fletcher, 1930). Whatonga's canoe is said to have been made of four keel lengths sewn together and furnished with washstrakes. It was fitted with 26 paddling thwarts and had a complement of 52 paddlers, who sat double-banked, together with 14 men for other duties. Apparently both the canoes of this expedition were outriggers, one hull only being mentioned for each. Shortly after this event four more Society Islands canoes reached New Zealand, via Rarotonga. Two of these were double canoes and a third was presumably an outrigger. These three belonged to a chief called Nuku, who eventually returned home; tradition affirms that he separated his double canoes and sailed them back as single vessels, which would be provided with outriggers, as Tahitian canoes used in the double form are too narrow to be safe if sailed as single hulls (Best, 1925, p. 278).

There is substantial evidence that Tahitian influence caused extensive modification of the customs of the original inhabitants of Hawaii, and there can be no room for doubt that the Tahitians voyaged frequently to these northern islands at a distant date, put by Fornander at about the middle of the twelfth century—probably about the time Kupe was sailing southwest to the discovery of New Zealand.

Of shorter journeyings made by Society Islanders nothing need be said except to recall that as late as Cook's time a Tahitian, Tupaea, was able to enumerate and give sailing directions for nearly all the islands in the Austral and Cook archipelagoes, many in the Tuamotus, and others farther afield, including Rotuma and some which appear to belong to Fiji: among these were many not at that time known to Europeans but subsequently found and identified with islands in Tupaea's list.

It is clear, then, that the Society Islanders were among the boldest of Polynesian navigators for several centuries after 1000 A.D. Of what they were capable before that date little or nothing is known except that their ancestors, the first settlers, must have been equally enterprising and venturesome and withal most skillful sailors or they would never have reached their island home in the center of the Pacific. From a time long prior to 1000 A.D. they must have possessed vessels fit to perform voyages of many hundreds of miles in comparative safety. From the New Zealand, Rarotongan, and Tahitian traditions it seems certain that both double and outrigger canoes were employed, and it has already been shown that these traditions indicate that the construction of these vessels was the same in essentials 1,000 years ago as when Wallis discovered Tahiti seven and a half centuries later. Nowhere is there any hint to suggest that the sea craft of the early adventurers were other than double canoes and single outriggers with hulls formed out of dugouts, having their sides raised by the addition of deep washstrakes. I do not attach importance to the suggestion made by Best (1923) that certain Maori traditions can be understood to contain references to the use of double outriggers by the early settlers. (See p. 197.)

Of these vessels as they existed during the earlier days of European contact much has been written, yet with few exceptions the descriptions which have come down are as vague, confused, and unsatisfying as they are verbose. An immense amount of chaff must be sifted in order to extract even a few grains of good material; the chronicler envies La Perouse (1798, vol. 2, p. 383), who could write:

> I flatter myself you will observe with pleasure that, in this long voyage, I shall not have had occasion to touch at those tedious Society Islands, on which more has been written than on several of the kingdoms of Europe, and I acknowledge I shall think myself happy in not having to speak either of Otaheite or Queen Oberea.

At the time when Wallis, Bougainville, and Cook brought Europeans into relations with the islanders, the golden age of Polynesia was already a thing of the long distant past. The people of the Society Islands in particular, softened by generations of easy living in the nearest approach we can imagine to an earthly paradise, had no longer that overpowering love of the sea possessed by their ancestors in the days when communication was maintained with Hawaii on the one hand and with Rarotonga and far-off New Zealand on the other.

The first description of any newly discovered land always has particular interest and that by Wallis (Hawkesworth, vol. 1, p. 487) of the canoes of Tahiti as they were in 1767 is here quoted by way of introduction to the detailed account of the various types:

> The boats or canoes of these people are of three different sorts. Some are made out of a single tree, and carry from two to six men: these are used chiefly for fishing, and we constantly saw many of them busy on the reef: some were constructed of planks, very dexterously sewn together: these were of different sizes, and would carry from 10 to 40 men. Two of them were generally lashed together and two masts set up between them: if they were single, they had an outrigger on one side, and only one mast in the middle. With these vessels they sail far beyond the sight of land, probably to other islands. . . . A third sort [war canoes] seem to be intended principally for pleasure and show: they are very large, but have no sail, and in shape resemble the gondolas of Venice: the middle is covered with a large awning, and some of the people sit upon it, some under it. . . .
>
> The plank of which these vessels are constructed is made by splitting a tree, with the grain, into as many thin pieces as they can. They first fell the tree with a kind of hatchet, or adze, made of a tough greenish kind of stone, very dexterously fitted with a handle; it is then cut into such lengths as are required for the plank, one end of which is heated until it begins to crack, and then with wedges of hard wood they split it down: some of these planks are 2 feet broad, and from 15 to 20 feet long. The sides are smoothed with adzes of the same material and construction but of smaller size. . . . These planks are generally brought to the thickness of about an inch, and are afterwards fitted to the boat with the same exactness that would be expected from an expert joiner. To fasten these planks together, holes are bored with a piece of bone that is fixed into a stick for that purpose, a use to which our nails were afterwards applied with great advantage, and through these holes a kind of plaited cordage is passed, so as to hold the planks strongly together: the seams are caulked with dried rushes, and the whole outside of the vessel is payed with a gummy juice which some of their trees produce in great plenty and which is a very good succedaneum for pitch.

Whether fashioned as outrigger canoes or as double canoes, all appear to have been undecked or at the most partially covered with a platform, intended primarily as a stage to accommodate warriors or passengers rather than as a protection against swamping.

OUTRIGGER CANOES

At the present time the outrigger craft of the Society Islands are represented by small paddling canoes used in inshore and lagoon fishing and a rapidly decreasing number of medium-sized sailing canoes employed in offshore fishing. The paddling canoes (*pu hoe*) alone remain comparatively unchanged from pre-European days, whereas the sailing canoes have been modernized to a considerable extent. Insofar as the particulars which follow describe the details of existing types of canoes, they are the result of a lengthy visit to the islands in 1925.

Paddling Canoes

The paddling canoes are always dugouts, ranging between 15 and 28 feet in length, with a breadth (outside) of 16 to 19 inches and a depth of 12 to 18 inches. A stout squared bar is usually nailed or pegged upon the upper edge of the dugout to form a neat gunwale rail; in the larger canoes an upper strake may be intercalated to increase the freeboard and carrying capacity (fig. 68).

There is marked uniformity in the characteristic shape of the hull and in the fashion of the single outrigger with which paddling canoes are equipped.

The hull is slab-sided and round-bottomed, the bottom straight for the greater part of its length. The fore end of the hull is sharp and nearly vertical, with a slight concavity in profile. From the angular forefoot it curves gently in to the straight bottom. The aft end is lean, streamlined to a point, and is sheered slightly upward (fig. 73). There are local variations in the shape of the hull. In some canoes, as in several large sea-going craft seen at Tautira in Tahiti-iti, the forward end runs into a long and narrow, vertical, boardlike, solid prow. In the one measured, this region was 17 inches long.

FIGURE 68.—Modern fishing canoe of Tahiti, four narrow strakes in addition to gunwale rail, underbody a dugout; shows typical Tahitian outrigger attachment of fore boom—two pairs of converging stanchions and a mesial pair of braces, here of wire, arranged in V fashion; also shows method used to support canoes out of water when not in use (photographed in 1925).

The outrigger is fitted normally upon the port side. It consists of two asymmetrical booms connected with a long cylindrical float in what may be termed the mixed manner, the attachment of the fore boom being indirect, that of the after boom direct or semidirect.

The float, made of a branch of *purau*, is exceptionally long, straight or slightly bowed. Its pointed fore end extends forward to a level with the prow; aft, it terminates in a blunt point immediately behind its attachment to the after boom. The fore end never turns up, being usually brought to a median point; in some few it is cut to a sharp edge by a deep slice taken off the upper side.

The fore boom is usually a squared pole of strong wood, as *tamanu*, roughly rectangular in section, and is doubly curved as shown in figure 73. Another characteristic feature is the projection of the butt end on the off or starboard side from 12 to 22 inches in paddling canoes. The length ranges from 6 to 8 feet inclusive of the whole butt region, the sectional dimensions being 2 to 2.5 inches in width by 1.5 to 1.75 inches in depth. In the smallest canoes this boom may be a rough unsquared pole, nearly straight or only slightly curved.

The outboard projection of the fore-boom butt on the starboard side is a vestigial character, a relic of the starboard balance board still to be seen on the old-time type of sailing canoes (*va'a motu*); in present-day paddling canoes it has no longer any functional value except as a handy lifting grip when the canoe is carried to or from the beach.

The attachment of the fore boom to each side of the canoe is by several turns of sennit passed (typically) through two holes bored just beneath the gunwale in simple dugouts, or beneath the gunwale seam in those with the sides finished off, as is the practice, with a squared gunwale rail; the holes are spaced apart a distance about equal to or slightly less than the width of the boom. In small canoes one hole only is used.

The technique of the lashing varies. In the most common method, after passing a running loop around the boom, the braid is passed from the exterior through one hole, over the boom on the inside of the gunwale, through the second hole to the outside again, and then over the boom outer to the gunwale. This procedure is repeated several times, some of the turns being crossed beneath the booms. The lashing is sometimes completed by taking a few horizontal turns around the joint so as to enclose and tighten the vertical portions of all previous turns. In other instances there may be no crossed lashing beneath the boom or no circumferential turns. In some the lashing upon each gunwale is independent; in others, after the completion of one lashing, the sennit is carried along the boom toward the opposite side; halfway across, two half-hitches are made around the boom, after which the sennit is taken along to the other gunwale, where it lashes the boom to the canoe in the same way as has been described. Sometimes a peg is driven into each hole to secure the lashing further.

The after boom is slender, flexible, and strongly bowed in the outboard portion. The stouter inboard section which lies athwart the gunwales is straight. Its distal extremity may be attached to the float in four different ways, three of them direct: it may be inserted into a hole bored vertically in the upper surface of the float, or tied upon it by lashing passed several times around the float, or it may be lashed to the float by fine sennit passed through a V-shaped hole bored through its upper surface; all these are comparatively rare methods, though they represent older and more primitive methods than the fourth. In the fourth attachment, which is the one generally in use, the end of the boom is lashed to a short peg driven into the upper side of the float (fig. 73); frequently a small nail or staple is substituted for the wooden peg, a degenerate modern method now becoming common. The attachment of this boom to the gunwales is similar to that of the fore boom, but the lashing sennit is passed through only one hole in the underbody.

The distance separating the two booms is characteristically great; in one canoe 22 feet long it measured 12 feet.

Local Characteristics

TAHITI

The attachment of the float to the fore boom consists typically in Tahiti of an inner and outer pair of obliquely directed stanchions with a mesial pair of sennit braces, a suspensory lashing, between them.

The stanchions in each pair are spaced widely apart below, thence converging obliquely upward to the boom, whereas the lower ends of the two sennit braces arise close together to diverge upward in V fashion at right angles to the axial plane of the float (fig. 69, *a*, 1, 2). The lower ends of the stanchions of each pair are inserted in holes in the convex upper surface of the float, one well in front of and the other at a corresponding distance behind the boom. The converging units of the inner pair slope upward toward the canoe; those of the outer pair incline upward and outward, away from it. The upper ends in each pair are cut off obliquely and adpressed to the opposite sides of the boom, to which they are lashed by many turns of sennit whipped into a neat and characteristic diamond pattern on the upper side of the boom (fig. 70, *a-c*). The outer of the two cord braces runs upward and outward to an attachment at or near the distal extremity of the boom, and its fellow runs upward and inward to a point on its shaft. These braces may be attached to the boom close to the lashed-on ends of the stanchions or at some distance beyond as seen in figure 69, *a*, 1. As in the after boom, these sennit braces are usually attached to the float by being tied to short pegs or to nails or staples driven into the float; less commonly the two cords are continuous below, being threaded through a V-shaped hole bored transversely in the convex upper surface of the float. This arrangement, which is probably the older, has great importance in the interpretation of the holes found in an outrigger float discovered in a cave in New Zealand, the only positive proof that the Maori used this type of craft in former times.

Paired stanchions may be either straight or curved; single or unpaired ones are always straight. The distance separating the insertions of the units of each pair is considerably greater when they are straight, usually from 19 to 24 inches; it is only 12 to 17 inches when they are curved. The insertion holes for the straight stanchions are oblique, whereas those for the curved are vertical or subvertical. Curvature of a stanchion is obtained by bending its upper end forcibly toward the boom until it butts against the side, where it is held until secured by an elaborate whipping of sennit.

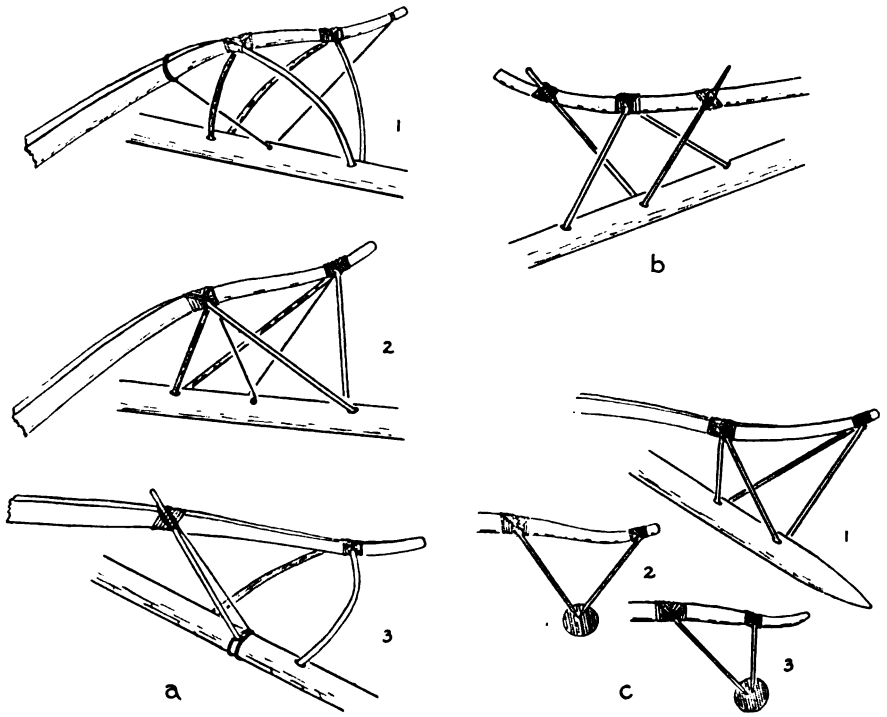


FIGURE 69.—Fore-boom attachment, Tahiti. *a*, three typical varieties: 1, stanchions curved; 2, stanchions straight; 3, one brace and one inner stanchion suppressed. *b*, attachment seen at Tautira. *c*, two exceptional varieties, sennit braces suppressed: 1, both pairs of stanchions obliquely disposed; 2, diagrammatic side view of 1, showing relative positions of stanchions and their insertion into float; 3, outer pair of stanchions vertical (diagrammatic side view).

One of the canoes seen at Tautira showed variation from the normal Tahitian type just described. The V-disposed sennit braces were absent, their place taken by two diverging straight stanchions inserted close together in the float directly under the boom. One passed upward and outward, and the other upward and inward toward the canoe, precisely as the V braces would have done had they been present; their upper ends projected four inches above the boom, to which they were attached by simple oblique lashing (fig. 70, *d*). One rested against the fore side, the other against the after side of the boom (fig. 69, *b*).

The two normal pairs of lateral stanchions were replaced in turn by a single mesial pair, disposed in a true fore and aft direction relative to the float. Their converged upper ends butted against the sides of the boom and were whipped on with sennit.

In several other attachments similar mesial stanchions were noted, some straight, others curved; in all, these mesial pairs were lashed to the boom by many turns of sennit disposed in diamond pattern.

At Teahupu, also in Tahiti-iti, were several large canoes, among them one which would accommodate 18 people. All had the normal type of attachment save one; in this exception one only of the inner pair of oblique stanchions was present and here again the upper end projected beyond the boom and was lashed to its side instead of butting against it. In some canoes the outer pair were nearly in the vertical plane or only slightly inclined away from the float (fig. 69, *c*, 3).

Several other varietal combinations were noted here and there. It is obvious that the bonds of fixed tradition have been loosened and that canoe builders allow themselves the liberty to try new combinations or to adopt some simplification that gives less trouble to assemble. (See fig. 69, *a*, 3; *c*, 1, 2.)

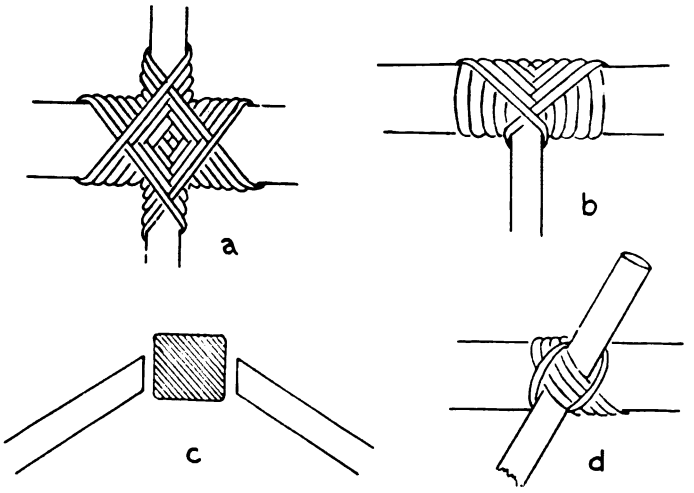


FIGURE 70.—Technique of lashing stanchion connectives to boom, Tahiti: *a*, *b*, method of arranginig sennit lashing in diamond pattern; *c*, sliced-off ends of opposed stanchions butted against sides of boom prior to applying diamond lashing; *d*, oblique lashing of single stanchion to side of boom (after Buck, 1929).

MOOREA

In Moorea, lying within sight of Tahiti, the fore booms of small fishing canoes have the typical Tahitian indirect attachment of two pairs of oblique stanchions and two mesial V-disposed sennit braces. The after boom in many is, however, not deeply arched in bow shape; it is merely curved toward the distal end and inserted either directly into a hole in the float, or else the end is laid over it and lashed thereto; even in direct insertion it is lashed to the float as an additional precaution. In a few canoes it has the usual Tahitian form.

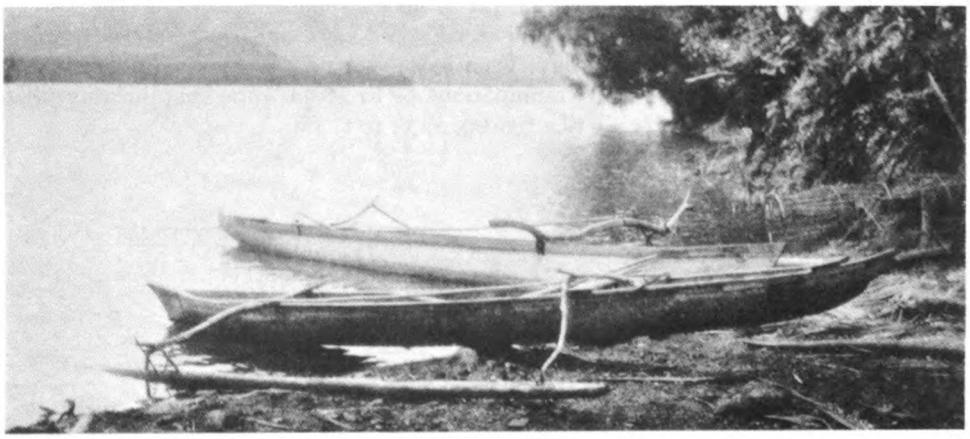
On the south coast one canoe with two pairs of overcrossed stanchions that extended well above the boom was seen.

HUAHINE

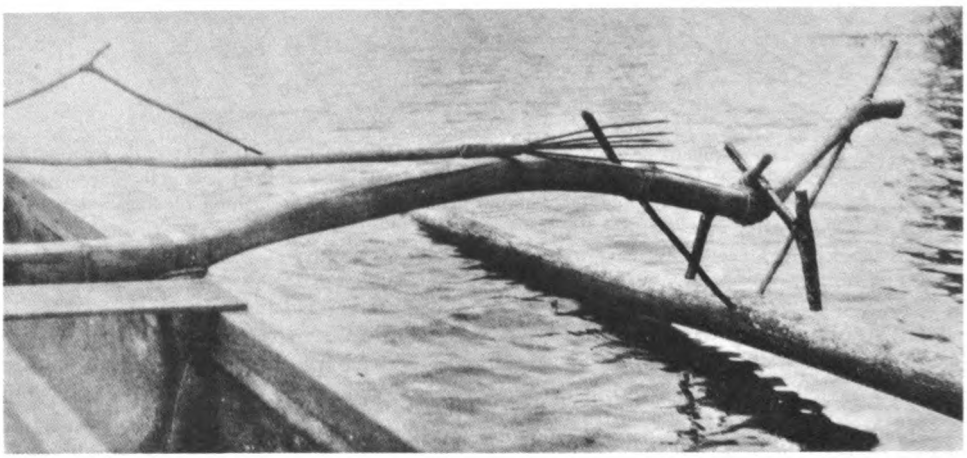
The type of outrigger connective in Huahine is distinctive; its essential features were seen nowhere else except in stray examples that have been imported into Tahiti. The characteristic feature is the use of a gate-shaped or H-frame support for the end of the fore boom, the stick stanchions and sennit braces being reduced to one each in typical examples (fig. 71, *a*).

The H or gate frame is formed normally of two vertically placed sticks, each having a lateral branch either at right angles or at a very obtuse angle near the upper end; each is

therefore of an inverted L form. These two-branched L sticks are placed with the lateral branches turned facing each other, and either crossing one another or lying side by side. The distal end of the boom is normally placed over them (fig. 72, *a*) and is lashed down with sennit; exceptionally it is lashed below them. In a degenerate variation the H frame is formed of three pieces, two uprights and one crossbar (fig. 72, *d*).



a



b

FIGURE 71.—Modern canoes of Huahine: *a*, canoes with typical outrigger attachment; *b*, fore boom of paddling canoe, characteristic H or gate connective typical of Huahine, sennit braces absent. (Photographed in 1925.)

Typically there is only one oblique stanchion connective; this runs upward and inward from between the insertions of the legs of the H frame to a point 20 inches or more inward along the shaft of the boom (fig. 72, *a*, 3). The upper end may either be lashed against the side of the boom, or be continued upward and beyond, with a lashing at the point of crossing. The single cord brace, typically of sennit, runs parallel with the oblique stanchion, its lower end tied to a peg driven into the float just outside the point where the stanchion is inserted. This type was seen at all ports touched at, Parea at the extreme south end, Maroe at the middle of the eastern side, and Fare on the northwest coast. The insertions in the float of the H frame, strut, and brace are as shown in figure 72, *a*.

In all canoes the after boom was of the slender, bow-shaped Tahitian pattern, the extremity either inserted into the float, or, much more commonly, lashed upon it, the lashing sometimes passing through a hole bored transversely in the float or else secured round a short peg or an iron spike.

The booms were tied to the edge of the canoe by sennit, passed through two holes for the fore boom and through one for the after boom.

A few exceptional forms of boom and float attachment were noted, showing that these people do not all copy old styles slavishly, and indicating how easily one type may suffer change at any moment when experiments such as these are frequent.

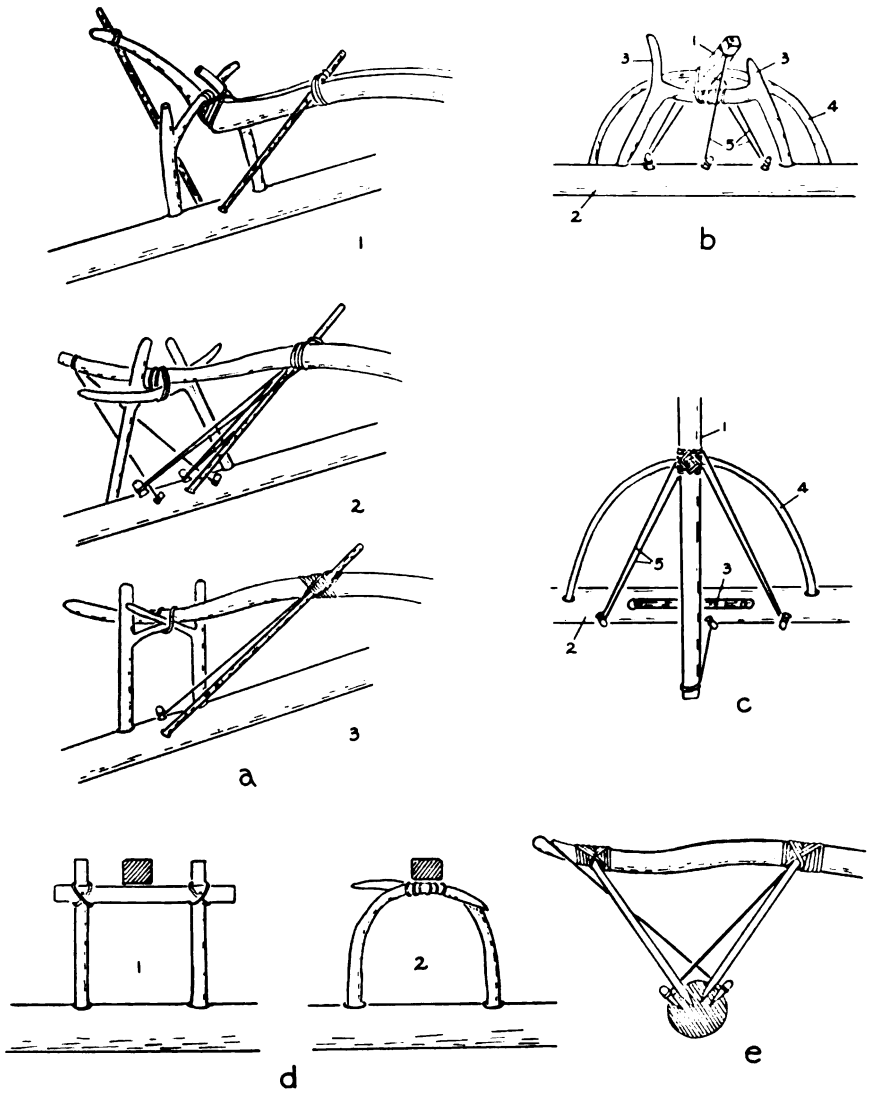


FIGURE 72.—Fore-boom attachments, Society Islands. *a*, varieties seen in Huahine: 1, boom lashed beneath crossed arms of H frame; 2, 3, boom lashed above crossed arms, typical method. *b*, end view, and *c*, top view, intricate Huahine variety: 1, boom; 2, float; 3, branched stanchions (H connective); 4, curved stanchions or struts; 5, sennit braces. *d*, exceptional forms of H attachment, Huahine: 1, rectangular, formed of bar nailed across tops of two uprights; 2, degenerated into two opposed curved rods. *e*, Raiatean attachment, fore boom in side view, float in transverse section, one stanchion in each pair omitted in drawing.

In one canoe, instead of by the H support, the boom was steadied by two opposed rods curved at mid length into a right angle, with overlapping ends (fig. 72, *d*, 2). Another had the usual H support but the strut and brace were doubled and disposed laterally and a third unpaired sennit brace ran outward from between the legs of the H to the distal extremity of the boom (fig. 72, *b*, *c*). In a third, this last-named sennit brace was itself duplicated, and the paired sennit braces were bifurcated just outside their attachment to the pegs securing them to the float (fig. 72, *a*, 2). In another there was no brace and the outer stanchions were reduced to one (fig. 71, *b*).

The dugout hull of these Huahine canoes has the Tahitian form. In the larger, a washstrake surmounted by a wide gunwale rail is added, the washstrake attached by single stitches of sennit at intervals. When unladen the head and the stern rise clear of the water. In large canoes 26 to 30 feet long there is a short fore decking and another aft, extending between each end and the adjacent boom.

The dimensions of a large canoe measured at Fare were as follow:

Length, 22 feet; float (exceptional), 22 feet; beam (inside), 12 inches; depth, 13 inches; distance of the float from the hull, 4 feet 2 inches; distance of fore boom from prow, 6 feet 8 inches; distance of aft boom from stern, 3 feet 2 inches.

RAIATEA

The outrigger attachments of the canoes of Raiatea closely approximate in detail to those of Tahiti. They show nothing of that curious diversity seen in Huahine and suggest closer relations in the past between Tahiti and Raiatea than between Tahiti and Huahine. The cord braces are usually attached at their lower ends to pegs or to nails driven into the float and seldom pass through a hole bored through the float as is fairly common in Tahiti. (See figs. 72, *c*; 73.) The paired stanchions are more commonly curved than they are in Tahiti.

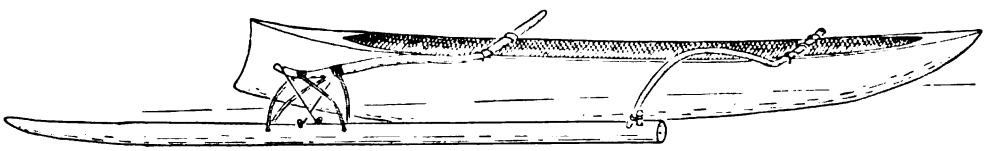


FIGURE 73.—Paddling canoe, showing outrigger attachments characteristic of Raiatea.

SAILING OUTRIGGER CANOES

A large outrigger, the *va'a motu* (island canoe) or simply *va'a*, was formerly in use (Ellis, 1829, vol. 1, p. 171), "built for sailing and principally used in distant voyages". A canoe of smaller size was employed in "dolphin" and other offshore fishing, a canoe which has survived in a modernized form although dolphin fishing is now extinct.

The hull of the *va'a motu* was built up variously. The simplest consisted of a dugout body, round-bottomed and slab-sided, with a washstrake added in the form of a plank sewn vertically upon the edges of the dugout. Ellis gives the width of this washstrake as 12 to 15 inches, Wilson as 10 to 12 inches. In hulls of larger size, the dugout portion was reduced in the height of its sides and might be made up of two or even three sections sewn end to end, the number being dependent upon the length of timber available. To gain sufficient freeboard two strakes were added to the keel base. Greater height was not desirable, for although these craft were technically sailing canoes, paddles were freely resorted to for long stretches, particularly when the wind was light or unfavorable and for lengthy overseas voyages on which any undue delay was liable to entail starvation and death. The canoes had so little accommodation for the stowage of provisions that they could seldom carry more than would suffice for a fortnight or, at the most, 20 days, even when two hulls were joined together to form a double canoe (Banks, 1896, p. 159).

The side strakes curved upward toward the after end so as to form a prominent stern or poop raised 4 or 5 feet above the level of the waist. The after aspect of this stern was truncate and vertical, filled in with planking to form a shield-shaped transom end comparable to the transom sterns of Chinese junks and sampans.

The fore part of the canoe had little or no sheer; it terminated in a sharp and nearly vertical cutwater. Over the head was a broad covering board (*ihu va'a*) which also extended beyond the cutwater to a distance of 3 to 4 feet. A transverse vertical breakwater was sometimes added behind the *ihu* (Lee, 1920, p. 116); this appears to have closed in the forward ends of a weather board fitted above the washstrake along each side.

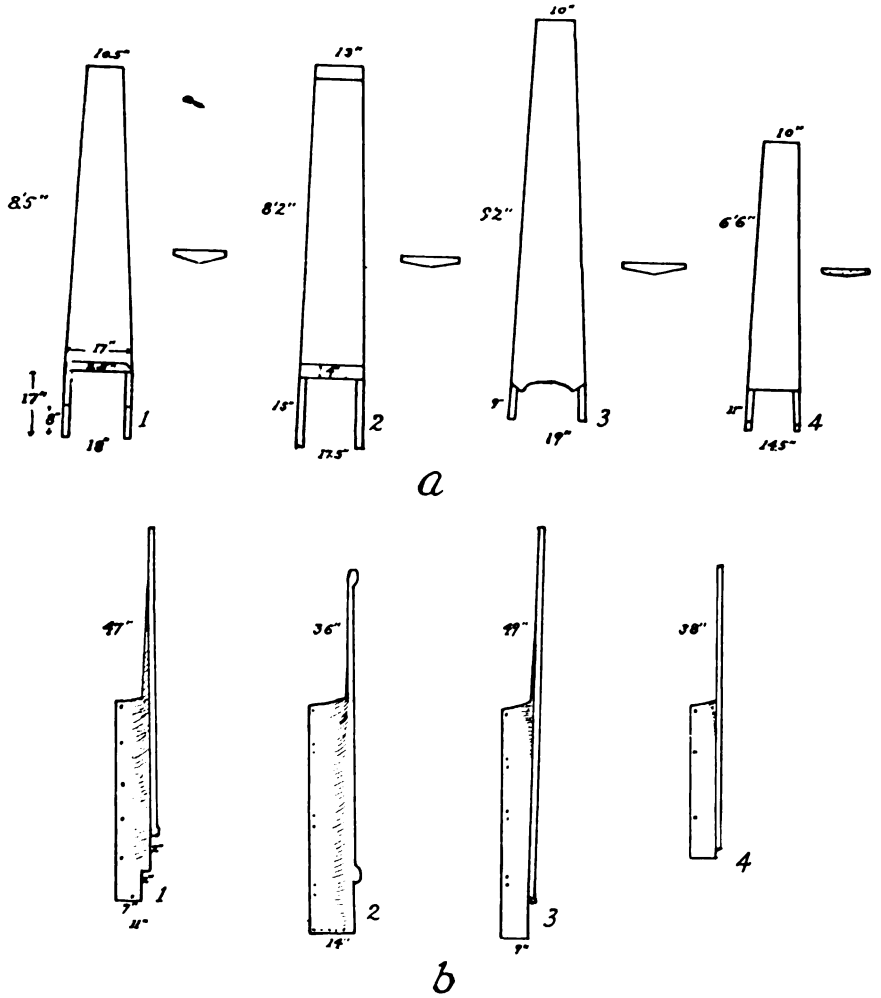


FIGURE 74.—Forms of fore end piece (head board) of old type of Huahine canoe: *a*, top view; *b*, side view; 1, at Haapu; 2, at Fare; 3, at Maeva; 4, at Parea (from Handy, 1932).

As described and figured by Handy (1932, p. 42) from old examples seen by Emory in Huahine, the *ihu* is a horizontal plank 1 to 2 inches thick, 10 to 13 inches wide, and 5.5 to 8.5 feet long, narrowing slightly toward the outer end. It rests upon the converging edges of the fore part of the dugout base by means of a deep A-shaped flange on its lower side, 7 to 14 inches deep. The flange on each side is prolonged backward as a wing 9 to 17 inches long to meet the fore end of the washstrake (*oa*) and is joined thereto and to the edge of the dugout underbody by lashings of sennit passed through opposed holes, circular in shape and from 0.5 to 1 inch in diameter. The upper side of the *ihu* is perfectly flat but the under part is axially ridged weakly (fig. 74).

In the underbodies made up of two or three sections the method of joining these sections as described by Emory (Handy, 1932, p. 43) is related to that characteristic of the Marquesas but of a simpler and more primitive type. In the canoe described the after section of the hull body has the lower half of the front end cut back for 14.5 inches; the upper half of the fore section is cut away reciprocally. In this way, whereas the upper part of one section overlaps the lower part of the other, the edges butt together and are lashed in position through opposed circular holes half to three quarters of an inch in diameter (fig. 75).

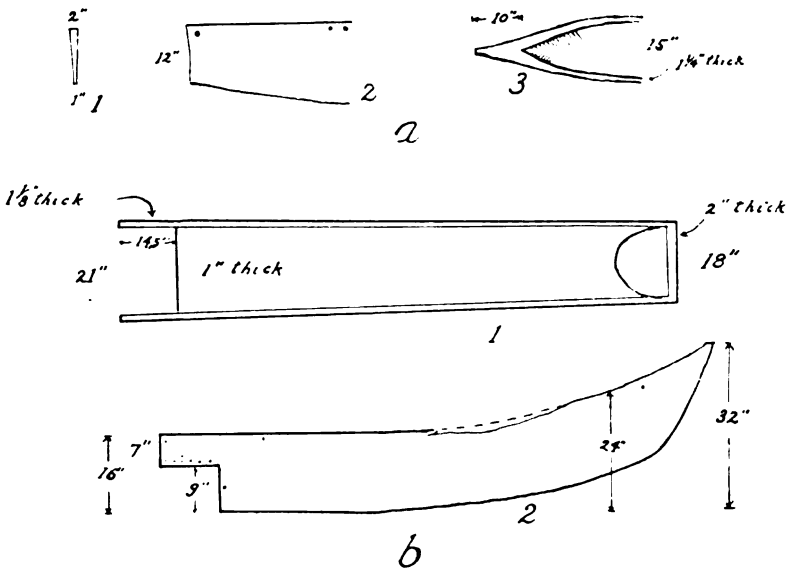


FIGURE 75.—Details of old canoe, Huahine. *a*, fore end piece: 1, front view of cutwater; 2, profile of head; 3, top view of head. *b*, after end piece: 1, plan; 2, profile (from Handy, 1932).

The outrigger was of the same mixed type seen in present-day fishing canoes, the fore boom stout and connected to the float by two pairs of obliquely disposed stanchions, the after one slender, bowed, and lashed either directly to the float or to a short peg inserted into it. In the larger canoes the fore boom was straight and horizontally disposed (Ellis, 1829, vol. 1, p. 171; Paris, 1841, pl. 123); in the smaller, as in those of the present day, it was so curved as to show a series of undulatory bends when the canoe was viewed end on. In all the after boom was curved and pliant. The outrigger was always placed on the port side as is still customary. In Tobin's drawing (Lee, 1920, p. 116) the connectives are shown unusually long; they extend nearly as high above the boom as is their length beneath it. As a consequence they overcross as is customary in Tonga and was formerly in the Marquesas.

BALANCE PLATFORM

The most remarkable feature of the *va'a motu* was the presence of a long and narrow balance platform about two feet wide (Wilson, 1799), placed athwartships, its ends projecting outboard on both sides, usually, of the canoe. Its position coincided with that of the fore boom, for this was employed as its main support. The general arrangement is described clearly by Ellis (1829, vol. 1, p. 171):

> A strong plank, 12 or 14 feet long, [is] fastened horizontally across the centre [of the canoe] in an inclined position, one end attached to the outrigger [the fore boom] and the other extending 5 or 6 feet over the opposite side, and perhaps 4 or 5 feet above the sea. A small railing of rods [a marginal pole] is fastened along the sides of this plank, and it is designed to assist the navigators in balancing the keel, as a native takes his station the one side or the other, to counteract the inclination which the wind or sea might give to the vessel. [See fig. 76.]

The description by Andia y Varela (Corney, 1915, vol. 2, p. 283) of this balance fitting is much the same—"two gangplanks, as it were, projecting seaward on

either side from the heel of the mast, which allow a man, or when the wind is fresh, two men, to pass out on them to windward as far as may be, in order to preserve the [craft's] equilibrium".

Although what may have been the usual custom is described by Ellis and Varela, it appears that in some canoes the balance board extended outboard from one side only, that opposite the outrigger. The very earliest sketch of a Society Islands canoe (fig. 77), made by the artist on Bougainville's voyage (1777, p. 211), shows

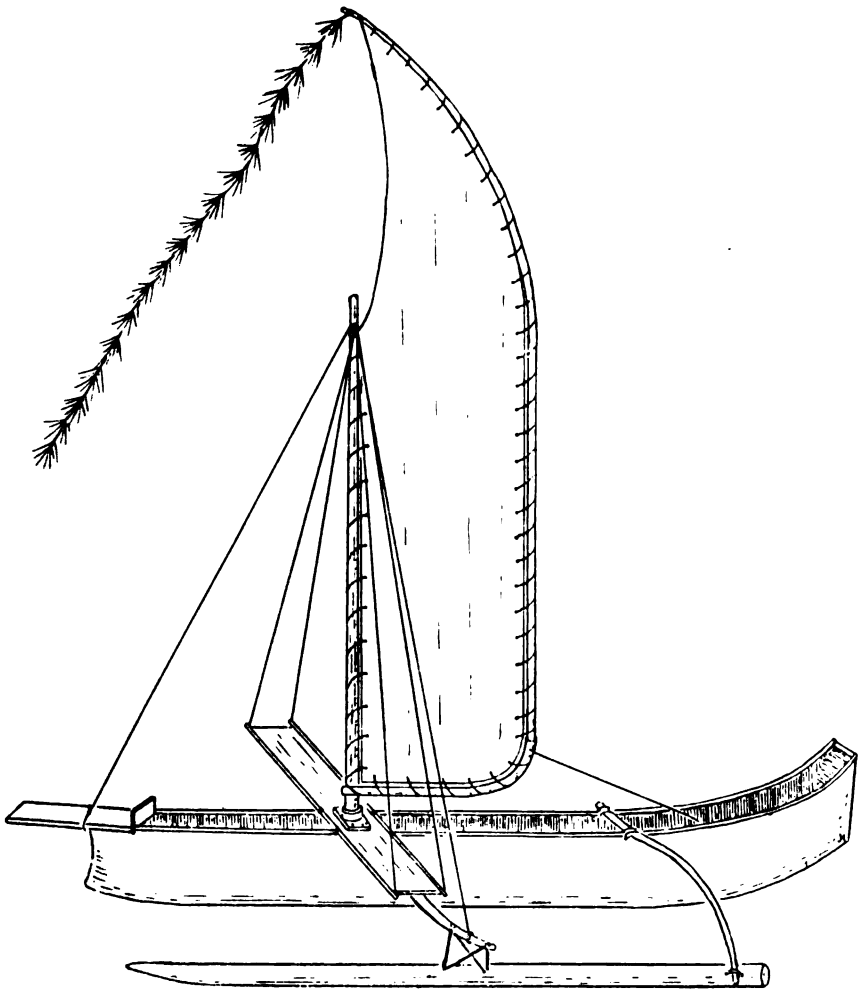


FIGURE 76.—Reconstruction of a Tahitian *va'a motu* under sail, position of balance board as described by Ellis (1829).

the balance board extending sharply upward from abreast the mast on the starboard side only. No other figure of this variation exists, but there can be no doubt of the artist's accuracy, for this is precisely how the unilateral balance spar is fitted in sailing outriggers in Tahiti and Raiatea at the present day. Furthermore, Bougainville gives a specific description of it (Duponchel, 1841, vol. 1, p. 290) as "a plank which is extended outboard from the side opposite to the outrigger, when the canoe is under sail. Its use is to give attachment to the cordage which supports the

FIGURE 77.—Earliest figure of a Tahitian *va'a motu* in existence, from a sketch by Croisey (Bougainville, 1771).

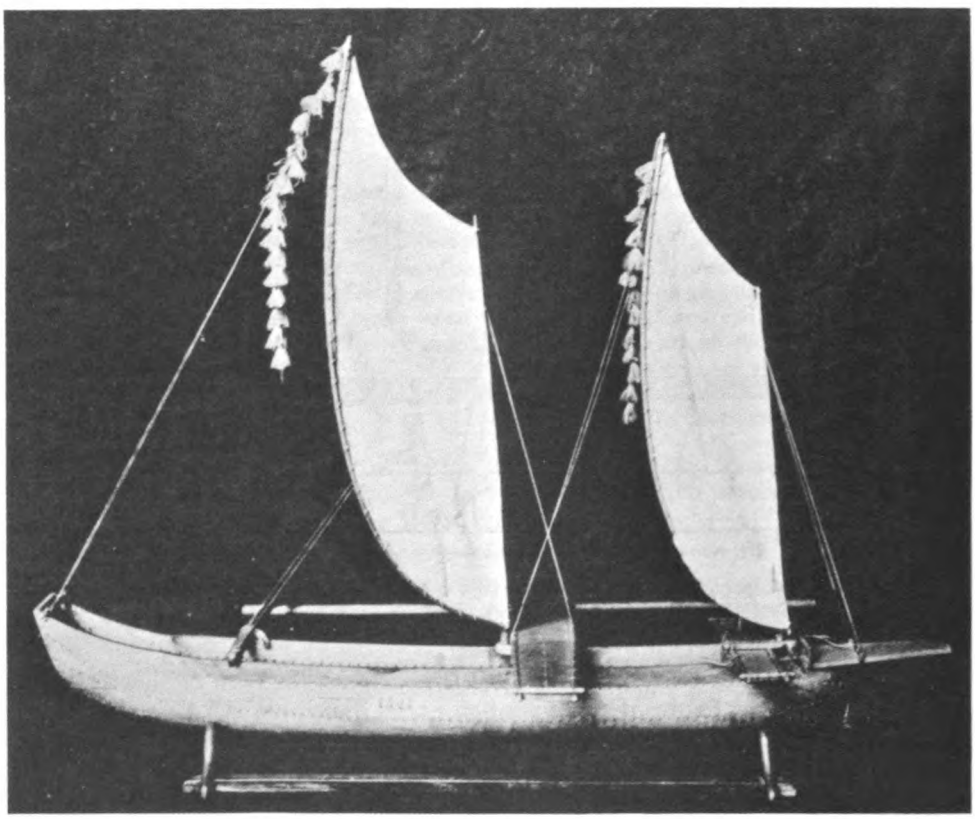


FIGURE 78.—Model of a Tahitian *va'a motu* (Musée de Marine, Louvre, Paris), made under the direction of Admiral F. E. Paris, seen from the off side; two balance boards are shown.

mast and to render the canoe more stable by placing a man at the end of the plank" when necessary.

Other original illustrations of the *va'a motu* differ so greatly in the position and support of the balance board that even after making much allowance for inaccuracies in the drawings, it is apparent that wide variation existed in these particulars, paralleled by the equivalent range of differences seen in the balance-board canoes of Palk Bay and Strait in India or by those seen in the form of outrigger attachment characteristic of different islands in the Society Islands at the present time.

The principal difference appears to have been entailed by increase in the length of the hull and the employment of a second mast. But for the fortunate chance that Admiral Paris in 1827 saw the damaged and neglected hull of what was probably the last of the true *va'a motu* rotting on the beach at Tahiti, nothing would be known of the details of this, the highest development of the Tahitian outrigger canoe.

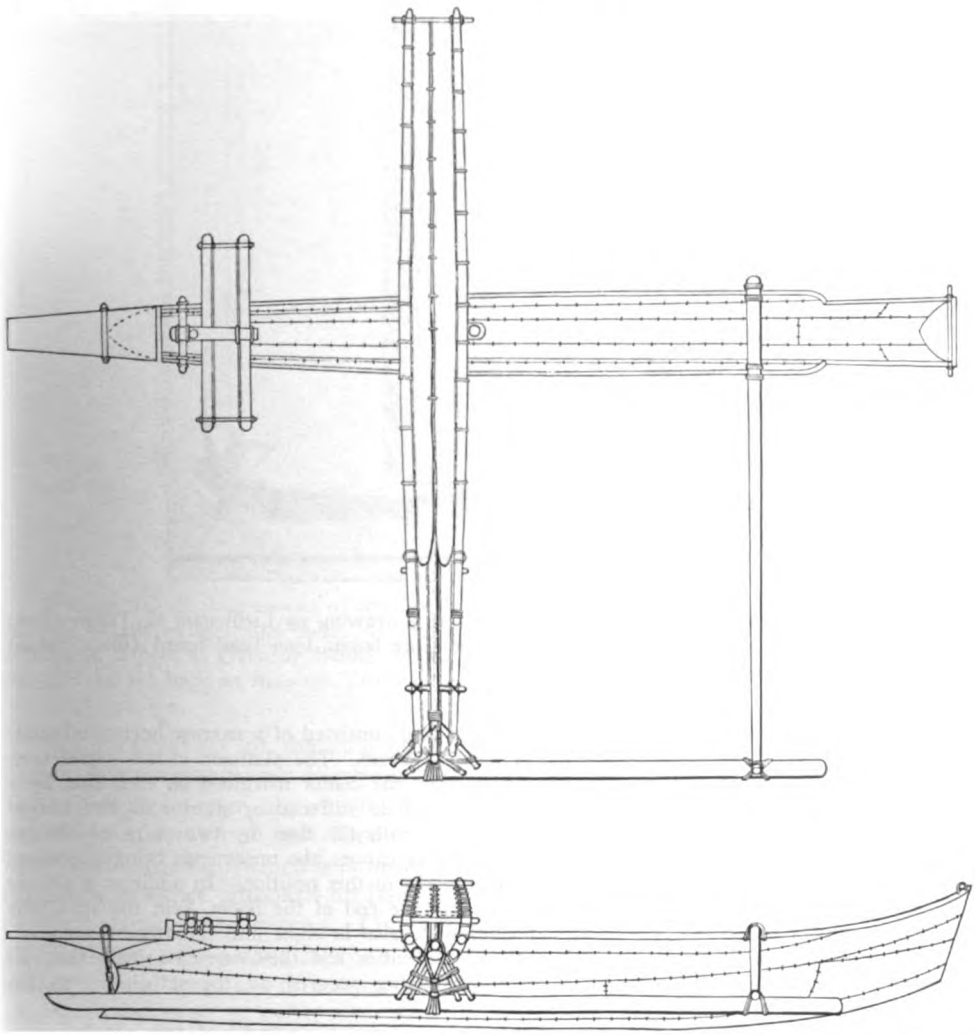


FIGURE 79.—Details of construction and arrangement of outrigger and balance board of a large *va'a motu* of Tahiti, probably the last of its kind (after Paris, 1841). Compare with figure 78.

Paris made careful drawings of all the essential parts remaining; the masts and rigging were, unfortunately, wanting. A balance-board of complex design was fitted immediately in front of the after mast, which was stepped nearly amidships; a second balance board, quite short, was placed athwart the hull just aft of the foremast step, which was right in the bows. (See figs. 78, 79.)

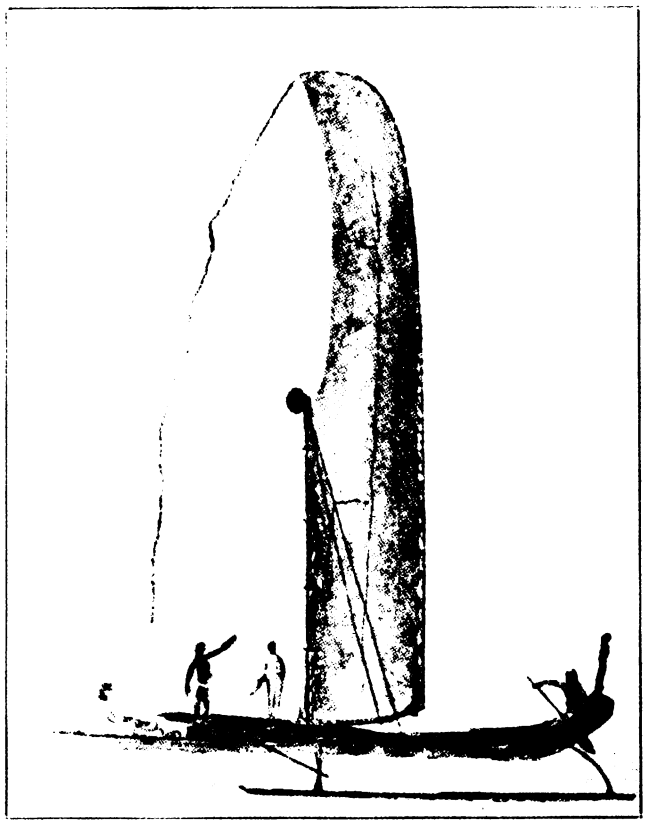


FIGURE 80.—Tahitian *va'a motu*, reproduced from a drawing by Lieutenant G. Tobin (Lee, 1920, p. 116), showing balance board separate from fore boom, long head board (*ihu*), raised stern, and form of sail.

The port section of the after or main balance board consisted of a narrow horizontal platform supported upon the outboard portion of the fore boom. The platform in this canoe consisted of two narrow planks forming a gangway down the center margined on each side by a strong pole, the two becoming accessory booms, the whole stiffened by short rods tied across the marginal poles. The main boom was connected with the float by two pairs of oblique stanchions in the same way as is common in present-day canoes, the upper ends being adpressed to opposite sides of the boom and lashed very securely in this position. In addition a strong suspensory sennit brace, passed around the float and the end of the boom, kept the stanchion attachment taut and secure. The marginal poles were also brought into the attachment complex by traneverse lashings passed around their extremities and then carried around the two inner stanchions. Lateral or transverse lashings further secured all the stanchions to the suspensory brace.

The starboard section of the balance board was formed similarly of two planks sewn together in the middle line, the outer edge of each lashed to a lateral pole. It was separate from the port section which it overlapped partially as it extended outboard on the port side more than one third the outboard length of the outrigger boom. Unlike the port section it was

fitted to incline upward, rising at the free distal end (that outboard on the starboard side) to a couple of feet or so higher than its inboard end, which thus made a wide angular joint with the horizontal section on the port side. To obtain this inclination, a narrow plank was set on edge beneath it upon the starboard gunwale. From the arrangement seen in old drawings it is certain that at least two shrouds passed from near the masthead to the outer extremities of the two lateral poles on each side, thereby helping materially to stiffen the balance platform. The short fore balance board was horizontal throughout its length; its use was probably confined to that of affording suitable positions for the attachment of the foremast shrouds.

A stout cord stay connected the outer end of the fore boom with the head of the canoe in order to counteract the lateral strain set up by water pressure as the float was dragged through the waves by the forward motion of the canoe. A similar outrigger stay is used commonly in Indian outriggers.

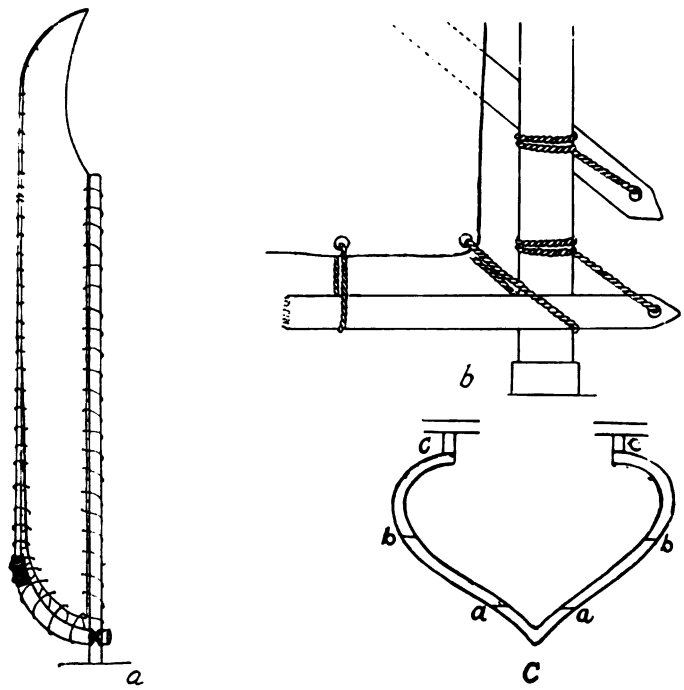


FIGURE 81.—Sailing canoes of the Society Islands: *a*, old form of sail as figured by Webber; *b*, details of sprit and boom attachment in modern sailing canoe; *c*, diagrammatic cross section of a *pahi* as given by Banks (1896), showing channeled keel, bulging side strake, and washstrake set back as in some Tuamotuan canoes of the present day (from Handy, 1932).

Another variety of the *va'a motu* is represented in a drawing by Lieutenant Tobin, who accompanied Bligh on his second voyage to the South Seas. Tobin's figure, made in 1792, shows (fig. 80) the balance-board to be of two long planks fitted athwart the hull just forward of the mast but a considerable distance abaft the fore boom, with which it is in no way connected. It extends apparently to about the same distance outboard on both sides, an arrangement paralleled in some Palk Strait balance-board canoes. On each side two shrouds lead from the masthead to its outer end. Other rigging consists of a fore stay and two ropes (vangs) which extend from the upper part of the sprit to the stern; there appear to be two sheets (Lee, 1920, p. 116).

It is clear that the old type of balance-board functioned and was fitted in essentially the same manner and relative position as the balance spar used on modern sailing outriggers in the Society Islands at the present day; in these it consists of

a lengthening of the forward outrigger boom on the off side, by the lashing thereto of the inner end of a long spar projecting outward and upward on the same side so that its outer extremity is elevated about two feet above the level of the gunwale (fig. 83).

So far as is known, the only other localities in Polynesia where use was made of the balance-board or spar were Tonga and Samoa. Tasman, Schouten, and others figure or describe this appliance as an essential fitting aboard the double canoes as well as on the large outriggers, obviously for the same reason as called for its employment in the Society Islands, namely, the fact that these people sailed their canoes always with the same end forward; as a consequence, on one tack the outrigger would be on the lee side, a position fraught with danger unless some compensatory device was employed—the result being the adoption of the balance-board or spar. In practice, whenever the outrigger was on the lee side, one or more of the crew took up position on the balance-board jutting out on the weather side. When the counterpoise was adjusted properly, the outrigger float was kept from burying itself in the sea and thereby deflecting the course steered as well as preventing the hazard of its breaking up. Similarly when the canoe was on the other tack, with the outrigger on the weather side, as it should be whenever possible, the value of the outrigger as a counterpoise to the force of the wind was increased greatly when one or more of the crew went outboard upon the fore boom.

This device is akin to one employed today in southern India (Hornell, 1920, pp. 162-167), where the fishermen of Palk Bay, whose boats are unprovided with outriggers, fit a plank athwart the hull of length sufficient to project outboard several feet on either side; in a strong breeze, 1, 2, or even 3 men are stationed outboard upon the plank on the weather side to counterbalance the pressure of the wind upon the sail; in skilful hands this gives a more adjustable counterpoise than an outrigger by itself. Similarly in the Sinhalese double-ended fishing outriggers (*oruwa*), in which the outrigger is kept always on the weather side, when the weight of the float is deemed insufficient in a strong wind, one or several of the crew are, in like manner, stationed on one of the booms to increase the counterpoise.

Another device employed when Tahitian canoes were prepared for deep-sea voyaging was the temporary heightening of the sides by means of weather boards. Ellis (1829, vol. 1, p. 160) refers to this feature: "Planks 12 or 15 inches wide are fastened along their sides, after the manner of washboards in a European boat. The same were also added to double canoes, when employed on voyages". Wilson (1799, p. 401) mentions it as follows:

> The single canoes, when rigged for sailing, are raised with a washboard of 10 or 12 inches above the gunwale; and on top of this, opposite the outrigger, is a stage about 2 feet wide, and running about 10 or 12 feet along the side of the canoe: this is made of planks well lashed to the spars which support them, and to this they bring the shrouds.

What Wilson means by the "stage" is uncertain unless the words "along the side" be a misprint for "from the side", which would make the description one of the balance-board already detailed.

MAST AND SAIL

Whereas the largest voyaging outriggers had two vertical pole masts, the majority were single-masted. The single mast was usually stepped immediately abaft the balance-board and fore boom, thereby differing from the modern sailing outriggers in which it is immediately forward of both. Ellis (1829, vol. 1, p. 174) states that it was movable and raised only when sail was to be made, and that it

was "slightly fixed upon a kind of step placed across the canoe and fastened by strong ropes or braces extending to both sides and to the stem and stern".

The simplest form of stepping was in a shallow hollow cut at the center of a mast thwart lashed upon the gunwales; in others, judging from some of the rather indefinite figures seen in old illustrations, it appears to have been stepped in a hollowed boss upon the balance-board (fig. 76). In the large two-masted canoes figured by Paris a stout wooden bar a few inches wide was bound in a fore and aft direction amidships to the booms supporting each of the balance-boards; one end, in which was a cup-shaped cavity, projected beyond the booms, on the after side in the case of the after balance-board, and on the fore side in that of the forward one. In the hollows of these bars the masts were stepped, according to Paris. (See fig. 79.)

Banks (1896, p. 160) writes that in a canoe 32 feet long which he measured the mast was 25 feet long, "which seems to be about the common proportion". From near the masthead a pair of shrouds passed to each extremity of the balance-board. Similarly a forestay was led from the masthead to the head platform. The backstay mentioned by Ellis is not shown in most drawings.

The sail used is described by Banks (1896, p. 161):

> To the mast is fastened a sail about one third longer [than the mast] but narrow and of a triangular shape, pointed at the top, and the outside curved; it is bordered all round with a frame of wood, and has no contrivance either for reefing or furling, so that in case of bad weather it must be entirely cut away. . . . The material of which it is made is universally matting. With these sails their canoes go at a very good rate, and lie very near the wind, probably on account of their sail being bordered with wood, which makes them stand better than any bow-lines could possibly do. On the top of this sail they carry an ornament which, in taste, resembles much our pennants. It is made of feathers, and reaches down to the very water, so that when blown out by the wind it makes no inconsiderable show [fig. 76].

Wilson (1799, pp. 401, 402) writes:

> [This wooden sail frame consisted of] a kind of sprit laced up and down the after leech and reaching one third higher than the masthead . . . and the lower part [of the sail] is extended on a bamboo boom, to which the sprit is securely lashed; and here also the sheet is made fast. In the single canoe the mast is placed nearly before the midships.
>
> [These canoes could not sail] above 5 or 6 knots an hour. As they have no method of reducing their sail at the head, being only able to cast it off at the foot and roll up a part, they are driven to the greatest inconvenience when overtaken by bad weather, and are frequently dismasted, overset, or blown off the coast, and heard of no more. When a squall comes, they luff the head of the sail to it; and if she is likely to fall off, they jump overboard and hold her head to windward till the gust of wind is passed, then get in and pursue their course. When overset, their first care is to lash everything fast and tow the canoe round with the masthead to windward; and having a line fastened to the sprit end, they get all hands on the float of the outrigger, and hauling the head of the sail out of the water, swing off with their whole weight, and the wind getting under the sail rights the canoe: two or three continue in the water and hold her head to the wind, and when clear they proceed on their voyage. The accident frequently happens on returning from fishing; and so little danger do they apprehend from being overset 4 or 5 miles from land that they never think of assisting each other.

These descriptions of the sail are by themselves difficult to understand, but when read in conjunction with the information supplied in the figures given by Cook, Bougainville, Paris, and Tobin it becomes possible to gain a clear conception of the form of this remarkable sail. It differed radically from the Oceanic lateen as employed in Micronesia and Melanesia, as also from that of the Tuamotus and of Manihiki, inasmuch as it was not confined between two yards (or boom and yard) and hoisted obliquely, apex downward, upon a mast usually raking forward. It was certainly subtriangular in form and, morphologically, it was set apex down, but two of the sides, the posterior and the upper, were curved and only the anterior

one was straight. The anterior side was tied to a vertical mast, the posterior to a light spar curved sharply upward at the outer end of a short boomlike foot section. Paris shows this spar as single and continuous with its sharpest curvature near the foot; in Cook's and Tobin's figures, which agree closely with Wilson's description, the spar is compound, composed of a short, stout basal section which seems sometimes to have been cut from a bamboo stem, attached at the inner end to the mast near its foot, and a long slender distal section, directed vertically upward (fig. 76). The lower end of the distal section is connected with the stout basal section, sometimes, apparently, by insertion into the hollow end, if a bamboo is used, but more usually by a lashing. The upper section of this spar, which may be called the boom sprit, reaches to a considerable height beyond the masthead, curving in toward the mast axis.

To this compound spar is laced or tied the posterior margin of the sail, now becoming differentiated into a weak foot region and a true leech. In Bougainville's figure (1771, p. 221) and also in Tobin's (Lee, 1920, p. 116) the stout basal part is nearly horizontal, the boom sprit rising from it almost at a right angle; in Cook's figure, the basal part is shown shorter and strongly curved. Probably there was a certain range of variation in these details, and something must be allowed for shortcomings on the part of the artists, who at that period were seldom rigorously exact in rendering technical points. In several old illustrations the sail is shown as laced to the mast and boom sprit. This is probably incorrect, for the Polynesian custom was to tie the margins of the sail to the spars by paired cords, spaced apart at short intervals. The modern sailing canoes of the Society Islands still adhere to this old method in preference to lacing.

This form of sail looks clumsy, but so does the battened sail of the Chinese junk, and yet no vessel can lie closer to the wind than does the junk. The Society Islands sail had similar good qualities, as expressly stated by Banks.

In its essentials the Society Islands sail is strictly comparable with the old Hawaiian sail and the two must be classed as variants of the same type; the Society Islands sail is actually an advance on the Hawaiian model, for in it is seen the first step in the evolution of a boomed sprit sail from the fully triangular one of Hawaii, which represents the older and more primitive form. At the time of my visit to the Society Islands (1925) several large outrigger cutters were seen, rigged with a true quadrilateral sprit sail but having a stout boom along the foot (fig. 83); to people accustomed to the old style of sail the transition would be easy, for the European boomed sprit sail has distinct points of resemblance thereto which these people would be quick to perceive and adopt when they saw how superior in handiness and power was the new model.

Outrigger Pahi

The *va'a motu* is the highest type of Tahitian outrigger craft of which there is a written account. It is therefore of great interest to find in the British Museum in a portfolio of drawings by Webber, Cook's artist on his third voyage, a large tinted drawing (Add: MS. no. 15513) of an outrigger vessel of large dimensions but with a hull of typical *pahi* (double voyaging canoe) construction except in minor particulars. No manuscript details are given and, so far as I am aware, the only published reproduction of the drawing is a roughly made copy entitled "a Tahitian single canoe" in Edge-Partington's album (1890, vol. 1, pl. 29), which does not do justice to the original. It is a fairly beamy vessel with both ends strongly curved upward (fig. 82). The after end is considerably higher and is also more sharply curved than the head. Each is surmounted by a carved *ti'i* figure, seated,

in human form. Omitting these ornaments, this handsome vessel resembles in general form the *orembai* of the Moluccas and the *mon* of the Solomon Islands.

The hull is broad and apparently is not narrowed in the washstrake region to the extent usual in the Society Islands design of the double *pahi;* rather does it resemble the beamy boat-shaped hull of the Tuamotuan type. Two-thirds of the length is covered in by a planked deck platform supported upon six or seven cross beams projecting outboard on both sides 2 or 3 feet; this permits a few planks to be laid lengthwise on the outboard ends, thereby increasing the width of the deck platform. A low thatched cabin with ridged roof and open sides extends nearly the whole length of the platform, giving shelter to passengers and cargo.

The curved-up region at the fore end is covered in with cross planking, and the corresponding region aft appears to be protected by coconut leaves tied upon the stern with many turns of cord.

FIGURE 82.—Tahitian coast scene showing an outrigger *pahi*, reproduced from original drawing by Webber, Cook's artist on his third voyage (British Museum, Add. MS no. 15513).

The hull is built up of planking sewn together after the *pahi* fashion described later. Above the deep garboard strake forming the lower part of the side is a broad and salient wale strake, convex in vertical section on the outer side. This is topped by a vertical washstrake of less depth set back to the fore-and-aft line of the upper edge of the garboard strake. A cross section of the hull would approximate more closely to that of the Tuamotuan *pahi* given by Paris (fig. 59, *b*, 4) than to that characteristic of the Society Islands according to Banks' diagram (fig. 81, *c*), in which the lower curve of the convex strake is continuous with that of the garboard strake and without the abrupt change of angle seen in the Tuamotuan design.

The stern post is deep and salient, suggestive of continuation into an equally salient keel.

On the port side an outrigger of simple form is fitted. The booms, two in number, curve gently downward to direct attachment to the float. The float is a long cylindrical pole cut off a short way abaft the after boom; the fore end is prolonged much farther beyond the fore boom.

On the beach in the background a number of typical outrigger hulls of the ordinary Tahitian type are seen, the heads low and horizontal, the sterns curved upward and lofty.

In the absence of any identifying title attached to the drawing, the great differences from any recognized Tahitian type embodied in the design suggest that this strange craft belongs to some other locality. The form of the prominent wale or rubbing strake, the considerable number of pieces or patches in the hull indicated by

the artist, and, in particular, the direct attachment of the outrigger float, are strongly suggestive of a Tuamotuan origin. Against this have to be set the high pointed head and the still higher pointed stern, characters not found in any Tuamotuan canoe except in a modified degree in a model in Bernice P. Bishop Museum from Tatakoto (fig. 44). If indeed Webber's sketch represents a visiting canoe, as I believe it to be, it is more likely to have belonged to the Austral Islands, where the high head and stern were distinctive of both Rurutu and Raivavae, associated as this form was with direct attachment according to local tradition. This view is strengthened when it is noted that Ellis (1829, vol. 1, p. 182) once saw a very large canoe at Tahiti "somewhat in the shape of a crescent, the stem and stern high and pointed and the sides deep", which had brought over a chief from Rurutu.

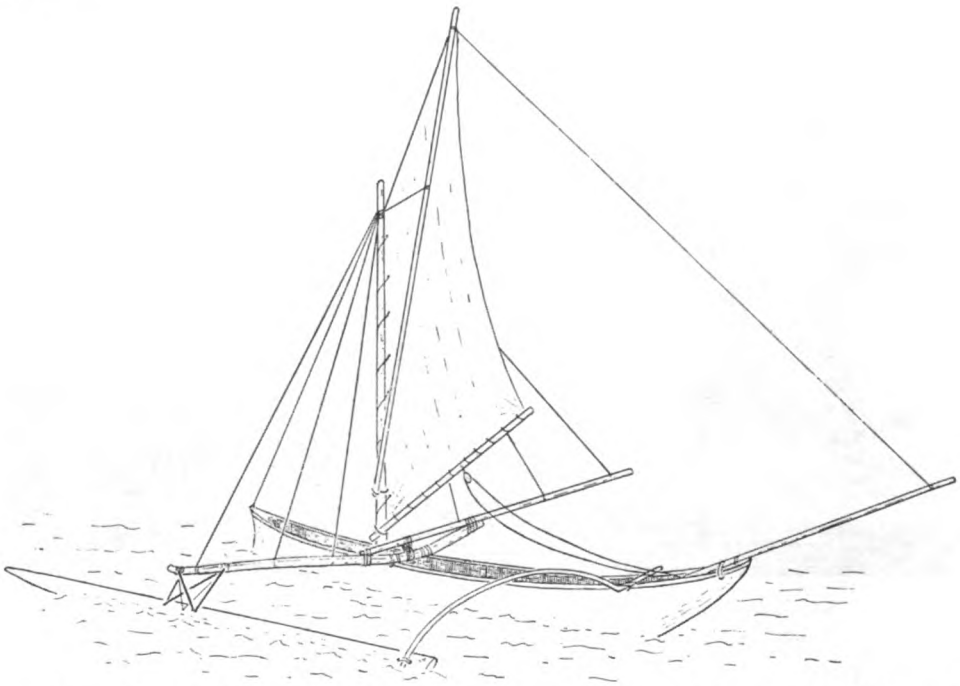


FIGURE 83.—Modern sailing canoe of the Leeward Society Islands, rigged with boomed sprit sail and long bumpkin; hull is dugout; long balance spar present, the homologue of the old-style balance board (Raiatea, 1925).

MODERN SAILING CANOES

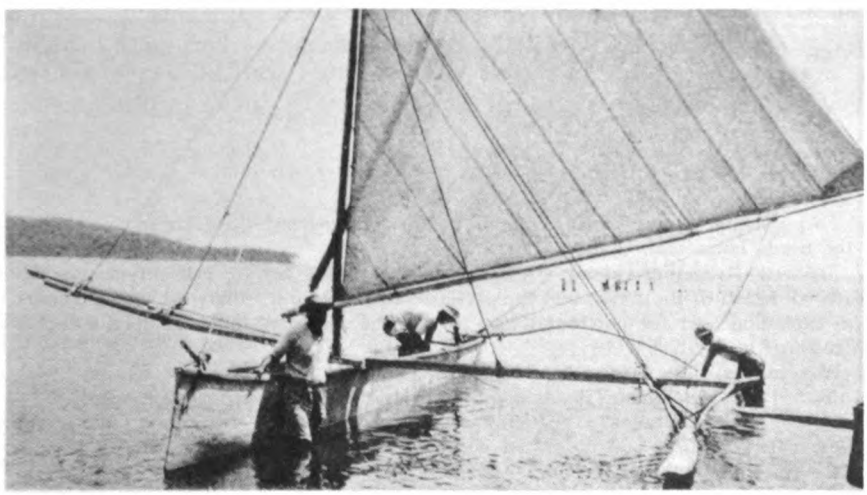
USED FOR FISHING

The present-day sailing outrigger of the Society Islands, the so-called *pahi,* is a beautiful little craft, handy to sail and of considerable speed, capable indeed of going 12 or even 14 knots under favorable conditions. As seen in the lagoon at Raiatea in 1925, these canoes have the same general form of hull as the larger-sized paddling canoes, the head sharp with a slightly concave cutwater, the stern pointed and definitely sheered. The hull is formed of a round-bottomed dugout underbody, with the freeboard raised by one or two strakes sewn on, and finished off with a narrow topstrake forming the gunwale. It is normally fully open and without decking. (See fig. 83.)

The outrigger, permanently fitted on the port side, has the typical form of attachment characteristic of the island to which the canoe belongs; the fore boom is less curved than in paddling canoes. The float extends relatively farther forward than in the paddling canoes and may even project beyond the level of the head.

The butt of the fore boom extends outboard on the starboard side a couple of feet or so, curving upward lightly. This gives support to the proximal section, rather more than one third the total length, of a long straight balance spar, which is extended outboard on the same side to a distance about equal to the length outboard of the fore boom on the other side—6 or 8 feet or even more. (See fig. 84.) Its proximal portion lies athwart the canoe above the

a



b

FIGURE 84.—Modern sailing canoes of the Leeward Society Islands: *a*, canoe under sail, one of crew stands outboard on balance spar to counteract tendency of float to dip deeply into water when on a tack with outrigger to leeward; *b*, details of parts and rigging (after Handy, 1932).

butt section of the fore boom, to which it is lashed at three places. The inner extremity is usually scarfed to make a more secure joint with the boom. Owing to the upward curve of the boom butt, the balance spar is given a gentle inclination upward so that its outer end is perhaps 18 inches or 2 feet above the level of the gunwales. In the larger ones three shrouds run from the masthead to three equidistant points on this balance spar, and three others to three other points on the fore outrigger boom; besides being useful as supporting braces to the balance spar itself, they serve as handholds when members of the crew are stationed outboard on either side as live ballast; smaller canoes employ fewer shrouds. The fitting is obviously a reduced form of the narrow balance platform characterizing the ancient type of voyaging outriggers (*va'a motu*) which went out of use early in the nineteenth century.

In these canoes the mast is stepped in the bottom of the hull immediately forward of the fore boom, thereby departing from the ancient custom, which was to step it on a thwart abaft the boom or upon the boom itself. The rig also departs considerably from the original type, but the transition has been a natural one and is not really great when analyzed. It consists of a relatively large quadrilateral sprit sail, with a stout boom extending the foot. An extremely long bumpkin projects over the stern to extend the vang running to the outer end of the sprit. Unlike the European sprit, the heel of this spar is lashed to the mast instead of resting in a loop or snotter, and in place of lacings the sail is tied at intervals to mast and boom. Its evolution from the pre-European type is definite and has already been noted.

A powerful steering paddle continues to be used in preference to a fixed rudder.

The smaller fishing canoes of 1827, when Paris visited Tahiti, were almost identical with those of the present day. Even then cotton cloth had displaced matting as the material for sails and the mast was stepped on the fore side of the fore boom. The only important difference was that the mast at that time was stepped on a thwart lashed upon the gunwales. The larger fishing canoes differed in retaining a hull form similar to that of the *va'a motu*—the stern somewhat elevated and a horizontal board projecting over the head. In both these varieties of fishing outriggers the fore boom was curved as in existing canoes, thereby differing from the *va'a motu*, in which it was nearly straight.

DOUBLE CANOES

Double canoes were sometimes extemporized for fishing, voyaging, or even fighting, by connecting a pair of outrigger canoes, denuded of their special fittings, by means of poles (booms) laid athwart the two hulls, which were thereby held apart and parallel to one another. All large ones were, however, constructed specifically for their respective purposes. The double canoes may be classified as follows:

1. *Macha'a* (twins). Small double canoes of which each hull is a single dugout; put together as occasion demands.
2. *Tira* (double fishing canoe). Used in albacore fishery. The sterns were cuved upward, the heads horizontal.
3. *Tipairua* (traveling canoe). A large edition of the fishing canoe type, distinguished by greater elevation of the sterns and the presence of a temporary thatched "cabin", either on a platform extending over the horizontal fore part of the conjoined hulls, or upon a decked-over section toward the stern.
4. War canoes. The largest type of the double canoe, used solely for fighting; both ends curved upward like a Solomon Islands *moa*, the after end the higher. Never sailed.
5. *Va'a ti'i* (sacred canoe). A richly adorned vessel of the war canoe type, ornamented with many carved figures and decorated with feathers and pennants; it carried shrines containing the emblems of the gods.
6. *Pahi*. Specially employed for voyaging to distant islands. It was rigged for sailing and had two masts. The hull was keeled and plank-built, and had inserted ribs.

MAEHA'A

The *macha'a* are equal-sized dugout canoes joined together temporarily by a few poles, usually two, lashed athwart them. Gaily decorated with festoons of

tender green leaves, fringes of *more,* and sprays of scarlet *Hibiscus* arranged on a light framework to form a lovely canopy, and paddled by crews of laughing Tahitian maidens, these little craft form one of the most effective items in the water carnivals occasionally organized at Papeete and elsewhere in the islands. According to Ellis (1829, vol. 1, p. 170) the hulls are exactly alike, the stem and stern usually sharp: "Occasionally there is a small board projecting from each stem. These are light, safe and swift, easily managed, and seldom used except by chiefs".

In the old days they were employed when necessary for a very different purpose. Cook (1777, p. 342), who calls them "Marais", describes them as small double canoes which followed the fleet to battle; on their fore part was a "sort of double bed place laid over with green leaves, each just sufficient to hold one man. These, they told us, were to lay their dead upon". The term *marai* (*marae*) employed by Cook implies that these canoes had a religious status, that they were floating biers attached to the great *va'a ti'i;* but further information is lacking.

Tira

The component hulls of the *tira* (double fishing canoes), like those of the traveling canoes, were built low for paddling. They consisted of slab-sided, round-bottomed dugouts, with the sides in the larger ones raised by the addition of a broad plank sewed vertically upon each edge of the two dugouts.

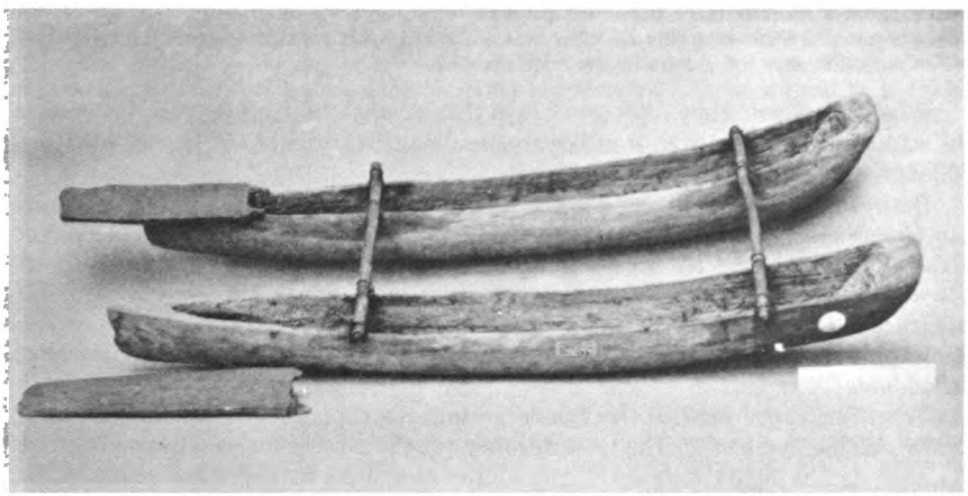


Figure 85.—Model of double canoe brought to England from Tahiti by Vancouver (British Museum), probably a fishing canoe: although rude in construction, form of hull and method of connection are well rendered; head board end pieces are shown (one dismounted) and though detail of their under side is omitted, their position and shape in plan are accurate.

In each a plank (*ihu va'a*) several feet long and about 20 inches wide projected horizontally forward over and beyond the bows to form a platform on which one of the crew stood while fishing was in progress. The hull ended forward in a sharp, nearly vertical cutwater; aft, it curved upward into a raised stern, truncate on the after side, where it was closed in by transverse planking forming a characteristic shield-shaped transom. (See fig. 85.)

The hulls were usually somewhat unequal in length; in one of the last of these canoes that survived until a few years ago, a small example, the larger hull was 24 feet long, the smaller 20 feet. The two were connected by two cross booms

(*'iato*) at a distance apart of about 5 feet, the smaller invariably on the port side. The forward boom as in typical outriggers was a heavy spar, some 3 inches in diameter, and long enough to project 18 inches outboard of each canoe in order to provide a purchase for the side stays of the fishing "crane". The after boom was slighter, barely half the diameter of its fellow and without any outboard projection. Both were lashed to the gunwales by sennit (*nape*).

These canoes were employed in the albacore factory. The fishing gear is well described by Nordhoff (1930, pp. 141-153).

> The fishing gear consisted of a long, compound fishing rod or "crane", originally called *tira* (literally "mast"), but in later times termed *purau* (so named because it is made from a branch of *purau*), 25 to 36 feet in length according to the size of the canoe. This was bifurcated about a foot from the distal end, and to each of the short divergent branches thus given off a fishing line, rather shorter than the *purau*, was tied. Athwart the four gunwales between the fore boom and the after end of the head platform (*ihu va'a*) a stout cylindrical bar (*rio*) was laid, its ends projecting a few inches beyond the canoes on each side. To the after side of this, at a point between the two hulls just outside the port gunwale of the starboard or larger hull, the fishing crane was lashed some little distance from the butt, which rested under and against the lower side of the fore boom when the *purau* was lowered into the fishing position. Three stays were attached to the fishing crane about 8 feet above the *rio;* two of these, the side stays, were led to the projecting ends of the fore boom. The third formed a forestay, attached below to the head of the starboard hull, and of a length carefully adjusted to permit raising the fishing crane when required until it was almost but not quite vertical, when this stay checked its further movement. Besides these, a strong backstay was attached to the *purau* a short distance below the point of bifurcation, the other end passed aft to men at the stern of the canoe. This backstay was a specially soft rope made from the inner bark of the *purau,* to save the pullers' hands from abrasion.

Ellis (1829, vol. 2, pp. 296, 297) says that a bunch of feathers was fastened to the end of each of the rod branches to simulate the presence of the sea fowl that follow the track of a shoal of small fish.

Between the two hulls, made fast to the cross booms fore and aft, was a livefish car (*hapi 'uma*), a broad, canoe-shaped basket 8 to 12 feet long, 2 feet deep, and about a yard across. Its base was made of a length from the bottom of an old canoe; on this were built-up basketwork sides and ends. The ends were blunt, upturned, and covered in, leaving a large median opening. In this car was carried the supply of live bait consisting of young red mullet (*Mulloides auriflamma*) called *'uma*.

When the canoe reached the fishing ground the captain, with a scoop, began to throw out the live bait sparingly and slowly till the albacore were attracted to rise. As soon as any fishes were seen, one of the two short fishing lines, ready armed with a large flattened, barbed metal hook (anciently it was of mother-of-pearl) was baited with a fish and thrown overboard. At the same moment the crew began to paddle backward, so that the bait was trolled along the surface in a lifelike manner. The instant a fish took the hook the men aft jerked up the *purau* by means of the lifting backstay, thus swinging the hooked fish aboard into the grasp of a man stationed on the port head-platform.

The two fishing lines were used alternately, and not together as shown in Ellis' drawing (1829, vol. 2, p. 297).

When the fishing was over, the empty *hapi 'uma* was hoisted aboard and carried athwart the two hulls, as otherwise it impeded progress homeward. Paris (1841, pl. 122) figures one in this position.

These double canoes, which with their fishing equipment were termed collectively *tira* in modern times, were the property of a number of men and women working in cooperation; one man would own the starboard canoe, another the port one, a

third the fishing crane or *purau*, and so on; the women caught bait. Twelve years ago only a single *tira*, the last in Tahiti, was at work. Two years later, 1925, when I visited the island, even this had ceased to be used and lay rotting on the beach.

Tipairua

It is probable that many of the great historic voyages to New Zealand and Hawaii were made in *tipairua* (traveling canoes), the state canoes of the great chiefs and the specially fitted canoes used for deep-sea voyaging when the *pahi* was not employed. A low head and high upturned stern are typical alike of the *tipairua* and of all the larger craft of the New Zealand Maoris. (See fig. 86.)

The *tipairua* was a larger and better finished edition of the albacore fishing canoe. The ordinary ones used for short journeys had a broad platform built over the horizontal fore part of the conjoined hulls; on this a light thatched shelter was erected for the protection of the passengers. The canoes varied greatly in size. Ellis (1829, vol. 1, p. 167) states that they ranged up to nearly 70 feet in length, each hull about 2 feet wide and 3 or 4 feet deep, "the sterns [of the larger] remarkably high, sometimes 15 or 18 feet above the water and frequently ornamented with rudely carved hollow cylinders, square pieces or grotesque figures called *ti'is*".

On larger canoes employed in voyaging to other islands the shelter, according to Bougainville (Duponchel, 1841, vol. 1, p. 291), was placed at the after end of the conjoined hulls,

> . . . a very light frame covered with a roof of reeds (*roseaux*). It gave shelter from the rain and sun and provided also a place where their provisions could be kept dry. . . . These are the canoes which the chiefs always make use of. They are propelled both by sail and by paddles.

In canoes belonging to chiefs, the size, the number of the paddlers, and the height and ornamentation of the sterns were significant of the fancied or real importance of their owner. Wilson (1799, p. 400), in discussing the *tipairua*, tells of sterns which he saw raised 14 feet, carved with representations of

> . . . men supporting each other on their hands, tier upon tier, and surmounted by a piece of carved wood of 3 or 4 feet, round and hollow, something like a Gothic tower. These according to their bulk, are paddled by from 4 to 20 men and can be rowed single or made double as occasion requires.

Webber made an excellent drawing of such a grand traveling craft (fig. 87) which shows a number of interesting features:

> The carved ornamentation at the stern is concentrated upon a tall cylindrical pillar in each hull, surmounted by a large *ti'i* figure; the shaft appears to be carved in the round into a columnar series of six or seven smaller *ti'i* figures. At the base is an angled foot by which it is tied upon the stern. The port hull has in addition a separate *ti'i* figure attached upon the corner of the stern opposite that where the carved pillar is tied.
>
> The prows of the canoe have also some ornament, for across the extreme end of each headboard (*ihu*) is lashed a saddle-shaped piece of carved wood with the ends enlarged into something like the scroll of a Doric capital.
>
> The *ihu* of each hull is unusually long, and the thatched cabin, large and roomy, is placed amidships upon a rude decking supported on 13 cross beams projecting outboard some distance as in the "outrigger *pahi*" already described. Two primary booms pass through the hulls at the junction of the upper and lower strakes; these are probably homologues of the two booms of an outrigger canoe.
>
> Each of the hulls consists of a shallow basal dugout of which the sides are raised by the addition of two broad strakes, which here appear to be vertically disposed. The upper one, the washstrake, rises a few inches above the level of the *ihu;* the space between their fore ends is, presumably, closed in by a transverse board or breakwater.
>
> The single mast is stepped far forward and immediately behind the inner end of the two *ihu;* how it is stepped is not shown. A light ladderlike frame is affixed to the mast, its rungs probably the equivalent of the ratlines of a sailing ship. There are two forestays, one to each

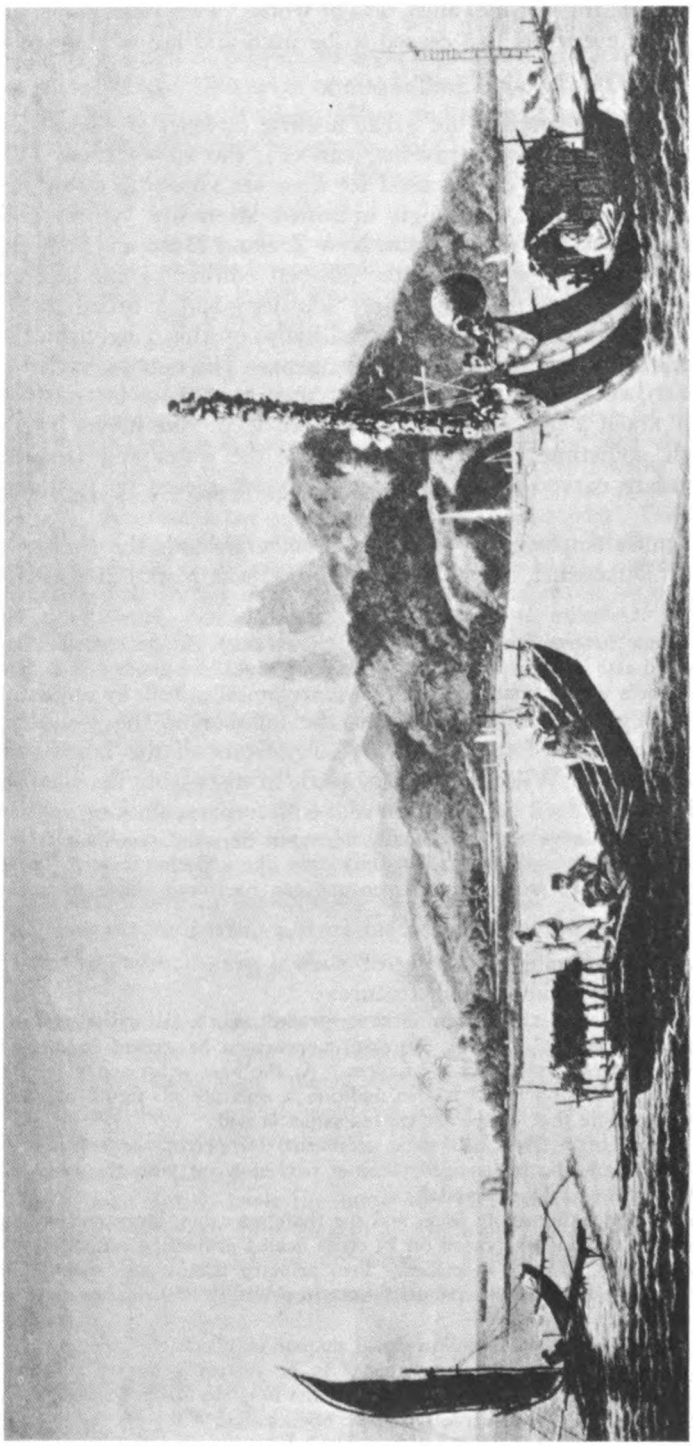


FIGURE 86.—Tahitian *tipairua* (traveling canoe), after a plate by Hodges (Cook, 1777, Atlas): foreground, two double traveling canoes; extreme right, outrigger canoe with ladderlike fitting to mast; left, another with the mixed attachment still in use.

end of a crosspiece athwart the two *ihu* immediately above the cutwaters. Other paired ropes appear to be shrouds, and a single one leading aft may be a backstay. Their relative positions are shown in figure 87.

Ellis (1829, vol. 1, pp. 164-166) gives a good description of the ordinary form of this type of canoe as used for coastal traveling:

It was between 30 and 40 feet in length, very strong, and, as a piece of native workmanship, well built. The keel, or bottom, was formed with a number of pieces of tough *tamanu* wood (*Calophyllum inophyllum*), 12 or 16 inches broad and 2 inches thick, hollowed on the inside and rounded without so as to form a convex angle along the bottom of the canoe; these were fastened together by lacings of tough elastic cinet made with fibres of the cocoanut husk. On the front end of the keel, a solid piece, cut out of the trunk of a tree, so contrived as to constitute the forepart of the canoe, was fixed with the same lashing; and on the upper part of it a thick board or plank projected horizontally and formed a line parallel with the surface of the water. This front piece, usually 5 or 6 feet long and 12 to 18 inches wide, was called the *ihu va'a*, nose of the canoe, and, without any joining, comprised the stem, bows, and bowsprit of the vessel. [See fig. 74.]

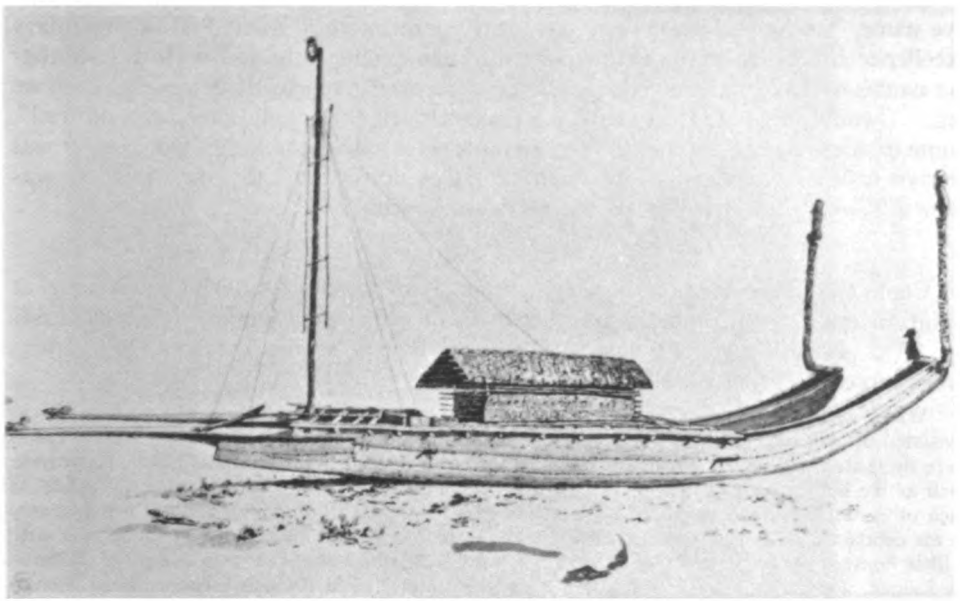


FIGURE 87.—Sketch by Webber of a Tahitian *tipairua*, the most careful drawing of this kind of craft known (British Museum, Add. MS no. 15515).

The sides of the canoe were composed of two lines of short plank or board 1.5 or 2 inches thick. The lowest line was convex on the outside and 9 or 12 inches broad, the upper one straight. The stern was considerably elevated, the keel was inclined upward, and the lower part of the stern resembled the bottom of a pointed shield, while the upper part of the *noo* or stern, was 9 or 10 feet above the level of the sides. The whole was fastened together with cinet, not continued along the seams, but by two, or, at most, three holes made in each board, within an inch of each other, and corresponding holes made in the opposite piece, and the cinet passed through from one to the other. A space of 9 inches or a foot was left, and then a similar set of holes made. The joints or seams were not grooved together, but the edge of one simply laid on that of the other and fitted with remarkable exactness by the adze of the workman, guided only by his eye: they never used line or rule. The edges of their planks were usually covered with a kind of pitch or gum from the breadfruit tree, and a thin layer of cocoanut husk spread between them. The husk of the cocoanut, swelling when in contact with water, fills any apertures that may exist. The two canoes forming *Tiaitoerau*, were fastened together by strong curved pieces of wood placed horizontally across the upper edge of the canoes, to which they were fixed by strong lashings of thick cinet. The space between the two bowsprits or broad

planks projecting from the front of our canoe, was covered with boards and furnished a platform of considerable extent; over this a kind of temporary awning of plaited cocoanut leaves was spread and under it the passengers sat during the voyage. The upper part of each of the canoes was not above 12 or 15 inches wide; little projections were formed on the inner part of the sides, on which small movable thwarts or seats were fixed, whereon the men sat who paddled it along. . . . The steersman stands or sits in the stern, with a large paddle: the rowers sit in each canoe 2 or 3 feet apart.

According to Bougainville (1771, p. 221), it would seem that a tree trunk having a natural bend in it was employed whenever possible to form the after end of the basal portion of the hull, the so-called "keel". This would facilitate greatly the building of the sharply curved stern. Bougainville confirms what Ellis says as to the raising of the sides; he states that two strakes, each about a foot wide, were added to give additional height. He also describes the component sections of the keel as being butted together end to end and secured in position by lashings passed through holes in the opposite edges and the hulls as connected about four feet apart.

Ellis (1829, vol. 1, pp. 163, 170) writes that every large canoe had a distinctive name, "always arbitrary, but frequently descriptive of some real or imaginary excellence in the canoe, or in memory of some event connected with it. Neither the names of any of their gods or chiefs were ever given to their vessels: such an act . . . would have been deemed the greatest insult that could have been offered". Some of these names appear to have been perpetuated, as the king's state canoe was always called *Anuanua* (Rainbow). Another in which the king traveled was named *Tiaitocrau* (literally, "Wait-for-the-west-wind").

War Canoes

Cook and his companions were fortunate in witnessing during their stay at Tahiti in 1774 one of the great naval reviews in which the islanders delighted. (See fig. 88). Cook (1777, pp. 320-321) records having seen upward of 300 canoes ranged in order along the shore, and continues:

When we got into our boat we took our time to view this grand fleet. The vessels of war consisted of 160 large double canoes, very well equipped, manned, and armed. . . . The vessels were decorated with flags, streamers, etc., so that the whole made a grand and noble appearance, such as we had never seen before in this sea. . . . The vessels were ranged close alongside of each other with their heads ashore and their sterns to the sea, the admiral's vessel being nearly in the centre. Besides the vessels of war, there were 170 sail of smaller double canoes, all with a little house upon them, and rigged with mast and sail, which the war canoes had not. These, we judged, were designed for transports, victuallers, etc.; for in the war canoes was no sort of provisions whatever. In these 330 vessels, I guessed there were not less than 7,760 men; a number which appears incredible, especially as we were told they all belonged to the districts of Attahourou and Ahopatea. In this computation I allow to each war canoe 40 men, troops, and rowers, and to each of the small canoes 8. . . . It is certain that the most of them were fitted to row with more paddles than I have allowed them men; but at this time I think they were not all complete.

Hamilton (1793, p. 49), who visited Tahiti in the *Pandora* in 1791, states that on their war canoes, which "are very large, a platform is placed capable of containing from 150 to 200 men". Wilson (1799, p. 114) says the largest was able to carry 300 persons. Moerenhout's estimate (1837, vol. 2, p. 40) is equally high, from 150 to 300 in each canoe. According to Moerenhout, warfare on land was rare; all great disputes were settled by naval combats. These took place usually within the lagoon in some great bay sheltered by the reef, the party on the defensive ranging their fleet in a battle order of three lines.

Forster's account (1777, vol. 2, pp. 61-63) of the same scene contains detailed particulars of these war canoes more explicit than any given by others. In Cook's company, he had walked

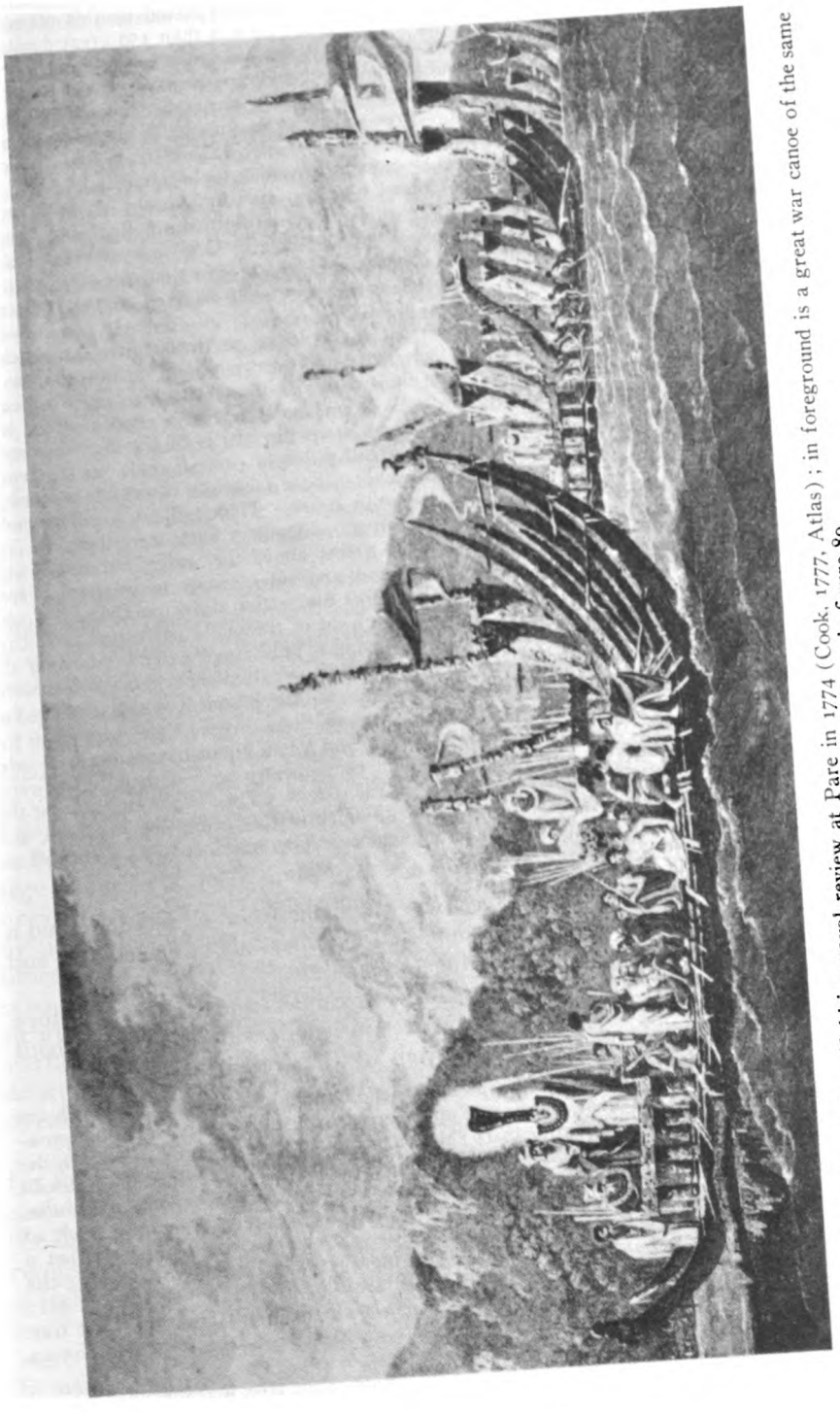


FIGURE 88.—Vessels in a Tahitian naval review at Pare in 1774 (Cook, 1777, Atlas); in foreground is a great war canoe of the same class as that shown in figure 89.

. . . along the whole range of vessels, whose prows were turned to the shore. All our former ideas of the power and affluence of this island were so greatly surpassed by this magnificent scene that we were perfectly lost in admiration. We counted no less than 159 great double war canoes from 50 to 90 feet long betwixt stem and stern. When we consider the imperfect tools which these people are possessed of, we can never sufficiently admire the patience and labour with which they have cut down trees, dubbed the plank, made them perfectly smooth, and at last brought these unwieldy vessels to the great degree of perfection in which we saw them. A hatchet, or properly, an adze, of stone, a chissel, and a piece of coral are their tools, to which they only add the rough skin of a ray, when they smooth or polish their timber.

All these canoes are double, that is, two joined together, side by side, by 15 or 18 strong transverse timbers, which sometimes project a great way beyond both the hulls, being from 12 to 24 feet in length, and about 3.5 feet asunder. When they are so long they make a platform 50, 60, or 70 feet in length. On the outside of each canoe there are, in that case, two or three longitudinal spars, and between the two connected canoes one spar is fixed to the transverse beams.

The heads and sterns were raised several feet out of the water, particularly the latter, which stood up like long beaks, sometimes near 20 feet high, and were cut into various shapes. A white piece of cloth was commonly fixed between the two beaks of each double canoe, in lieu of an ensign, and the wind swelled it out like a sail. Some had likewise a striped cloth, with various red chequers, which, as we afterwards learned, were the marks of the divisions under the different commanders. At the head there was a tall pillar of carved work, on the top of which stood the figure of a man, or rather of an urchin, whose face was commonly shaded by a board like a bonnet, and sometimes painted red with ochre. These pillars were generally covered with bunches of black feathers, and long streamers of feathers hung from them.

The gunwale of the canoes was commonly 2 or 3 feet above the water, but not always formed in the same manner, for some had flat bottoms, and sides nearly perpendicular upon them, whilst others were bow-sided, with a sharp keel, like the section drawn in Captain Cook's first voyage. A fighting stage was erected towards the head of the boat, and rested on pillars from 4 to 6 feet high, generally ornamented with carving. This stage extended beyond the whole breadth of the double canoe, and was from 20 to 24 feet long, and about 8 or 10 feet wide.

The rowers sat in the canoe, or under the fighting stage on the platform, which consisted of the transverse beams and longitudinal spars; so that wherever these crossed there was room for one man in the compartment. Those which had 18 beams and 3 longitudinal spars on each side, besides 1 longitudinal spar between the two canoes, had consequently no less than 144 rowers, besides 8 men to steer them, 4 of whom were placed in each stern. This, however, was not the case with the greatest part of the canoes here assembled, which had no projecting platform, and where the rowers or paddlers sat in the hulls of the canoes. The warriors were stationed on the fighting stage to the number of 15 or 20.

Banks gives the dimensions of the platform as "about 10 or 12 feet long and a little broader than the two boats: this is supported by pillars about 6 feet high and upon it stand the people who fight with slings, spears, etc."

Wilson (1799, pp. 307-309), who saw some war canoes a quarter of a century later, and gives their dimensions as 60 to 90 feet in length with a beam of about 3 feet and a depth of 6 feet, the stern rising from 12 to 24 feet high, writes:

The war canoes differ from common ones in construction, having high bows, on which are carved rude figures of men; and their sterns run up tapering, sometimes to 24 feet, and ornamented with the like figures: the bottom is sharp; the sides rounding in towards the top in the midship frame, like the print of a spade on a pack of cards. They are built of short pieces about 6 feet each, except the keel, which seldom exceeds three pieces, of 20 or 30 feet long, and sometimes is formed of two only. The short pieces are lashed together securely with sinnet made of cocoanut fibres; the seams are calked with the same, and payed with the breadfruit gum; but a heavy sea opens the seams and makes them leaky, and they have no methods of clearing the water but by bailing with scoops, so that five or six hands are thus constantly employed at sea; and in port they are hauled up on dry ground, to prevent their sinking. The breadfruit tree plank is preferred for durability; for though not a close-grained wood, the saltwater worms will not touch it, a property which few others of their woods possess.

In building their canoes, they use fire to burn out the inside of the tree, and smooth the sides with coral and sand. They prepare their pitch for paying the seams, by wrapping the gum of the breadfruit tree round candle-nuts stuck on skewers of cocoanut leaf ribs: these being lighted, the pitch drops into a tray of water, and squeezing out the aqueous particles, they spread it on

the plank edge and lay the cocoanut husk beaten fine over it; then smear it with pitch and fit on the next plank, pressing it powerfully with ropes and levers, and securing it in its place with lashings.

The war canoes and those presented to the Eatooa [Atua] are built by a general levy: the chief issues his orders to the *towhas* [*tahu'a*, master craftsmen], they to the *ratirras* [*ra'atira*, landed proprietors] who call upon their tenants, the *manahoune*, for hogs, cloth, oil, etc., to support the carpenters who are sent to the work. They first examine the hills, and pitch on the proper timbers: the *ratirra* on whose land it is found, sends men to cut it down and hew it in the rough, under the carpenters' directions, that it may be the easier removed, as it is sometimes at a considerable distance. When the timbers are collected, they are laid under the shed where the canoe is to be built: a feast is then made to engage the favorable assistance of the Eatooa; and being very acceptable to the workmen, they hold one before the tree is cut down, another at the commencement of the building, and on making fast every course. When the first strake or bottom is completed, there is a great entertainment and offering, and so on till the whole is finished, when the festivity is greatest, and the canoe for the Eatooa dressed out with cloth, breastplates, and red feathers, and a human victim is offered. The offerings for the war canoes are only hogs, etc., which are brought to the morai of the chief in whose district it is built; there the priests strangle them as usual and clean them, smearing them over with their own blood, and placing them on the *fachatta* or altar, with young plantain-trees, and long prayers: the entrails and guts are cleaned and eaten at the morai. Sometimes the hogs are dressed before they are offered on the altar; there they are left to putrefy, or be eaten by the birds which frequent these places, the heron especially and the woodpecker. These birds are respected as sacred, and never killed, as it is supposed the deity descends in them, when he comes to the morai to inspire the priest, and give an answer to their prayers.

It is clear from the foregoing accounts that the war canoes, though agreeing as to fittings and military equipment, were of two distinct types of hull form: one was of the round-bottomed, slab-sided design characteristic of canoes used for coastal transport and fishing, but with the prows elevated instead of low and horizontal, and with much loftier sterns; the other was sharp-keeled and rounded in the sides and identical in form with the deep-sea *pahi* employed for voyaging to distant islands. It is certain that types so widely divergent would not be built specifically for the same purpose; the explanation appears to be that the second type consisted of *pahi* hulls temporarily commissioned as war canoes.

Both Cook and Forster saw reviews of the war fleet in Tahiti which included large numbers of small double canoes, evidently traveling canoes pressed into war service as transports and victualers. If small canoes were included in the fleet, certainly all available *pahi* would also be adapted for inclusion. This presented no difficulty, as all that was required was the removal of the masts and rigging, the extension of the gunwale platform, and the provision of a fighting stage. The incorporation of such vessels in the war fleet, even when not specifically built for warfare, was particularly necessary in islands where large vessels could be constructed only at the cost of immense effort and the expenditure of months of strenuous and costly labor.

The typical Society Islands war canoe of indigenous design, built specifically for the purpose, may be defined as a vertical-sided double canoe of the largest size, each hull built up of two or three wide strakes upon a round-bottomed dugout base, the dugout made up of several sections sewn together, end to end, to make up the requisite length. The largest were usually about 90 feet long with a width of about 3 feet to each hull and a depth of 3 or 4. But Cook records seeing two sister hulls, each 108 feet long, in Tu's royal dockyard in Tahiti, nearly ready to launch; they were intended to form a magnificent double canoe, which Cook requested should be named the *Britannia* (fig. 89).

When in commission the two hulls were placed parallel with one another 3 or 4 feet apart and connected at regular intervals by numerous—15 or 18—transversely disposed booms lashed upon the gunwales. These booms projected outboard a considerable distance on the off or outer

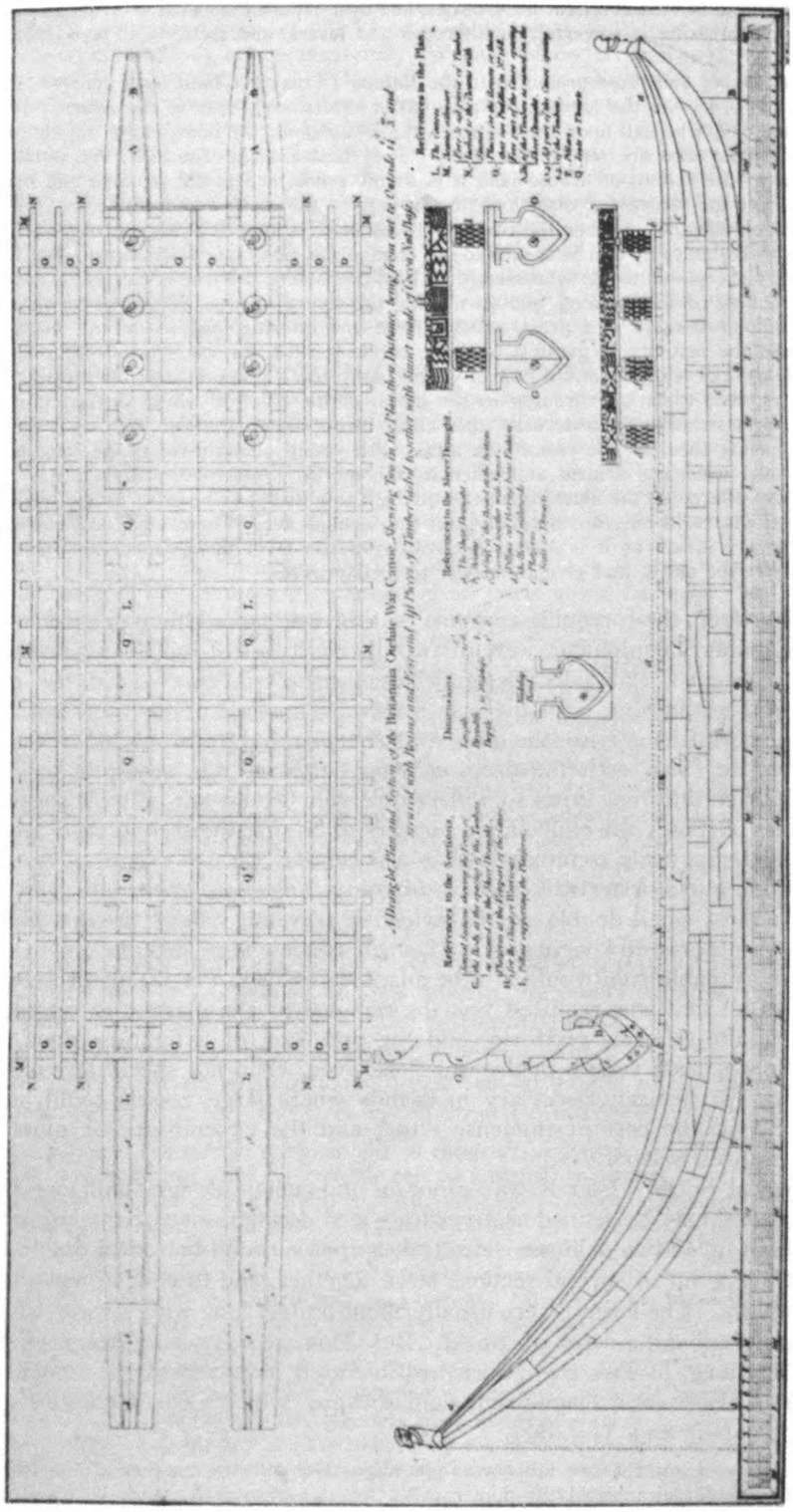


FIGURE 89.—Draft, plan, and sections of Tahitian war canoe, *Britannia*, drawn to scale under the supervision of Captain Cook in 1774 (1777, Atlas), showing details of construction—curved-up ends, great platform, and elevated staging near head.

side of each hull; over them were laid longitudinally, at short intervals apart, five or seven other spars, the whole forming a great rectangular latticework platform for the accommodation of the many paddlers forming the crew; one paddler appears to have been stationed in each compartment or mesh of this huge network of spars. By this arrangement it will be seen that the majority of the paddlers were actually disposed outboard of the hulls.

Toward the fore ends of the joined canoes, a fighting stage 10 to 24 feet long and 8 to 10 feet wide was supported upon pillars 4 to 6 feet high, a height more than sufficient to clear the heads of the paddlers below.

The hulls might be of equal size, or one might be somewhat smaller than the other; there seems to have been no rigid custom. The stern of each was unusually lofty, rising in a graceful curve to a recorded maximum of 24 feet. It usually bore on the summit a carved *ti'i* figure or some conspicuous and conventional emblem of a deity. The heads were also raised, but only to about one third or at the outside one half of the height of the stern; they also bore *ti'i* images.

Such vessels were not employed for long voyages and were not rigged for sailing, propulsion being entirely by paddles. They were for use solely in warfare, and this, to some extent, accounts for the striking divergence in the shape of the fore ends from that of canoes employed for fishing and traveling. When advancing against an enemy the raised head gave a measure of protection to the warriors and paddlers, whereas in retreat the high sterns were still more effective against the missiles of the pursuers. They probably perpetuated a type of canoe brought to the islands by warlike newcomers who eventually became the ruling caste.

All double-hulled vessels of large size appear to have been termed *pahi* by the islanders. As this name is applicable strictly to the keeled vessels used for voyaging, round-bottomed war canoes were essentially double *va'a*.

Va'a Ti'i

The *va'a ti'i* (sacred canoe), dedicated to the service of the gods, was a double canoe of the largest and finest description, more highly ornamented with carving and feather decorations than any of the others. Ellis (1829, vol. 1, pp. 168-169) writes:

> Small houses [shrines] were erected in each, and the image of the god, sometimes in the shape of a large bird, at other times resembling a hollow cylinder ornamented with various coloured feathers, was kept in these houses. Here the prayers were frequently preferred and the sacrifices offered. . . . The *vaa tii* formed part of every fleet and were generally the most imposing in appearance and attractive in their decorations.

It is not clear whether the *vaa ti'i* was always built specifically as such; Ellis (1829, vol. 1, p. 176) mentions that "valuable canoes were often among the national offerings presented to the gods, being ever afterward sacred to the service of the idol".

Pahi

The *pahi* (sea-going sailing canoe) was a large, two-masted double canoe, rigged with peculiar crab-claw sails closely resembling those of Hawaii. Unfortunately the term *pahi* appears to have been employed loosely by the Society Islanders for any large vessel, much in the same way as we use the word "ship". A further complication arises from the use of mastless *pahi* as war canoes. There is, in consequence, a certain amount of confusion in some of the accounts, and this is increased by the difficulty of knowing whether the *pahi* described truly represent the local design or are copies or importations of Tuamotuan sea-going vessels. Cook (1893, p. 98) for example, states that on his first visit (1769) he saw but six of these *pahi* in the whole of Tahiti and "was told that they were not built here".

From this and from Ellis' statement (1829, vol. 1, p. 181) that the natives of the eastern islands (Tuamotus) frequently come down to the Society Islands in large double canoes which the Tahitians dignify with the name of *pahi paumotu*, Best (1925, p. 219) has assumed that the *pahi* mentioned by Cook were deep-sea vessels obtained from Tuamotuan natives. Considering that the Society Islanders are known to have kept up communication in olden days with both Hawaii and New Zealand, they must be credited with the ability to build their own sea-going *pahi*. The six seen by Cook on his first visit to Tahiti were almost certainly built at Raiatea, as he himself suggests (1893, pp. 118-19), for when the *Resolution* visited that island, Cook saw canoes being "built full-bellied, and after the very same model as those six we saw on George's Island [Tahiti], which I have already described, and some are full as large; it is more than probable that these six proes were built at some of these islands". Banks (1896, p. 115) saw the inhabitants of Raiatea "at work making and repairing the large canoes called by them *pahie*". At the same time it may be freely admitted that the Tuamotuan natives were superior in skill in canoe-building and endowed with greater energy than the Society Islanders at this period. For these reasons Tuamotuans were employed by the island chiefs, particularly on Raiatea, which appears to have been the center of canoe-building in Cook's time, upon the construction of *pahi*, as stated by Moerenhout (1837, vol. 1, p. 159). A passage in a letter written in 1773 to the Spanish Viceroy, quoted by Corney (1915, vol. 1, p. 358), from Juan de Hervé, Master of the frigate *Aguila*, states:

> They [the natives of Tahiti] also tell us that there is in that island [Raiatea] a very great abundance of good timber trees, some very large, and that the canoes built there are much larger than those of the other islands. Each *arii* owns a large vessel that they call *paxia* [*pahi*].

But if men from the Tuamotus supervised and helped in the building of Society Islands *pahi*, it is evident that they had to modify their design to conform to their employers' taste and give the hulls high, curved sterns, a feature unknown in the double canoes of the Tuamotus. The hatchway was also narrower, owing to a characteristic rounding in of the hull between the bilge and the gunwale.

Banks (1896, p. 115) gives the details of a typical *pahi*, measured by himself at Raiatea:

> Her extreme length from stem to stern, not reckoning the bending-up of those parts, 51 feet; breadth in the clear at the top, forward 14 inches, amidships, 18, aft 15; in the bilge forward 32 inches, amidships 35, aft 33; depth amidships, 3 feet 4 inches; height above the ground, 3 feet 6 inches; her head raised, without the figure, 11 inches; her stern, 8 feet 9 inches; the figure 2 feet. Alongside of her was lashed another like her in all respects, but smaller in proportion, being only 33 feet in her extreme length.

Another *pahi* which Banks saw (1896, p. 116) was "much longer".

According to the description and the sectional figure given by Banks (1896, p. 115), the construction of the hull bore considerable resemblance to that of the Tuamotuan double canoe as figured by Paris (1841, pl. 126).

> The hull consists of a deeply channeled salient keel not more than 4 or 5 inches deep, formed of two or at most three lengths, each 20 to 30 feet long, butted and sewn endwise together. On each edge is sewn a garboard strake, about 18 inches deep and 2 inches thick, flaring outward at an angle of about 45 degrees; on these a strake, bow-shaped in vertical section, hewn and shaped from the solid, of the same width, is sewn; the upper part of the latter being bent inward abruptly, narrows the opening or hatchway considerably. A shallow vertical washstrake finishes off the sides. The strakes are made up of short pieces each only some 4 or 5 feet in length. "Such a number of pieces must necessarily be framed and fitted together before they are sewed; and this they do very dexterously, supporting the keel by ropes made

fast to the top of the house under which they work, and each plank by a stanchion; so that the canoe is completely put together before any one part is fastened to the next, and in this manner it is supported till the sewing is completed. This, however, soon rots in salt water; it must be renewed once a year at least; in doing so the canoe is entirely taken to pieces and every plank examined."

Banks adds that the best of the *pahi* were very leaky, as no calking was used; this is a mistake, for both Wilson (1709) and Ellis (1829, vol. 1, p. 165) state that the seams were calked with coconut fiber and payed with breadfruit gum, leaks being the result of the working of the structure under the stress of heavy seas.

Cook's description (1893, pp. 98-99, 119) of the six *pahi* seen on his first visit to Tahiti in 1769 sums up their salient features concisely, and adds important items to that of Banks:

> The two largest was each 76 feet long, and when they had been in use had been fastened together. These are built sharp and narrow at both ends and broad in the middle; the bottom is likewise sharp, inclining to a wedge, yet bulges out very much and rounds in again very quick below the gunwale ["full-bellied", he terms them on p. 118]. They are built of several pieces of thick plank and put together as the others are [the war canoes], only these have timbers in the inside, which the others have not. They have high curved sterns, the head also curves a little, and both are ornamented with the image of a man carved in wood. . . . They manage them very dexterously and I believe perform long and distant voyages in them. . . . They wear for show or ornament at the masthead of most of their sailing canoes pendants made of feathers.

The strakes forming the sides of *pahi* built in the Society Islands appear to have been fewer in number (two only) and made up of longer and stouter lengths of planking than those in similar vessels constructed in the Tuamotus; this would follow naturally as a direct consequence of the larger timber available in quantity in the Society Islands. Wilson (1709) gives the length of the component planks as "about 6 feet" in the Society Islands, and Banks (1896, p. 161) as "about 4 or 5 feet long and about 18 inches broad". Best (1923, p. 19), quoting Barstow's description of a Tuamotuan double canoe, says it "was built of many pieces of *tamanu* wood, the largest probably not exceeding 4 feet in length by 1 foot in width".

The form of the hull also differed considerably. That of the Society Islands rounded in very quickly and deeply above the bilge, narrowing the hatchway much more than in the Tuamotuan model.

To protect these valuable canoes from the weather, they were kept in great sheds thatched with palm leaves having the sides so gracefully curved inward to a high median ridge as to suggest a rustic Gothic hall. One measured by Banks was 50 paces long, 10 broad, and 24 feet high. The roof was supported on one side by 26, and on the other by 30 squat posts about 2 feet high and 1 foot thick, upon most of which were rudely carved human heads and various fanciful figures (Banks, 1896, p. 111).

It may be fairly concluded that the *pahi* was similar to the double sailing canoe in the Tuamotus except in the shape of the heads and sterns, and probably in being narrower in beam at the gunwales; it introduced into the canoe design of the Society Islands a number of foreign structural features. Conspicuous among these variations were the use of a sharp and narrow keel, a hull with a wedge-shaped bottom and prominent bilges rounding in conspicuously below the gunwale, and, most significant of all, the presence of timbers on the inside. The other types of canoes built by the Society Islanders were all round- or flat-bottomed, slab-sided vessels, with no specific keel and wholly without internal timbers.

Mast and Sail

The masting of the larger types of double sailing canoes is difficult to understand, owing to the seemingly contradictory accounts left by observers. Wallis (Hawkesworth, 1773, vol. 1, p. 486) describes the double canoes seen at Tahiti in 1767 as having "two masts set up between them", whereas Banks (1896, p. 160) writes that "when sailing they have either one or two masts fitted to a frame which is above the canoe: they are made of a single stick; in one I measured of 32 feet in length, the mast was 25 feet high, which seems to be about the common proportion". Neither writer specifies the particular type of canoe to which he refers, which does not appear to have been a *pahi*. Nor does Cook help in this problem, save that in the plates by Hodges the masts of every canoe depicted (no *pahi* is figured in any of his scenes) are shown as fitted vertically in the middle line, amidships in single canoes and on the connecting platform in double ones, which accords with the statement by Wallis. Ellis is equally vague; by his time (about 1820) the building of sailing *pahi* appears to have ceased in the Society Islands. The only ones seen were those in which the natives of the Tuamotus came when they visited the islands on a trading trip. Ellis (1829, vol. 1, p. 174) describes these as having two masts, which were stationary, whereas in Society Islands canoes, both single and double, they were "movable and only raised when the sails are used. They are slightly fixed upon a kind of step placed across the canoe and fastened by strong ropes or braces extending to both sides and to the stem and stern". This method of stepping is evidently what Banks refers to when he describes the masts as fitted to a frame above the canoe.

The only positive statement on the subject is that of Juan de Hervé (Corney, 1915, vol. 1, p. 358), who states that some of the double canoes "fitted on the inside with knees", which clearly identifies them with the *pahi* type, were rigged "with two masts and their sails. The heel of the mast fits or rests on a stout plank fixed across the two canoe bodies, with the mast at the middle of the part".

It is probable that all *pahi* were not rigged in this fashion, for in a description which seems to relate specifically to the *pahi*, though this is not distinctly stated, Wilson (1799, p. 401) writes that "the foremast is raised in the one hull, and the mainmast in the other, at nearly one third each", meaning probably that the foremast was one third the hull's length from the head, the mainmast the same distance forward of the stern. Andia y Varela (Corney, 1915, vol. 2, p. 284) confirms Wilson's account, saying, "For long voyages they employ two canoes coupled together by means of cross scantlings securely lashed and leaving space enough between them for the crew of both bodies to scull in. . . . They generally set two sails, one in each canoe-body".

Certain museum models of Manihiki double canoes exhibit a similar arrangement of the masts; in them the masts are usually pivoted upon bars placed athwart the hulls.

The quotations given point to the employment in large double canoes of two types of sail rig: 1, with the masts tandem and stepped amidships on the platform connecting the hulls; 2, a mast stepped in each hull, one upon a cross beam well forward of amidships, and the other at about an equal distance abaft the midships point. Both methods would be suitable for the *pahi*, which could sail either end forward, but the probability is that the first only was used in the *tipairua*, which had not this ability.

A third type of mast and standing rigging is that which was employed on the *tipairua* shown in Webber's sketch (fig. 87). A single mast combined with ladder

rungs, after the Tuamotuan fashion, is stepped far forward. A ladder mast is also seen in figure 86.

So far as is known, the sails of a *pahi* were similar to those of the sailing outriggers of the period during which Europeans first visited the Society Islands. The silence of all writers on this point is fairly conclusive, for had it been otherwise any marked difference would have claimed attention and record.

Ornamentation

Few details of the ornamentation bestowed upon the various classes of Society Islands canoes have survived, though Banks (1896, p. 161) states: "The people are fond of ornaments in all parts of their boats; in the good ones they commonly have a figure at the stern and in the *pahies* they have a figure at both ends, and the smaller *iwahahs* have usually a small carved pillar upon the stern".

Ornament, mainly of a propitiatory nature, was lavished upon the war canoes and the state canoes of great chiefs. Both Wilson and Ellis give descriptions of *ti'i* figures carved on the sterns of state canoes, both single and double, comparable with the less conspicuous ones on Marquesan canoes.

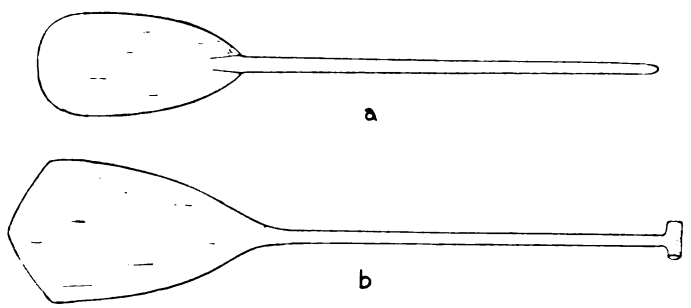


Figure 90.—Society Islands paddles: *a*, present-day paddle, Tahiti; *b*, steering paddle, Raiatea (after Edge-Partington).

Other and more conventionalized representations of patron deities consisted of carved wooden cylinders, hollow, and painted with red ocher; they were fixed upon the towering sterns of the large ceremonial craft and were generally covered with bunches of black feathers. Long feather streamers hung from them, according to Forster (1777, vol. 2, pp. 61-63). Forster also mentions the use of white cloth spread sail-like between the beaks [sterns] of war canoes, and of "striped cloth with various red chequers", used as the distinguishing marks of the different commanders in a fleet. At the peak of the sail a long feather pennant was tied, long enough, says Banks (1896, p. 161) to reach "down to the very water, so that when blown out by the wind it makes no inconsiderable show". At the top of the mast a stiff bunch of short branches is seen in some old illustrations; Handy (1932, p. 54) suggests these would doubtless be *miro* branches, a token of peace.

The woodwork of the superstructure and particularly of the supporting pillars and crossbeams of the fighting stage of war canoes was frequently ornamented with carving (Forster), and this (fig. 89) appears to have been of the angular geometric type particularly associated with the Austral Islands. Handy (1932, p. 48), however, mistrusts the accuracy of the details; he considers it unlikely that these would have been copied on the spot as accurately as the dimensions and structure of the craft were recorded.

Paddles

The paddles are of simple form, the loom long and cylindrical and without ornament. The blade is short, broad, and spathulate, widening toward the rounded distal end (figs. 90, *a*; 37, *a*). A few are longer in proportion to the width and more elegant, and this form is accentuated in the steering paddles in use in sailing canoes. These are from 6 to 8 feet long and have a crutched grip (fig. 90, *b*). None of the great steering paddles or oars used aboard the ancient *pahi* have survived.

Anchors

In former days anchors (*tutau*) were of stone, either grooved equatorially for the lashing around of a rope, or perforated at one end to allow the rope to be passed through before making fast.

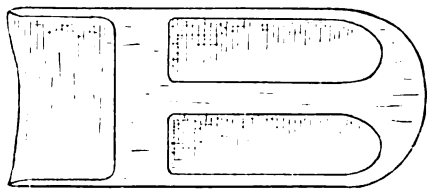


Figure 91.—Bailer from Tahiti (British Museum).

Bailers

The old form of bailer (*tata*) is a variety of the Oceanic type. The handle, instead of being free at the distal end as in the ordinary design, is connected at that point to each side of the body by a broad lateral bar. It may be described as a short and wide flattened cylinder, open at one end, closed at the other, in which two elongated parallel holes have been cut on one side, leaving a stout bar between as a hand grip. Ornamental carving is absent. One of these aberrant or possibly primitive bailers (fig. 91) is similar to the one recorded by Handy (1932, p. 57) from Maupiti, which measures 15 inches in length, 5 inches in depth, and 7 inches in diameter.

The form of the Aitutaki bailer (fig. 109) is closely related to this very unusual type, thereby affording additional concrete evidence of the intimate relationship that traditionally existed in former times between the Society and Cook Islands.

Bailers of the same peculiar type are also found in the Palau Islands and in Yap in the western Caroline Islands.

Tightening Appliances

Forster (1777, p. 461), describing the construction of a Society Island canoe remarks:

> Their mechanical genius I particularly admired, having an opportunity of seeing one day a man sewing a large canoe together: he employed a stick with a forked branch for the purpose of drawing the string more powerfully together; one of these branches he fixed against the lowermost plank, and to the other he fastened the string or rope, which gave him an amazing purchase, and as soon as the string or rope was stretched to its utmost an assistant struck a peg into the hole through which the string passed to prevent its giving way again.

This device is widespread in Polynesia; Seurat (1905, p. 306) records it from Reao in the southeast region of the Tuamotus under the name *keke*, Best (1925, p. 79) from New Zealand, and Buck (1927, fig. 227) from the Cook Islands. Emory saw one still in use in Huahine (fig. 92).

A widespread device to hold planks in position for sewing and calking, seen by Emory (Handy, 1932, p. 51) at Huahine, is the Spanish windlass (fig. 92). This was already in use in ancient Egypt fully 2,000 years B.C., and today it is in general use in southern India for tightening and securing the booms of outrigger canoes both to float and gunwale. Its employment in the Marquesas Islands has already been noted, and it is also found in use in Samoa and New Zealand.

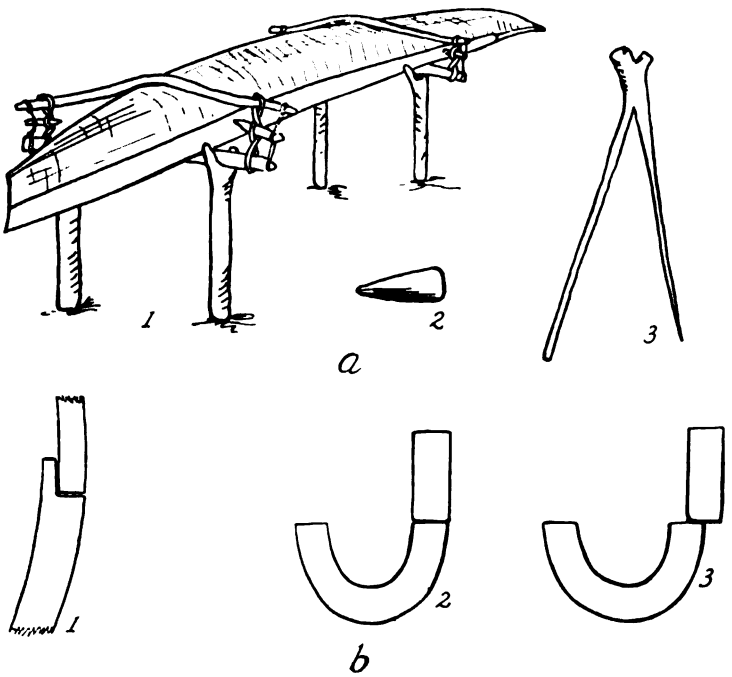


FIGURE 92.—Society Islands, canoe features. *a*, Spanish windlass (*rore*) used in tightening lashings, canoe not in use is supported by uprights; 2, calking tool used to drive home material in plugging lashing holes; 3, device for pulling lashing taut. *b*, differences in technique of joining washstrake to underbody in modern Raiatean canoes: 1, at fore end; 2, amidships; 3, near stern (from Handy, 1932).

RAFTS

Handy (1932, pp. 57-58) gives the only available information concerning the use of the raft in the Society Islands (fig. 93, *b, c*). At Raiatea, a raft (*reho*) was observed in use for transporting coral blocks. In the shallow water of the lagoon the raft was pushed by men wading in the water, or poled by men on the platform.

Perhaps more interesting than the use in the Society Islands of the raft itself is the fact that kites were formerly used to propel them. There is a well-known story of a time when the district of Vairao in Tahiti, having a debt of revenge to pay Varai (now Papeari) which lies to the northwest across a broad bay, loaded rafts with food and sent them across the bay by means of kites; this was ostensibly a freewill gift, but in reality intended to lead the Papeari people to return the compliment by coming unarmed to Vairao with a return gift. The ruse succeeded and the people of Vairao had their revenge. Concerning the use of rafts in this bay in ancient times, Corney (1915, vol. 1, p. 324) writes: "Kites have been used for towing rafts of timber and bamboos at this part of the coast—Mataiea and Papeari!"

This information brings the Society Islands into line with the Marquesas Islands and with Mangareva, Samoa, Tonga, Fiji, and New Zealand, whose people were all well acquainted with the navigational use of rafts. It supports the view that rafts were utilized freely in some at least of the movements from island to island of the first migrants into Oceania. It is significant that the Society Islands term for raft (*reho*) is almost identical with the New Zealand term *raho* (floor-gratings of a canoe), a fitting constructed on the same principle as a raft.

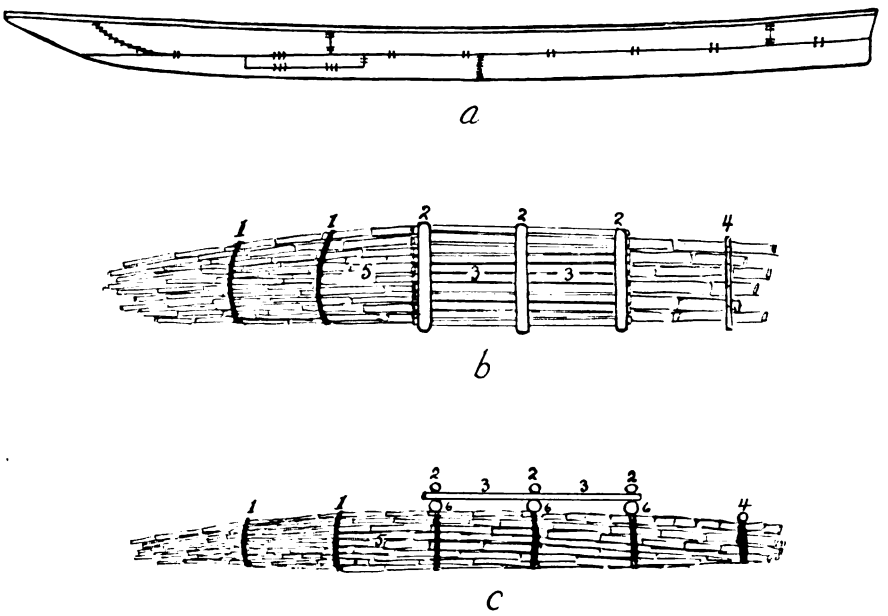


FIGURE 93.—Leeward Society Islands, canoe and raft. *a*, hull of Raiatean sailing canoe, underbody made up of two lengths butted together, end pieces retained and gunwale rail present. *b*, *c*, top and side views of bamboo raft: 1, lashings of *purau* bark; 2, cross pieces; 3, poles used for decking; 4, binding pole at stern; 5, bundle of long bamboos constituting body of raft; 6, cross pieces supporting deck (from Handy, 1932).

NAVIGATION

Reference has already been made to the knowledge concerning island groups scattered around the Society Islands shown by the high priest Tupaea. So far as is known the islanders in their distant voyaging depended for their course during the day upon their knowledge of the general direction of their destination in relation to the sun's position at a given hour, upon the run of the sea, and upon the direction of the wind on leaving port; the long feather pennant at the sprit end served to indicate any variation of wind. During the night they were guided by the stars.

Unfortunately the notices left by those European voyagers who visited the islands prior to the dying out of the knowledge formerly possessed by the islanders of the science of navigation and of the methods employed are lacking in detail with one notable exception—the account written in 1774 by Andia y Varela (Corney, 1915, vol. 2, pp. 284-87):

> There are many sailing masters among the people, the term for whom is in their own language *fatere* [*faatere*]. They are competent to make long voyages like that from Otahiti to Oriayatea [Raiatea], which counts 40 or 50 leagues, and others farther afield. . . .

They have no mariner's compass, but divide the horizon into 16 parts, taking for the cardinal points those at which the sun rises and sets. . . . When setting out from port the helmsman reckons with the horizon thus partitioned counting from E, or the point where the sun rises; he knows the direction in which his destination bears: he sees, also, whether he has the wind aft, or on one or other beam, or on the quarter, or is close-hauled: he knows, further, whether there is a following sea, a head sea, a beam sea, or if it is on the bow or the quarter. He proceeds out of port with a knowledge of these [conditions], heads his vessel according to his calculation, and, aided by the signs the sea and wind afford him, does his best to keep steadily on his course. This task becomes more difficult if the day be cloudy, because of having no mark to count from for dividing out the horizon. Should the night be cloudy as well, they regulate their course by the same signs; and, since the wind is apt to vary in direction more than the swell does, they have their pennants [made] of feathers and palmetto bark, to watch its changes by and trim sail, always taking their cue for a knowledge of the course from the indication the sea affords them. When the night is a clear one they steer by the stars, and this is the easiest navigation for them because, these being many [in number], not only do they note by them the bearings on which the several islands with which they are in touch lie, but also the harbors in them, so that they make straight for the entrance by following the rhumb of the particular star that rises or sets over it; and they hit off with as much precision as the most expert navigator of civilized nations could achieve.

They distinguish the planets from the fixed stars, by their movements, and give them separate names. To the stars they make use of in going from one island to another, they attach the name of the island, so that the one which serves for sailing from Otahiti to Oriayatea has those same names, and the same occurs with those that serve them for making the harbors in those islands.

What took me most in two Indians whom I carried from Otahiti to Oriayatea was that every evening or night they told me, or prognosticated, the weather we should experience on the following day, as to wind, calms, rainfall, sunshine, sea, and other points, about which they never turned out to be wrong: a foreknowledge worthy to be envied, for, in spite of all that our navigators and cosmographers have observed and written anent this subject, they have not mastered this accomplishment.

Sir Joseph Banks (1896, p. 162) evidently received similar information in the year 1769, for he writes:

In their longer voyages they steer in the day by the sun, and in the night by the stars: of these they know a very large number by name, and the cleverest among them will tell in what part of the heavens they are to be seen in any month when they are above the horizon. They know also the time of their annual appearance and disappearance to a nicety. . . . The people excel much in predicting the weather.

From these quotations it seems certain that the knowledge and practice of navigation in the Society Islands was about equal to that possessed until recently by the Micronesians of the Carolines and Gilberts. Whether the courses and schools of nautical training which existed formerly in Micronesia had their counterparts in this Polynesian group of islands is unknown. There is no record of any, but the fact that Tupaea was a high priest suggests that knowledge of the higher branches of nautical knowledge and particularly of stellar navigation was limited to the ranks of the ruling classes; this in turn would require the provision of some method of imparting the knowledge acquired through long experience to those who were marked out to become the leaders and navigators of the following generation.

In addition to the assistance afforded by their astronomical knowledge, the islanders—keen observers of nature and natural phenomena—had several other means of determining the position of islands not yet in sight. The flight of certain birds, the smell of the land, lagoon reflection in the sky, and the sight of a peculiar form of cloud that hovers above the islands however bright the day, were probably all utilized for this purpose. Smith (1921, p. 230) gives a traditional instance:

Toi's grandson, Whatonga, sailing from Tahiti, lost his way in a fog and landed on Raiatea. After some years' sojourn there, Whatonga's trained bird found him, and by the course the bird took on its return with an answer (by quipus or knotted cord) "the wanderers discovered the direction of their home".

It also seems probable that the direction taken by flocks of certain birds during their periodical migrations led to the discovery of some of the more distant island groups. As Cartwright (1929, p. 109) has pointed out, the islanders would infer that migrant birds like the golden plover could not live on the open sea, not being water fowl, wherefore they went to some land and later returned from it:

> They would naturally reason that if birds could fly to this land in one flight, they, in a large *wa'a* certainly could sail to it. When once they had proved the theory it would not be long before they were following migrations of shore-birds in different directions until all the islands to which these birds migrated would be discovered.

Thus, probably, was Hawaii discovered by the people of the Society Islands, or perhaps, conversely, the Society Islands were discovered by the Hawaiians. Similar reasoning led to the finding of New Zealand by Kupe the Raiatean, according to Smith (1921, p. 216):

> Kupe had observed in his many voyages the flight of the *kohoperoa*, or long-tailed cuckoo, year after year, always coming from the southwest and wintering in the Central Pacific islands. He and his compeers would know at once that this is a land bird and consequently that land must lie in the southwest. By following the course preserved in the Maori College from his time, viz.: 'In sailing from Rarotonga to New Zealand, let the course be to the right hand of the setting sun, moon, or Venus, in the month of February', he would certainly strike New Zealand. This course is quite right, as any one may prove for himself by trying it on a chart.

TECHNICAL TERMS

Ama: outrigger float.
Hoe: paddle.
Huhui or huihui: washstrake or gunwale.
Iato: outrigger boom.
Ie: sail.
Ihu: the projecting headboard.
Maeha'a: small double canoe of two dugouts.
Mua: head or prow of a canoe.
Muri: stern of a canoe.
Oa: washstrake of a *pahi*.
Pae: balance board.
Pahi: double-hulled voyaging vessel, plank-built.
Pu hoe: small paddling canoe with outrigger.
Purao (modern): mast of a bonito fishing boat.
Reho: raft; also paepae.
Rei-mua: figurehead of large canoes.
Rei-muri: carved figure on the upturned stern of large canoes.
Tata: bailer.
Ti'ati'a: stanchion connectives between boom and float.
Tipairua: double canoe used for local traveling.
Tira: double canoe used for bonito fishing.
Tira (ancient): mast.
U: peg in the float to which the end of the after boom is attached.
Va'a and va'a motu: sailing outrigger canoe.
Va'a ti'i: sacred double canoe.

AUSTRAL ISLANDS AND RAPA

INTERISLAND INTERCOURSE

The Austral Islands, lying about five degrees south of Tahiti, are among the least known and least visited in Polynesia. What little trade there is, is carried on by infrequent schooners from Tahiti, commanded by native and half-caste skippers. This present-day intercourse continues that of pre-European days, for most things in the islands, and in particular the construction of their canoes as described by the first voyagers and as seen today, bespeak an intimate relationship with the Society Islands.

The Austral archipelago comprises the islands of Rurutu, Raivavae, Rimatara, Tubuai, and the uninhabited Maria (Hull) Islands. Rapa is not recognized as a member of the group, but as it has ethnological affinity with the Austral Islands it is treated with them for convenience. Except for the small Maria cluster, the islands are of volcanic origin and have hills of considerable elevation. Both Ru-

rutu and Tubuai rise to an approximate height of 1,300 feet, and Rapa rises to 2,100 feet.

Cook (Hawkesworth, 1773, vol. 2, p. 180), who discovered Rurutu (Oheteroa) in 1769, obtained information of its existence from Tupaea, whom he refers to as the chief priest of Tahiti, with "great experience and knowledge in navigation and particularly acquainted with the number and situation of the neighbouring islands". Tupaea told Cook of the existence of several islands situated from the south to the west and northwest from Rurutu which he had visited himself, and this information was proved to be correct by Cook's discovery in 1773 and 1777 of Atiu, Mangaia, and Manuae in the Cook Islands (1803, pp. 87, 121, 229), and of Samoa and Fiji by other navigators.

A further hint of this interisland intercourse is afforded by Ellis (1829, vol. 1, p. 182), who mentions the coming to Tahiti (about 1820) of a chief from Rurutu in a great plank-built canoe fully 12 feet deep amidships.

Unfortunately, little definite information exists concerning the construction of the sea-going canoes of the Austral Islands. Voyagers who visited the islands while the old types of canoes still existed appear to have been impressed with their apparent similarity to those of the Society Islands and so considered it unnecessary to particularize.

RAPA

Ancient Canoes

Vancouver (1798, vol. 1, p. 77), who discovered Rapa in 1791, remarks of the canoes:

> From the number that in so short a time assembled round us, it is natural to conclude that the inhabitants are very frequently afloat. . . . We saw about 30 double and single canoes, though most of them were of the double sort: the single canoes were supported by an outrigger on one side, and all built much after the fashion of the Society Islands, without having their very high sterns, though the sterns of some of these were considerably elevated, and their bows were not without some little ornament. They were very neatly constructed, though the narrowest canoes I ever saw. . . . The island did not appear to afford any large timber, the broadest planks of which the canoes were made not exceeding 12 inches. . . . Some of the stoutest double canoes accommodated from 25 to 30 men.

An incidental reference (Vancouver, 1798, p. 77) to the fact that the islanders were "nearly destitute of iron and possessed very few implements of that valuable metal" is indirect testimony to canoe intercourse with Tahiti, for Vancouver was the first white man to visit Rapa and any iron possessed by the natives must have been brought from an island of earlier discovery and with intimate relations with Europeans—Tahiti is plainly indicated.

Ellis (1829, vol. 1, p. 54), although he did not describe the Rapa canoes, in making mention of the canoes of Tubuai likened them to those of Rapa.

Apart from this and Vancouver's note, no information about the ancient type of canoe, now entirely displaced and almost forgotten, exists except for some observations made by Mr. J. F. G. Stokes (Bernice P. Bishop Museum MS).

The natives have memory of three types of ancient canoes: the *kamia* (*kami'a*) or *vaka*, a single outrigger canoe; the *taurua*, a double canoe; and the *taurua tamaki*, a special form of double canoe used in warfare. The *kamia* and ordinary *taurua* were used principally for fishing. The *taurua tamaki* are said to have been of large dimensions, some accommodating 40 men. The connecting beams in the double canoes were floored and supported a shelter. All these canoes were constructed of short planks, sewn together with the local *nape*, here braided of hackled *kiekie*. No knowledge survives concerning the sail rig. What knowledge their an-

cestors had of sailing is unknown to the present inhabitants, who do not use sails either in their canoes or in the whale boats that are supplanting them.

From the evidence afforded by old canoe planks found buried and in caves (Stokes, Bernice P. Bishop Museum MS), it is proved that the old canoes were largely if not entirely plank-built, being constructed of short boards 3 to 6 feet long by about 1 foot wide and having a thickness of about 2 inches. From one set of planks found in a taro patch at Akanauue, a local canoe-builder estimated that the hull length when put together must have been 40 feet. The width could not be ascertained. It appears probable that when these planks were assembled originally, the resulting canoe consisted of a round-bottomed base or keel region with low sides made up of two lengths butted end to end and of side planks or washstrakes sewn thereto to give the necessary freeboard. The upper edge of the washstrakes was finished off with a moulding comparable with the flat gunwale covering strip in use in canoes of the present time.

Four pieces belonging to an outrigger boom were found in a grave at Naokiri. They were all curved longitudinally, and from this form it would appear that this boom was intended to be lashed directly to the float, as is customary in the old type of outriggers still existing in the outlying islands of the Tuamotus. One old man had heard of this rigid type of outrigger attachment, but none of the other natives recognized the nature of the remains. Mr. Stokes states that the Raivavae natives, who adopted their present type of canoe from Tahiti, assert that originally their outrigger booms were both of the rigid type with direct attachment to the float.

Modern Canoes

Fifteen small outrigger canoes seen and examined in Ahurei Bay, Rapa, in 1925 had dugout underbodies heightened irregularly by a washstrake on either side and were of a type closely approximating to that of Tahiti and Raiatea, with slight local deviations.

The old and now extinct types were all plank-built. Today, thanks to the introduction of trees that grow to a good height and girth, notably the *tira* (*Melia azadirachia*), the small canoes in use are all dugouts.

The shape of the hull is similar to that of the modern Tahitian dugouts, but rather flatter on the bottom. The fore part and the waist are horizontal, the stern with a slight sheer; the head is flat and covered in by a short horizontal board extending aft as far as the fore boom, a relic of the projecting head board of the old Society Islands canoe.

The dugout body is made in one piece whenever possible, but most of the canoes more than 12 feet long have the dugout formed of two lengths butted end to end and secured together by U-shaped iron "dogs". The larger size of the tree trunks now available has enabled the natives to increase the depth of the dugout base so that the sides of the present hull require little heightening. The washstrakes used for this purpose vary much from canoe to canoe in their depth and longitudinal extent. As the upper edges of many dugout bases are irregular, the lower edge of the washstrakes is shaped to fit these curves upon a rabbeted groove cut therein on the outer side, the seam being secured by nailing through the joint (fig. 94, *a*), after the modern Hawaiian fashion.

Upon the upper edge of the washstrake a strip of wood is nailed horizontally to form a narrow covering board or gunwale moulding. This extends the whole length of the hull, curving in at each end to meet its counterpart from the opposite side.

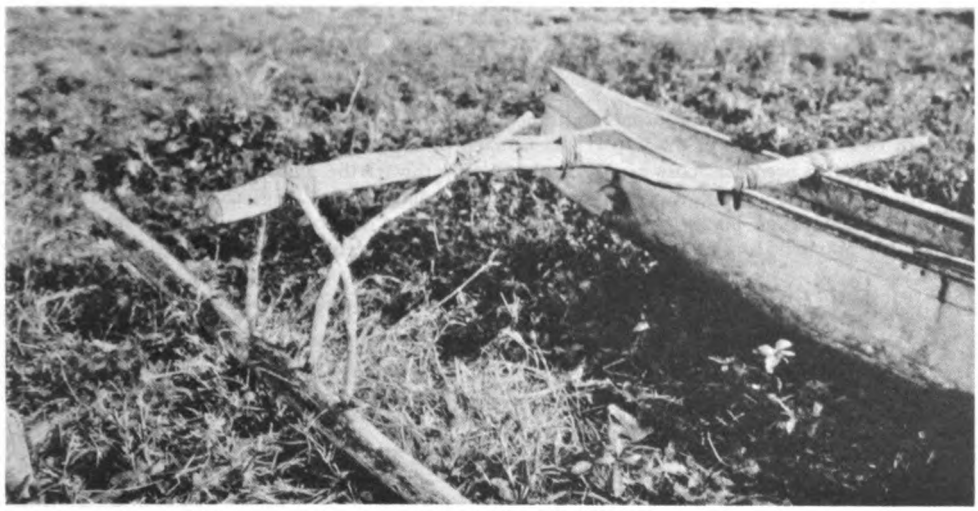
The head and stern of the canoe are normally shaped out of the same log that forms the underbody. Both these extremities are shaped exactly as in the dugouts of Tahiti. The wedge-shaped head ends in a sharp vertical cutwater, which meets the keel line at a right angle; the slightly sheered stern is sharp and pointed, the under side curving up quickly from the straight line of the transversely rounded bottom.

The head board which in some canoes covers the hull forward of the fore boom projects slightly beyond the bow on either side and generally a few inches beyond the cutwater.

The outrigger, always placed on the port side, is similar in essentials to that of Tahiti (fig. 95). The fore boom is stout and distinctly curved and recurved in the peculiar undulatory

fashion characteristic of that of Society Islands canoes, with which it agrees also in the projection of the proximal end to a distance of 18 to 24 inches outboard on the starboard side. Attachment to the float, which is boomed outboard at a distance of 4 or 5 feet from the hull, is by means of four curved stanchions of tough wood such as are frequently seen in Tahiti, but here they are inserted into the float (*ama*) in a serial row fore and aft instead of in two pairs, each of two stanchions, placed abreast. (See fig. 94, *b*). The upper end of the stanchion at each end of the row is bent sharply toward the boom and the pointed extremity inserted into a hole bored in its side close to the distal extremity, where it and its fellow on the opposite side are lashed in position by sennit disposed in the diamond form of lashing so characteristic

a



b

FIGURE 94.—Modern canoes, Rapa: *a*, group of canoes, flexible after boom with direct attachment, irregularity in run of under side of washstrake; *b*, fore end of canoe, outrigger attachment and curve of fore boom are typical as is projection outboard on starboard side of butt end of that boom, but a covering board at head is absent (photographs in Bernice P. Bishop Museum).

of the Society Islands technique. The two inner or median stanchions, which are considerably longer, are inclined inward toward the hull and converge toward one another, to be lashed to opposite sides of the boom about 15 or 18 inches from its end (fig. 95, *a*, *b*).

The after boom is a slight, flexible branch of *purau* (*Hibiscus tiliaceus*), bow-shaped, its distal end inserted into the float (fig. 94); it is further secured in many canoes by an inverted V stay of cord or sennit which is made fast to the boom a few inches above its insertion; from this point the two cords diverge, the lower end of each passed through a hole bored transversely through the float 3 or 4 inches distant from the insertion of the boom (fig. 95, *c*). In some canoes an alternative method is employed whereby the lashing after being secured around the boom is carried straight down and given one or two turns around the float before being made fast. (See fig. 94.)

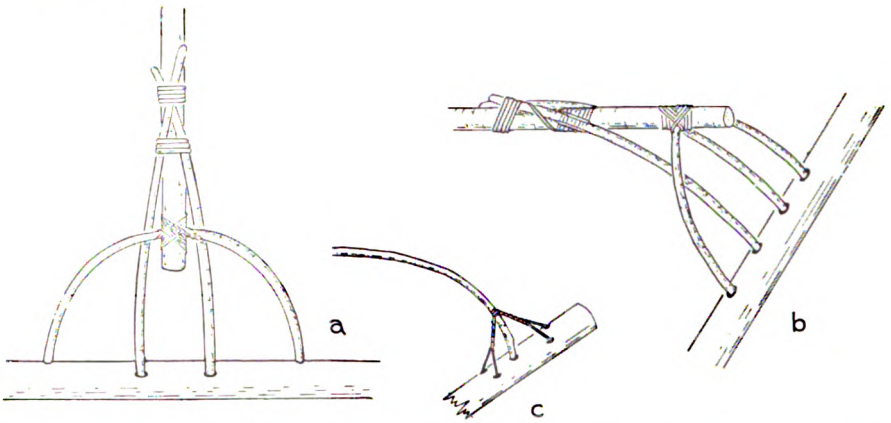


FIGURE 95.—Modern outrigger attachments, Rapa: *a*, fore boom end on, seen obliquely from above; b, fore boom attachment, oblique view; *c*, after boom attachment, side braces seized together in upper region as in Cook Islands canoes.

The cylindrical float (*ama*) is typically Tahitian in shape, the after end truncated a little way behind the attachment of the after boom; the pointed fore end, usually cut to a sharp edge from under to prevent diving, often extends a little beyond the head of the canoe.

The booms (*kiato*) are spaced widely apart, each near its respective canoe end; each is lashed to the gunwales in the usual Tahitian fashion by several turns of sennit or cord passed through two holes bored in the upper part of each of the washstrakes.

The thwarts used are loose pieces of plank laid athwart the gunwales.

The paddles have long shafts and broadly lanceolate blades (fig. 96), a local difference from the short, broad blades of the Society Islands and Cook Islands paddles. Probably this variation from the Tahitian pattern is a survival of the ancient Rapan type.

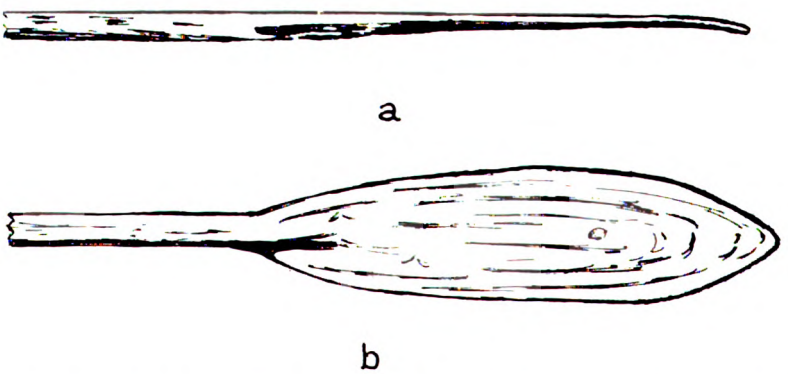


FIGURE 96.—Modern paddle, Rapa, face and side views (Bernice P. Bishop Museum).

It is noteworthy that the term *vaka*, commonly used throughout Polynesia for a small canoe, and formerly in use in Rapa, is replaced today in this island by *kami'a*. According to Stokes (Bernice P. Bishop Museum MS), the term *kami'a* occurs elsewhere only in Mangareva. In Tregear's Mangarevan Dictionary (1899), the term is given as *kamiha* and defined as "the trunk of a tree hollowed out as the outrigger of a canoe". As outriggers (? floats) are not hollowed out, presumably a "dugout canoe" is what the term implies. The common use of this unusual term indicates contact between the two islands—probably fairly recent, as we are told that *vaka* was formerly the Rapa term.

TUBUAI

The ancient canoe types of Tubuai had an equally strong resemblance, together with those of Rapa, to their equivalents in the Society Islands, for Cook (1784, vol. 2, p. 7), who discovered Tubuai in 1777, describes the canoes thus:

> [They were] about 30 feet long and 2 feet above the surface of the water, as they floated. The fore part projected a little and had a notch cut across, as if intended to represent the mouth of some animal. The after part rose, with a gentle curve, to a height of 2 or 3 feet, turning gradually smaller, and, as well as the upper part of the sides, was carved all over. The rest of the sides, which were perpendicular, were curiously incrusted with flat white shells, disposed neatly in concentric semicircles, with the curve upward. One of the canoes carried seven and the other eight men; and they were managed with small paddles, whose blades were nearly round. Each of them had a pretty long outrigger; and they sometimes paddled with the two opposite sides so close together that they seemed to be one boat with two outriggers, the rowers turning their faces occasionally to the stern and pulling that way, without paddling the canoes round.

The projecting head, the perpendicular sides, and the curved-up stern thus described are primary characteristics which associate this type with the ancient one peculiar to the Society Islands, the Marquesas, and some of the Cook Islands.

The same characteristics persisted in Ellis' time (about 1820), for he says (1829, vol. 1, p. 54):

> The stem projected nearly horizontally, but the stern, being considerably elevated, extended obliquely from the seat occupied by the steersman. The sterns were ornamented with rude carving, and, together with the sides, painted with a kind of red ochre, while the seams were covered with the feathers of aquatic birds.

Ellis likened the Tubuai canoes to those of Rapa and from his description of those of Tubuai it is clear that Vancouver was correct in identifying the Rapa type with that of Tahiti. Ellis gives the length of the Tubuai hulls as "generally 16 or 20 feet; the lower part being hollowed out of the trunk of a tree, and the sides, stem, and stern, formed by pieces of thin plank sewed together with cinet, and adorned with shells". The last four words occur in the second edition but not in the first.

The outrigger canoes used in Tubuai at the present day are figured and described by Aitken (1930, pp. 68-71). They are indistinguishable from typical Society Islands canoes. The hull may be a dugout with the edges covered with a gunwale beading, but if the dugout part be low-sided, more freeboard is given by the intercalation of a washstrake (fig. 97).

> The details of the attachment of the fore boom follow very closely those of the Raiatean arrangement. Two pairs of obliquely disposed sticks have their heads butted and lashed to the sides of the boom, and two suspensory sennit braces diverge upward from their lashing to a peg in the float immediately under the boom to the places where the two pairs of stick connectives are lashed (fig. 97), a different arrangement from that followed in Rapa. The after boom is pliant, strongly bowed, its outer end lashed to a short peg inserted into the float.

The booms are spaced widely apart and placed close to the ends of the canoe. The float extends the full length of the hull, its fore end projecting well beyond the head and dressed on the under side to give the effect of a slight upward curve.

As in the Rapa type the space, forward and abaft respectively, of the forward and after booms, is decked over with planking. All other details agree with the modern Tahitian design.

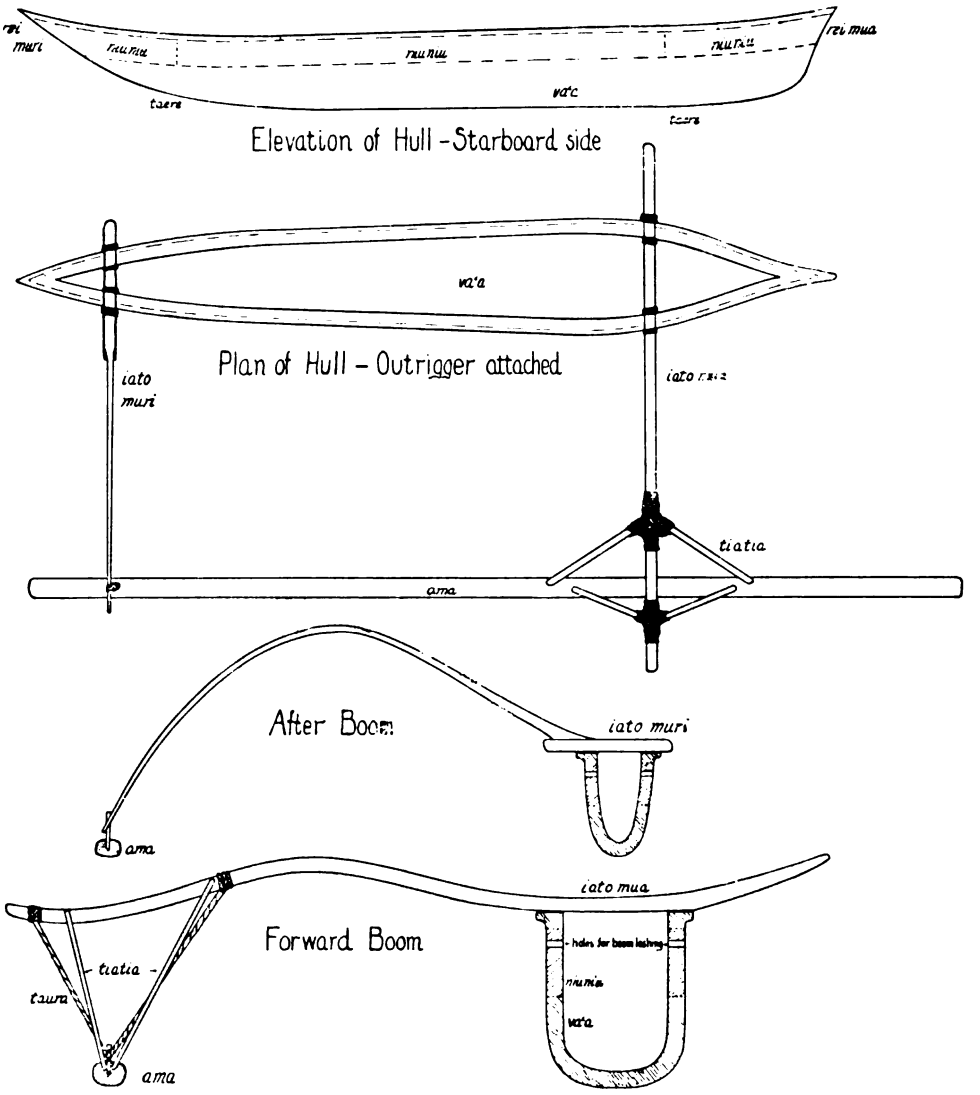


FIGURE 97.—Outrigger and attachments now in use in Tubuai, scale of boom plans one third greater than that of hull and outrigger plans (from Aitken, 1930).

Aitken examined the hull of what was pointed out as being of the old and now obsolete type. He states that it was the same as that commonly used at Raivavae. Apart from the outrigger, which was missing, the description is that of one of the older Tahitian canoes. The basal part of the hull was made of two lengths of hollowed tree trunks butted together. Each end piece, "shaped like a wishbone", was integral with the deck, which at the forward end of the canoe projected as a plat-

form for 3 feet beyond the cutwater. The thwarts were supported on bosses or projections on the strakes forming the sides; in modern canoes they are laid loose on the gunwales as in Rapa.

RURUTU

When the missionaries Tyerman and Bennet (1831, p. 403) arrived off Rurutu in 1822, the first-comer from the shore arrived alongside in an exceedingly small vessel which proved to be nothing more than a poi dish about 7 feet long and 30 inches wide. He told the missionaries that the islanders had been so busy building a chapel and dwelling houses that "they had neglected to repair or replace their canoes as they fell to decay".

Later two larger craft came off; one was a canoe "built after the fashion of the country" with high head and stern, both pointed, and the sides ingeniously carved; the other was the mere trunk of a tree hollowed out and very clumsy.

It was a canoe of the larger type which Ellis (1829, vol. 1, p. 182) saw at Tahiti about the same time. He describes it as a very large canoe somewhat in the shape of a crescent, both head and stern high and pointed and with deep sides. It had brought over a chief from Rurutu. This description tallies so closely with the hull form of the large crescent-shaped canoe in the untitled drawing by Webber of a Tahitian coast scene (fig. 82), that, when taken in conjunction with the assertions, elsewhere quoted, of natives of Rapa and Raivavae that their ancient outrigger canoes were characterized by direct attachment of the float, it seems exceedingly probable that Webber's sketch actually represents a visiting outrigger from either Raivavae or Rurutu. Unfortunately Ellis does not mention whether the vessel which he saw was a double canoe or was furnished with an outrigger. Probability favors the inference that it was an outrigger, as Ellis had just stated that single canoes (outriggers) were considered safer than double ones for long voyages (the opposite opinion prevailed in the Marquesas, Hawaii, and the Tuamotus); also, his reference to the hull is in the singular.

At the present time the islanders of Rurutu are discarding their outrigger canoes for the more roomy whaleboat of the white man; not a single outrigger was seen when the *St. George* visited the island in 1925, though a few certainly persist as mentioned by Aitken (1930).

RAIVAVAE

Raivavae had canoes of the same type as those of Rurutu, according to the description given by Andia y Varela (Corney, 1913, vol. 2, p. 313), who, with Gayangos, discovered the island in 1772. The description is contained in a report by Don Raimundo Bonacorsi, an officer of the *Aguila*, who penetrated into the lagoon. "The canoes", he said, "have twin hulls: the bows and sterns sheer up very high. The timber of which they are built is the *toa*, which has somewhat the look of mahogany; and they are painted along the gunwales".

Gayangos' account of his visit (Corney, 1913, vol. 2, p. 179), which was independent of that of Varela, is to the same effect. The canoes seen were "twin-hulled and better constructed than those of Amat's Island [Tahiti] and were ornamented with particolored fringes depending from the gunwales. There was nothing to indicate that they make use of sails".

In a footnote Corney (1913, vol. 2, p. 178) considers that Bonacorsi was mistaken in saying that the canoes were made of *toa* wood (ironwood, *Casuarina*) and suggests that it was probably *tamanu*.

RIMATARA

The outrigger canoes of Rimatara, which lies between Mangaia of the Cook Archipelago and the main body of the Austral Islands, exhibit characteristics which point to particularly intimate intercourse of the inhabitants with Mangaia. As described and figured by Friederici (1912, fig. 130), the booms, two in number, are straight poles which give off immediately short of the distal extremity a downturned branch, almost at right angles, whereof the end is inserted into the upper surface of the float (fig. 106, *c*), a method of attachment closely related to that of Mangaia and entirely different from the Tahitian type seen in Tubuai and elsewhere in the Austral Islands at the present day. No braces are shown in Friederici's figure; he omits them also in his figures of the outrigger attachment of the canoes of Atiu and Mitiaro (1912, figs. 127 and 128) where they are always present.

ORNAMENTATION

The canoes of the Austral Islands were usually most handsomely decorated. The washstrake was concealed in large part by feathers of sea birds tied beneath the sennit binding, and both the head and the stern were decorated with tufts and streamers arranged probably in like fashion to that which prevailed in New Zealand (Best, 1925, pp. 94, 101). Shells were also sometimes employed for the same purpose, for Ellis saw canoes thus bedecked at Tubuai, where carved ornament was an additional method of beautifying the hull. At Rurutu, Cook (Hawkesworth, 1773, vol. 2, p. 278) was impressed by the richness of ornament displayed by a small canoe, "the carving executed in a better manner . . . than any we had seen before", that is, in the Society Islands; the same canoe had "a line of white feathers hung from [? between] the head and stern".

Banks (1896, p. 124) is probably referring to the same mode of decoration when he mentions "two lines of small feathers placed on the outside of the canoe". Alexander (1895, p. 110), who describes the visit paid to Rurutu in 1832 by a party of missionaries, says that they found the canoes still ornamented in the old way. The whole exterior of a double canoe which met the ship six miles out "exhibited very neat carved work. The sides and stern were tastefully ornamented with feathers". The carving seen was presumably of the same elaborate description which covers every inch of the ceremonial paddles peculiar to Raivavae (fig. 98), but probably common to Rurutu as well.

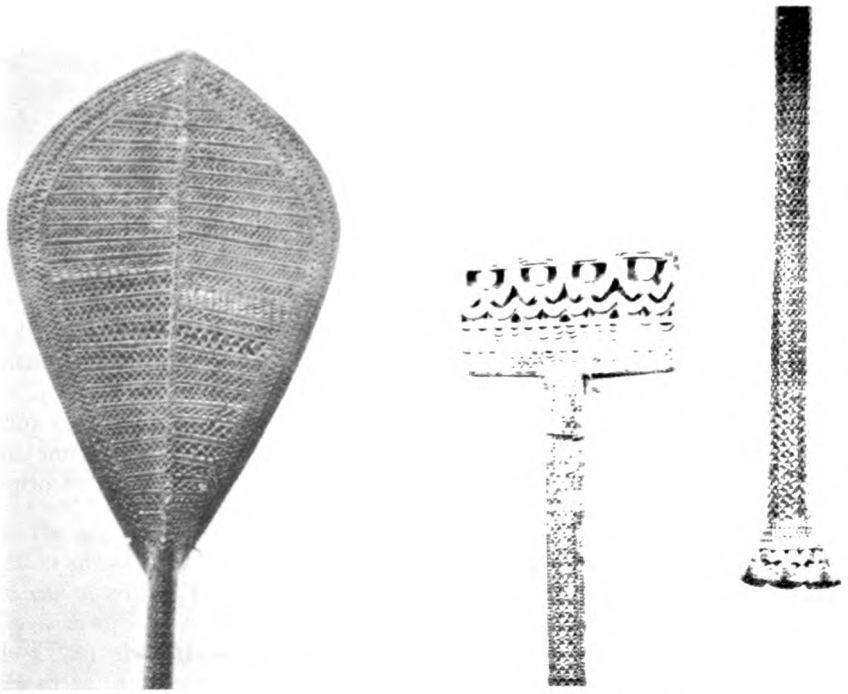
At the present day the canoes of the Austral Islands are wholly without ornamentation; indeed, all woodwork in the islands is quite plain.

PADDLES

Judging from the examples of so-called "ceremonial paddles" to be found in many museums labeled as from "High Island, Austral Group" (Raivavae), the blade is short, broad, and obovate in shape, the broad obtuse end being distal (fig. 108, *b, c*). The front side, that facing the paddler, is convexly curved and is faintly ridged axially, the hinder side being concave in cross section. The whole blade is also lightly curved forward toward the tip. The loom is long and usually cylindrical. Its distal end flows into the rounded axial ridge on the forward side of the blade, and the proximal end is capped by a knobbed handgrip in the form of an inverted cone. In some paddles, which possibly come from a different tribal locality, the loom is four-sided, the width greater than the thickness; in these the handgrip is large and rectangular when viewed from the front, but in thickness is the same as the loom; as in many New Zealand paddles, the loom curves backward slightly so that its junction with the blade is about an inch from the vertical behind the handgrip.

As at Easter Island there are examples of a double-ended form; the British Museum has one, 54.5 inches long, and the Pitt-Rivers collection, Oxford, contains another. Both are labeled "High Island".

Every part of these paddles is covered with carving in minute geometrical patterns which on rectangular handgrips are combined into conventionalized anthropomorphic figures. (See fig. 98.)



a *b*

FIGURE 98.—Ceremonial paddles, Raivavae: *a*, finely carved blade; *b*, looms with differing form of hand grip (Bernice P. Bishop Museum).

Owing to the resemblance of the motive employed in the carved ornamentation of the supports of the ceremonial adzes characteristic of Mangaia with that seen on Raivavean ceremonial paddles, many of these beautifully carved paddles have been wrongly attributed to Mangaia in many museums. The Mangaian type of paddle is entirely different in shape and in the art motives employed; the blade is longer and narrower in its proportions, and is strongly shouldered instead of having the loom flowing gracefully into a blade, which broadens gradually for more than two thirds of its length before beginning to narrow in to form an obtuse-angled tip. Neither has the Raivavaean blade the apical reinforcing rib characteristic of well-made Mangaian paddles. Instead of having the entire surface of the paddle covered with minute carving, as in Raivavae, the Mangaian paddle when ornamented with carving has it restricted to the apical rib, the shoulder region, and the handgrip.

The single-ended Austral Islands paddles may not be purely ceremonial. The handgrip suggests use as steering paddles, for such addition to this class of paddle is not uncommon in Polynesia, in contrast with ordinary ones which are characteristically without handgrip. The steersman's post was a position of honor in islands

where navigation was actively pursued and highly developed. For this reason it is probable that these so-called "ceremonial paddles" were actually used as steering paddles on important occasions when the chief steered his own canoe.

The double-ended paddles may have been either dancing paddles or batons of office.

In the form of the blade the ancient Austral Islands paddle conforms closely to the Tahitian type.

AFFINITIES

Present-day intercourse with the outside world is mainly with Tahiti; because of this and the fact that the Bible in use is in the Tahitian tongue, the current language is that of Tahiti. The terms used throughout the Australs to designate the various parts of a canoe are therefore in general the same as those employed in Tahiti. The influence of that island has submerged whatever differences there may have been formerly.

The available evidence of cultural contact between these islands and the outside world in olden times suggests that the western islands had closer intercourse with the Cook Islands than with Tahiti, whereas the converse is true of those in the eastern section. A remote connection with the Tuamotus is also probable. Stokes, quoted by Aitken (1930, p. 166), from a study of the adze forms of Tubuai, considers that "there may have been early relations with the Tuamotu group". The direct outrigger attachment persisting in Rimatara and traditional in Rapa and Raivavae, which has its counterpart in Reao and Napuka, points to the same conclusion, or possibly to the Tuamotus and Australs as having been settled originally and at the same period by the same branch of the Polynesian race.

COOK ISLANDS

PRE-DISCOVERY TYPES

During the period of European discovery in the Cook Islands (1773-1823), both double canoes and outriggers were in use. The double canoes, as in Hawaii and the Society Islands, were the war canoes of the chiefs and the vessels generally employed in deep-sea voyages—for inter-island communication, for voyages of discovery, and as transports used by defeated tribes or septs when forced to flee in search of new homes across the sea. The outrigger canoes were then and are still the craft proper for fishing and coastal traffic; most are one- and two-man dugouts.

Distinct relationship in the fashion of these canoes is shown on the one hand with the Marquesas Islands, and on the other with New Zealand far to the southwest. From structural peculiarities it is found that the most powerful influence has been exerted from the Marquesas, modified in some islands probably by Tongan or Samoan immigration.

NAVIGATION

The extensive knowledge of navigation and acquaintance with other islands that were possessed by the inhabitants are well illustrated by the discovery of Rarotonga by Williams in 1823, due directly to the accuracy of the sailing directions given to him by the Atiu Islanders, who told him of this island, 120 sea miles distant as we now know. On his asking for directions, Williams was taken to a particular spot from which the voyage to Rarotonga was invariably begun. Williams (1837, pp. 96-98) remarks:

> The natives, in making their voyages, do not leave from any part of the island, as we do, but, invariably, have what may be called starting points. At these places they have certain

landmarks, by which they steer, until the stars become visible; and they generally contrive to set sail so as to get sight of their heavenly guides by the time their landmarks disappear. . . . We steered our vessel round to the "starting point". Having arrived there, the chief was desired to look to the landmarks while the vessel was turned gradually round; and when the marks on the shore ranged with each other he cried out, "That's it! That is it!" I looked immediately at the compass, and found the course to be southwest by west and it proved to be as correct as if he had been an accomplished navigator.

OUTRIGGER CANOES

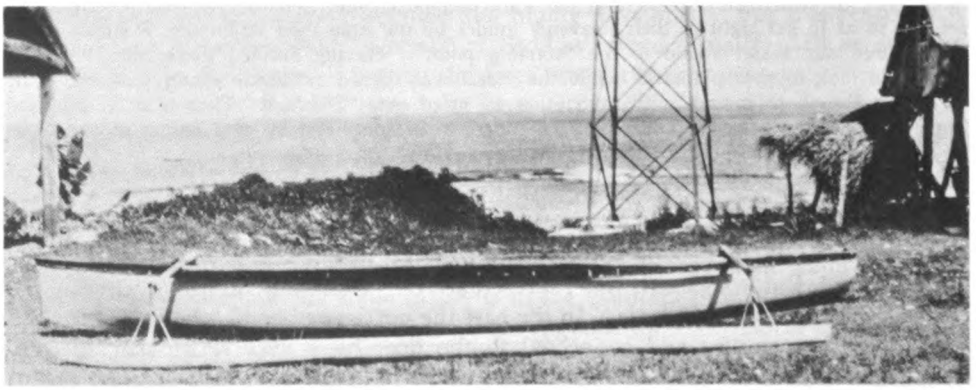
The outrigger canoes of the Cook Islands fall into two well-marked categories: 1, an eastern, which includes Atiu, Mitiaro, and Mauke; 2, a western, of which Aitutaki and Rarotonga are the representatives. Standing midway between the two are the canoes of Mangaia. In the east the outrigger booms are curved toward their distal extremities and connected to the float by a very short arm, directly inserted, with the connection reinforced by two or more obliquely running sennit braces. In the west each of the two booms is straight, and either connected directly by means of an arm forked off on the under side, strengthened by sennit braces (Rarotonga and Mangaia), or else attached indirectly to the float by a Y connective (Aitutaki), without bracing.

Friederici (1912, p. 314) has further differentiated these two sections according to the form of the stern; he states that the canoes of the east have high curved-up sterns, whereas those of the west have low sterns scarcely if at all raised above the level of the gunwale. This may be correct with regard to the degenerate canoes of the present day, which are all small dugouts used for inshore fishing, a type nearly everywhere in Polynesia characterized by extreme simplicity and the elimination of everything superfluous to the limited requirements of the owner. Reference to the accounts left by the early voyagers shows that in former times no such distinction prevailed. Belcher (1843, vol. 2, p. 19), for example, depicts a Rarotongan canoe with a beautifully carved, tall, upstanding stern suggestive of close kinship with the New Zealand type of war canoe, and Portlock, of Bligh's second voyage (Lee, 1920, p. 288), describes some of the Aitutaki canoes as also having high sterns. Such evidence proves that an elevated stern was common formerly to all the islands of the archipelago without exception and not restricted as now to the eastern islands (Atiu, Mauke, and Mitiaro). In spite of considerable local variation, there can be no doubt about the fundamental unity of design throughout the islands in pre-European days, with the partial exception of Aitutaki.

The hull was a dugout, which, when not of the smallest and rudest type, was given additional freeboard by means of a washstrake (*oa*) sewn with sennit upon the edges of the dugout. Cook (1784, vol. 1, pl. 173) noticed that the Mangaian dugout underbody was of white wood whereas the washstrake was of black, the converse of the Hawaiian custom.

When long canoes were required and no single tree of sufficient length was available, two or even three of the largest *tamanu* (*Callophyllum inophyllum*) trees procurable were joined together by their ends after being hollowed out and shaped to size (Best, 1925, p. 205). In the joining of the sections little ingenuity was displayed, as transverse butted joints were employed. The open ends of two lengths were simply brought into contact, and, after being carefully adjusted, were laced together with sennit through holes bored in the opposing edges, each turn being hove tight with a forked lever (*keke*) (Buck, 1927, p. 261). Bligh in his usual blunt way characterizes this system as "injudicious", and certainly it is to be so regarded when compared with the strong and substantial mortise-and-tenon jointing employed by the Marquesans and the Maoris when they were faced with the same necessity of using two lengths of timber to form one hull. As bearing on the origin of the inhabitants, it may be noted that this plain butted joint also characterized the building method of the Society Islanders.

Bligh and Portlock (Lee, 1920, pp. 133, 228) both suggest that a stout length of wood, 1.5 inch thick, which was found in the Aitutakai canoes, lashed securely within and just below the gunwale, was placed there for the purpose of compensating for the weakness inherent in the butted joint. This strengthening device is still remembered in the island by the name of *tango* (Buck, 1927, p. 262), but according to local belief it was lashed upon the outer side of



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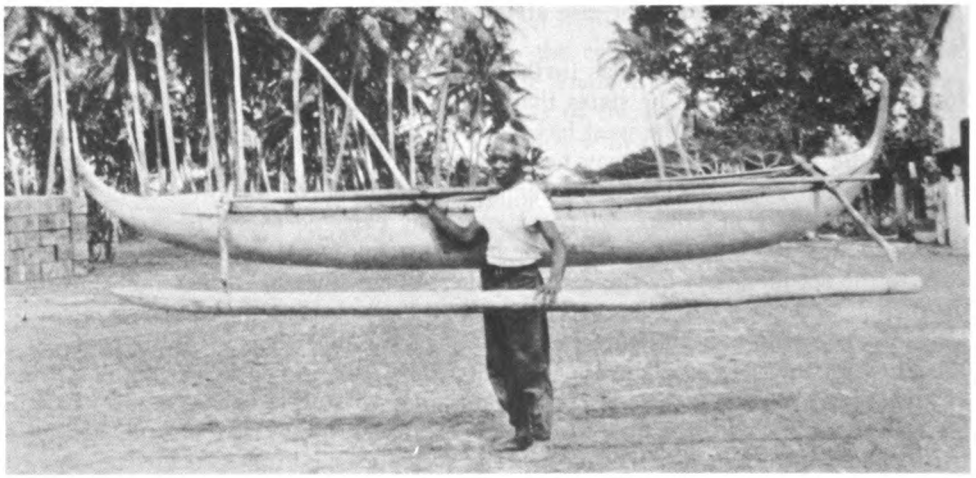

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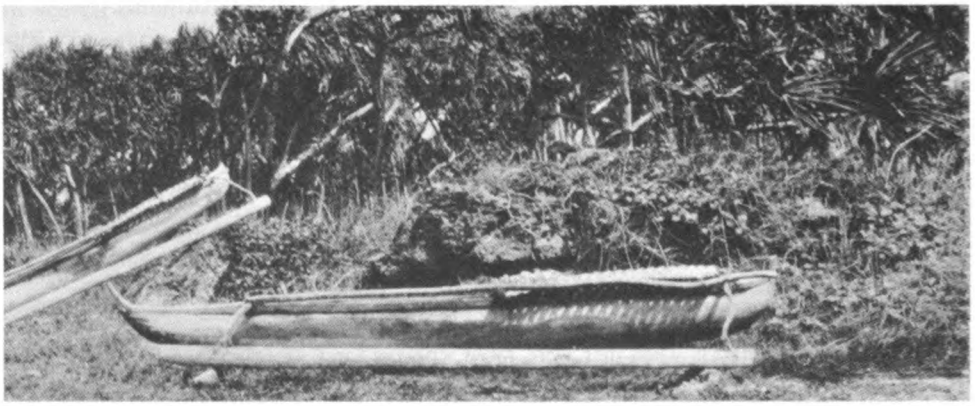


c

FIGURE 99.—Modern outrigger canoes, Cook Islands: *a*, side view of canoe of Mangaia; *b*, side view of canoe of Mitiaro illustrating method of carrying with *tangō* resting on shoulder; *c*, views of Atiu canoe (photographs by P. H. Buck).

the dugout gunwale, and not on the inner aspect; the *tango* of the present day is a stout stringer lashed upon the booms outside the weather gunwale, used when carrying the canoe to or from the sea. (See fig. 99.) No frames are seen in present-day canoes, but according to Major Large (Best, 1925, p. 205), it was the custom when hewing out large hulls, to leave strengthening, riblike projections at intervals on the inside.

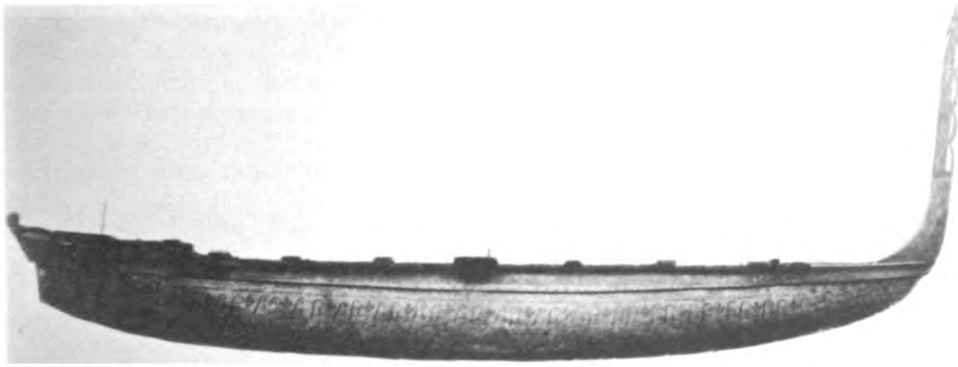


FIGURE 100.—Hull of small outrigger canoe of Mangaia (Dominion Museum, New Zealand).

The form of the dugout underbody of the canoes in Mangaia and Rarotonga was formerly, and remains today, practically identical with the shape of hull seen in Tahitian dugout canoes now existing, the cutwater sharp and nearly vertical, rounding at the lower angle into the keel line with the lower side of the after end curving fairly quickly from the horizontal bottom to terminate in a bluntly pointed stern. In the northern islands the two ends were well curved below, a characteristic still retained. The fore end in the old-time Mangaian canoes was always low, with little or no sheer; to compensate for this, the islanders fitted a stout board or slab (*papahua*) over it, "projecting out, to prevent the sea from getting in on plunging, like the small Evaas [*va'a*] of Otaheite", as Cook (1784, vol. 1, p. 173) remarked when he saw this feature in a small canoe that visited his ship at Mangaia. At Atiu, however, the flat head "turned down at the extremity, like the end of a violin" (Cook, 1784, vol. 1, p. 181), whereas at Manuae and Auotu, Cook (1784, vol. 1, p. 211) describes the head as projecting nearly in the same manner as in the Atiu canoes, but with the extremity turned up instead of down; the stern bore "some resemblance" to that seen at Atiu. In larger canoes this headboard was thickened, shortened, and hewn to a triangular form, with the apex, which projected only a little beyond the cutwater, wrought into a small knobbed figurehead. In the center of the upper surface was a hole to take a wooden stylet, about 15 inches long (fig. 100), used according to Large (Best, 1925, p. 206) in some obscure way, not understood, for shaping a course at sea.

There was also a similar short after-decking. On the after end of this, in canoes of former times, a lofty vertical stern ornament was fitted and carried several feet upward; even in the small Mangaian one noticed by Cook (1784, vol. 1, p. 173), measuring only 10 feet in length, this great stern projection was "about 5 feet high, like some in New Zealand, and the upper end of this stern post was forked" (fig. 101); at Atiu (Cook, 1784, vol. 1, p. 181) it was "elevated about 3 or 4 feet". In others it seems to have ended in a barbed ornament, and the after side was perforated in a vertical series of carved-out loops (figs. 100, 102, *d*). From

these hung short bights of rope, from which, in turn, stout ropes could be carried to the forward outrigger boom on both sides in rough weather, functioning then as life lines; there might be three on each side. A song is current to the effect that a good captain prepares his life lines when he sees bad weather approaching (Best, 1925, p. 206).

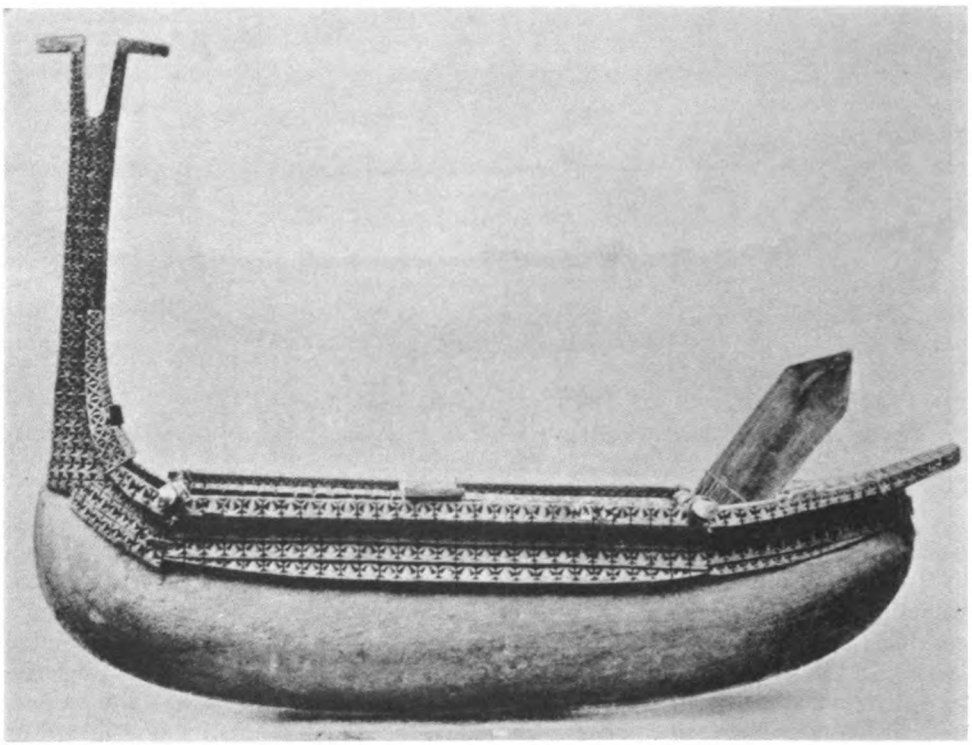


FIGURE 101.—Model of Mangaian outrigger canoe (Australian Museum, Sydney): though badly proportioned, it shows all the characteristic features of the Mangaian canoe—dugout hull, richly carved washstrakes and gunwale rail, projecting headboard, and tall stern piece with bifurcated summit; form of paddle is typical.

Thwarts in the old canoes were always placed across and upon the gunwales, whether the canoe was large or small; as seen in a half-size model of a Mangaian canoe (Dominion Museum, New Zealand), they were elegantly shaped, with the upper surface concave in the median part between the gunwales, to which they were lashed with sennit.

The outrigger, single in all canoes, is always on the port side. In the large canoes formerly in use in Mangaia the booms might project several feet outboard on the starboard side, useful for the attachment of the starboard life lines. They are invariably two in number, connected directly to the float either by a curved elbow or by a forked branch, except in Aitutaki, where the attachment is indirect. Both booms rest on the gunwales, attached by lashings passed through paired holes below.

PRESENT-DAY OUTRIGGER CANOES

In Atiu, Mitiaro, and Mauke the canoes retain a number of their old characteristics. It is only in Mitiaro that a high curved stern persists; in the canoes of Atiu

and Mauke this is so insignificant as to be vestigial, whereas in Rarotonga and Mangaia no trace of it survives.

Hull

ATIU, MITIARO, AND MAUKE

In Atiu, Mitiaro, and Mauke, lying in the northeast sector of the archipelago, the form of the dugout underbody and of the outrigger are of identical type, what differences there are being confined within small limits. The hull is reduced to little more than a dugout; the added fittings consist of a stout gunwale rail (in place of a washstrake), and short end covers and small end pieces which are relatively unimportant (fig. 102).

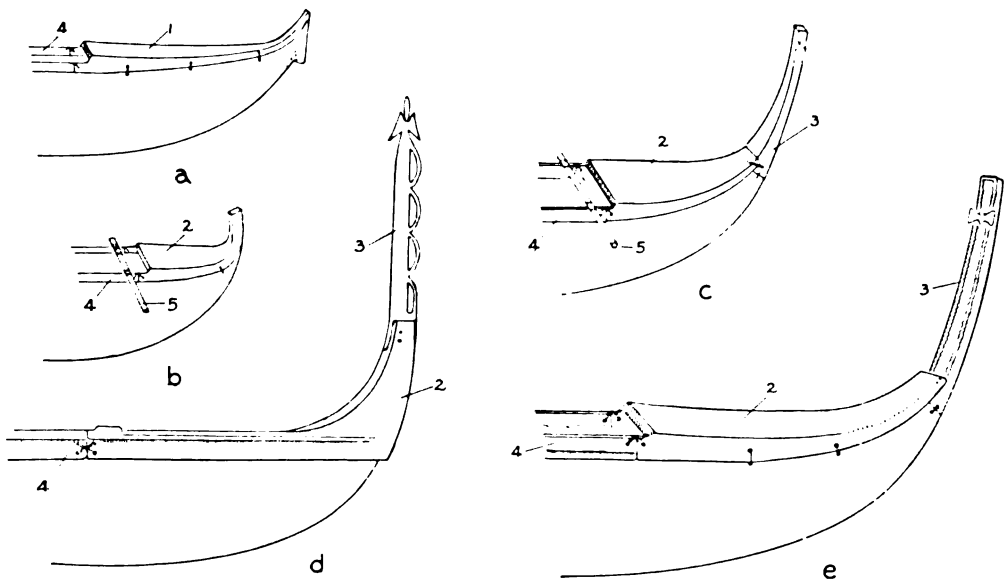


Figure 102.—Canoe structure, Cook Islands: *a*, head, *b*, stern of paddling canoe of Atiu; *c*, stern of paddling canoe of Mitiaro; *d*, stern of sailing canoe of Mangaia (Dominion Museum, New Zealand); *e*, stern of double-canoe hull of Atiu; 1, fore end piece or bow cover; 2, after end piece or stern cover; 3, ornamental stern projection; 4, gunwale rail; 5, outrigger boom (*a*, *b*, *c*, *e*, from photographs by P. H. Buck).

The dugout underbody has no sheer except for a short distance at each end. Along the bottom it is straight for most of its length; transversely it is well-rounded with the sides inclined inward above the well-rounded bilges, so that the gunwale width is less than that at the level of the bilges. The ends are moderately sharp; they round up unequally from the bottom, the fore end being finer and with a longer and more gradual curve than that of the stern, which is short and abrupt, the converse of the custom in other islands (figs. 102, *a-c*). In Atiu the extreme fore end is wrought on the under side into a slight downturned projection analagous to the heel seen at the stern of the Samoan *paopao* (fig. 102, *a*). A trace of the same feature is present in the canoes of Mitiaro but is absent in Mauke.

Upon the edge of the underbody on each side a stout gunwale rail is sewn on, having a depth of about 2 inches and a width rather greater. At each end, beyond the point where the boom crosses the hull, the underbody is covered in by a short triangular decking or end cover cut out of the solid; the fore end cover is the longer, usually twice the length of the after one, owing to the fitting of the after boom nearer the stern than that of the fore boom in relation to the head. The sides of the end covers are sewn to the underbody by a few stitches spaced long intervals apart. To finish off the ends, up-curved end pieces are sewn on, and it is the slight differences in their size which distinguish the canoes of one island from those of another. The fore end piece is usually the shorter, curving up gently for a few inches only, but it is in

Mitiaro alone that the stern end piece is of prominent height (fig. 99, *b*), recalling the great length characterizing this part in canoes of former times. In Atiu and Mauke the stern end piece is short, abruptly turned up, and truncate at the summit. It may even merge into the stern cover and be hewn from the same block.

Of great interest is the ingenious method employed in the sewing on of the gunwale rail, whereby the stitches are partially concealed on the outside:

In order to make a good joint the builder either bevels the edge of the underbody on both sides and cuts a V-shaped longitudinal groove in the under surface of the rail (*oa*) or adopts the alternative plan shown in figure 103. The rail is flanged horizontally on the inner side along the lower edge and as it is considerably thicker than the edge of the underbody the builder is able to bore a hole obliquely upward from its lower outer edge to emerge on the inner side above the marginal flange; through this several turns of sennit lashing are passed after being threaded through a hole bored transversely in the side of the underbody, close to the upper edge.

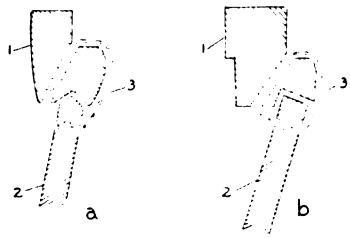


FIGURE 103.—Cook Islands, two methods of joining gunwale rail to underbody so that seam is overlapped on under side, outer side of canoe on left: *a*, Mauke method; *b*, Atiu method; 1, gunwale rail; 2, underbody; 3, sennit lashing passing over inner flange of gunwale rail (from sketches by P. H. Buck).

In Atiu, Mitiaro, and Mauke a stout stringer is lashed athwart the booms a few inches outside the gunwale on the outrigger side. It serves as a carrying bar (fig. 99, *b*). To support it and to keep it rigid while the canoe is being carried, one end of a short crossbar, lashed athwart the hull amidships, projects sufficiently outboard to be lashed to the stringer on the under side. A stout paddling thwart, slightly bowed concavely and recessed or shouldered at each end on the under side, fits over the gunwales and covers, inboard, the midships crossbar.

The forms of outrigger attachment in these three islands are primitive and retain archaic features in common; in the other islands these are either modified or lost.

MANGAIA

Save in the outrigger design the existing canoes of Mangaia have lost all the features distinctive of the older type described by Large (Best, 1925). The hull approximates to the modern Tahitian design. It is formed of a dugout underbody finished off with a strong gunwale rail extending the whole length of the hull to which it is sewn directly edge to edge. The fore end of the underbody is sharp and nearly vertical, the stern truncate in transom fashion, evidently in imitation of a square-ended European boat. The canoe is open except when a flat fore decking board is fitted to cover the space forward of the fore boom. A carrying stringer is present as in the Atiu series, but here it is lashed to the under sides of the booms; no median supporting crossbar is fitted, the stringer being lashed to one end of the midships thwart. (See fig. 99, *a*).

RAROTONGA AND AITUTAKI

The modern Tahitian hull form has been adopted in Rarotonga and Aitutaki and differs little from that of Mangaia save that a true washstrake may replace a

gunwale rail; the stern runs finer and ends less abruptly. Only in the outrigger attachment is there any link with the past.

Outrigger Structure

BOOMS

The booms are invariably two in number, spaced widely apart, the after one very close to the stern, the fore one at a somewhat greater distance from the head. They are cylindrical poles, curved downward in the canoes of Atiu, Mitiaro, and Mauke, straight in those of Mangaia, Rarotonga, and Aitutaki. Except in Aitutaki they are attached directly to the float by a down-turned side branch, long in those that are straight, and short in those that are curved. They are lashed upon and across the gunwale rails or the washstrakes if present; their butt ends project moderately on the off side.

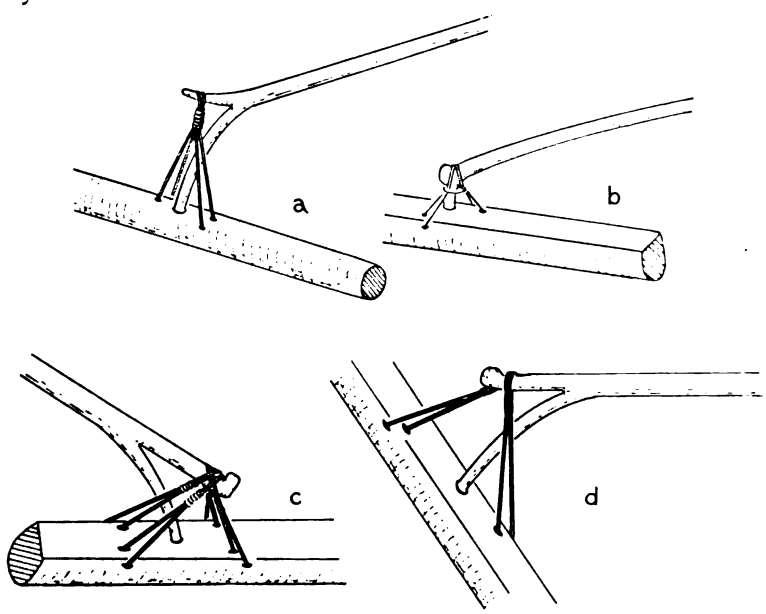


Figure 104.—Outrigger attachments, Cook Islands: *a*, Mangaia; *b*, Atiu; *c*, *d*, Rarotonga; in *d*, attachment reinforced by two unpaired double sennit braces; in *c*, by four pairs of braces (after photographs and published sketches by P. H. Buck).

FLOAT

The float is straight; usually it is rounded below, flattened above and so plano-convex in cross section; in Mitiaro it is usually cylindrical, in Mangaia subangular, midway between the two forms. The fore end is pointed and curved up from below; it extends to within a short distance of a point opposite the head of the hull. The after end is usually truncate, ending a few inches abaft the attachment of the after boom; in the sailing canoes of Aitutaki it may be pointed and turned up at each end (Alexander, 1902, p. 780).

OUTRIGGER ATTACHMENT

The forms of attachment found in the Cook Islands, Aitutaki excepted, fall into a well-marked series showing progressive development from a very simple type to one of considerable complexity, with Atiu at one end and Rarotonga at the other (fig. 104).

1. In the outriggers of Atiu, Mitiaro, and Mauke, the booms are cut from curved branches of ironwood which give off a branch nearly at right angles on one side (fig. 104, *b*). The main branch beyond the fork is trimmed down till it becomes a mere knob or heel projecting outward. The side branch, after being cut to the requisite length, is pointed and the end driven into a hole in the upper surface of the float. To prevent it from drawing out, doubled sennit braces link the end of the main branch and its projecting heel to the float. Usually one brace passes to the outer edge of the float and another passes to the inner edge, one being fitted forward of the boom and its companion at an equal distance abaft. The doubled braces employed, which may number either 2, 3, or 4 in all the islands, are formed as follows:

One end of a length of sennit braid is made fast around the main limb of the boom at the point where it gives off the side branch; the other end is then threaded through a V-shaped hole in one edge of the float some inches on the fore side of the axis of the boom; thence it is carried upward and passed over the boom, afterwards passing downward again to the float to be threaded through a second hole as much to the after side of the boom as the first was to the front of it but on the opposite side of the float; the sennit end after several turns made similarly seizes together all the units of the two braces by a number of circumferential turns in order to tighten the lashings. In the canoes of Atiu the inserted branch of the boom is so extremely short that little seizing is possible. In Mitiaro and Mauke it is a little longer and more seizing is employed. In some canoes the number of braces is doubled, two on the outer and two on the inner side of the float (fig. 104, *b*).

2. In Mangaian and Rarotongan canoes each boom, instead of being curved, is straight. As a consequence the length of the side branch has been increased and more gently curved; it leaves the main axis at about 80 degrees from the horizontal. Concurrently with this the main or straight part of the boom is prolonged beyond the point where it forks, as a free spike or arm 5 to 10 inches in length; in some canoes it is slightly curved upward, in some straight and knobbed at the end (fig. 104).

As in the more northerly islands the end of the downturned arm is inserted into the float and further secured in the manner described either by two or by four paired and doubled sennit braces which here connect with the free horizontal arm of the boom instead of with the boom itself at the point of branching (figs. 99, *a*, 104). In Rarotonga two pairs of braces are usual, symmetrically disposed, one pair forward of the boom axis, one on each side of the float, a corresponding pair being fitted abaft the boom. A reduction to two and even to three braces may occur; there is considerable irregularity in custom. In Mangaia the number may also be reduced to two, when the braces are placed asymmetrically, one on the outer side of the float and the other on the inner side but on opposite sides of the boom axis. In all, the downwardly diverging sets of sennit turns in each brace are tightened by seizing around the upper ends immediately below the booms (fig. 104).

Friederici (1912, figs. 127-130) shows that the canoes of Rimatara, the island in the Australs nearest to Mangaia, have a form of boom intermediate between classes 1 and 2; instead of choosing a pole with a curved side branch, a pole is selected with a side branch as nearly straight as possible at right angles to the main stem; the free projection of the boom beyond the point of branching is shorter than in Class 2 but more pronounced than in 1 (fig. 106, *c*). Although no braces are shown in Friederici's diagram, it is more than likely that they are employed to supplement the direct insertion of the boom arm, and that Friederici has omitted them as not necessary to his argument; this is rendered more probable by his omission of braces in the figures he gives of Atiu and Mitiaro attachments (1912,

figs. 127-128). There is no question of their presence in the canoe attachments of these islands.

3. In the Aitutaki outrigger attachment described and figured by Buck (1927, p. 266), the sole connective is a Y-shaped stanchion; the base of the stem is driven deeply into a vertical hole in the float, and the two ends of its divergent limbs, set obliquely to the longitudinal axis of the boom, are lashed to its sides by oblique lashings, one limb on the fore side of the boom, the other on the after one (fig. 105, *a*). In many canoes Buck noticed that the butt was driven right through the float and cut off flush below.

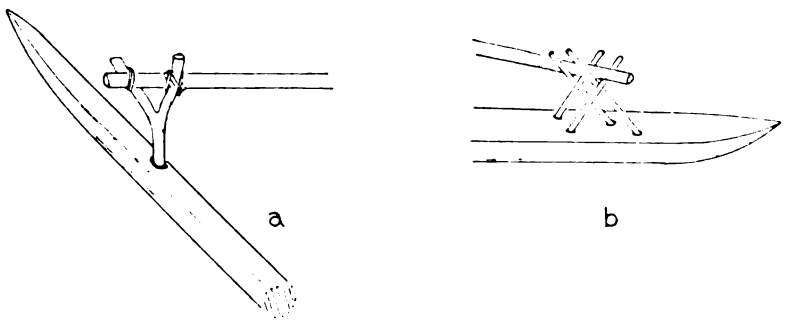


FIGURE 105.—Outrigger attachments, Aitutaki: *a*, modern form; *b*, traditional ancient type (after Buck, 1927, 1929).

According to Buck (1929, p. 214) this connective, which is different from any other Cook or Austral Islands type, is identical with that characteristic of the outriggers of Manihiki, more than 540 sea miles distant to the north. This, however, is not referred to in his subsequent monograph on Manihiki (1932, p. 147), where he describes the old form of connectives as "four straight pegs [stanchions] termed *tiatia*", which agrees with the evidence furnished by a unique model in the Peabody Museum, Salem. The modern Manihiki connectives are stated by Buck (1932, p. 156) to be a pair of inserted short boards notched concavely at the upper end to receive the boom. It is possible though doubtful, that this may be a variation upon the Y type of connective; at any rate it is of modern origin.

Buck (1927, p. 267) states that in the large voyaging canoes (*pahi*) of Aitutaki formerly existing, the connectives consisted of two pairs of undercrossed stanchions (fig. 105, *b*). The source of the information is not given; presumably it was received from some of the oldest natives. This use of paired stanchion connectives, if correct, agrees with the traditional account of the form of attachment formerly characteristic of Manihiki and would suggest relationship in former times between the two islands.

The Cook Islands furnish a complete and illuminative series connecting the very simple and primitive Atiu and Mitiaro attachment type with the comparatively complicated one seen in Rarotonga and Mangaia; incidentally they afford strong evidence in favor of the conclusion that direct attachment was the primitive Polynesian system. Such a series, showing the gradual evolution of the more complex types, is graphically represented in figure 106.

Dimensions and Decorations

In Bligh's time canoes were much larger than the paltry dugouts of today, which range between 12 and 20 feet in length. Lieutenant Pirlock, in his journal of Bligh's voyage (Lee, 1920, p. 228), says of the Aitutaki canoes that they were

both double and single and more numerous than might be supposed from the small size of the island. Pirlock continues:

> We saw upwards of a dozen—none carrying less than five men, the long single ones carrying some eight and some ten. . . . The canoes are made from a single tree hollowed out and kept exceedingly white and clean and ornamented all round with a kind of little red pea with a black eye, stuck on the outside of the canoe. . . . The largest was 40 feet long and between the gunwale 1 foot 4 inches wide, increasing to about 2 feet in the middle and round in the bottom. They are, too, very handsomely finished, tapering away gradually towards each end, and terminating in a blunt point. Some of the canoes had a kind of gallows erected in the stern about 6 feet high and decorated with many man-of-war-birds' feathers.

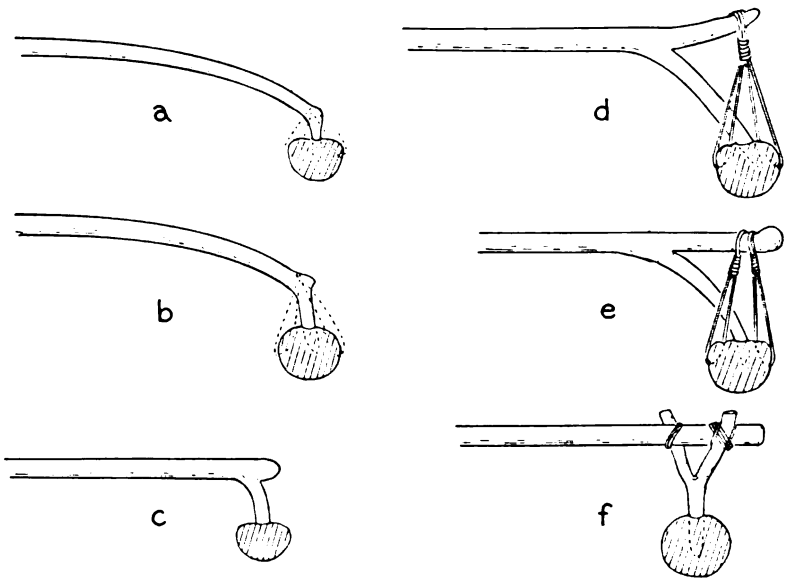


FIGURE 106.—Diagrammatic comparison of the types of outrigger attachment in the Cook Islands and Rimatara: *a*, Atiu; *b*, Mitiaro and Mauke; *c*, Rimatara (after Friederici, who omits the braces); *d*, Mangaia; *e*, Rarotonga; *f*, Aitutaki (except *c*, from photographs and information supplied by P. H. Buck). Braces in *d* and *e* shown by double lines, in *a* and *b* by dotted lines.

Bligh (Lee, 1920, p. 133) confirms this last statement, saying, "Some of the canoes had high black feather ornaments at the stern".

These statements regarding Aitutaki canoes, taken in conjunction with Belcher's woodcut of a Rarotongan canoe (1843, vol. 2, p. 19) with a beautifully carved tall upstanding stern, are sufficient, albeit they are the only evidence available, to prove that at one time a lofty stern post was the prevalent type of these canoes throughout the whole archipelago and was not, as now, restricted to the eastern islands of Atiu, Mangaia, and Mitiaro.

A characteristic feature of the larger and finer of these canoes was the lavish ornamentation of the hulls, both by carving and by painting; the double canoes were similarly adorned. The attention of Anderson, the surgeon of the *Resolution*, was drawn to this at Atiu (Cook, 1784, vol. 1, pp. 196-197): "Two of the canoes were most curiously stained or painted all over with black, in numberless small figures, as triangles, squares, etc." That this decoration was not universal is evident from his mention that in all there were eight or ten canoes "all double ones", and his reference is to two only as ornamented. Best (1925, pp. 206-207) gives two illustrations of a Mangaian canoe most profusely and artistically ornamented

both by carving and by staining, and Belcher (1843, vol. 2, p. 19) remarks that the Rarotongan canoes were very beautifully carved. Hamilton (1911, p. 101) mentions that some of the painted ornamentation of a Mangaian canoe was taken "from ancestral marks tattooed" on the chief's body.

Present-day outriggers, as already mentioned, are generally degenerate, particularly in size, European whaleboats having replaced the better and larger examples. Alexander (1902, p. 780) gives particulars of a typical Aitutaki canoe, which, summarized, are:

> Length 13 feet, width 13 inches at the gunwale, the sides tumbling home as the original rounding of the log is retained. Fore decking 2.5 feet long, after one 14 inches. Float boomed out 6 feet, with a length of 12 feet, width 6 inches, thickness 4 inches, turned up at each end; booms 7 feet apart, attached to the float by branched or Y connectives, the butt ends wedged into holes cut in the float and their arms seized to the booms.

Sail Rig

The outrigger canoes of the Cook Islands are seldom sailed except in Aitutaki, where the fishermen evince a decided preference for sailing as against paddling. Every canoe in Aitutaki as noted by Alexander (1902, p. 780), even the smallest, is provided with a mast step and mast partners on the midships side of each of the two booms; this arrangement permits of the canoe's being sailed either end forward and yet with the outrigger maintained on the windward side. Thus, when sailing against the wind, at the end of each reach, the mast with its sail is taken down and stepped at the other end of the canoe, which now becomes the functional head.

The sail in former times was either of matting made from strips of lauhala or from *pakoko,* a native cloth made from the bark of the *aoa* and *anga* (Best, 1925, p. 206). In shape it was probably triangular, though Buck (1927, p. 270) states: "It was said that the old sails were rectangular, and that old sleeping mats were used on occasion. . . . It was fastened to the mast by one side and had a diagonal sprit (*toko*)". So far as is known, such a sail is foreign to Polynesia; it was, however, adopted in various islands, notably Tahiti, soon after contact with Europeans, and it is probable that this is the explanation of its occurrence in Aitutaki.

In the small paddling canoes of Mangaia of the present day no regular mast and sail are employed, but in a gentle breeze a mat or cloth may be hung from an improvised mast made of any available pole (Friederici, 1912, p. 314). This is also the explanation of Belcher's figure (1843) of a rectangular sail spread between two uprights, which from the serrations along their edges are evidently spears to which the opposite margins of a square of cloth or matting have been tied. It can not be recognized as any form of permanent sail.

Paddles

A critical examination of recorded descriptions, few though they be, and of the paddles labeled as from the Cook or "Hervey" Islands in many museums, reveals three facts quite conclusively: 1, there was formerly close resemblance in the basic design of the paddles used throughout the Cook Islands; 2, confusion between the paddles from Mangaia in the Cook Islands and those from Raivavae in the Australs has existed for a long time in nearly all the great museums; 3, instead of similar designs being common to these two islands, these were radically different and belonged to separate types.

The typical Cook Islands form is well described by Pirlock (Lee, 1920, p. 229), who accompanied Captain Bligh in 1792 on his second voyage to the Pacific. According to him the paddles of Aitutaki were

. . . 5 feet 7 inches long and 9 inches broad, neatly made and pains taken to ornament them. One side of the blade, nearly at the grasp, is cut out like Cornish work and on the other side, just above the point of the blade, is a ridge about half an inch above the surface of the blade . . . They take pains in staining them with a black dye in variety as their fancy directs.

A fine example of the same type of paddle is figured by Edge-Partington (1891, ser. 1, pl. 5, fig. 5) from Mangaia and two similar ones are in the Peabody Museum, Salem. Edge-Partington's figure agrees closely with Pirlock's description even to size, for it is also 5 feet 9 inches long and just 9 inches wide. The shape is an unusual one. The blade is sharply shouldered at the insertion of the loom, and there is no definite axial ridge. From the shoulders the sides widen gradually till they reach the widest part, about 9 inches from the tip. The distal part beyond this is wedge-shaped, terminating in an acute point (fig. 107). The

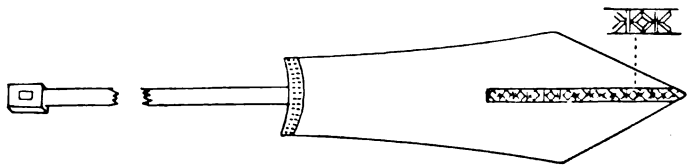


FIGURE 107.—Ornamented paddle of Mangaia: carved row of facetted squares toward tip of blade; length 69 inches, length of blade 29 inches (after Edge-Partington).

ridge mentioned by Pirlock is here developed into a low axial rib, 13.5 inches long, extending back from the tip and carved into a serial row of four-sided facets. The only other carved ornament on the blade is a transverse band across the shoulder region; the pattern consists of a double series of vertical incisions, evidently the equivalent of Pirlock's "Cornish work". The loom, bare of carving, is surmounted by a small, squared grip, covered with minute carving; if this is characteristic of Mangaia it would differentiate the paddles of this island from those of the more northerly ones where the grip is typically rounded or knob-shaped. Paddles so beautifully ornamented as this one were probably more or less ceremonial, like those of Raivavae.

The ordinary paddle of Mangaia is probably represented by an example in the Pitt-Rivers Museum, Oxford:

The blade agrees with Edge-Partington's figure in being squarely shouldered and in the way in which it widens toward the farther end, but the broader part instead of being angular is rounded, and the long, median rib behind the tip is reduced to a short, lateral protuberance without carved ornament. The "Cornish work" on the shoulder band here consists of 12 transverse rows of chevron design; a vertical row of single chevrons is also incised on the flattened edge of the blade in the same region. The loom is plain; there is no definite handgrip, only a slight thickening at the proximal end.

An old model of a canoe definitely of Mangaian design in the Australian Museum, Sydney (fig. 101), is accompanied by a paddle having a blade of similar shape and ornamentation.

At the present time this type of paddle is no longer used in Aitutaki, but the figure given by Buck (1927, fig. 234), reconstructed from the description of a native informant, so closely resembles those above described that it is obviously of identical type and so affords conclusive evidence of the identity in form of the paddles of Mangaia and Aitutaki at the time when Europeans first visited these islands. Buck's figure (fig. 108, *f*), shows the shoulder to be narrowed till it is only slightly wider than the loom; a transverse mark a short way down the blade marks off the region which was occupied by incised carving. The shape of the

blade otherwise is the same, but the terminal ridge at the tip is wanting—a detail likely to be omitted by a man attempting to describe a memory many years old.

Although paddles of this design are not now in use in Aitutaki, the type survives in Atiu, Mauke, and Mitiaro, according to Buck, who writes (personal communication) that the people of these islands "still make their paddles according to the old pattern. The blades are shaped like my figure of the Aitutaki paddle; the shoulder is squared and there is a reinforcing ridge extending for 1 to 2 inches down the middle of the blade to the tip. The handles are very long and terminate in a knob" (fig. 108, *e*).

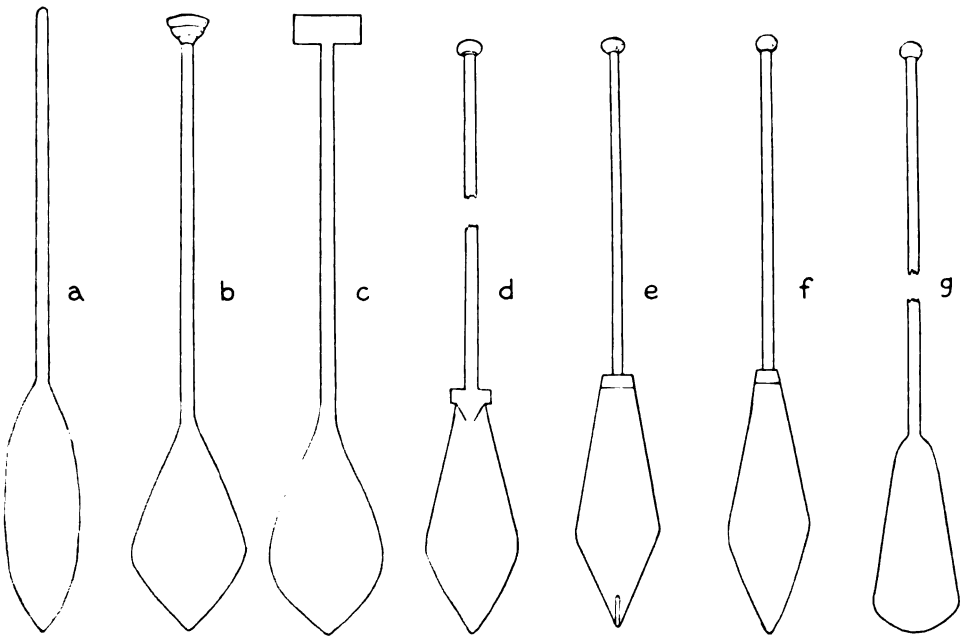


FIGURE 108.—Paddles of the Cook and Austral Islands: *a*, ordinary paddle of Rapa (Bernice P. Bishop Museum); *b*, ceremonial paddle of Raivavae with sub-conical knobbed grip (British Museum); *c*, ceremonial paddle of Raivavae, with rectangular grip (Bernice P. Bishop Museum); *d*, steering paddle of double canoe of Atiu (Royal Scottish Museum); *e*, ordinary paddle, Atiu (from particulars furnished by P. H. Buck); *f*, of Aitutaki (after Buck); *g*, of Rarotonga (after Best).

From the above it is evident that the paddles of all the islands, except perhaps Rarotonga, had a similarly shaped blade. That from Atiu figured by Friederici (1912, fig. 136), having an ovate blade and no handgrip, is a degenerate form and not typical of the island.

As mentioned in connection with those of the Austral Islands, many paddles with ovately shaped blades without shoulders, and having the entire surface covered with delicate carving, obviously belonging to Raivavae, are wrongly labeled in museum collections as coming from Mangaia, whereas this type is entirely foreign to that island.

In a photograph of a modern Rarotongan canoe given by Best (1925, p. 204) the blade of the paddle in use is distinctly broad and rounded at the distal end (fig. 108, *g*), after the fashion now prevailing in Tahiti. The loom is long and, in common with the paddles of the other islands of the Cook archipelago, it is surmounted by a rounded knob absent in those of Tahiti.

Within the reefs canoes are propelled by punting poles.

Bailers

In present-day canoes half a coconut shell generally serves to bail out any water that comes aboard. The old type of bailer (*tata* or *ahu*) used in Aitutaki and described by Buck (1927, p. 269) was of a very distinctive form (fig. 109).

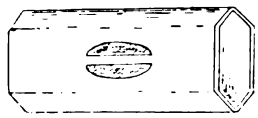


Figure 109.—Aitutaki bailer of unusual form (after Buck, 1927).

Instead of the open scoop shape generally in use in Polynesia, a short wide cylinder was employed, open at one end and closed at the other; two closely set parallel slots in the upper side permitted the fingers of one hand to be passed through; the dividing strip of wood formed a handle. This may be a survival of a very primitive form made from a joint of stout bamboo. A link connecting this form with the fully developed Oceanic bailer is that characteristic of the Society Islands (fig. 91).

Canoe Amulets

In the Cook Islands as in Hawaii, the Marquesas, and sometimes in Tahiti, the fishermen carried to sea with them either a carved wooden image of a god or some sacred emblem supplied by the priests, in order to secure the god's protection and assistance in their work. In Rarotonga it is related by Williams (1837, p. 116) that a tiki figure was placed upon the fore part of every fishing canoe and, prior to setting out for the fishing grounds, it was the invariable practice of the fishermen to present offerings to the god with invocations to grant them success.

In Mangaia the wooden tiki was replaced by a palm frond secured with fine plaited sennit tied into a bow (Gill, 1880, p. 104):

> This Mokoiro, as it was called, was supposed to be all powerful in regard to the winds and waves. . . . 'The aged king of Mangaia informed me that in those days a fleet of, say, 200 small canoes—carrying only one man apiece—would assemble in front of the site of the present village of Oneroa at the beginning of the fishing season. The little leaf gods would be got ready against the appointed night, which was indicated by the recurrence of the phase of the moon favorable for catching certain kinds of fish.

An analogous custom appears to have prevailed in the Marquesas Islands, where both D'Urville (1834-35, vol. 1, p. 486) and Stewart (1831, vol. 1, p. 243) noticed canoes decorated with three or four coconut leaves placed erect on the flat and projecting head board of what appear to have been fishing canoes.

DOUBLE CANOES

Beyond the fact that double canoes (*vaka katea*) were formerly in use in Rarotonga and Aitutaki, no reliable details from these islands are available. Double canoes disappeared long ago and no one appears to have left a description of their appearance or construction. Only in Atiu, Mauke, and Mitiaro did they survive into the present time and that solely because the double canoe is specially well adapted for employment in the scoop-netting of flying fish by torchlight, a sport in which these islanders delight.

Best (1925, p. 205) gives the only good account of the big double canoes that were formerly the ordinary means of transit from island to island and for the purpose of warlike expeditions, furnished in 1913 by Major Large, a former British resident of the Cook Islands:

Atiu, Mauke, and Mitiaro (the two latter until recently belonging to the first-named by right of conquest) are the only islands in the group where the old-style double canoes (*vaka katea*) are still used, though now only for the nocturnal sport of scoop-netting flying fish by torchlight. Formerly, before the advent of the European boat, these big double canoes were the ordinary means of transit from island to island, and carried crowds of warriors on their warlike expeditions, the canoes often returning to their own islands laden with the cooked bodies of the slain, and the wives and children of the latter as slaves for the conquerors.

These canoes were 50, 60, and even as much as 80 feet long, made from the trunks of the *tamanu*, one of the largest, most durable, and suitable trees in these islands for the purpose. It required the full length of two trees to make an ordinary canoe, the bow length being called the *aumi* and the stern length the *noko*. In the case of very big canoes it took three of the largest *tamanu* to form the canoe, the centre length being called the *puke*. The joinings (*pouanga*) are fitted with great nicety, as they have to be lashed together (*a'au*) with coconut fibre (*ka'a*) laced through holes (*putaka*), each turn being hove taut with a lever.

The keel of the canoe is called the *takere*, and the inside the *riu*. In the hollowing-out of the latter, riblike projections are left at intervals to strengthen the canoe; these are called *vaitorea*.

The broad board or slab (always in one piece) covering in the bow (*ei*) of the canoe is called the *utu-mua*; it follows the curve of the bow and projects upwards to a point called the *vacutu*, 12 or 18 inches high, according to the size of the canoe, while the bow itself ends in a point projecting downward, called the *tara kokiri*. Small ornamental carvings on the upper side of the former are called *tapu*. In like manner part of the stern (*noko*) is covered in with a slab called the *utu-muri*, which follows the sharp curve upwards of the stern. On its upper part is a curious ornamental carving (*akatiki-tiki*) shaped like two human ears joined together. The signification of this symbol appears to have been lost. The after end of the *utu-muri* is fastened to the *muri vaka*, a triangular-shaped piece of timber, 4 or 5 feet long, rising straight up from the point of the stern, to which its bottom end is lashed. The *muri vaka* of these canoes is identical with the New Zealand Maori *rapa* or *taurapa*, though it is not so elaborately carved and decorated—at least, not in these days.

Extending from the *utu-mua* to the *utu-muri* the topsides (*oa*) are lashed on. . . . With the double canoes I am describing the left-hand canoe is called the *ama*, while the right-hand one, which is always the larger and better one, is called the *katea*. The two, which are 2.5 or 3 feet apart, are connected by three or more cross pieces (*kiato*) very securely lashed to the canoes. These cross pieces also form the joists for the centre staging (*ataata*) extending over the two canoes, on which most of the occupants of the canoe sit or stand. In their old voyaging canoes this staging was walled in as a protection from the weather, while a portion was raised and ornamented as a place for the chiefs: it was then called *ura*. The mast (*tira*) was stepped in the fore part of the staging and guyed, the sail (*kie*) being of matting. The double canoes were also propelled with long oars (*oe*), the thole pins being fixed in stout beams lashed on to the ends of the *kiato*. The steer oar is called the *oe akatere*, and the bailer *tata*.

In catching flying fish (*maroro*) with the scoop net (*kupenga*) . . . the fish are attracted to the side of the canoe by the glare of the torch (*rama*). . . . The man who holds the torch . . . stands on the fore part of the *ataata*, while the one who takes the scoop net, the most expert man of the party, called the *tangata taii*, stands in front of him with a foot on the *utu-mua* of each canoe.

This description agrees except in minor particulars with the structural details of a fine model of one of these double canoes, probably from Atiu, in the Royal Scottish Museum, Edinburgh (fig. 110).

In the model the position of the twinned ear ornament is not, as Large states, on the upper part of the *utu-muri* or after deck slab; instead, it is high up on the fore side of the upright stern piece (*muri-vaka*) of the port hull. In the starboard hull, here the shorter, the stern piece is considerably lower than that of the port hull, and is without the eared ornament.

The central stage referred to by Large is represented by three spars lashed fore and aft across the booms immediately above the space separating the two hulls. By restriction to this central position, the rowers would not be incommoded by passengers or cargo carried on the stage. The ends of the loose thwarts provided for the rowers rest upon the flanged inner margin of the gunwale rail on each side. In the first thwart abaft the first cross boom in each hull a hole has been cut for the setting up of a mast. What form the sail had originally in these islands is not definitely known.

All the three connecting cross booms project outboard some distance, probably 1 foot to 18 inches in a full-sized canoe, on the outer side of both hulls. The ends are connected by a fore-and-aft spar lashed upon them in the position of an outrigger float, except that, in this model, as the booms are straight, the longitudinal spar is on a level with the gunwale. Midway between the center boom and the one on each side of it, a thole pin is inserted into the connecting spar, so permitting the use of two oars in each hull. The arrangement is analogous to the outrigger fitting of European racing skiffs. Were it not for the presence of the thole pins, the longitudinal spars might be mistaken for some kind of balancing contrivance.

An oar of European design belongs to the model, as does also a heavy steering paddle, shorter than the oar. The paddle has a low, squared projection on each side at the shoulder of the blade, and a knobbed handgrip at the proximal end (fig. 110).

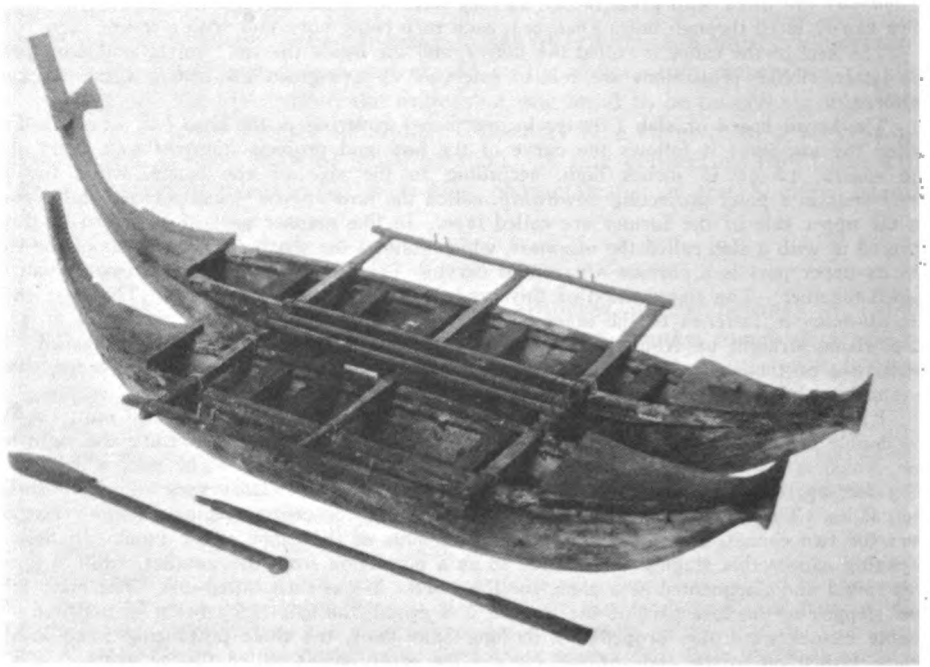


FIGURE 110.—Model of double canoe of Atiu (Royal Scottish Museum, Edinburgh, no. 1895, 358), European contact evidenced in adaptation of boom frame so that oars may be used in place of paddles; oar and steering paddle also shown.

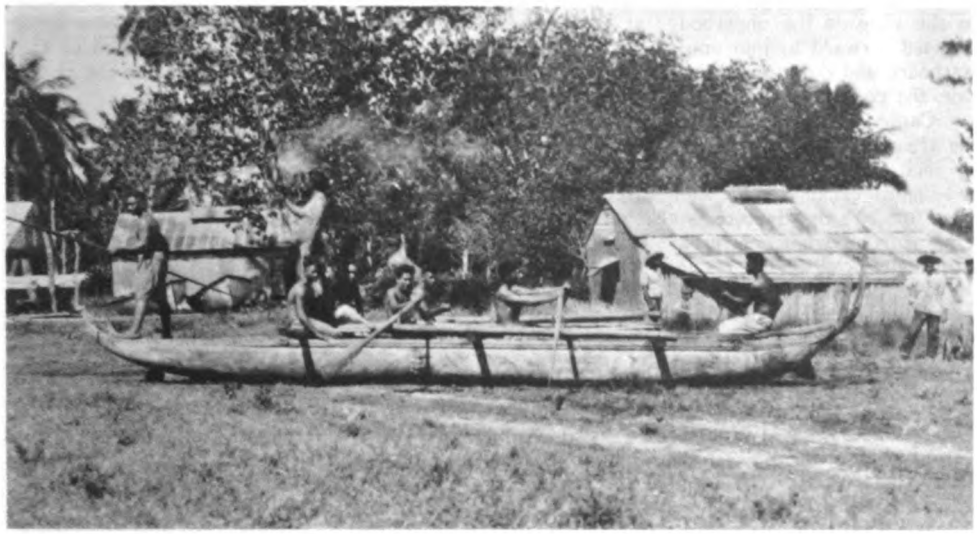
Although thole pins and oars are fittings obviously of foreign origin, adopted after contact with Europeans, the Atiu construction otherwise appears to adhere closely to the ancient design at the period when canoes were propelled by paddles except when under sail. Williams (1837, p. 272) remarks that the islanders have, "with very considerable ingenuity, so constructed their canoes as to be enabled to use boat oars, which they prefer, as being less exhausting than their paddles".

The tall stern piece was decorated with feathers in the old days, emphasizing again the traditional and constructional relationship with New Zealand. Bligh's and Pirlock's remarks on the feathered stern pieces of the Aitutaki canoes have already been quoted.

The double canoes that survive in Atiu and Mitiaro, or did till recently, follow the same general design as above described, differing only in minor details. Dr. P. H. Buck has kindly supplied notes and photographs (fig. 111) of a double canoe belonging to Atiu, and from these the following particulars are compiled:

The two hulls are approximately equal in dimensions, the port hull slightly the shorter and with a shorter stern end piece. The hulls in general form are enlarged replicas of the outrigger hull of Mitiaro; each consists of a dugout underbody made up of two lengths butted together, a stout squared gunwale rail along each side between the short triangular deckings which cover in the ends of the underbody. In addition a tall and slender upstanding end piece, triangular in horizontal section, is fitted upon the extreme after end of the underbody.

The hulls are round-bottomed and have sheer only at the extreme ends, both of which run fine to a tapered end, sharp below. The fore end gives off a small heel beneath as in the



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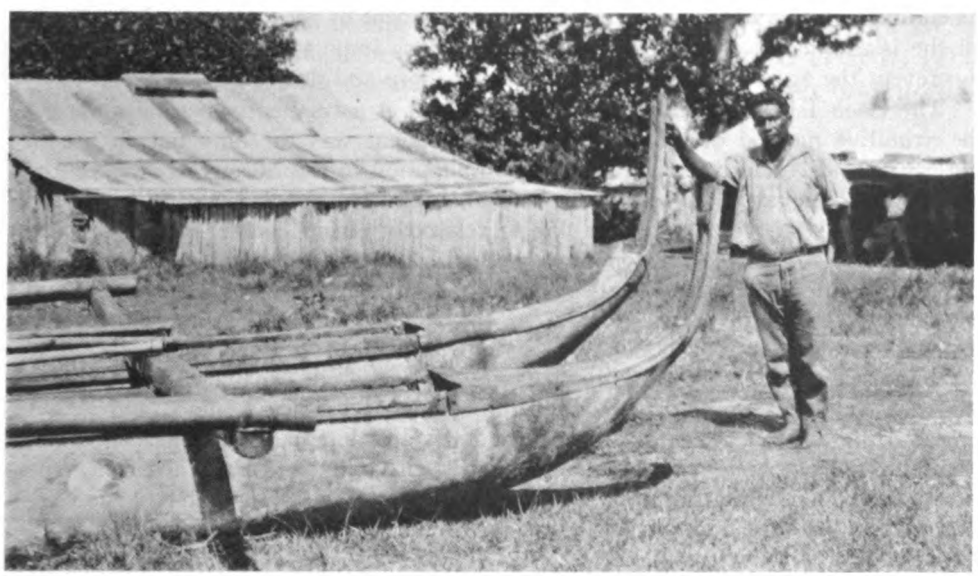


b

FIGURE 111.—Double canoe of Atiu: *a*, side view of entire vessel, crew occupy positions they have when afloat, four men rowing; *b*, details of stern (photographs by P. H. Buck).

single hulls; the extreme end of the curved-up stern is truncate to provide seating for the broadened butt end of the tall end piece.

The gunwale rail (*oa*) is shaped rather differently from that which has been described as usual in outrigger canoes. Here the upper edge of the underbody has been left untrimmed, and therefore at right angles to its inclined side; consequently, in order to fit the *oa* securely to it, an obliquely cut right-angled groove in the lower edge of the *oa* is made to receive it (fig. 103, *b*).

The fore end cover is usually a combined cover and fore end piece; the apex curved upward gives the head a gracefully pointed upturned extremity. The after end cover has each lateral margin prolonged downward to form a stout flange which seats upon and is lashed to the edge of the underbody; at the fore end each of these sides gives off a short wing directed forward to join onto the after end of the *oa* (fig. 102, *e*). On the after end of the starboard end cover an obliquely triangular projection a few inches high rises from the upper side, the pointed apex directed aft.

Carved ornament is mainly confined to minute, closely set chevrons on the upper edges of the after half of the stern end cover, and to a low ribbing, V-nicked on each side, which runs up each border of the fore side of each tall stern end piece. In addition there is a twinned ear-shaped ornament, the *akatikitiki* of Large, high up on the stern piece of the port hull (fig. 102, *e*); this feature is also seen in a similar position in the Edinburgh Museum model. Fragments of what was probably a like ornament appear on the companion end piece in the Atiu double canoe (fig. 111, *b*).

The booms and outboard rowing frame are exactly as described from the Edinburgh model; the thwarts rest loose on the inboard ledges marking the position of the lateral hull seam on the sides, and not upon the upper edges of the gunwale rail as in outrigger canoes.

All lashings are of a simple pattern, the primary turns alternately crossed, and the whole finished off with a few circumferential turns.

AFFINITIES

Although the method of outrigger attachment varies considerably between the different islands, these differences, except in the canoes of Aitutaki, are superficial. Omitting Aitutaki, it is safe to say that there is fundamental unity, the boom curved and connecting directly with the float by the downturned extremity or by its equivalent, a straight boom giving off a curved side branch inclined downward, with its end fitted into a hole in the float; its reinforcement by means of sennit braces in all the islands is an accessory device of secondary importance, introduced merely to prevent the accident of the boom becoming loose and drawing out.

The Cook Islands appear to have been settled at a very early period while yet the primitive method of direct outrigger attachment was the only one in use in Polynesia, and certainly prior to the partial adoption in the Society Islands of the indirect stanchion attachment of Melanesian origin. The Aitutaki exception, as has been mentioned above, is probably due to relatively recent contact with Manihiki, where also was practiced the concealed method of sewing on the washstrake.

Analysis of the canoe and outrigger designs in the Cook Islands generally, and with them may be included Rimatara of the Austral Islands, shows distinct evidence of stratification of population, and of remote Melanesian influence. The horizontal headboard and the tall upstanding stern piece ornamented with elaborate carving and decorated with plumage betoken Melanesian contact, and would appear to be derived from that early period when Polynesian migrants conquered certain islands inhabited by Melanesians, first enslaving and then absorbing the remnant of the original Melanesian inhabitants who escaped slaughter; to the resultant racial blend it is probable that an important element in the Maori and Marquesan stocks is to be traced.

The ribbed tip of the paddle and the direct attachment of the float may be considered as being survivals of an early Polynesian element, which in the presence of racial blending became associated in canoe design with ornamental motives derived from a Melanesian source.

That the primitive Polynesian curved boom has become modified in all of the islands, except Aitutaki, into an elbowed form is possibly due to later Samoan contact and influence; an elbowed direct attachment is characteristic of Tutuila, the nearest large Samoan island. This hypothesis is rendered the more probable by a considerable number of legendary tales recorded by Williams (1837, pp. 192-197), by Gill (1880, pp. 36, 105), and by Stair (1895 *a*, p. 616), of Tongan and Samoan invasion and immigration; many place names in the Cook Islands are those of Samoan and Tongan islands and localities, slightly altered, according to Gill (1876, p. 167).

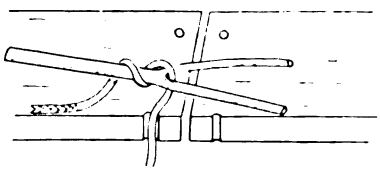


FIGURE 112.—Diagram showing method of employing the *keke*, a forked implement used to tighten seam lashings, Aitutaki (after Buck, 1927).

The influence of the Society Islands, whence immigrants were also received (Williams, 1837, pp. 192-196), upon the canoe design is difficult to assess, though it is clear that the low head, covered with its projecting head board, and the lofty stern, which were pronounced characteristics of the canoes of the Society Islands and of Mangaia, Rarotonga, and probably Aitutaki, have had a common and closely related origin. The paired sennit braces found in all the islands except Aitutaki may represent a modification of attachment based upon the paired stanchion connectives characteristic of the fore boom attachment of the Society Islands. The form of the present-day Rarotongan paddle is also to be derived from the type prevalent in the Society Islands, and it is notable that the *keke*, an implement used for tightening lashings (fig. 112), which is reported by Buck (1927, fig. 227) from Aitutaki, is identical with a similar implement known from the Society Islands (Handy, 1932, fig. 11, *a*, 3), the Tuamotus (Seurat, 1905), and New Zealand (Best, 1925, p. 79).

TECHNICAL TERMS

OUTRIGGER CANOE[a]

Ama: outrigger float.
Aumihi vaka: fore section of a vaka poinga.
Hoe: paddle.
Hoe tu oe: steering paddle.
Keke (A): forked tightening lever; known by the same name in Reao, in the Tuamotus.
Kiato: outrigger boom; also tito (obsolete).
Moe: middle section of a vaka poinga if three present.
Muri vaka: after section of a vaka poinga.
Nohoanga: thwart.
Oa: washstrake.
Oa-i-ama: port or outrigger side.
Oa-i-katea: starboard side of canoe.
Pa-tiatia (A): outrigger connectives.
Poinga (M): potu (A): joint between the component sections.
Poki (M, A) or papahura (A): fore decking plank.
Ra (M); hie or hahangi (A): sail.
Repe (M): high vertical stern-post.
Takere (A): dugout underbody when washstrakes are present.
Tata (A, M) or ahu (A): bailer.
Tira: mast; mast partners (perforated thwart) papatira (A).
Vaka: canoe (general term).
Vaka poinga (A): canoe formed of two or more hollowed logs.
Vaka tavatai (M); vaka tavai (A): dugout made from one log.

[a] The authority for the Mangaian terms (M) is Large, quoted by Best (1925, p. 206), that for Aitutaki (A) is Buck (1927, pp. 257-276). Where no locality is indicated such terms are common generally throughout the Cook Islands.

DOUBLE CANOES OF ATIU, MAUKE, AND MITIARO[b]

Ama: port hull.
Ataata: central platform between the hulls.
Aumihi: fore end of either hull.
Katea: starboard hull.
Kiato: connecting booms.
Kie: sail.
Noko: after end of either hull.
Pahi: voyaging double canoe.
Tata: bailer.
Tira: mast.
Utu-mua: fore decking plank.
Utu-muri: after decking plank.
Vaka katea (general): vaka tirua or unu rua (Aitutaki): double canoe.

[b] Except for the term for a double canoe in Aitutaki (Buck, 1927), these terms are quoted from J. T. Large's description of the double canoes of the islands (Best, 1925, p. 205).

MANIHIKI AREA

Although politically included in the Cook Islands, Manihiki, Rakahanga, and Tongareva form a geographical entity, for they lie isolated in the center of an otherwise void sea at about equal distance, roughly 500 miles, from the Tokelau, Samoan, and Cook Islands and are not much farther from the Society Islands. Manihiki is an atoll with a closed lagoon; Rakahanga, about 20 miles distant, has one also; Tongareva, 180 miles north of Manihiki, is a discontinuous atoll, a ring of land broken into numerous islands set around an extensive lagoon with several good entrances from the sea.

Traditionally the islanders claim to be of a common stock. Those of Tongareva assert their descent from a party of refugees expelled from Rakahanga. Those of Manihiki and Rakahanga, who, until the middle of last century, formed a single community, trace their origin to Rarotonga (Best, 1923, p. 14).

MANIHIKI AND RAKAHANGA

Manihiki and its companion Rakahanga are noteworthy for the curiously elaborate type of canoe, single as well as double, formerly constructed there. Brigham, in his index to the islands of the Pacific (1900, p. 97), has confused Manihiki, which he spells "Monahiki", with Manihi in the Tuamotus, for he states that the inhabitants of Manihi "make curiously elaborate canoes". This the Manihi people did not, whereas it is true that those of Manihiki did. The approximation in the names was evidently the cause of the mistake.

Unfortunately, knowledge of the structural details of the canoes of Manihiki and Rakahanga is derived almost entirely from examination of a few hulls of single canoes and of numerous models of double ones surviving in museum collections. To add to the difficulty, the models differ widely in important particulars and it becomes well nigh impossible to be certain which of them most nearly represents the design actually used.

OUTRIGGER CANOES

ANCIENT TYPES

Two types of outrigger canoe were formerly in use, but neither has survived. One, the smaller, was a simple dugout (*puni*); it had, according to Buck (1932, p. 148), a sharp bow and a blunt stern and was without added parts save the outrigger. The other and larger, the *waka*, as ascertained by examination of a few surviving examples in museums, was constructed after the same design as the hulls of model double canoes. The fundamental characteristics consisted of the lengthening of the hull by the addition to each end of a dugout base of a large and solid "end piece" curiously shaped, the use of washstrakes and weather screens to give

more freeboard, and of an unusual form of strengthening cross braces stretching from gunwale to gunwale.

The following description of the structure of a *waka* is based mainly upon Best's description (1925, pp. 209-210) of a full-sized hull in the Dominion Museum, New Zealand, and my own examination of one a few feet shorter in the United Services Institution, London, and of a smaller one in the British Museum (figs. 113, 114):

The dimensions of the first are: length over all, 29 feet; beam at junction of washstrakes with dugout underbody amidships, 11.75 inches; between the gunwales 14.5 inches; greatest depth, 20 inches, of which 9 are contributed by the washstrake. Both this and the other two examples have lost their outrigger fittings.

The basis of the hull, in the single as in the double canoe, consists of a dugout underbody (*takere*) in one or several sections. The New Zealand hull has an underbody of three sections butted end to end and sewn together with sennit passed through opposed holes in the edges. A batten covers the seam under the lashing, which is exposed and not countersunk as in the equivalent joints in Maori hulls. The median section, about one third the length of the whole canoe, is well-rounded both below and within; each of the two other sections of the underbody, somewhat shorter than the median, sharpens on the bottom toward the distal end. The form of the extremities of the dugout base differs greatly; the after one curves upward and narrows to its junction with the stern end piece, somewhat in the Samoan manner, whereas the forward region has a raked fore side with a small finlike downward projection beneath forming an incipient fore foot, comparable with that of Indian boats on the Bombay coast.

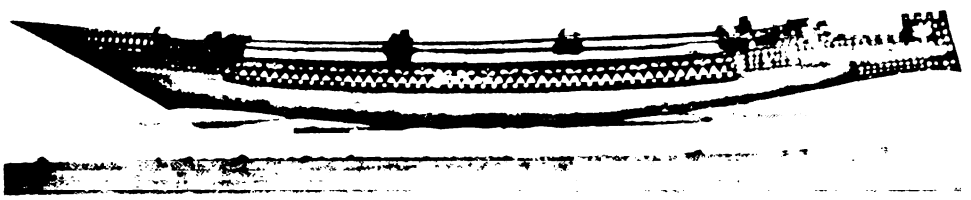


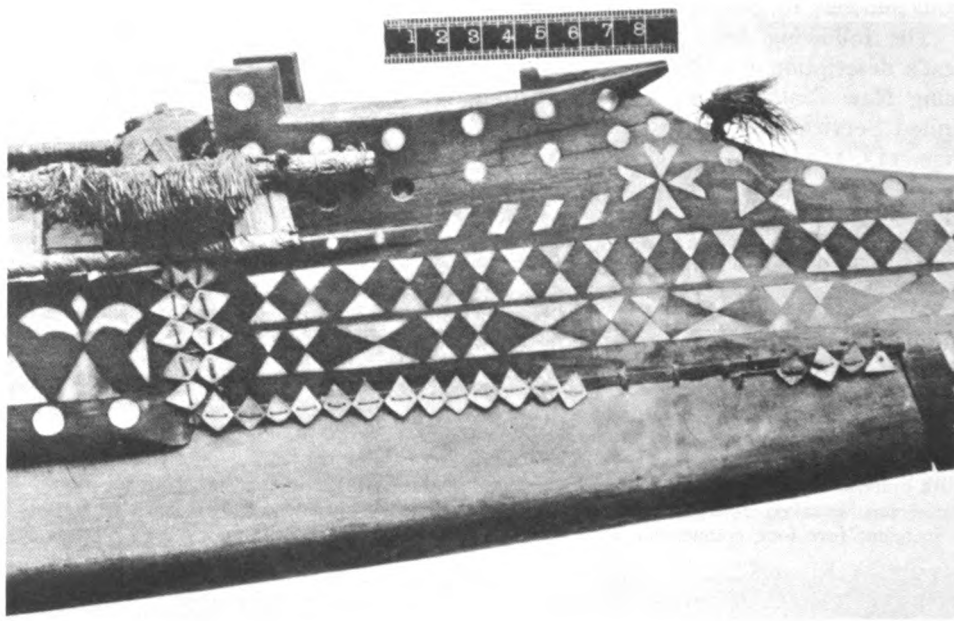
FIGURE 113.—Small canoe of Manihiki (British Museum), complete save for outrigger; shell inlay is particularly beautiful and is present not only on exterior of hull but also upon fore and after seats and on all the gunwale braces.

Above the bilges the sides trend gently inward to meet the washstrakes, which are either vertical or inclined slightly outward.

The head of the canoe consists of a massive tapered block, pointed sharply at the fore end, resting upon the fore end of the underbody; the forward side is raked at the same angle as the forward end of the underbody, with which it joins to form a long sharply raked cutwater (figs. 115, *a*; 116, *a*). The upper surface has a slight sheer, ending in front in a sharp point.

The stern end piece fits on the after end of the underbody by a scarfed base. On the upper surface at the laterally compressed extreme end, a line of square-cut knobs, usually four in number, are arranged fore and aft in a row, homologues probably of the knobs seen on Samoan canoes. (See figs. 115, *b*; 116, *b*).

At each end of the New Zealand hull, where the washstrakes butt against the end pieces, a short length is covered in by a transverse decking or "seat" raised on deep sides, the whole hewn from the solid; it is sewn marginally to the washstrakes and also, distally, to the adjoining end piece (fig. 115, *a*, *b*, 5). The upper surface of the forward decking is carved into the form of a small oblong rectilinear table, that of the after one into a slightly longer triangular area, the steersman's seat, sheered a little toward the after and apical end. Each of these flattened areas, which may be appropriately termed "seats", bears abreast at its proximal end two short squared projections, one at each side. In addition, a low, median, squared ridge is present on the fore part of the forward seat, merging distally into the crest of the end piece. In smaller hulls and in all models, this separation of the seats from the end pieces does not



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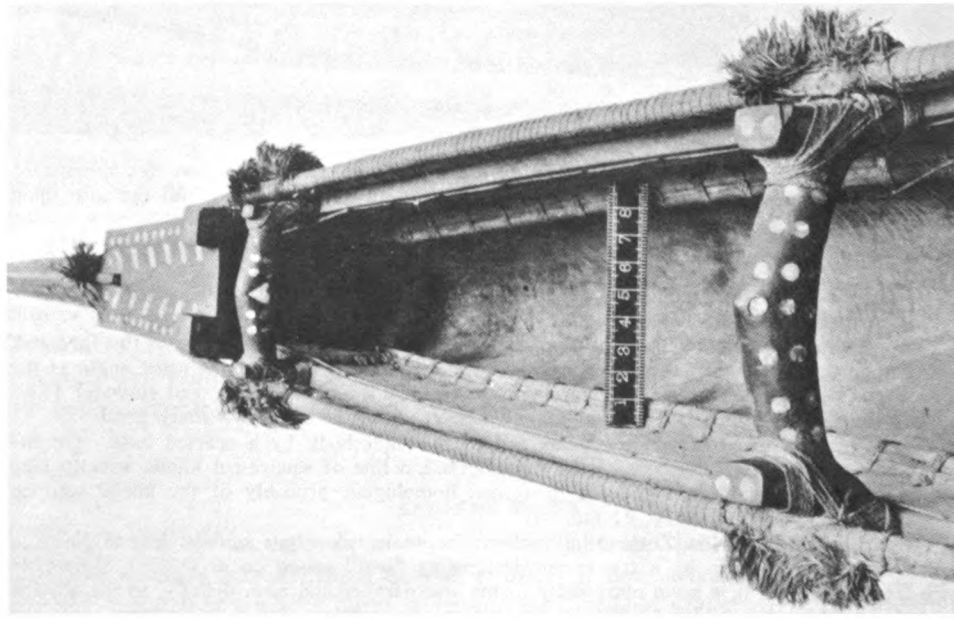


b

FIGURE 114.—Details of Manihiki canoe (British Museum). *a*, after portion of hull showing on left overlap of washstrake seam; above it, after end of weather screen; in center, after seat with upper part of aftmost gunwale brace to left of the two short pillars of seat; the exquisite finish of inlaid shell bespeaks high level of craftsmanship; *b*, forward portion of hull from above showing small fore seat, form of two gunwale braces and their use for support of weather screens which are lashed to them and to upper edge of washstrake, also flanged lower edge of washstrake with stout semicircular batten covering seam; all lashings are of sennit except that around leaf-covered upper pole of weather screen, which is of coconut-fiber cord.

exist, each seat, together with the sections of washstrake below, being hewn in one with the end piece (fig. 124).

As the end pieces rise considerably higher than the edges of the underbody, the gap is partially filled in by means of a washstrake on each side; in the canoe in the Dominion Museum, New Zealand, this is 9 inches deep amidships, decreasing to 6.5 at each end. In large canoes such as this it may be made up of several lengths (five) butted together and sewn end to end; in smaller ones it consists of a single long section. A narrow beading, from a quarter to a third of an inch in width, runs along the upper outer edge in the Dominion Museum canoe.

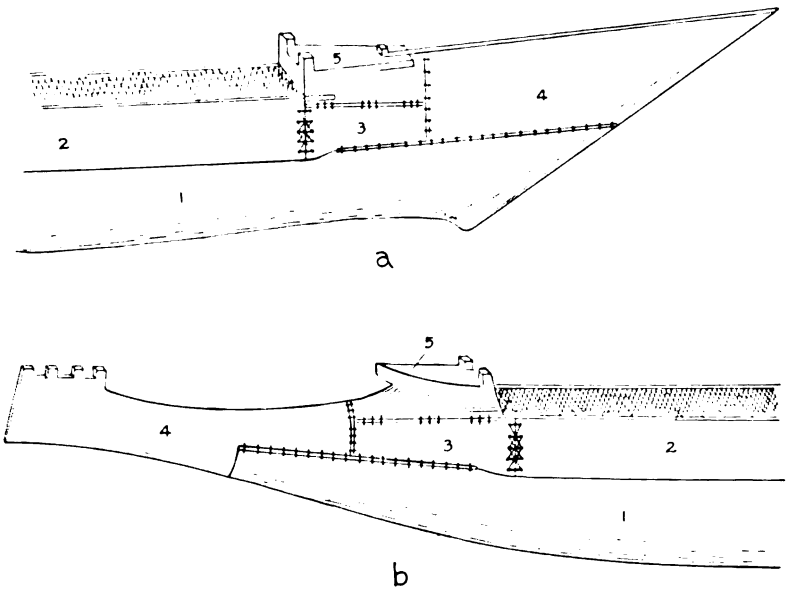


FIGURE 115.—Manihiki canoe (Dominion Museum, New Zealand): *a*, fore end; *b*, after end; 1, dugout underbody; 2, median section of washstrake; 3, end section of washstrake; 4, fore and after end pieces; 5, forward and after seats.

The method of attachment of the washstrake to the underbody is ingenious and novel. The lower edge, instead of resting upon the edge of the underbody and being sewn directly to it, fits thereon by means of a flange about three quarters to an inch wide, which projects inward at right angles an inch or so above the lower edge. Through this flange or beading vertical or slightly oblique holes are bored at short intervals, corresponding holes being bored horizontally through the side of the underbody just below the edge. Through each pair of these opposed holes several turns of sennit are passed and secured in the usual manner, the sennit braid being carried along obliquely between adjacent pairs of holes to avoid cutting it. To render the joint as watertight as possible, in addition to the plugging of each hole a covering layer of fibrous material is laid over the seam on the inner side and pressed home by means of a semicylindrical rod of split hala placed battenwise over it; this packing is tightened progressively as the seam is sewn up by the sennit lashing being carried over it as each turn is made (fig. 117).

The seam is concealed and further protected on the outside by the continuation downward of the washstrake beyond the place where the lateral flange is given off (figs. 116, *c*, 4; 117). In this way the lower edge of the washstrake, here thinned considerably by beveling, overlaps the seam sufficiently to hide all trace of the sewing. This concealed seam is similar to that usual in the Cook Islands and is seen in a simpler and more primitive form in Hawaiian canoes, in which an inner flange fitting upon the edge of the underbody is absent.

At each end, the horizontal seam between the end piece and the underbody is unprovided with this protective overlap; its place is taken by a narrow covering batten of tortoise shell. The vertical joints between the washstrake and the end pieces are also covered by a protective batten, again normally of tortoise shell. All these battens appear to have been decorated and concealed by rows of angular discs of mother-of-pearl, sewn over them.

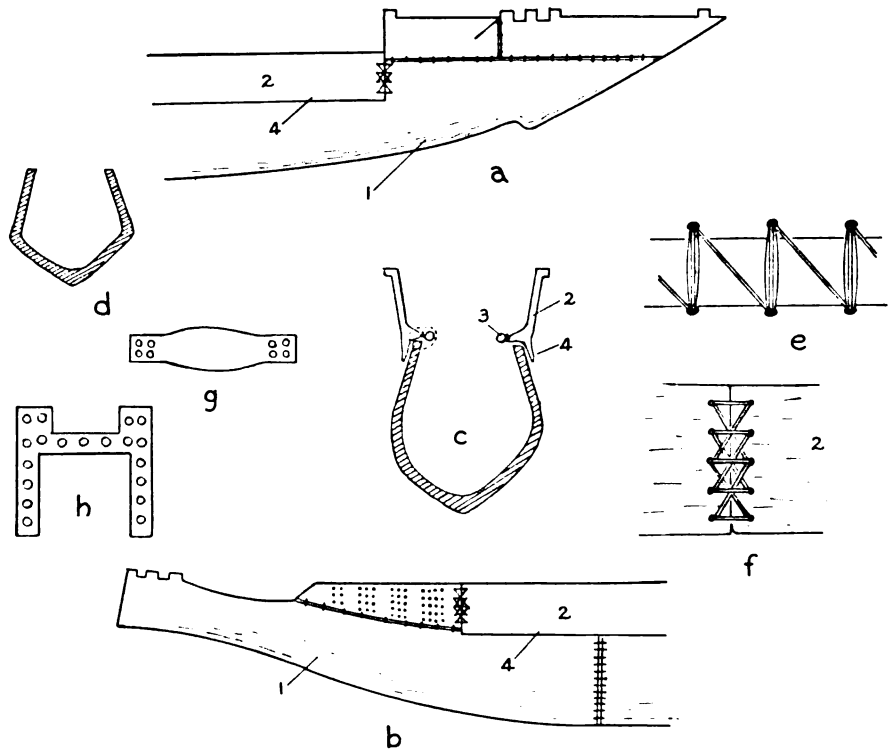


FIGURE 116.—Outrigger hull from Manihiki (United Services Institution, London): *a*, fore end showing several rectangular projections on end piece, an unusual feature; *b*, after end, steersman's seat missing and on the aftermost section of washstrakes are four series of pearl-shell discs, the only inlaid ornament upon sides of canoe; *c*, cross section amidships, showing overlapping flanges of washstrake and inner cylindrical batten covering seam; *d*, cross section near stern; *e*, broad batten covering inner side of vertical joints of underbody sections, with type of lashing used; *f*, special type of lashing used to secure vertical washstrake joint at each end of hull; *g*, thwart inlaid with pearl-shell discs; *h*, after side of fore seat, also inlaid with pearl shell; 1, underbody; 2, washstrake; 3, batten covering underbody joint on inner side; 4, outer flange of washstrake.

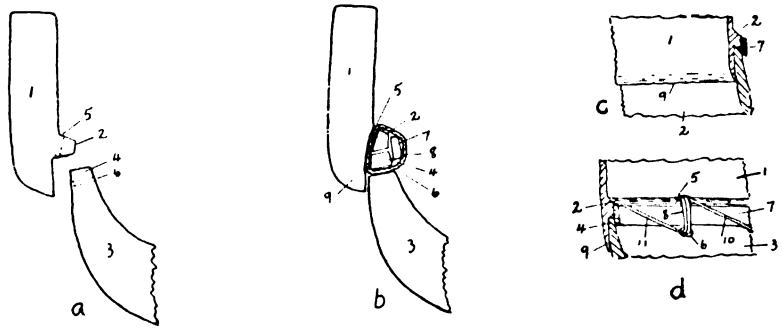


FIGURE 117.—Method of lashing washstrake to underbody, Manihiki. *a*, vertical section: 1, washstrake; 2, inner flange; 3, underbody; 4, its upper edge; 5, spaced holes bored through flange; 6 corresponding ones bored through underbody below upper edge. *b*, sections fitted and lashed: washstrake (1) so fitted that its flange (2) rests on upper edge (4) of underbody with paired holes coinciding; long batten (7) laid over seam on inside; after two or more turns of sennit have been passed through the opposed holes, braid goes diagonally upward on inside to next flange hole, where process is repeated; outer flange conceals lashing on outside. *c*, outer side of seam showing overlap or downward flange (9) of washstrake concealing lashings. *d*, inner side, showing batten (7) in position, with braid (10) ascending to flange hole (5) to make two lashing turns (8) and passing on (11) to flange hole of next pair (after Buck, 1932).

In the small paddling canoe hull in the British Museum and in all museum models of the double canoe of Manihiki, the sides are heightened to nearly the level of the upper surfaces of the end pieces by the provision of a weather screen (figs. 113, 114):

The weather screen consists of a continuous series of lauhala strips doubled severally at half length over a slender pole stretched between the head and the stern end piece, just below the level of the end seats (fig. 118, *a*). After swathing the pole with a pad of leaves laid longitudinally over the turn of the doubled lauhala strips to protect them from damage, the strips are secured in position by a running lashing made of closely set half-hitches of coir cord (not sennit). According to the size of the canoe, the strips hang 6 to 8 inches or even considerably more below the pole; to hold their free ends down, a long leaf-twined batten, parallel with the larger spar above, is laid over them and then stitched to the outer side of the washstrake gunwale through unpaired holes spaced rather far apart. The upper margin of the screen is secured by lashing to the sides of the arched gunwale braces described below and is sometimes further supported by a few stout vertical struts resting upon the gunwale wherever necessary (figs. 118, 119).

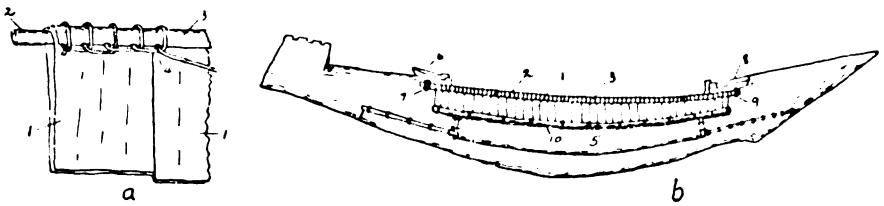


FIGURE 118.—Weather screen of Manihiki canoe. *a*, strips of lauhala (1) doubled over round pole (2) and narrow pieces of other leaf (3) stretched along top to fold over for depth of pole to protect lauhala from injury; doubled-over parts stitched to pole by series of closely set half-hitches (4) of two-ply coir cord (*whauhoto*). *b*, lauhala weather screen (1) placed above washstrake (5) and its pole (2) stretched between the two end pieces, its ends secured by lashing (7) and (9) below aft seat (6) and fore seat (8); batten (10) over lower edge of weather screen jams this against sides of washstrake and washstrake moulding and is secured by series of widely spaced sennit stitches to upper edge of washstrake; any extra length of lauhala cut off below batten (after Buck, 1932).

Tufts of frayed-out *tou* bast are usually tied on at intervals along the top edge of the screen. In the British Museum hull they are placed opposite the ends of the gunwale braces, partly concealing them. A very small tuft is also found at the inner end of the crest ridge of each end piece (fig. 114, *a*).

The full-sized canoe hulls in the Dominion Museum, New Zealand, and the United Services Institution, London, are exceptional in being without weather screens. As they are the bodies of outrigger canoes, it is probable that this fitting disappeared when the outriggers were removed.

For the purpose of stiffening the upper works and of giving support to the weather screen, the broad bases of a number (usually four or six) of highly arched wooden braces (fig. 119), are lashed at intervals upon the broad gunwales. Except the aftermost brace on the fore side of the stern seat, which has a flat upper surface without projections, these arches give off at each upper corner a short truncate heel, useful when lashing the brace to the gunwale. These braces are the morphological equivalents of the low-arched braces of Tongarevan canoes, which differ from the present ones in being sessile, a divergence due to the circumstance that weather screens are not used in Tongareva to heighten the sides.

Six narrow thwarts rest on the inwardly projecting beading of the washstrake seams (fig. 116, *g*), loosely tied in position, in the large hull of the Dominion Museum, New Zealand; there are no signs of any in the smaller British Museum one.

The washstrake and end pieces and even the gunwale braces are usually elaborately ornamented with inlaid mother-of-pearl. In the Dominion Museum hull, which has its name "Tuhuna" inlaid upon one bow and "Manihiki" upon the stern end piece, cruciform stars formed of a central circular disc surrounded by four radiating lozenges alternate with double vertical rows of round discs upon the washstrakes. In one model a line of inverted lotuslike discs is the principal part of the design. Handsomest of all is the inlay upon the hull in the British Museum, the "Maui" of "Rakahanga" (figs. 113, 114). In this beautiful canoe the washstrake is adorned with three parallel rows of inlaid discs. The top row consists of a long string of winged symbols, the second of equilateral triangles, and the bottom one of round discs, all perfectly aligned and absolutely symmetric and clean-edged. The end pieces are similarly ornamented with various combinations of round, triangular, lozenge- and diamond-shaped inlaid discs, and the seams between the end pieces and the underbody are concealed by ovately angular pieces of mother-of-pearl over a sewn-on batten of tortoise shell.

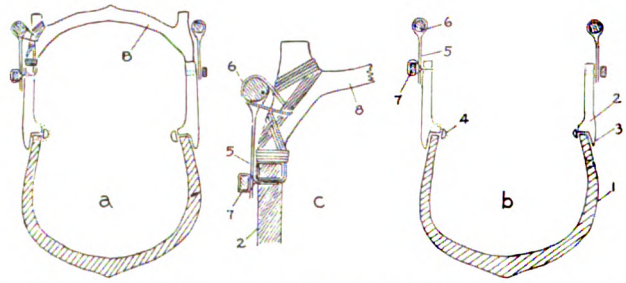


FIGURE 119.—Structural details of Manihiki canoe hull: *a*, section at placement of cross brace; *b*, transverse section between arched braces; *c*, details of lashings (as in British Museum canoe hull) which secure cross brace to washstrake and weather screen to cross brace and washstrake; 1, underbody; 2, washstrake; 3, washstrake flange covering washstrake seam on outer side; 4, batten covering this seam on inner side, lashing shown by dotted line; 5, weather screen; 6, weather-screen pole; 7, leaf-covered batten holding lower edge of weather screen in position against washstrake; 8, arched cross brace.

The outrigger hull in the United Services Museum is a few feet shorter than the one in the Dominion Museum, with a beam of 15 inches, dimensions apparently the average for ordinary canoes of Manihiki. Evidently it is a workaday craft, for besides showing signs of wear, the amount of pearl inlay used to ornament it is small in amount and restricted in its distribution.

The general form is as already described. The underbody is in four sections, each averaging about 6 feet in length. These are butted end to end and lashed together with sennit through opposed paired holes; the joint is protected on the inside by a batten of wood 1 inch wide, under the lashing (fig. 116, *e*), and on the outside by a narrower strip of tortoise shell, 0.5 inch wide. Generally four turns of sennit show on the outside, crossing the tortose-shell batten, with three on the inside and a single one passing obliquely to the next pair of holes.

The bottom has an angular keel ridge throughout its length. The bilges are rounded and prominent and the sides have a distinct tumble home. Toward the stern, in the region originally occupied by the missing "seat", the bilges become moderately but distinctly angular (fig. 116, *d*).

The washstrake, which is 7 inches deep, is slightly everted; its lower edge is fitted upon the underbody as in those described by means of two flanges, one inner, short and horizontal, and the other outer, long and vertical (fig. 116, *c*, 4); the seam is made secure on the inner side by means of a cylindrical batten pressed against a fibrous layer laid over the seam, the

whole lashed tightly together by turns of sennit which do not show externally. Two sections make up the right washstrake, three the left.

The form of the ends is as in the small British Museum example, but from the after end the stern seat is missing. The weather screen on each side has also disappeared, together with the sternmost of the cross braces that held it in position. There remain four cross braces: of these the foremost, placed immediately behind the forward seat, is slender, the third and fourth stout and typical, and the second intermediate in size between the first and third. All are of the usual shape. Two thwarts, stoutly fusiform in plan, rest on the gunwales (fig. 116, *g*).

The stern end piece has three rectangular knobs of the usual shape in line at the after end. Contrary to the usual custom as seen in models and the two hulls already described, there appear to have been several similar knobs along the median line of the fore end piece, forward of the fore seat (fig. 116, *a, b*).

An exceptional feature is the frugal use made of pearl inlay; this is restricted to four vertical compound series of round discs on the aftermost section of the washstrake below the stern seat, to others arranged in serial rows on the upper surface of the cross braces and on the arched after side of the fore seat, and to a group of four at each end of the two thwarts that remain (fig. 116, *b, g, h*).

The outrigger in both the *puni* and the *waka* was formed of two straight booms (*kiato*) connected indirectly with the float (*ama*) by four stanchions (*tiatia*); Buck, who supplies this information, states that the lower ends were let into the float and the upper ends lashed to the extremities of the booms, and adds:

> Unfortunately this form of connection has been completely abandoned and I can only suggest that the four pegs [stanchions] consisted of an outer and inner pair, but whether they simply embraced the sides of the boom as in the Samoan canoe or crossed under it, I am unable to say. I was told in Aitutaki that instead of the [present] usual Y-shaped peg, the larger canoes had two pairs of *tiatia* which were crossed under the boom. There has been traditional intercourse between Aitutaki and Manihiki.

In this connection it is worthy of note that drift-voyage communication between these islands is attested by Williams (1837, p. 468), who mentions information received by him of a canoe full of people having drifted from Manihiki to Aitutaki, 50 or 60 years before his time, that is, about 1770 or 1780.

Although several museums possess examples of the hull of the Manihiki outrigger canoe, so far as I know there is but one which retains its outrigger; this is a model, 1 foot 10 inches long, in the Peabody Museum, Salem, Massachusetts (fig. 120).

The booms are two in number, straight cylindrical poles lashed athwart the gunwales and without ornament. The float is abruptly pointed at the fore end, attenuate and truncate at the after one. In section it has the form of an inverted top with the apex cut off. Each of the sloping sides is ornamented with a discontinuous row of inlaid pearl-shell discs lacking in the middle region, where a curious ornament in the form of an inverted four-sided pyramid is pegged on, upon the narrow upper edge; a pearl-shell disc is inlaid on its broad flat summit and on each side is a single one of obovate shape.

As the connectives were missing when the model was received at the museum, the float has been tied on with string. How it was originally attached is doubtful. Toward the fore end there are indications of the former presence of two pairs of inserted stanchions and a transverse hole above and between their insertions: toward the after end the indications suggest that here there was but a single pair of inserted stanchions, associated with two transverse holes, one before and the other behind these stanchions, indicative of the use of sennit braces of some description.

The hull is of the usual design and is richly inlaid with circular and heart-shaped discs of pearl shell. Besides the outrigger booms and the usual arched gunwale braces, there are three stout cylindrical thwart spars lashed upon the upper edges of the weather screens. All the ends have six circumferential grooves of use to make fast the shrouds, stays, and other rigging. On the starboard side a large quarter rudder is pivoted, a deep groove in one shoulder fitting over the projecting end of the after thwart on the starboard side.

The canoe is rigged to sail. Two masts are present, each with a mat sail of the Oceanic lateen type, laced on with running half-hitches to a stout yard and a slender boom, the latter curved inward toward the outer end. The heel of each yard is long and pointed.

The two masts are alike. Each masthead is large, angular, and perforated with a transverse hole through which the halyard is rove. Toward the lower end of the mast but above the level of the thwart spars is another perforating hole; the lower end of the halyard may have been passed through this to be made fast or it may have accommodated a long belaying pin for the same purpose.

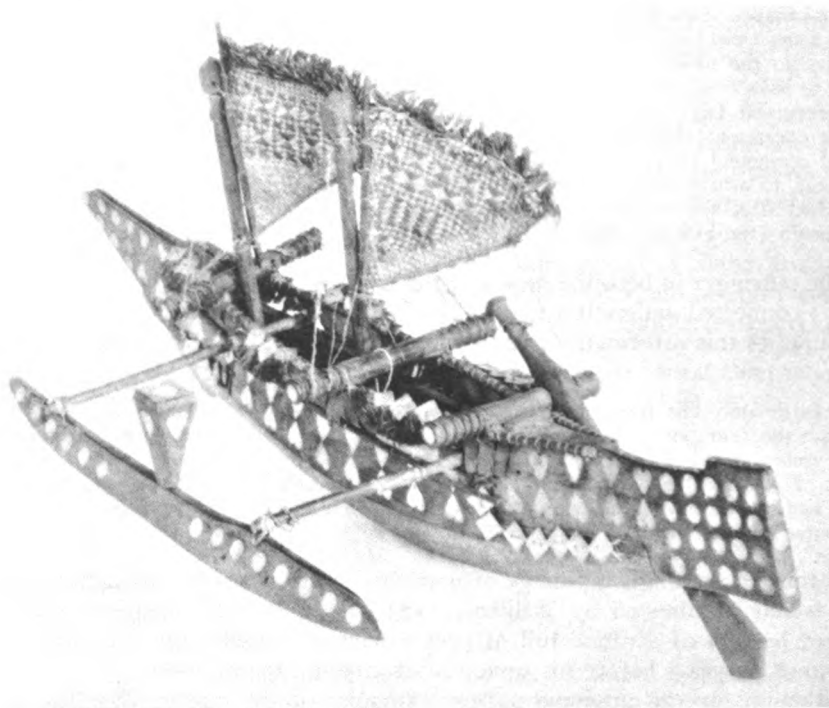


FIGURE 120.—Only known model of a Manihiki outrigger canoe of ancient type with outrigger still in position (Peabody Museum, Salem); connectives missing, attachment improvised; masts probably improperly stepped.

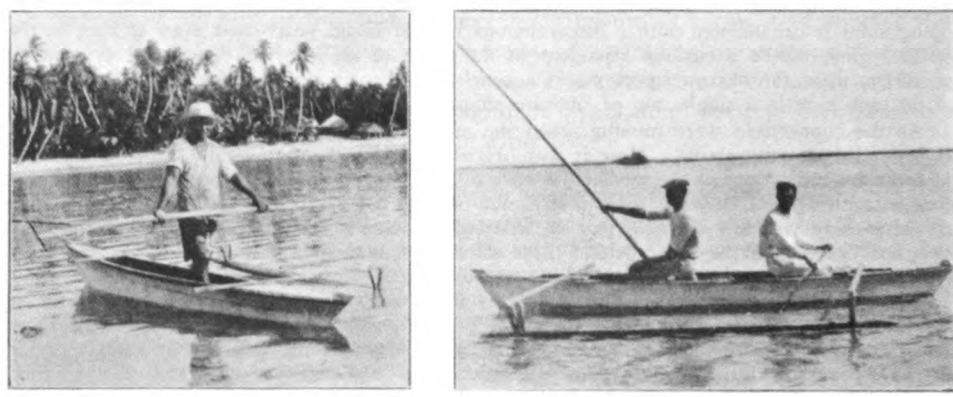


FIGURE 121.—Modern outrigger canoes of Manihiki, plank-built after a European model, with stem and stern posts to which side strakes are nailed; both ends covered in for a short distance; outrigger has two booms, each with a board attachment, consisting of two flat staves diverging upward from float to boom, which rests on their upper ends (from Buck, 1932).

The mat sails are handsomely patterned by the use of lauhala strips of two colors and the head is heavily fringed with frayed out *tou* bast. At present one mast is stepped in the bottom of the hull right forward against the first thwart spar and the second amidships on the fore side of the second thwart spar. Actually the second mast should be stepped abaft this second spar, in which there is a socket hole amidships for the stepping of the yard heel.

MODERN TYPE

According to Buck (personal communication) the present canoe in universal use is made of imported sawn timber (fig. 121). It has both ends pointed and is flat-bottomed.

The two straight outrigger booms are [each] attached to the float by two pieces of board a little wider than the diameter of the boom. The lower ends are inserted wedge form on either side of its mesial longitudinal line, and the upper ends, which diverge in V form, support the boom on their upper edge, which may be concave. The lashing is made by tying a running loop over the boom on one side around the boom, passing the braid through the stanchion hole, looping it over the boom on one side, back through the hole, and looping it over the boom on the other side of the stanchion. This is continued for a few turns and then circumferential turns are taken around the lashing between the stanchion and the boom and the end fixed to one of the vertical limbs of the lashing by half-hitches or an overhand knot [fig. 122].

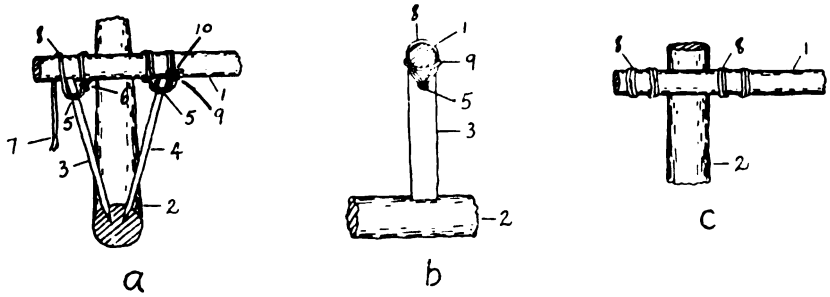


FIGURE 122.—Outrigger attachment of modern Manihiki canoe: *a*, view from aft, plank connectives may have their upper ends slightly curved to accommodate rounded boom and their lower ends are sharpened and inserted obliquely into float; *b*, view from one side; *c*, view from above. 1, boom; 2, float; 3, outer plank connective; 4, inner plank connective; 5, single hole bored through each connective a little below upper edge; 6, slip noose passed around boom; 7, sennit passed through stave and over boom; 8, transverse turn over boom; 9, circumferential turn; 10, finishing tie (from Buck, 1932).

It is quite possible that, through communication with Aitutaki, this peculiar form of connective has been derived or developed from the Y connective employed there. The modern Marquesan board connective has also a distant resemblance to this unique Manihiki design, but this is only superficial, the method of making connection with the boom being quite different in the two localities.

DOUBLE CANOES

MODELS

Apart from the knowledge to be gleaned by examination of models of the double canoe (*waka taurua*) formerly in use in Manihiki, scattered among museums, no information is available respecting their construction. The present inhabitants are unable to afford any help beyond furnishing the names of a few of the principal parts. Most great museums throughout the world contain models of this peculiar craft, but scarcely two agree in the number, form, and position of the fittings and particularly of the masts, sails, and standing rigging.

It is otherwise with the form, construction, and embellishment of the hulls; the models show them to have been identical in all respects with those of the larger outrigger canoes (*waka*) already described, hence no further description of these is necessary.

The two hulls of each double canoe in these models are connected a short distance apart by several stout cylindrical cross booms, usually three, but numbering four in models in Cologne Museum and the Royal Scottish Museum, Edinburgh (fig. 123). These booms (*kiato*) rest directly upon the edges of the washstrakes and pass through the weather screen on the inner side of each hull, that is, the side facing the companion hull; on the outer side they are cut off at the gunwale so that their ends are within and concealed by the weather screen.

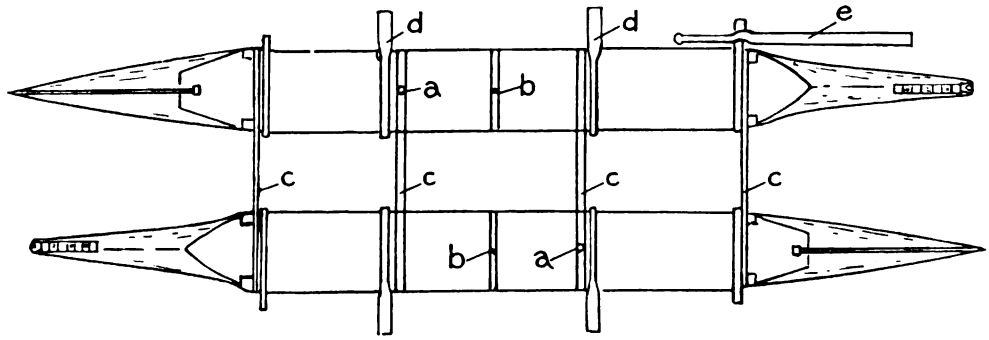


FIGURE 123.—Diagrammatic plan of double-canoe model from Manihiki (Royal Scottish Museum, Edinburgh): *a*, mast steps; *b*, pit wherein heel of yard is stepped; *c*, primary booms connecting the two hulls, which are respectively connected heads and sterns together; d, thwart spars which here flatten distally and project outboard, the homologues of secondary booms; *e*, quarter steering paddle.

In addition to the usual connecting booms common to all double canoes, many models (Sydney and Cologne) have the hulls further connected by a number of stout rectangular "thwart spars" crossing both hulls and projecting outboard to a considerable distance on the outer aspect of each canoe. Their number ranges from three to five, but four are most common and this number is generally seen in models which appear to be most carefully made. In a considerable number, however, there is a separate set for each hull (British Museum, Royal Scottish Museum, and Berlin Museum models); each spar, here broad and thwartlike, though projecting as usual on the outer side, is cut off abruptly on the inner side of the same hull, beyond which it does not extend. These thwart spars also differ in their form; in some models all are broad and thwartlike (British Museum and Bernice P. Bishop Museum); in others those nearest the ends of the hulls are cylindrical, and the inner ones lying betwixt the others are narrow inboard and spathulate in the outboard section (Royal Scottish Museum). (See figs. 123, 124).

In a few models (Australian Museum, Sydney, and one of three Berlin models) the space between the two hulls on a level with the upper margin of the weather-screen is filled in with continuous planking and for the same length.

MASTS AND SAILS

A characteristic feature is that the hulls are connected with the heads in opposite directions—that is, they lie head to stern; in size the hulls are approximately of equal length. This arrangement would enable them to sail either end forward. The Tuamotuan type of double canoe had the same ability, but the hulls were not arranged head to stern, as each had both ends alike. The type of sail set on most Tuamotuan double canoes was also closely related to that of Manihiki, if indeed not identical—a variety of the Oceanic lateen.

The differences in masting of the models are so great and so numerous that it is difficult to find two that agree in all particulars. Indeed, the divergences are so

striking as to arouse a suspicion that the models have been manufactured specifically for sale to travelers and that their makers allowed themselves considerable latitude when rigging them. Or it may be that models continued to be made long after double canoes had ceased to exist, with the consequence that the makers of the later models had no longer sufficient knowledge of the correct rig. Some divergences have undoubtedly arisen through errors made in attempts to repair and set up the rigging when the parts were adrift. Mistakes of this kind are fatally easy to make. The only important mast feature which all models have in common is the number—two invariably.

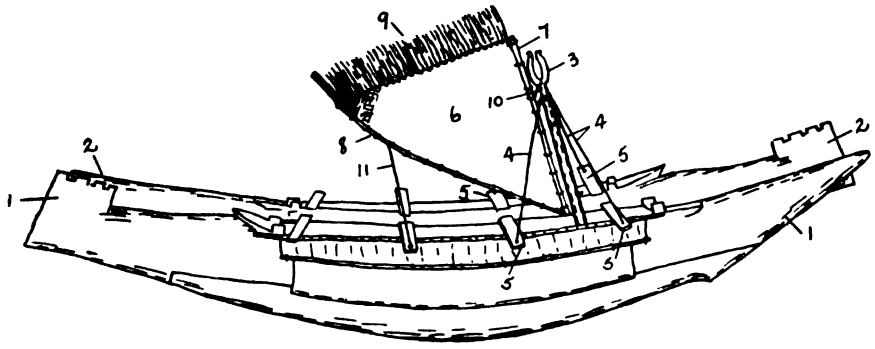


FIGURE 124.—Model of double canoe, Manihiki, the two canoes joined with heads in opposite directions, the connecting booms hidden by weather screen: 1, 2, hulls; 3, bifurcated masthead; 4, shrouds; 5, thwart spars; 6, sail; 7, yard; 8, boom, slightly curved toward outer end; 9, sail fringe; 10, halyard rove through a sheave hole below arms of masthead; 11, sheet (after Buck, 1932).

Approximately half the models are rigged with the masts tandem, sometimes in the same hull (Berlin, two models, and Horniman Museum, London), sometimes on supports midway between the two (Australian Museum and Cologne). The remainder have them stepped one in each hull; even here there is no consistency, for in some they are stepped abreast (Peabody Museum, Salem, and Berlin), and in others they are upon alternate booms or alternate thwart spars (British Museum and Hamburg). In a few they are stepped on the connecting booms (fig. 123) (Royal Scottish Museum, Cologne, and Salem); in the majority, upon the thwart spars (Berlin, A and C, British Museum, Oxford, Hamburg, and Sydney).

The general method of stepping a mast is to pivot it upon the rounded side of a thwart spar or of a cross boom, the heel of the mast being fashioned into a wide semicircular notch to fit upon the side of a cylinder (Horniman Museum, British Museum, Edinburgh, and Hamburg). In two models (British Museum and Berlin C) the heel of each mast is provided with a central peg which fits into a socket in the upper side of one of the thwart spars. In two others the heels of the masts are rounded to fit into corresponding cup-shaped hollows on the thwart spars (Horniman Museum and Berlin A). In a single model (Berlin B) the masts, here abreast, are lashed to the fore side of the second thwart spar, probably due to an error in rigging the model after its arrival in Europe.

Taking the normal number of thwart spars to be four, the usual arrangement of the masts is with the fore mast stepped upon the second thwart spar (the second cross boom in the Cologne and Edinburgh models) and the after one upon the fourth spar (the fourth cross boom in the Cologne model and the third one in the Edinburgh model), counting from the functional fore ends. When abreast they are stepped against the second thwart spar if there are four (Berlin B), or on the middle one when there are three (Salem).

From the evidence of the best models, though these are not in the majority, I am definitely of the opinion that the usual arrangement in these Manihiki double canoes was for one mast to be fitted in each hull, stepped or rather pivoted either upon the first cross boom from the respective head, or, alternatively, upon the

first or the second thwart spar, according to whether the number present was three or five. In twinned hulls set head to stern this would enable the craft to have a functional foremast and an aftermast in the same respective positions whichever end was being sailed foremost.

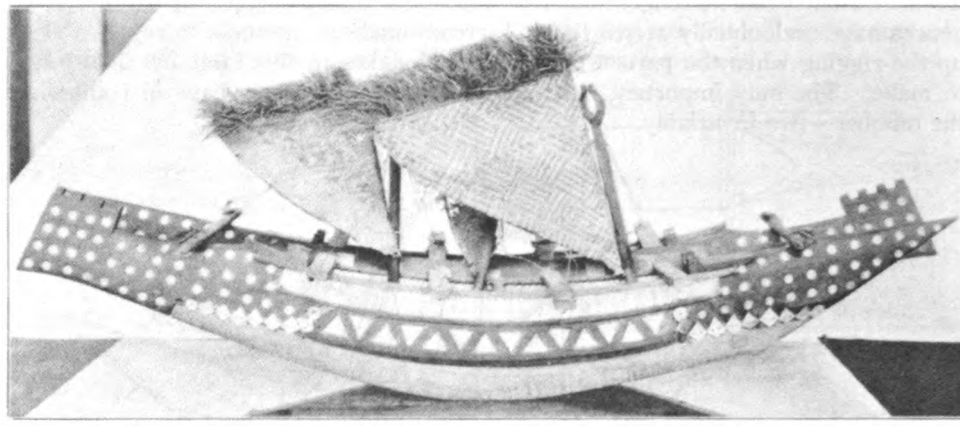


FIGURE 125.—Model of double canoe, Manihiki (Bernice P. Bishop Museum).

The sails are of matting; each has the usual triangular Oceanic form, enclosed between two spars, a yard and a boom, and is set apex downward. The pointed heel of each yard is stepped in a socket cut normally in the upper surface of the thwart spar immediately forward of the one on which the mast is stepped. An exception is seen in the British Museum model; in this the mast in the port hull is stepped on the third thwart spar, that of the starboard one on the second. But the sail step in each is on the median gunwale brace immediately abaft the median cross boom, there being three, so, while the port sail has its tack stepped forward of its mast, the starboard one has it abaft the mast! Another exception is seen in the Royal Scottish Museum model (no. 1902-73). Here the mast in one hull is stepped on the second cross boom; that in the other on the third one, there being four in all. The tacks of the sails are arranged as in the British Museum model, each being turned toward midships and so facing one another. Here again the heel of each yard is stepped upon the median gunwale brace or spreader in its respective hull. In other models the long pointed heel of the yard, instead of being forward of the mast as in other localities, is lashed to the lower end of the mast as in the model from Fagatau in the Tuamotus in Bernice P. Bishop Museum. This arrangement causes the yard to lie against the mast in its whole length and is one I do not consider likely to have been employed for a variety of reasons. The pointed heel of the yard is obviously intended to be stepped in a socket, an arrangement which, indeed, actually appears in several models. The mast and yard may have been tied together for reasons involved in the packing of the model or possibly due to error in setting up for exhibit.

The masts in most models are square in section for most of their length, or square sections may alternate with cylindrical ones; in some the masts are cylindrical throughout their whole length. The mastheads are generally of the form seen in Fijian *thamakau*, shaped into a deep, upturned crescent, the halyard passing through a sheave hole immediately below it. In the model in the Australian Museum the masthead has the form of a rounded knob, with the sheave hole just below.

The rigging of many models is misplaced or partly missing, making it difficult to ascertain the original arrangement. There can be no doubt, however, that each mast had a pair of shrouds, one on each side, attached below to the outboard ends of the connected or nearest thwart spar. Also a corresponding pair of backstays led from a point just below each masthead to the ends of the thwart spar immediately abaft the mast. In the models the sheet is attached about two thirds along the boom, and there is reason to believe that a spilling line was also used. The tail end of the halyard is made fast round a belaying pin passed through the mast at a convenient height above its lower end.

A single steering oar with a long parallel-sided blade was employed, pivoted by means of a semicircular notch cut out of one side upon the outboard end of the aftermost thwart spar of whichever was the starboard hull when sailing. This portion of the spar is always cut into a cylindrical form for the purpose. (See figs. 120, 126, *a*.) The ordinary paddle (fig. 126, *b*) had an elegant lanceolate blade like those of New Zealand.

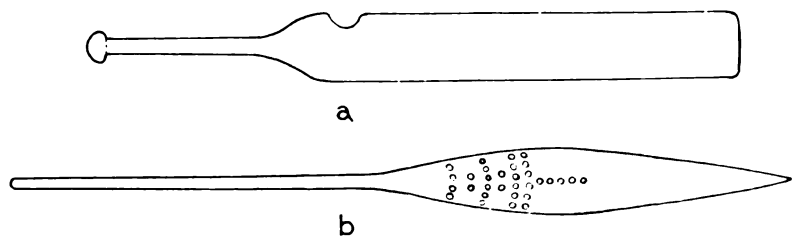


FIGURE 126.—Manihiki paddles: *a*, quarter steering paddle, double canoe model (Royal Scottish Museum, Edinburgh); *b*, paddle of an ancient outrigger canoe, blade inlaid with discs of pearl shell (British Museum).

Dr. P. H. Buck (personal communication), who recently visited Manihiki, states that not only have these double canoes disappeared, but that even models are no longer made. No detailed information could be obtained in the field concerning their construction. Almost the only particulars that survive are the names of the principal parts.

USE FOR PERIODICAL MIGRATIONS

It appears probable that these double canoes were employed for no other purpose than of transporting the entire population on the occasion of the annual migration between Manihiki and Rakahanga and that they were improvised, for this 20-mile voyage, out of pairs of sailing outrigger canoes temporarily joined together, head to stern; this would account satisfactorily for the mast arrangement —one stepped in each hull. As large numbers of women and children had to be conveyed, in addition to quantities of fishing gear and domestic materials, the use of double canoes would be desirable because of their greater carrying capacity and stability over those of the outrigger type.

Possibly the fact that the hulls of these double canoes were taken apart and refitted as outriggers as soon as they had fulfilled their special purpose may have prevented the stereotyping of many of the equipment details. Such may have been left largely to individual fancy and convenience and these individual differences may afford a reason for some of the puzzling museum models.

Although the canoe type described is continually referred to as belonging to Manihiki, it is to be noted that the population of this island and that of Rakahanga constituted a single stock until 1852, one island only being in occupation

at any one time. Gill (1876 *a*, p. 12) states that the frequent loss of life occasioned by the periodical migration of the whole population from one island to the other induced the islanders, at the suggestion of Gill, to divide themselves into two distinct communities, one occupying Manihiki and the other Rakahanga. He describes them as "clever and industrious natives".

Sea-God Propitiation

The people of these islands (Gill, 1880, p. 104) were accustomed in former times to exhume the corpse of a king, a priest, or a distinguished fisherman after it had been buried for three days and to cut off the head, a coconut being placed in the grave in its stead, "the fruit of which was eaten by strangers". The head was deposited in a finely woven coconut basket and placed in the fore part of a canoe as a sea god. "When overtaken by unfavorable winds on a voyage, or drenched by tropical rains, the head would be taken out of the basket and held aloft by the hair whilst prayers were offered to it for favorable weather. The hands and feet of dead chiefs, priests, and prominent fishermen were used for the same purpose by people of inferior rank."

Affinities

Leaving out of consideration the origin of the modern outrigger canoe of Manihiki, it is found that concealment of the washstrake seam by means of an overlapping flange is a remarkable feature of technique common to Manihiki and the Cook Islands and that it is found nowhere else except in Hawaii, where it is slightly less developed. In nothing else is there any close resemblance with the Cook Islands, but it may be that the presence of arched gunwale braces in the canoes of both Manihiki and Hawaii is further evidence of an ancient community of origin. The form of the arched braces is approximately the same in both places, but the curvature is reversed; in the Hawaiian brace the chord of its arc is uppermost, whereas it is turned downward in that of Manihiki.

Closer affinity is shown with Samoa: the hulls of the canoes of both localities are without high or curved-up ends and are equal in length when employed as the twin units of double canoes. The knobs on the upper edge of the after end piece of Manihiki canoes appear to be homologues of the median row of knobs provided for the attachment of egg cowries on Samoan canoes. Another link with Samoa is the use, in common, of *velo* as a term for the stern or stern end piece (Buck); this application of the word is unusual in Polynesia, its place being taken generally by *muri* or *taumuri*.

With the Tuamotus relationship centers in the ability of the double canoes of both regions to sail either end foremost; in the double canoes of both places it was the prevalent custom to fit two masts, carrying sails of a primitive lateen form, handled and probably rigged somewhat differently from the Oceanic lateen of Fiji and Micronesia.

TONGAREVA

Outrigger Canoes

Wilkes (1845, vol. 4, pp. 277-279), who visited Tongareva (Penrhyn) in 1841, states that his ship, on arrival, was approached by great numbers of canoes, many of them large, containing from 7 to 16 men each. They were fashioned of "a dark-colored wood, with a light outrigger and without sails: they were ingeniously constructed of pieces sewed together with sennit; they leaked badly, however, and it was necessary to keep one man constantly bailing. They were the largest that had yet been seen constructed on a low island".

Choris (1822-26, vol. 1, p. 15, pl. 12, fig. 2) gives a figure made in 1816, but provides no description except for saying that these canoes were constructed of several pieces of wood sewn together, and that some held as many as 30 men. This capacity is confirmed by Lamont (1867, p. 195), who accompanied a war party of 30 on one occasion.

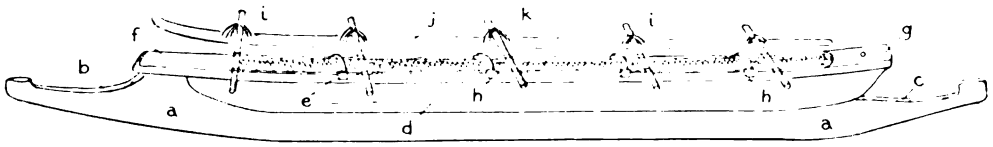


FIGURE 127.—Outrigger canoe, Tongareva: *a*, underbody (*oa*); *b*, stern (*vero*); *c*, head (*isu*); *d*, washstrake; *e*, gunwale rail (*huatanga*); *f*, steersman's seat; *g*, lookout's seat; *h*, gunwale brace (*mann*); *i*, outrigger booms (*kiato*); *j*, float (*ama*); *k*, connectives (*tutuki*); a stringer (*torutoru ama*), lashed fore and aft over the booms, is omitted for the sake of clearness (after Choris, 1822-26, vol. 1).

From the canoe drawn by Choris (fig. 127) and the details given by Lamont, eked out by some fragments of information gathered by Dr. P. H. Buck during a recent visit to the island, it is possible to gain a fairly clear understanding of the characteristic features of this peculiar Tongarevan type; comparison with the Manihiki hulls preserved in museums enables several points to be further elucidated. The canoes appear all to have been single outriggers; there are no references to the existence of double canoes. The majority, if not all, appear to have been furnished with multiple booms; Choris' figure shows five, with indirect attachment of the float.

The hulls were constructed of the *tou* (*Cordia subcordata*). According to Lamont (1867, p. 151) the tree trunk selected was split into variously sized pieces, the longest and narrowest of which was shaped into the keel portion, about a foot in width, rounded below, hollowed longitudinally above. The ends were left solid, to project in ram form well beyond the points which were destined to mark the positions of the head and stern. The keel line under these long projections sloped slightly upward and terminate in Choris' figure in blunt upturned knobs.

By a peculiar linguistic displacement, the keel, according to Buck (1932, p. 191), is now termed *oa;* elsewhere in Polynesia this word is the term appropriated either to the gunwale of a canoe or to its washstrake.

Upon the edges of the dugout base between the head and stern the sides, sometimes three strakes deep (Buck, 1932, p. 191), were built up with pieces of plank of irregular shape, sewn together at the edges between which a layer of coconut fiber was placed as calking. Covering each seam a narrow batten (*takatua*) 2 to 3 inches wide was countersunk in a groove cut out half from the outer edge of each adjoining plank. The sennit lashing passed through opposite

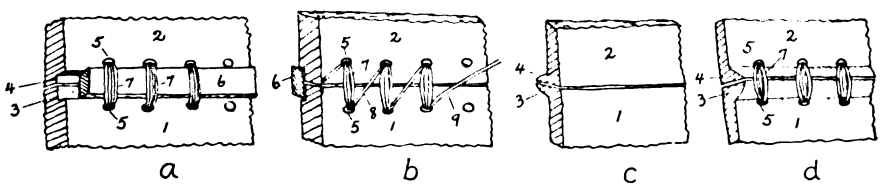


FIGURE 128.—Comparison of hull lashings of plank canoes, outside and inside views (from Buck, 1932): *a*, *b*, Tongareva; *c*, *d*, Samoa. 1, lower plank or keel piece; 2, strake above 1; 3 and 4 of *a*, wide rectangular groove along outer side of seam; 3 and 4 of *b*, flanges on inner side of seam; 5, 5, paired holes; 6, batten placed in groove; 7, lashing; 8, braid carried diagonally from lower hole to upper holes of next pair. Samoan lashings do not show on the outside; lashing of each pair of holes is separate and end of braid is cut off so that they show as interrupted lashings.

and paired holes bored through the plank edges on either side of the batten; after several turns were made through one pair of holes, the braid was carried on to the next pair and the operation repeated. When the planks were all sewn together, the through holes were plugged with coconut fiber (fig. 128).

The upper edge of the topmost strake (the gunwale rail) was margined on the inner side by a broad ledge or flange after the fashion of the better-made Samoan canoes; on this the paddlers sat, according to Lamont (1867, p. 152). The gunwales had little or no sheer and were held apart and stiffened partly by the proximal ends of the booms, which were lashed upon and across them, and partly by several stout, arched wooden braces (*manu*) fixed convex side upward, of a form closely related to those characteristic of the Manihiki canoes, in which the horizontal arched region is supported on two fairly long subvertical limbs; in the Tongarevan type the arch is almost sessile. As seen in a Manihiki hull in the Dominion Museum, New Zealand (Best, 1925, p. 209), and also in the smaller British Museum example, the base of each limb is lashed upon the upper surface of the gunwale, whereas in Choris' figure of a Tongarevan canoe it appears to be lashed upon the outboard side of the gunwale. Buck considers, however, from examination of certain models of Manihiki double canoes, that the braces were lashed against the inboard edge of the opposite gunwales in both localities, but as this is certainly not true of the two surviving Manihiki hulls, the presumption follows that the braces were also lashed upon the gunwales in Tongarevan canoes. Weight is lent to this conclusion by the fact that attachment to the inboard edge would be faulty from the constructional standpoint; when so attached the gunwale edge would be liable to damage more readily than with the stouter attachment that would result from lashing the limbs upon the broad horizontal surface of the gunwales.

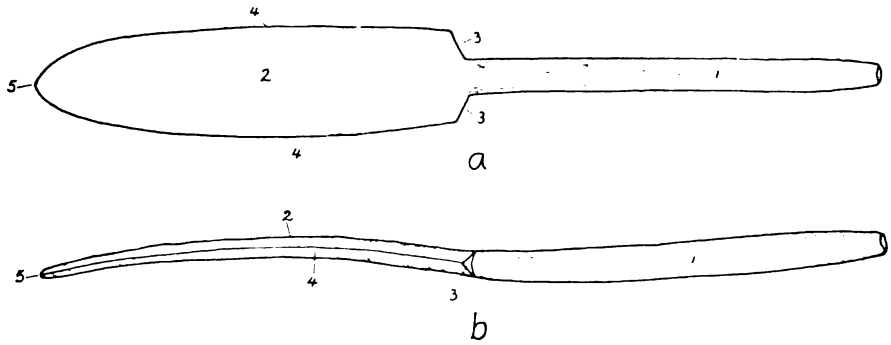


FIGURE 129.—Model of ancient Tongarevan paddle: *a*, face view; *b*, side view; 1, loom, may be proportionately too thick; 2, blade; 3, shoulders; 4, sharp side edges; 5, blunt tip without thickening or projection (from Buck, 1932).

The ends of the built-up region of the hull appear to have been decked over by very short but heavy covering boards. The after cover (fig. 127) seems to have rested partly upon an isolated upward projection from the keel; the form was rectangular. The fore cover, according to Buck's informant, may have been similarly supported in part by an upward projection from the keel, but in figure 127 none is shown, the cover resting wholly upon the forward and converging ends of the two washstrakes. Both covers are comparable or rather homologous with the small "seats" characteristic of the Manihiki hull.

The outrigger, fitted as usual on the port side, consisted of several straight booms (*kiato*) from 3 to 5 in number according to the size of the canoe, attached indirectly to a long float (*ama*) which extended the whole length of the hull with the exception of the terminal ram projections; the after end projected well back beyond the aftermost boom.

The connectives (*tutuki*) took the form of two pairs of stanchions to each boom; judging from Choris' figure, the only authority, they appear to have been overcrossed as in Samoa. Buck's informant (1932, p. 195) stated that a suspensory cord (*ua*) was also used to strengthen the connection of boom and float, again as in Samoa.

The figure of Choris shows a stringer lashed fore and aft over the booms to form a paddle rest, but for the sake of clearness this is omitted in the copy given as figure 127.

The paddles (*hoe*) are described by Lamont (1867, p. 152) as long, the blade narrow and curved. The curvature distinguishes them from the straight, lanceolate-bladed ones of Manihiki (figs. 126, *b*, 129).

Sail Rig

The Tongarevans appear to have made little use of sails. Of the older writers Chamisso (Kotzebue, 1821, vol. 3, p. 219) alone mentions seeing a canoe under sail, but he gives no description. Fortunately Lamont (1867, pp. 242, 243) describes in detail the sail rig used by a canoe within the lagoon:

> The sail [*ra*] is as simple in construction as it is primitive in appearance. For the purpose three long palm-boughs are cut from the nearest tree and, after a few strips of bark have been torn from them, they are conveyed to the canoe. The lower or thick end of a bough is placed at the bottom of the canoe, with its long slender leaves standing perpendicularly to the height of about 10 feet, and made fast to the crossbar of the outrigger, which runs across the little vessel. A bough is then placed on either side of this, attached to it at the bottom, but inclined outward, and also fastened to the crossbar. At the top the slender ends of the latter are bowed over to the centre end, the mingling leaves of all being interlaced a little to present further resistance to the wind. This, when completed, forms a broad sail. Strips of bark are fastened to the most extended part of the outer boughs, which are again secured to the stern outrigger [boom]: and thus the cocoanut tree supplies more of their necessaries—sails, masts, spars, and rigging being all constructed in a few minutes from its boughs.
>
> As there is no step for the mast to rest in, this deficiency is supplied by a little boy, who sits in the bottom of the *vaka* with his feet against it. By trimming the lee side of the sail a little aft, the boat will keep her course by the help of the paddle when the wind is on the quarter, but will not sail on a wind, or even with the wind abeam, when, having little hold on the water, she drifts to leeward. When the wind shifts thus the sail is taken in in as primitive a manner as it is set. The lashing being cut, and the backstays cast off, away goes the whole ship's rigging overboard, the work of refitting being very speedy and easy.
>
> Toward the end of our voyage we had the wind on our quarter, blowing pretty fresh, and I had to remain with my feet at the bottom of the mast, whilst the small boy sat on the outrigger to keep her from capsizing, moving out on it or in again as the wind increased or fell.

Primitive and makeshift as this type of sail is, in essentials it is identical with the triangular Maori sail and belongs therefore to the same class as the Hawaiian and old Tahitian rigs.

Comparisons

Comparing the canoes of Tongareva and Manihiki, it is evident that while the designs clearly betoken derivation from a common source, the Tongarevan canoe exhibits evidence of considerable degeneration, most marked in the form of the sail and gunwale braces and in the construction of the head and stern. The mat sails of Manihiki, slung on stepped masts, are degraded in Tongareva into a fan of palm leaves without yards or mast, while the elaborately shaped added end pieces of Manihiki and its long-limbed thwart braces are replaced respectively in Tongareva by simple ram projections shaped out of the same log as forms the keel-like underbody and by braces almost sessile. Neither has the Tongarevan canoe any weather screen to make it more seaworthy. These marks of degeneration are to be correlated with the large extent of protected water within the lagoon of Tongareva, which is 9 miles across; it was needless for the inhabitants to have voyaging canoes for intercommunication between the islands of the atoll. The palm-leaf sail may be taken as the index of degeneration reached.

In Manihiki and Rakahanga, lying about 20 miles apart, the periodical exodus from one island to the other made it imperative to possess large and well-found vessels and to provide them with efficient sails; this in turn enabled the people to undertake longer voyages.

At the present day in Tongareva, according to Buck (1932, p. 189), the old type of canoe "has been completely supplanted by large sailing boats used in connection with diving for pearl shell, and small outrigger canoes made of sawn planks after the modern Manihiki design".

TECHNICAL TERMS (AFTER BUCK)

	MANIHIKI	TONGAREVA
Dugout canoe	Puni	Puni
Five-piece canoe	Waka	
Double canoe	Waka taurua	Waka taurua
Canoe hull	Tino waka	
Dugout base	Takere	Oa
Head end piece	Ihu	Isu
Stern end piece	Velo	Vero
Washstrake	Awa	Huatanga
Weather screen	Paruru	
Outrigger boom	Kiato	Kiato
Outrigger float	Ama	Ama
Outrigger stanchions	Tiatia	Tutaki
Stringer over booms		Torutoru ama
Arched cross brace	Manu[a]	Manu[a]
Cross boom of a double canoe	Kiato	
Thwart spar of same	Tuatara	
Platform or deck between the two hulls	Horiki	
Mast	Tira	Tira
Sail	Ra	Ra
Thwarts	Nohoanga	
Paddle	Hoe	Hoe

[a] The term *manu* is also used in Niue and the Ellice Islands. In Niue it is applied to the U-shaped spreaders within the cavity of the hull, which appear to be vestigial rib frames. In the Ellice Islands it is the name of a rod lashed athwart the hull just aft of the fore end cover and of a companion rod fitted just behind the aftermost boom; these rods are called "lifting grips" by Kennedy (1929).

NEW ZEALAND

HISTORICAL RECORDS

The Maoris of New Zealand trace their origin by means of genealogical lists to immigrants from the Society Islands and from Rarotonga who began to arrive in their new home some 32 (or 40?) generations ago, or, reckoning 25 years to a generation, during the first half of the twelfth century. The newcomers, according to tradition, arrived in double canoes and single outriggers, and various particulars have been handed down orally concerning them; the only items of importance here have already been mentioned in discussing the canoes of the Society Islands.

The canoes in which the settlers came would necessarily be similar in type to those in use at the time in the home islands. If the design was not altered greatly in the interval, the principal characteristics would be closely related to those of the canoes described by Cook and his contempoaries: low, projecting prows, lofty sterns, often richly ornamented with carving and decorated with feathers, hulls formed of a keel-less dugout underbody with plank-raised sides, without timbers, and having a decking of the simplest and scantiest description, lacking entirely the elaboration distinctive of Fijian double canoes and sea-going outriggers.

At the time when the Maoris made contact with Europeans they were using double and single canoes and single outriggers. The outriggers appear to have been already rare and on the point of disappearance at that time and the double canoes followed them into oblivion in the early decades of the nineteenth century. By a curious mischance no first-hand details of the construction of the Maori outrigger are on record.

Still more strange, references relating to the double canoes, although they survived much longer, are limited to a crude drawing in Tasman's "Journal", to a bald and sketchy description by Forster, and to a few unenlightening notes by Banks and others. The most feasible explanation of this omission is that the

double canoes were so simply constructed and the outriggers so like those of central Polynesia already familiar to Cook and later voyagers that they considered detailed description unnecessary.

It is noteworthy and significant that nowhere is there any suggestion that the Maoris ever had vessels of the plank-built, keeled *pahi* type in use in the Society Islands and the Tuamotus for voyaging when these islands became known to Europeans.

DOUBLE CANOES

When Tasman (1898, p. 19) discovered New Zealand in 1642, double canoes were in common use, for he writes thus:

> Their boats consisted of two long narrow prows side by side, over which a number of planks or other seats were placed in such a way that those above can look through [to] the water underneath the vessels; their paddles are upward of a fathom in length, narrow and pointed at the end: with these vessels they could make considerable speed. [See fig. 130.]

Tasman makes no mention of seeing outrigger canoes.

A century and a quarter later the double canoe was rapidly giving place to the single canoe, probably coincident with a decline in the maritime enterprise of the people. In North Island double canoes had become rare (Cook saw but one there), though they continued to be numerous in South Island. There are records of their existence in South Island in ever diminishing numbers, at Otago and elsewhere, till about the middle of last century, and a few actually survived until recent times in a comparatively isolated district on the west coast (Skinner, 1912, pp. 145-146).

These Maori double canoes were of a simple and primitive construction, calling for no particular comment save in respect to the profuse ornamentation in the ones used as war canoes. They consisted merely of two open hulls connected by straight beams or poles lashed athwart the gunwales. In one variety the canoe bodies were lashed together side by side (fig. 130); more commonly a short distance separated the two hulls. This interval appears to have been unusually narrow; Banks gives it as "about a foot", but Best (1895, p. 11), quoting a statement made by a native of the Bay of Islands district, places it at about 30 inches. According to the same informant, canoes joined side by side were termed *waka hourua* and those separated by a short interval *mahanga* (twins). Banks (1896, p. 194) further mentions that the double canoe seen off Whale Island, was "covered with boards so as to make a kind of deck", and Forster (1777, vol. 2, p. 381) describes seeing "about 20 canoes, each of which was provided with sails and consisted of two hulls connected by a platform of boards on which lay a heap of soil and ashes, where the natives kept a constant fire". Skinner (1912, p. 146) notes that a Maori informant stated that this platform united the hulls over the middle region, the mast being erected thereon.

At Dusky Bay, Forster (1777, vol. 1, p. 132) saw

> . . . a double canoe hauled upon the shore . . . It consisted of two troughs or boats joined together with sticks tied across the gunwales with strings of the New Zealand flax plant. Each part consisted of planks sewed together with ropes made of the flax plant, and had a carved head coarsely representing a human face, with eyes made of round pieces of ear-shell.

Foster (1777, vol. 1, p. 228) gives a few particulars of another seen in Queen Charlotte Sound in 1773:

> Their double canoe was about 50 feet long and seemed to be new; both the high stern and the head were very curiously carved with fretwork and spiral lines, as described in Captain Cook's former voyage. A misshapen thing, which with some difficulty we perceived was meant to represent a human head, with a pair of eyes of mother-of-pearl, and a long tongue lolling out of its mouth, constituted the foremost extremity of the canoe.

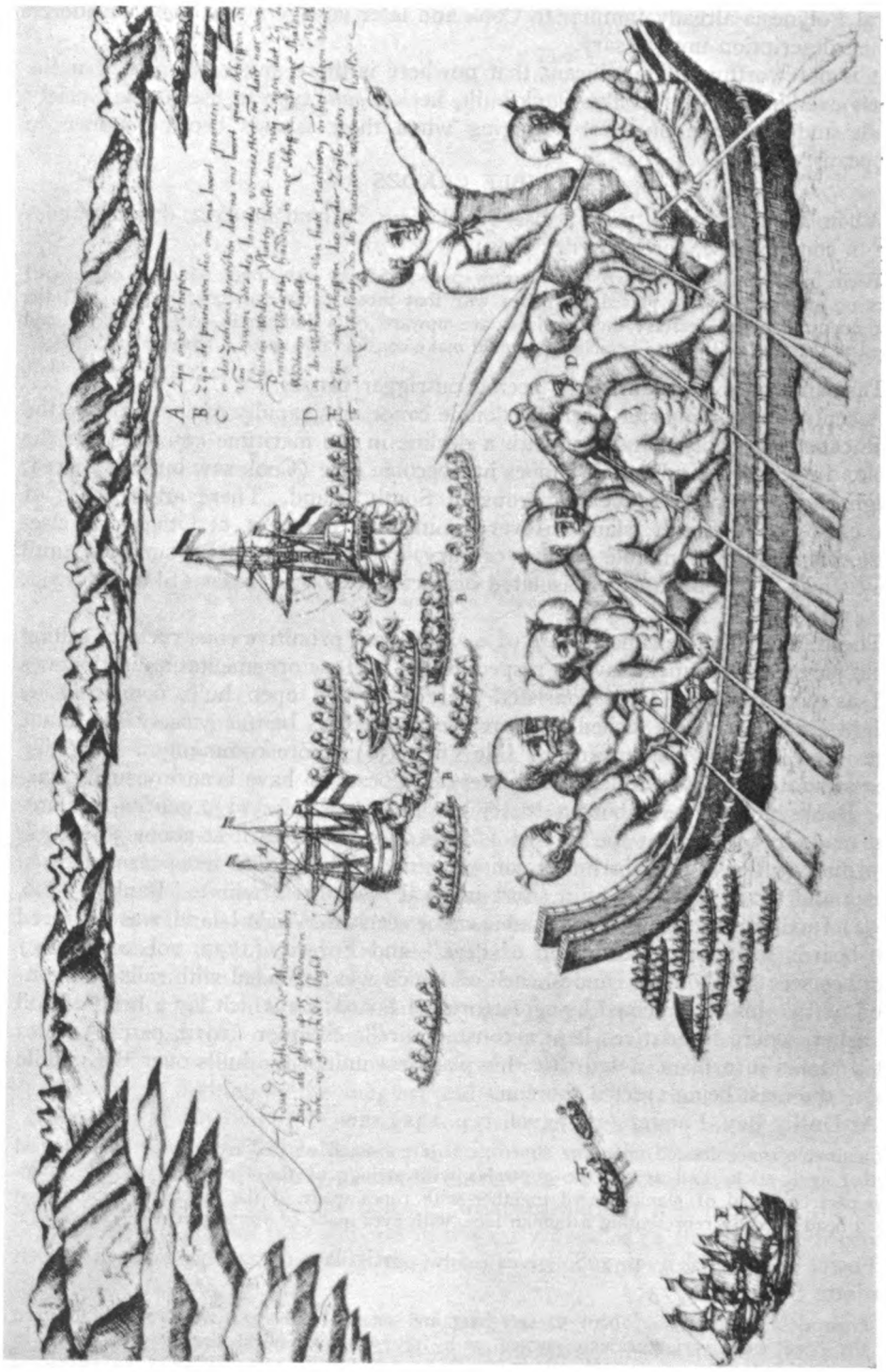


FIGURE 130.—Maori attack on Dutch ships in Murderers Bay, 1642, showing a canoe with twin hulls lashed gunwale to gunwale (after Tasman, 1898 ed.).

These meager particulars constitute everything definitely on record regarding the structure of these vessels; so simple, however, was the design that there is no difficulty in reconstructing their aspect. This represents the most primitive type of double canoe known—the joining together of two similar hulls by a number of crossbars. In canoes used for war purposes, the twin hulls were as nearly as possible of equal length. Each hull, judging from Forster's account, had the same form and ornamentation as were characteristic of canoes used singly. Double canoes intended for war or the use of the chief had hulls similar to the highly ornamented single war canoes; the rest, intended to subserve more or less utilitarian purposes, showed every gradation from the war type down to workaday fishing canoes, poorly finished and almost destitute of ornament. Many canoes were constructed or used doubly, but others were normally employed as single canoes and only converted into double ones to meet a passing need or emergency.

Except for the very rudest, the hulls had high sterns, beautifully carved in fretted spirals and ornamented with feathers; the prows were low and bore a boldly projecting and highly ornate figurehead, of which the characteristic motive was a conventionalized human figure with hideous face and enormous protruding tongue. The body of each hull was a beamy dugout with a deep washstrake sewn on. There were no timbers, although the hull when long was made up of two or more, usually three, sections joined end to end. Tradition says that some of the canoes in which the first settlers came from Tahiti were also made in three sections, simply butted together and sewn in position, the washstrake being depended upon to prevent this compound underbody from buckling. The butted joint, judging from examples of single canoes in museums, gave place later to a kind of mortise-and-tenon joint that imparted much greater strength. No frames were used, but the many thwarts lashed upon the gunwales were serviceable substitutes.

Owing to the large girth of the timber available in New Zealand, the two hulls were roomy enough to accommodate the crew and passengers without need of decking other than a small median platform, absent in many canoes. This lack of necessity for a large deck rendered it needless to join the hulls at anything like the distance apart requisite in those types which depended for passenger and crew accommodation upon a roomy deck platform.

The method of attaching the washstrake and head and stern ornamental pieces, the form and fittings of the mast and sail, and other details of structure have not been recorded by those who had opportunity to do so; there is no reason to doubt that they were essentially the same as those of the single type, of which a short notice of these details is here given.

DOUBLE OUTRIGGER CANOES

Both Smith (1921) and Best (1923) argue that the double outrigger canoe was known to the ancestors of the Maori. They base this opinion upon the wording of certain old Maori traditions orally transmitted. The objections to this conclusion are both linguistic and technical (Hornell, 1932, pp. 131-143).

The principal reference whereon these authors rely is found in the account of the fitting out of the vessel "Takitumu" for a voyage from Tahiti to New Zealand about 500 years ago. As will be seen, a great deal turns upon the accuracy or otherwise of the translation of a single word.

Best (1923, pp. 204-205) gives the text of the Maori tradition and the following translation:

> The two *korere* were then manipulated, one for each side of the vessel. The *korewa* timbers were composed of extremely light wood. The use of the *korewa* is to safeguard the

vessel lest it capsize, and, if it does chance to capsize, that it may continue to float, so that it may be turned on to the keel by the swimming men when it so capsizes. As to the names of the outriggers (*korewa*) I did not hear them mentioned in the *whare wananga.*

Best comments:

The speaker meant the proper names here, not the descriptive names. . . . It is not certain whether *korere* is another name for an outrigger or not, but it looks like it. Herein we have a plain statement that "Takitumu" was a double outrigger vessel, and the office of the outriggers is clearly explained. This is taken from the superior version of the voyage, as preserved by the trained experts of the *whare wananga* or tapu school of learning. In another version of this tradition certain men are instructed to launch the vessel and to attach the ocean-going outriggers (*ka whakamau ai nga korewa moana ki runga*). Again the plural form.

In translating from the Maori version Best gives "outriggers", presumably meaning outrigger floats, as the translation of *korewa.* As is noted above, these *korewa* are described by the Maori expert as being of extremely light wood, and intended to keep the vessel afloat if it were to capsize, which so far as I know is not a function of the outrigger float in any modern canoe, although its presence may contribute in some slight degree to keep a canoe afloat after such a mishap.

That the translation of *korewa* as "outrigger" is open to grave doubt is increased when Best (1923, p. 210) says: "The word *korewa* seems to denote buoyancy and drifting, hence it was applied to both an outrigger and to what may be termed a drift anchor, or sea anchor".

Later Best (1925, pp. 296-297) gives the terms for outrigger as *ama, amatiatia,* and *korewa,* but makes no reference to "outrigger float" and uses the term "outrigger" indiscriminately for outrigger booms, outrigger floats, and for the combination of these into an outrigger frame. Now I doubt greatly Best's inference and identification of *korewa* as meaning outrigger either as boom, float, or frame, though more likely the float, as he says it connotes lightness. *Korewa* is not used elsewhere in Polynesia, so far as I am aware, for either outrigger boom or float; *ama* in some form is universal for outrigger float, and *kiato* for the outrigger boom. I can not think that the Maori would not have used *ama* if the thing meant were an outrigger float. *Ama* is given by Best in his glossary (1925) as a synonym of *korewa,* but in all the quotations given *korewa* alone is the word used although *ama* is the ordinary Polynesian term. The old-time Maori must certainly have used *kiato* generally as the term for outrigger boom, for the word remains to the present day as a word for thwart, the nearest approach to an outrigger boom that is to be found in modern canoes and boats in New Zealand, and if *kiato* was used, why not *ama* also, as these are companion or linked terms throughout the rest of Polynesia?

Besides the linguistic difficulty, there are serious technical objections to the acceptance of *korewa* as meaning an outrigger in part or whole. Best (1923, pp. 201-202) translates a passage from a very old tradition as follows:

Should it be known that a gale was approaching, then immediately the vessel was prepared to meet it. The *tokotu* and *whiti* were set up, the covering mats were drawn over and stretched taut, so that, when the storm broke, all would be well. Then the outriggers of the vessel were thrust out [*katahi ka kokiri i nga korewa o te waka ki waho*], the *hokai* and *huapae* were secured, the water fenders were drawn into place, and the *pare arai wai* secured in place.

If outrigger booms and floats were put out on both sides in stormy weather as is here indicated, it must be concluded that the vessel was sailing without outriggers until the storm threatened, which is most improbable. Nowhere in Polynesia is the outrigger ever other than a permanent fitting when afloat. The Maori "experts" who related and sought to explain the traditions had never seen an outrigger canoe, and I am convinced that a misunderstanding of facts is involved, leading to a misreading of the technical terms.

From the use to which the *korewa* were put according to the accounts quoted, I am inclined to infer that they were some form of contrivance to give additional buoyancy to the hull, rather than true outrigger frames or floats of which the canoe must have had her complement when leaving shore. Even in Best's translation, *korewa* is interpreted both as "outrigger" and "sea anchor". I must also point out that a canoe fitted with a double outrigger is much less easy to right after it has capsized than is a single-outrigger canoe; indeed, the lee outrigger frame is an actual impediment to the operation.

SINGLE OUTRIGGER CANOES

Apart from traditional references to the use of single outriggers as well as double canoes by the Polynesian discoverers and settlers of New Zealand, the only authentic information concerning them is contained in a few brief notices left by members of Cook's first and second expeditions to the Pacific. Cook himself remarks that some of the small canoes seen in Hauraki Gulf had outriggers, "but this is not common". Banks (1896, p. 241) contributes the observation: "Now and then they made use of an outrigger, as is practiced in the islands, but this is more common to the southward". Parkinson (1773) also mentions seeing canoes with outriggers on the east coast of North Island, off Te Mahia: "One of them had a very curious piece of ornamental carving at the head of it". Forster's account (1777, vol. 1, p. 218) is equally superficial; all he says when describing canoes seen in Queen Charlotte Sound in 1773 is: "Some of the canoes were double . . . but where that was not the case they had an outrigger, or narrow piece of plank, fixed parallel to one side of the canoe by means of transverse poles, to prevent their oversetting". D'Urville, an acute observer, makes no reference to outriggers; neither do any other European voyagers. Tasman made none. From this it may be inferred that they had already become very scarce before the end of the eighteenth century. A few appear to have lingered on in out-of-the-way places to a much later date, for Best (1925, p. 15) quotes a Maori who told him that in 1853, when he was a boy of twelve, he had traveled on the east coast on board what may have been the last survivor of this type.

Except for the hypothesis that the Maori canoes resembled the outriggers of the Society Islands, no indications were available regarding the details of construction until the discovery in Moncks Cave some years ago of what is unquestionably the float of a small outrigger canoe. This object, now in Canterbury Museum, is a slender cylindrical pole, less than 6 feet in length, the ends drawn out into long tapered points. The remarkable feature, and the one which stamps it as a veritable outrigger float, is the presence of three sets of holes on one surface; one set is at mid length, the other two close to the extremities. Each set consists of two shallow vertical pits about 3.75 inches apart in the long axis of the float, and two closely set holes at right angles to and between the others. These latter are the external openings of a V-shaped perforation. H. D. Skinner (1927, pp. 363-365) figures this float and suggests that the three sets of holes, each consisting of two pits and a V-shaped tunnel, are evidence that this float was attached to three booms by connectives similar in design to those seen joining the float to the fore boom in existing Tahitian outrigger canoes but reduced in number from four to two because of the smallness of this particular canoe; according to this view each vertical pit had originally accommodated the base of a slightly flexible stanchion of which the dressed upper end was lashed against the side of a boom under an elaborate cover of ornamental lashing, whereas the V perforation gave passage to sennit braids

arranged as two-cord boom braces in a manner identical with that in use in Tahiti today.

Buck (1929, pp. 207-214) has pointed out that the distance between the two vertical pits is too short to permit the stanchions fixed into them to be bent sidewise and their ends dressed to fit against the sides of the boom in Society Islands fashion. He suggests that the two stanchions were disposed vertically, the distance apart, 3.75 inches, being so short that the natural elasticity of the sticks used would enable them to be bent sufficiently to be tied directly to the sides of the boom, above which their ends would project. This is very probably the method employed, but I consider it to be more nearly akin to the Samoan system of attachment than to the Tahitian, for in Samoa, in small paddling canoes used by boys, the insertions of the two pairs of stick stanchions are set so closely together that their upper ends lie against the sides of the boom in an almost vertical plane. A sennit brace is also present, passed through a V-shaped perforation in the float similar to that in the Moncks Cave float.

The number of booms in many Samoan canoes is multiple, and not restricted to two as in the Society Islands; this further reinforces the view that the New Zealand float indicates relationship with Samoa rather than with Tahiti. Skinner (1927, pp. 363-365) is therefore probably right when he suggests that "three was the normal number and that it imposed itself on floats, like this one, which were really too short to need three".

The float of an outrigger was ordinarily known to the Maori as *ama,* the usual Polynesian term, but *amatiatia* was also sometimes employed (Best, 1925, p. 18); as *tiatia* is Tahitian for the stanchion connectives of outriggers, the original meaning of *amatiatia* would be "stanchioned float", a descriptive term corroborative of the conclusion that the Maori connectives were similar to or a close variation of those used in central Polynesia.

SINGLE CANOES WITHOUT OUTRIGGER

Of the three types of canoes used by the Maoris in former times, the single canoe without outrigger is the only one which has survived to the present day. This type consisted of three main classes: 1, war canoes; 2, fishing and traveling canoes; 3, harbor and river dugouts. The last-named alone have remained in use until the present day. A few fishing canoes are or were till recently also in existence, and these on occasion were converted into rough replicas of the old and highly ornamented war canoes for purposes of special pageants.

The reasons for abandoning the use of both double and outrigger canoes in favor of the single form without outrigger were mainly two—the presence of timber of great girth in the virgin forests that covered much of the land, and the concurrent decline of oversea voyaging. For ordinary coastal journeys within sight of land, open canoes of beam such as their Tahitian forefathers could never command required no longer the assistance of artificial stabilizing devices—the connection of two hulls or the use of a counterpoise float.

War Canoes

CONSTRUCTION AND ORNAMENTATION

War canoes (*waka taua*) were the largest and finest canoes ever possessed by the Maori. Much labor was expended upon their construction and their ornamentation with superb carving. They were made from the stoutest and largest timber available, some exceeding 100 feet in length, though 60 and 70 feet may be taken as the average. Cook gives the dimensions of one canoe as 68.5 feet long, with a

beam of 5 feet and a depth of 3.5; Crozet measured another and found the length 70 feet, the beam 6 feet, and the depth 4 feet.

A typical war canoe consisted of a dugout underbody, sharply crescentic in transverse section, with the sides heightened by the addition of a deep washstrake. As timber of sufficient length and girth out of which to hew a hull complete in itself was not always available, a lengthening section (*haumi*) was added at one end or even at both ends. The *haumi*, as described and figured by Best (1925) was spliced to the body section by a great mortise and tenon joint, a median tongue of which fitted into a deep angular slot in the *haumi*. The two parts were sewn together through holes pierced at intervals in the opposing edges (fig. 131).

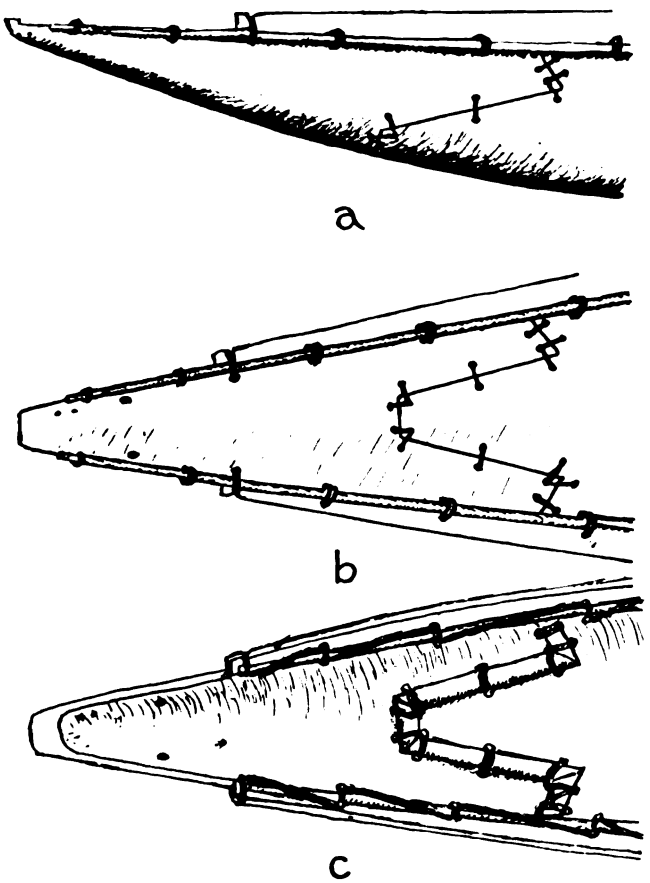


FIGURE 131.—Method of lengthening Maori canoe underbody by joining on an end section (*haumi*) by a great mortise-and-tenon joint: *a*, side view; *b*, view from below; *c*, view from above showing batten covering joint (after Best, 1925).

The washstrake, fitted on each side, was 10 to 12 inches deep in the middle region, decreasing slightly toward the ends to fit the gently sheered form of the dugout underbody and to give a perfectly horizontal gunwale line in the finished canoe. Numerous thwarts to accommodate the many paddlers were added, fitting in some canoes by shouldered ends upon the gunwales, to which they were lashed.

The method of making the washstrake seam watertight is of particular interest, for it is identical with the eastern Polynesian practice as followed today in the Tuamotus. After inserting a calking layer of dried bulrush stems, the joint was covered with a narrow strip or batten of wood on each side and the whole secured in place and drawn tightly together by several turns of flax braid, passed through holes in the opposing edges (fig. 132, *a*, *b*, 3). To tighten the lashing to the utmost, a peculiar Y-shaped levering implement was used, called *tanekaha* or *mimiro* (Best, 1925, p. 79), precisely in the same way as a similar tool called

keke continues to be employed for the identical purpose by the islanders of Reao in the Tuamotus (Seurat, 1905, pp. 295-307), as well as in the Society Islands (Handy, 1932, fig. 11, *a*, 3) and the Cook Islands (Buck, 1927, fig. 227); in the Cook Islands it is also called *keke*.

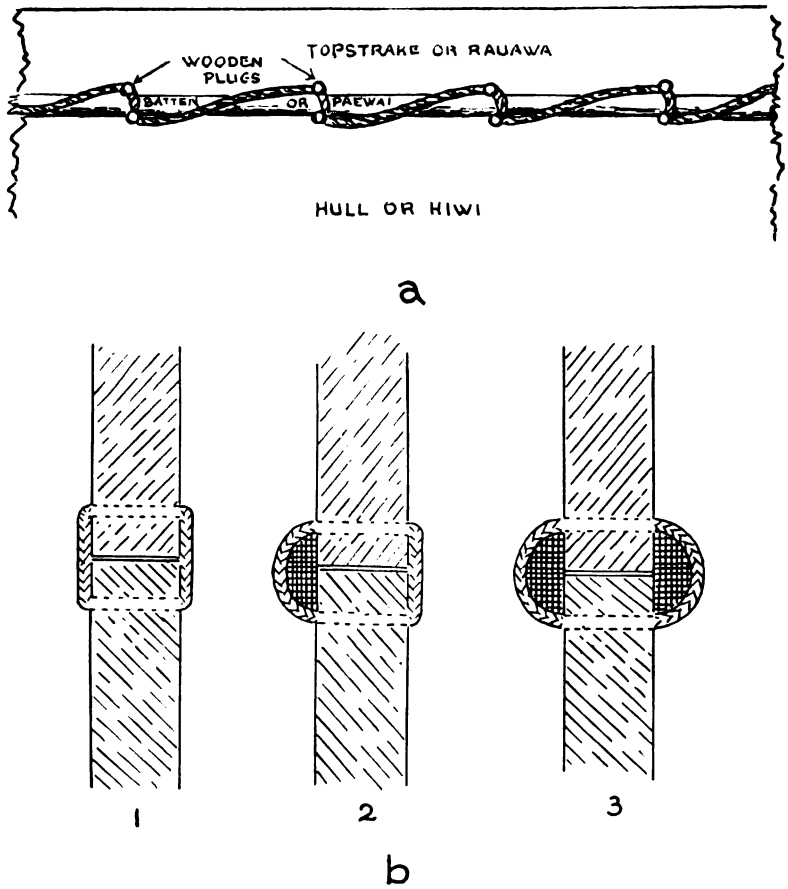


FIGURE 132.—Maori attachment of washstrake (topstrake) to underbody. *a*, view from inside canoe, attachment by continuous stitching over a batten (after Best, 1925). *b*, cross sections showing stages in evolution of the Maori system of lashing: 1, primitive method, without batten covering seam; 2, batten on outer side only; 3, fully-developed Maori method, stout batten on both sides.

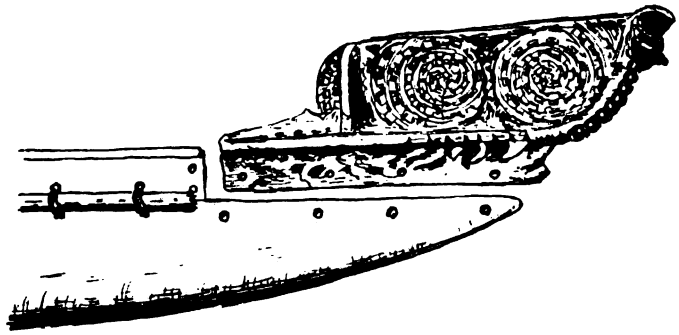
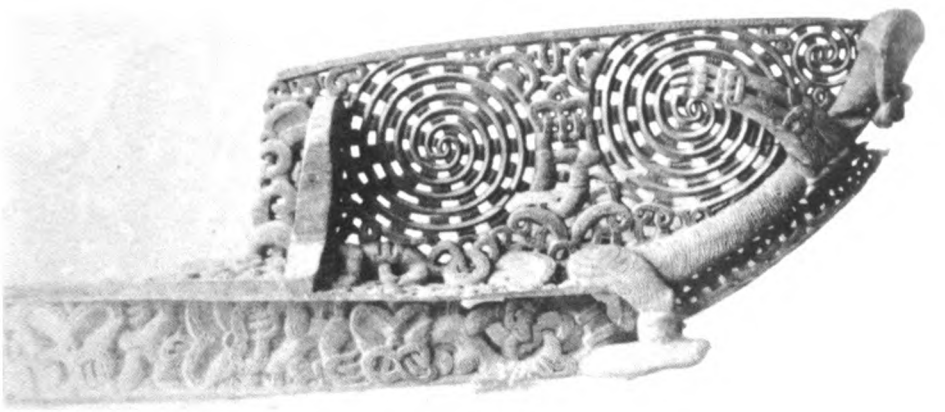


FIGURE 133.—Fore end of war canoe, showing method of fitting on a *tauihu* of the southern type (after Best, 1925).

a



b

FIGURE 134.—Figurehead (*tau-ihu*) of a Maori war canoe, southern type, of the design called *ringa-whiu* because the arms are extended backward: *a*, view from above; *b*, side view (Otago University Museum, Dunedin).

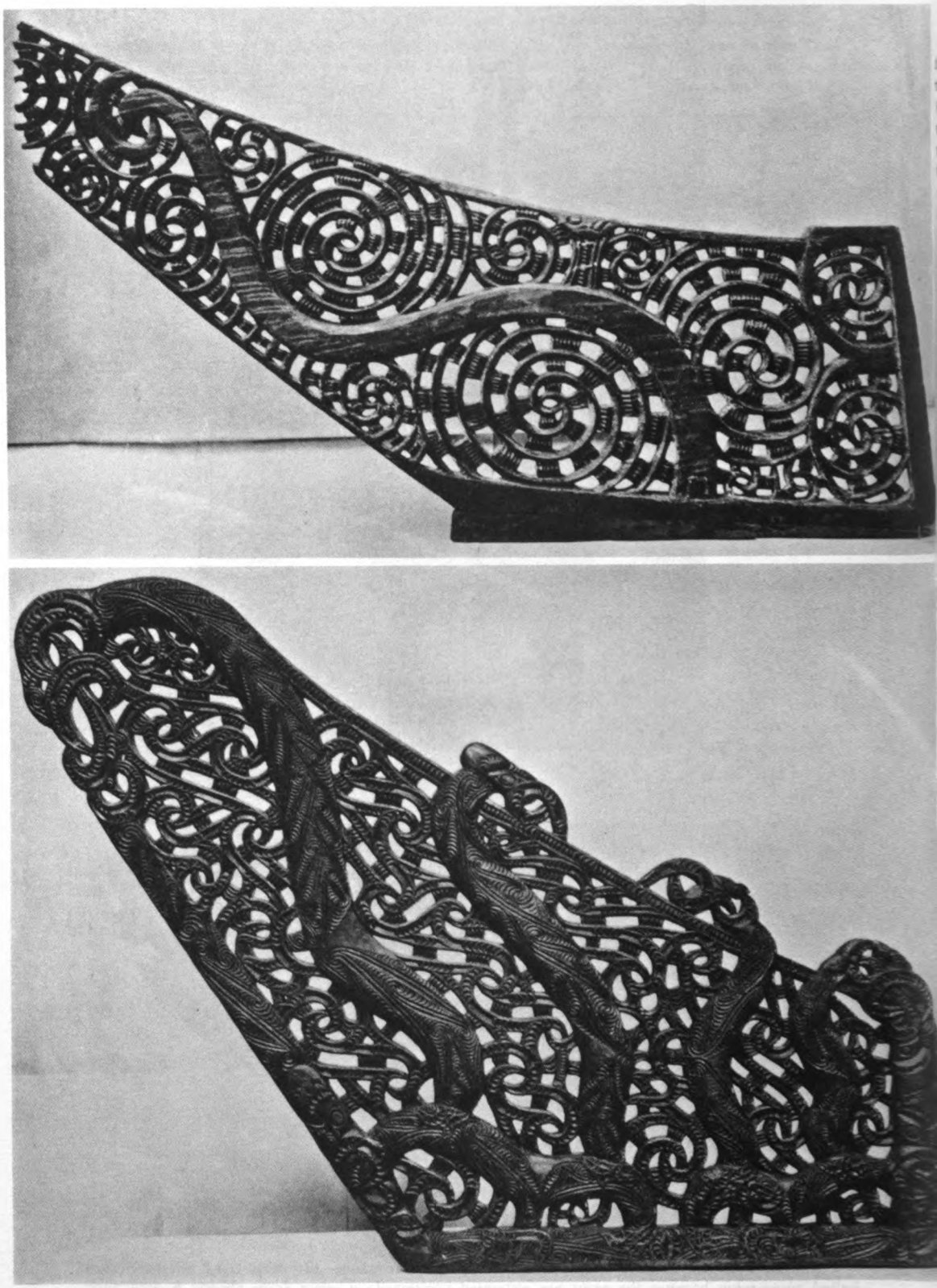


FIGURE 135.—Two median boards of figureheads of war canoes, of the type peculiar to the northern part of North Island (British Museum)

After the washstrakes had been sewn on, a richly carved figurehead (*tauihu*) was fitted; this also subserved the purpose of a forward breakwater, as its after end was fashioned into a transverse vertical board closing in the open ends of the opposed washstrakes at that end (fig. 133). It might be of either of two designs. In the favorite, *pitau*, two great double spiral scrolls were fret-carved upon the vertical median plank, and in front was sculptured in the round a highly conventionalized human figure. The face was large and hideous, the eyes of mother-of-pearl and the tongue protruding in insult to the enemy (fig. 134). The second pattern, the northern type, embodied a most artistic and charming perforated complex of double and reversed spiral scrolls strengthened by sinuous ribs, themselves generally elaborately sculptured (fig. 135).

FIGURE 136.—Stern ornament (*tau-rapa*) of war canoe, New Zealand (Dominion Museum, New Zealand).

On the after end an extremely tall upstanding fretted stern piece (*taurapa* or *rapa*) was added, 10 to 18 feet high, about 18 inches wide, and 2 inches thick. This was carved into a perforated design of which the chief motive took the form of double spirals, strengthened by two parallel curved ribs (fig. 136); a small human figure, grotesque in features, was often incorporated in the basal carving on the forward side, the equivalent of the *tiki* figure commonly found on the fore side of the stern projection in Tahitian and Marquesan canoes.

A floor grating was laid a little above the bottom, crossing from bilge to bilge; it was formed of light rods lashed longitudinally upon a series of cross bars (fig. 137). On long journeys this flooring was covered with rush mats, in some canoes supplemented by a layer of bracken underneath. At one or at two places, according to the size of the canoe, spaces were left in the grating to serve as bailing wells. Best (1925, pp. 107-109) gives detailed particulars of the technique of the construction of these gratings in their several variations.

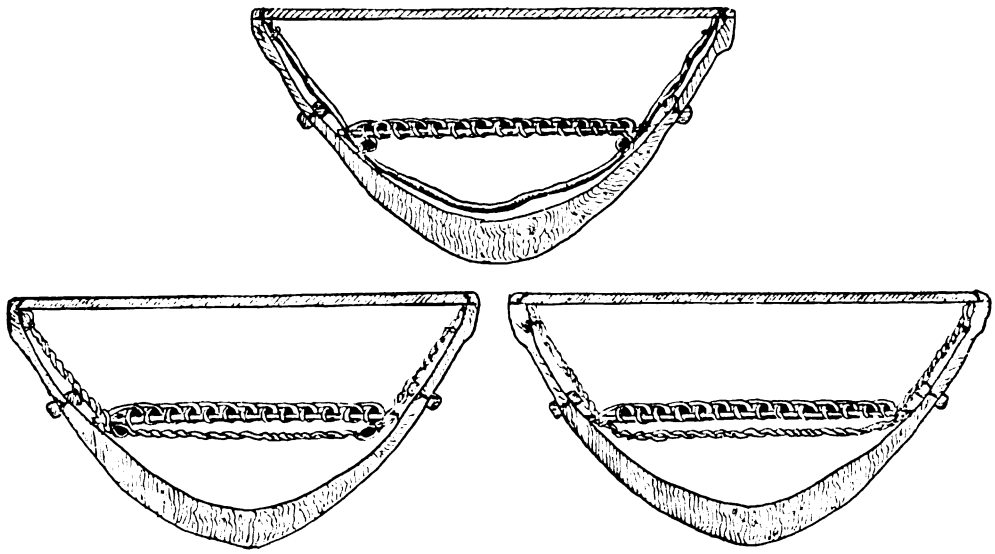


FIGURE 137.—Three methods of supporting floor grating of Maori war canoe; first may have arisen from utilization of rib frames that had ceased to be used (after Best, 1925).

The richly carved figureheads and high upturned stern pieces have already been described. Further rich carving ornamented the outer side of each washstrake, executed in characteristic Maori bas-relief, often enriched with shell decoration and painted red, according to D'Urville. The carving on the narrow beading along the outer edge of the upper margin of the washstrake was different in design from that covering the wide lower portion of the plank. Like the head and stern carvings, these incised patterns were painted with red ocher mixed with oil.

Black and white also entered into the scheme of decoration. The narrow batten covering the washstrake seam was painted black, relieved by splashes of white at short intervals by means of tufts of the white feathers of the albatross or the gannet, caught by the quills under each stitch in the lashing securing the batten in position. A pair of long black feather streamers fluttering from the summit of the high stern was a usual decoration as depicted by Cook's artist (fig. 138), with feather fringes of the same color outlining the carving of both head and stern (Banks, 1896).

Whenever a war canoe was put into commission, its figurehead was further ornamented by the provision of two long and curving antennae (*ihihi* or *hihi*). These consisted of a pair of slender wands projecting forward, one on each side of the hideous face of the figurehead. At short intervals small bunches of feathers were tied along the shafts, with a specially fine feather ornament at the forked tip of each (fig. 139). Forster (1777, vol. 1, p. 521) presumably referred to these antennae in his description of a war canoe which "had a carved head ornamented with bunches of brown feathers, and a double forked prong projecting from it, on which the heart of their slain enemy was transfixed".

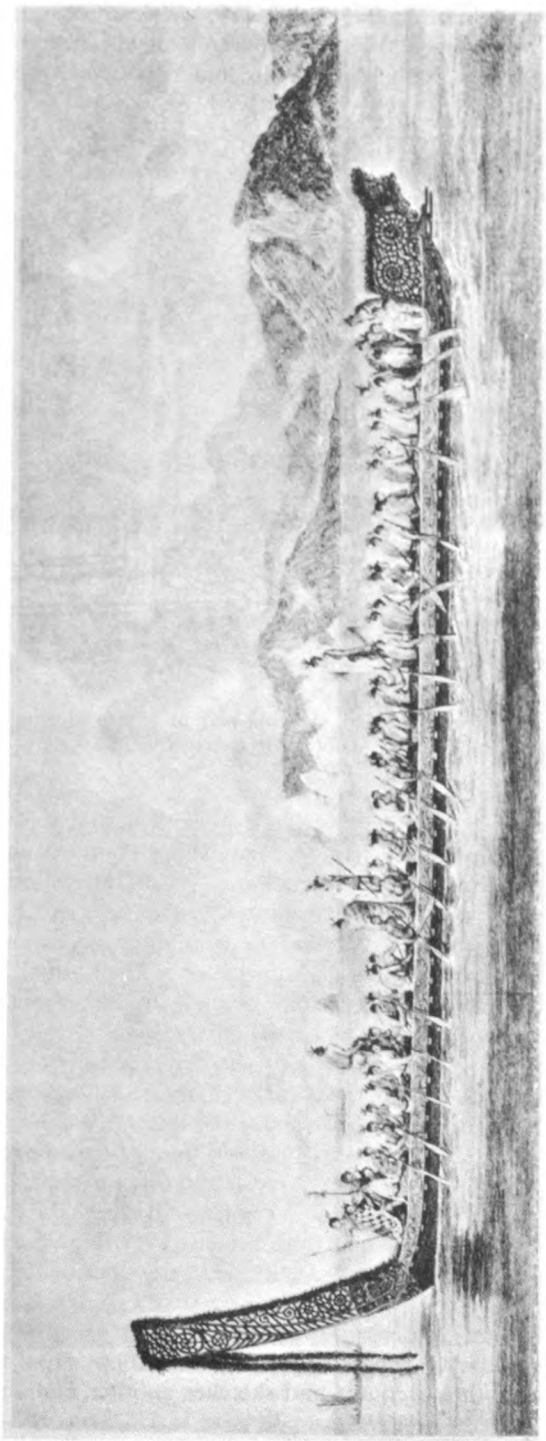


FIGURE 138.—Maori war canoe, probably the best illustration in existence (drawing made on Cook's first voyage, Hawkesworth, 1773, vol 3).

MAST AND SAIL

The ordinary Maori rig (*ra kautu*) either preserved an extremely archaic and primitive design, improved elsewhere into the oceanic lateen, or else it was a degenerate form of the lateen. The probability is altogether in favor of its archaic character. Forster (1777, vol. 1, p. 217), who saw three canoes under sail in Queen Charlotte Sound in 1773, says:

> Sails are but seldom seen among them. The sail consisted of a large triangular mat, and was fixed to a mast and a boom, joining them at an acute angle, which could both be struck with the greatest facility. The upper edge or broadest part of the sail had five tufts of brown feathers on its extremity.

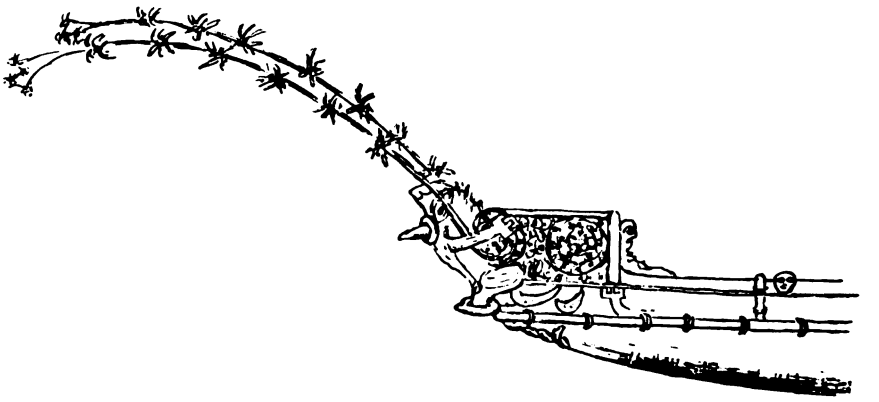
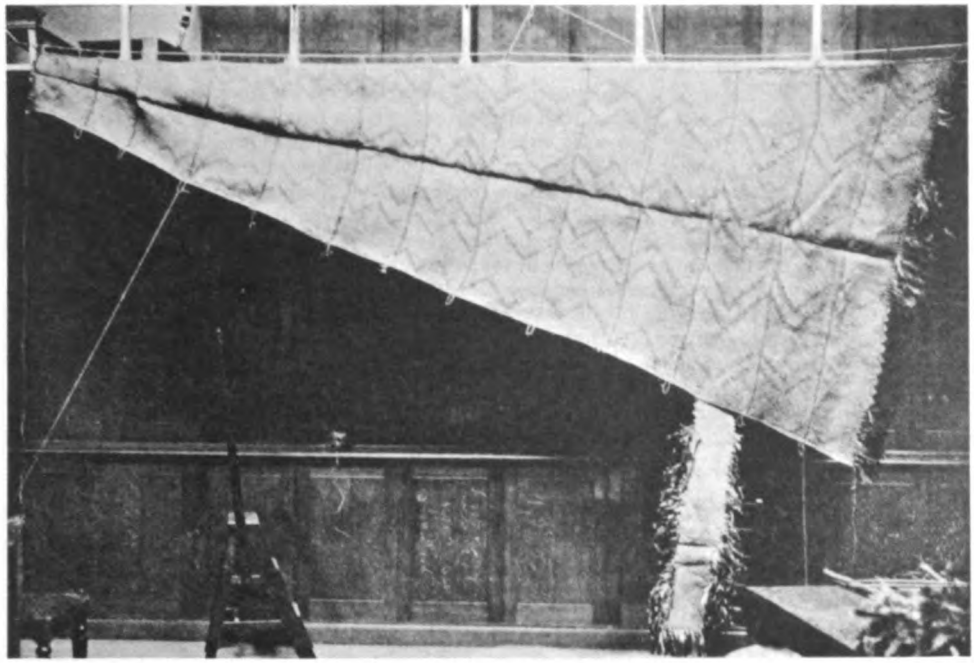


FIGURE 139.—Maori war canoe, fore end, showing pair of long projecting wands (*ihiihi* or *hihi*) decorated with bunches of feathers at intervals (after Best, 1925).

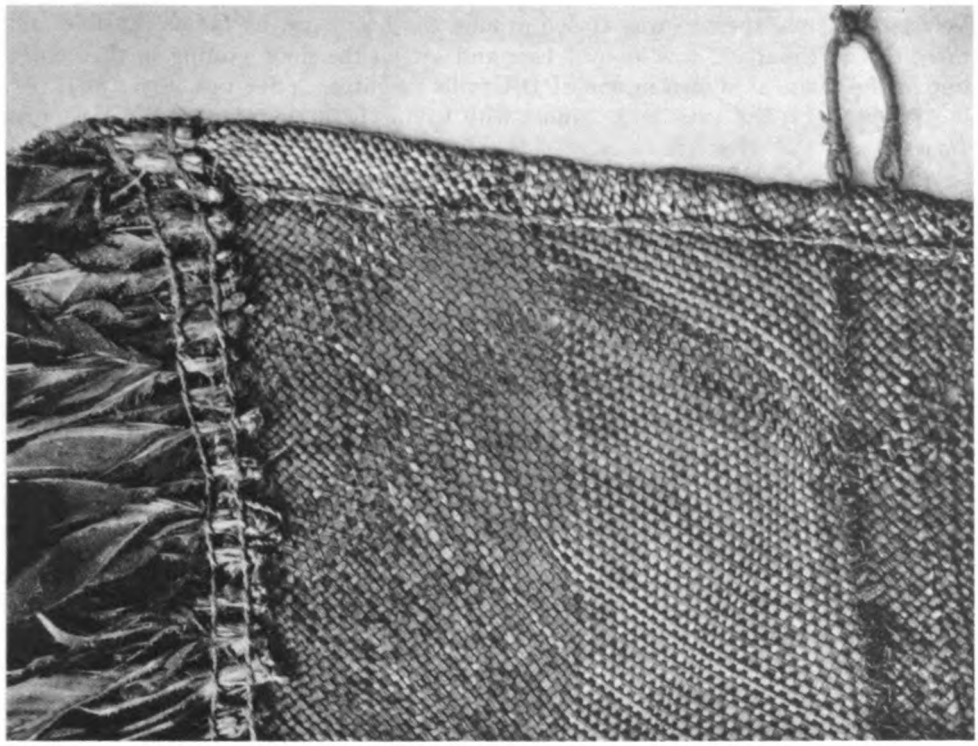
From this and other fragmentary notices it is evident that the sail consisted of a triangular sail set apex downward without being slung from a separate mast. The two long sides of the sail, enclosing the acute angle at the lower end, were attached at short intervals to two spars. The one normally used as a yard functioned here as the mast and was stepped well forward in single-masted canoes. The hinder margin was, in like manner, tied to a lighter spar of about equal length or somewhat longer; this may be regarded either as a sprit or as a boom. According to Best (1925, p. 183), when sail was to be made, the heel of the mast was passed through a grommet made fast against one of the thwarts and stepped upright in a cupped boss on the floor of the dugout; the heel of the boomsprit was secured in turn "to the bottom part of the mast, just above the thwart, by means of a rope ring or cringle fixed as a step but loose so as to allow the sprit to move".

D'Urville (Atlas, 1833, vol. 1, pl. 60) gives an excellent figure of a canoe under sail which shows two shrouds passing from a point well above the mid length of the mast to be secured at each side to the thwart behind that against which the mast stands; a fore stay is also present, and a sheet or vang attached close to the outer end of the boom sprit. (See fig. 141.) In some views a back stay is shown in addition. The sail is of matting with a pretty zigzag pattern; the upper free margin is fringed with feathers. A long feather pendant droops from the elevated end of the boomsprit. From other accounts and sketches another fashion was to cut the free upper edge into a series of vandyke points.

Probably the only example in existence is a small and very old one in the British Museum (fig. 140).



a



b

FIGURE 140.—The only old Maori sail in existence (British Museum), possibly from Captain Cook's collection: *a*, entire sail, 6 feet 4 inches wide at top (fringed edge), 14 feet 6 inches long, 13 transverse segments with loops along each long side for tying to mast and sprit, feather tufts adorning upper margin, broad feathered streamer attached to upper edge of sprit side; *b*, upper posterior corner showing technique of plaiting, attachment of feather tufts, turned-in edge over bolt rope, and one of the marginal loops.

The sail has the form of an inverted isosceles triangle, with the apex cut off, narrow for its length, for it is only 6 feet 4 inches wide at the top against a length of 14.5 feet. It is woven loosely of narrow strips of the leaves of either flax (*Phormium tenax*) with a check plait and an open zigzag pattern peculiar to New Zealand. Along each of the long sides are strong cord loops by which they were attached to the mast and the boom sprit respectively. A bolt rope strengthens the border on all three sides; the edges of the mat material are turned in over this rope and stitched down with thin cord. The free border forming the top of the sail is decorated with feathers in tufts, arranged in four discontinuous series occupying approximately half the length of the edge. The feathers are chiefly those of the hawk, mingled perhaps with some of the pigeon. Where the feathers are absent the edge of the sail is seen to be fashioned into a closely serrated pattern. A long feather streamer 3 feet 6 inches long and 9 inches wide depends from a point about 3 feet from the top on the side which would be attached to the boom sprit when rigged. The basal material is of matting similar to that of the sail, with feathers sewn on along the end and both sides.

The usual method of rigging a sail in peripheral Polynesia is to tie it to the mast and boom sprit by means of pairs of cords fitted at intervals along the borders. Here (fig. 140) loops replace paired cords. According to a native informant (Best, 1925, p. 183), the sail was laced on by a cord which at each turn around the spar was passed through one of the loops or cringles tied to the border of the sail. Firth and Buck (1931) give further details of the technique characterizing the British Museum specimen.

The sail was attached permanently to mast and boomsprit in the manner described. As a consequence the whole had to be set up or taken down together. When not in use the sail was furled around the boomsprit as far as possible and then, tied to the mast, was stowed fore and aft on the floor grating in the center line of the canoe as shown in one of D'Urville's figures. (See figs. 141, 142).

Tradition credits some large canoes with having been rigged with two sails, one forward and the other aft.

One of Best's Maori informants avers that a second form of sail (*ra kaupaparu*) was also employed (1925, p. 184). This rig, according to his description, was a form of the Oceanic lateen, consisting as it did of a triangular sail provided with yard and boom and slung by its yard from a short mast stepped in a projecting shoe left when the basal dugout was hewn into shape. As all reliable illustrations of canoes under sail show the rig as without any mast free or separate from the sail, it is difficult to accept this statement without corroboration. If it was in use it must have been introduced in comparatively recent times from western Polynesia, where such form of sail was borrowed from Micronesia, directly or by way of Fiji.

The true Maori sail belongs definitely to a very primitive type that lingered till the end of last century in Malekula and other islands of the New Hebrides.

AFFINITIES

In many particulars the Maori war canoe is very closely related to that of the Marquesas Islands. The forms of the head and stern pieces are more elaborate, but the fundamental structural design is extremely close. In the Marquesan fore end piece there is an after section lashed onto the forward end of the dugout underbody, a transverse breakwater across it, and a figurehead carved into the representation of a human face or figure. In the Maori form this figurehead is developed greatly and is a much more prominent feature, but, fundamentally, it is cognate, as it may also be to the carved human figure commonly carried low down on the prow of the Solomon Islands war canoe.

The carved washstrakes of the Maori canoes and the black-painted covering batten along each side seam, with tufts of white feathers under the lashings, are repro-

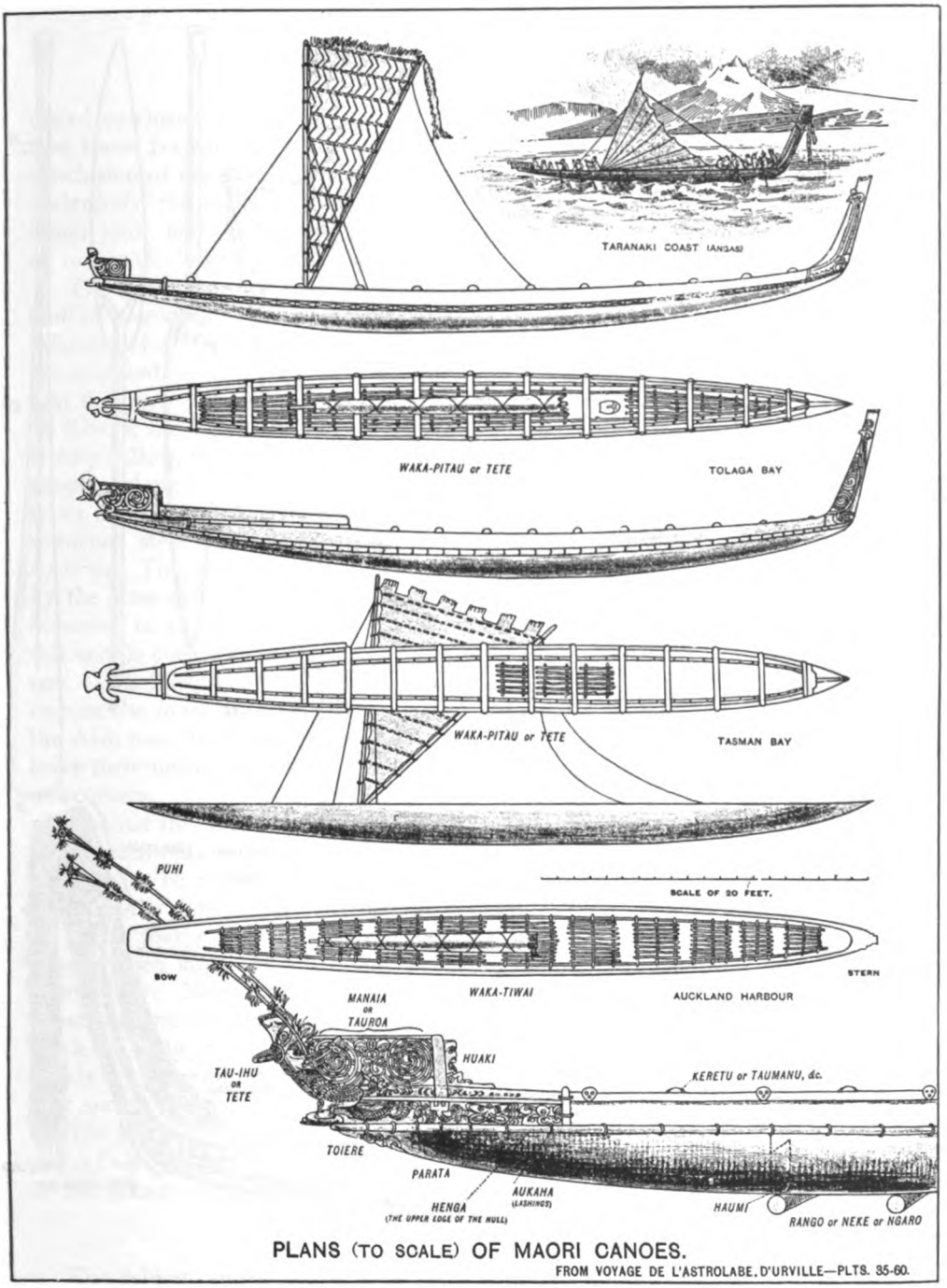
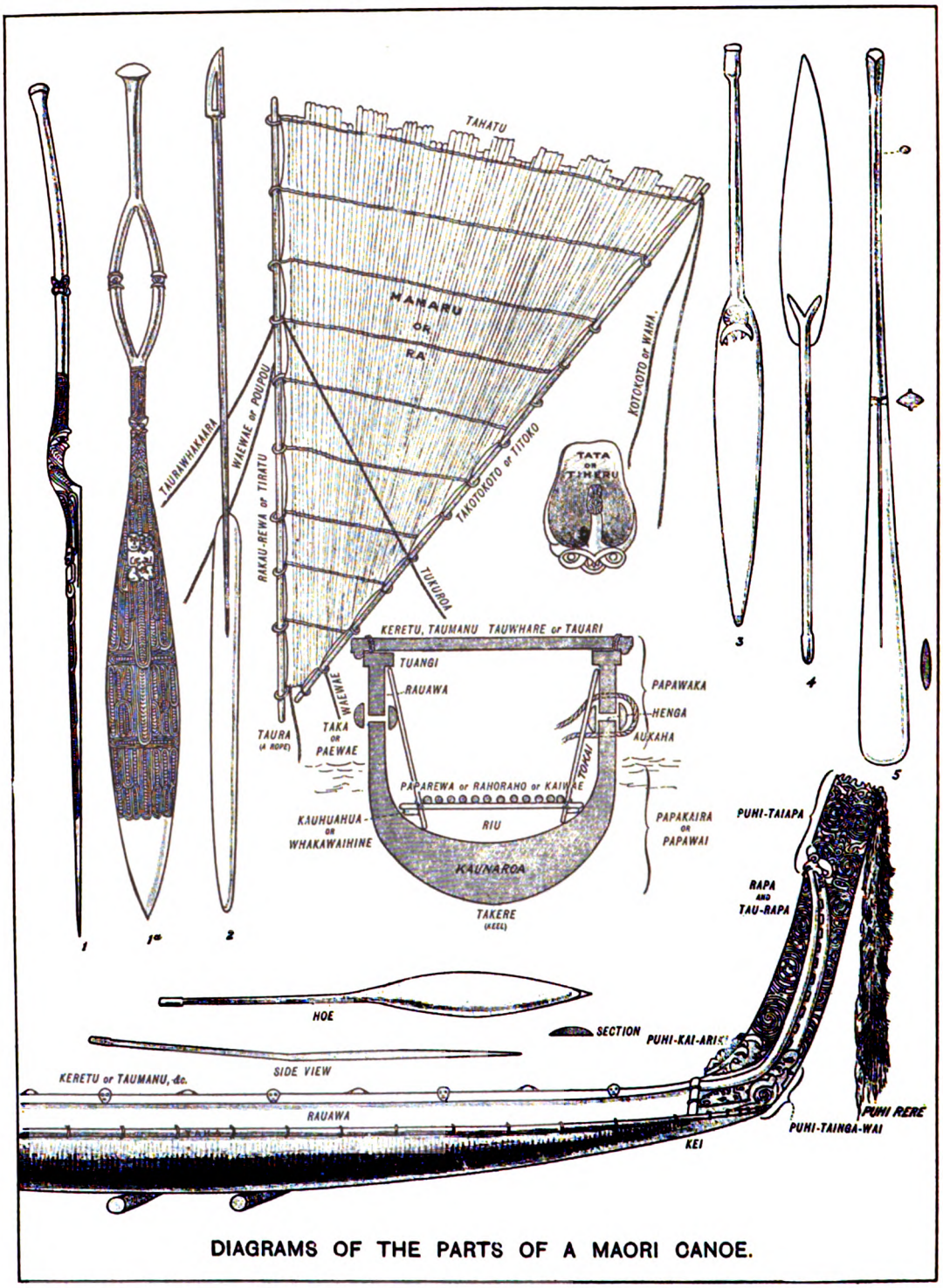


FIGURE 141.—Typical Maori canoes: sketch of war canoe under sail on the Taranaki coast, carries local variation of *raupo* mat sail, free edge vandyked, probably not fully spread; war canoe of *waka-pitau* class, Tolaga Bay, North Island, side view of canoe under sail and plan, showing sail rolled around mast and lashed fore and aft amidships upon thwarts; floor grating covering whole bottom of hull except at bailing well indicated by figure of a bailer; another *waka-pitau* seen under paddles, Tasman Bay, side view and plan, secondary washstrake or fore weather board attached on each bow as further protection against waves, floor grating restricted to short distance abaft center; *waka-tiwai* used in harbors and rivers, side view and plan, a dugout without washstrakes, thwarts, or carved ornament, the larger ones fitted with floor gratings and sail of same form as that of war canoes; at bottom, diagram of fore half of war canoe marked with names of parts (from Hamilton, 1896, upper sketch after Angas, the three central canoes after D'Urville, 1830, Atlas).



DIAGRAMS OF THE PARTS OF A MAORI CANOE.

FIGURE 142.—Maori canoe and accessories: 1, front and side views of carved ceremonial paddle from Bay of Islands (Dresden Museum); 2, steering paddle of unusual pattern found buried on banks of Waipori Lake, Otago, length 8 feet 6 inches, width of blade 3.75 inches; 3, fine paddle, length 5 feet 9 inches; 4, paddle with curiously forked ornament at butt of blade, Otago district (2-4, Otago University Museum); 5, oar-shaped implement 7 feet long, may have been used as steering paddle but probably functioned as club, Otago district; plate also shows mat sail (*ra*) attached to mast and yard by loops at short intervals; bailer (*tata*); diagrammatic section through hull of war canoe marked with names of parts; ordinary paddle (*hoe*), face view, profile, and section, profile shows the bend at junction of loom and blade characteristic of the Maori paddle; at bottom, after part of a war canoe marked with names of parts (from Hamilton, 1896).

duced so closely in those of the Marquesas that there can be no room for doubt that these features have had a common origin. Other similarities reinforce this conclusion of the closeness of the relationship: for example, the form of the dugout underbody, the method of joining two sections of dugout hull by a mortise-and-tenon joint, and the type of sail employed—one tied directly to the mast, instead of to a yard slung from the masthead.

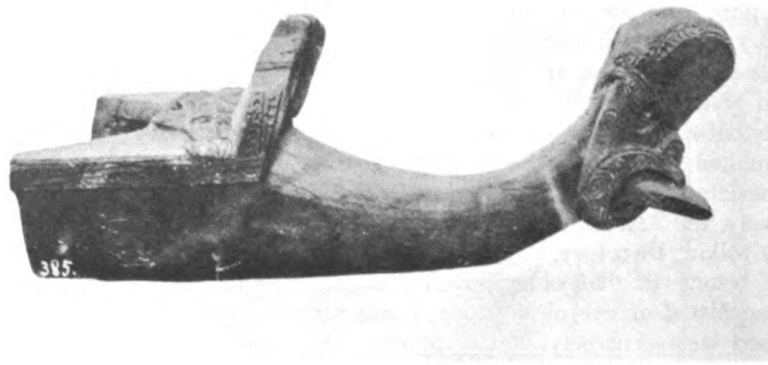
The absence of any tradition or even suggestion of the former use in New Zealand of plank-built vessels suggests that the ancestors of the Maori left the Society Islands before the introduction there of the *pahi* type. Considerable evidence has accumulated in favor of the inference that it was in some form of this *pahi* craft that the latest immigrants arrived in Polynesia from Indonesia—the "kava people" of Rivers, the "Tangaroans" of Williamson, and the "conquering Arii" of Handy. It may follow, therefore, that some considerable number of the New Zealand Maori people belong to that older stratum of the Polynesian population whose canoe types consisted of five-piece canoes characterized typically by low heads and lofty, upturned sterns, namely the Marquesan war canoes and the Tahitian *vaka* and *tipairua*. This stratum was represented at the end of the eighteenth century mainly by the class called "manahune" in Tahiti and "menehune" in Hawaii. It would, however, be an injustice to the Maoris to consider them as descended from men of this servile class who represented the inferior element among the conquered aborigines. It is likely, as Handy has suggested (1930, pp. 8, 12), that they had as ancestors the more virile and high-born of the people dispossessed of their lands by the Arii, men too proud to bow their necks to the conquerors and who preferred to leave their native land in search of new homes rather than become servitors to the newcomers.

Against this inference must be set the fact that Maori traditions do not allude to any such reason or events as the cause of their departure from the homeland. It has also to be remembered that the evidence suggesting ignorance of plank-built craft by the Polynesian settlers is entirely negative. Instances are on record of reversion to the dugout type on the part of people previously using plank-built canoes when large enough timber became available (Napuka and Makemo in the Tuamotus). New Zealand is eminently suitable as the venue of such a change in constructional design, and I incline to think that the canoes of the descendants of the large body of immigrants credited by tradition with having arrived in a "fleet" nearly 23 generations ago, or about the middle of the fourteenth century, represent such a change.

The earliest settlers, represented by the ancestors of the Moriori, were probably proto-Polynesians mixed with Melanesians and closely related to the "manahune" of the Society Islands.

Fishing Canoes

The fishing canoes (*waka tete*) were built on the same model as the war canoes but smaller and without the elaborate ornamentation of ends and washstrakes. The figurehead was reduced to a rudely carved representation of a grotesque human face with the tongue protruding (figs. 143, 144) and though the stern piece rose vertically several feet above the gunwales, it was solid and little-ornamented (fig. 143). A specimen of this type of canoe in the Dominion Museum, said to be about a hundred years old, is 47.5 feet long, 3 feet 7 inches beam at gunwale level but only 2 feet 8 inches between the sides of the dugout underbody and has a depth of 16 inches. The washstrakes are 9 inches deep in the middle, tapering to 5.75 inches and 5 inches at the forward and after ends respectively. In another the



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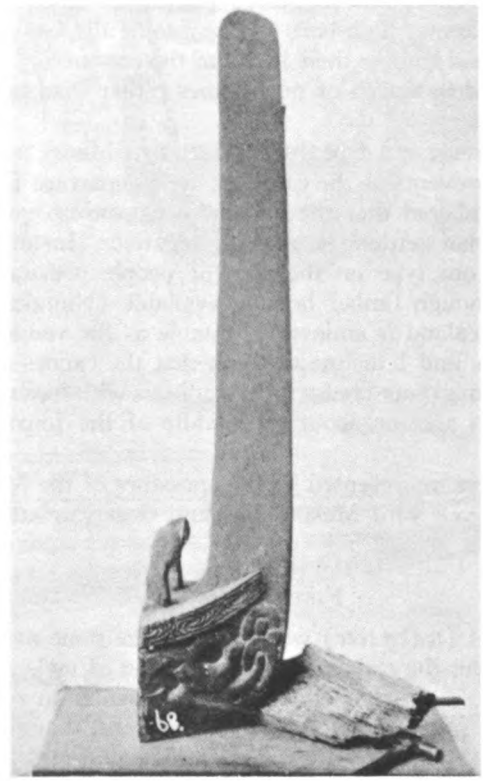


b

FIGURE 143.—Figurehead (*a*) and stern ornament (*tau-rapa*) (*b*) of fishing canoes, New Zealand (Dominion Museum).

dimensions are: length 42 feet, beam inside 3 feet 11 inches, depth 17 inches; in this the hull sheers upward toward each end; both ends are 9.5 inches higher than amidships.

River Canoes

A few river canoes (*waka tiwai*) survive to the present day. They are two-ended dugout hulls, the bottom round, the ends pointed, and with little sheer. There are no added pieces of any kind; even thwarts are wanting. (See fig. 141.)

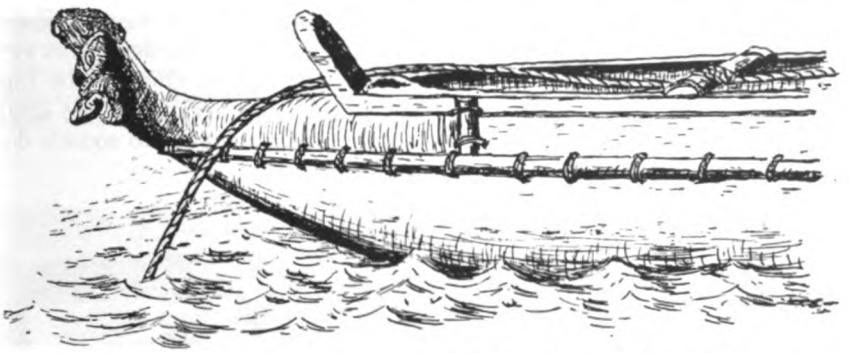


FIGURE 144.—Figurehead and fore part of fishing canoe (after Best, 1925).

PADDLES

The paddles used formerly by the Maoris have a beautifully proportioned thin blade, lanceolate in shape, plano-convex in section; distally it narrows gradually to an acuminate sharp point (fig. 145, *c, d*). The loom is distinctly shorter than the blade. Typically it has a short knob at the proximal end, which may be carved with human features; some are without knobs; total length of paddle ranges from 4 to 5.5 feet. Loom joins blade at a slight angle; in a paddle having a total length of 5 feet 6 inches, the terminal knob is about three inches out of alignment with the blade, a form believed to give greater drive to the paddle stroke (Hall, 1932, p. 235). The paddles used for steering are of the same form but longer, stouter, and quite straight; length 6 to 12 feet, proportionate to the size of the canoe.

The loom in paddles from the Waikato district is exceptional in form, being characterized by the sinuous curves into which it is carved.

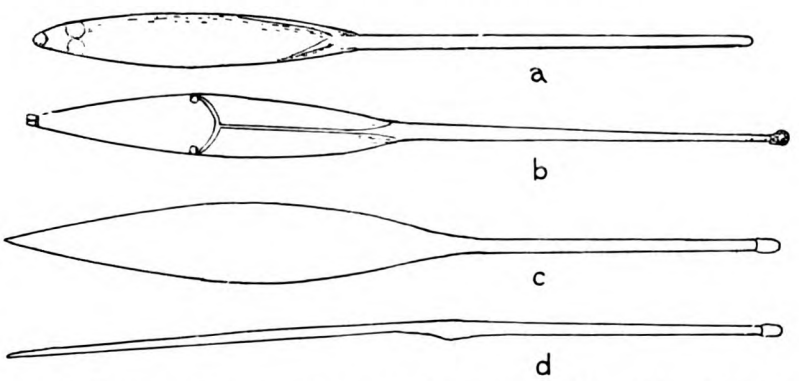


FIGURE 145.—Maori paddles: *a*, ancient paddle from Moncks Cave (Canterbury Museum); *b*, peculiar form of paddle with ornamented blade and twinned thickening at tip (Dominion Museum); *c, d*, face and side views of paddle of ordinary form.

The blades of paddles used for ordinary purposes were not ornamented with carving. At most, patterns were painted upon them with red ocher; on some, arabesque designs in black and white were produced by charring the wood (Best, 1925, p. 162). A paddle that boasted a blade covered with elaborate carving was used only as a symbol of rank—a ceremonial staff or baton, wielded on important occasions, sometimes even as a weapon of no mean power (fig. 142). To this class of ceremonial paddle staffs is attributed one found in a swamp in the Taranaki district and figured by W. H. Skinner (1932); in this the tip of the blade is curved backward in a way suggestive of the beaked tips of eastern Polynesian paddles. It measures 1.97 meter in length and is made of a dense, heavy wood. It has been suggested that this was the baton wielded by the chief or the fugleman of a war canoe, but objection has been taken to this view because of the length and weight; the alternative is that it was a steering paddle, but this too sounds doubtful as it measures only 8 cm at the widest part of the blade.

FIGURE 146.—Bailer of sugar-scoop pattern, said to be a modern form (British Museum).

Two paddles figured by Best (1925, figs. 118, 119) show a small enlargement at the tip of the blade. In one in the Dominion Museum, New Zealand, it has a minutely bilobed form (fig. 145, *b*). The second, found in Moncks Cave, and now in the Canterbury Museum, New Zealand, has a small rounded swelling on one side of the tip (fig. 145, *a*). Both these paddles exhibit carving on the blades akin to those on certain Melanesian paddles, as, for example, those of the Santa Cruz Islands.

BAILERS

Bailers (*tata, tiheru,* and *ta wai*) were in general of the usual Oceanic form, shallow and more than usually broad scoops with curved handles on the inside. Those pertaining to war canoes were magnificently carved with Maori curvilinear designs. The handle in a considerable number of existing examples has a phallic motive in its ornamentation. The specimens in museums are the most beautiful of Polynesian bailers, indeed almost the only ones on which ornamental carving has been lavished.

A few of the sugar scoop form, with straight external handle, exist. They are usually roughly made and with little or no carved ornament. One in the British Museum collection is of superior workmanship (fig. 146), as is another in Vienna (Firth, 1931, fig. opp. p. 97). Best (1925, p. 174) states that this type is "said to be quite a modern form". Yet this pattern is met with in the Marquesas (Steinen, 1925-28) and in several of the Melanesian islands—examples from the Santa Cruz Islands and Anchorite Island are present respectively in the British Museum and the Pitt-Rivers Museum, Oxford. A bailer of old type is shown in figure 142.

In large war canoes two bailing wells were provided, in small ones a single well only. These were spaces left open in the floor grating. In rough weather, when a

large canoe was shipping much water, two men were stationed on opposite sides of each well, filling and emptying their bailers alternately.

RAFTS AND FLOATS

On certain parts of the east coast peculiar rafts or rather outrigged catamarans were at one time in use. Colenso, as quoted by Best (1925, p. 137), describes seeing in 1838,

> . . . all along the coast, in many places, small rafts hauled up above the high-water mark, each being 8 or 10 feet long and 3 or 4 feet wide, composed of only a few small poles, roughly and distantly but very strongly lashed together with open spaces between them. On these the east coast Maoris went out to fish in deep water, one on each; and also, when opportunity offered, to a ship, with a pig or two fastened to the raft. They said these rafts were quite safe—more so, indeed, than a small or middle-sized canoe, as there was no danger of upsetting.

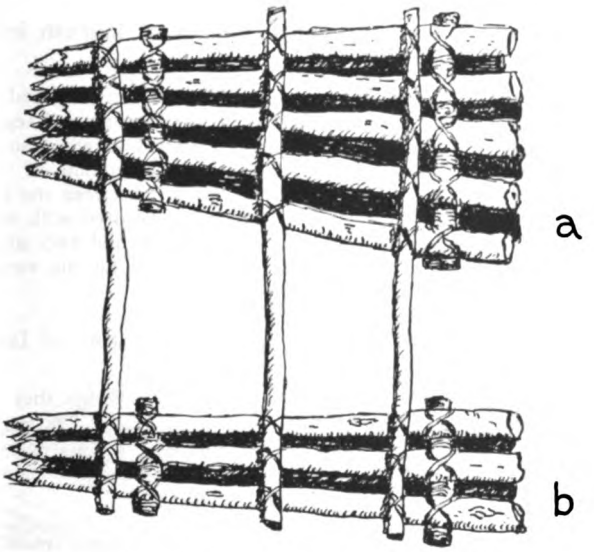


FIGURE 147.—Outrigger raft formerly used by fishermen on the east coast of North Island: *a, mohiki*; *b, ama-tiatia* (after Best, 1925).

Best gives a more detailed description, from which it appears that this raft consisted of two definitely shaped structures, a large and a small, each built up of equal-length poles of the soft and extremely buoyant *houama* wood (*Entelea arborescens*), two tiers deep, each layer through-pinned with trenails of hard wood, and then the two layers lashed together. The thinner ends were pointed and arranged in one and the same direction; this was the fore end in the completed structure. When the two sections were finished, they were connected at a distance apart of 3 to 5 feet by three or four stout poles lashed athwart in the manner of the booms in double canoes and outriggers. The pliant stems of the supplejack (*Rhipogonum scandens*) were employed to lash the various parts together. (See fig. 147.) It is significant that the smaller bundle was termed *amatiatia,* which is a Maori term for an outrigger float.

These outrigger rafts were much used in fishing for crawfish. Accommodation for the traps or pots was obtained by making a grating with extra poles laid over the space between the two sections of the raft (Best, 1925, pp. 136-137).

I can not help thinking that these outrigged *mokihi* have a very ancient ancestry

and fall into the same class as the model of an outrigger raft of Samoa figured by Krämer under the name of *amatasi*, the *vaka-vaka-amei* of Tonga, the *ulatoka* of Fiji, and others of the rafts and floats of which there are traces and traditions in so many places. Those named were all outrigged rafts, of definite form and method of construction.

To cross rivers and lakes, rafts and floats made of bundles of dried bulrushes, or of the flower stalks of flax (*Phormium*), were commonly employed. The former (*mokihi*) were craft directly comparable with the balsas of Lake Titicaca and the reed rafts of Mesopotamia and Seistan. There appear to have been several variations in the form of *mokihi*. Some, like one made in 1846 to cross a flooded river and described by Brunner, were formed of bundles of dry flax stalks lashed tightly into bundles 20 to 24 feet long and 10 inches in diameter, built up by being lashed together, into a concave boat-shaped structure, pointed at one end, truncate at the other (Best, 1925, p. 138). Another and superior design was canoe-shaped, pointed at each end and built up of spindle-shaped bundles of bulrush leaves. Shortland (1851, p. 204) writes:

> Three bundles of *raupo* [leaves of the bulrush] about 18 feet long and 2 feet in diameter at the center, but tapering toward the extremities, were first constructed separately, each being tightly bound and secured with flax, and were then fastened together so as to form a flat raft. Another bundle similarly made was next laid along the middle of this and secured in that position, forming a sort of keel; the hollow intervals left between the keel and sides were filled with *raupo* packed carefully and tightly in layers and secured with bands of flax. The bottom of the *mokihi* being thus finished, it was turned over, and two smaller bundles were laid along its outer rim, from stem to stern, for topsides, and all the vacancies within were filled up with layers of *raupo* tied down with flax.

Polack (1840, vol. 1, p. 227), an early trader at the Bay of Islands, states that he had seen reed rafts

> . . . nearly 60 feet in length, capable of holding as many persons, but they are now wholly in disuse. They were remarkably thick, formed entirely of rushes, except the thwarts, and resembled the model of a canoe in every particular. They were remarkably light . . . though many bundles of rushes were consumed in forming them, and were paddled with much velocity, until saturated, when they settled down in the water.

Best, to whom we are indebted for so much information on this subject, mentions and illustrates a huge cylindrical bundle of dried bulrushes (*moki*) astride which a man sat, paddling with his hands (1925, p. 140). This is comparable with the *caballito* of the coasts of Ecuador and Peru.

CHATHAM ISLANDS

RAFTS

The Chatham Islands, which are believed to have been colonized from New Zealand by the ancestors of the Moriori people, who were the inhabitants when the islands became known to Europeans, are without any timber suitable for making canoes, whether dugouts or of planks sewn together. The only materials available and suitable are the flower stems of flax (*korari*), the stalks of tree ferns, the pliant withies of the supplejack, and short pieces of wood obtainable from two large shrubs, the *ake-ake* and the *matipo*; the sea furnished bladders made from the bull kelp (*rimu*) for use as floats. With these scanty and unpromising materials the Moriori made cratelike boat rafts ranging from a one-man raft 9 feet long by an extreme width of 20 inches (*waka korari* or *waka puhara*), up to deep-sea craft (*waka pahii*, also called *pepe*) 50 feet long, having a width of 8 feet and a depth of 5 feet; the *waka pahii* were used to cross between

the islands, the minimum distance of such trips being 12 miles. They were esteemed safe even in rough weather (Shand, 1894, p. 86).

These curious craft were punt-shaped structures with truncate sterns, propelled by oars. Except that the fore end was broad instead of pointed, the smaller sizes, viewed from the side, were not unlike the form of an Arab *sambuk* or of a *machwa* of the Bombay coast of India; there was the same long grab bow and steeply sloped transom stern. In the small examples preserved in the Dominion Museum this resemblance is emphasized, owing to the greater relative elevation of the stern as compared with what it was in the larger sizes.

The particulars which follow and summarize the knowledge of these strange craft, long extinct, are derived entirely from the invaluable works of Shand (1871, 1911) and of H. D. Skinner (1919, 1923, 1928), wherein is to be found all that is known with certainty of Moriori ethnology; to these the reader is referred for further details.

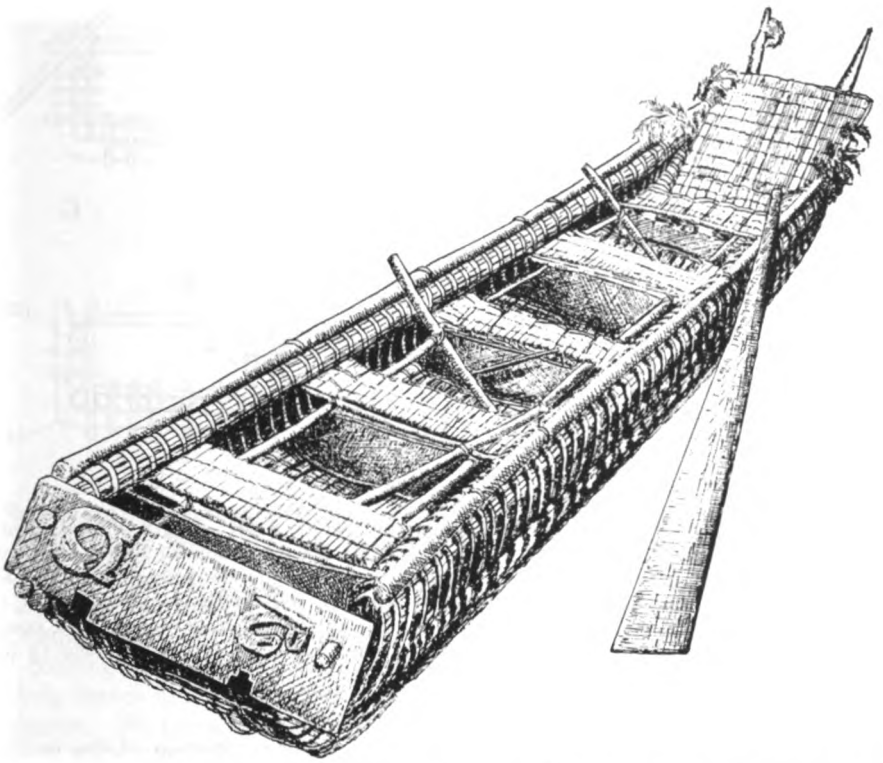


FIGURE 148.—Moriori sea-going canoe raft, propelled by oars; length 13 feet 3 inches; width over stern 19.25 inches (after Skinner, 1919).

The general construction of the framework, apart from specialized features due to local necessities and materials, is surprisingly like that of framed vessels; in many respects the design shows a remarkable comprehension of the principles of advanced marine architecture. It seems probable that this type represents a specialized development of a form of raft used by the Moriori when they lived in New Zealand, and lends weight to the hypothesis that much of the earliest movement in the Pacific was effected by men who employed some form of sailing raft in their voyaging from island to island.

The framework, as described and illustrated by Skinner, consists of a pair of parallel keels or runners, separated by a considerable distance which in small "canoes" is equal to about half the gunwale beam. Each is made up of several strips of thin wood set edgewise and lashed together over scarfed joints; the fore ends curve up gradually, the after ones more sharply. Several observers have likened the shape of the smaller rafts to that of a wheelbarrow. Upon the upper edges of the runners a great number of light frames are tied, made of slender supplejack stems laid 1 to 2 inches apart. To hold them in position the free ends are lashed to fore-and-aft rods extending from the stern to the prow; when there is need, owing to the shortness of the frame rods, lengthening side ribs are added. The horizontal middle sections of the frames lying athwart the keel runners are secured to several long rods laid longitudinally over them. Two of these in turn are lashed to the runners. Bundles of dried fern stalks and flax stems are tied laterally to the upper extremities of the frames, both on the outer and inner aspects; these bundles may be taken to represent the washstrake of a planked canoe or boat. A covering board or gunwale rail is supplied by a long tough pole tied upon the upper edge of these side bundles. A stern board of *ake-ake* (*Olearia traversi*) closes in the stern between the curved-up after ends of the twin keels. (See fig. 148.)

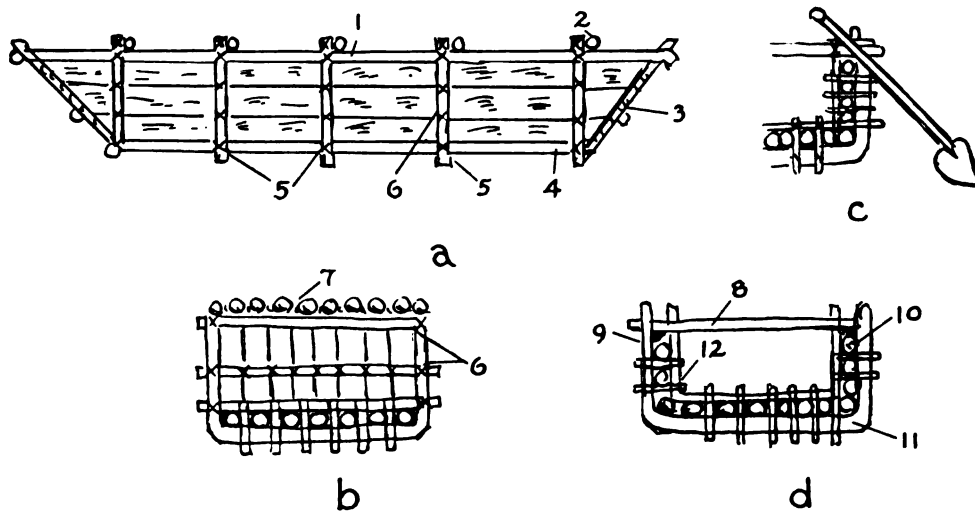


FIGURE 149.—Moriori punt built for bird-hunting, width 8 feet, length 28 feet, height 3 feet: *a*, side view; *b*, end view; *c*, cross section of half the punt showing paddle in place; *d*, cross section; 1, upper side pole of frame; 2, cross ties; 3, oblique end pole of frame; 4, lower side pole of frame; 5, knee-shaped supports; 6, lashings; 7, rolls of *Phormium* stalks; 8, cross tie; 9, through lashings; 10, rolls of *Phormium* stalks; 11, knee-shaped supports; 12, covering battens; length of paddle 6 feet 6 inches, width of blade 9 inches, length of blade 13 inches (after Skinner and Baucke, 1928).

To form a flooring and give additional buoyancy the lower portion of the interior is tightly packed with fern stalks and flax stems lashed together and to the frames by flax cord. In larger craft, intended to be afloat for longer periods than the smaller ones, inflated bladders of bull kelp replaced wholly or in part this buoyant packing of flax and fern. The kelp floats were confined under a rude grating made of rods passed from side to side of the hull. Rowing seats were formed of short lengths of fern stalks lashed side by side, supported on slender rods crossing the hull and, in large vessels of this type, by a vertical plank of *ake-ake* wood (Skinner, 1919, p. 66).

Immediately in front of each seat, on alternate sides, a stout rod was lashed obliquely against the gunwale rail. The lower end was thrust deeply into the flooring material; the upper projected 2 or 3 inches above the rail and appears to have been used as a thole pin, for, curiously enough and one more feature differentiating the Moriori from true Polynesians, the Moriori did not use paddles, rowing with a long bladed oar (*hiwa*) in the European style, that is, facing the stern.

The largest *waka pahii* are said to have been able to carry 60 or 70 people.

A special punt-shaped craft was used when hunting birds; Baucke (1928, fig. 6), the only person living who has seen them, gives diagrams of their construction (fig. 149).

The kelp-bladder floats, which appear to have been used to give additional buoyancy to the larger of these strange craft, deserve particular notice. Taylor (1870, p. 18) describes them:

> [They were made] from the *rimu*, a seaweed with large flat leaves, which were converted into tubes by making a small orifice through the outer skin of one side and then inflating the intervening space and stopping up the opening; they thus became large air tubes, and when dry retained their shape, becoming hard and buoyant. . . . The air tubes were lashed to the sides of the frame [of the boat raft] and the interstices filled up with moss, so that the whole was rendered tolerably watertight and so buoyant as to be unable to sink.

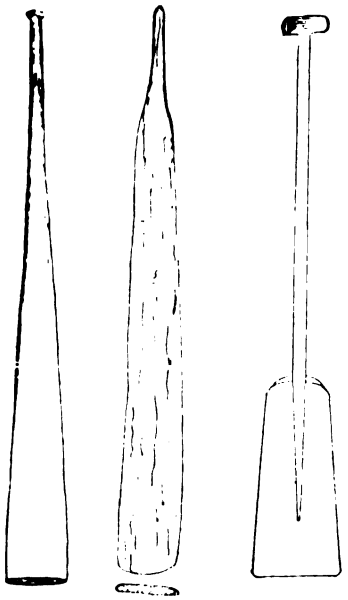


FIGURE 150.—Moriori oars and paddles: left, oar (*hiwa*), length 5 feet 7 inches; middle, oar; right, steering paddle (?) after Edge-Partington (from Skinner, 1923).

H. D. Skinner informs me in a letter that the South Island Maoris make somewhat similar kelp bladders called *poha* to contain split and gutted "mutton birds" after cooking; these receptacles are said to remain air-tight for several months. The kelp leaves are filled with vesicular cellular tissue resembling honeycomb in appearance. By pushing a knife through the hole where the "leaf" has been cut from its stalk, this soft filling is broken up quite easily, thereby converting the leaf blade into a potential bladder a couple of feet long and 8 or 9 inches wide. The *puha* can then be kept inflated by tying or stopping up the inlet orifice after inflation. A few of these disposed as described above would be the homologues of the air chambers fitted in modern lifeboats.

Against the statements by Taylor and Shand that the bull-kelp bladders were used to give increased buoyancy, must be set the denial of Baucke (Skinner and Baucke, 1928, p. 363) that they were ever used for any other purpose than as receptacles in which to keep food and as water bags. Although Baucke is almost the only surviving person who can pretend to any first-hand knowledge of Moriori culture, it is certain that his acquaintance with their boat rafts is confined to those of small size; it must be noted that the older writers specifically limited the use of

these bladders to the large craft (*waka pahii* or *pepe*) which had on occasion to remain afloat for considerably longer periods than the small ones used inshore for fishing. In view of the fact that bundles of flax stems become sodden and saturated after a comparatively short immersion in water, Baucke's own statement that kelp bladders were used as water bags goes far to justify belief in their use as air bags or air chambers in the construction of *waka pahii* employed in making voyages of from 12 to 20 miles to and from the outlying islands, as stated by Shand.

Sails were never used and, in strange contrast with the Polynesian custom, paddles were replaced by what can not be regarded as other than true oars. In shape these oars (*hiwa* or *kiwa*) were of almost normal European form, rudely fashioned. Only the immediate proximal region was cylindrical, flattening quickly into the blade but widening gradually. The widest part of the blade was at the distal end, which was truncate (fig. 150). Other forms appear to have been also in use, according to Baucke (1928, p. 363), who states that a common one was of typical paddle form, the blade cordate in shape and the loom provided with a rounded knob as a grip (fig. 149, *c*).

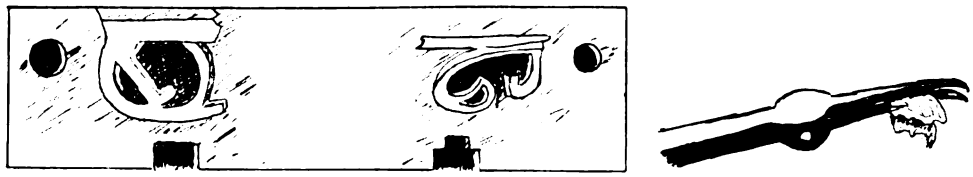


FIGURE 151.—Details of carving of *waka-korari*: *a*, at stern; *b*, at bow (after Skinner, 1923).

The Moriori rowed sitting, using as thole pins short rods projecting 2 or 3 inches above the gunwale; the oars were pulled by the crew with their faces turned toward the stern as in ordinary European rowing. There seems to be no suggestion that the method was a borrowed one; neither can it be believed to be an independent invention of the Moriori, save insofar as it may be a modification of the method mentioned by Porter (1822, vol. 2, p. 173) as seen by him in the Marquesas, where the canoes were "managed with paddles more resembling an oar, and, in some measure used as such, but in a perpendicular position, the fulcrum resting on the outriggers projecting from each side".

The limited use of planking in these raftlike structures limited the scope for carved ornamentation, which, in the example figured by Skinner (1919) consists of curvilinear design, understood to represent two conventionalized birds (fig. 151) upon the transom board at the stern and the fashioning of the outer ends of each of the "prow sticks" into the form of a sea bird's head. Apart from these (Skinner, 1919), the decoration of these craft was confined to the attachment of bunches of white sea-bird's feathers along the upper edge of the gunwale, "from abreast the front seat onward and carried out along the two projecting prow sticks".

According to Shand (1911, p. 10) a small raft (*waka-ra*), made of flax and fern stalks and constructed after the fashion of the Maori *mokihi*, was set afloat and adrift on certain occasions as a votive offering to a sea deity.

> It was quite low and had wooden images of men placed upon it, from 12 to 24 in number, each with a paddle in its hands. With a fair wind the canoe [raft] was started off to sea as a messenger to the god Rongotakuiti, who, in response, sent ashore shoals of seals and blackfish.

SAMOA

When Bougainville discovered the Samoan islands in 1768, the first sight which arrested his attention as he sailed along the coast was the multitude of canoes constantly on the move in the open sea outside the reef; ignorant of their limitations, he concluded that the inhabitants were skilled and enterprising seamen, hence he considered it eminently appropriate to bestow the name "Les Îles des Navigateurs" upon the islands. The canoes seen by Bougainville were, however, fishing canoes engaged mainly in the pursuit of bonito shoals and quite unfitted for lengthy voyages. From traditional accounts, the islands deserved Bougainville's appellation far better five or seven centuries ago than at the period when European intercourse began. Turner (1861, p. 270) describes the Samoans as

> . . . quite a domestic people who rarely venture out of sight of land. The group, however, is extensive, and gives them some scope for travel; it numbers 10 inhabited islands and stretches east and west about 200 miles. Within these bounds they have kept up an intercourse from the earliest times in their history, which is proved, not only by tradition, but by the uniformity of customs and language which prevails from one end of the group to the other.

At the present day examples of the three smallest types of indigenous seacraft survive. Two of these, the *paopao* and the *soatau*, are dugouts, and the third is the elegant *va'a alo* (bonito canoe) with a plank-built, sewn hull; all three are paddling outriggers. A sailing outrigger canoe, the *amatasi*, of considerable size and equipped with a balance spar, existed till about the middle of the last century. Double canoes (*'alia*), constructed on the Fijian model, also persisted till comparatively recent years; this borrowed type had displaced the indigenous one, the *va'a tele*, in the same way and probably about the same time as the Tongan *tongiaki* was similarly supplanted.

OUTRIGGER DUGOUT CANOES

Types

Dugout canoes are the ordinary craft employed for inshore fishing; they comprise two types, the *paopao* and the *soatau*. The *paopao* is a one-man paddling canoe fitted with two outrigger booms, used in the quiet water of the lagoon within the shelter of the reef (fig. 152); the *soatau*, in several varieties, is a multiboom outrigger of larger size, used for longer fishing excursions along the coast and out to sea (fig. 156); like the *paopao* it is propelled normally by paddles.

The varieties of the *soatau* were formerly distinguished by terms indicative of the number of outrigger booms present; today, so few survive that whether they have three, the usual number, or the rare four (fig. 153, *a*), all are referred to as *soatau*. When larger ones existed, the commonest had five booms, the *'iatolima;* next came the *'iato-ono* with six booms, and so on up to one having nine, the *'iatova*, which appears to have been the limit to boom increase according to Demandt (1913, p. 19), who even at the beginning of this century was compelled to say, "Nowadays one scarcely ever sees a canoe with more than five *'iato*". In the British Museum is a finely made model of a paddling *soatau*, equipped with eight booms.

Construction

The hull in both the *paopao* and the *soatau* is typically a dugout without added parts except the outrigger. Buck (1930, p. 378) states that he was informed that the *'iatolima* of former days had washstrakes, end deckings, and a balance spar (*suati*), and were rigged for sailing. *Soatau* of any size are still occasionally used under sail and provided with short end deckings (fig. 159) and some may have had washstrakes, for even a *paopao* may be so provided if the original freeboard is considered too low. This divergence from the regular type is, however, very rare.

The forward end of the dugout hull sheers very slightly upward; it is of the clipper-bow type, with a distinctly concave profile which in some examples shows a tendency to become bifid. The stern has very fine lines and curves somewhat upward but to no great extent. In the *paopao* it terminates in a characteristic knob, truncate on the after side, with the lower part usually prolonged downward to form a blunt claw (fig. 153, *b*); this knob is of service as a purchase when drawing the canoe ashore or when anchoring in the lagoon. The hull of the *soatau*, though having the same general form, is longer in proportion to its width; the stern is wider and instead of tapering up to a terminal knob is cut off square, sub-triangular in end view.

In the better-made *paopao* and generally in the *soatau*, in which the solid ends are longer than in the *paopao*, this region at each extremity is decorated with a few triangular projections or knobs, along the middle line (fig. 152, 159), homologues of the row of cleat projections (*salue*) fully developed in the bonito canoes, whereto white cowries (*pule*) are tied.

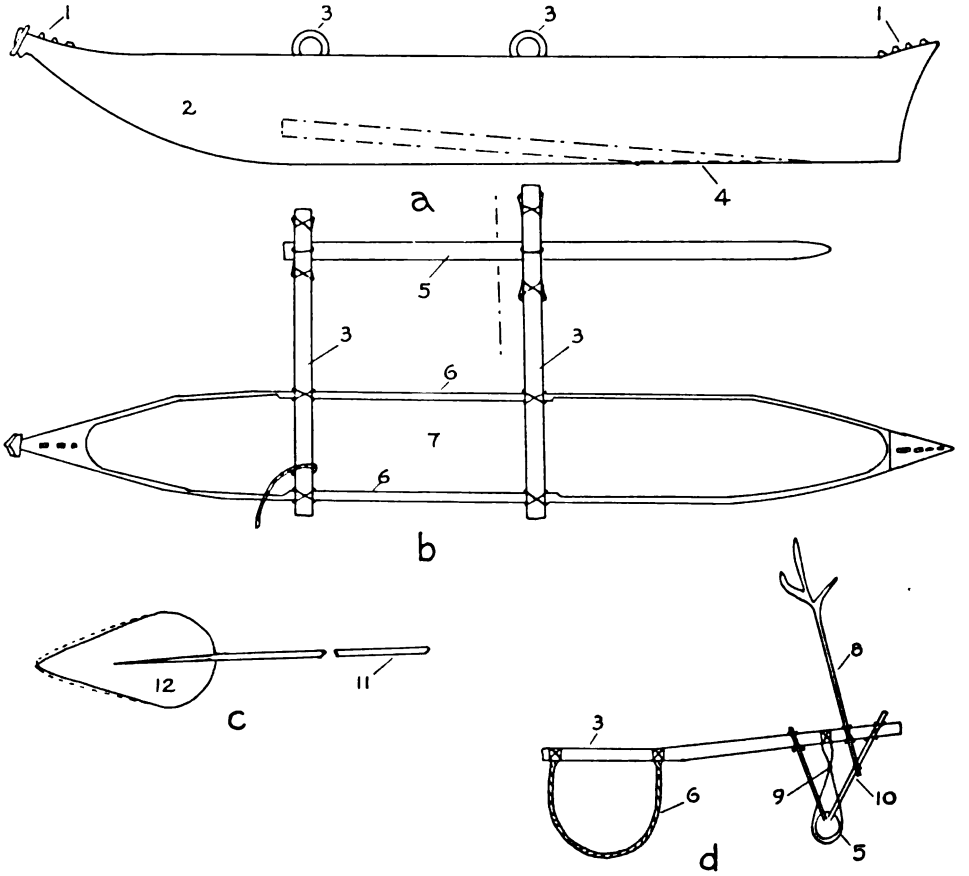


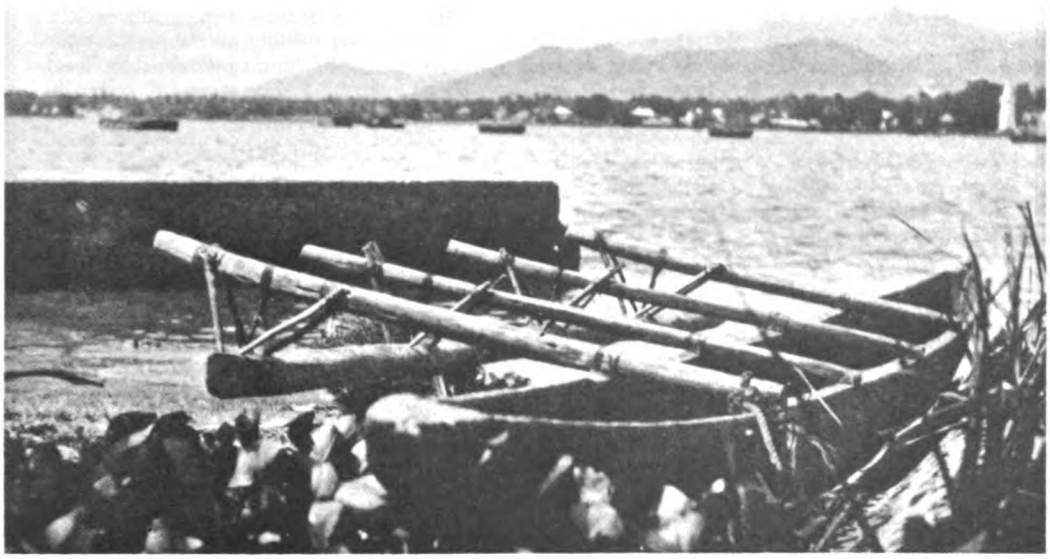
FIGURE 152.—Structural details of a *paopao*, smallest of Samoan outrigger canoes: *a*, side view; *b*, top view; *c*, paddle; *d*, cross section; 1, *pule*; 2, *taumuli*; 3, *iato*; 4, *ta'ele*; 5, *ama*; 6, *oa*; 7, *liu*; 8, *langa ofe*; 9, *li*; 10, *tuitui*; 11, *au*; 12, *lau*; broken lines indicate the lie of the float relative to the longitudinal axis of hull (after Demandt, 1913).

The hull is open, without decking; neither are there any thwarts, the paddlers using the inboard ends of the outrigger booms to sit upon. The bottom is straight except toward the extremities, and in transverse section is well rounded. The sides are nearly vertical, sloping gently inward in the upper part, so that if the beam of a 17-foot canoe is 14 inches, the width at the waterline will be about 16 inches; the depth of such a hull is about 15 inches. These dimensions appear to vary little in the different islands of the Pacific for dugout canoes of this length wherever timber of sufficient girth is available.

In hewing out the hull a wide inwardly projecting strengthening flange (*oa*) is left along the gunwale on each side of the waist, extending all the way between the lashings of the fore

and the after boom and for a few inches beyond; it is upon this widened gunwale that the booms are lashed (fig. 152).

The outrigger, which is normally fitted on the port side, consists of two or more booms, each connected indirectly to the float by two pairs of stanchions and a sennit brace. In the *paopao* there are two booms only; in the *soatau* from three upward, the greatest number being nine (Demandt, 1913, p. 19). More than three are now uncommon; whereas I saw several



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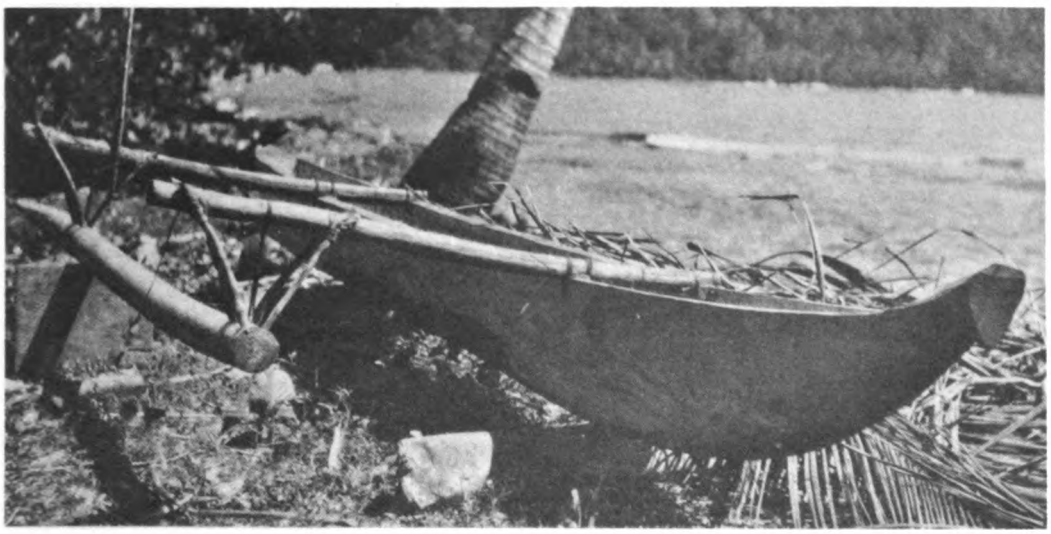


b

FIGURE 153.—Modern Samoan outrigger canoes: *a*, four-boom *soatau* (*'iotofa*) on the beach, Apia; *b*, typical *paopao* of Upolu viewed from port quarter—note curved-up, bluntly pointed stern ending in sub-triangular knob, truncate after end of float, closely set bases of units of each pair of stanchion connectives, and median sennit brace (photographed in 1925).

with three in 1925, I noticed one only with four and none with more. This tendency to a multiplication of booms is probably due to Melanesian influence, direct or indirect.

The booms are typically straight and cylindrical, but in several canoes they were seen to be roughly squared. In some of the better-made *paopao* and *soatau* each boom is slightly angled at the point where it leaves the hull, rising slightly in the outboard region (fig. 152, *d*). They are tied down upon the gunwales with sennit, the lashing passing through a single hole bored in the side immediately under the *oa* flange. In two-boom canoes they are situated respectively somewhat abaft the fore and after ends of the middle third of the length of the hull.

Most floats nowadays are cylindrical; formerly, before iron fittings were available, the upper surface was commonly ridged longitudinally to facilitate the drilling of the perforations required for the passage of the sennit braces. The fore end, extending approximately level with the head of the canoe, is cut horizontally to a chisel edge by a slice taken off generally from the upper side, but occasionally this is reversed, the cut being on the lower side. The after end is truncate, ending immediately behind its attachment to the after or aftermost boom. The float is not adjusted to lie in the same horizontal plane with the long axis of the hull; its fore end is depressed somewhat as compared with the after end. Similarly it is also slightly out of alinement with the hull, and the fore end is a few inches nearer the side of the canoe than is the after end.

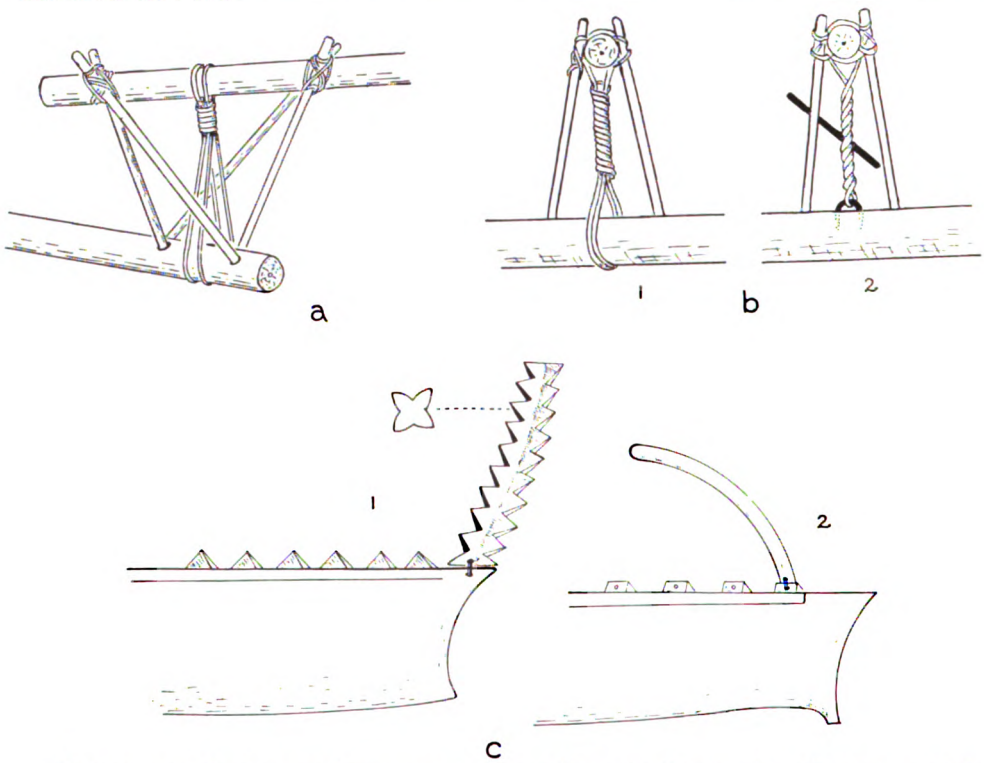


FIGURE 154.—Samoan outrigger canoes. *a*, outrigger attachment of small *paopao*, sennit brace carried around float. *b*, methods of tightening vertical sennit brace of outrigger attachments: 1, by seizing; 2, by use of Spanish windlass; in 2, loops of brace pass through iron staple driven into upper surface of float, a modern innovation substituted for the older methods. *c*, figureheads of *soatau*: 1, grooves between pyramidal points carved on four vertical ridges of post, may have been useful in keeping in place strings of shells tied around post (British Museum model); 2, common type (British Museum, two models).

OVERCROSSED STANCHION ATTACHMENT

The attachment of the float to the booms is indirect except in one peculiar Tutuilan type hereafter described. As in the fore-boom attachment seen in the Society Islands it consists of a combination of paired stanchion connectives with a

sennit brace, but the brace is median and vertical instead of being bifid and divergent upward from the float (figs. 154, *a*; 152, *d*).

Certain minor variations affect both the arrangement of the stanchions and that of the sennit brace. In all existing types of Samoan canoes, the stanchions consist inviarably of two pairs to each boom. As in Tonga and the Society Islands they are divisible into an outer and an inner pair, the connectives being *Cusuarina* (*toa*) rods. The pointed ends of the inner pair are inserted into shallow pits in the float a little way on the inner side of the median line, those of the outer pair similarly on the outer side of that line. The inner pair inclines toward the canoe, the outer away from it, so that the units of each pair diverge in a V-shaped manner from those of the other. The upper ends of the units of each pair are lashed to opposite sides of the boom in a simple but tasteful crisscross manner, quite unlike the elaborate diamond lashing characteristic of the Society Islands.

In the *paopao,* the units of each pair are commonly inserted unusually close together; their insertions are separated by a distance approximately equal to the diameter of the boom or only slightly greater. As a consequence they remain nearly parallel in their whole course (fig. 154, *b*). In the *soatau* their insertions are sometimes more widely separated, as in Tonga, so that they have to converge upward in order that their upper ends may lie against the sides of the boom (fig. 153).

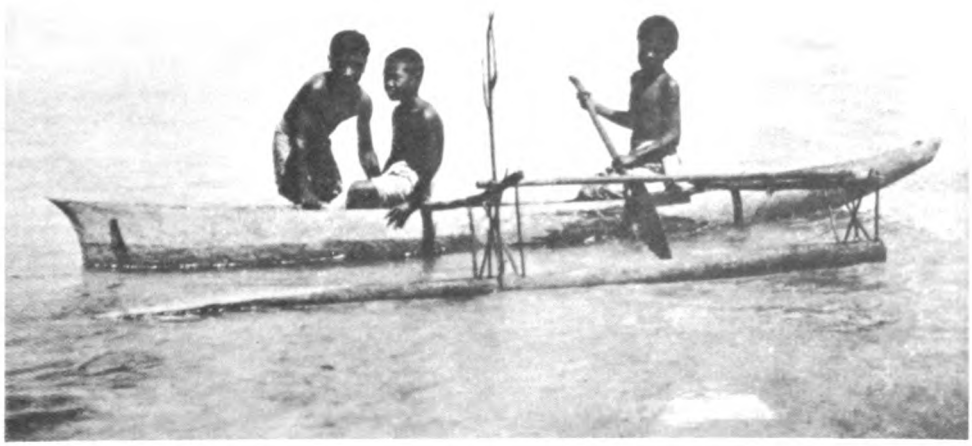


FIGURE 155.—Small Samoan *paopao,* great length of the free forward part of float notable; fore extremity brought to sharp edge by slicing away upper surface obliquely, after end truncate immediately behind after attachment; lower ends of sennit braces passed through iron staples driven into float (Apia, 1925). In eastern Samoa the brace loops may pass through a transverse perforation in the upper part of the float.

The sennit brace in both types is formed typically of several loops of braid, each of which is passed consecutively over the boom above and then carried vertically down to be threaded through a hole bored transversely through the median longitudinal ridge of the float, if present, or through a V-shaped hole if the float be cylindrical. In the degenerate and roughly made *paopao* and *soatau* of the present time the lower bights of the loops are very commonly passed through the eye of an iron staple driven into the upper surface of the float, instead of through a hole in the float itself (figs. 154, *b;* 155). The loops are subsequently drawn taut by a number of turns made around the vertical cords, the end of the braid being finally made fast by a couple of half-hitches. Alternatively, the cords are tightened by means of a short stick thrust

into the loops midway between boom and float, and rotated, Spanish windlass fashion, till the brace be sufficiently taut. The crossbar is left in the tightened loops with one end so adjusted between the stanchion connectives that they prevent it from yielding to the tendency of the tightly twisted braids to unwind (fig. 154, *b*).

The position of each sennit brace is normally midway between the associated two pairs of stanchions which the brace is intended to safeguard from the danger of being pulled out of their insertions when the float is dragged violently upward whenever the canoe lists suddenly to leeward.

The length of the stanchions in the fore boom attachment is typically somewhat greater than that of those in the after attachment of two-boom canoes; in those with a greater number, the decrease in length is progressive from front to rear; this causes the float to be lower forward than aft in relation to the line of the gunwale, and is thus arranged in order that it shall lie horizontal upon the water when the weight of the steersman weighs down the stern of the canoe, and raises its head, its ordinary trim (fig. 152).

At the end of the fore boom in both the *paopao* and the *soatau*, a branched stick (*langa 'ofe*) is lashed in an upright position to serve as a rest for the fishing rod (*'ofe*), spear, or other gear.

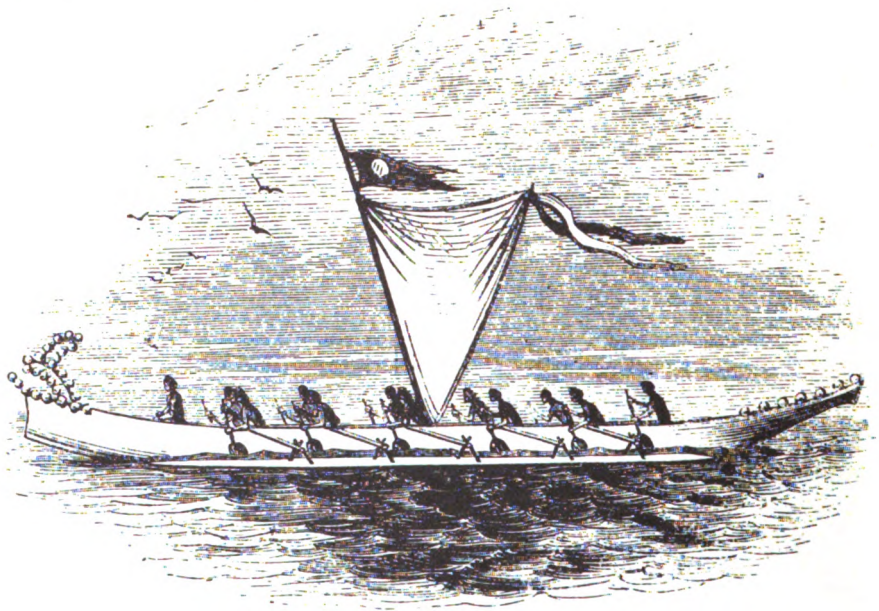


FIGURE 156.—Samoan *'iatolima*, figurehead of elaborate design decorated with many egg cowry shells (after Turner, 1861).

ORNAMENTATION

Besides the cowry decoration already described, the larger *soatau* in former times sometimes had definite figureheads adorned with the same shells. Many old museum models retain the curved pillars to which the shells were attached. In two examples in the British Museum the pillar is stout, cylindrical, and sharply curved backward with its lower end based upon the foremost of the median knobs upon the fore decking (fig. 154, *c*, 2). Shells strung on cord were wound around it as is still done in Fiji in the decoration of the projecting ends of the ridgepole of a chief's house.

In another model, also in the British Museum (fig. 154, *c*, 1), an eight-boomed dugout, the figurehead is an upright, slightly curved, four-sided post lashed by the

lower end to the head of the canoe, and not upon a decking knob as in the other examples. Here, probably, the shells were tied individually to the pillar, for this is V-grooved longitudinally along each of the four sides with each of the resulting triangular ridges notched into a vertical series of pyramidal projections resembling those down the center of the end deckings. If a shell were tied to each the appearance would be extremely handsome. Turner (1861, p. 267) figures an even more decorative form of shell-covered figurehead on a large *'iatolima* (fig. 156).

Direct Attachment

In Tutuila, Krämer (1906, p. 415) found and figured an exceptional form of outrigger attachment which is in use simultaneously with the ordinary Samoan type above described. In this Tutuilan type each boom is cut from a straight pole giving off a branch nearly at right angles. The straight main section is used as a horizontal boom and is cut off just beyond the fork. The side branch, turned downward, is used to connect with the float, being trimmed to a length suitable to maintain the float at the desired distance below the boom. The lower end is inserted into a socket in the upper side of the float (fig. 157). Although Krämer does not

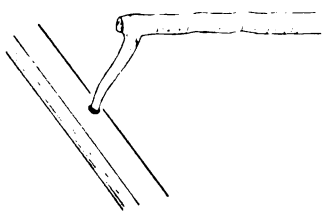


Figure 157.—Direct inserted outrigger attachment used in small canoes in Tutuila (after Krämer, 1906).

state that this form of attachment is restricted to use in small canoes (dugouts), this is probably so, for a photograph of a bonito canoe (*va'a alo*) from Tutuila in the Archaeological Museum, Cambridge, shows the attachment to be of the normal stanchion type current in Upolu and Savaii; egg cowries are also seen decorating each end of the end covers. Buck (1930, pp. 376-377) records both types of attachment as present in Tutuila, but the only one he observed of the direct type was in a *paopao*.

The method of direct attachment above described is closely related to the usage followed in most of the Cook Islands, as well as in the Ellice Islands, where, however, the down-turned end of each boom is lashed upon the float instead of being inserted into it. As the natives of the Ellice Islands claim a Samoan origin dating back, according to their own count, more than 27 generations (Brown, 1910, p. 416), it is probable that the Ellice Islands method of attachment is a modification of the Tutuilan one, and that this represents the original Samoan type; the stanchion type would then be of subsequent adoption, like the multiple booms of the *soatau*, from a Melanesian source. This conclusion harmonizes with other facts which point to direct attachment as the original method employed by the Polynesians at the time when they migrated to their present home.

Sailing Soatau

Sometimes the *soatau* uses a sail, which today is of European model. Formerly, to judge by museum models, the larger ones were equipped both with a sail and a balance board (*suati*) like the built-up sailing vessels (*amatasi*) here-

after described. Krämer (1902-3) depicts one having five booms (fig. 158) arranged as a forward pair, a middle pair, and an after single boom. On the first two, lashed together, the heel of the yard is stepped; the units of the second pair are spaced apart exactly the width of the *suati* and by means of two fore-and-aft bars secure it in position. This model is of great interest, for no mast is present; the triangular sail, enclosed on the long sides by two spars, one of which functions as a mast, is supported by a fore stay and a shroud running to the outer part of the *suati;* a sheet or vang attached to the upper part of the after spar (boomsprit) is secured below to the inboard part of the aftermost outrigger boom.

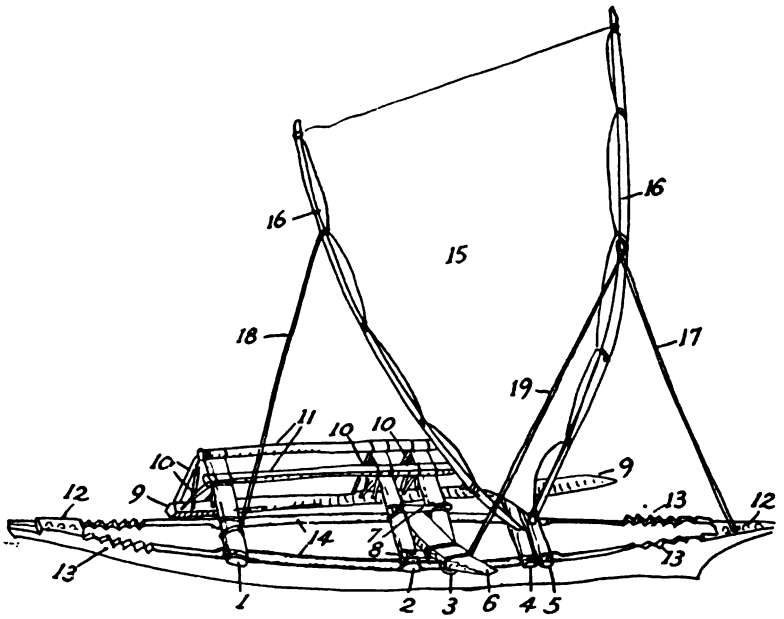


FIGURE 158.—Model of a five-boom *soatau* (*iatolima*) having sail and balance spar: 1-5, outrigger booms; 6, balance spar (*suati*), secured by having inner end passed under one cross bar (7) and over another (8); 9, float; 10, stanchion connectives; 11, two stringers over boom; 12, knob ornamentation; 13, serrated ornamentation of gunwale; 14, wide gunwale flange (*oa*); 15, sail; 16, yard and boom; 17, fore stay; 18, sheet; 19, starboard shroud (from Buck, 1930; after Krämer, 1903).

If the model represents an actual Samoan type, the sail shows remarkable affinity to that used by the New Zealand Maoris. The hull is a dugout without end deckings, but with a few median knobs on the solid ends; the gunwale on each side for a short distance at each end is serrated by the cutting of V-shaped notches in the edge, which is here left raised a little above the ordinary gunwale level; this is a form of ornament still found in Savaii dugouts, according to Buck.

A model of a four-boom *soatau* in the British Museum is also fitted for use under sail; here, however, the booms are nearly the same distance apart, and the balance spar (*suati*), instead of being lashed between two booms, is lashed to the after side of the second boom (fig. 159). No mast or sail is present, but there can be no doubt that they were used, for a mast thwart with a cup-shaped mast shoe is lashed athwart the hull on the after side of the first boom. Unlike Krämer's model, this one is decked over at the fore end and has a row of cowry cleats along the median line of this decking. The after decking is missing. The hull is a

dugout, but the original may have been plank-built, which would make it an *amatasi* and not a sailing *soatau*.

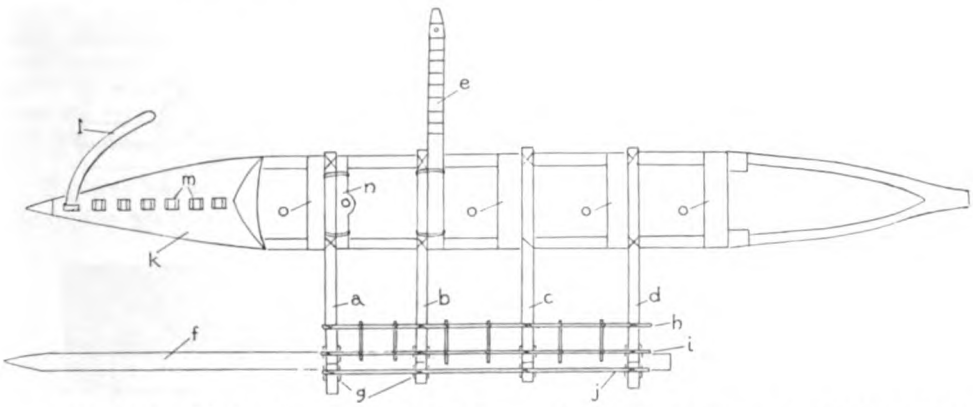


FIGURE 159.—Model of a four-boom sailing *soatau* (British Museum): *a-d*, booms; *e*, balance spar cut into foothold steps in outboard region, at distal end is a hole for attachment of a shroud; *f*, float; *g*, upper ends of stanchion connectives; *h-j*, stringers; *k*, fore decking; *l*, curved figurehead on which cowry shells were tied; *m*, six truncate knobs; *n*, mast thwart; *o*, paddling thwarts; stern decking is missing.

The balance spar (*suati*) in this canoe (figs. 159, *e*; 160, *a*, *b*) has a considerable length of the distal region cut into nine horizontal "steps" on the upper surface; these probably were footholds for members of the crew when stationed outboard in a strong breeze. Near the outer end is a vertical hole through which the end of a shroud was probably made fast.

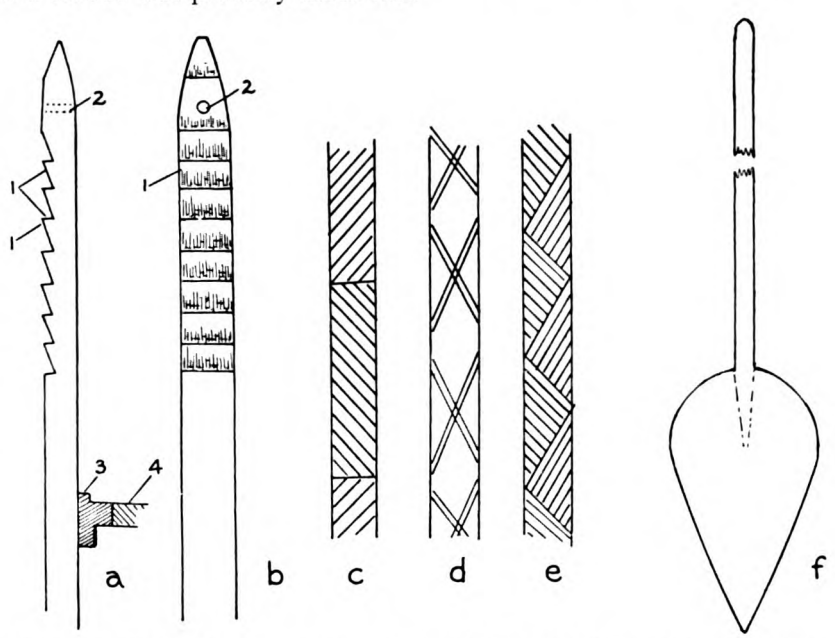


FIGURE 160.—Parts of Samoan canoes, *a*, *b*, side and top view of balance spar of sailing canoe (fig. 159): 1, foothold ridges; 2, hole through which side stay or shroud is made fast; 3, gunwale rail (*oa*); 4, side of canoe. *c-e*, incised patterns on upper surface of outrigger booms, model sailing *soatau* (British Museum). *f*, paddle.

The same model has rectilinear patterns incised upon the upper surface of the outrigger booms (fig. 160, *c-c*). Patterns of related type were also used in the ornamentation of prominent parts of the deck house and platform of the larger double canoes (*'alia*).

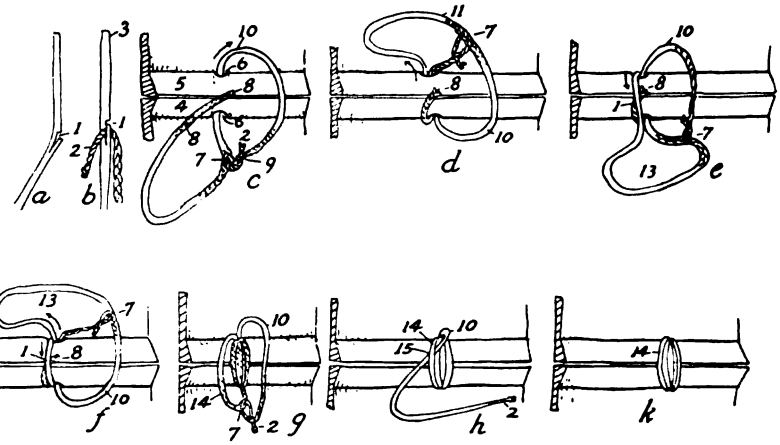


FIGURE 161.—Lashing together of edges of adjoining planks or "patches" in Samoan *va'a-alo* through marginal flanges by means of the continuous loop technique: *a*, coconut leaflet midrib pinched through to half its thickness at 1 and the lower end split back by slight bending; *b*, thin end of braid (2) put through slit (1) which is closed by straightening midrib; *c*, inside view showing two flanges (4, 5) fitted together with holes (6) coinciding, long end (3) of braid threaded through paired holes and braid drawn gently through, midrib discarded and thin end of braid (2) passed through under one of the plies of braid at 7 to form a loop, point 7 selected so that length of braid between it and end (8) is long enough to complete lashing turns, but in figure the length is much reduced; thin end (2) after passing through braid, is doubled back and passed through a ply on its standing part (9) to fix working loop; knot end of loop pulled through holes and new turn drawn taut, this manipulation repeated three or four times giving lashing of five or six turns; to finish off, the continuous loop (10) is unfastened by withdrawing thin end of braid from under plies at points 2 and 7; *h*, freed end (2) passed under last turn (14) and jerked down till the actual crossing (15) is moved down into lower hole; *k*, end cut off close, last turn (14) fixing it and finishing lashing (after Buck, 1930).

BUILT-UP OUTRIGGER CANOES

BONITO CANOE

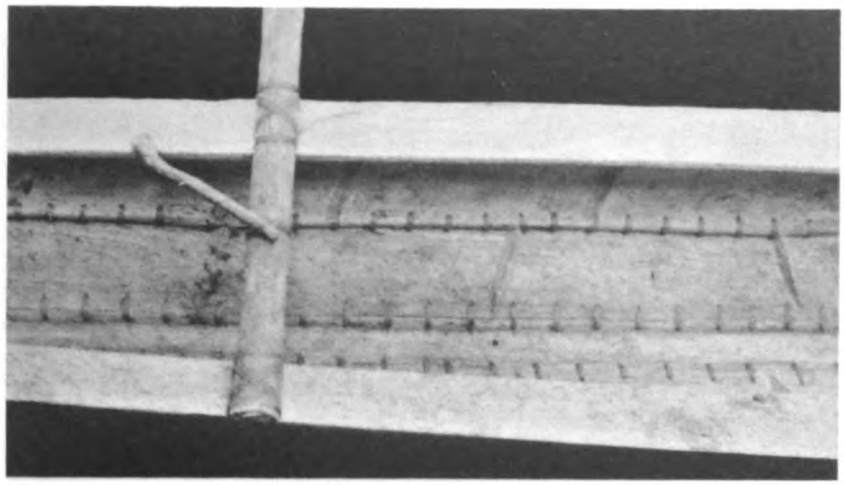
For deep-sea fishing and for voyaging between the islands and to Fiji, several varieties of large paddling and sailing outrigger canoes were formerly constructed of planks sewn together and raised upon a definite keel. Only the smallest of these survives, the *va'a alo,* employed in the bonito fishery. A larger one was used for dolphin fishing (Brown, 1910, p. 350) and one still larger for voyaging. Wilkes (1845, vol. 2, p. 143) describes the largest as ranging from 30 to 60 feet in length and large enough to carry from 10 to 12 persons; elsewhere (1845, vol. 2, p. 66) he mentions that at Manua the outrigger canoes were 30 to 40 feet long, some being "capable of containing 20 or 25 men and very swift".

Turner (1861, p. 266) gives an excellent account of the method of hull construction:

> Next to a well-built house, Samoan ingenuity is seen in their canoes. Anyone almost can fell a tree, cut off the branches, and hollow out the log, some 15 feet long, for a common fishing canoe, in which one or two men can sit. But the more carefully built canoe, with a number of separate planks raised from a keel, is the work of a distinct and not very numerous class of professed carpenters. The keel is laid in one piece, 25 to 50 feet long, as the size of the canoe may be, and to that they add board after board, not by overlapping and nailing but by sewing each close to its fellow, until they have raised [the side of the canoe] some 2, or, it may be

3 feet from the ground. These boards are not sawn, squared and uniform, but are a number of pieces, or patches, as they are called, varying in size from 18 inches to 5 feet long, as the wood split up from the log with felling axes happens to suit; all, however, are well fastened together, and, with the help of a little gum of the breadfruit tree for pitch, the whole is perfectly watertight. In dressing each board, they leave a ledge or rim all round the edge which is to be inside, making it double the thickness at the edge to what it is in the middle of the board. It is through this ledge or rim they bore the holes, and with a few turns of cinnet sew tight one board to the other. The sewing only appears on the inside. Outside all is smooth and neat, and it is only on close inspection you can see that there is a joint at all.

Figures 161 and 162, *a*, show how this lashing is made. In all full-sized canoes the hull is plank-built; some models have dugout underbodies.



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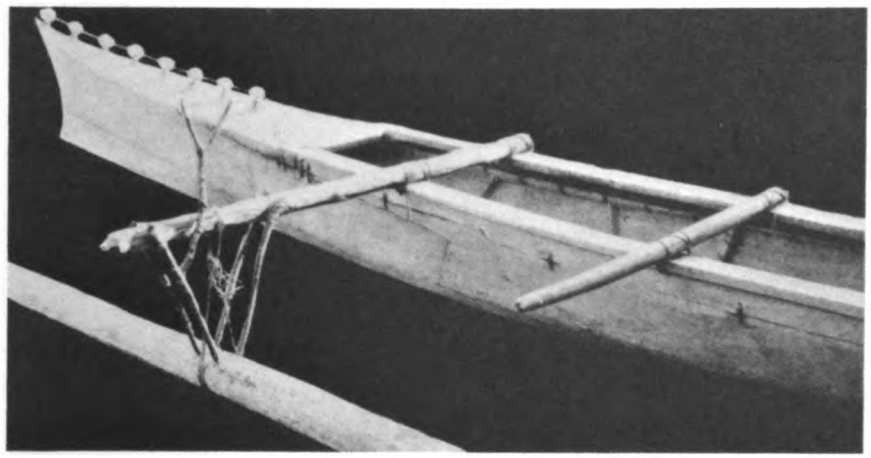
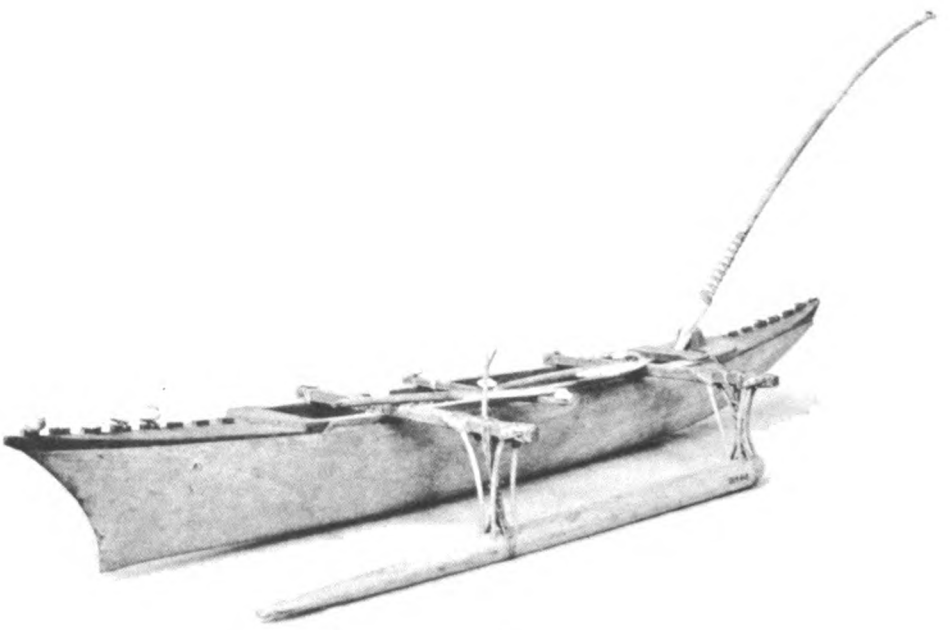


b

FIGURE 162.—Samoan plank-built bonito canoe (*va'a alo*): *a*, section of hold showing marginal flanges with sennit lashings on either side of narrow "keel" and also between first and second strakes, strengthening "ribs" on two of the patches of which strakes are made up, wide gunwale rail (*oa*) and hand hold (*pu'enga*) between gunwale and after boom; *b*, forward section of same canoe (after Buck, 1930).

a



b

FIGURE 163.—Samoan bonito canoe (*va'a alo*): *a*, posed photograph, note stanchion connectives of fore boom longer than of those of after one, broad gunwale rail (*oa*), median row of knobs on end deckings, rod socket behind second man, and short pseudo-boom on which first man sits (photograph by Tattersall's Studio, Apia); *b*, model (Science Museum, London) elucidating details of outrigger frame; each connective has elongated heel at upper end which enables it to be lashed to boom more securely than when quite straight, underbody a dugout.

According to Brown (1910, p. 350) and Buck (1930, p. 412) the gum was spread on both sides of a strip of bark cloth before being placed in the seam, but Buck (1930, p. 389) corroborates Turner's statement that the gum is applied direct to the joining surfaces in the smaller canoes.

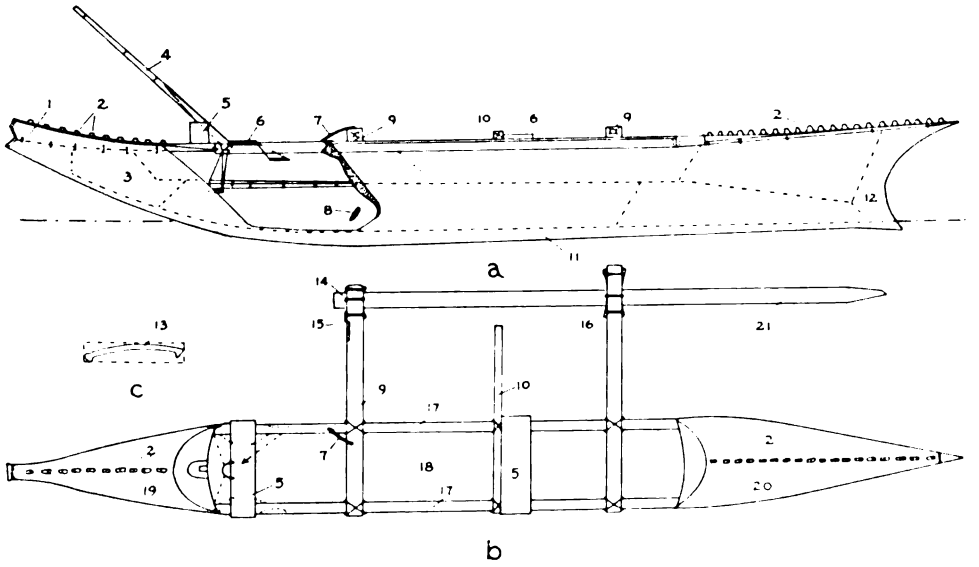


FIGURE 164.—Samoan bonito fishing canoe (*va'a alo*): *a*, side view, part of side cut away near stern to show how butt of fishing rod is secured and stayed; *b*, view from above; *c*, section of hull plank "patch" showing flange on each inner edge for binding lashing. 1, *fa'a fulufulufe*; 2, *pule*; 3, *taumuli*; 4, *'ofe*, *launiu*; 5, *pou'ofe*; 6, *nofoa* (in *b* the *nofoa* are numbered 5); 7, *puenga*; 8, *tulanga*; 9, *iato*; 10, *iato loto*; 11, *ta'ele*; 12, *taumua*; 13, *laufono*; 14, *li*; 15, *ia*; 16, *tu'itu'i*; 17, *oa*; 18, *liu*; 19, *velo*; 20, *tau*; 21, *ama* (after Demandt, 1913).

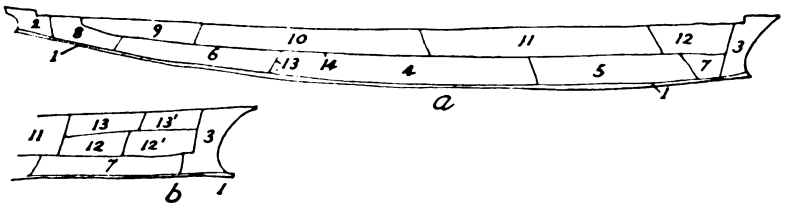


FIGURE 165.—Arrangement of plank "patches", hull of Samoan bonito canoe: *a*, side view; *b*, patch (12 in *a*) formed of four small patches. 1, keel; 2, after end piece; 3, fore end piece (*pale*); 4, middle patch (*tumatua*), ends running obliquely upward and inward; 5, 6, *tatao o le tumatua*, press (*tatao*) against the *tumatua* on either side; 7, *angai o le pale* (companion of the *pale*); 8, *angai o le taumuli* (companion of the *taumuli*); 9-12, patches forming upper strake (*laulua*), without specific names; 13, vertical seam (*tautu*); 14, strake seam (*aufono*) (after Buck, 1930).

In its lines the *va'a alo* is the most graceful of all Polynesian canoes (fig. 163). The features of the *soatau* are there, but refined and sharpened. A long and gentle sheer raises the forward end a few inches higher than the waist and ends in a sharp head hanging over a deeply crescentic cutwater. The lower portion of this crescent forms an angular forefoot. The after end as in the *soatau* runs fine to a point, the upper or decked surface very slightly sheered. Long fishing rods are used, and two or three men form the crew (fig. 163, *a*). On the fishing ground all would usually

be paddling, the steersman ready to throw down his paddle and swing round the fishing rod against which he leans when he feels the tremor of a hooked fish.

The hull (fig. 164) consists essentially of a narrow keel (*ta'ele*) 4 to 7 inches wide at the broadest part (amidships), the homologue of a dugout underbody, on which sides are built up, usually two strakes deep; the open ends of the built-up region are closed in respectively by bow and stern pieces hewn from the solid. In smaller hulls the stern piece may be in one with the keel. Both the end pieces are laterally winged at the inner and broader ends, to connect with the side strakes. The lower or garboard strake on each side consists typically of five "patches", each with a distinctive name; those in the upper strake are not individually named as their number and shape depend upon the planking available (fig. 165).

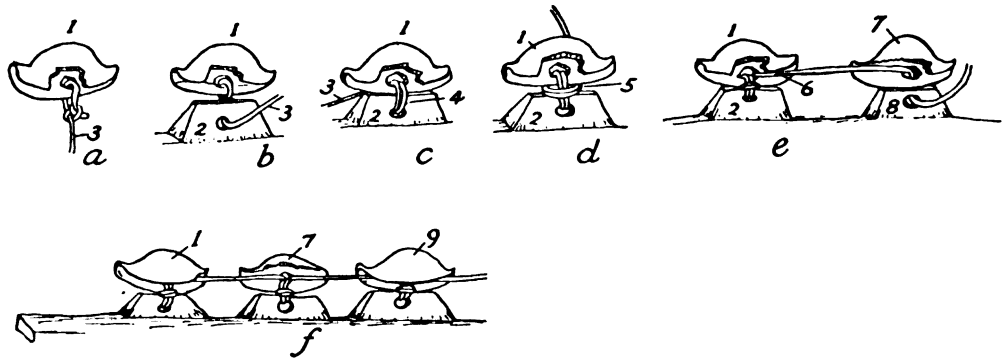


FIGURE 166.—Lashing of egg cowries upon median knobs (*salue*) of fore and after deckings, Samoan bonito canoe: *a-e*, lashing braid passed twice (4) through holes broken in sides of each shell (1) and through corresponding transverse hole in supporting knob (2), two circumferential turns (5) then taken around vertical turns (4), braid (6) afterwards brought back through holes in shell and passed to shell (7) to be attached to knob next in order (8); *f*, first and third shell (1, 9) as they actually appear, circumferential turns and those passing through inner shell hole hidden, second (7) with part removed to show course of braid as in *a-e* (after Buck, 1930).

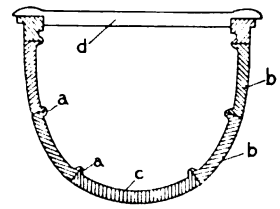


FIGURE 167.—Diagrammatic cross section through hull of Samoan bonito canoe: *a*, marginal cants or flanges inside; *b*, strakes; *c*, keel; *d*, stiffening thwart (*nofoa*), resting on the broad gunwale flange (*oa*).

A long decking adzed out of the solid covers the forward part of the hull, a slightly shorter one the stern end. Neither, however, reaches to the actual extremity of either head or stern, as the end pieces rise here to deck level. Down the center of each decking extends a long row of rectangular knobs (*salue*) hewn out of the same block as the decking itself; in a fine *va'a alo* which I saw near Apia in 1925 there were 17 knobs in the median line on the fore decking and 13 on the after one. On all these knobs the gleaming white shells of the egg cowry were attached when the owner possessed a sufficient number, but in the one seen only four of the *salue* on each decking carried shells (fig. 166). In former days they were also tied "along the upper part of the outrigger" (Turner, 1861, p. 269).

Besides the row of knobs carved out of the after decking, a high-walled semicircular socket (*pou'ofe*) is also hewn out of it, just behind the forward margin, to form a rest for the bonito rod.

The washstrake on either side of the open waist is broadly flanged horizontally on both its outer and inner sides, so forming a wide shelf-like gunwale rail (fig. 167). A thwart resting on the gunwales forms the captain's seat a short distance forward of the after deck cover.

When beginning fishing, the butt of the bonito rod, raking sharply aft, rests in the deep groove of the half socket on the after decking; its heel is thrust into a sennit-made grommet suspended beneath the steersman's seat (fig. 163). This man, leaning his buttocks against the rod as he and his companions paddle along through a shoal of bonito, knows instantly by the feel when a fish takes the hook; throwing down his paddle, he seizes the rod and with a deft movement swings the fish inboard. According to the number of paddlers other than the steersman, either one or two loose thwarts are usually provided, shaped below at the ends to fit over the flanges (*oa*); if two, one is placed in front of each boom.

The outrigger consists of two straight cylindrical booms lashed upon the gunwales and connected to the long float by two pairs of stanchions and a vertical sennit brace passed twice around the float and tightened by a serving of sennit between the boom and the float (fig. 168). A variation on this method is depicted in figure 169. In each pair of stanchions the units are set closely together, nearly parallel and only slightly inclined from the vertical. The attachment of the sennit brace to the boom is different from that adopted in the *soatau*, where the bracing loops pass typically through a transverse perforation in the float; the *soatau* receive rougher handling than the *va'a alo*, being dragged across the rough coral beach both in launching and in beaching, hence if the braids of the brace were passed around the float they would be subject to constant damage and would require frequent renewal. The *va'a alo*, being lightly built and of much value to the owners, are always carried to and from the sea, hence the loops of the brace may be passed around the float without danger of abrasion (fig. 163).

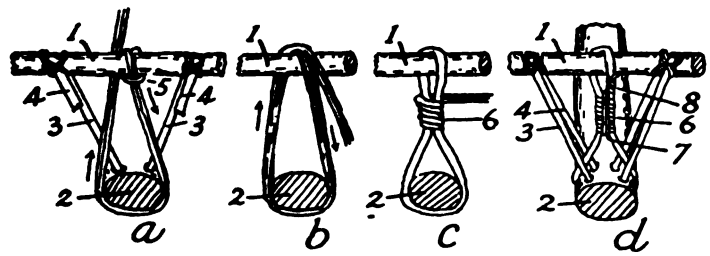


FIGURE 168.—Method of forming sennit brace (*li*) between boom and float in Upolu and eastern Samoa: 1, boom; 2, float; 3, fore stanchion connectives; 4, after stanchions cut off below; *a-c*, back views of sections made between fore and after stanchions; in *a*, length of braid doubled, loop passed forward over boom and brought back under it, the two limbs of braid passed through loop (5) and drawn taut, doubled braid then brought down right side of float between inner stanchions, passed under float and up between outer stanchions, thence upward behind boom; in *b*, braid brought over boom and a number of turns made around float and boom in same manner as first turn; in *c*, number of vertical turns being sufficient series of close transverse turns (6) made around both limbs of lashing which draws them together and tightens up lashing; *d*, top view, couple of longitudinal turns (7) made over transverse turns by passing braid between diverging limbs above and below, couple of turns taken around one of upper limbs and lashing completed with couple of half-hitches (8) (from Buck, 1930).

The stanchions of the after boom, as in dugouts, are again shorter than those of the forward one. The float is similar in form and arrangement to that in dugout canoes, bluntly pointed in front, truncate behind.

A secondary boom, which may be termed a pseudo-boom, fitted about midway between the two outrigger booms, projects outboard on the same side but does not extend as far as the float, with which it has no connection. Its outboard part is useful as a support for fishing rods when not in use. The inner end may serve as a seat for a paddler if a proper thwart is not provided, as in western Samoa when the canoe is manned by two hands only.

The remaining fittings consist of a short curved bar (*pu'enga*) passing obliquely forward from the port gunwale in front of the steersman's thwart to the middle of the inboard part of the after boom, and of the usual forked branch (*lango'ofe*) attached vertically to the outer end of the fore boom. The *pu'enga* serves as a steadying grip for the steersman's left hand when swinging a hooked bonito into the canoe, the *lango'ofe* as a rest for the rod when not in use.

The average dimensions of one of these canoes are: length 25 to 30 feet, beam 12 inches, depth 18 inches; the head and stern deckings are from 8 to 10 feet long; the float, made of hau (*fau, Hibiscus*), is boomed out 8 feet from the hull.

A larger-sized canoe, now extinct, was used in dolphin fishing. Built on the same lines as the *va'a-alo,* apart from size it differed mainly in having a multiboom outrigger in place of one with two only. The crew complement, 3 in the *va'a-alo,* was correspondingly increased according to the length and number of booms to 9 or even 12 (Brown, 1910, p. 350).

The Samoans never paint their canoes, so when the bonito season comes to an end the *va'a-alo* is dismantled, the outrigger removed, and the hull hung from the rafters high up in the owner's dwelling.

FIGURE 169.—Doubled form of sennit outrigger brace in use in Savaii: 1, boom; 2, fore stanchion connectives; 4, after stanchions; *a,* completed attachment, showing two sets of turns passing under float and crossing one another in their turns over boom; *b,* sennit turns with stanchions omitted. Braid fixed to boom and makes first turn (5) around float but passes over boom on same aft side; passing over boom to front the braid makes a second turn (6) round float and returns up over boom on same front side; the two series continued on either side of boom until sufficient turns have been made; a series of half-hitches (7) made around the two limbs of first set (5) and braid passes directly across to make a series of half-hitches (8) around the two limbs of second series (6), which completes attachment; this method used in Upolu in conjunction with variation in which half-hitches, instead of being made separately around each of the two series of turns, are made around both series taken together (from Buck, 1930).

VOYAGING CANOE

Large sailing outriggers were in use until the middle of the last century (Erskine, 1853, p. 60), when they were replaced—and forgotten—as the chiefly traveling craft by the *taumualua,* which made its first appearance in 1849. The large sailing outriggers, which appear to have been called *amatasi,* in common with the equivalent sailing outrigger of the Ellice Islands, were, so far as the hull is concerned, plank-built like the *va'a-alo* but with multiple booms like the *soatau.* In length they ranged up to 50 feet with a beam up to 30 inches (Turner, 1861, p. 267).

The outrigger was identical in type with that in use in existing multiboom *soatau* canoes. In a crude illustration by Croisy given by Bougainville (1771, p. 238) four booms project from the starboard side, an unusual arrangement; these are connected by stanchions to a float correctly shown as prolonged forward almost level with the head of the canoe, which is depicted as decked in at each end for a considerable distance. On the port side is a pole or narrow platform projecting outboard a considerable distance and apparently inclined upward in an oblique direction; obviously this represents a balance spar or boom on which one of the crew has his station, adding his weight to the counterpoise.

The rig of these canoes was a typical Oceanic lateen. The sail was of matting, of a triangular shape, set apex downward and confined between two poles, a yard

and a boom. It was slung from the head of a vertical mast, stepped about amidships. From the boom, as seen in Croisy's sketch, floated out streamers in the Fijian manner. Erskine (1853, p. 60) states that they had no way of reefing and adds that they were said to be often blown off the coast.

Of particular interest in these canoes is the balance boom (*suati*). This, which was also part of the equipment of the Tongan *hamatafua* and a homologue of the balance platform of the sailing outriggers of the Society Islands, is well described by Wilkes (1845, vol. 2, p. 144):

> Having both a prow and stern, these canoes can not be manoeuvered without tacking; consequently the outrigger, that constituted their safety, is, in using their sail, alternately to leeward and windward, and does not, when to leeward, add much to the stability of the canoe. They carry less sail than the canoes of the other natives of Polynesia, and to guard against the danger of upsetting, the natives rig a sprit or boom (*suati*), projecting from the opposite side to that to which the outrigger is fitted. This boom is secured by guys to the top of the mast. When the wind blows fresh, some of the men go out upon it, and thus balance or counteract the force of the wind. Those on the other side of the canoe are kept ready to go out on the outrigger when this becomes necessary.

Another reference to the use of this accessory stabilizing device is one by Erskine (1853, p. 60), who saw, in 1849, some of the large canoes in which the Samoans made voyages between the islands:

> They are capable of holding 14 paddlers, besides a sitter [presumably a chief in the place of honor at the fore end], and are similar in construction to the smaller canoes, although in addition to the floating outrigger they have a long spar projecting to windward, on which stands one of the crew, as ballast, regulating his distance from the gunwale according to the strength of the breeze.

From the mention of the balance spar being on the windward side it may be inferred that the canoe was tacking and had the outrigger on the lee side on this particular tack; indeed, when sailing with the outrigger float to windward, the balance spar would not be functioning. When describing the outrigger of Niue canoes, Erskine (1853, p. 26) remarks that this "must not be confounded with that of a spar projecting to windward when under sail to enable a man to ballast the canoe with the weight of his body, although we afterward saw that plan sometimes in operation among the Navigators Islands [Samoa]".

The allusions to the use of a balance spar projecting outboard on the side opposite to that from which the float of the outrigger was boomed out explain the meaning of the confusing statement by Brown (1910, p. 350):

> All these canoes had outriggers, and in the case of the sailing canoes they had one on both sides. If the breeze was strong, one of the crew stood on the windward side, going out farther and farther as the wind increased, and especially when the canoe was struck by a squall, and stepping inboard as it slacked.

Like so many of the older observers, Brown uses "outrigger" in an inexact sense and means merely an outboard counterpoise. Hence the difficulty writers have had to reconcile this apparently clear and precise record of the presence of double outrigger canoes in Samoa with its absence elsewhere in Polynesia.

According to Turner (1861, p. 269) these canoes usually carried as a figurehead some rude device representing the human figure, a dog, a bird, or something else that had been from time immemorial the "coat of arms" of the particular village or district to which the canoe belonged.

Some of the sailing canoes ranged up to 60 feet in length, carrying 12 persons, according to Wilkes (1845, vol. 2, p. 143), who, however, states elsewhere (1845, vol. 2, p. 66) that at Manua he had seen canoes 30 to 40 feet long, "capable of

containing 20 or 25 men". When the wind was not favorable for sailing, the crew, sitting two abreast, paddled the canoe along at a pace which Wilkes calls "very swift". As in the *taumualua,* which superseded this sailing canoe about the middle of last century, the seat of honor was on the forward deck.

MODERN CRAFT WITHOUT OUTRIGGER

The *taumualua* (double stem) was—for it no longer exists—a local adaptation of the European whaleboat. It was of comparatively recent introduction, the first having been built in 1849. European and Samoan features were blended with notable success, and the result was a distinct triumph for Samoan adaptative ingenuity. It was a double-ended craft with a long open waist and with ends sharp, similar, and slightly sheered.

The hull was made of irregular lengths of dressed planks sewn together on the inside with sennit lashings passed through marginal ledges as in the *va'a alo.* To stiffen it, the European system of fitting frames was adopted. These, however, were secured not by bolts but by sennit lashings to cleats projecting horizontally from the inner surface of the hull planking, a method familiar to the builders as that already in use in double canoes (*'alia*). A substantial covering board along the gunwale and numerous thwarts gave further support, and at each end a length of several feet was covered in with a decking under which considerable gear could be stowed. The decked part at the forward end was the seat of honor and there would sit the chief of the traveling party, cross-legged, at his ease. The *taumualua* was propelled by paddles, the crew facing forward, double-banked; it was occasionally fitted for sailing with mast and triangular sail.

The length ran originally from 50 to 60 feet but in later years this size was sometimes greatly exceeded. Probably none surpassed the size of one seen in Upolu by Smith (1898, p. 155) which was 147 feet long, pulling 65 oars each side; from the mention of oars in this record it appears probable that this particular craft was not a true *taumualua* but rather a *fautasi,* a large type of whaleboat made of nailed planks which eventually took the place of the *taumualua,* and still enjoys popularity.

Thilenius (1901, p. 168) has suggested and some Samoans maintain (Buck, 1930, p. 406) that this type is of indigenous origin, evolved from some such two-ended craft as that brought home from the Tuamotus by Wallis in 1767 and now in the British Museum. In the following account of its origin Ella (1898, p. 247), who from a long residence in Samoa may be relied upon for a correct presentation of the facts, gives the date of the building of the first *taumualua* in Samoa as 1849. The civil war of 1848-51 was then desolating the island and considerable damage had been done to the property of British subjects by the adherents of the Malietoa party. The captain of H.M.S. *Calypso* imposed a fine, and, pending satisfaction, blockaded the Malietoa position near Apia. Ella states:

A long-boat from the *Calypso,* manned by a few marines, was sufficient for the purpose and kept the *itu-taua* (war party) in their fort. This event filled the Samoans with astonishment and dismay, from the fact that the large force of Malietoa was held in check by a single war boat from the ship. The other war party, A'ana and Atua, took a hint from this circumstance and resolved to build similar boats; an American resident at A'ana, Mr. Eli Jennings, undertook the work. Two boats of 50 feet in length were built by him on the model of a large whaleboat. They were further improved for the purpose required. Planks were fastened across the gunwales, projecting about a foot from each side of the boat, and on the planks were raised bulwarks of bamboo closely fitted together, to protect the warriors and crew from the missiles of the enemy. These boats were ornamented fore and aft by figureheads decorated with white shells, etc. Since that time the *taumualua* have come into fashion and are highly prized by Samoans. They soon learned to construct them themselves.

Ella added that the Samoans at the time he was writing (1898) were exhausting their funds in the raising of a big fleet of these boats.

DOUBLE CANOES

Prior to the coming of Europeans in 1768 and for a number of years thereafter, a form of sea-going double canoe (*va'a tele*) was employed for lengthy voyages, for the transport of heavy and bulky cargo, and probably also as a war canoe when necessary. It was a clumsy vessel of the type of the Tongan *tongiaki;* over the two hulls, which were approximately equal in size, was built a large deck platform extending much farther aft than in the *'alia* which eventually superseded it and whose platform was restricted to a relatively smaller rectangular area covering the central region of the two constituent hulls.

That these *va'a tele* must have attained at times very considerable dimensions is clear from the statement of Stair (1895 *b,* p. 617):

> Upon the fishing expeditions made at certain seasons of the year to a reef midway between Wallis Island [Uvea] and Savaii they were accustomed to carry two *va'a alo,* or large fishing canoes, on the deck, which, on reaching the reef, were used in fishing for bonito, etc., the large canoe being reserved for crew and cargo.

Although inferior to the *'alia* in sailing qualities, for Stair confirms the Tongan tradition of the difficulty experienced in handling it in bad weather, the *va'a tele* was probably the better adapted of the two to carry ponderous weights and bulky objects, as evidenced above and also by the Tongan tradition that a vessel of this description was employed to transport the great stone masses used in constructing the Ha'amonga and some of the langis. Stair, however, gives a misleading description of the *'alia* and the *va'a tele.* It is evident that in the long interval between 1838, when he says that he saw the last survivor of the *va'a tele* type, and 1895, when he wrote, his recollections had become confused, causing him to transpose the characteristic features. He states that the *'alia* had hulls of nearly equal length, whereas in the *va'a tele* one hull was much longer than the other. The exact contrary is true on the evidence of all other observers.

A good figure of the *va'a tele* is given by Schouten (1619), who in 1616 fired upon one of these vessels off Tafahi, his "Cocos Island", lying between Samoa and Tonga. Both Tasman (1898, pl. 2) and Cook's draughtsman, Hodges (1777, vol. 2, pl. 42), give other figures.

Cook has given a good description and it is the only full one of this old type, for it so happened that the process of replacing these canoes by the manageable Fijian *ndrua* type was actively going on in Tonga at the time of Cook's visits in 1773 and 1774; Cook saw both kinds in use and by great good fortune he had scaled plans of the older type prepared (1777, vol. 1, pl. 16). Early in the nineteenth century the older *tongiaki* had entirely disappeared from Tongan waters, and probably only a slightly later date should be assigned for the supersession of the Samoan *va'a tele* by the same Fijian *ndrua,* called *kalia* in Tonga and *'alia* in Samoa (fig. 170); Stair (1895 *b,* p. 617) states that the last survivor of the *va'a tele* type was still in existence when he reached Samoa in 1838.

The outstanding difference between the Fijian double canoe as typified in its highest development in the *ndrua* and that equivalent Polynesian type exemplified in the indigenous double canoes of the Tongans and Samoans was the faculty possessed by the *ndrua* of being able to sail either end forward; the other on the contrary had a definite pair of prows and therefore when changing tack had to be put about in the same general way as European sailing vessels. It is probable that each of these two classes of double canoes had an independent origin, the Fijian type from an outrigger ancestor, the Polynesian from the connection of two equal or twin hulls after the fashion which persisted to the last in the design of the double canoes of Hawaii and the Society Islands.

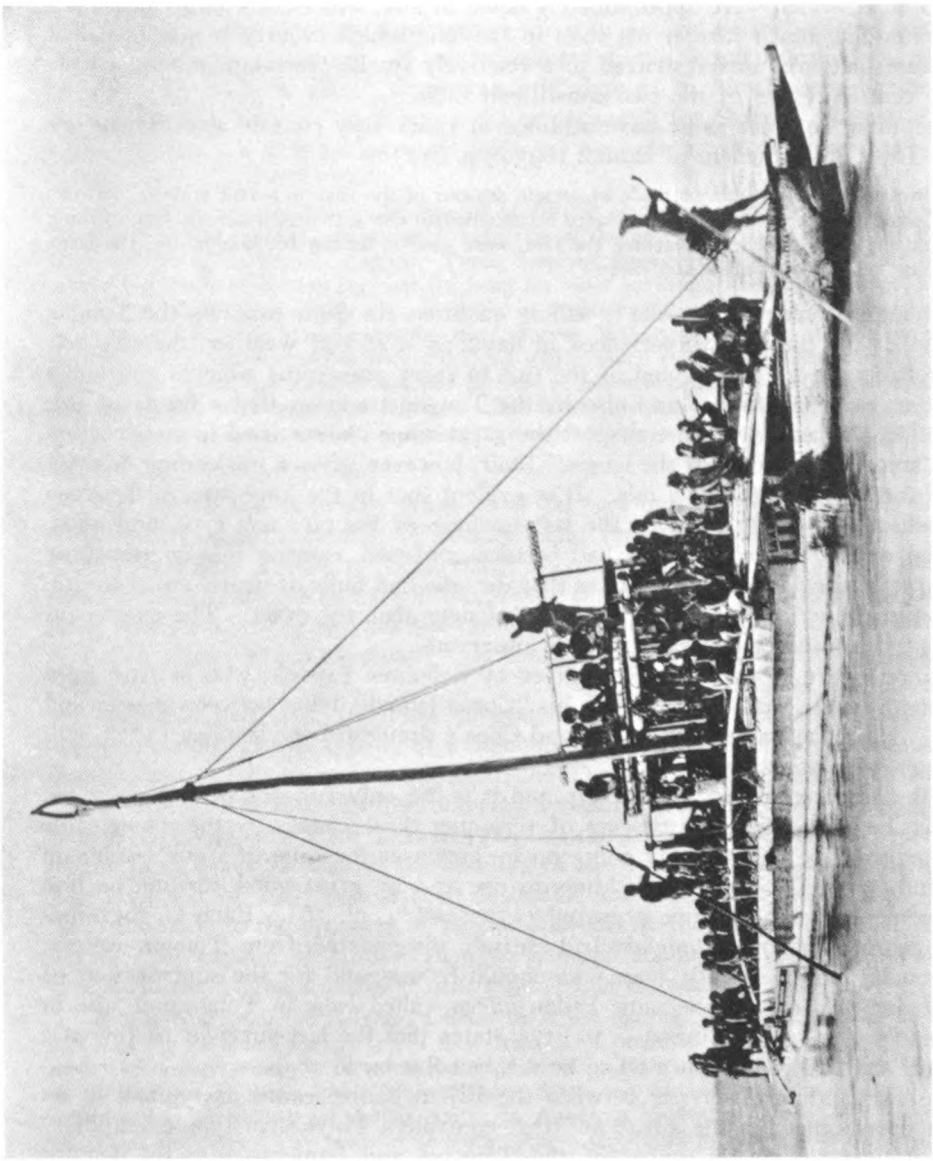


FIGURE 170.—Last Samoan double canoe of the *'alia* type, built and presented to the German Kaiser. Owing to its size transportation to Germany proved too difficult and its eventual fate was to fall to pieces gradually, lying on the beach. (Photograph by Tattersall's Studio, Apia.)

It is needless to furnish details of the Samoan *'alia*, for it was in nearly every respect a replica of the Fijian *ndrua*. It has been described and figured by Krämer (1902-3), and Buck (1930, p. 412) gives many technological particulars based upon a model in Bernice P. Bishop Museum. As so often happens with models, the rigging in the one described by Buck is incorrectly set up in a most important detail. This concerns the fitting of the running stays (*tu'u; tuku* in Fijian). As described, a continuous rope does duty for both the fore and the after stay; in practice this arrangement would be unworkable. The two stays are entirely sep-

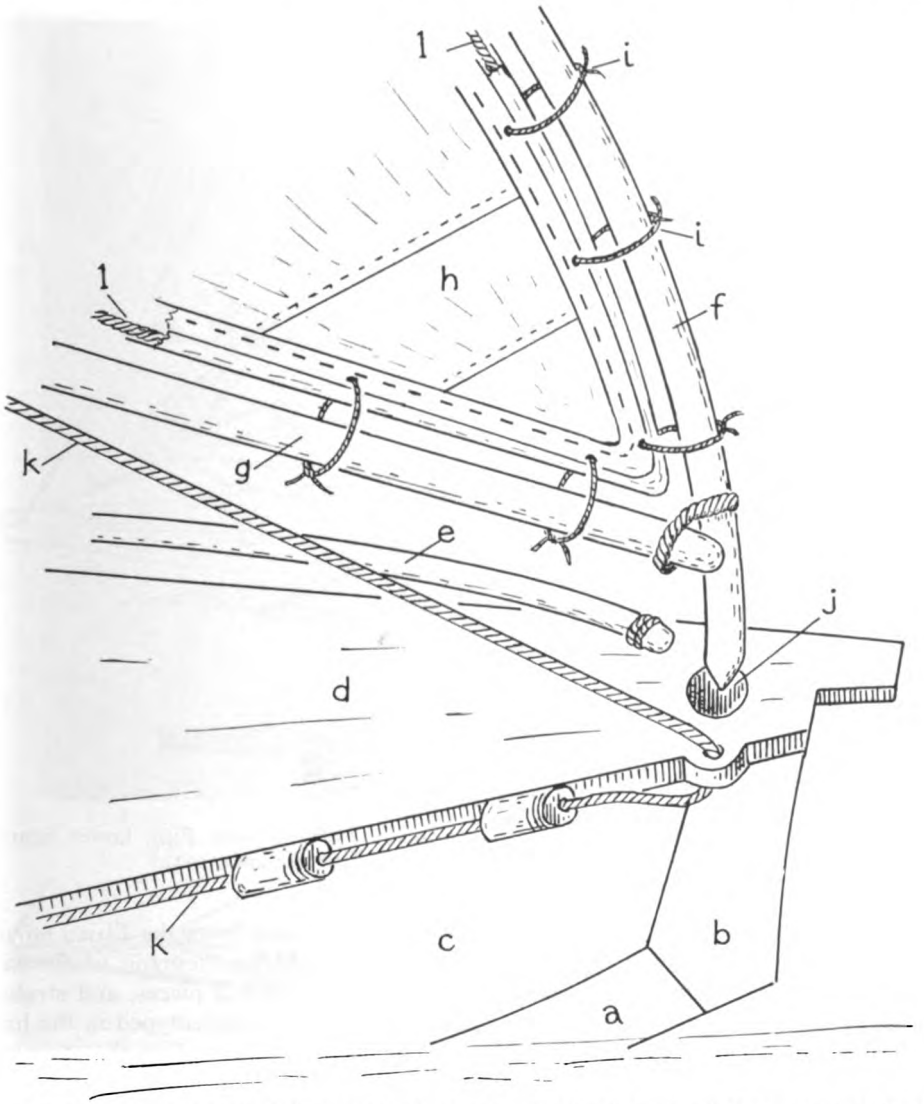


FIGURE 171.—Fore end of the larger hull of a Samoan double canoe (*'alia*) : *a*, keel (*ta'ele*) ; *b*, end piece (*velo*) ; *c*, side of hull (*lealii*) ; *d*, fore decking (*taumua*) ; *e*, spar running between head of hull and fore corner of deck platform on the off side (*vavata*) ; *f*, yard of sail (*tilatu*) ; *g*, boom of sail (*tilalalo*) ; *h*, mat sail (*la fala*) ; *i*, cords (*aita*) tying sail to yard and boom; *j*, cavity wherein pointed heel of yard is stepped; *k*, running stay (*tu'u*) which passes through a vertical hole in edge of *taumua* near its fore end and then through horizontal leads back to deck platform, where it is made fast; *l*, bolt rope of sail (after Krämer, 1903).

arate; one end of each is attached to the lower part of the topmast (*tomotomo*) and the other end, after being passed through various leads at either end of the larger hull, passes to the platform to be made fast there. In going about, the stay that had been functioning as the fore stay was slacked away, the after one being hauled in simultaneously until by this maneuver the mast had been drawn over till it inclined toward the end which had hitherto been the stern, but which now became the head. The two stays were then made fast in order to hold the mast at the proper inclination.

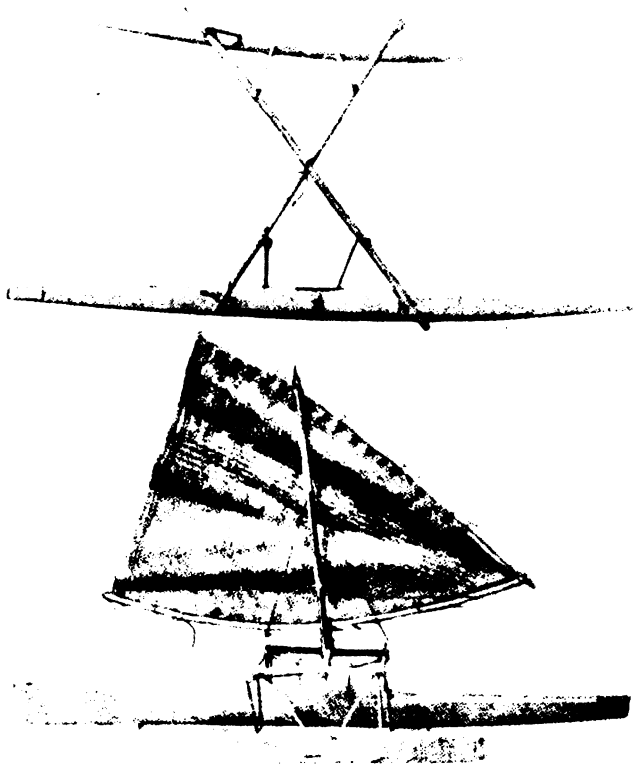
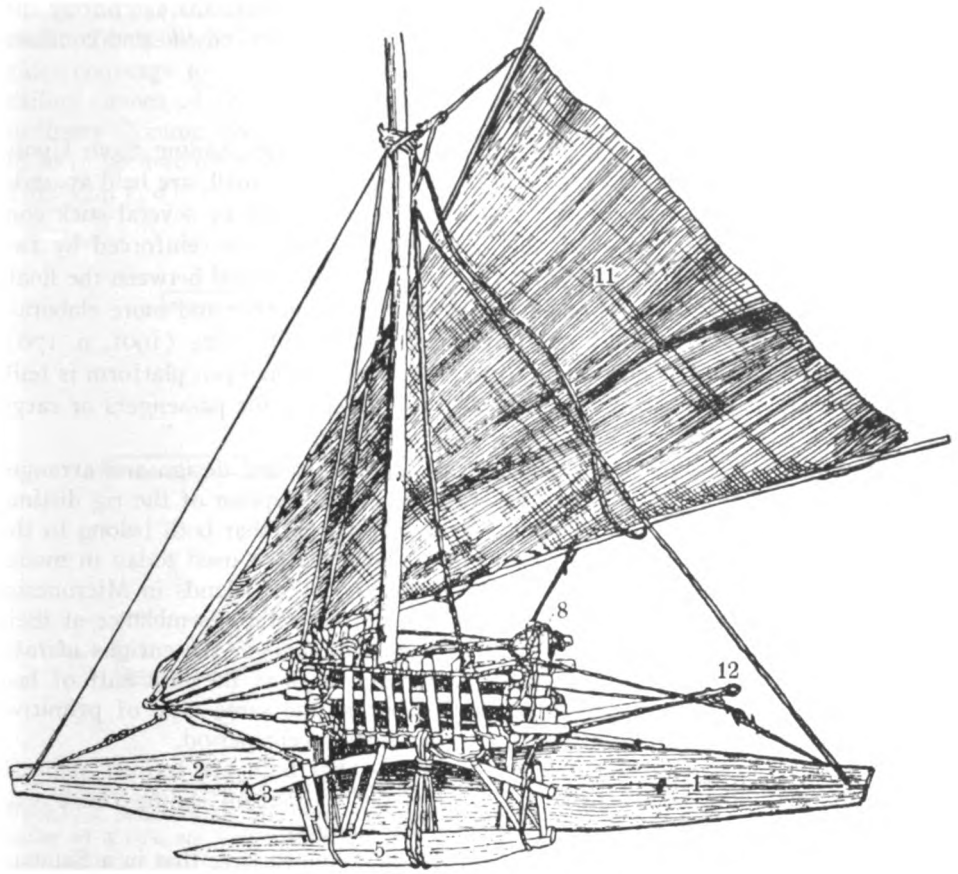


FIGURE 172.—Upper figure: an *oaunga* (toy canoe) from Ovalau, Fiji. Lower figure: model sailing outrigger (*amatasi*) from Upolu, Samoa. (From Krämer, 1903.)

The principal features in which the Samoan *'alia* differed from the Fijian *nārua* appear to have been in the construction of the hulls and the stepping of the sail yard. The hull was built up of a basal part or keel, solid end pieces, and strakes in sections or patches of definite shapes and relationships as stereotyped in the hull of the *va'a alo* instead of in the simpler Fijian manner. Regarding the stepping of the yard, figured by Krämer and confirmed by models, its heel was set in a hole as near the head as possible instead of against an angular ridge (fig. 171); this enabled the crew to dispense with the perforated cleat (*tauoka*) to which the heel of the yard is made fast in the Fijian design.

As in Tonga, most of the technical terms pertaining to the *'alia* were adopted from Fijian, particularly those relating to the mast, *fana* (lower or main section) and *tomotomo* (topmast), adapted respectively from the Fijian *vana* and *domo-*



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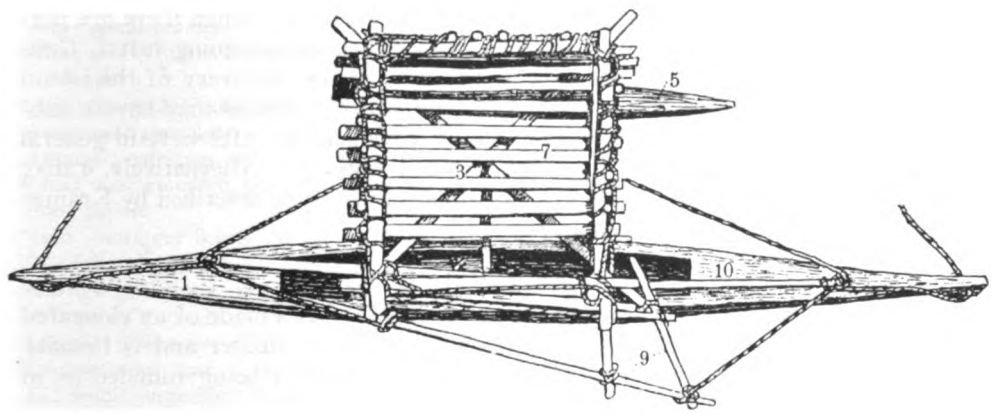


b

FIGURE 173.—Model of Samoan sailing canoe (*amatasi*), probably a toy: *a*, side view; *b*, plan; 1, hull (*va'a*); 2, fore decking (*taumua*); 3, booms crossing one another midway outboard; 4, stanchion connectives (*tuitui*); 5, float (*ama*); 6, sennit brace (*li*); 7, platform (*fata*) over outrigger booms; 8, vertical support (*potu*) to platform; 9, balance spars (*suati*); 10, *tulanga la*; 11, sail (*la*); 12, *salemanu* (from Thilenius, 1901).

domo. Evidently the Fijian mast was considered by the Samoans as entirely different from the one they had previously used, which was called *tila* and consisted of a single spar.

TOY CANOES AND RAFTS

Krämer (1902-3, vol. 2, p. 269) figures a curious model, hailing from Upolu, bearing the name *amatasi*. Two solid floats, a large and a small, are held apart by two booms whereof each is connected indirectly to each float by several stick connectives. The two booms are parallel, as is normal, but are reinforced by two equally strong struts which intersect at the center of the interval between the floats (fig. 172). The model shows no sign of decking. In another and more elaborate model having the same name, figured and described by Thilenius (1901, p. 170), the large float is hollowed into canoe form and a rectangular open platform is built over the booms in such a way as to provide a large space for passengers or cargo (fig. 173).

Both models are rigged with mast and sail of the general design and arrangement that characterized Samoan sailing craft after the adoption of the rig distinctive of the Fijian *thamakau* and *ndrua*. Krämer believes that both belong to the category of toy boats (*Spielkanu* or *Spielboot*) such as are used today in model canoe races in the Gilbert Islands, the Carolines, and other islands in Micronesia. This is probably true of these particular models, but from the resemblance of their basal structure—apart from the presence of mast and sail—to the curious *ulatoka* which was actually in use in Fiji in the rivers and bays in the first half of last century (Williams, 1858, p. 76) it seems likely that the same type of primitive craft was also employed in Samoa at a comparatively recent period.

A point of much interest about the models is that both are termed *amatasi*. This corroborates the statement that the old type of Samoan sailing canoe was known by the same name as in the Ellice Islands—*amatasi*.

No record of the actual use of rafts in Samoa is known save that in a Samoan myth told by Smith (1898, p. 156) which purports to tell how the Samoans first obtained the dugout canoe; it ends with the words, "Before this time the Samoans had only rafts." This has more than passing interest, for in Tonga there are persistent traditions of the use there in ancient times of large sea-going rafts. Considering that the people of Mangareva at the time of the discovery of the island had no other means of transport save large rafts, these traditions may have a substratum of fact and may refer to a very remote period when rafts were in general use by certain of the ancestors of the Tongans and Samoans. Alternatively, it may be a reference to the use of sailing craft of the primitive type described by Krämer and Thilenius under the name *amatasi*.

PADDLES AND BAILERS

The paddle used in Samoan bonito canoes (*va'a alo*) has a blade of an elongated ovate form; that pertaining to the *paopao* is shorter and stouter and is broader relatively across the shoulders, which are angular instead of being rounded as in the bonito canoe paddle (fig. 174, *a*, *b*).

The back of the blade is slightly concave, whereas the front, the side which pushes against the water, is gently ridged along the median line; this shape is claimed by Samoans to allow the paddle to cleave the water more easily.

The loom is cylindrical, straight, and without either a knobbed or crutched grip in both varieties; at the distal end it merges into the front of the blade either as a distinct rounded rib gradually diminishing in diameter, or as a faint axial ridge.

In the *paopao* and the *soatau* the bailer (*tata*) is usually the half of a coconut shell. In the bonito canoes it consists of a narrow handleless scoop, in which the sides converge to a blunt point at the open end (fig. 174, *e*). That of the large sailing canoes of former times was a rather narrow, square-ended variety of the ordinary Oceanic scoop form, with forwardly projecting internal handle; it appears to have been strictly utilitarian in shape, and devoid of carving or other ornament (fig. 174, *c, d*).

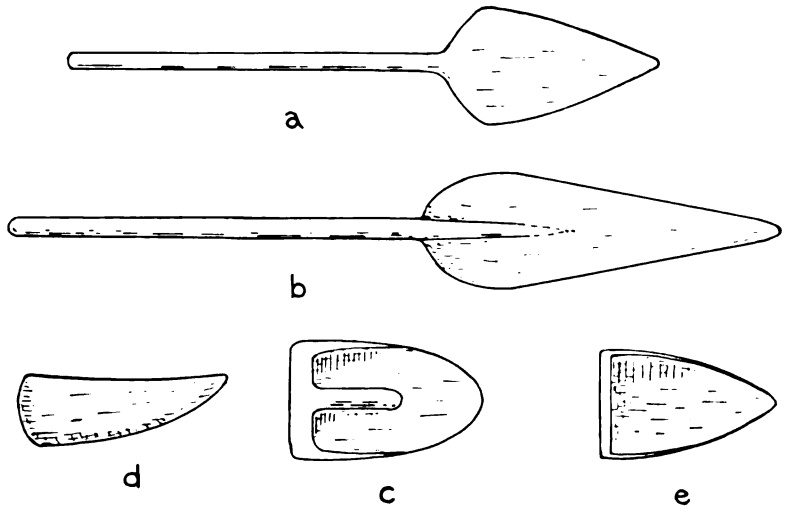


FIGURE 174.—Paddles and bailers, Samoa: *a*, paddle of a *paopao*; *b*, of a *va'a alo* (after Buck); *c*, bailer of an *'alia* seen from above (British Museum); *d*, the same in side view; *e*, bailer of a *va'a alo* (after Buck).

TECHNICAL TERMS

'Afa: sennit braid.
Aita: short lengths of braid tying the sail to the spars.
'Alia: the double canoe borrowed from Fiji.
Ama: outrigger float.
Amatasi: outrigger sailing canoe.
Fana: mast (modern, borrowed from Fiji).
Foe: paddle.
'Iato: outrigger boom.
La: sail.
Laufono or lauva'a: separate pieces or "patches".
Laulalo: lower tier of patches in a *va'a alo*.
Laulua: upper tier of patches in a *va'a alo*.
Li: sennit suspensory brace.
Maea sisi: halyard.
Maile: belaying rail.
Nofoa: thwart.
Nofoanga: steersman's seat.
Oa: gunwale and gunwale flange.
Paopao: small paddling dugout canoe.
Pule: egg cowries.
Salue or tulanga pule: knobs on end-covers.
Soatau: large paddling dugout canoe.
Suati: outboard balance spar.
Ta'ele: keel.
Tata: bailer.
Taumua or tau: fore deck cover.
Taumuli (usually restricted to the solid stern post section of the keel) or velo: after deck cover.
Tila: mast (old term).
Tila lalo: boom of the sail.
Tilatu: yard of the sail.
Tomotomo: topmast (borrowed from Fiji).
Tu'itu'i: stanchion connectives.
Tulafana: mast step or shoe.
Tu'u: running stay (borrowed from Fiji).
Va'a: canoe (generic term).
Va'a alo: bonito-fishing canoe (plank-built).
Va'a tele: indigenous double canoe.

TOKELAU ISLANDS

DOUBLE CANOES AND OUTRIGGERS

When Atafu, the northernmost island of the Tokelaus, was visited by Wilkes in 1841, the islanders possessed both double canoes and outriggers. The double canoes must have been numerous, for Wilkes states that three came off to the ship. He describes them (1845, vol. 5, p. 6) as "made of pieces of wood sewed together like those of Samoa, and ornamented in like manner with white *Ovula* shells. The blades of their paddles also resembled those of the Samoans, being oblong and slender. . . . In each canoe there were 10 men". None of these double canoes now exist, but Lister (1892, p. 57) was told on Fakaofu that "in the old times they had two vessels—each with two masts, and without outriggers—described as being as large as the trading schooners which visit the islands. Each of these would hold, it was said, all the available fighting men in the island—perhaps 150 to 200 men".

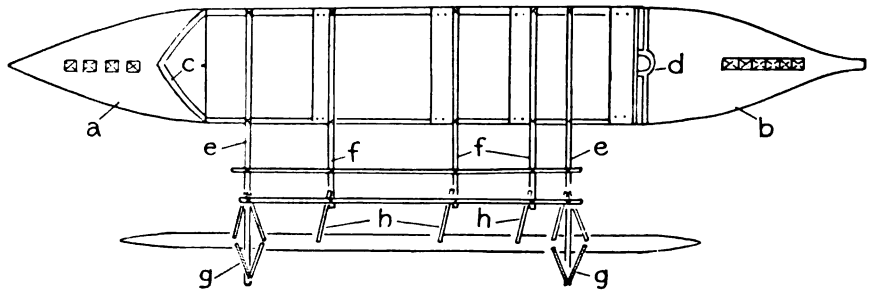


FIGURE 175.—Large Tokelau paddling canoe in plan: *a*, fore decking (*puke mua*); *b*, after decking (*puke muri*); *c*, fore breakwater; *d*, after breakwater, grooved rod rest (*futia*) at center; *e*, main booms; *f*, subsidiary booms; *g*, paired stanchion connectives; *h*, unpaired stanchions.

The following notes on the outriggers at present in use in the islands I collected when in the Pacific in 1925. One type only is employed for all purposes, varying chiefly in size and the number of outrigger booms. The smallest are rough dugouts with short solid ends.

The larger canoes seen by Hale (1845, p. 155) at Fakaofu were described by him as "made of several pieces of wood joined together by lashings of sennit and resembled in every respect those of Samoa". To-day they differ considerably therefrom in many details: the end deckings in particular are shorter, the lashings securing the strakes are exposed and not concealed on the outside, the float is pointed at both ends, and the outrigger connectives are of two varieties in every canoe as contrasted with the homogeneous Samoan type (fig. 175).

The hull has the same general form as in the small dugouts. The bottom, rounded in transverse section, is straight for the greater part of its length, bending up very slightly forward to merge by means of an angular forefoot into the slightly sheered or nearly vertical cutwater at an angle of about 50 degrees. Aft, the sides, keel, and after decking converge into a tapered stern, ending in a bluntly pointed extremity (fig. 176).

The dugout underbody may consist of one or several lengths—even as many as four, says Lister, owing to the scarcity of large trees; if compound, the sections are butted end to end and sewn together through holes bored in the opposite edges. According to the size of the timber available for the underbody, so varies the depth of the washstrake added to obtain requisite height in the sides. To avoid cutting away any part of the dugout, the washstrakes are usually of irregular shape on the lower edge in order to fit the sinuosity of the margins of the underbody. The seam after calking is sewn by separate lashings of sennit passed through opposed and paired holes in the two edges.

Each end is covered by a fairly long decking or end piece hewn from the solid, of the full breadth of that part of the hull which it covers; it is lashed down through holes in the edges, partly to the deadwood of the ends, partly to the gunwales behind. The fore decking is nearly

horizontal and the after one slopes downward at a gentle angle to the stern (fig. 176). At the hinder end of the fore decking a thick vertical ridge, semicircular in plan, is left when shaping it, to serve as a breakwater (fig. 175, *c*). Between this and the forward extremity a median line of little truncated pyramids projects, as in Samoan canoes. On the after decking a little breakwater is also present, usually straight; at the center it expands into a deeply crescentic slot to form a shouldered rest for the butt of a bonito fishing rod (fig. 175, *d*). A row of low angular knobs runs down the center of this decking, matching that on the forward one. Not uncommonly a bar (*tu'i tu'i*) connects the summits of these projections (*'elo*), a departure from Samoan custom. White cowries are attached to as many as possible of the knobs or to the *tu'i tu'i* if present. To the *tu'i tu'i* three are generally attached, one at each end and a third at the middle. If white cowries are not obtainable, bleached specimens of common species are used; the custom is falling rapidly into disuse, and in most canoes the knobs survive as meaningless ornamentation.

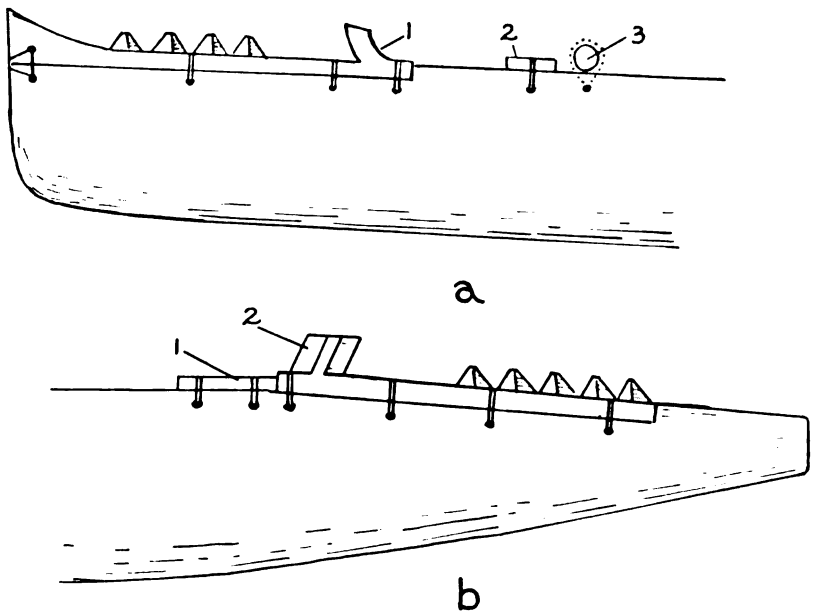


FIGURE 176.—Tokelau canoe. *a*, fore end, covered with short decking bearing four knobs to which cowries are often attached: 1, breakwater; 2, thwart; 3, fore boom. *b*, after end, decking does not extend to extremity of underbody which forms stern: 1, a thwart; 2, after breakwater and rod rest.

A couple of low transverse ridges, following the curve of the interior, are sometimes left when hewing out the underbody in order to give additional strength; one is placed about one third the length from each end. These may represent what were originally sewn-on ribs as employed in the Gilberts; if so, they are vestigial. There are usually five thwarts in large canoes; they rest upon the gunwales, lashed thereto by sennit passed through a hole in the washstrake a little below the edge.

The outrigger, which, as usual, is attached on the port side, has from 4 to 6 booms, according to size. These, like the thwarts, are lashed upon the gunwales by sennit passed through a single hole in the side. All are horizontal and none project outboard on the off side. The cylindrical float, unlike the Samoan one, is pointed at both ends and extends a considerable and equal distance beyond the outermost connectives at each end. The foremost and aftermost booms are each connected with the float by two pairs of convergent stanchions and a V-shaped sennit brace (fig. 177). The disposition of the former is as in Samoan outriggers, but here the brace is bifurcated and the branches divergent; after the plaited sennit has been passed around the float, the two end lengths are crossed above it and then carried, one to the attachment to the boom of the heads of the two inner stanchions, the other to that of the outer two. This form of brace is similar to the Tahitian in being branched and divergent, but follows the Samoan *'a'a alo* type in passing around the float instead of through a transverse hole therein.

The inner booms are considerably shorter than the outer, reaching only just level with the float; each is connected thereto by a single stanchion, slightly inclined outward in its downward course to insertion into the float (fig. 177, *b*).

These single stanchions have the same relative position as the inner units of the paired stanchions belonging to the outer booms; they represent a reduction to unity from the multiple condition seen in the outer booms. Were they all restored to the multiple condition, the canoe would then be a replica of the Samoan multiple-boom outrigger of the present day.

The upper ends of all stanchions are lashed against the sides of the booms and project no farther than is adequate to permit of security in lashing (fig. 178, *a*).

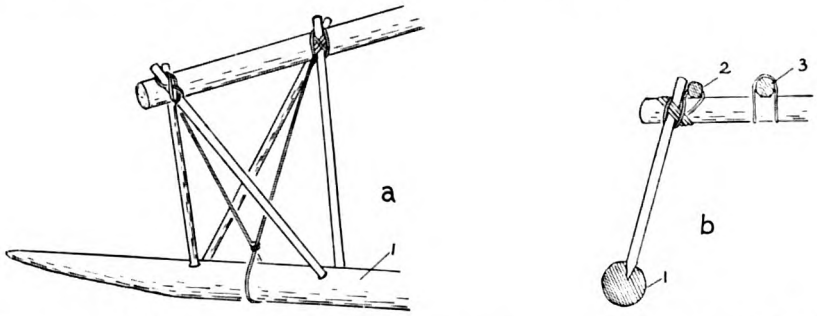


FIGURE 177.—Outrigger attachments, Tokelau canoe: *a*, typical attachment of first and last booms; *b*, single stanchion attachment of subsidiary booms, side view; 1, float; 2, 3, stringers.

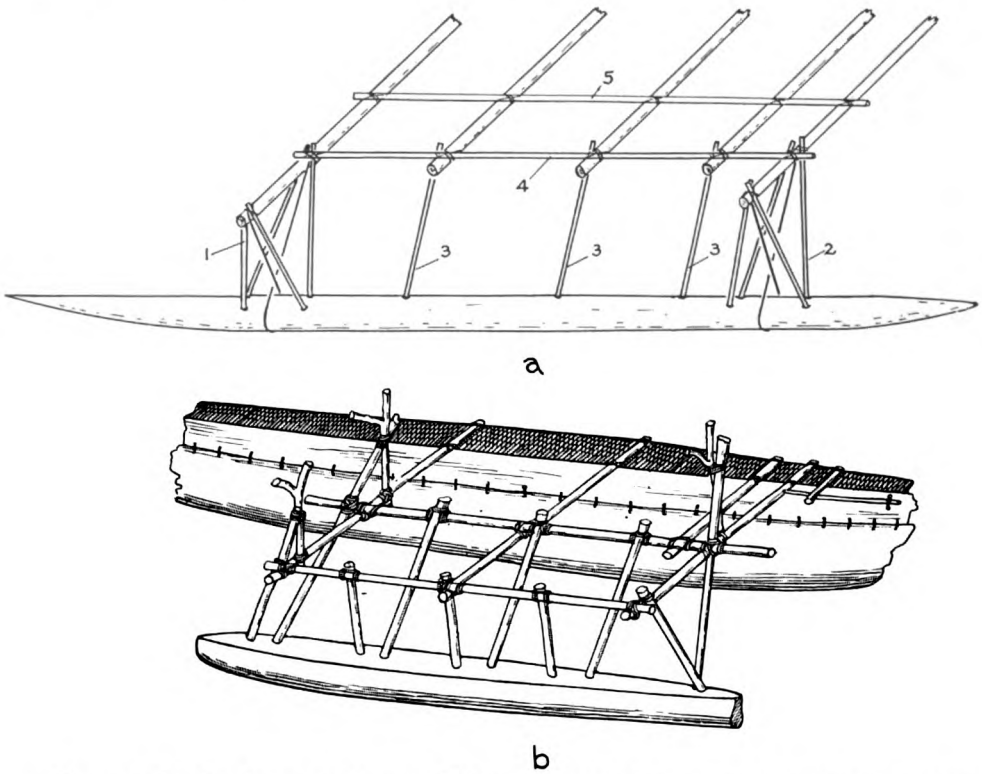


FIGURE 178.—Outrigger attachments, Tokelau. *a*, general arrangement: 1, foremost boom attachment; 2, aftermost boom attachment; 3, intermediate reduced attachments; 4, 5 stringers. *b*, variety found on a model made by a Tokelau canoe builder living in the Ellice Islands (from Kennedy).

Two poles are disposed as longitudinal stringers upon the booms, one just inside the attachments of the connectives, the other a little way nearer the hull of the canoe.

In one variety the stringers are placed farther out, the outer being lashed over the extreme ends of the booms, the inner lashed on at the points where the inner stanchions are attached to the booms (fig. 178, *b*). The connectives attached to the outermost boom at each end are reduced to one divergent pair. Those connected with the inner booms may be either similar in number and disposition or they may be reduced to one nearly vertical in position. In addition, one or more pairs of stanchions are intercalated between every two booms. These accessory stanchions connect only with the stringers, the outer vertical stanchions with the outer stringer, the inner very oblique ones with the inner stringer. Kennedy (1929, fig. 71) figures a canoe of this description. (See fig. 204.)

When cargo is to be carried, a temporary platform is made by lashing additional poles over the booms between the gunwale and the inner of the two stringers; on this the goods are carried. Cargo is never stowed within the dugout hull.

The paddles have rather longer and narrower blades than the Samoan pattern, the shape being described by Lister (1892, p. 57) as "oblong acute, not ovate," and by Wilkes as "oblong and slender".

The traditions of the islanders, according to Newell (1895, pp. 603-612), refer the original settlers to Samoa. The habits, customs, and language of the people confirm these traditions, which also indicate that the Tokeluans were great navigators in former days.

TECHNICAL TERMS

Ama: float.
Foe: paddle.
Futia: rod rest.
Kau-foe: paddle loom.
Kiato: boom.
Kiato mătua: each of the two long booms.
Lau-foe: paddle blade.
Li: sennit brace.
Nofoa: thwart.
Oa: gunwale.
Puke: decking.
Puke mua: fore deck.
Puke muri: after deck.
Pule: cowry.
Teitu-ama: outrigger side of hull.
Teitu-katia: off side.
Tila-lalo: mast boom.
Tila-lunga: mast yard.
Toko: mast.
Tolu tolu ama: stringers.
Tua vaka: bottom of hull.
Tu'i tu'i: bar connecting *velo*.
Tūtūki: stanchion connective.
Vaka: canoe.
Vĕlo: knobs on deckings.

PUKAPUKA

CONSTRUCTION

The canoes of Pukapuka (Danger Island) differ considerably from those of the Tokelau Islands and deserve special mention.

Hull. The fore end tends to be horizontally conical in the form seen in the after end of typical Tokelau canoes (fig. 176, *b*), whereas the stern sheers upward to terminate in a truncate knob, as in the Samoan *paopao* (fig. 153, *b*). The sides are raised by a deep washstrake sewn on by through stitches and are closed in at each end by a covering end piece hewn from the solid. Each has a curved breakwater at the inner end which may be formed out of separate pieces of board set edgewise and sewn on, or perhaps in one with the cover.

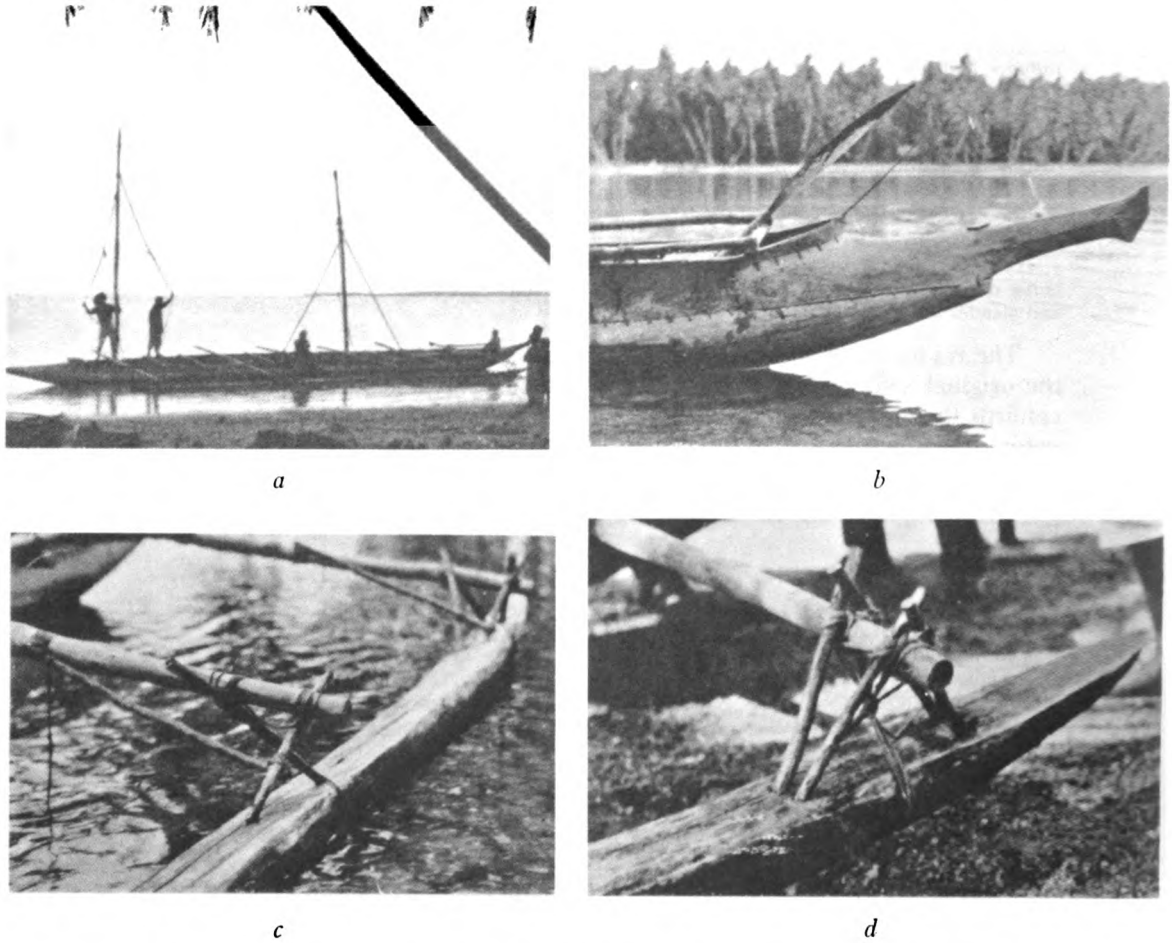
Small canoes are fitted with two outrigger booms attached to the float in typical Tokelau manner (fig. 177, *a*); usually the figure-of-eight lashing is made up of several turns.

The float is flat above, curved transversely below. It is a straight log with the fore end horizontal, the after one slightly sheered to a flattened point.

Apart from the small canoes, a single large, two-masted canoe, about 60 feet long (fig. 179), survived at the time of the visit of the Templeton Crocker Expedition in 1933.

The hull is of the same type as that of the small canoes, but is more carefully constructed and instead of two outrigger booms it has six. The forward end cover slopes slightly downward toward the fore end and the lower part of the underbody sheers upward to meet it in a short, sharp, vertical cutwater. This form of prow approximates to that of canoes in the northern Ellice Islands (fig. 219), with which the whole canoe body bears close resemblance.

The stern is shaped as already described. A single diamond-shaped carving in low relief on the stern cover probably represents in a vestigial condition the median row of knobs seen in figure 176.



a *b*

c *d*

FIGURE 179.—Pukapuka canoes. *a*, large two-masted outrigger canoe, only one surviving: length 60 feet; six booms connect indirectly with float and six false booms connect with a long stringer placed fore and aft over true booms about half-way outboard; each mast has a fore and an after stay; prow is horizontal and obtusely pointed; stern slightly sheered, ending in truncate knob. *b*, stern of same canoe showing details; single diamond-shaped carving in low relief on stern piece probably represents vestigial knob to which egg-cowries are attached in Samoan and other outriggers in a similar position. *c*, two forms of outrigger attachment, same canoe: farther attachment consists of two pairs of converging overcrossed stanchions of ordinary Tokelau type, strengthened by an oblique accessory rod attached at inner end to boom and at outer end to one of the inner pair of stanchions, and by an X-shaped suspensory lashing which makes several figure-of-eight turns around boom below and lashed-on ends of stanchions above, finished off by several turns at point of crossing midway between boom and float; this type characterizes attachment of outermost boom at each end of the set of six; attachments of the inner four, of which one is seen in foreground, are reduced to a single pair of undercrossed stanchions; an oblique accessory rod and a wire suspensory lashing are present. *d*, aftermost outrigger attachment of small canoes, similar to the form typical of the canoes of the western Tokelau Islands, no oblique accessory rod being present. In this and in all other Pukapuka canoes the float is flat above, rounded below; it is a straight log, the fore end horizontal, the after one slightly sheered to a flat-topped point. (Photographs by the Templeton Crocker Expedition, 1933.)

Outrigger. On the port side six booms connect with the float in typical manner (fig. 177, *a*), with the addition of a strengthening withy brace attached on one side of each set of connectives. This withy runs obliquely upward and inward from its distal attachment near or to the lower end of one of the inner stanchion connectives to be lashed to the boom at a point well inside of the attachment of the upper end of the same stanchion. (See fig. 179, *c*.)

A stringer is lashed fore and aft over the booms and under it are lashed the outer ends of six short pseudo-booms which do not connect with the float.

The booms are lashed upon the edges of the washstrakes with the attachment further strengthened on each side by an oblique sennit brace lashed above around the boom outside of the hull, and below through holes in the side of the dugout underbody. As the offside washstrake is slightly higher than that on the outrigger side, the booms slant downward toward the float; this enables the stanchions to be made shorter than if the booms were horizontal.

Rig. Each of the two masts is stepped in a socket in a circular boss on the bottom of the underbody and of one piece with it.

Formerly each mast was lashed against the after side of one of the booms, but today it passes through a median hole in a stout thwart lashed to the gunwales. The fore mast is stepped well forward and immediately abaft the foremost boom, the second mast behind the fourth boom.

This sailing canoe is used only within the lagoon and is said to load three tons of copra.

TECHNICAL TERMS

Aioka: withy brace to attachment.
Ama: float, outrigger side of canoe.
Ekengaulu: large double canoe.
Iekelima: large outrigger (five-man canoe).
Kaukau: outrigger boom.
Katea: off or starboard side.
Kiato: stringer across booms (the usual Polynesian term for "boom").
La: sail.
Mua vaka: forward end of canoe.
Muli vaka: after end of canoe.
Oa: washstrake.
'Oe: paddle.
Puke: forward end cover.
Talamoko: diamond-shaped boss on end cover.
Tata: bailer.
Tau ama: outrigger stay.
Tila: mast.
Tila lalo: boom of sail.
Tila lunga: yard of sail.
Tukuku mua: fore stay.
Tukuku muli: after stay.
Tutuki: stanchion connective.
Vaka: canoe or hull.
Vakalua: double canoe.
Velo: after end cover.
Wawa: sheet.

For the foregoing particulars of the Pukapukan canoe I am indebted to the courtesy of Mr. Gordon Macgregor, ethnologist of the Templeton Crocker Expedition.

TONGAN ARCHIPELAGO

At the present time the only surviving sea craft of indigenous origin in Tonga are numerous small dugouts (*bobao* and *tuingutu*) used in inshore fishing and a few plank-built sea-going canoes (*tafa'anga*) employed exclusively in the bonito fishery. All are provided with single outriggers having indirect attachment; the small dugouts are in general more roughly constructed than their Samoan equivalents, the *paopao* and the *soatau*. The *tafa'anga* is the counterpart, save in outrigger attachment, of the Samoan *va'a alo*. Larger vessels were formerly numerous but all are now non-existent. They comprise the following:

1. The ancient *vaka* type of voyaging outrigger canoe in use before intercourse with Fiji in the latter part of the eighteenth century caused its displacement by:

2. The modern *vaka* or *hamatafua*, a large and stoutly built sailing outrigger canoe, constructed on the lines of the Fijian *thamakau*.

3. The *tongiaki*, a double canoe of the same type as the Samoan *va'a tele*.

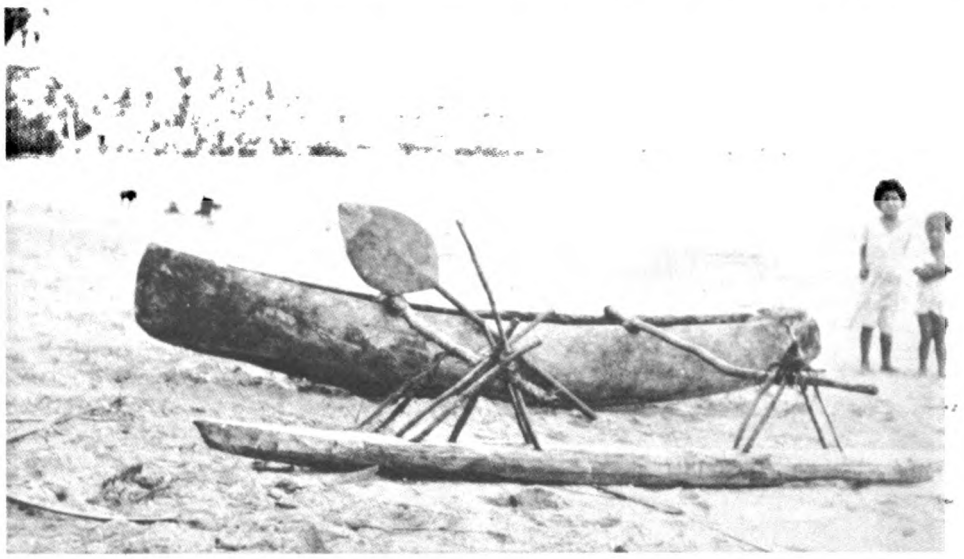
4. The *kalia*, a double canoe of Fijian origin and design which displaced the *tongiaki* during the last quarter of the eighteenth century.

Another extinct type is the *vaka-vaka-amei*, an antique float or raft of peculiar design.

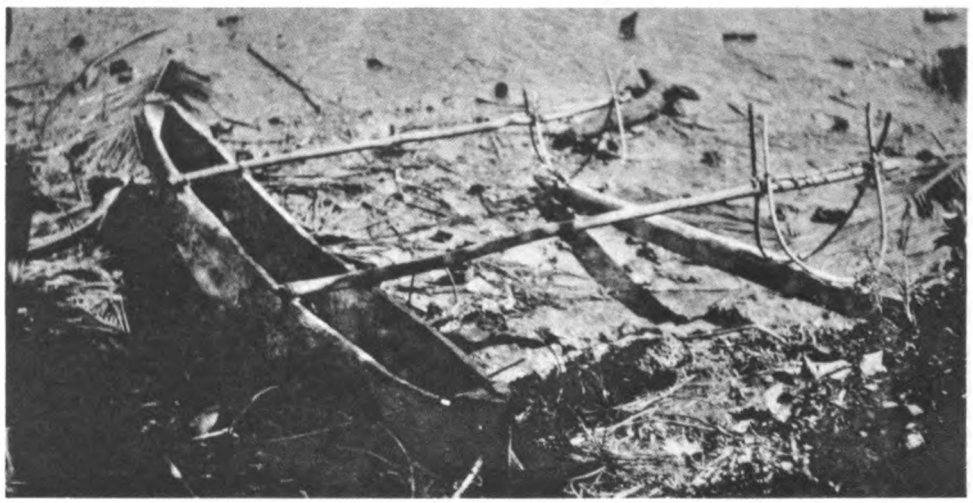
OUTRIGGER CANOES

Bobao

The *bobao* of today, a small paddling canoe, has a dugout hull, the bottom round, the sides tumble-home, and commonly so roughly hewn out as to be little more shapely and adapted to be a canoe than one of the village slit drums were it to have the ends pointed. As observed during my visit to the islands in 1925, the hulls range in size from 10 to 15 feet in length, with an outside beam at the gunwale of 8 to 9 inches, increasing at the bilge to 12 to 16 inches; the depth ranges



a



b

FIGURE 180.—Modern Tongan dugout outrigger canoes (*bobao*): *a*, from Haapai, connectives are paired sticks, the forward set reinforced by an unpaired one; *b*, from Vavao, two double U connectives to each boom (photographed in 1925).

between 12 and 15 inches. (See fig. 180.) There are indications of a definite head and stern, one end being sharp or bluntly wedge-shaped, the other roughly pointed, characteristics also of Samoan and Tahitian hulls. The ends are solid for a distance of several inches.

The outrigger consists of two straight booms, projecting outboard on the port side 5 to 7 feet, and commonly connected with the float (*hama*) by U-shaped withies (*tukituki*). The float is cylindrical; in the smallest canoes it is pointed at both ends, in the larger only at the fore end, the other being truncate. As in Samoa the fore, free part extends well forward, though not quite to a level with the head; the after end, behind its attachment to the boom, is short.

The U type of connective, characteristic particularly of the *bobao*, consists of a pair of tough flexible withies to each boom, each withy bent into a deep bow or U shape, the limbs spread from 8 to 10 inches apart in the *bobao* and about 12 inches or more in the *tuingutu* (fig. 181).

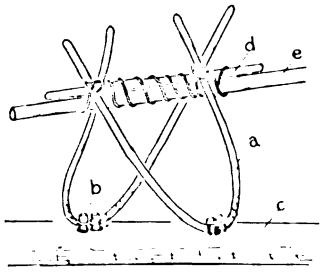


FIGURE 181.—Double U-shaped outrigger attachment, Tonga: each withy (*a*) lashed at its base to two pegs (*b*) driven into float (*c*); horizontal cross bar (*d*) tied under crossed arms of withies; end of boom (*e*) then slipped under cross bar and the two lashed together by several turns of cord or sennit (Vavao, 1925).

The bent base of each withy is secured to the upper side of the float by lashing passed around two short, stout pegs driven abreast into the float. One of the pair of withies is attached to the float some inches forward of the axis of its boom, the other at an equal distance on the after side. The pegs to which the withies are lashed project about 2 inches; the heads are slightly swollen.

The limbs of each U are turned obliquely upward, inclining toward those of the opposite pair, with the result that the upper ends of the two withies cross one another. To keep them in position, a short rod of *toa* (*Casuarina*) is inserted as a brace immediately beneath their decussation and lashed thereto in this position. To make connection with a boom, the outer end of this is slipped under the bracing rod and made fast with sennit lashing.

This accessory device is of service when the outrigger frame has to be partially dismantled: all that is necessary is to unlash the braces from the booms; the float with its connectives held together by the braces may then be removed from attachment to the booms without disturbance of the various parts. Reassemblage can also be effected in a fraction of the time that otherwise would be necessary. In no other Pacific area does this device exist.

Exceptional forms of float attachment are occasionally found. In Lifuka a very small and roughly made *bobao* was seen in which the connection was by means of paired straight stanchions of the type characteristic of the *tuingutu* (fig. 180, *a*). Another in the same island had a mixed connection, the after boom having the paired U connection, the forward one the paired stanchion form.

A third attachment is found on the great shallow backwater lagoon in Tongatabu, where there are in use a few rude dugouts of such low freeboard that direct

attachment is possible, the outer ends of the two light bamboo booms being lashed directly to the float; such craft are readily improvised when the occasion requires.

Early in the nineteenth century the *bobao* was more carefully constructed, according to the description and figures furnished by Paris (1841, pt. 1, p. 123, pl, 122, figs. 12-14). Unlike the present-day *bobao* the dugout underbody had fairly long end covers roughly sewn on, together with a low washstrake and transverse breakwaters protecting the open waist. The ends were similar and bluntly pointed. Across the washstrakes were lashed the inner ends of three outrigger booms; the outer or end booms were attached to the float by means of two pairs of convergent overcrossed stanchions, and the median one was supported by a single vertical stanchion. No cord brace was employed, if the figure may be trusted. As drawn, the float, like the hull, was pointed at each end (fig. 182). Paris remarks

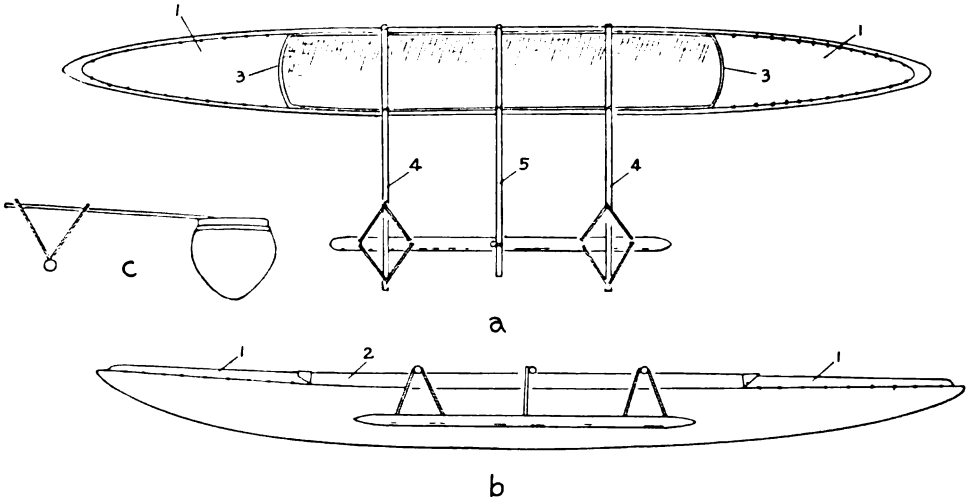


FIGURE 182.—Tongan *bobao* of ancient type: *a*, plan; *b*, side view; *c*, cross section, showing boom tilted upward slightly in its outboard section as in Samoan canoes; 1, end covers; 2, washstrake; 3, curved breakwaters; 4, outer boom attached to float by two pairs of converging overcrossed stanchions; 5, median boom, connected by one upright stanchion (after D'Urville, 1846).

that the rounded hulls "were neither polished nor rubbed with oil and appeared to be used only by the lower classes of the population". Its length seldom exceeded 5 meters. This old type of *bobao* is intermediate in design between the existing degenerate type and the larger sailing one, the *tuingutu*.

TUINGUTU

The *tuingutu* has also a dugout hull. Being a larger and more valuable craft and adaptable for sailing as well as paddling, greater attention is paid to the finish. (See fig. 183.)

The two ends are more carefully shaped and approximate more closely to the equivalent Samoan form, the *soatau*, the sharp fore end often with a distinct though slight concavity in the cutwater as seen in side view, the stern running to a point, and in a few canoes ending in a downturned subtriangular knob, useful when tying the canoe up, and of exactly the same shape as seen in the better-finished of Samoan canoes. There are the same rounded bottom and tumble-home sides as in the *bobao*, but here a narrow washstrake, 5 to 6 inches wide, is sewn on with sennit, each pair of holes separately sewn and all the holes plugged with wooden pins. A batten of split bamboo is inserted on the outside along the joint under the stitches.

Each end for a length of about 12 inches is solid. The intervening space between each of these solid regions and the near-by boom is usually decked over with transverse planking, the innermost board with a mast hole in the center, an arrangement which permits the canoe to be sailed either end forward; this is associated with a float sharp at each end. The rig in use is, however, derived from a European type; no canoe is now rigged in the manner current at the time of the discovery of the islands. In one canoe a wide triangular platform, nearly equilateral, covers each end of the hull, the lateral angles projecting outboard a little distance; this platform is to give footing to the fisherman when spearing fish.

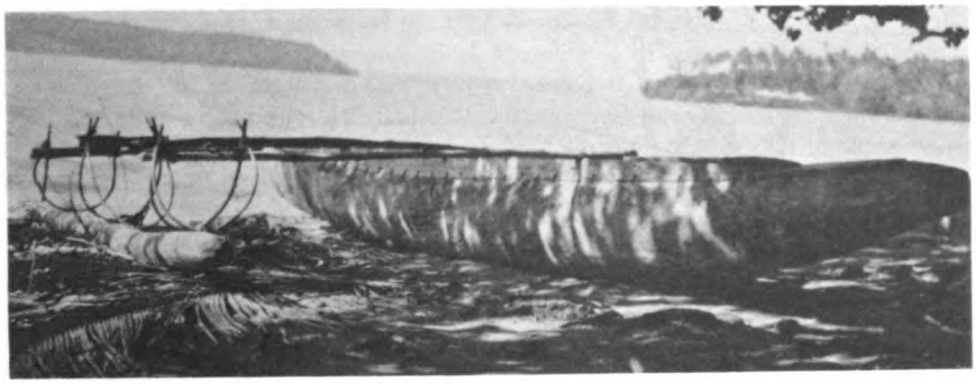


FIGURE 183.—Tongan inshore canoe (*tuingutu*) of Vavao with three booms, each with two pairs of U connectives, typical of the Vavao attachment (photographed in 1925).

In some small canoes the central space or well between the booms is surrounded by a box-like structure consisting of two long side boards, forming rude washstrakes connected at the fore and after ends by a transverse board or breakwater. In the larger ones with three booms, the washstrakes are more typical and extend nearly the whole length of the hull; they are generally closed in at each end by a low transverse breakwater. (See fig. 184.)

Two or three thwarts rest loose upon the edges of the dugout hull at its junction with the washstrake.

Most of the smaller canoes, 16 to 18 feet long, are provided with two straight outrigger booms, fitted horizontally, and the larger, ranging from about 20 to 30 feet in length, with three. The booms may either be slender *toa* (*Casuarina*) poles or somewhat stouter bamboos.

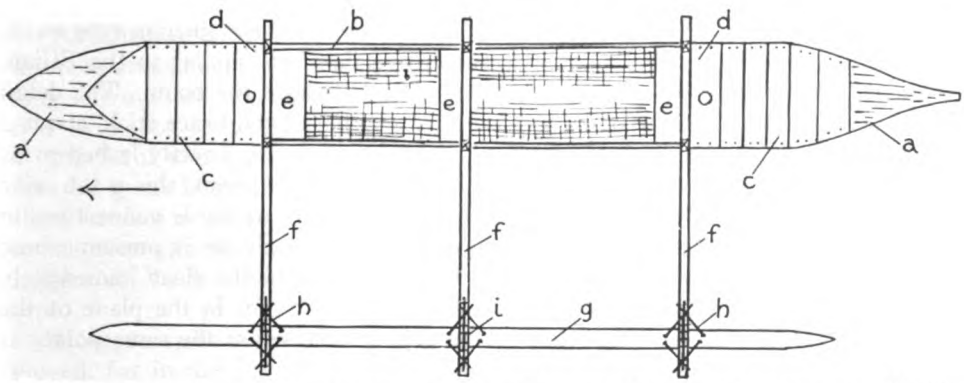


FIGURE 184.—Modern Tongan *tuingutu*: *a*, solid ends; *b*, washstrakes; *c*, cross planking covering space between each outer boom and adjacent solid end of underbody and nailed upon edges of washstrakes; *d*, mast thwart at each end enabling outrigger to be kept to windward on any course; *e*, loose paddling thwarts resting on edges of underbody; *f*, booms; *g*, float; *h*, stanchion connectives; *i*, horizontal rod holding stanchions in position when outrigger is dismantled, when in use lashed upon upper side of boom.

They rest upon the edges of the washstrakes, to which they are lashed by sennit or by cord passing through, usually, one hole a little below the gunwale.

The float varies considerably in shape and relative length; in the smaller or paddling canoes it is cylindrical, the fore end conical, the after one truncate; in the larger, which are frequently used under sail, it is roughly canoe-shaped, flat above, rounded below, and with the ends sliced away on each side and from below to a point.

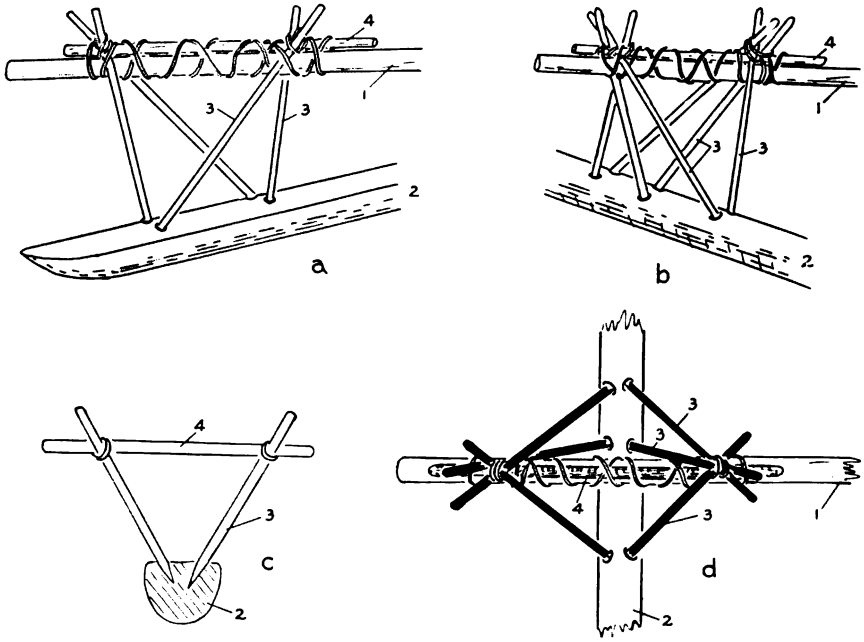


FIGURE 185.—Tongan stanchion attachment: *a*, two-paired, and *b*, three-paired form of stanchion attachment; *c*, attachment separated, float seen in cross section, only one pair of stanchions shown; *d*, top view of *b*; 1, boom; 2, float; 3, stanchions; 4, brace rod.

The float connection is either of the U type or by means of paired stanchions. The U type is the same as described for the *bobao*; the stanchion type is comparable with the Samoan and Fijian types. Two varieties of the stanchion type exist, the double and treble. The double, except in one detail, is similar to the Fijian, two pairs of obliquely converging stanchions crossing above the boom. The detail in which it differs is the use of an intermediate and horizontal brace stick, about 2 feet long (fig. 185), to which the heads of the stanchions are directly lashed prior to the lashing of the brace in turn to the end of the outrigger boom; this is the same device as that employed in conjunction with the attachment of the U connectives in the *bobao*. In the treble variety an additional pair of stanchions is present; these two extra stanchions, which are inserted close together in the float immediately under one side of the boom, diverge upward from this point in the plane of the long axis of the boom, to which they are respectively lashed at the same points as are the members of the two other pairs (fig. 185).

The largest *tuingutu* (fig. 183) was 30.5 feet long, the beam outside at the gunwale 13 inches, at the bilge 20 inches; depth of dugout hull 15.5 inches; width of washstrake 5.5 inches, a total depth of 21 inches; length of float 16 feet 9 inches; distance of float from gunwale 6 feet; booms three, attached 14.4 inches above the float; arms of U connectives 12 inches apart where lashed to the booms; booms 4

feet 6 inches apart; fore boom 69 inches aft of prow; after boom 75 inches forward of stern. The fore end of the float projected 31 inches in front of the first boom, the after end 18 inches behind the third boom.

Tafa'anga

Among the most elegant of Pacific outriggers, a few Tongan *tafa'anga* are known to have survived on the windward side (*liku*) of Tongatabu into the present century; in 1925 I saw the outrigger of one that was still in use at a village near the Haamonga trilithon, so the type is not yet extinct. A fine model of one now in the Cambridge Anthropological Museum is of great historical as well as ethnological value, for Thomson, who presented it, states in letters that it was made in 1891 by King George Tubou I when he was over 90, partly with his own hands and partly under his direct supervision. Thompson adds that the king was a great canoeman in his youth, and records (1894, p. 343) that "none could handle a *tafa'anga* laden with fish in a seaway as he". Thompson states that all the old men who saw it declared it to be accurate in every detail, yet an error has crept in, the arms of the U connectives crossing under the boom, an arrangement seen in none of the numerous canoes examined in 1925; in these, as also in Thomson's illustration (1894, p. 343), the arms invariably cross above the boom. The model has every appearance of having had its outrigger parts detached and subsequently reassembled after leaving Tonga; this would account for the discrepancy.

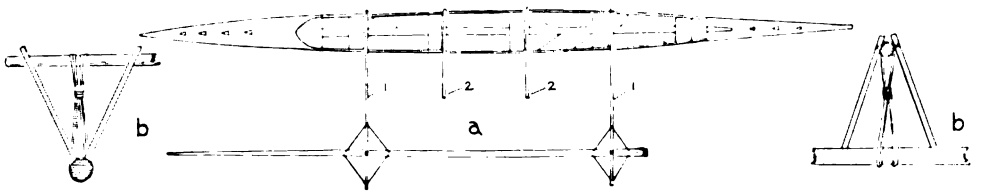


Figure 186.—Tongan *tafa'anga*: *a*, plan showing two functional booms (1) and two accessory ones (2), the bonito-rod rest and the median row of pegs shown somewhat conventionalized; *b*, details of outrigger attachment, stanchion lashings to boom omitted in original plate (after Paris).

As illustrated by this model, the *tafa'anga* is identical in all respects save the float attachment with the Samoan bonito canoe (*va'a alo*). There is the same long narrow hull, the same long decking at each end, ornamented with a median row of knobs to which snow-white cowry shells are tied as a decoration; the arrangement and number of the booms (two) are identical, as is also the fitting for the great bonito rod behind the aftermost thwart. There is also present a short median accessory boom, a pseudo-boom, not connected with the float. But in the float attachment the paired U type characteristic of the small dugout outriggers of Vavao and Haapai takes the place of the Samoan inserted stanchion type.

It appears, however, that the Samoan type of attachment was formerly employed, for in the figures of a "tafahanga de Tongatabou" given by Paris (1841, pl. 122) the details of both the hull and the outrigger are precisely those of the Samoan *va'a alo*; the attachment is identical, consisting as it does of two pairs of obliquely running inserted stanchions and a vertical cord brace passed around the float (fig. 186). In figures of the same type of Tongan vessel given by Cook (1777, pls. 16, 43), attachment is again shown quite distinctly as consisting of

inserted stanchions, but the cord brace is omitted. Such evidence indicates that the *tafa'anga* was originally identical with the Samoan *va'a alo* and that the attachment was of the inserted stanchion type; it suggests that the attachment has been modified into the existing U type at a comparatively recent date.

It was probably a *tafa'anga* which Tasman, in 1643, saw put off from the land with three men in it. He describes it (1898, p. 26) as a small prow "very narrow, covered in to a good distance in front and abaft". Another canoe (1898, p. 27), seen later, had "the outriggers trimmed with shells and conchs", from which embellishments Tasman judged it to belong to the king or chief of the country. In the same drawing in which a double canoe under sail is the central figure, Tasman gives the figure of a paddling outrigger which is unmistakably a *tafa'anga*; all the features, down to the backwardly inclined bonito rod in position behind the steersman, identify it with certainty. Two booms, the correct number, project from the port side; the attachment of each is by two pairs of stanchions and not by U withies (fig. 190). The only other marked divergences from the existing design, allowing for the crudity of the drawing, are the absence of an accessory pseudo-boom and of the row of knobs down the center of the end deckings. It is worthy of note that Cook also does not show a pseudo-boom in his plan of the same kind of craft figured in his scaled drawings (1777, Atlas, pl. 16), and as some of the canoes met with during his visits were without egg-cowry decoration Tasman's figure may be correct in this omission. The remarkable accuracy of Tasman's details, so far as they are to be seen, goes far to inspire confidence in the artist's delineation of the larger Tongan vessel, the *tongiaki* (double canoe).

Cook had great praise for the Tongan canoe builders. Of his first visit in 1773 he writes (1777, vol. 1, p. 125):

> Nothing can be a more demonstrative evidence of their ingenuity than the construction and make of their canoes, which, in point of neatness and workmanship, exceed everything of this kind we saw in this sea. They are built of several pieces sewed together with bandage, in so neat a manner, that on the outside it is difficult to see the joints. All the fastenings are on the inside, and pass through kants or ridges, which are wrought on the edges and ends of the several boards which compose the vessel, for that purpose. They are of two kinds, viz., double and single . . . The single ones [*tafa'anga*] are from 20 to 30 feet long and about 20 or 22 inches broad in the middle; the stern terminates in a point and the head something like the point of a wedge. At each end is a kind of deck, for about one third of the whole length, and open in the middle. In some the middle of the deck is decorated with a row of white shells, stuck on little pegs wrought out of the same piece which composes it. These single canoes have all outriggers, and are sometimes navigated with sails, but more generally with paddles, the blades of which are short, and broadest in the middle.

Cook's figures show the float attachment to be of the stanchion type; no cord brace is present, neither is there a pseudo-boom.

Forster suggests that the islanders took the bonito and albacore as their model in designing the hulls of their canoes, and that the row of pegs along the center of the deckings represents the finlets along the tail of these fishes (1777, vol. 1, p. 461).

A larger *tafa'anga*, the equivalent of the Samoan dolphin canoe, also existed, but the sole record of it is the figure in an aquatint by Webber, Cook's artist on his third voyage. The outrigger canoe in the foreground (fig. 193) has a hull larger but otherwise similar to that of a *tafa'anga* and with a bonito rest conspicious on the fore part of the after decking. The larger size of the canoe has entailed several notable additions to the *tafa'anga* design; the number of booms is increased to four, a balance spar is added, and mast and sail are carried. The

booms are attached to the float in the normal way by paired stanchions but there are indications in addition of the use of bracing cords, as lines are shown passing around the float at the places where the stanchions are inserted. Over the outboard region of the four booms is lashed a rude fore and aft staging of planks. From the starboard side a balance spar giving purchase to a shroud projects far outboard, its inner end lashed upon or to the side of the second boom.

Unlike the ordinary *tafa'anga,* this large vessel, which has a crew of four, is fitted for sailing. A mast, short and vertical, is stepped apparently upon or just forward of the first boom. The precise form of the sail can not be determined as it is partially furled by being loosely tied up to the mast by a rope passed around it, midway up; from the masthead run a fore stay to the head of the canoe, a side stay or shroud to the outer end of the balance spar, and another, on the opposite side, to the outer end of the second boom, also a back stay to the stern.

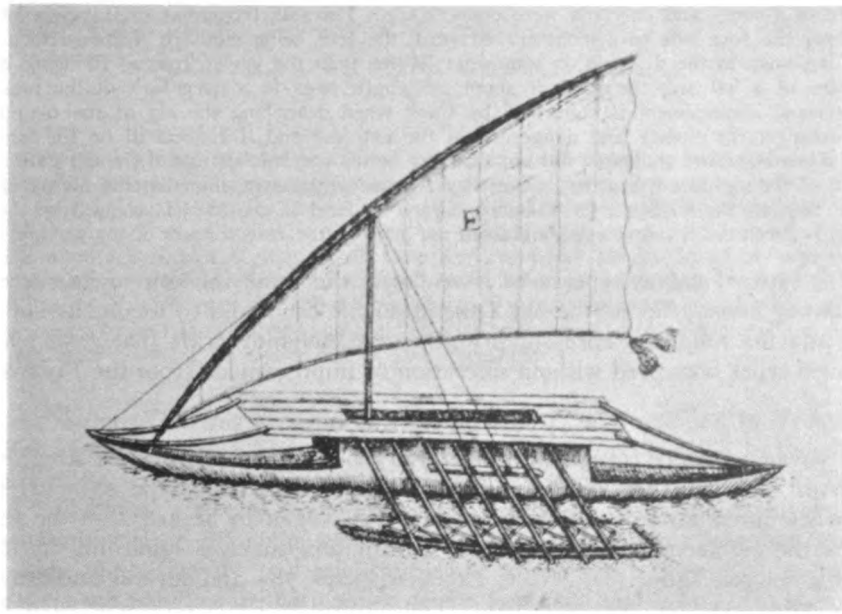


FIGURE 187.—Multiboom canoe seen at Namuka, Tonga, in 1643 (from Tasman, 1898).

A link between the *tafa'anga* as it is known today and the four-boom design drawn by Webber is that figured by Paris (1841, fig. 122) which has two accessory pseudo-booms, equally spaced between the two effective booms. Four paddling thwarts are present in addition to the steersman's seat. (See fig. 186.)

The available evidence points to the early type of *tafa'anga* as a multiboom canoe which by reduction of the median booms both in number and length has evolved into the present design of two effective booms and a median one of a vestigial character.

ANCIENT VOYAGING CANOE

The voyaging outrigger canoes had two forms, an earlier and a later. No description has survived of the earlier type, which was displaced within historic times by a Fijian model. Tasman (1898, fig. 4), however, gives an illustration which depicts a vessel of kindred type to the Fijian *thamakau* but simpler in construction and differing in many important details (fig. 187).

The underbody, the hull proper, is without sheer, and is pointed and decked over at each end; in the median section, extending for considerably more than one third the length of the hull, a deep washstrake is fitted on each side, supporting seven athwart beams which project far out on the port side and to a short distance on the starboard side. To their outer ends on the port side a float is attached by pairs of convergent stanchions in the Samoan and Fijian fashion; the float is flat above, round-pointed in front and truncate behind. A wide planked platform is lashed upon the booms where they cross the hull. At both ends it projects beyond its supports, and on each side it also projects outboard some little distance. Two spars at each end connect the pointed end of the hull with each of the adjacent corners of the platform. (In the Fijian *thamakau* there is one only of these connecting spars at each end, both upon the lee side.) No deck fittings are shown. Down the center of the platform a wide continuous hatchway opens into the body of the vessel, exactly similar in position to the long hatch over each hull in the contemporaneous double canoe (*tongiaki*).

The mast is short and vertical, fitted behind the first boom and well forward of the midlength of the hull; probably it was stepped upon one of the booms. Two shrouds pass on the weather side from below the masthead to a stringer lashed athwart the three median booms a few feet outboard; a forestay runs from the same point to the pointed head. No indication is given of a sheet, and halyards were unnecessary. The sail, triangular in shape, is laced or tied along the fore side to a stout curved yard, the foot being similarly fastened to a boom which is shown in the drawing as somewhat lighter than the yard. Instead of being hoisted by means of a halyard, the yard at about midlength rests in a deep fork at the masthead. This unusual arrangement is confirmed by Cook when describing the rig of the *tongiaki*; it is an arrangement clumsy and dangerous in the extreme and it reflects ill on the ingenuity of the Tongan sailors that they did not find any better way of hoisting their sail until nearly the end of the eighteenth century, when they adopted without modification the highly efficient method used by the Fijians. In Tasman's figure the heel of the yard is stepped on the fore decking between the two spars passing from the prow to the fore corners of the platform.

This type of canoe appears to have borne the same relation to its successor, the *vaka* or *hamatafua*, as the old Tongan double canoe did to the *kalia*; both this canoe and the *tongiaki* represent primitive and unhandy craft that gave place to improved types borrowed without alteration or improvement from the Fijians.

Vaka or Hamatafua

A voyaging canoe (*vaka* or *hamatafua*) built after the still-existing Fijian design of the *thamakau* displaced an older and indigenous type soon after the time when intercourse between Tonga and Fiji began to be active in the second half of the eighteenth century. Little information survives regarding its details except a colored figure (D'Urville, Atlas, 1833, pl. 78) and several line drawings (Paris, 1841, pls. 119, 121, fig. 10). The figures by Paris represent what is unmistakabably a copy of a finer type of Fijian *thamakau* than any now existing.

The hull remained much the same as in the older type, but the median platform, instead of projecting equally on each side, extended farther over the outrigger framing on the weather side and the long hatchway became two short ones in order to permit the mast to be stepped between them, immediately over the weather gunwale, and exactly amidships (fig. 188). On the weather side of this, partly over the outrigger frame, an elaborate form of thatched hut was erected, with an open stage and railing above its roof to accommodate the chief and his principal officers; various parts of the framework were adorned with egg-cowry shells.

Of the outrigger booms, three only were connected with the float, the attachment being by paired convergent stanchions; the greater number of the booms failed to extend outboard as far as the float, and became accessory booms functioning solely as supports for the deck platform. Spar struts connecting the ends of the hull with the corners of the platform were present only on the lee side as in the *thamakau*.

From the *thamakau* the design differed in only one particular: the two ends were similar and each was brought to a sharp point instead of one end being deep and sharp, to form a vertical cutwater, the other running fine to a small, ovately truncate extremity a few inches in diameter. Whether Paris is correct in showing the ends similar and sharp-pointed can not now be decided. He depicts the Tongan double canoes of the *kalia* design as having similarly sharp-pointed hulls, which is correct neither for the Fijian *thamakau* and *ndrua* nor for models of Tongan double canoes found in museums, which agree in this and other details with the

Fijian type. It is, nevertheless, not unreasonable to infer that during the transitional period when the change over in type was taking place, Tongans engaged in building large canoes in the Lau Islands of the Fiji Archipelago may have modified this part of the Fijian design to harmonize with the form of the canoe ends which characterized their older and indigenous model (compare Hodges' figures in Cook, 1777). The rig is typically Fijian.

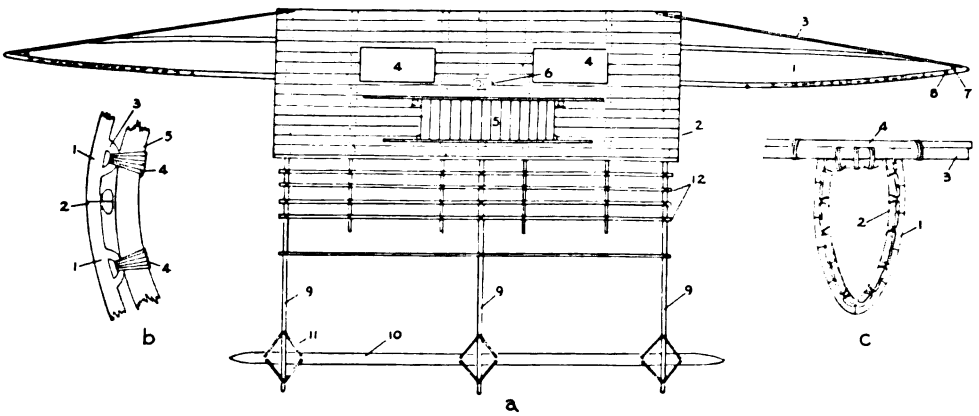


FIGURE 188.—Tongan *vaka* or *hamatafua*. *a*, plan: 1, end cover; 2, deck platform (*rara*); 3, strut between corner of platform and head of canoe; 4, hatchways; 5, deck hut; 6, mast shoe; 7, hole serving as step for heel of yard; 8, vertical hole through which tack of yard is made fast; 9, three main booms; 10, float; 11, paired stanchion connectives; 12, stringers. *b*, details of attachment of portion of rib to hull: 1, two hull planks joined at seam (2) by projecting flanges lashed together through perforating holes; 3, comb cleat, wrongly shown as vertical instead of horizontal, through which lashings (4) pass to secure it to inserted rib (5). *c*, cross section of hull showing ribs and their position within hull: 1, planks of hull; 2, inserted rib; 3, outrigger boom; 4, deck planking. (After Paris, 1841.)

Some memory of this type of outrigger canoe is still retained in Tongatabu. The Rev. John Havea, a Tongan pastor well-known for his wide knowledge of native customs, informed me in 1925 that the proper term for this vessel in Tongatabu is *hamatafua*. It was, he said, a single outrigger of large size, rigged with one mast and a large triangular sail, but propelled by sculls in calms and contrary winds. He added that the hull might either be a very large dugout or be built up of planks sewn together in the manner of the *tafa'anga* and *kalia*. It could carry a considerable number of people.

The only reference in literature to this vessel under its rightful name is one by West (1865, p. 271), who relates how a number of the inhabitants of Atata, in order to escape from a raiding party from Namuka, "hastily manned a *hamatefua*, or single-sailing canoe, which happened to be moored on the lee side of the island . . . Wind and sea carried them straight upon Ata, the Pylstart's Island of the charts, where the little company grew into a Tonguese colony".

The *hamatafua* appears to have lingered on till comparatively recent times, for Mr. L. B. Levin of Nukualofa stated to me that he saw what he believes was the last one in 1883 during a visit to Lafonga in the Haapai Islands.

Although this form of *vaka* was copied undoubtedly from the Fijian, it has so many points in common with the older Tongan design that it seems probable that the Fijian was evolved from one akin or similar to this old Tongan one. The presence of a number of accessory booms not connected with the float suggests derivation from a multiboom ancestor such as is seen in Tasman's Tongan figure. The changes in the form of the deck platform and its fittings are also such as would be expected as skill in canoe building advanced, and I am therefore of

opinion that this was actually the course of evolution. But this evolution took place in Fiji, and not in Tonga.

It is unquestionable that the Fijians were notably the superiors of the Tongans and Samoans in the art of canoe designing, although the Tongans could claim the credit of being the more skilful carpenters and the more daring and experienced navigators.

U Attachment

Of the three groups of islands in the Tongan Archipelago, in Vavao the U type prevails to the virtual exclusion of the stanchion type, probably because there are no longer any large canoes in use there; in Haapai, it is predominant, whereas in Tongatabu it is found only in the fishing villages on the south and east coasts; on the more populous north coast of Tongatabu the stanchion type alone is in use.

This distribution might lead to the inference that the U type is of older employment in these islands than the stanchion type. Against this conclusion have to be placed two facts. The first is that both in the canoe types surviving in Tonga and in those that have disappeared there is the closest possible affinity with those of Samoa except in regard to the U attachment, which the Samoans have certainly never employed since European contact; neither has there ever been any suggestion that they had it previously. The second fact is that both Tasman and Cook, the one in 1643 and the other in 1773, figured the stanchion attachment as the one in use at the time of their visits. So also did D'Urville and Paris. It seems probable that the Tongans, originally an offshoot from the same stock as the Samoans, had primitively the Samoan stanchion attachment, subsequently modifying this for use only in their smaller canoes into the U type, which may be a localized modification of a pair of stanchions inserted in the float in a Y or V manner, or may be a comparatively recent introduction from some non-Polynesian locality. It is a form of attachment unknown in Polynesia outside of Tonga.

There is evidence that Tongan voyages, usually involuntary, extended to New Caledonia, and it is known, for example, that Wallis Islanders were drifted to the Loyalties about the beginning of the nineteenth century (Lambert, 1900, pp. 54-55). Many of these castaways remained there and formed permanent settlements in Uvea, Lifu, and other islands, but we may be sure that some returned home, and it may be that in this we have the explanation of the occurrence of the U connective in Tonga.

In New Caledonia the shank of the Y connective in use there is sometimes so deeply inserted into the float that it becomes reduced to an approximation to the V type. The Tongan form may have arisen from the substitution of this modified Y form for two stanchion connectives—the ordinary Tongan attachment. The V part of the device, increasing in relative importance at the expense of the shank, might assume eventually its present form, a broad and deep U-shaped section lashed at the base to two diminutive pegs, the homologues of the original stanchions or a duplication of the shank of the Y. The introduction of the U connective may have taken place at a comparatively recent date; there is reason to believe that the southern New Caledonians adopted the *ndrua* form of double canoe from the Tongans, who did not begin to change over to this design until the latter part of the eighteenth century, as is learned from the accounts of Cook and others; the sketches given by Tasman, Cook, and Paris of Tongan canoes, the *tafa'anga* in particular, all show the connectives as paired stanchions and none make any allusion to the U form.

Corroboration of the course of evolution above outlined is afforded by the form of attachment seen in a canoe of Mare, in the Loyalty Islands, where, although a Y connective is employed, a very short peg is inserted into the float at each side of the shank of the Y, to which both pegs are lashed. This would appear to represent an intermediate phase between the New Caledonian Y and the Tongan U attachment.

On the other hand, it is possible that the U attachment was introduced into Tonga by a section of the Indonesoids who were the last-comers into Polynesia. In the extreme eastern islands of Indonesia the U attachment, but in the single U form, is common and occurs in the same Moluccan localities as the *orembai* and its near relatives. A double U attachment, but undercrossed, occurs along the whole coast of New Britain and in the Witu Islands; in San Cristoval at the south end of the Solomon Islands it recurs and this time in the overcrossed condition. However, in all these instances the U withies are attached to the float by cord lashings passed around the float itself. I incline to the conclusion that the U attachment seen in Tonga, where the withies are attached to accessory pegs and thereby have indirect attachment, has had a different origin as suggested above. Further, what evidence we have indicates that the U attachment is too recent in Tonga to have been introduced from a comparatively ancient Indonesian source.

The story of Oceania contains many instances of the substitution of new designs for old in canoe details; the islanders are receptive and quick to recognize and adopt any detail in the design of canoes of other islands which by accident or otherwise come under their notice. Instances in point within recent times are the adoption by the Marquesans of a plank connective in place of paired stanchions and the Samoan utilization of the whaleboat design in the construction of their great modern paddling canoe, the *taumualua,* displaced in the present century by the long *fautasi,* rowed by many oars.

DOUBLE CANOES

Tongiaki

The *tongiaki* was the form of double canoe in use in Tonga till toward the end of the eighteenth century, when the Tongans began to substitute the Fijian *ndrua* (Tongan *kalia*) as a more serviceable and weatherly craft. Fortunately several excellent illustrations of the *tongiaki* and a fairly full description by Cook himself exist. It happened that the change-over of types was beginning when Cook visited the islands in 1773 and 1774; he saw both and has several references to each.

Schouten (1619, p. 39) came across a *tongiaki* off Tafahi (called by him "Cocos Island") in 1616; it had been drifted out of its course and the crew were in a starving condition:

> [The vessel consisted of] two long and handsome canoes connected together but at some distance apart. Along the midships region of each, two broad planks of red wood were secured upon the edges [one on each side]; across these [washstrakes] small beams were laid [from hull to hull] and over them a platform of planks, the whole carefully fitted and made watertight with all the parts strongly lashed together. Toward the fore part of the starboard hull was stepped a short mast, forked at the top, on which was slung the sail; this was of matting and made after the fashion of those carried by Spanish boats [i.e., the lateen]. . . . Their cordage was strong and well laid. [See fig. 189.]

Two days later they came across two other vessels of the same kind and the chronicler records:

> The crew of one of them had aboard their vessel a canoe which they could launch whenever the occasion required. [Compare the Samoan custom of shipping two *va'a-alo* aboard

a *va'a tele*, their equivalent of the *tongiaki*, when going on a fishing excursion toward Uvea.] . . . The rig of these vessels is so excellent and they go so well under sail that there are few ships in Holland that could overhaul them. They steer them by means of two oars at the stern, one for each canoe.

Toward the upper end of the sail a figure representing a cock was outlined. This was evidently a common Tongan custom, for Forster (1777, vol. 1, p. 462), after remarking that some of these double canoes are large enough to carry 150 men, adds, "Their sails are latine, made of strong mats in which the rude figure of a tortoise or a cock, etc., is sometimes represented".

FIGURE 189.—Tongan *tongiaki* seen off Tafahi in 1616 (from Schouten, 1619).

Twenty-seven years later, when Tasman discovered the Tongan islands (1643), this fine double canoe so impressed him that he devoted a whole page of his journal to the illustration of one under full sail (1898, fig. 2); another drawing shows two of the same kind of craft at anchor. (See fig. 190.)

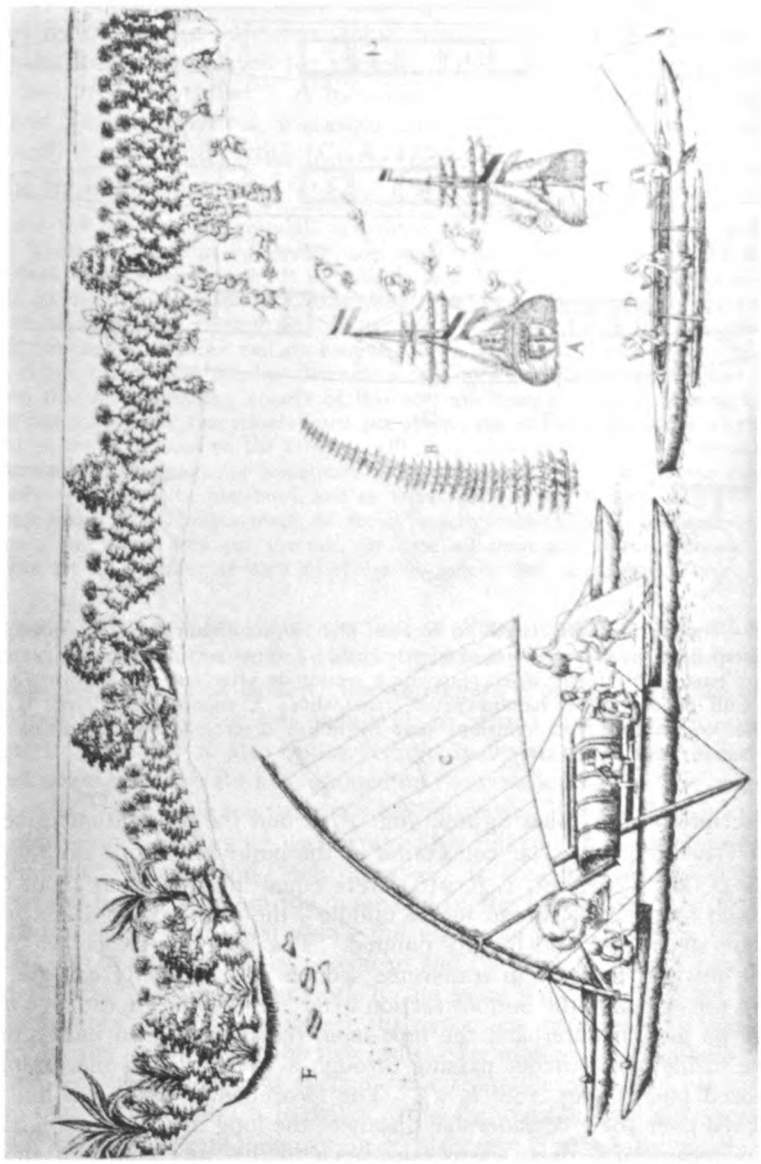


FIGURE 190.—Tongan *tongiaki* seen off Tongatabu in 1643, masthead crutch-shaped, two steering paddles in action; right, bonito fishing canoe (*tafa'anga*), fishing rod correctly shown behind aftmost paddler (after Tasman, 1898).

An equipment not described, but clearly seen in Schouten's and Tasman's figures, is the great balance spar laid athwart the hulls immediately abaft the mast to project outboard on each side. In both these figures the short mast is stepped well forward on the platform and has a crutch-shaped masthead in which the yard rests.

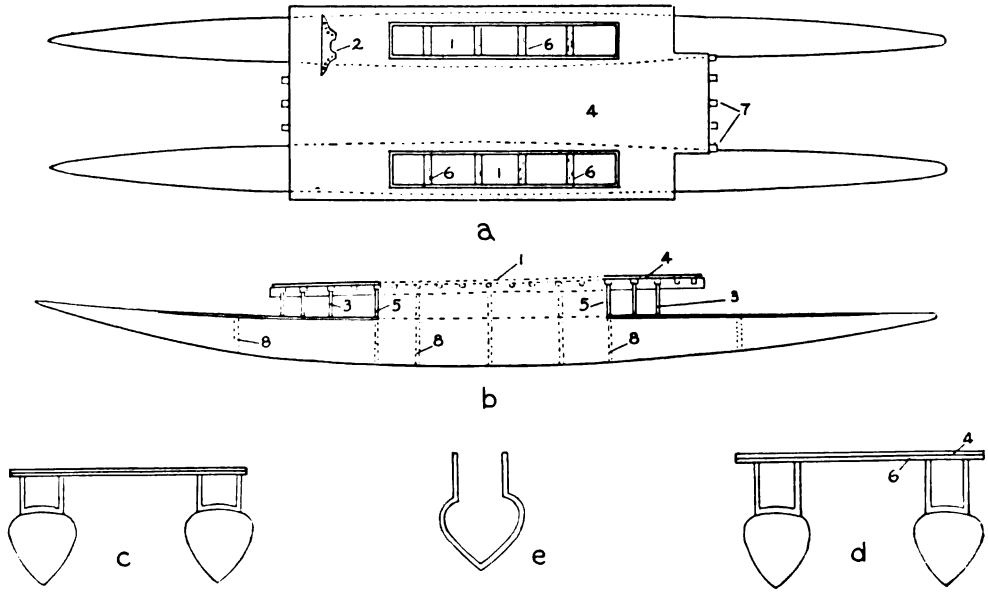


FIGURE 191.—Tongan *tongiaki*, length 69 feet: *a*, plan; *b*, longitudinal section through one hull, vertical dotted lines indicate position of inserted ribs; *c*, cross section through fore end of vessel under fore part of platform; *d*, corresponding section at after end of platform; *e*, cross section of one hull amidships; 1, hatchways; 2, mast shoe; 3, supporting pillars; 4, deck; 5, breakwater to keep water from midships part of hulls; 6, crossbeams supporting deck; 7, fore-and-aft beams under deck (after Cook, 1777).

Cook's description and scaled figures (fig. 191) and the illustrations given by Schouten and Tasman give a clear conception of the build and rig of the *tongiaki*. The two hulls (Cook, 1777, vol. 1, p. 216) were equal in size, "each about 60 or 70 feet long, and from 4 to 5 broad in the middle", the heads pointed and with a slight sheer, the sterns low and bluntly pointed. The bottom of each was sharp along the keel line and the hull in transverse section was distinctly cordate, with sides raised on the edges of the bottom section after the fashion of the *va'a alo* of Samoa and of its local counterpart, the *tafa'anga*, the planks sewn neatly to one another on the inside with stitches passing through a stout beading margining the edges of opposed planks (fig. 188, *b*, 2). The two ends of the open hull thus built were decked over for a considerable distance; the long median section had its sides raised by means of a deep washstrake sewn to the upper edge of the side planking, each end closed in by a transverse board or breakwater.

Two such hulls were connected, 6 to 7 feet asunder, by a number of stout cross beams lashed securely to the upper edges of the four washstrakes. Over these beams (Cook, 1777) and "others supported by stanchions fixed on the bodies of the canoes" was laid a boarded platform of rectangular form. The two extremities projected well beyond the ends of the raised middle section, particularly at the after end, where its longer median part reached nearly to a level with the two

sterns. In Cook's figure the outermost planks on each side are cut off short near the stern, thus forming an angular rest for the great steering paddle (fig. 191). In Tasman's sketch, a steering paddle is seen in operation on the leeward side of each hull at the after end of this platform.

Above the central section of each hull a long hatch was left open in the platform, wherein one of the crew was kept constantly bailing out the water that entered by the seams. Between these two hatchways a low arched hut thatched with palm leaves was placed for the use of the passengers and "to screen the crew from the sun and weather". A movable fireplace (*talafu*), shown in both Schouten's and Tasman's figures, was always carried—a square, shallow wooden trough filled with stones [and earth] (Cook, 1777, vol. 1, p. 217).

The rig is thus described by Cook (1777, vol. 2, p. 18):

> Some [of their sailing vessels], and those of the largest size, are rigged so as to tack about. These have a short but pretty stout mast, which steps on a kind of roller that is fixed to the deck near the fore part. It is made to lean or incline very much forward; the head is forked; on the two points of which the yard rests, as on two pivots, by means of two strong cleats of wood secured to each side of the yard, at about one third its length from the tack or heel, which, when under sail, is confined down between the two canoes by means of two strong ropes, one to and passing through a hole at the head of each canoe; for it must be observed that all the sailing vessels of this sort are double. The tack thus fixed, it is plain that, in changing tacks, the vessels must put about; the sail and the boom on the one tack will be clear of the mast, and on the other it will lie against it, just as a whole mizzen. However, I am not sure if they do not sometimes unlace that part of the sail from the yard which is between the tack and the masthead, and so shift both sail and boom leeward of the mast. The drawings which Mr. Hodges made of these vessels seem to favor this supposition. . . . The outriggers and ropes used for shrouds, etc., are all stout and strong. Indeed, the sail, yard, and boom are all together of such an enormous weight that strength is required.

Cook here makes but bare mention of the long stout spar athwart the deck platform abreast of the mast, which projected outboard on either side to a considerable distance. Cook calls it "the outriggers"; properly it is an outrigged spar or balance spar. Its use was primarily to afford attachment to sundry shrouds and guys. Probably it also subserved the purpose of a spar whereon in heavy weather some hands might be stationed on the weather side as live ballast. Williams (1870, p. 64) describes the two ends as "projecting like monster horns".

Exactly how the rigging was arranged is difficult to determine, for the figures by Schouten, Tasman, and Cook disagree. In that of Schouten a guy, or it may be a spilling line, runs from the outer end of the balance spar on the weather side to a point on the yard well above the masthead; in Tasman's large figure it is attached half-way between the masthead and the tack. A short stay or guy is also shown running from each foredeck to the same point on the yard where is made fast the balance spar guy; these are the two ropes mentioned by Cook as confining the tack of the sail between the two hulls. In another of Tasman's figures, where some canoes lie at anchor, a shroud runs from the masthead on each side to an end of the balance spar; a backstay from the masthead is also present.

Two of the principal figures in a plate by Hodges, to which Cook refers, though agreeing in many details with Cook's description, do not agree in all (fig. 192):

> The double canoe in the center of the plate has no balance spar (Cook's "outrigger"); the mast is stepped to one side of the deck cabin; and the heel of the yard, instead of being confined between the heads of the two hulls, is stepped at the head of the port hull as in the *kalia*; features pertaining to the type of the *kalia* are combined with others belonging to the *tongiaki*, so producing a hybrid design. The double canoe on the right in the same plate, although only partly seen, is more typical of the *tongiaki* design as described by Cook; it

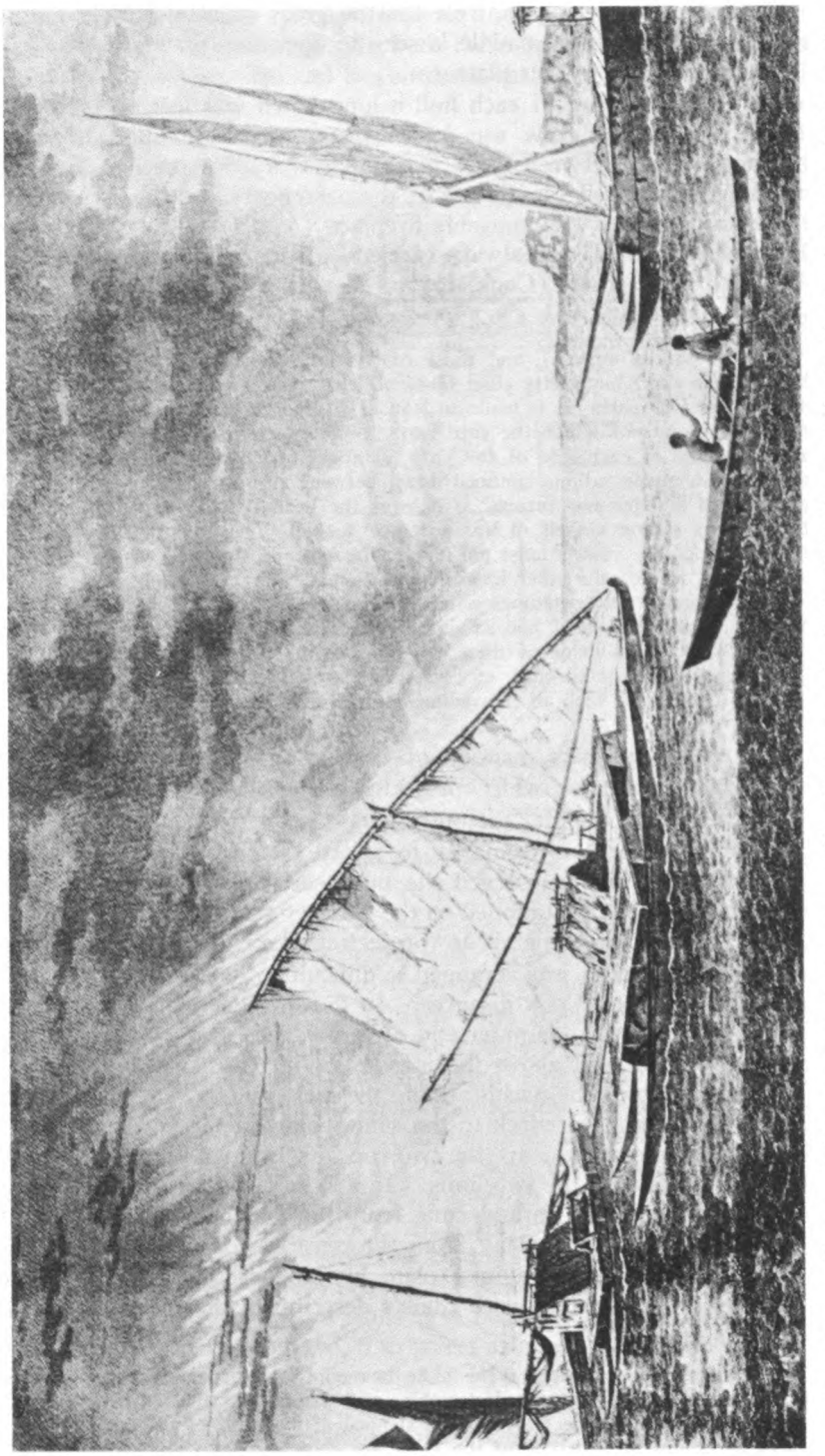


FIGURE 192.—Tongan double canoes; two seem to combine features of the *kalia* with others peculiar to the *tongiaki*; step cleats on after side of mast in canoe at right; in foreground a paddling canoe with stanchion connectives (from Cook, 1777, vol. 2).

shows the deck hut some distance aft of the mast, and the peculiar shoe in which the mast is stepped; a balance spar is present, abreast the mast but projecting only on the port side of the port hull, and a series of small step cleats are shown on the after side of the mast, as well as two broad cleats on opposite sides of the yard at the point where it rests on the forked masthead—features not present in the central figure. A third double canoe on the left in the drawing, though the hulls and platform are those of the *tongiaki*, has the mast stepped amidships, with deck fittings typical of the *kalia*.

Discrepancies are also seen in the drawing of a double canoe in an aquatint by Webber, who accompanied Cook on his third voyage (fig. 193):

FIGURE 193.—Tongan canoes seen on Cook's third voyage: center, a *tongiaki* having *kalia* features; left, four-boomed sailing outrigger with mast up and sail partly furled against it; balance spar on off-side (aquatint by Webber, published in 1791).

This vessel must be classed as a *tongiaki*, for the hulls are of equal dimensions and are similar in form, with a median row of knobs on each end decking as in the *tafa'anga*. The platform is not raised on a deep median washstrake as in the *kalia*, and there are no spars connecting the head and stern of one hull with the two lee corners of the platform. Conversely, the sail is slung by halyards from the masthead instead of resting in a fork or crutch and appears to be stepped amidships. No balance spar is shown, and the deck hut appears to have a platform over its roof, all characteristics of the *kalia* design.

It is most unlikely that Hodges and Webber should both by mistake mix up in their drawings the characteristics of the two types. The reasonable explanation of the departures from the *tongiaki* design shown in their figures is that the *kalia* design—a copy of the Fijian *ndrua*—which at the time of Cook's visits was in course of introduction into Tonga, had been adopted in part only by some of the Tongan chiefs; the inference is natural that, at the beginning of the transition phase, certain of the old *tongiaki* hulls were equipped with the rig and deck fittings of the *kalia*. Only by such hypothesis can the discrepancies noted be explained satisfactorily. A parallel is found in Rotuma.

The *tongiaki* required a steering paddle in each hull; Collocott and Havea (1922, p. 91) state that three were sometimes required for these vessels. They remark also that in fine weather one man apiece sufficed but that when it was stormy more were needed.

The principal features wherein the *tongiaki* differed from the *kalia* were: 1, in the approximate equality of the two hulls; 2, in sailing, the same ends were always

directed forward and in consequence the manipulation of the sail was entirely different; 3, the mast was much shorter and had a forked head in which the yard rested, with the tack of the sail confined by ropes between the prows and not stepped at the fore end of one hull; 4, the presence of an outrigger balance spar; 5, the deck platform was relatively larger and extended considerably farther aft than in the *kalia*; 6, the deck shelter was a tunnel-shaped hut without a platform above the roof.

It is common tradition in Tonga today that the *tongiaki* was a notoriously difficult and dangerous craft to handle in bad weather and one not able to beat to windward. It was essentially a fair-weather vessel, a fact pithily expressed in the Tongan proverb, "Takanga a tongiaki", literally, a "*tongiaki's* company", said of a fair-weather friend. Collocott and Havea (1922, p. 91) says: "A couple of these canoes might sail along in company in fair weather, but if a storm sprang up neither could rely much on the other for assistance".

The clumsiness and lack of weatherly qualities of the *tongiaki* contributed very largely, if indeed not mainly, to the involuntary colonization by Polynesians of several islands well within the Melanesian area. As Thomson (1908, p. 295) remarks, the rig of the vessel enabled it

> . . . to lie close to the wind on one tack, but on the other the sail was broken up into pockets by the mast, which held the wind and stopped all headway. Consequently it was the practice to wait for a fair wind, and set the sail on what would be the lee of the mast, and if the wind changed there was nothing for it but to change the course. It was, no doubt, this fact that led to so many Tongans' being cast away on remote islands, and to the mixing of Polynesian with Melanesian blood.

According to the Prince Consort William Tungi, the huge stones of the Haamonga trilithon were quarried at Uvea (Wallis Island) and transported to Tongatabu on an exceptionally large *tongiaki* built on Uvea for the purpose. Collocott and Havea (1922. p. 55) also mention what is probably a variant of the same tradition: a double canoe, the "Lomipeau" (erroneously termed a *kalia*), was used to convey from Uvea many of the stones required in the building of some of the royal supulchral langis on Tongatabu. Another version, recorded by Wilson (1799, p. 284), who was in Tongatabu in 1797, though averring that the langi stones came from Lifuka in the Haapai Islands, confirms the statement of their transport by means of double canoes, according to information which he received from the "Futtafaihe".

Kalia

Like the *'alia* of Samoa, the Tongan *kalia* is in no essential particular different from the Fijian *ndrua*. In Cook's time, 1773-74, the Tongans had begun to acquire some of these magnificent craft from the Fijians in substitution for their smaller and more primitive form of double canoe, the *tongiaki*. A few years later the process was accelerated and Thomson (1908, p. 295) states that "from 1790 to 1810 it had become the custom of Tongan chiefs to voyage to Fiji in their clumsy *tongiaki,* join in the native wars, and take as their portion of the loot Fijian *ndrua,* in which they beat back to Tonga; and in a very few years the *tongiaki* was extinct".

These *kalia* were also built in the Lau Archipelago of Fiji in later years by Tongan carpenters sent there for this purpose by their chiefs. Whether the design was modified in minor details is uncertain. Models of the Tongan *kalia* do not depart from the Fijian design in any respect, but in the figures given by Paris (1841, pls. 118, 121), the ends of both the hulls are shown pointed and similar,

the identical form, indeed, that they had in the older type, the *tongiaki*. Whether Paris' figures are correct in this particular is uncertain; in details his figures sometimes show minor inaccuracies, though as already stated there probably was a transitional period when old *tongiaki* hulls were adapted to the new design borrowed from Fiji. A model which I saw being made in Lifuka in 1925 for the Prince Consort by an old Tongan carpenter had the Fijian form of head and stern, and the builder, who was reputedly 93 years of age and the last survivor of the old carpenters' guild, asserted that such was the normal and correct shape.

Another difference to be noted is that Paris figures the heel of yard as stepped in a hole at the extreme end of the hull (fig. 188, *a*, 7), instead of lashed against an angular ridge socket not quite so far forward. As Krämer (1902-3, vol. 2, p. 258) shows the heel of the yard in the Samoan *'alia* to be stepped similarly (fig. 171), the probability is that this particular difference in design did exist in Tonga as well as in Samoa.

The double canoe has long been extinct in Tonga, longer indeed than in Samoa, but occasionally, as in Hawaii and Tahiti, two small dugout hulls are temporarily joined together at some few feet apart by two cross booms lashed athwart the gunwales. One of these is seen in a photograph taken from the "Albatross" in 1899, as she lay in Vavao Harbor (U.S. National Museum negative no. 40181). It is noteworthy that the *bobao* hulls are connected head to stern, as in the double canoes of Manihiki.

TECHNICAL TERMS

According to the old carpenter in Lifuka, many of the principal terms for the various parts were common to Fiji and Tonga, either the same or with the substitution of Tongan words for Fijian when these were descriptive. The more important of these in the two languages are the following (Fijian in parentheses):

Fana (vana): mast.
Fohe (vothe): paddle.
Fohe uli (vothe uli): steering paddle.
Fohe-lahi-matau (?): starboard steering paddle; literally the "large right-side paddle".
Fohe-i-hama (?): left side steering paddle.
Fono (vono): strake or run of planking.
Fono tabu (vono tambu): garboard strake.
Fono bajini vaka (vono laulalo): strake above garboard strake (*bajini*, a necklace made of whale's teeth).
Fono ngutu vaka (vono mbati ni wangga): topmost strake (*mbati*, the mouth, i.e. the open well of the hull).
Hama (thama): the smaller hull.
Hua (sua): scull.
Katea (kata): the larger hull.
Kiato (kaso): cross boom.
La (lathe): sail.
Takele (takele): basal or keel region.
Taumua (taumua levu): fore end or decking.
Taumuli (taumua lailai): after end or decking.
Toko (ndoko): poling stick or quant.
Tomotomo (ndomondomo): topmast.
Tuku (tuku): running fore and back stays of mast, also as a verb, "to slacken" or "to let go".
Vilinga hua (?): sculling hole in platform.

RAFTS

A persistent tradition prevails in Tonga to the effect that in former times rafts were employed in navigation. According to information given by Havea, the name *vakavaka-amei* was applied to this primitive kind of craft. He describes it as a shaped raft with side logs boomed out after the fashion of a double outrigger. He states that his father told him that he had seen a small one made of three logs; the median one was longer than the two lateral ones, which were separated from the median by a space, the whole being kept in position by several poles (*kiato*) laid athwart the three logs and lashed thereto. In larger examples it is said that there was more than one log on each side. Probably if more logs were employed

the space between the central log and the original two lateral ones would be filled in. The timber used in construction may have been that of the breadfruit tree (*mei*). Havea says that these rafts had some sort of a raised platform on which the crew and passengers sat. They were propelled by paddles, or sometimes by means of a sail. According to some of the old people these rafts were used even for journeys between Tonga and Samoa; they also held that it was by rafts and not by double canoes that the huge sepulchral monoliths required in the building of the royal langis were transported.

The Prince Consort, when discussing this subject with me, confirmed the statement that rafts were formerly in use in Tonga; his grandfather, King George I, had assured him that rafts were the first sea craft used in Tonga. His description, however, was that they were formed out of two great bundles of bamboos, held apart and connected by several cross spars (*kiato*).

Havea's account of this raft, after making due allowance for inaccuracies in detail in a description furnished by a person who had never seen the object he describes, points definitely to the former existence of a Tongan sea craft akin to or possibly identical with the sailing catamaran of Mangareva figured and described by Beechey (1831, vol. 1, p. 105) and closely related to the large river rafts still in active use in Fiji. The specific statement that it was used to maintain intercourse with Samoa is particularly interesting in view of the old Samoan myth, mentioned elsewhere, which claims that rafts were in use there prior to the introduction of canoes.

The variations found in the several accounts make it clear, however, that tradition cannot be relied upon for details; all that can be reasonably certain is that rafts were in use at an early period in the history of these islands and that they were probably employed in interisland communication.

NIUE

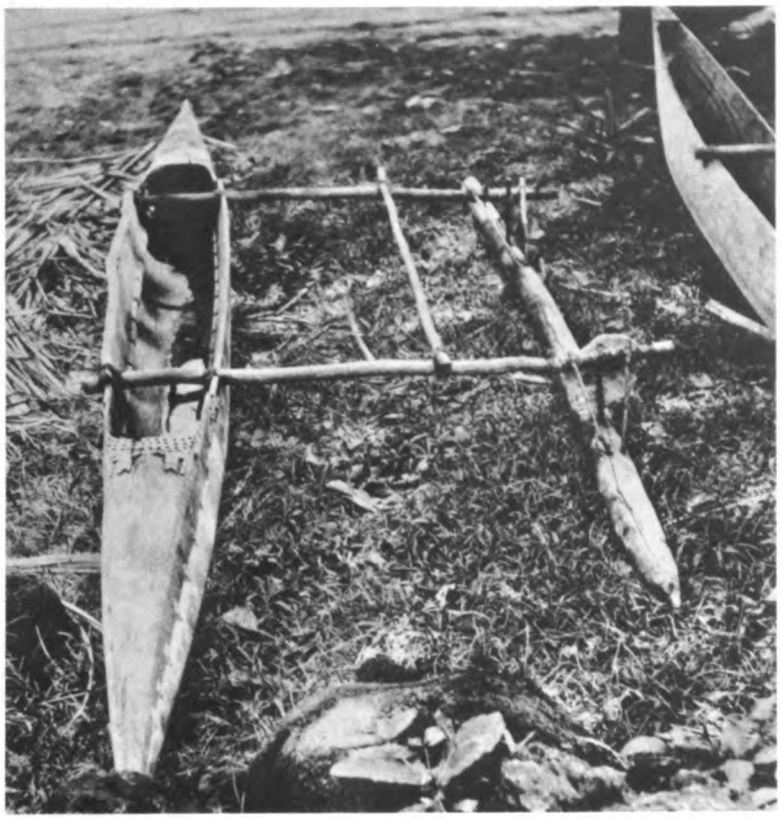
Niue, named "Savage Island" by Cook, owing to the fierce hostility of the natives on the occasion of his landing in 1774, is about 30 miles in circumference. It is relatively populous, for the soil is fertile and flying fishes abound in the sea. Owing to the absence of any lagoon, the fringing reef surrounding it makes it impossible to use canoes of a size larger than can be hauled to land over the reef in rough weather. For what the Niue canoes lack in size, their numbers compensate; on every dark night the torches of little fleets of canoes spangle the sea off the leeward coast with dancing lights.

OUTRIGGER CANOES

Cook (1777) describes the canoes which he saw as

> . . . precisely like those of Amsterdam Island [Tongatabu], with the addition of a little rising on each side of the open part; and [they] had some carving about them, which showed that these people are full as ingenious. Both these islanders and their canoes agree very well with the description M. de Bougainville has given of those he saw off the Isles of Navigators [Samoa], which lie nearly under the same meridian.

The only canoes the islanders now possess are dugout fishing outriggers of small size. The largest, which accommodate four persons (*vaka heke fa*), do not exceed 25 feet in length, with a depth of 18 to 24 inches; the majority, paddled by one man, and with room for not more than two, are much smaller, ranging from 17 to 20 feet long (fig. 194). Formerly six-seated canoes (*vaka heke ono*) were built, but these were rare (Loeb, 1926, p. 91).



a

b

FIGURE 194.—Small fishing canoe of Niue: *a*, end view, head on, each end of hull covered by long whaleback end piece, rude gunwale rail present, batten covers washstrake seam inside, single stringer lies across booms, float cylindrical and bluntly pointed in front, truncate behind; *b*, side view showing torpedo shape of hull, short median washstrake, and long end pieces, Samoan *paopao* in background (photographed at Apia, 1925).

The hull is of a very distinctive torpedo shape, equal-ended and bluntly pointed, formed of a shallow dugout underbody covered for a considerable distance at each end by a crowning deck of whaleback form hewn out of a single piece of timber; it is sewn by single stitches at wide intervals to the edge of the basal dugout. Connecting the inner ends of the two end covers, on each side is a washstrake, of the same height, often slightly everted, whereby the beam at the gunwale is made 2 or 3 inches greater than it is at the junction of the washstrakes with the dugout (fig. 196, *a-b*).

The bottom is rounded transversely, and slopes gradually upward toward each end. As the upper surface of the decking above slopes downward at the same angle, a torpedo form is achieved. Both the rounded deckings and the washstrakes are entirely covered with incised lines, either forming series of chevrons or else alternate sets of vertical and crossed lines (fig. 195), sometimes varied by bars and crosses made up of series of burned-in pittings. The joint between the dugout and the superstructure is calked with strips of lauhala and protected by a coating of hard gum (*pili*) obtained from the *ai*.

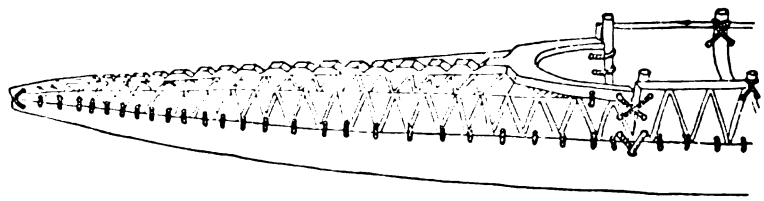


FIGURE 195.—End region of a Niue canoe: whaleback end cover, lashed upon dugout underbody, has incised ornament on sides and long row of truncated pyramidal knobs along middle line; stitches lashing cover to underbody are exposed and not covered with batten; within hold are seen two U spreaders, one lashed to washstrake by crossed sitiches, the other at junction of washstrake and inner end of end cover (from Alexander, 1902).

Buck (1911, p. 92) states that a Niue native informed him that in large canoes the lower edge of the washstrake (*oa*) is "grooved, and the inner lip, which is elongated and projects downward, is drilled for lashing to the hull, the holes thus not showing on the outer surface of the *oa*". This account appears to be founded on some misunderstanding respecting the direction taken by the flange. In all canoes examined both in 1899 by Alexander (1902, p. 781) and in 1925 by me, as also in all models examined, neither were the *oa* grooved nor the attachment holes concealed in any way. In the better-constructed canoes there is indeed a strong flange on the lower and inner edge of the *oa*, but this projects inward at right angles to the plank and not downward. It appears to be present solely to afford additional strength. The lashing is of the ordinary simple and direct type, by sennit passed through paired and opposite holes drilled respectively in the edge of the washstrake and the underbody; in its course it passes over the projecting flange of the *oa* and not through it (fig. 196, *b*).

In the larger and better-finished canoes, a median row of pyramidal knobs is carved from the solid along the center of each end decking, a vestigial survival of the knobs adorned with egg-cowries on Tongan and Samoan bonito canoes, from which this Niue type appears to have been derived. These shells are also used in Niue to decorate the canoes, but instead of being tied to the deck knobs they are fastened along the longitudinal seam on the sides of the hull in evenly matched size (Alexander, 1902, p. 781; Smith, 1903, p. 65).

The single outrigger frame consists of a float attached to two booms in the smaller canoes and to three and sometimes four in the larger. The booms are straight, horizontal poles sunk in notches in the upper edges of the washstrakes to which they are lashed. In the hulls

of the larger canoes, attached to each boom is a deeply bent spreader (*manu*) disposed vertically and transversely, usually in the form of a U and more rarely in that of a V with curved arms. The U spreader consists of a strong withy bent to shape, the V spreader of a forked branch cut off below the junction of the two branches. Each of the upwardly directed arms is lashed to the upper edge of the washstrake on its respective side through a single hole, and by the same lashing to the boom against which the ends of the arms also rest. In a large four-boomed model in Hamburg Museum, each arm of the V spreaders has a second attachment to the side of the canoe, one of the washstrake lashings being also passed around the arm of the spreader. In some models (one in the British Museum) two additional spreaders are present, one at each end of the open waist, at the junction of the washstrake with the covering board at the end. (See fig. 196, *a-b*.)

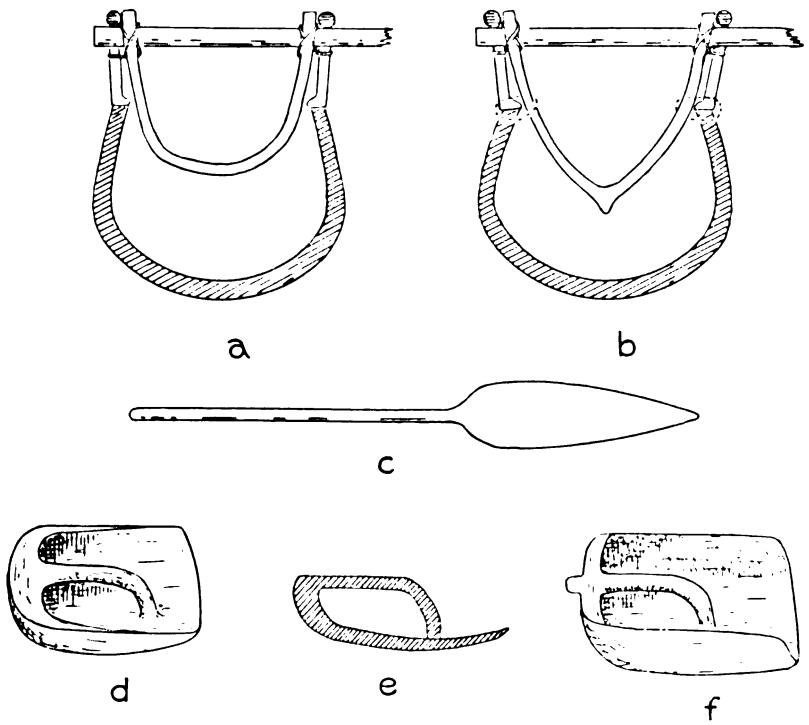


FIGURE 196.—Niue canoe deatils: *a*, *b*, cross sections of hulls showing variations in shape and attachment of U spreader; in *a* each arm of spreader is attached to washstrake by lashing which also passes around boom, in *b* each arm has same attachment as in *a* and in addition is secured by inclusion in one of the seam lashings (dotted lines); *c*, paddle; *d*, *e*, bailer, top view and axial section (British Museum); *f*, bailer from Uvea (British Museum).

In no canoe does the lower and median part of the spreader lie against the bottom of the hull as in a boat's frame; all are raised 6 or 7 inches above it. This curious fitting closely resembles in relative position, and roughly, in one of the two varieties, in form, the stout curved U spreader found in Hawaiian canoes, the only other instance known.

A pole stringer is lashed athwart the booms midway between the hull and the float. Another is fitted along the edge of the offside gunwale, thereby covering the proximal ends of the booms and forming a rude gunwale rail.

The float is cylindrical, usually pointed at both ends. It is connected with each of the two booms characteristic of the smaller canoes by two pairs of obliquely disposed stanchions and by a single unpaired vertical one (fig. 197).

In the larger canoes only the two outer booms have this attachment; that of the median one consists solely of an upright stanchion on each side of the boom. A third variety not observed among any of the present-day canoes is seen in many well-made models, as in those of the Berlin and Hamburg Museums, and the Pitt-Rivers Museum, Oxford; in these, all the booms in models representing the larger size of canoes, whether the number be four or three,

are attached by two stanchions only, both almost or quite vertical, one on each side of the boom; if this be an older method of attachment than where five stanchions are used, it may be a relic of a very ancient and primitive type.

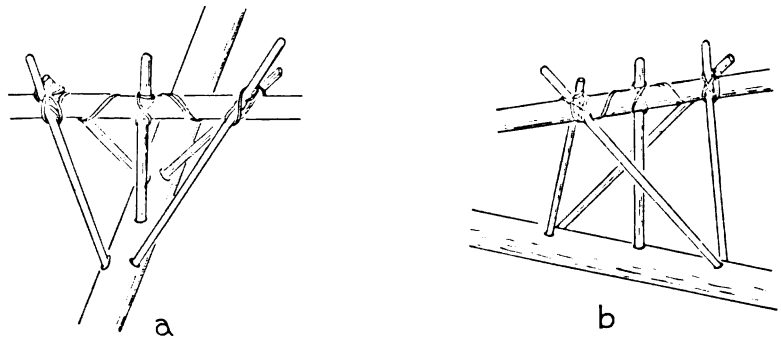


FIGURE 197.—Typical outrigger attachment in canoes of Niue: *a*, side view; *b*, oblique view.

All stanchions are lashed directly to the booms; there is no trace of the short rod to which the connectives are attached primarily in the Tongan system of attachment. In its general features the Niue canoe is more closely related to the Samoan type than to the Tongan; the arrangement of the five-stanchion attachment in the two-boom canoes would be precisely like the Samoan type, were the vertical stanchion to be replaced by a vertical cord brace. Indeed, the possibility must not be overlooked that the original Niue attachment (? that by two vertical stanchions to each boom) has been modified through increased contact with Samoa in recent years. A colony of Niue fishermen, occupying a whole hamlet, is settled today in Apia and their canoes are beached alongside of Samoan canoes having the normal Samoan outrigger attachment.

The larger canoes are said to carry a mast and sail occasionally. The paddle used has a short shaft without hand grip; the blade is broadly lanceolate, beautifully proportioned (fig. 196, *c*).

The bailer (*tata*) is a variety of the Oceanic type; the fore end of the handle is downturned and attached to the floor of the scoop (fig. 196, *d-e*).

The dimensions of two typical fishing canoes are:

	Two-boom Canoe (Hornell)		Three-boom Canoe (Alexander, 1902)	
	Feet	Inches	Feet	Inches
Length of hull	17	0	25	0
Beam at gunwales	0	12	0	16
Beam at junction of washstrake and underbody	0	14	0	18
Depth of dugout underbody	0	12	0	13
Length of float	11	6	10	0
Distance outboard of float	3	4	5	6
Length of end deckings	4	6	8 and 7 feet respectively	

The list of technical terms contains the following: canoe, *vaka*; decking, *puke*; fore end, *ulu*; fore decking, *puke-ulu*; after end, *mui-mui*; after decking, *puke-muimui*; washstrake, *oa*; thwart, *nofoa*; U spreader (? a vestigial frame), *manu*; stanchion connectives, *tutuki*; outrigger boom, *kiato*; float, *hama*; mast, *fana*; sail, *la*; paddle, *fohe*; bailer, *tata*.

DOUBLE CANOES

Although no double canoes now exist, the natives preserve the memory of them under the name *vaka hai-ua* (Smith, 1903, p. 65). Probably *foulua,* by which they now designate a ship, was originally a synonym for the same kind of vessel.

Whether they ever built or possessed any double canoes is doubtful, for the fringing reef around the island would make it extremely difficult and dangerous to bring ashore or to launch a heavy and bulky vessel. Loeb (1926, p. 91) says that though the islanders were familiar with the double canoes of the Tongans, they "seem not to have made them for their own use". He adds, "However, I have seen Niue children sailing models of double canoes along the shallow reef".

It may be that a fine model in the Berlin Museum für Völkerkunde, labeled as a Niue double canoe, is one of these children's toy canoes. The two hulls are equal in all dimensions and are identical in form with the better-made of the single canoes of the present day except that they are more elaborately ornamented with carving than usual; at one end the median ridge of the covering end piece is deeply notched as in figure 195. The hulls are connected fairly widely apart by two stout beams, resting upon the gunwales. There is no median platform, merely a single stringer pole lashed athwart the booms midway between the hulls.

Against the inference that this is a child's toy canoe, is to be set the fact of the elaborate carved ornamentation lavished upon it and the general careful workmanship of all the parts. The people of Niue may possibly have extemporized double canoes at sea from two large hulls after these had been separately launched over the reef. Loeb (1926, p. 91) states: "According to legends and songs, the Niueans were in the custom of visiting Tonga and Samoa in their canoes. Even the four-seated canoes were capable of traveling from island to island, according to native traditions. One account relates to a trip to New Zealand." If there be any truth in the last-mentioned tradition, the voyage could only have been performed if a double canoe had been employed; even the largest of the single canoes built on Niue would be unsuitable for this long voyage owing to lack of space to carry provisions.

ROTUMA AND THE ISLAND DEPENDENCIES OF TONGA

ROTUMA

The Rotumans today possess only small dugout outriggers used for fishing about the reefs. When Duperrey (1822-25) visited the island, double canoes still survived.

The single canoes (*vak*) were described by Wilson (1799, p. 294) as "nearly the same in all respects as at the Friendly Islands [Tonga], being of the same shape, sewed together on the inside, and decorated in the same manner with shells; but, being rather shorter in proportion to their width, seemed not so neat and well-finished".

Duperrey (1827, pl. 49, figs. 1-3) gives figures which show that the type of canoe employed agreed more closely with that at present in use in Samoa than with that of Tonga, for the three outrigger booms are connected to the float in the distinctive Samoan fashion by means of two pairs of oblique stanchions and an accessory vertical support, which may either be a stick stanchion or a suspensory sennit brace; the drawing is too indefinite to allow of certainty in regard to the nature of the accessory support. The hull agrees with those of Samoan and Tongan canoes in general design, having both of the low extremities decked over by a transversely curved plank bearing five or six knobs. According to Wilson, the knobs were

decorated with shells (fig. 198, *c*). The hull had little sheer and the planks were sewed together on the inside through marginal ledges as in the present-day *tafa-'anga* and *va'a alo*. The two ends differed slightly, one being more curved below than the other. The booms were straight and three in number in the larger canoes, which according to Duperrey had four thwarts. His figure shows no sign either of a wave-breaker at the inner end of each decking or of bonito-fishing fittings, which its Samoan prototype has; probably these have been omitted by oversight, for such defects are common in Duperrey's sketches.

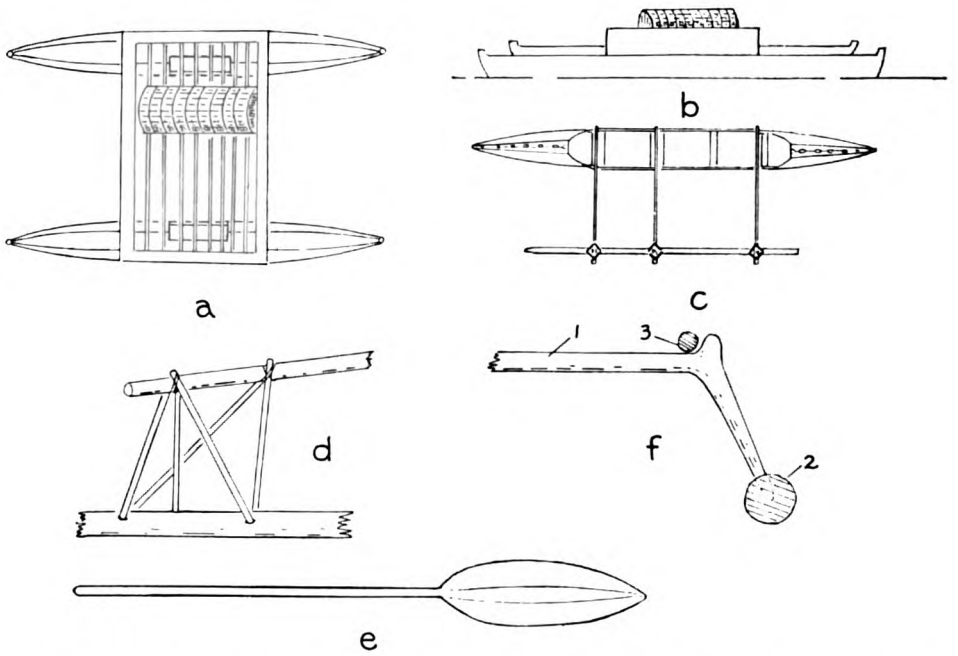


FIGURE 198.—Canoes of Rotuma: *a*, *b*, plan and side view of double canoe; *c*, plan of old type of outrigger canoe; *d*, outrigger attachment as employed in *c*, consisting of two pairs of convergent stanchions and a vertical strut or brace; *e*, paddle (*a-e* after Duperrey, 1827); *f*, outrigger attachment of modern type: 1, boom with downturned end inserted into float (2) seen in cross section; 3, stringer in section, lying in upper angle of shoulder of boom (after photograph by A. M. Hocart).

Duperrey (Paris, 1841, p. 105) gives the length of these outrigger canoes as ranging between 5.84 and 13 meters; the beam of the smallest was only 0.38 meters. He mentions that the canoes seen were generally rather roughly constructed and that their sail rig showed that they were not suitable for long voyages.

The small outrigger canoes in use at the present day, as shown by photographs kindly placed at my disposal by Mr. A. M. Hocart, depart radically in design from the type described by Duperrey. The design has been simplified to such an extent that the hull has degenerated into a simple dugout deprived of all accessory pieces and with the outrigger attachment of the direct type.

The body of the canoe is a double-ended dugout, open from end to end; the bottom is rounded transversely, as are also the sides, for they usually curve in slightly above the water line. The gunwale line has little or no sheer and the median region of the bottom, representing half the total length, is also straight. The ends are long and acuminate, the bottom sheering upward gradually to meet the horizontal gunwale line in a fine point. End covers and wash-

strakes are alike absent and there are no permanent thwarts. The ends contain hardly any dead wood. A small oblong cleat, perforated to take a mooring rope, surmounts one extremity, the other having a smaller non-perforated vertical projection.

The outrigger booms are always restricted to two. The inner end of each rests upon both gunwales, to which it is lashed by cords passing through two holes bored in each side of the dugout. The outboard region is either straight or very slightly bowed. At the distal end a stout arm, about a foot in length, is given off at an obtuse angle on the under side, the end pointed for insertion into the float (fig. 108, *f*). Above the angle of junction a low massive spur or heel projects upward to form a catch or grip for a longitudinal stringer. Each boom is equidistant from the near-by end of the hull, being placed immediately above the point at which the straight, median region of the bottom passes into the up-curved end section.

Like the hull, the float is double-ended and straight on both upper and under surfaces; each end is shortly pointed by being cut away below and at the sides, and extends for only a short distance beyond each boom. Over the booms, on the inner side of the spur at the end of the horizontal region of each, a bamboo stringer is lashed, approximately equal in length to the float. Its purpose is to secure the float from becoming detached from the booms; to effect this, suspensory cord braces pass from the stringer to the float. One of these is placed on each side of the down-turned arm of each boom; the lashing, after passing around the stringer, is threaded through an iron staple driven into the upper surface of the float, and the end, after several turns have been made in this way, is served around the connecting vertical cords; these are seized together with the free end of the lashing cord or sennit, which is then made fast. In addition to the paired braces, an unpaired one is occasionally placed midway between the booms. As the inserted arm of each boom meets the float obliquely, so also do these braces run obliquely outward and downward from the stringer to the float.

When the type of hull and outrigger here described were adopted is unknown. Both are wholly unlike those of the form figured by Duperrey and indeed have no exact counterpart anywhere. It seems probable, however, that they are adaptations of the Ellice Islands *paopao* as seen in Nanomea. In this, both ends of the canoe are pointed, end covers are wanting, and each connective consists of a long branch given off obliquely at the outer end of the horizontal region of the boom. The differences to be marked in the Rotuman canoe are: 1, the number of the booms are reduced to two from the three or sometimes four usual in Ellice Islands canoes; 2, the downturned arm of the boom, instead of being long and thinner than the boom proper, is short and stout; 3, the stringer, which in the Ellice Islands is lashed to the booms only, in Rotuma has four and sometimes five suspensory cord braces connecting it to the float.

In the Rotuman canoe each boom consists of a strong pole cut off about a foot below its junction with a larger branch, which forms, when shaped and pointed, the connective to the float; in the Ellice Islands the procedure is reversed, the larger branch forming the main or horizontal part of the boom, whereas the arm connecting with the float is trimmed out of a thinner side branch given off by the thicker one.

The angled Rotuman boom is also closely related in form to that characteristic of Rimatara in the Austral Islands (fig. 106, *c*) and seen in somewhat modified shape in certain of the Cook Islands; the proximity of Rotuma to the Ellice Islands, the use of a boom stringer and the pointed form of the ends of the hull, taken together, make it reasonably certain that the Rotuman dugout is a comparatively recent modification of the Nanomea type of the Ellice Islands *paopao*.

Double canoes, now no longer built, were formerly numerous in Rotuma and well adapted to make such long voyages as those to Tonga and Samoa. Duperrey's description as communicated to Paris (1841, p. 105) is the earliest, and his figures, sketchy though they be, are invaluable, for they show that the Rotuman double canoe in the twenties of last century was in transition from an older type similar to that of the Tongan *tongiaki* to another modeled upon the design which originated in Fiji.

The only double canoe which Duperry saw was composed of two hulls, stated to be much smaller (*beaucoup plus petites*) than the hulls of the outrigger canoes; both hulls were completely decked over with planking, sewed to the sides, save for a rectangular hatch or bailing well situated amidships in each. The median upper part of each hull was walled in with longitudinal planking connected by a transverse bulkhead at each end. Over this region, connecting the two hulls, which were placed a considerable distance apart, a rectangular platform was laid upon numerous transverse cross beams. A thatched hut, semicircular in section, to contain the provisions, occupied the center. The particular double canoe described by Duperry carried a crew of seven men under the command of a chief. Paris remarks that no dimensions are given, but the length of the steering paddle is stated as 4.80 meters or about 15.5 feet. This great length of the steering paddle would not have been necessary had the hulls been "beaucoup plus petites que celle à balancier", which latter had been previously given as between 5.84 and 13 meters; in view of this and of the account given below by a subsequent writer, it seems certain that the "beaucoup plus petites" of the description should be read "beaucoup plus grandes" (much larger). The vessel was not seen under sail. The sail lay furled on the platform according to the figure. The canoe came alongside propelled by "rowers" who worked standing; evidently they were sculling after the Fijian fashion.

As Duperrey's figure (fig. 198, *a*) shows the two hulls to be about equal in dimensions, with a single bailing well in each, it would seem that the design was fundamentally that of the Tongan *tongiaki*. The presence of scullers and the rectangular form and central position of the platform are, however, Fijian features, so it must be inferred that the design was a transitional one wherein these characteristics were superimposed upon an older design. This view is confirmed by the description of a later type seen by Lucett, who sojourned in Rotuma for some time between the years 1837 and 1849.

According to Lucett (1851, vol. 1, p. 178) the hulls of the double canoe of that period had considerable disparity in their dimensions, the larger being from 80 to 90 feet in length, the smaller 50 to 60 feet; the beam ranged from 4 to 5 feet. The two hulls were connected about 6 feet apart by crossbeams on which planks were lashed to form a central platform 14 to 16 feet wide. Other features characteristic of the Fijian type were present—closed-in hulls, hatchways for bailing with sliding covers, a small deck shelter, and a sail of triangular form set apex down from a mast stepped amidships.

Lucett remarks that, owing to the small size of the island, the natives, who were noted as daring seamen, were periodically compelled to reduce the population by emigration. Canoes were built for the purpose and parties sent away in quest of new homes across the sea. Such expeditions as these were common from Polynesian islands of limited extent and resources and account for the settlement of these people on islands such as Ticopia on and even within the confines of Melanesia, and, in earlier days, for the general dispersion of the Polynesians throughout the greater part of the South Sea.

According to Hocart (personal communication), the Rotuman language in its construction and vocabulary is related neither to Polynesian nor to Fijian, though the numerals and various technical terms have reached the language from Fiji by way of Tonga and other terms have come direct from Samoa. West (1865, pp. 426-427) remarks: "The Rotuman language is very peculiar. It differs materially from that of the Polynesians generally, in the number and use of the consonants. Its utterance approaches much nearer to the sound of Chinese or Malayan than any I had previously heard in the South Seas".

UVEA

Uvea (Wallis Island) appears to have had up to the beginning of the present century both single outriggers and double canoes not differing in any essential fea-

ture from those of Tonga and Samoa. All that is on record concerning them, together with a description of those of the present day, is contained in a manuscript report on the ethnology of Uvea by E. G. Burrows. The details of construction which follow are summarized from this work.

The canoes of Uvea are of three types: dugouts, single outrigger canoes, and double canoes.

The dugouts are nothing more than large wooden bowls used by one or two persons for paddling about within the lagoon, as in Futuna, where they are primarily vessels used in cooking comparable to the adaptation of earthenware cattle troughs to water transport in Bengal (Hornell, 1924). Whether or not this is a comparatively recent introduction is uncertain, for Oliver (Dix, 1848) says that "the small canoes of the Wallis Islanders, being used chiefly for sailing about the harbor, which is seldom much disturbed, have no outriggers", and Bataillon defines *vaka tafua* as "a small canoe made of a single tree trunk". These statements suggest something more like the hull of a two-boom canoe (*paopao*) rather than a food bowl.

Two kinds of outrigger canoe are in use, a small two-boom canoe with simple dugout hull, and built-up five-piece canoes having a variable number of booms, depending upon the length of the hull.

The two-boom canoes (*paopao*) are said to have been introduced in recent times from Samoa, a conclusion confirmed by their name and construction. The attachment of the booms is similar to that seen in the larger five-piece canoes.

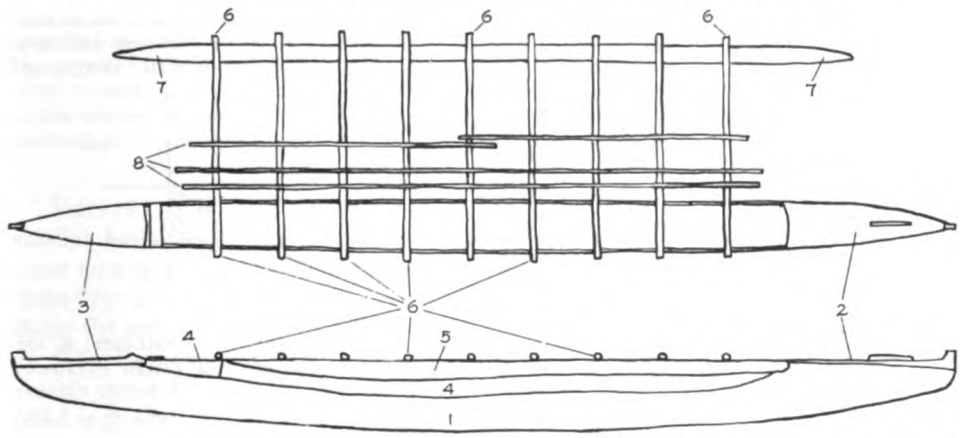


FIGURE 199.—Uvean canoe, 43 feet 9 inches over all: 1, underbody; 2, bow cover; 3, stern cover; 4, strakes; 5, washstrake; 6, outrigger booms; 7, outrigger float; 8, stringers (from Burrows).

A typical Uvean canoe of large size (*vaka tafa'anga*), the second largest in the island, is shown in figure 199. The largest is about 48 feet long. These two are the only ones with nine booms. Generally the booms range from two to seven and the number of strakes likewise varies with the size. The canoe is built on the lines of Tongan and Samoan canoes but with the ends nearly equal in size and shape; it is provided with flat, horizontal end covers and has generally a marked resemblance to the multiboom outrigger of Samoa. The median row of truncate bosses characteristic of the end covers of well-finished Samoan canoes and formerly seen in Tongan ones, is here reduced to a short median rib on the fore cover.

Though the fore end of the hull in canoes made from smaller trunks is tapered as in figure 199, the stern, which represents the thin upper end of the tree trunk,

has of necessity to be finished to a blunt point. Most canoes with such a stern are fitted with a sloped stern cover ornamented with two or three median bosses. This is locally termed the "Tokelau stern" and has probably been introduced from the Tokelau Islands, where this design is characteristic.

Another recent introduction is a canoe with booms attached directly to the float made by a man from the Ellice Islands; it has, therefore, no local significance.

The strakes and the end covers of the local type are sewn to the underbody with sennit in three different fashions (fig. 200). Local opinion considers that the

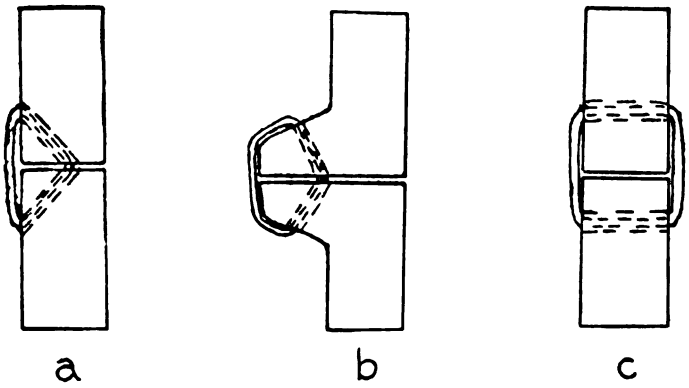


FIGURE 200.—Types of lashing used to join planks of Uvean canoes: *a*, through oblique holes, meeting in center of plank edges; *b*, through oblique holes in flanges left on inboard side of planks; *c*, right through lashing. Probable evolutionary series: *c*, simplest and most primitive; *a*, refinement of *c* leading directly to *b*; *b*, method perfected in Fiji, Tonga, and Samoa (from Burrows).

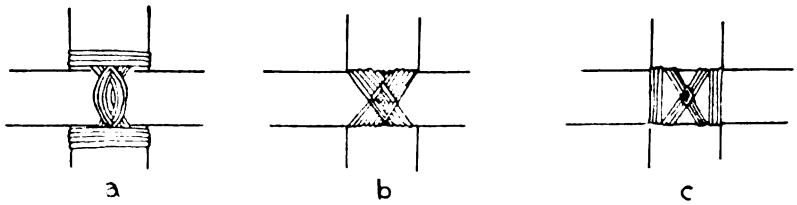


FIGURE 201.—Uvea: ornamental lashings joining outrigger booms to washstrakes: *a*, lozenge; *b*, diamond; *c*, cross with small diamond in center and bands at sides (from Burrows).

concealed method of lashing is the original one used formerly in Uvea and that the right-through method is modern, borrowed from Tokelau. Bamboo battens lashed over the joints are not commonly used except on the inside when the lashing is of the right-through type. Joints are calked with small sticks of the *ifi-ifi* (*Parinarium glaberrimum*) crushed and driven in; the bast of the *fau* is also used, especially to fill the holes when the lashing comes through to the outside. The joints are further tightened by smearing inside and outside with a gum from the fruit of the *ifi* (*Inocarpus edulis*).

The outrigger booms range in number from two to nine. Each is a straight pole lashed upon the gunwale; the more usual patterns of lashing used in the ornamentation of canoes of the best class are shown in figure 201.

The float is straight, pointed at each end, and set very slightly in toward the head of the canoe with a view to making it steer better.

The attachment of the booms to the float is by pairs of overcrossed stanchions after the Fijian and Samoan fashion. Usually there are two pairs to each boom,

but sometimes a single pair is used for all the inner booms, only the boom nearest each end of the canoe having the full complement of two pairs.

The connectives are hard sticks sharpened at the lower end, easily driven into the soft light wood of the float, which may either be of *mohokoi* (*Cananga odorata*) or of *fau* (*Hibiscus tiliaceus*). They are adjusted at such height that the base of the float and the bottom of the underbody are about level.

The paddles average 6 feet in length. The loom is straight, without terminal knob. The blade, oval in shape, is without point or other projection at the terminal end but is somewhat thicker along the middle than at the sides—one eighth of an inch at the edge, increasing to half an inch at the middle; no definite median ridge is, however, present.

The bailer figured by Burrows is of the ordinary Oceanic type. Another (fig. 196, *f*) is of that peculiar variety of the type in which the fore end of the returned handle is bent downward to merge into the floor of the scoop region. In general shape the Uvean bailer is short and broad, instead of elongated and narrow as in the Ellice Islands bailer of related shape. A model bailer from Niue is of the same type. A similar disposition of the handle is found in some Solomon Islands bailers figured by Edge-Partington (ser. 3, pl. 44, figs. 5, 6).

Anchors are of stone. Conch shells are carried for the purpose of signaling.

The last of the Uvean double canoes (*kalia*) was seen at the beginning of the present century in Hihifo. None now exists. Bataillon (1895) says:

> Their canoes are built of two hollow logs, 50 to 60 feet long, of the diameter of a huge cask, thinner and raised in the form of a prow at their extremities. Over these two logs, placed parallel 6 or 7 feet apart, is placed a platform which extends for about a third of their length. In the center of the craft rises a little house to shelter the navigators. Then, with the aid of a tiller, a mast, and a sail made of mats, they go seeking adventure on the seas. There are double canoes which can hold more than 100 persons, and with which they travel from one archipelago to another.

Burrows adds that the hulls differed in size, the larger being called *katea,* the smaller *hamani* (a term related to *ama,* "outrigger float"). It is probable that the same course of development occurred in Uvea as in Samoa and Tonga—that the older type (*tongiaki*) was equal-hulled, and that this was replaced by the *kalia* type about the end of the eighteenth century.

Like the *tongiaki* double canoes seen by Schouten and by Tasman, the Uvean vessels carried food and firewood stored in the hulls, food being cooked in a firebox filled with earth and supplied with stones for heating as in an earth oven.

Instead of the conch shells used by outrigger canoes for signaling, these large craft appear to have carried wooden drums (*lali*) for this purpose.

Nothing is known of the old rig except that the Uvean vessels were single-masted. The inference is that they were rigged similarly to those of Tonga.

All that is known of the Uvean art of navigation is that they steered their courses by certain constellations. An old story told by Henquel leads to the inference that the Uveans, like other islanders, utilized the run of the waves as an indication of direction.

Technical Terms

As is to be expected from the close political connection which existed between Tonga and Uvea, nearly all the canoe terms in use in Uvea are similar to those of Tonga. The probability is that Uvea was settled by people from there, that it was in fact a Tongan colony. Uvean terms are as follows:

Double canoe: kalia.
  Larger hull: katea.
  Smaller hull: hamani (Henquel); hama (Bataillon).
Small outrigger canoe, hull in one piece: paopao.
Built-up canoe (5-part): vaka tafa'anga.
  Underbody: faka hekaheka.
  Strakes: fono.
  Washstrake (topstrake): oa.
  Bow cover: puke mua.
  Stern cover: puke muli.
  Outrigger boom: kiato.
  Outrigger float: ama.
  Stanchion connectives: tutuki.
  Stringers: fakamanuka.
  Sail: la.
  Mast: fana.
  Mast step: tu'ulanga la.
  Bailer: tata.
  Paddle: foe.

FUTUNA

Although Futuna (Hoorn Islands) has larger and more abundant timber than Uvea, its canoes are less carefully built and less seaworthy. No record remains of the craft of former days; the only evidence that they once possessed double canoes is the word *tongiaki,* the Tongan term for the old pre-Fijian type of double canoe. Even this inference is open to question, for Burrows (1936), says he found *tongiaki* used in 1932 as a distinctive local term for an outrigger canoe which happened to be the largest in the island. Kau Moala, as reported by Mariner, said that in 1810 the Futunans "were not in possession of sailing canoes."

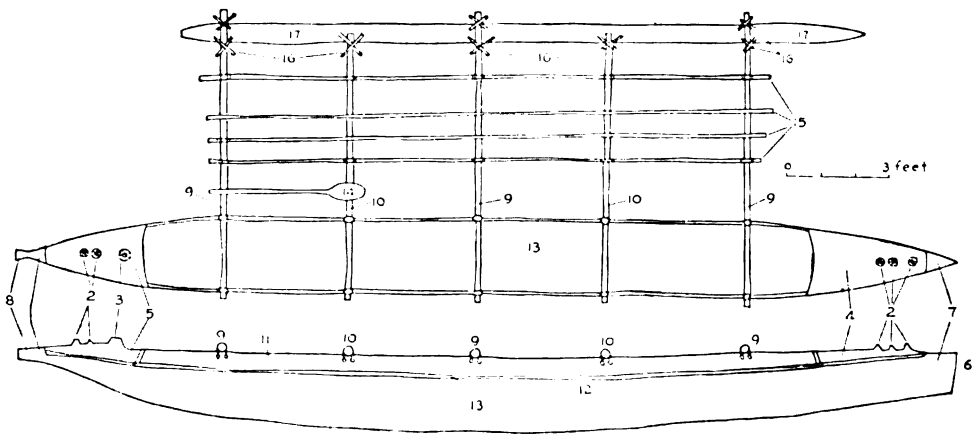


FIGURE 202.—Futunan canoe, length over all 27 feet 4 inches, maximum beam 2 feet 3 inches: 1, stern shoulder; 2, ornamental projections on end covers; 3, vestigial fishing-pole support on stern cover; 4, head cover; 5, stern cover; 6, cutwater; 7, bow; 8, stern; 9, long outrigger booms; 10, short outrigger booms; 11, washstrake; 12, bamboo battens covering joints; 13, underbody; 14, paddle resting across booms; 15, stringers forming a scaffolding over booms, some of these lashed, others loose; 16, stanchion connectives; 17, outrigger float, length 20 feet 4 inches (from Burrows, 1936).

At the present time the only craft used are large wooden dugout bowls employed for paddling about in shallow water, and 5-piece outrigger canoes. The paddling bowls are like the dugouts in Uvea and function indifferently as a receptacle for food in preparation and as a means of transport. Usually one person sits in the bottom and paddles with both hands as in the Bengal *tigari* (Hornell, 1924), though a wooden paddle may be used.

Nearly all the outriggers now in use are paddling canoes employed to ferry workers across the channel between Futuna and Alofi. A few are used for fishing

at Singave. They conform strictly to a single type modeled after that commonly seen in Samoa, though the design was probably derived from Tonga. The hull consists of a dugout with the freeboard heightened by the addition of a single washstrake along the waist and closed in by an end cover (*puke*) at stem and stern. As in Samoa the fore end is sharp and vertical, the stern tapered and wrought to a blunt point. (See fig. 202.)

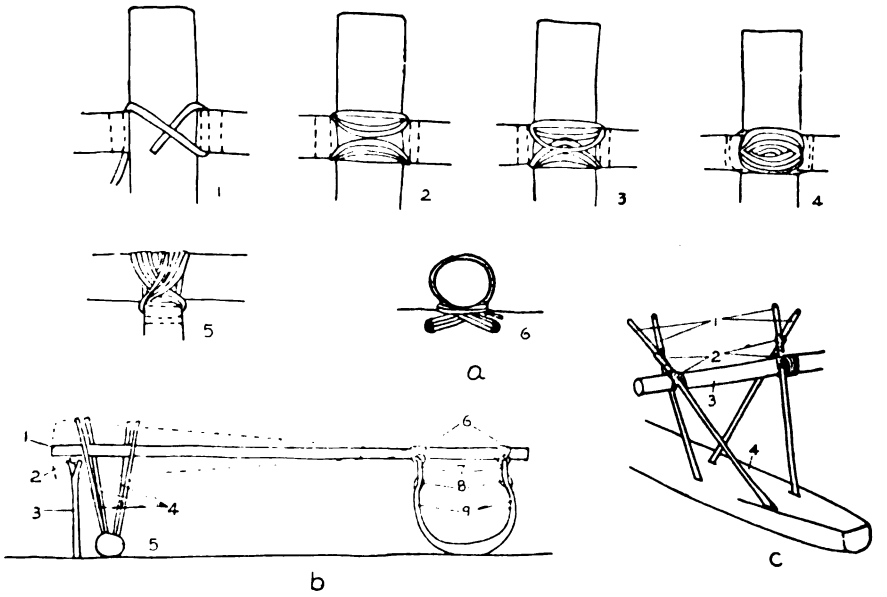


FIGURE 203.—Futunan outrigger attachment. *a*, lashing boom (1-4, in plan, 5-6, in elevation): 1, first turn; 2, first layer, turns meeting on top of boom; 3, beginning of second layer, turns crossing on top of boom; 4, completed lozenge pattern; 5, front view, before circumferential turns are made; 6, side view, showing final circumferential turns. *b*, adjustment of outrigger: 1, outrigger boom raised and lowered until desired level is reached; 2, rest for booms, removed when adjustment begins; 3, forked stick supporting rest for booms; 4, stanchions for connecting booms to float; 5, float; 6, lashings attaching boom to washstrakes; 7, washstrakes; 8, battens covering joint between washstrakes and underbody; 9, underbody. *c*, attachment of boom to float on long boom: 1, stanchions; 2, lashings; 3, boom; 4, float; short booms cut off directly over float lack outer pair of stanchions, their attachment like that of inner pair shown; stanchions are crossed above boom (from Burrows, 1936).

Usually three sub-pyramidal bosses ornament the median line of each end cover; the foremost of those on the stern cover is of specially large size and represents in degraded form the rod rest so characteristic a feature in Samoan bonito canoes. There is no recollection that these bosses ever had cowry shells tied upon them as in Fiji, Tonga, and Samoa, but Father Jacquemin stated that they were formerly regarded as luck-bringers and were then more carefully carved.

The hulls range in length from 23 to 28 feet over all, with a beam rather more than 2 feet and a depth about equal to the beam. The greatest diameter is about 4 feet from the fore end.

The attachment of the various parts is by lashings passed through holes bored in opposed edges. Before the lashing is drawn taut, battens of split cane are laid over the joint both inside and outside, under the lashing. The joint between the underbody and the washstrake is further protected in some canoes by a calking of coconut fiber or of old bark cloth.

Always five outrigger booms are employed—straight poles of *samasama* (*Pipturus*). These are lashed through holes to the gunwales at equal intervals with sennit worked into an ornamental pattern. The middle boom and each of the end ones are cut rather longer than the other two; they are attached to the float by two pairs of overcrossed stanchion connectives in the Fijian fashion. Those three booms are called *kiato loa* (long booms), whereas the two shorter ones, numbers two and four from either end, are called *kiato mutu* (cut-off booms); each is attached to the float by a single pair of overcrossed stanchions (fig. 203).

The float, always affixed on the port side, is preferably of *mosokoi* as in Uvea, though *fau* is also sometimes used; both are light woods. The forward end is cut to a blunt conical point; the after one is truncate but reduced somewhat by slices cut off all around, the chief cut being on the under side. The fore end projects beyond the first boom to a point about half way between the boom and the cutwater. The after end projects slightly sternwards of the last boom, as in Samoan canoes.

The connectives are paired stanchions from 3 to 3.5 feet in length, cut from branches of the dense *ola*, a wood hard in itself and further hardened by toasting it over a fire.

Finally, several stringers are placed outboard over the booms at intervals to stiffen the framework and provide a light platform to carry implements and other small articles.

The ceremonial putting in of the lashings is esteemed of the utmost importance, for the *tufunga* is supposed thereby to confer upon the canoe the spiritual power of his *kautoki*, in order to bring it luck. If the canoe proves unlucky, another *tufunga* is called in; he removes the old lashings and puts in new ones after his own particular fashion.

Technical Terms

The principal technical terms for canoes and canoe parts in Futuna are as follows:

Double canoe (old type): tongiaki.
Outrigger canoe: vaka.
Dugout underbody: fa vaka.
Washstrake: oa.
Bamboo battens over joints: kofe sau.
Bow cover: puke mua.
Stern cover: puke muli.
Ornamental bosses on end covers: tuu langongo.
Long booms: kiato loa.
Short booms: kiato mutu.
Stringers: tolutoluama.
Float: ama.
Connectives (stanchions): tukituki.
Vestigial bonito-rod support: pou kofe.
Paddle: foe.

Comparison of the Futunan terms with those in use in Tonga, Samoa, and the Tokelaus shows that Tongan and Tokelau influences predominate, suggesting more intimate relationship with these islands than with Samoa. The unequal lengths of the booms is a distinctive characteristic of Tokelau.

NIUATOBUTABU

Of Niuatobutabu (Keppel Island), discovered by Schouten and Le Maire in 1616, Schouten, (1648 edition) records that on May 12, "the chief came off in a great sailing canoe fashioned as previously described [that is, like the Tongan *tongiaki* upon which Schouten had fired some days before], formed like the ice sleds used in Holland, and escorted by 25 small canoes". (See fig. 189.) This comparison of the form of the double canoe with that of an ice sled is definite evidence that the two hulls were equal in length and general dimensions and therefore of the ancient Tongan type. The following day, "about 45 small canoes and a

fleet of 23 small sailing ones came off to trade. The latter were each manned by 25 men or thereabouts, whilst the paddling canoes held 4 or 5 apiece". Schouten adds, "This king must have assembled all his forces, for we were surrounded by quite 1,000 people afloat". They subsequently attacked Schouten in an attempt to capture his ship, hence his inference that the whole available force of the island was mobilized.

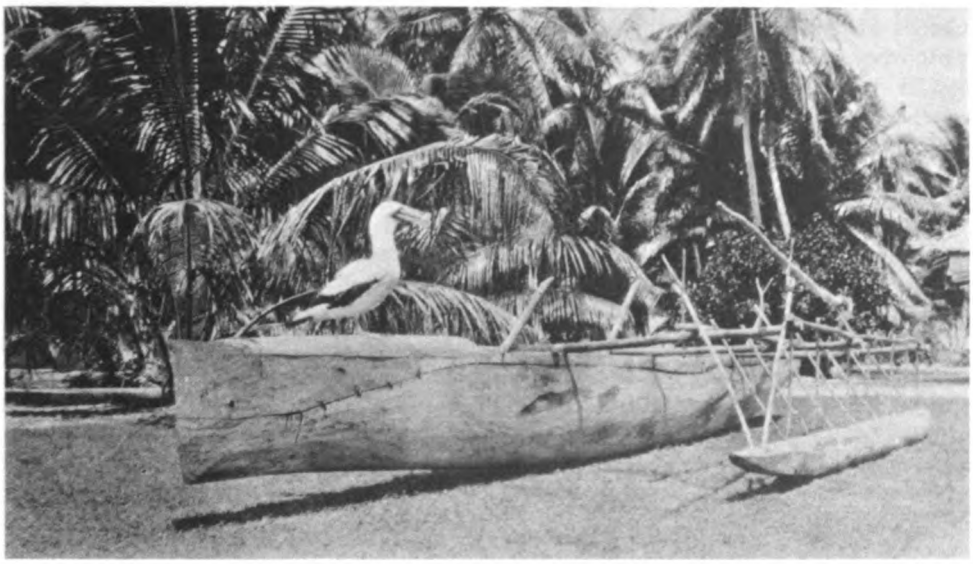


FIGURE 204.—Canoe built in Vaitupu by a member of an immigrant family from the Tokelau Islands, hull of southern Ellice Islands design, outrigger typical of Tokelau; one end of tree trunk of which dugout underbody is made being imperfect, a large piece of timber is shaped and fitted on to give cutwater proper height and form (photographed by D. G. Kennedy).

ELLICE ISLANDS

The details in this summary, apart from those gathered from Ellice Islanders during a visit to Samoa in 1925, are derived from a description of a Funafuti canoe by the late Mr. C. Hedley, and from the very excellent and exhaustive account of the variety in use in Vaitapu by Mr. D. G. Kennedy, Assistant Commissioner of the Ellice Islands, who has generously placed at my disposal his original drawings and photographs of this fine type of outrigger canoe. He has also supplemented this help by additional information upon certain critical points which I submitted to him. I have also to thank Dr. P. A. Buxton for several photographs of the canoes in use in Nui.

The Ellice Islands are believed to have been settled mainly from Samoa. The study of their canoe forms throws an interesting light not only upon this subject, but also upon the more important problem of the migration relationships of the Samoans themselves, and upon the influences which shaped their canoe design as it existed at the beginning of the nineteenth century.

OUTRIGGER CANOES

There is no fundamental variation in the construction of the canoes belonging to the different islands. Differences are chiefly in the shape given to the ends of

the hull and in minor details of the outrigger. Judged on this basis, Vaitupu, Funafuti, Nukufetau, and Nukulailai belong to one class, the southern, and Nanomea, Nanomanga, Niutao, and Nui to another, the northern. The local distinctions have become much less marked of late years owing to increase in the facilities for interisland communication; this has resulted in considerable borrowing of the northern type by the people of the southern islands. In Vaitupu this is particularly marked, Kennedy stating in his exhaustive description of the Ellice Islands canoes (1929, p. 86) that the introduced northern type occurs today in about equal proportions with the local one. The northern design is, however, not always followed slavishly, the result being to produce canoes in which are found a mingling of the characteristics of the two types (fig. 204); the hull may conform to the northern and the outrigger and superstructure to the southern, or the converse, according to the fancy of the builder.

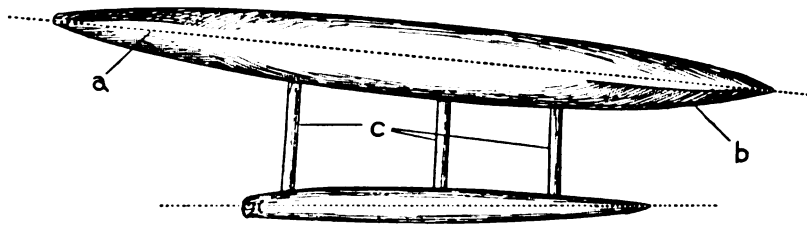


FIGURE 205.—Under view of an Ellice Islands canoe showing asymmetry of end keels (*kalisi*), sides (the outrigger one the more curved), and of spacing between float and canoe (from Kennedy, 1929).

The hulls of these canoes approximate closely to those characteristic of the Tokelau Islands, having a dugout underbody heightened by a single washstrake (*oa*) and two hewn-out covering end pieces forming short terminal deckings (*puke*). The bottom is rounded for most of its length, swelling on the bilges, which typically are slightly but definitely asymmetric, with a distinct tumble-home above, so that the breadth between the washstrakes is less than at a lower level between the bilges. In canoes used on the exposed windward side of an island the bottom for some distance at each end—from one fifth to one fourth the total length—is sharply but eccentrically keeled; the forward keel is the longer and lies to the port or outrigger side of the median line, and the after keel is upon the starboard side. When built for fishing on the quiet leeward side, the hull is without these keels. Other points of asymmetry consist in the outrigger side of the hull's having a slightly greater curvature than the other, and in the setting of the forward end of the float a little nearer to the hull than the after end (fig. 205).

In this asymmetry, designed mainly to compensate for the tendency of the outrigger float to steer the canoe to port while moving in a straight line, is evident the influence of Micronesian design, where, indeed, the asymmetry of the hull form is so extreme that the side away from the outrigger is sometimes almost straight, vertically as well as longitudinally, the other being full-bellied.

In longitudinal section or profile, the bottom may be lightly bowed, or may be horizontal for a considerable distance in the middle region. According to a Vaitupu *tufunga*, a definite bowing or curvature is of marked assistance in a seaway when maneuvering canoes with fore and aft keels on different alinements and with asymmetric sides. This statement receives corroboration from the deeply curved keel line of those Micronesian sailing canoes marked by pronounced asymmetry of the sides. If this correlation of shape and function be correct, canoes designed for

use on the weather side of an island may be expected to have a bottom markedly curved longitudinally and paddling canoes for use on the lee side only to be without any pronounced curvature of this character.

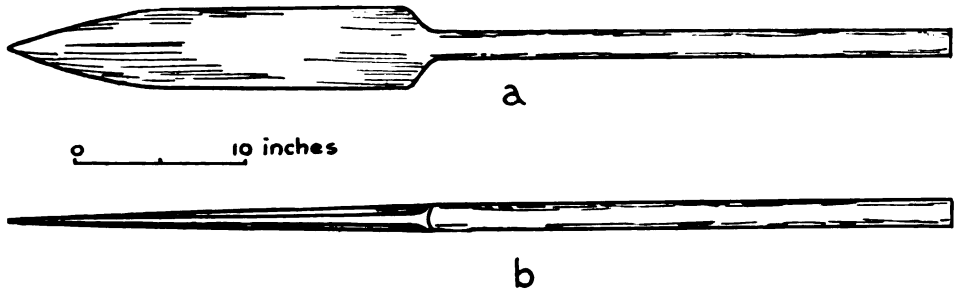


FIGURE 206.—Ordinary Ellice Islands paddle (*foe*), face view and profile (from Kennedy, 1929).

The single outrigger is always upon the port side. The usual number of booms is either three or four, though two and five are occasionally (rarely) met with. The distal region is curved downward to meet and be attached directly to the float in characteristic manner by lashing of sennit passed around short pegs driven into the upper surface; another method, rare at the present day, is to attach the ends of certain of the booms by lashings passed through a hole bored through the upper part of the float.

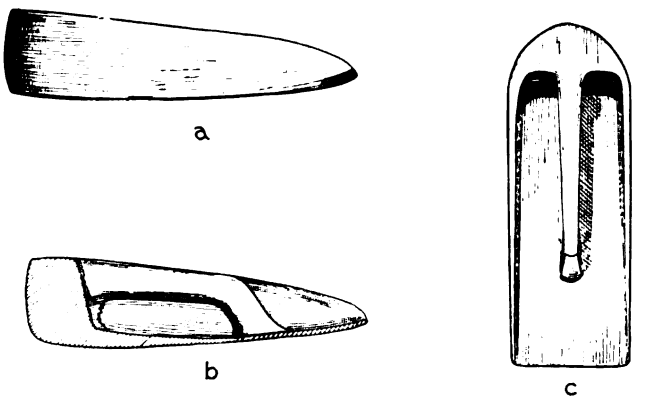


FIGURE 207.—Ellice Islands bailer (*te asu*): *a*, side view; *b*, one side cut away to show fusion of outer end of handle with bottom; *c*, top view (from Kennedy, 1929).

The paddles in use are distinctive (fig. 206). They measure over all from 4.5 to 4.75 feet, the blade somewhat shorter than the loom. The blade has sloped shoulders, parallel sides, and a short, acutely pointed end. The paddle used by the steersman is of the same form but longer and with a broader and longer blade. A typical loom measures 30 inches, with a blade about 27 inches long.

The bailers are of the Oceanic type, with internal or returned handle, but narrower in proportion to the length than usual, and of that variety in which the distal and usually free extremity curves down to fuse with the upper surface of the bottom, which may be either flat or rounded (fig. 207). This unusual form is also met with in Niue and Uvea (Wallis Island).

Southern Type

The southern type as seen in Vaitupu approaches most nearly that of Samoa, running fine aft to a slender, attenuate stern, typically truncate and vertical (fig. 208). The fore end is similar in general form, but the dimensions are slightly greater and the pointed extremity, the stem, is rounded instead of truncate; the cutwater may be either vertical or with a few inches of overhang. (See fig. 209, *a*).

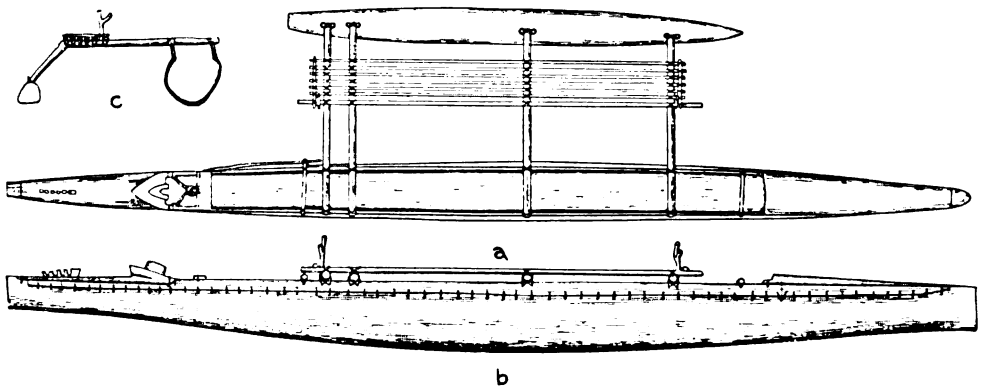


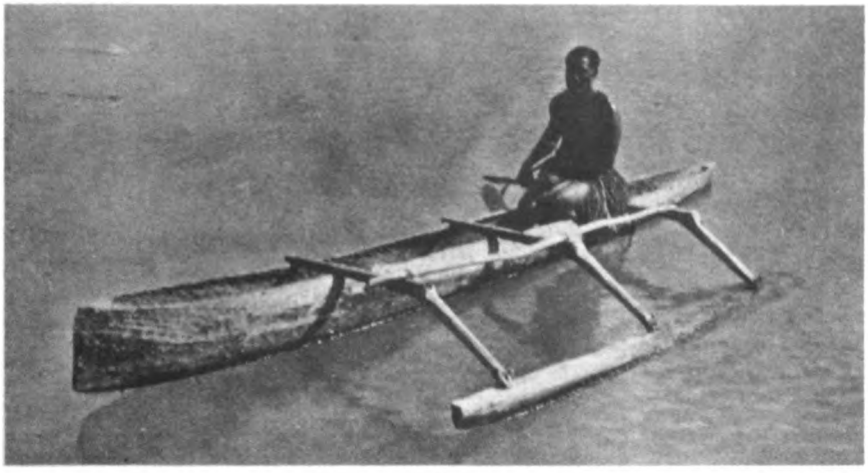
Figure 208.—Southern type of Ellice Islands canoe characteristic of Vaitupu: *a*, plan; *b*, side view; *c*, cross section showing asymmetry of sides of underbody and side view of outrigger frame (from Kennedy, 1929).

The canoe exhibits no sheer on the gunwale line, which is formed by the horizontal upper edge of a narrow washstrake (*oa*). This extends the whole length of the dugout save for a few inches at each end, where an angular projection extends upward from the dugout underbody to serve as a stop against which to butt the outer end of each end cover (*puke*). Each *oa* is sewn to the upper edge of the dugout in the same manner as in the Tokelaus by separate or self-contained lashings of sennit, passed several times through pairs of holes, spaced a short thumb to index span apart. The sennit is not carried along continuously between the paired holes as is usual in the Tuamotus except occasionally in the mending of cracks. Nor is there any attempt to employ the Samoan system of concealed sewing. The lashing holes are subsequently plugged with wooden pegs (*pono*) which hold the sennit securely and prevent leakage. The height of the *oa* is determined approximately by the height that will be reached by the paddlers' knees when sitting in the canoe. While the *oa* is being lashed on, it is held in position by an ingenious clamping implement (*fakafiti*) (fig. 209, *c*). This consists of a length of cord threaded through two lashing holes in the side of the canoe and then formed into a loop by tying the ends together. The inner and outer bights of the loop are drawn up and clamped over the top of the *oa* by means of two sticks, each of which holds the other from slipping out of place (fig. 210).

An end piece in the form of a long flattened covering board (*puke*), from 4 to 5 feet long, is fitted at each extremity and constitutes another point of resemblance with the Tokelau type. A low breakwater or wave guard (*pale ngalu*) at the after end of the forward decking (*puke mua*) is usually present, shaped into a forwardly projecting semicircular or semi-elliptical lip; this, though now a very common feature in the southern islands, is believed to be one borrowed from the north, the true Vaitupu type of *puke mua* finishing abruptly and without any projection at the after end. Recent tradition affirms that Nukulailai adopted this idea from the canoes of some Niutao people who lived there for a considerable time. From Nukulailai it spread to Vaitupu, and it is now found generally throughout the southern islands.

The stern cover or after end piece (*puke tua*), also nearly horizontal, has also a liplike transverse projection, arched in plan, the equivalent of the wave guard of the bow cover, but here used as a receptacle for prepared bait when line fishing. In the center of this on the fore side rises, as in the Samoan bonito canoe, a higher but smaller projection of the same form, grooved on the fore side to serve as the rod rest (*tokoulu*) in bonito fishing. Some little distance forward of this is the only permanent thwart in this southern model, the captain's seat, attached at each side by a single lashing. To the after edge of this thwart is fastened the *mata*

a



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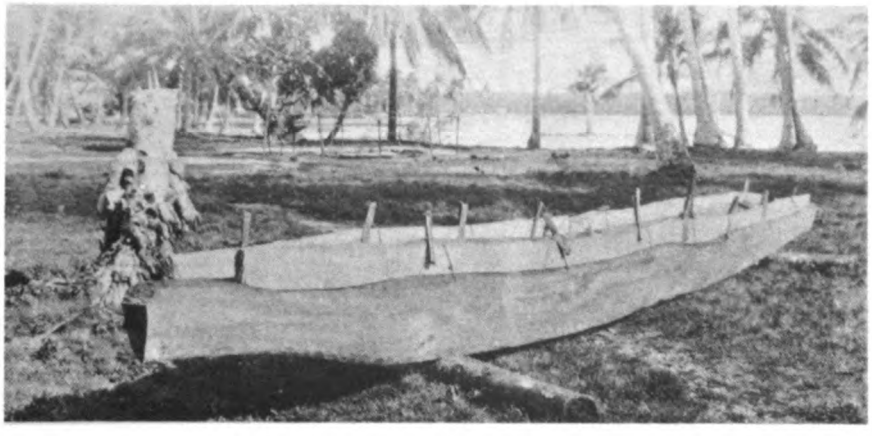


c

FIGURE 209.—Southern type of canoe, Ellice Islands, as seen in Vaitupu: *a*, fishing *vaka*, sharp deep stem, slightly curved, attenuate stern, sewn-on washstrakes, slightly arched end covers, and the elbowed booms, usually four directly connected with the float, are characteristic, as are also the bluntly pointed ends of float; *b*, lagoon canoe (*paopao*), rudely fashioned dugout hull without any of the fittings seen in the *vaka*, but outrigger frame similar; *c*, method of fitting and clamping washstrakes (*oa*) upon edges of underbody preparatory to sewing them in position (photographed by D. G. Kennedy).

pili, a stout sennit grommet, held in position by two pairs of guide cords attached to the sides of the hull close to the fore side of the stern cover. The butt of the bonito rod rests in the grommet, the shaft lying in the groove cut obliquely in the rod rest behind, an arrangement exactly as seen in Samoan bonito canoes.

Down the center of the stern cover in the better-built canoes is a median row of bluntly pointed knobs, homologues of the Samoan cowry pedestals, but here modified in form and become a mere traditional ornament (fig. 208). Hedley (1897, p. 286) remarks that these are "the only ornamental wood carving now executed by the Ellice Islanders". They are not found in canoes of the northern type.

Each *puke* is attached laterally to the ends of the two *oa* by tying strings for the sake of easy removal when the canoe is brought ashore to be dried out, a point of contrast with the northern system of sewing it permanently to the dugout underbody through paired holes at short intervals along the whole length of each side.

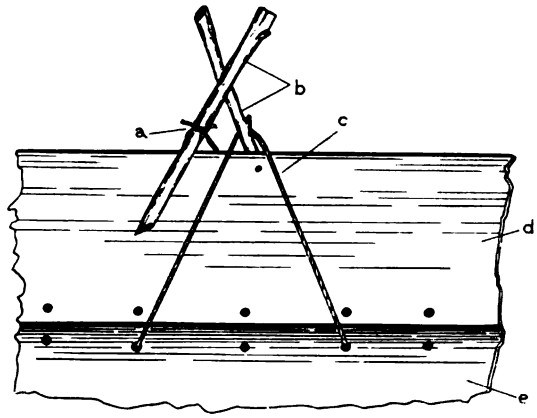


FIGURE 210.—Use of a peculiar clamp (*fakafiti*) in the Ellice Islands to hold washstrake (*oa*) in position while sewing it to underbody, cord generally quadrupled though for sake of clarity only one strand shown: *a*, inner end of clamp loop showing knot; *b*, clamp sticks; c, outer end of clamp loop; *d*, washstrake; *e*, side of canoe (from Kennedy, 1929).

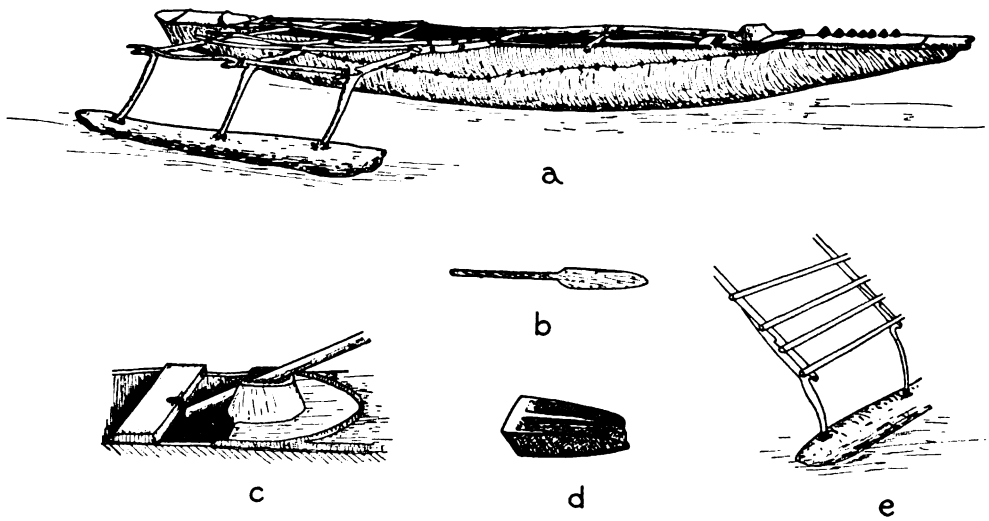


FIGURE 211.—Funafuti canoe differing from the Vaitupu form of southern type chiefly in the horizontal bifid shape of the stern, representing the tail of a sea-bird (*tala*), and the ornamentation of the after end cover: *a*, canoe; *b*, paddle; *c*, seat of the captain (*tautai*) with bonito rod in its rests; *d*, bailer; *e*, form of outrigger in which each end boom has a divisible "leg", attached by a lock joint (after Hedley, 1897).

In a few canoes the form of the stern departs from that described as typical. Some, as figured by Hedley (1897, pl. 15, fig. 1), have a horizontal bifid lip projecting beyond the vertical stern; this is found in Funafuti (fig. 211). In others, found throughout the southern islands, again including Funafuti, the stern itself may be deeply notched and so become vertically bifid (fig. 212). The hori-

FIGURE 212.—Outrigger canoe of Funafuti (photographed in 1901, United States National Museum).

zontal form, according to old masterbuilders (*tufunga*), is meant to represent the tail of a bird (*tala*, a small sea bird), whereas the vertical bifid stern represents the gaping mouth of the kingfish (*pala*). This vertical bifid form (fig. 213) is distinct from the bifid stern characterizing the northern islands, which is made differently and represents the tail of a fish—either the *pala* or the bonito (Kennedy, personal communication). A medial line of pyramidal knobs on the after end cover is typical of Funafuti (figs. 211, 213); the knobs are similar to those on Samoan canoes and have not suffered modification in shape as have those of Vaitupu.

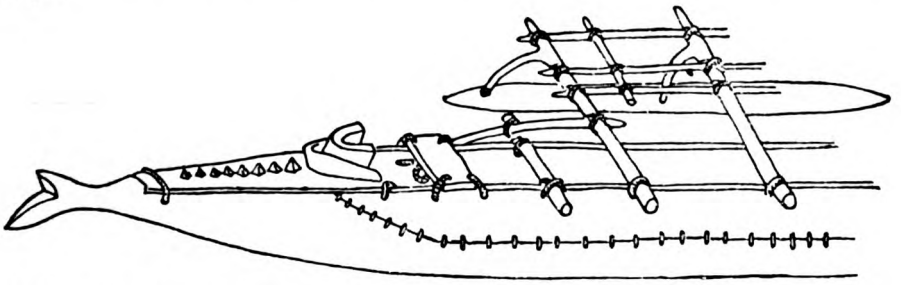


FIGURE 213.—Funafuti canoe in which the bifid stern represents the mouth of the king-fish (*pāla*) (after Alexander, 1902).

In the majority of sea-going canoes three booms project from the port side, though four are common; they are set closer together—3 or 4 feet apart—than is usual in Samoa. Their butts lie athwart the gunwales, into which, in a few, they are partially sunk in order to correct any unevenness, and to which each is lashed in one of two alternative methods by sennit passed either through a single hole, the more common, or through a pair, bored in the gunwale (fig. 214). The latter is termed the *manga-lua* (forked) method. In these southern islands the booms are cut from a straight bough which throws off a branch at an angle of about 40 degrees, such forked timber being abundantly provided by the *pua* (*Guettarda spe-*

ciosa) and the *tausunu* (*Tournefortia argentea*). Hedley (1897, p. 286) states that the angled booms of Funafuti canoes are cut from such branches as are supplied by *Rhizophora* (a mangrove), but Kennedy (personal communication) considers that Hedley is probably mistaken; he says, "The mangrove (*tongo*) is certainly not used in the southern islands since it does not branch at a suitable angle. Further, it is held to be too brittle".

The main branch is cut off a few inches beyond the fork, and the side branch is left about 18 inches long, generally the appropriate length at which to attach it to the float (fig. 215). On either side of its end, fore and aft, where it butts against the float, a stout peg 4 or 5 inches long is driven a couple of inches or so into the light wood of the float. With the end of the boom resting between the pegs, the three are securely lashed together by three-ply sennit (fig. 214). One or three pegs are sometimes used.

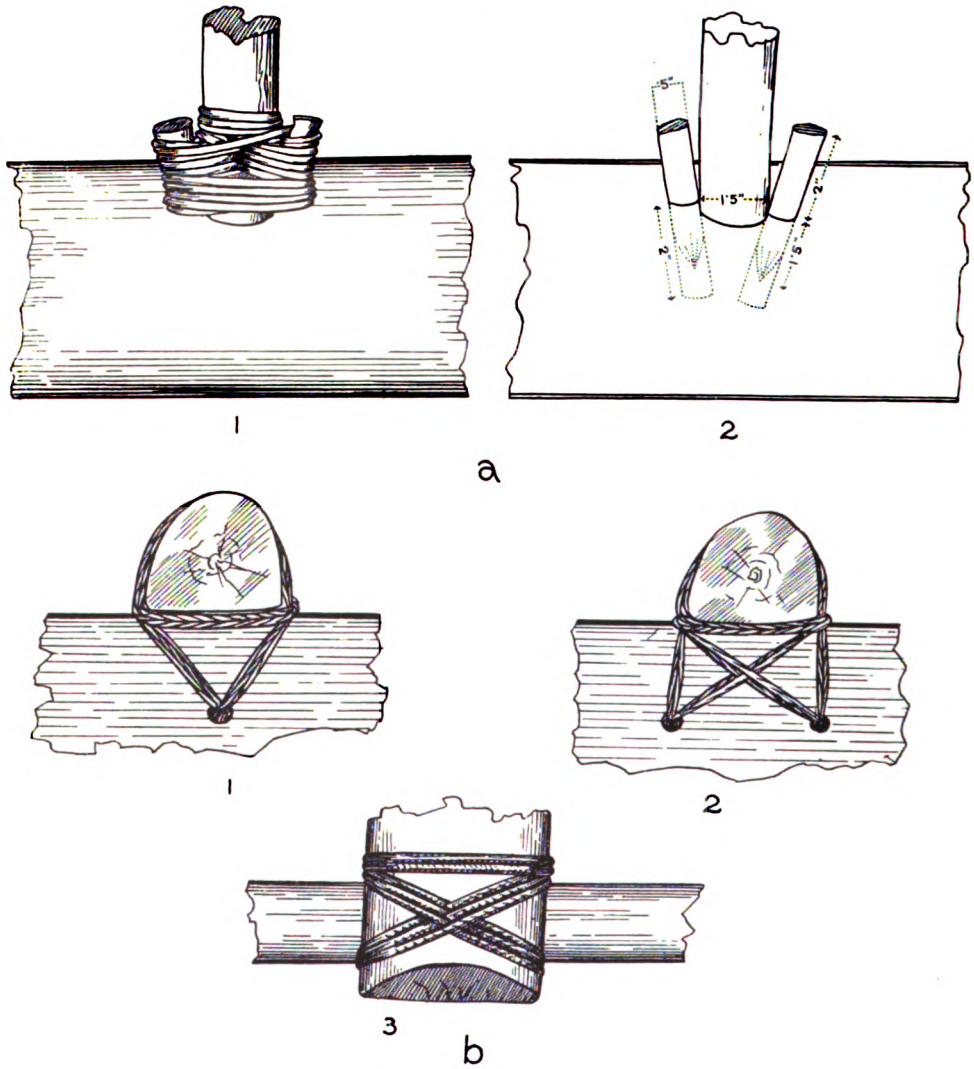


FIGURE 214.—Boom lashings, Vaitupu. *a*, method of securing end of boom leg to float: 1, lashing in position; 2, lashing removed. *b*, lashing of boom to gunwale; 1, ordinary method; 2, *manga-lua* method; 3, top view, finishing turns parallel on inboard side. (From Kennedy, 1929).

An alternative method, not so common, but probably older than the peg method, is to bore a hole through the float horizontally and pass a lashing several times through this and around the tip of the outrigger boom (fig. 216). In four-boom canoes it is not unusual for the outer one at each end of the float to be thus secured, the two inner ones being attached to pegs. A rare variation is the employment of a forked attachment (fig. 215, *b*).

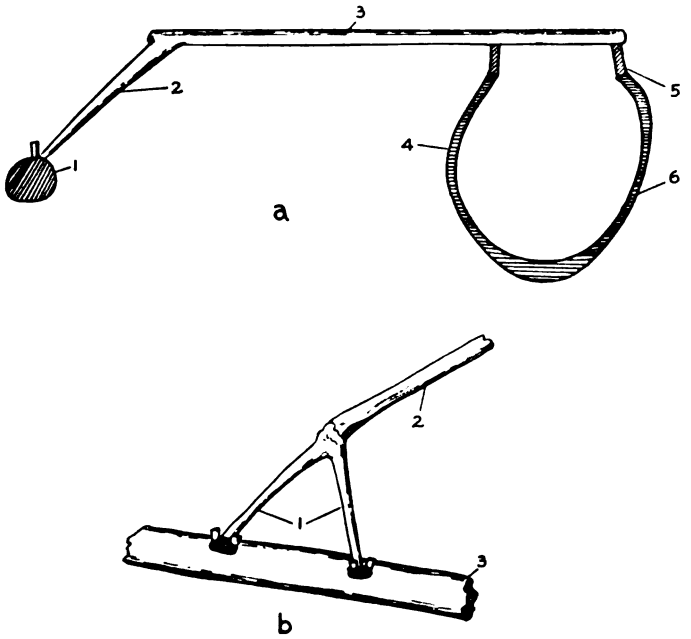


FIGURE 215.—Outrigger attachment, Vaitupu canoe. *a*, cross section of canoe amidships: 1, float; 2, boom leg (*tapuvae*); 3, boom; 4, port *inaki*; 5, washstrake (*oa*); 6, starboard *inaki*. *b*, forked attachment (*kiato manga-lua*) sometimes used: 1, *tapuvae*; 2, boom (*kiato*); 3, float. (From Kennedy, 1929.)

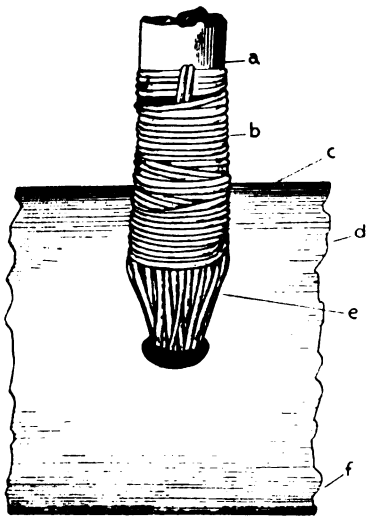


FIGURE 216.—Method of outrigger attachment found in some Vaitupu canoes, lashings passed through V-shaped hole in float: *a*, boom leg; *b*, seizing turns; *c*, starboard side; *d*, top of float; *e*, lashing turns; *f*, port side (from Kennedy, 1929).

According to Hedley (1897, p. 286) the outrigger booms are occasionally compound, each made of two sections, a straight shaft and a curved terminal (*tapuvae*), spliced together by a lock joint and served (fig. 211, *e*). This has the advantage of permitting the float to be quickly removed when the canoe is beached.

The float varies considerably in form. Commonly it is straight, but in some canoes it is curved up slightly toward the ends. Both ends may be pointed, but usually the after end is truncate. In length it is rather short, approximating about half the length of the hull. In section it is usually rounded above, flattened below. An interesting detail of construction is given by Kennedy (1929, p. 79):

> When the float has been trimmed roughly to shape it is set in position on the port side parallel with the body and distant from it about three quarters of a fathom. The forward end is then set in toward the body a short distance that varies with different makers from a few fingers' breadth to a span. Thus in its final position the lateral space between the keel and the outrigger at its after end exceeds its distance from the keel at the forward end. This is a most important point in the construction, as it determines the ease with which the canoe may be turned to starboard when at sea. . . . I have personally experienced that a canoe with parallel outrigger float is extraordinarily difficult to steer to starboard, although it is quite as easy to steer to port as one with a properly set float. The parallel float, theoretically, offers less resistance to forward motion, but one of the chief requirements in a fishing canoe is ease in handling, especially when one of the almost daily uses to which it is put is the hunting of flying fish at sunset in a precarious position within a few feet of the edge of the reef.

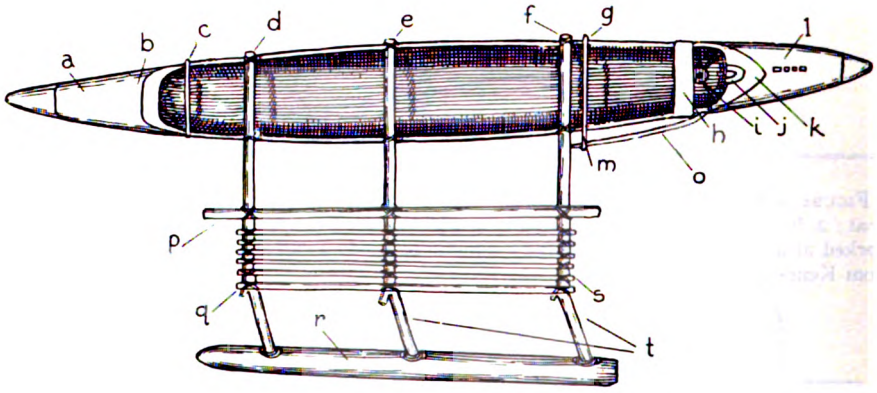


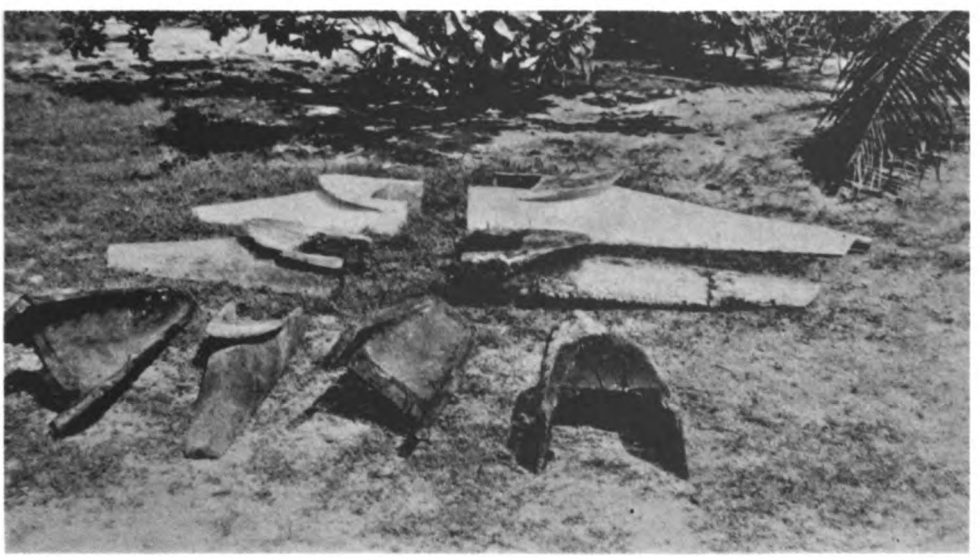
FIGURE 217.—Key plan of a small Vaitupu canoe: *a, puke mua; b, palegalu; c, manu mua; d, kiato mua; e, kiato loto; f, kiato muli; g, manu tua; h, nofonga-o-tautai; i, matapili; j, tokoulu; k, tukugane; l, puke tua; m, teli; o, saunga; p. saunga; q, taotaoama; r, ama; s, kaupalepale; t, tapuvae* (from Kennedy, 1929).

Upon the horizontal outboard section of the booms, an open platform (*kaupale-pale*) of thin rods, laid parallel fore and aft, is lashed to form a shelf on which to place fishing gear. The innermost rod or pole, spaced 14 to 21 inches from the gunwale, is stouter and a little longer than the others and forms a lifting grip (*saunga*) when the canoe is being carried to or from the sea. A second and lighter *saunga* for the hand of the man carrying the after end of the canoe extends obliquely outward and forward from the port side of the captain's thwart to meet one end, projecting a couple of inches, of a transverse rod (*manu*) lashed athwart the hull just behind the last boom (fig. 217, *o*). A short forked branch or crutch, about 1 foot high, is fixed upright at each end of the platform *saunga* to receive bonito rods and long-handled fishing nets. A second *manu* is fitted a little way abaft the inner end of the fore end cover.

Dimensions of the southern type of canoe (Kennedy, 1929, p. 89) are:

Length, 20 to 30 feet; beam at gunwale (within), 13 to 14.75 inches; beam at bilges (within), 14 to 20 inches; depth at center (within), 15 to 20.25 inches; length of float, 9 to 16 feet; distance of float from gunwale, about 4 feet. The fore end of the boom is set about 3 inches nearer the hull than the after end.

a



b

FIGURE 218.—Nanomea fishing canoe, northern Ellice Islands type: *a*, view from fore end showing tapered form, curved booms, wide outrigger platform, forked fishing-rod rests, and lipped fore end of tapered bow cover; *b*, bow covers on right, stern covers on left (photographs by D. G. Kennedy).

Special canoe sheds are not now built on these islands; instead, the canoes when ashore are merely covered with mats or coconut leaves. Before doing this, the end-decking planks are untied and removed and the interior thoroughly dried out.

Northern Type

In the northern islands, typically in Nanomea, the completed canoe (fig. 218) is torpedo-shaped, each end tapered to an elongated, bluntly conical shape, resembling closely the general form of the canoes of Niue.

As in the Niue canoe, the open dugout which forms the underbody has several feet at each end covered by a whaleback decking. The waist between is raised by a vertical washstrake sewed on, which ends abruptly at its junction with the inner end of each of the deckings; under these it does not extend as in the southern type. The upper edge of the washstrake is horizontal and without sheer. In transverse section the decked-in ends are almost circular. The deeply curved sides of the end covers are here lashed down permanently to the underbody in similar fashion to the washstrake and not temporarily tied on as in southern canoes (fig. 219).

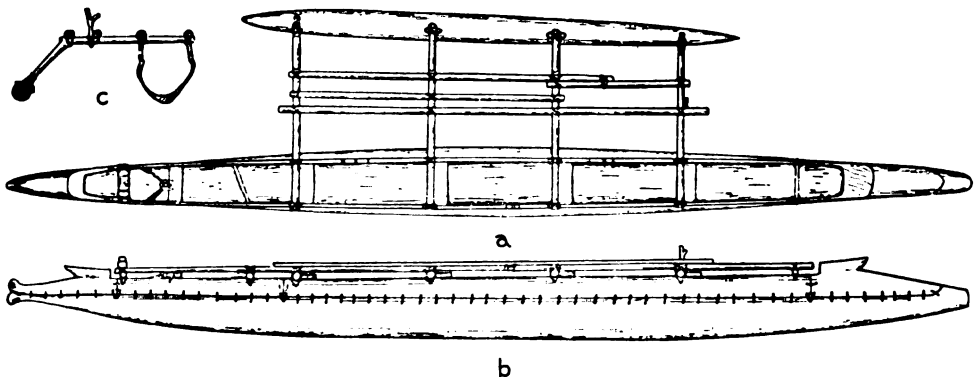


Figure 219.—Northern type of Ellice Islands canoe as built in Nanomea: *a*, plan; *b*, side view; *c*, cross section (from Kennedy, 1929).

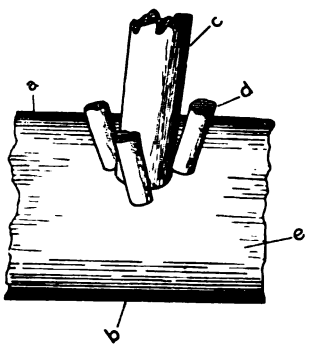


Figure 220.—Three-peg attachment characteristic of the outrigger canoes of the northern Ellice Islands, lashings removed: *a*, starboard side; *b*, port side; *c*, boom leg; *d*, peg; *e*, float (from Kennedy, 1929).

The forward whaleback decking has a strongly curved transverse breakwater as already described. The after one has one curved backward, similar in shape to that on the forward decking; it is, however, without either the bonito-rod rest or the median row of knobs present in the southern type. In well-made canoes the end of the stern is carved into a vertical bifid form representing the homocercal lobes of a fish's tail, either of the *pala* or of the bonito; the deck cover generally contributes the upper lobe, or, rarely the whole may be shaped out of the after extremity of the dugout underbody. The narrow "neck" preceding the forking of deck cover and underbody may be served with several turns of sennit.

The outrigger consists of three, or more typically four, booms attached directly to the float. Unlike those of the southern islands the branches from which they are cut are continuous, without fork or side branch, and chosen from those with a natural bend of the requisite curvature at one end. The distal extremity of each is butted against the upper side of the float

and lashed to three short pegs driven into the float—one on each side and the third in front, thus forming a triangle (fig. 220).

The float is short, thick, and cylindrical and is pointed at both ends. Its length is usually slightly less than half that of the hull. The fore end is level with the fore end of the waist and ends two thirds along it.

Over the horizontal portion of the booms an outboard platform, made of light poles, is laid longitudinally and lashed thereto. In the southern canoes this platform lies well away from the port gunwale; in the northern, it lies close in upon the inner side of the stout lifting grip (*saunga*), whereas in the southern it lies outside it. A slight rail (*kaufuatanga*) is added along each gunwale line above the booms to which it is lashed. It extends the whole length of each washstrake. Four or five plank thwarts and a couple of transverse bracing rods are present, the thwarts laid upon the edges of the dugout and covered by the rails.

The bonito-rod rest in these canoes is carved out of the forward edge of a special thwart placed midway between the fore end of the after decking and the captain's thwart. The grommet for the butt of the rod is hung from the after side of the captain's thwart, and supported as in the southern type.

The general dimensions are about the same as have been given for the southern canoes.

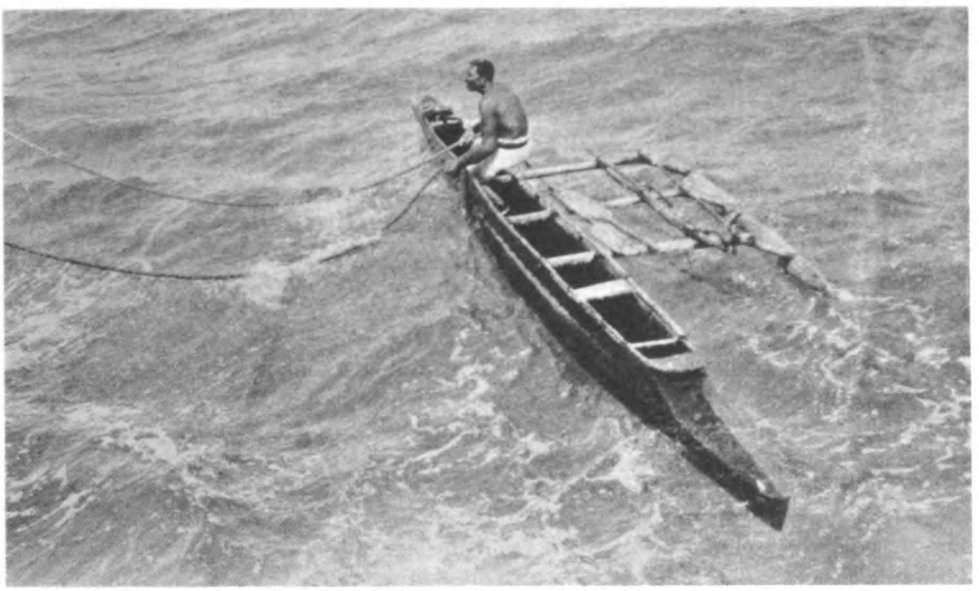


FIGURE 221.—Outrigger canoe of Nui Island, intermediate between northern and southern Ellice Islands type (photograph by Dr. P. A. Buxton).

NUI ISLAND

Although Nui has been settled from the Gilbert Islands, the canoes in use are not unlike those of the other northern Ellice Islands. They are generally more roughly constructed and in some the fore end is short and blunt without the elongated fore decking of the true Ellice Islands type. As in the Nanomea canoes, a gunwale rod over the inboard ends of the booms is a Gilbertese feature not present in the southern type. (See fig. 221.)

PAOPAO

For use within the lagoons, small canoes, 14 to 18 feet long with an extreme width of 12 to 14 inches, are employed. They consist merely of a roughly hewn dugout hull having a sharp, vertical cutwater, and a stern running fine to a point. They are provided with a three-boom outrigger of whatever pattern is favored in

each particular island. They are without end-deckings or any of the elaborate fittings seen in sea-going canoes. (See fig. 209, *b*.)

Summary

The construction of the Ellice Islands paddling canoes, though in general agreement with that of Samoan canoes, is quite different in the form of the outrigger from anything found in Upolu and Savaii, where the attachment is indirect by means of stanchions and cord braces. Krämer (1903, vol. 2, p. 415), however, found an elbowed direct attachment to be characteristic of some of the smaller canoes of the island of Tutuila; in its form, a straight shaft giving off a downwardly directed branch at an angle of about 140 degrees, its identity with the elbowed booms of Vaitupu and Funafuti cannot be denied. The boom form in the northern Ellice Islands is less closely related, being a continuous rod curved downward in its distal section, a feature which suggests affinity or rather close culture contact with the Gilbert Islands.

Although the Tutuilan type of attachment appears to have been the direct progenitor of that of the paddling canoes of the Ellice Islands, it need not be inferred that the islands were originally peopled from Tutuila. It is more probable that the present Tutuilan type was the original or primitive form of attachment common at one remote period to the smaller canoes of all the Samoan islands, and that the Ellice Islands were settled therefrom before the date when a Melanesian type of attachment was generally adopted in Savaii and Upolu for small canoes as well as large. Whether the Melanesian type was already in use for built-up sailing canoes at the time of the Polynesian settlement of the Ellice Islands can not now be determined.

SAILING CANOES

The sea-going canoes of the present day are all dugout paddling canoes of the type already described; they are used mainly in the bonito fishery and in consequence are termed *vaka-alo,* the verb *alo* meaning, as in Samoa, "to hunt for bonito" or, simply, "to paddle".

In former times large sailing outrigger canoes existed, but little is known about them except a few scraps of information communicated to me in a letter by Mr. D. G. Kennedy, who gathered them from the lips of several old *tufunga* in Vaitupu; these men, the hereditary master canoe-builders of the islands, remembered seeing some of the old craft (*amatasi*) in the days of their extreme youth.

The *amatasi* had plank-built sides, 2 to 3 inches in thickness, raised upon a dugout base. The planks were secured together after the Samoan manner of concealed sewing still followed there in constructing the beautifully built *va'a alo* canoes used in the bonito fishery; in the Ellice Islands this was known as the *fou-take* lashing. In the hewing out of the planks a projecting rim or ledge was left along the edges on the inner side wherever attachment had to be made to another plank. Each seam was in this way margined on the inner side by opposed narrow ridges. Through these, paired diagonal holes, one through the upper and the other through the lower, were drilled at suitable intervals. The opposed holes were made so that they slanted inward in such a way as to meet within the seam.

The method of passing the binding lashing through these holes was described by a Vaitupu *tufunga* as follows: a loop of fine sennit was thrust to the inner extremity of the lower hole; then the threading end of the lashing braid was forced down through the upper hole by means of a thrust needle (*tua-niu*, the midrib of a coconut pinnule), so that it entered the loop pushed in from below by which it was drawn out through the lower hole; this was repeated until six turns of cord had been passed through. Considering that the hole in each plank would be at most 1.5 inches long, it is curious that so elaborate a method of threading the hole was necessary. The reason given for having the lashings on the interior is that it prevented their being frayed or cut by a certain large fish (*te ika sele vaka*), which in the course of a long voyage was accustomed to appear at times and rub its body along the sides of the canoe! Such a fanciful

explanation ignores the obvious advantage resulting from a great reduction in the points at which leakage may occur.

The outrigger of the *amatasi* is said to have had three straight booms, each connected with the float by a pair of long stanchions on each side of which the units diverged upward to be lashed by their upper ends to the distal end of the boom. A longitudinal stringer was lashed over the booms on the inner side of the attachment of the inner stanchions. Whether or not the Samoan cord brace was employed is not remembered.

The sail was similar to that of Samoa and Tonga, triangular with the long sides laced respectively to a yard and a boom of about equal length. It was set apex downward and slung from a rather short mast stepped on a thwart close to the foremost boom.

Terms pertaining to the *amatasi* which have been preserved are *te fana* (the mast), *tila tu* (the yard), and *te kau lalo* (the boom). The words *suati* and *fakalupe* are also remembered, but no one now living knows what they signify. As *suati* or *soati* in Samoa stands for the balance board fitted outboard on the side opposite the outrigger for use when sailing with the outrigger to leeward, the same appliance was doubtless in use in the Ellice Islands *amatasi*.

According to the old *tufunga* who supplied these particulars, this craft was sometimes made of very large dimensions and capable of carrying 100 people.

In Samoa the term *amatasi* has been applied to two models described by Thilenius and Krämer which Krämer considers to be merely toy boats. He is probably correct, but there seems no doubt that it is, in reality, the obsolete appellation of the ancient type of Samoan voyaging outrigger canoe and that the term and type were common to Samoa and the Ellice Islands, as are also the terms for mast, yard, boom, and balance spar.

Kennedy (1929, fig. 71) figures an outrigger canoe seen at Vaitupu a few years ago which had an entirely different type of outrigger from that described above; on inquiry he found that it had been introduced by a Tokelau immigrant and that it was actually known locally as a *faka-tokelau*. It had four booms, to each of which the float was connected directly by a single pair of divergent stanchions; in addition, between each two booms there was intercalated a pair of similar divergent stanchions of which the upper ends were lashed respectively to the inner and the outer of two longitudinally placed stringers lashed athwart the booms. The outer stringer was attached to the distal ends of the booms, the inner one to the booms at those points where were attached the inner stanchions of the directly connected pairs.

DOUBLE CANOES

Double canoes existed in the Ellice Islands formerly, but few particulars survive. At Vaitupu, according to Kennedy (1929, p. 71, and personal communication), only the names—*foulua* and *lualua*—remain, plus the belief of an old *tufunga* that the hulls were put together by the concealed lashing method termed *fou-take* and that their rig was similar to that of the *amatasi*.

At Funafuti, Hedley (1897, p. 282) at the end of last century learned nothing except that at one time the islanders "possessed large ocean-going vessels (*fouroua*) in which cruises were made to Nui and Vaitupu". These existed until 1867, at the latest.

AFFINITIES

The outrigger design of the Ellice Islands confirms the traditional account of the settlement of the islands from Samoa; it also suggests that the ancient form of Samoan outrigger attachment was direct, although this is found at the present time only in Tutuila.

Another link with Samoa is the fact that *amatasi* was common to the Ellice Islands and to Samoa as the term for a large or deep-sea sailing outrigger canoe.

So far as I know, the use of this term is local and peculiar to these two island groups. In Tonga its equivalent is *hamatafua* and *vaka*.

Parallel with this evidence of Samoan relationship is distinct linkage with Micronesia, demonstrated by the asymmetry which characterizes the form of the hull even in the small canoes of the present time, a feature unknown elsewhere in Polynesia. As the Ellice Islanders traded formerly with the Micronesians (Hedley, 1897, p. 282) and as Nui is actually settled by a Gilbertese stock (Kennedy, 1929, p. 71), the opportunities afforded by this contact enabled the Ellice Islanders to learn and appreciate the advantages derived from the Micronesian method of hull construction, with the result that they adopted it, though possibly modified in degree. Seeing how ready the Polynesians generally have been to modify or change their canoe design when a better one came under their notice, it is strange that this particular design, the asymmetry of the sides of the hull, never appears to have spread into Polynesia beyond the Ellice Islands.

FIJI

INDIGENOUS TYPES

Except for that Fijian masterpiece, the double canoe (*ndrua* or *wangga tambu*), all the other indigenous types of canoe continue in use to the present day; even the details of the obsolete *ndrua* can still be studied first hand, for a fine example, built in 1913, is carefully preserved in Suva. The descriptions which follow are in consequence of this derived mainly from examination of actual canoes existing in Fiji in 1925; valuable assistance was rendered by Ratu Popi E. Seniloli, head of the Royal House of Mbau and a keen canoe yachtsman who races his splendid outrigger, the *Loatuithama*, on every possible occasion. The Fijian canoes can thus be described without any of that unfortunate uncertainty and vagueness so often unavoidable when considering the canoes of many other areas.

The possession of fine sailing canoes suitable for long voyages rendered intercommunication between the islands so easy and frequent that there are no local variations of any consequence in the design of the various types; the description of the Mbau and Rewa canoes serves equally well for those of all other localities.

Four types are distingiushable: the *takia* or *velovelo*, the *wangga vakatau*, and the *thamakau*, all fitted with outriggers, and the double canoe, the *ndrua*.

PADDLING CANOES

Takia

The *takia*, sometimes called the *velovelo*, is the simplest type:

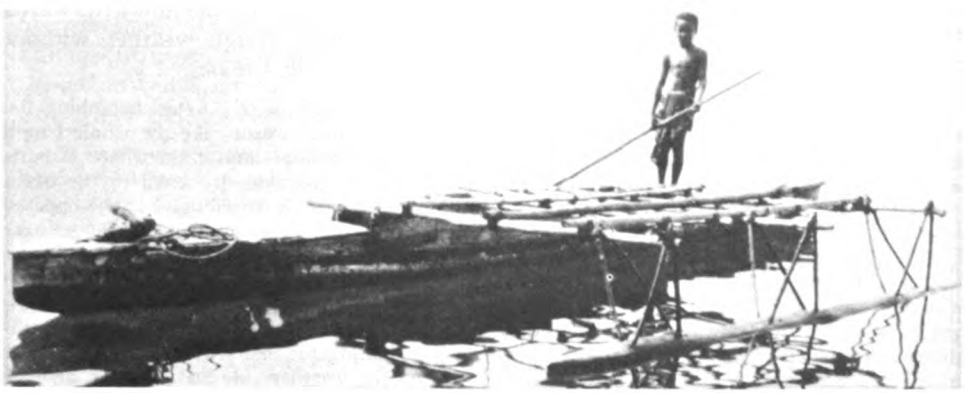
The hull is an open dugout, very roughly hewn out, made from any kind of tree deemed large enough. In general shape it conforms closely to that of the parent tree trunk—the bottom straight, save toward the ends where it curves upward, and the sides rounded in both above and below. The fore end, representing the butt of the tree, curves up gently on the under side and terminates in a wedge-shaped head, whereby the cutwater is deep and vertical in form. The after end, hewn out of the upper and thinner section of the tree trunk, has a long and fine run, tapering to a truncate cylindrical extremity 3 or 4 inches in diameter. The gunwales are nearly horizontal, and here, because of the rounding in of the sides, the beam is less than at mid height. At the head end a short length may be covered in with boards tied upon the gunwales. (See fig. 222, *a*.)

The outrigger is formed typically of three booms (*kaso tu*), straight poles equal in length and lashed at the inner ends upon the edges of the dugout, each distally attached to the float (*thama*) by two pairs of convergent, adpressed stanchions (*vatoto*). The outrigger frame is further strengthened by four longitudinal stringers and by two accessory booms, one of which is intercalated on each side of the median boom midway between it and the outer one.

The stringers are disposed about equal distances apart; one is lashed outboard across the inner ends of the booms close to the gunwale on the off side and another similarly on the

outrigger side, the third midway toward the float, and the last a little inside the stanchion attachments. The accessory booms reach outboard only as far as the outermost stringer, to which they are lashed. All points where the stringers cross both sets of booms are strongly secured by lashings.

a



b

FIGURE 222.—Fishing canoes, Mbau, Fiji: *a*, paddling dugout without washstrakes and end pieces, both ends tapered; *b*, larger type made out of hull of old sailing canoe (*thamakau*), washstrakes and end covers present, fore end sharp and vertical, rounding below into keel line, anchor stone shown on fore decking (photographed in 1925).

The stanchions connecting the float with the booms are arranged in two pairs to each boom, an outer and an inner. Each pair consists of a fore stanchion and an after one. The pointed lower ends of the stanchions of each pair are driven obliquely into the light wood of the float 18 to 22 inches apart; the forward one is placed 8 to 10 inches to the fore side of the boom, the after one at the same distance abaft it. The fore and the after stanchions respectively of the two pairs are inserted abreast into the float, a couple of inches or so apart. The two stanchions of the inner pair converge obliquely upward and inward, those of the outer pair upward and outward, eventually meeting the boom to which their upper ends are lashed; the head of each stanchion seldom projects sufficiently to cross the head of its opposite number. (See fig. 223.)

The float is straight and bluntly pointed at each end, rounded in section with the curve of the upper arc less pronounced than that of the lower. The ends project to no great length beyond the attachments of the outer booms.

These canoes are mostly made by the hill people inhabiting the river valleys who employ both adzes and fire in the hollowing-out process. As coconut palms do not grow in the inland forests, the canoe builders use vines (*midri*) in place of sennit for all lashings, and the wooden bailers of the coast people are replaced by scoops made from a bamboo joint laid open.

The *takia* may take its name from being hewn (*ta*) with adzes called *kia* in the hill country, according to Ratu Deve Tonganivelu.

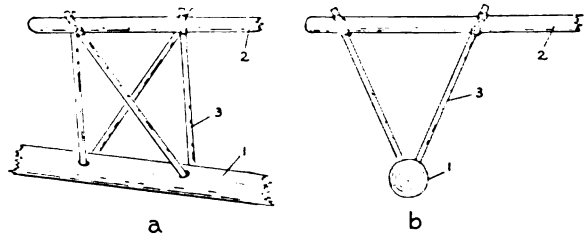


FIGURE 223.—Fijian type of outrigger attachment: *a*, seen obliquely; *b*, view at right angles to axis of float; 1, float; 2, boom; 3, stanchion connectives, two omitted in *b*.

WANGGA VAKATAU

The *wangga vakatau* is the ordinary canoe of the fishing community. Very often it originates as a river *takia* obtained by barter from the hill people and afterwards built up by the village carpenters to fit it to encounter rough weather without immediate swamping as would be the fate of the open-hulled *takia*.

The *takia* dugout becomes, in the *wangga vakatau*, the underbody. After smoothing the surfaces roughly worked by the hillmen, the carpenters fit a deep washstrake the whole length of the dugout upon each side except for a few inches at the head and stern, where it butts against a low vertical projection of the solid ends. The washstrakes are sewn to the edges of the dugout in the ordinary way by means of sennit passed through paired holes in the opposed edges; a protecting batten covers the seam on the exterior, the sennit braid being passed over it at each stitch.

A fairly long covering board (*tau*) of triangular shape is fitted as a decking over each end of this built-up hull, the edges sewn to the washstrake on each side. After this an outrigger is attached, identical in construction with that of the *takia*, but with stout sennit lashings substituted for vines. It is fitted on the port side, taking the end with the deep cutwater as the head; in sailing, the outrigger is always kept on the weather side and so often appears to be fitted on the starboard side.

These canoes when small are generally propelled by paddles and poling quants. The larger ones that venture beyond the protection of the reef are also rigged for sailing, carrying a mast and *vakasave* sail after the manner of the *thamakau*. According to Tonganivalu (1915, p. 9), the smaller ones manned by two men were rigged with a simpler and lighter sail (*ndumu*), described as one that "is lifted and pushed up spread out by the mast". This appears to have been a primitive spritsail of the kind used in former days by the Maori of New Zealand—a triangular sail with the long sides tied to two poles and set apex down in such fashion that one of the poles served as the mast (*i ndumu*), whereas the other acted as a sprit extending the wide upper side of the sail, the inverted base of the triangle. The *vakasave* rig, being much heavier than this, required a larger crew to handle it.

The only variations seen among *takia* and *wangga vakatau* are concerned with the shape of the ends. These, although of minor importance, have specific local

names. A *tambilai* is a canoe in which the dugout is left solid for several feet at each end and with a cutwater deep, vertical, and thick-edged (Williams, 1858, p. 72). According to Tonganivalu (1915), a *vaka ndranimbalawa* has both ends like the nominal head of the typical *thamakau*, but those of the *tovunga* are cylindrical, slender, and truncate, like the stern of the *takia* and the *thamakau*. He also enumerates a variety called *karia* in which the ends "were small like the form of white people's boats".

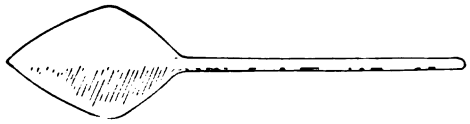


FIGURE 224.—Fijian paddle.

The paddles (*vothe*) are made of *vesi* wood and measure about 5 feet in length. The blade has a similar form to that of Tonga, being short, broad, and ovate; it measures about 8 inches across at the widest part, which is toward the shoulder (fig. 224). Paddles are, however, seldom used, the Fijians preferring to pole their canoes in the shallow water of the lagoon and to sail them when outside the reef.

SAILING CANOE

CONSTRUCTION

The Fijian *thamakau*, the great outrigger canoe used for traveling about among the islands and particularly for paying visits to friendly chiefs, shares with the Micronesian "flying proa" the distinction of being one of the two finest types of sailing outrigger canoe ever designed. Wilkes (1845, vol. 3, p. 57), describing a *thamakau* belonging to Tanoa, the Mbauan chieftain and father of King Thakombau, which he encountered in 1840, says:

> It had a magnificent appearance with its immense sail of white mats; the pennants streaming from its yard denoted it at once as belonging to some great chief. It was a fit accompaniment to the magnificent scenery around, and advanced rapidly and gracefully along; it was a single canoe, 100 feet in length, with an outrigger of large size, ornamented with a great number (2,500) of the *Cypraea ovula* shells; its velocity was almost inconceivable, and everyone was struck with the adroitness with which it was managed and landed on the beach.

Forty men were required for the handling of this fine vessel. Wilkes also mentions meeting a Tongan chief who told him that he and his men "were employed building canoes on some of the eastern islands; and that it generally took them seven years from the time they left Tonga to finish them and return". This, however, referred to the time taken to build a double canoe. A *thamakau* took considerably less.

The hull of a *thamakau* of moderate size consists mainly of a dugout basal portion (*wangga*), horizontal along the gunwale, lightly bowed longitudinally along the bottom. One end, the nominal head, ends in a sharp vertical cutwater about 24 inches deep in a hull of ordinary size and from 40 to 45 feet in length; the after end is formed as in a typical *takia* and has been compared with the fore end of a waggon pole.

In the building of canoes of the sizes used at the present time, the dugout underbody (*takele*) is hewn from a single tree trunk, hence the terms *mua levu* (great end) and *mua lailai* (small end) for the head and stern respectively; the butt end (*mua levu*) of the tree, being stronger and stouter than the upper part of the trunk, is in consequence the better adapted to be formed into the fore end of the canoe. Only in *thamakau* of such exceptional size as the 100-foot one seen by Wilkes, now no longer built, was it necessary to utilize two trunks, joined together at mid length to form the underbody. How the joint was made is uncertain; Williams (1858, p. 73) says it was scarfed but gives no details.

As soon as the dugout has been brought to trim and proper shape, a washstrake is added on each side. In the larger *thamakau* this may consist of two planks, a long lower one extending as in the *waangga vakatau* the whole length of the dugout save for the few inches of deadwood at each end. The seam thus made is covered by a narrow batten on the exterior, giving a neat finish to the work. The upper and shorter plank (*mbava*) is a broad, rectangular board sewn upon the edges of the lower one for about half its length midships. In smaller canoes a single plank takes the place of these two, but shaped to the same form, deep in the median section, lower in each of the end ones, which are decked over later by long triangular covers (*tau*) sewn marginally to the washstrakes (fig. 225, *a*, 10). These slope slightly toward the outer end, an effect which may be obtained in two ways: either the *tau* is hewn from a solid block into a miniature whaleback, higher at one end than the other and hollowed underneath, comparable with the end covers of Ellice Islands canoes except that the upper surface

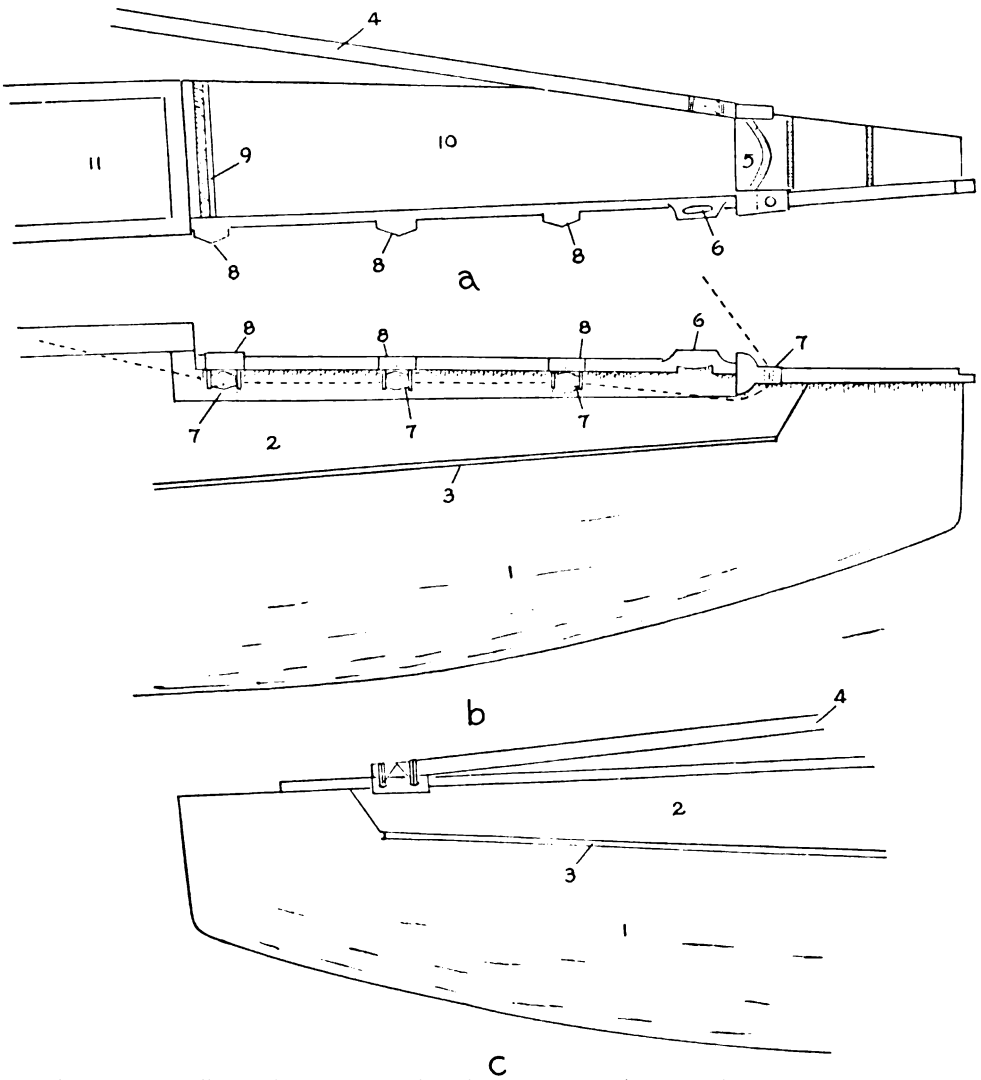


FIGURE 225.—Fijian *thamakau*, details of end: *a*, end, in plan; *b*, outrigger or weather side; *c*, off or lee side; 1, dugout underbody; 2 washstrake; 3, batten covering seam between underbody and washstrake; 4, diagonal strut connecting head of hull with lee corner of deck platform; 5, ridged socket or step to receive heel of yard; 6, hole through which short rope is passed to hold tack of sail in position; 7, perforated leads through which passes the running stay (*tuku*), its course shown by a dotted line; 8, guard projections covering horizontal leads (*sau*); 9, breakwater; 10, end cover; 11, hatchway (sketched at Mbau, 1925).

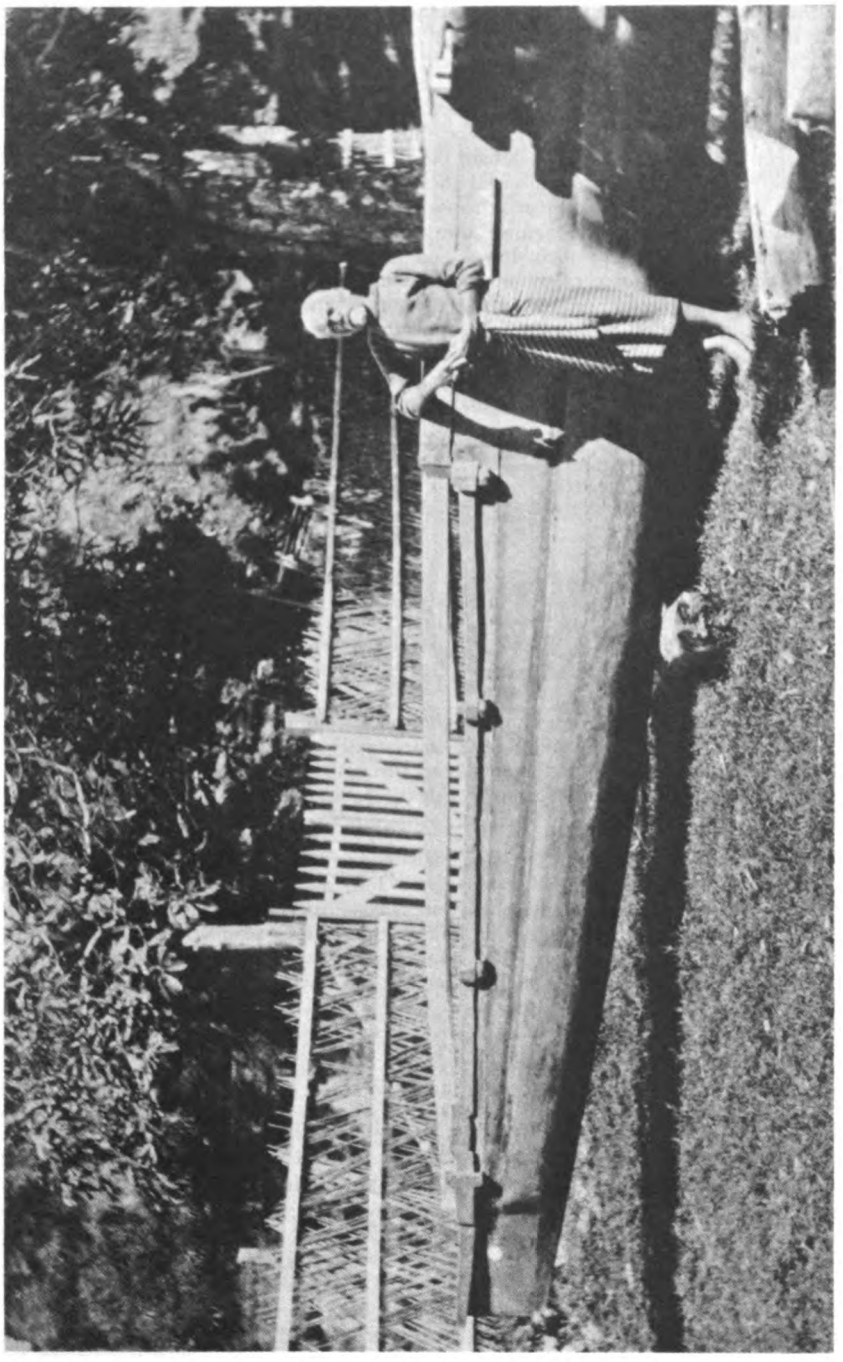


FIGURE 226.—One end of a large Fijian *thamakau*: just behind white spot at head is vertical lead through which running stay (*tuku*) is rove before being passed through the three horizontal cleat leads (*sau*), spaced along near margin of end cover (*tau*): immediately behind vertical lead is perforated lug to which heel of yard is made fast when sailing with this end forward; white beam on far side is slightly curved strut connecting head with near corner of platform (*rara*) (photographed at Mbau, 1925).

has no carved projections; alternatively, the low washstrakes between the *mbava* and each end of the canoe are shaped to trend very gently downward toward their distal end and are covered with a plain flat board. The first method, described by Williams (1858, p. 72), is the original and older; the second is a modern simplification.

Each of the *tau* has three perforated cleat-shaped leads (*sau*) disposed horizontally at intervals along its outrigger side (fig. 225, *b*, 7); a fourth, the *ndara-ndara ni tau oko*, at the distal end, has a vertical perforation through which a running stay (*tuku*), holding the mast in position, is passed before carrying it through the three *sau* leads. (See figs. 225, 226.)

Where each *tau* meets the ends of the *mbava*, a transverse board (*latitumbu*), set on edge, connects the two *mbava* and is sewn to them, thus forming a breakwater.

In the *thamakau* examined in detail at Mbau, the beautiful *Loatuithama* of Ratu Popi, five pairs of ribs or half-frames (*soka*) are inserted to strengthen the dugout and keep the washstrake, which here includes the central *mbava*, in position. These ribs are shaped to fit against the washstrake in the upper part and against the side of the dugout below, hence they are vertical above, curved below. Near their lower end is a deep notch which fits over and is lashed to a longitudinal rectangular ridge left outstanding from the inner side of the dugout when it was hewn out. Although set opposite one another, the lower ends of these ribs do not meet. In the median region where the *mbava* heighten the sides, reversed knees are also inserted to impart further rigidity; the vertical limb of each is lashed to the inner side of one *mbava*, while the free end of the horizontal limb, cut to a length exactly equal to the inside beam of the canoe, is butted against the upper margin of the opposite *mbava* (fig. 227).

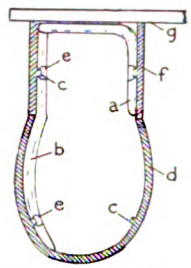


FIGURE 227.—Cross section through hull of *thamakau*: *a*, position of knee spreader; *b*, position of inserted rib; *c*, longitudinal ridge on inner wall; *d*, underbody; *e*, lashing attaching underbody and washstrakes to rib and knee, passed through vertical hole therein, the rib and knee grooved correspondingly at points opposite ridges; *f*, washstrake; *g*, boom.

Between the breakwater at the inner end of each *tau* and the median platform laid upon the outrigger booms, a large rectangular hatchway is left, about 4.5 feet long by 2 feet 3 inches wide. These are the bailing hatches, wherein, when necessary, stand men whose duty it is to bail out the water which may enter the hull at the various seams. Even in the most carefully built canoes, the strains set up when pounding through heavy seas entail constant attention to this duty. The sides of the bailing hatches are formed by the *mbava*, the outer end being closed by the breakwater uniting their ends. When the weather is fine and the wind light and bailing not required, flat movable covers (*umbi-ni-ndreke*) with deeply flanged edges are fitted over the openings. The bailer (*nima*) is the ordinary Oceanic scoop with handle within.

In *thamakau* of exceptionally large size, such as no longer exist, the design of the hull and deck fittings approximated so closely to that of the same parts in the *ndrua* as to be virtually identical. Photographs taken many years ago and now in the possession of Mr. F. W. Caine, photographer, Suva, confirm figures given by Paris (1841) and show that the deck platform (*rara*) was of greater relative dimensions than in the present-day type; as in the *ndrua* it extended so far toward each end of the hull that the two *ndreke* hatches opened onto its decking instead of between it and the end covers, as they do in the present-day *thamakau*. A deck house of the usual *ndrua* type occupied the middle of the *rara* with a belaying rail (*maile*) on the weather side, together with the minor fittings usual in a *ndrua*. This type is similar to that of the old Tongan *vaka* (fig. 188).

The outrigger and superstructure are composed as follows:

The central third of a medium-sized *thamakau* is crossed by 13 stout poles which project outboard to varying distances on the outrigger side; they also project a short distance, about 2 feet, on the off side. Three only of these are connected with the float, the outrigger booms properly so called. The accessory booms (*kaso*), deriving their name from *ai kaso* (the attendants of the children of a superior wife), are of use merely to stiffen the outrigger frame.

The median and most important of the three true booms, always made of *vesi* (*Afzelia speciosa*), is called *kaso tu*, the outer ones *kaso tumata*. Each is connected with the float (*thama*) by two pairs of stanchions, disposed exactly as in the small outrigger canoes already described, except that to tighten the sennit lashings one or two wedges (*kola*) are driven under each lashing after this has been drawn and secured as tightly as possible. The outer and inner pairs of stanchion attachments are spaced about 25 inches apart at the points where they are lashed to each boom.

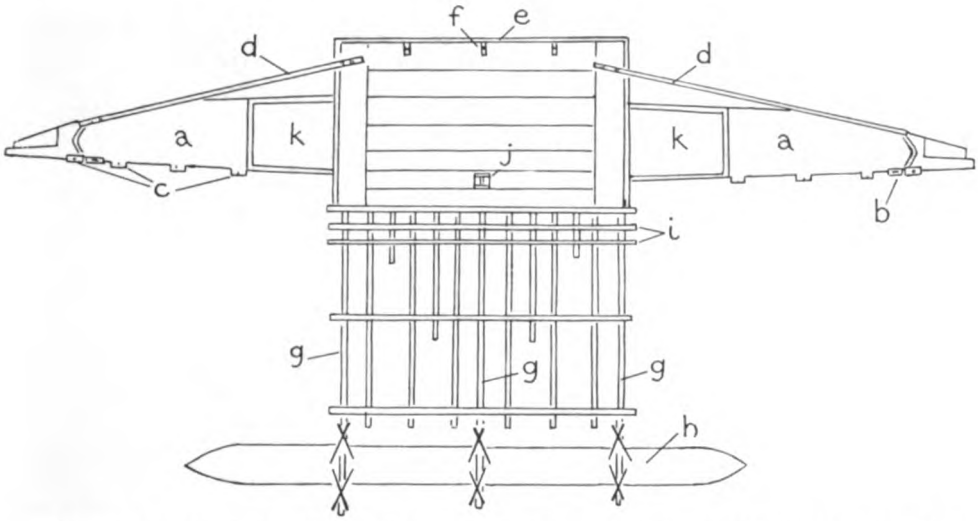


FIGURE 228.—Plan of modern Fijian *thamakau: a*, end cover (*tau*); *b*, perforated cleat for rope holding down tack or sail; *c*, leads of running stay (*tuku*); *d*, struts (*vavanda*) steadying deck platform (*rara*) at each corner; *e*, low protection rail; *f*, short knees (*nduru*) supporting rail; *g*, booms, three connected to float, ten others of varying length; *h*, float, connected to main booms by paired stanchions; *i*, stringers over outrigger platform; *j*, mast step; *k*, bailing hatches.

The accessory booms (fig. 228) are sunk half their diameter in notches cut to receive them in the starboard *mbava*; the three main booms, being thicker, are sunk a little deeper in order that the upper surface of all shall be at the same level. On the port or outrigger side, the booms rest upon the upper edge of the *mbava* without notches except for slight ones for the three main booms. This gives a rise of about 1.5 inches in a distance of 16 inches, the average beam of a medium-size *thamakau* amidships. As a consequence the booms project outboard at a slightly oblique angle upward, necessitating the employment of longer stanchions than if they were fitted horizontally.

Five stringers are lashed fore and aft over the outrigger frame. Three are fitted at short intervals apart near the canoe; the two inner are squared timbers, 2-5 inches square—between these are the sculling holes; the outer is a thin pole. A fairly strong one lies midway out on the booms, and the fifth, a very stout cylindrical spar (*tamba marawa*), just inside of the stanchion attachments. Six of the accessory booms (*kaso*) reach as far out as the outermost stringer, to which their ends are lashed; two others pass just beyond the stringer midway out and the remaining two only beyond the three inmost ones. All the crossings of these stringers and booms are lashed together with sennit. A temporary staging of loose planks may be laid over the inner part of the outrigger frame when baggage has to be carried.

Over the median third of the canoe, crossed by the booms, a rectangular deck platform is built supported upon their inner ends. It projects also outboard on the off side about 2.5

feet, thus giving a width from two and a half to three times the width of the hull. This platform (*rara*) consists of a median portion made of long boards laid longitudinally and of two end pieces (*kasorara*), laid transversely. These boards are sewn together and also to certain of the booms below. Along the off side is a low, vertically curved pole rail (*vanga-*

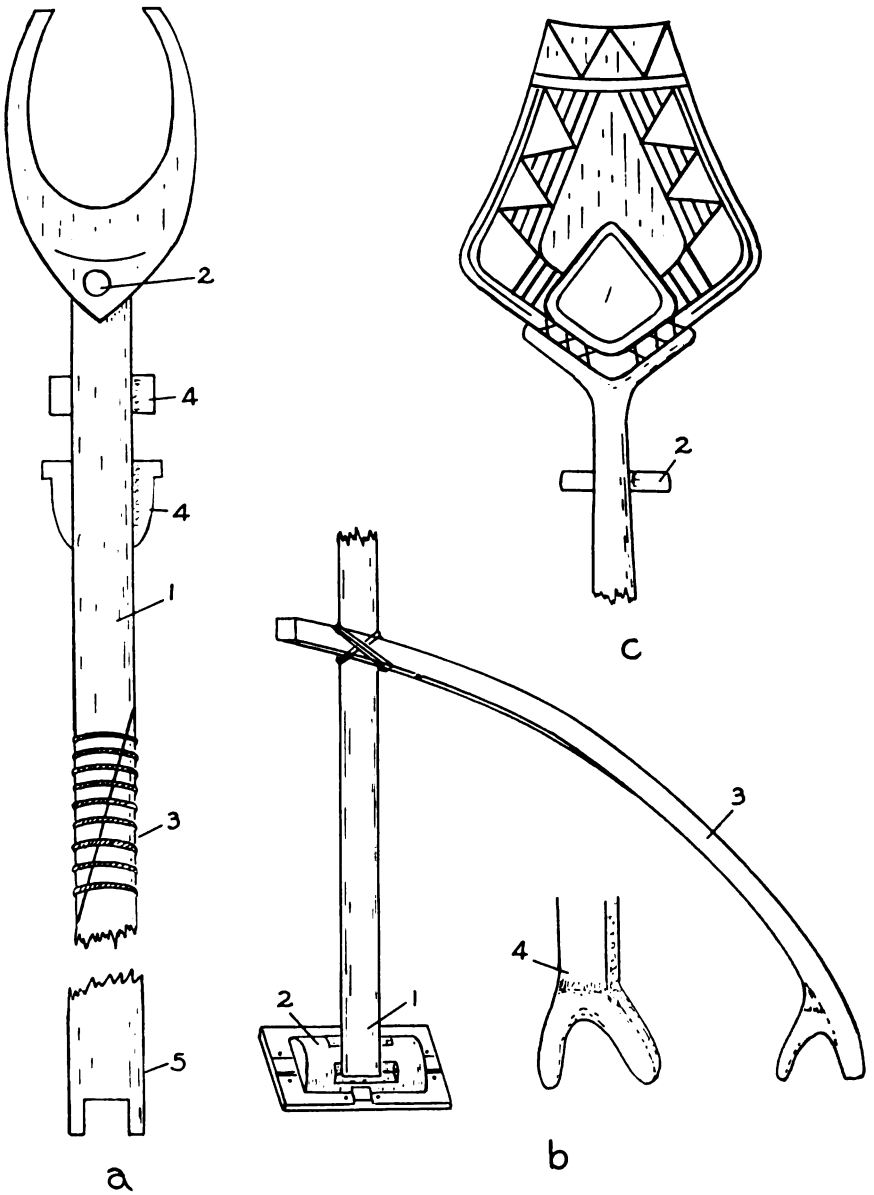


FIGURE 229.—Mast parts of Fijian *thamakau*. *a*, mast of large *thamakau* seen at Mbau, 1925: 1, upper section or topmast (*ndomondomo*) ending above in typical two-horned "truck"; 2, sheave hole through which main halyard is rove; 3, scarfed joint connecting topmast and main section of mast (*vana*); 4, cleats between which upper end of main shroud is made fast; 5, notched heel of mast. *b*, lower part of mast: 1, mast heel; 2, ridged chock (*vungakoto*); 3, mast shore (*rokoroko*) lashed above to mast, its end forked to straddle central boom of outrigger frame; 4, side view of fork. *c*, ornate type of masthead belonging to a smaller canoe: 1, sheave hole for halyard; 2, cleat which prevents main shroud from slipping down; in this canoe one halyard only is fitted.

ni-ua) supported and stretched by several L-shaped knees (*nduru*), of which the two median are the longer in order to give the desired curve. This railing is provided to afford some measure of foothold security to the men handling the tack of the sail when changing course.

Connecting the fore corner of the platform on the off or lee side with the head of the canoe is a stout squared spar (*vavanda*) (fig. 225, *a*, 4). A similar spar connects the after corner with the stern end of the after *tau*. Within the after of the two narrow triangular spaces thus formed between the *vavanda* and the side of the canoe, the steering paddle (*uli*) is lowered at sea. One end of a rope preventer or stopper (*uso-ni-uli*) is passed through a hole below the shoulder of the paddle with a knot on the end; the other end passes to a hole close to the edge of the platform at mid-length, as the steering paddle has to be raised and moved to the opposite end when the canoe goes about. In very large outriggers, as also in double canoes, two steering paddles are carried, one at each end, the forward one lifted clear of the water, in order to obviate the great labor involved in carrying the paddle from one position to the other.

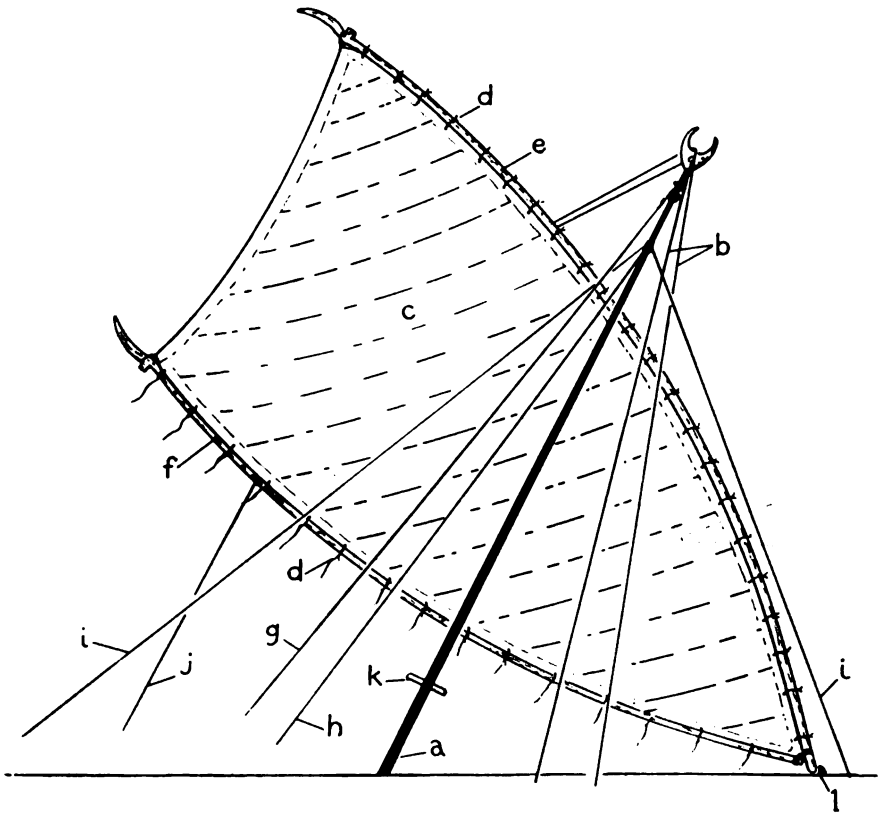


FIGURE 230.—Sail and rigging of Fijian *thamakau: a*, mast; *b*, halyards, one rove through sheave hole in "truck", the other passing between its horns; *c*, sail (*latha*) made of numerous strips of matting sewn together; *d*, short cords tying sail to yard (*e*) and boom (*f*); *g*, upper shroud; *h*, lower shroud; *i*, two running stays (*tuku*); *j*, sheet; *k*, belaying pin; *l*, projection on *tau* serving as step for heel of yard.

The steering paddles are of great length and extremely heavy, being made of *vesi* wood; in the comparatively small *thamakau* of the present day, 40 to 50 feet long, the ordinary length is 17 feet, with a blade 7 feet 6 inches long and 12.5 inches wide (fig. 234, *e*). In canoes twice this size the paddle was proportionately larger. These *uli* have the blade shouldered, the sides parallel, and the end angularly pointed; one side is flat, the other with a slight strengthening axial ridge.

In one shoulder of small ones there is a single hole, and in that of large ones, two holes, for attaching the end of a strong preventer lanyard.

Mast, Sail, and Rigging

The *thamakau* is fitted with a single short mast (*vana*) a little longer than half the length of the canoe. In the medium-sized canoe, 46 feet long, from which the following measurements were obtained, its length is 27 feet 6 inches.

The mast is made up of two sections, a short upper one, the topmast (*ndomondomo*), about 6 feet long, fastened to the longer and stouter lower section, 22 feet long, by means of a simple scarf joint served with sennit. In large canoes the *ndomondomo* terminates in a large crescent, horns upward, having a transverse perforation in the thickened base, through which one halyard (*ndarandara ni vaka-rewa*) is rove, a second (*virimbali*) passing between the horns. In smaller canoes this "truck" takes a flattened ovate shape perforated by one wide hole or two smaller ones. The crescentic form of *ndomondomo* is termed *tanganga*, the other, *vakaseniyambia* (fig. 229, *a, c*); they are always made of the hard *vesi*, whereas the main section is of the tough, springy wood of the *ndamanu*. The *ndamanu* (*Callophyllum burmannii* and other species) is not the same tree as the Polynesian *tamanu* (*C. inophyllum*), which, according to Im Thurn (1925, p. 133), is called *ndilo* in Fiji.

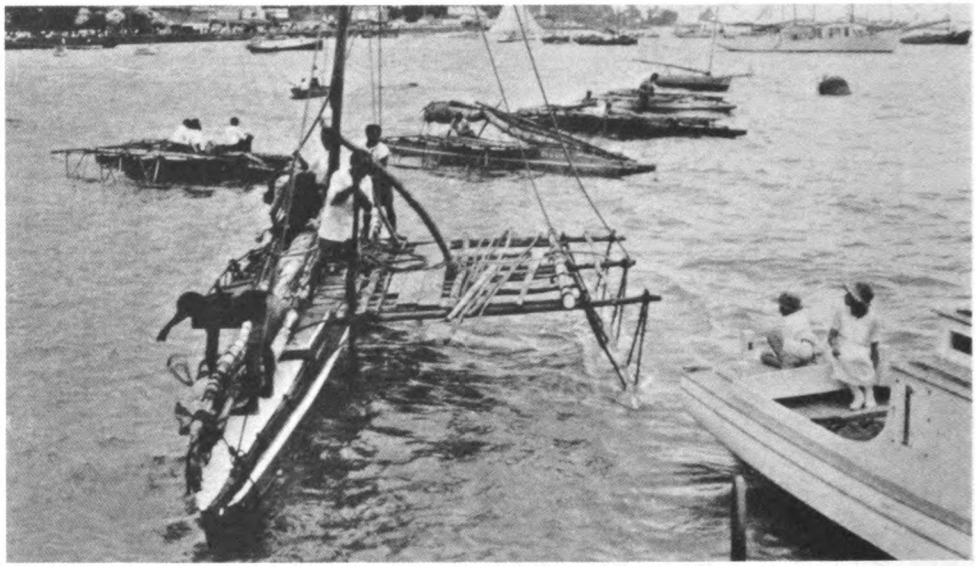


Figure 231.—Fijian *thamakau* coming to its moorings, sail furled and lying fore and aft on off side, two men sculling, one at each end of platform, sculls thrust down through interstices in it close to weather gunwale, between them the curved mast shore; outrigger frame is similar to that of paddling canoes.

The mast is stepped amidships on a ridged chock (*vungakoto*) cut out of the solid and tied down through holes in the platform to the central outrigger boom (*kasotu*) inboard of the nominal port gunwale. To pivot on the step ridge, the heel of the mast is deeply notched (fig. 229, *a*, 5).

When set up, the mast is supported by two weather shrouds, a fore and an aft running stay (*tuku*), and by a stout wooden shore or strut (*rokoroko*). The main shroud (*lomba ni vesi*) is made fast above to the shaft of the *ndomondomo* just below the "truck", the rope kept from slipping by two pairs of cleats, one above and one below, affixed on opposite sides of the *ndomondomo*. The lower end is belayed around the extreme end of the main boom. The lower shroud (*lomba ni ndamanu*) is made fast to the mast just below the splice, the free end being secured like the upper one to the main boom but at a point 2 feet inward. In small canoes only one shroud may be used.

The running stays are attached to the upper end of the mast at the same place as the lower shroud. The free end of each passes vertically through the foremost cleat lead (*ndara-ndara ni uthui mua*) on one *tau* and then horizontally through the three *sau* leads behind, before being belayed. (See fig. 230.)

The mast shore (*rokoroko*) may either be a curved or a straight wooden bar. The lower end, which is forked, rests astride the median outrigger boom (*kasotu*) and is stayed against the median stringer (fig. 231). Its upper end is lashed to the side of the mast 5 or 6 feet up, so forming a strong lateral strut (fig. 229, *b*, 3, 4); it is employed to obviate the danger of the mast falling over upon the outrigger if the sail be taken aback. The name is derived from

FIGURE 232.—Fijian *thamakau* affording vivid impression of driving power of great sail and of tremendous stresses set up in hull and outrigger as vessel surges along with hull and float almost entirely submerged; rope lashing which binds together the three sections whereof boom and yard are made up is clearly seen, also pole used to keep boom from swinging; two weather shrouds present, together with two running stays (*tuku*); tack of sail held down in notch close to head (photograph by A. M. Hocart).

rokoroko (reverence or respect), as Fijian etiquette requires inferiors to bend low or crouch in the presence of their chiefs.

One sail (*latha*) only is used. It has the form of a long isosceles triangle, with all three sides slightly curved. The two long sides are tied at short intervals by paired cords of sennit to two compound spars (*karikari*) representing respectively a yard and a boom (fig. 230).

In Ratu Popi's *thamakau* the head of the sail is 38 feet long, the foot 37.5 feet, and the free margin, stretching between the outer ends of the yard and boom, 27 feet. The yard and boom are each 1 foot longer than the head and the foot. (See fig. 232.) The sail itself is made of numerous narrow strips of finely plaited lauhala matting running across it from yard to boom. Each of the 17 strips of which this particular sail is made is a little more than 2 feet in breadth. The strips are sewn together with two rows of running stitches; fine sennit is used for this purpose and in former days the sail needles (*saulatha*), 5 to 6 inches long, were fashioned from human shin bones. (To use his bones for tools and base purposes was the last insult that could be offered to an enemy.) To strengthen the margins, the edges of the sail are turned in and sewn around a bolt rope made of several ply of sennit (fig. 233). Streamers of colored bark cloth were formerly attached to the lower margin and great chiefs flew a colored ensign from the peak.

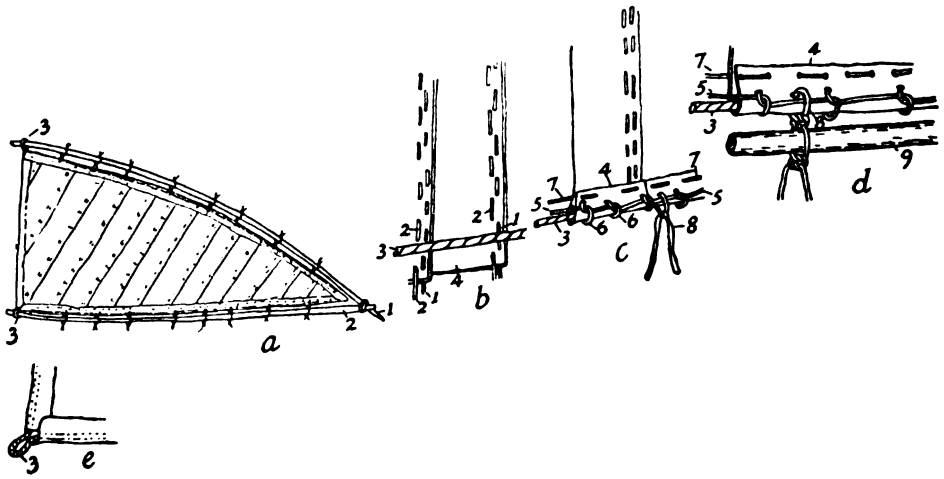


FIGURE 233.—Details of *thamakau* and *ndrua* sail as used in Fiji, Tonga, and Samoa: *a*, completed sail: 1, pointed end of yard; 2, inner end of boom lashed to foot of yard; 3, upper ends of both yard and boom passing through loops of bolt rope left exposed at upper corners of head of sail, seen on larger scale in *e*. *b*, overlapping edge of matting strips sewed together by two rows of long running stitches (1, 2), bolt rope (3) laid along side of sail a little inward from margin (4). *c*, margin turned in and hemmed down over bolt rope (3) by series of loops (6) made with braid (5), series of long running stitches (7) binds down cut edges (4) of turned-in margin, short length of braid (8) tied to edge by reef knot. *d*, ends passed round sail spar and made fast by knotting. (From Buck, 1930.)

Both the yard and the boom are made up of three main sections with a short piece added at the butt. The three joints, *vakavu* below, *lotho* in the middle, and *sukui* above, are scarfed together and served with sennit. (See fig. 234.) The *lotho* is strengthened by means of two rods (*roroi*) of tough wood bound to it, on one side, with sennit lashing at the ends and the middle. The lowest section (*vakavu*) has a short butt (*veikuku*) scarfed on. Its lower end in the yard is brought to a rounded point in order to fit into the sail step on the forward *tau*; that of the boom is truncate. The distal end of both yard and boom is carved into a peculiar sickle-shaped ornament about 11 inches long.

The respective lengths of the parts of the yard and boom are:

	Vakavu	Lotho	Sukui
Yard	16 feet 3 inches	18 feet 2 inches	4 feet 8 inches
Boom	15 feet 3 inches	18 feet 5 inches	4 feet 11 inches

In large canoes in which two halyards are used, one passes through the sheave hole in the crescentic "truck" of the *ndomondomo*, the second one over the curve of the crescent. When sail is set, the rounded heel (*veikuku*) of the yard is dropped into the curved sail step (*tokatoka ni vu*) at the head of the canoe and there held down by a short rope (*tauoka*) passed through the perforated cleat (*ndarandara ni tauoka*) on the weather side of the *tau*. This cleat is immediately abaft the fore stay lead (*ndarandara ni uthu i mua*). The sheet is bent onto the boom about one quarter of its length from the outer end; by giving it a couple of turns around a beam, one man can hold it even in a stiff breeze.

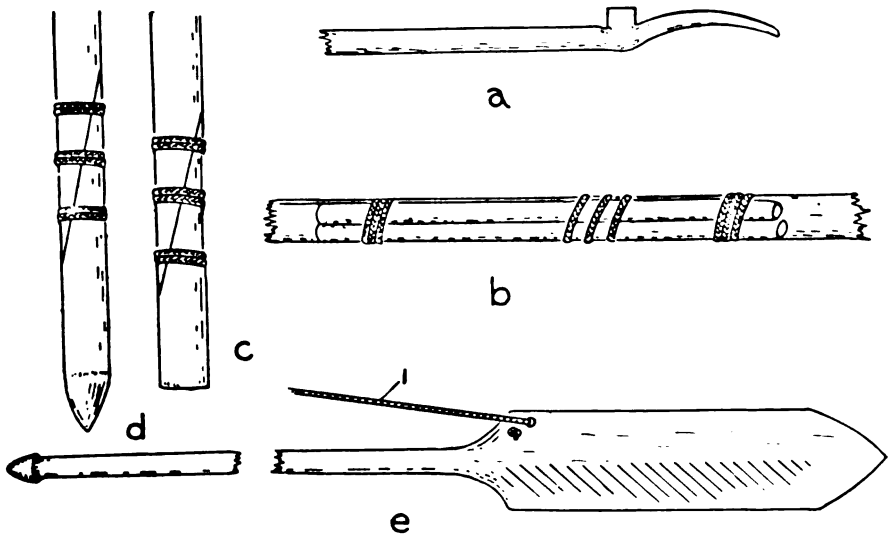


FIGURE 234.—Details of yard, boom, and steering paddle of Fijian *thamakau*: *a*, distal end of uppermost joint of both yard and boom showing sickle-shaped prolongation which is passed through exposed loop of bolt rope at one of upper corners of sail; *b*, two strengthening rods (*roroi*) placed over middle joint (*lotho*) of both yard and boom; *c*, *d*, lowermost section of boom and yard respectively, each with a scarfed-on butt (*veikuku*); *e*, steering paddle with stout lanyard (1) made fast through two holes in shoulder.

SAILING

The pace at which these magnificent canoes tear along with the wind on the quarter has evoked the enthusiastic admiration of all who have seen them. Eight and nine knots are ordinary speeds and they have been credited with considerably greater. Wilkes (1845, vol. 3, p. 57) can not be accused of exaggeration when he describes their "velocity as almost inconceivable". Wonderful dexterity and judgment are displayed in handling them; in the old days it was the custom for the chief to hold the end of the sheet, his the task to judge the exact moment when to ease away to prevent capsizing. A trained Fijian crew loves to scud along with the outrigger float lifted so high that it barely skims the waves, the balance so nicely adjusted that a moment's lack of viligance would send the outrigger flying upward, overturning the canoe. Thompson (1908, pp. 293-294) gives a vivid description of the complicated evolution involved in tacking:

> If the Fijian canoe is so carelessly handled as to bring the outrigger to leeward she immediately capsizes, for the pressure of the wind drives the outrigger [float] under water. In order to keep the outrigger to windward when tacking, it is therefore necessary to make what was formerly the bow become the stern, the sail must be turned inside out, and the mast, yards, and steer oar must all be changed over. This complicated manoeuvre is accomplished

with extraordinary skill. Instead of luffing up into the wind as in a cutter, the steersman keeps away until the wind is abeam, the sheetman slackening the sheet simultaneously until the sail is flapping. Two or three men then run out to the prow, seize the foot of the yards, and carry them bodily amidships.

During this operation they have to bear the weight of the mast, which is sloping forward at an angle of 45 degrees, and to relieve them of some of this extra weight, a man is hauling on the running stay, which runs through a block astern. As they pass the mast with their burden the lower yard [boom] is let go, the sheet is passed round their legs, and the sail turns inside out. They tramp forward, and the mast again begins to incline, throwing its weight upon them. A man now seizes the other running stay, and in obedience to their loud cries of "*Tuku!*" begins cautiously to pay it out. If he is too quick the weight of the mast precipitates the men and the sail into the water; if he is too slow, he holds them back. At last the foot of the yard is planted with a thud into its nest in the carving and lashed secure, but before the sheet can be hauled in, the heavy steer oar, which takes two men to lift, has to be dragged inboard and carried aft.

All this time the hull is heaving in the trough of the sea, and the mat sail is threshing itself to pieces. Sometimes the yard carriers slip on the wet deck, and tumble overboard, sail and all, in inextricable ruin, but if all goes well the canoe is gathering way on the new tack in less than 60 seconds, and though to the spectator on board the moment is full of excitement and risk, to those watching it on shore it is the most precise and beautiful manoeuvre known to seamanship.

Williams (1858, p. 88) writes:

Canoe-sailing is not silent work . . . If there should be drums on board, their clatter is added to the general noise. The announcement to the helmsman of each approaching wave, with the order to *lazi*—keep her away—and the accompanying "one, two, and another to come", by which the measured advance of the waves is counted, with passing comments on their good or ill demeanour, keep all alive and all in good humour.

Sculling

When the wind falls and the sail is no longer of use, Fijian sailors resort to the use of oar-shaped sculls (*sua*) 11 to 12 feet in length, with blades about 5 feet long and 5.25 inches wide, the loom cylindrical. These they thrust down perpendicularly into the water through the rectangular spaces between the two squared stringers close to the hull on the outrigger side. As these stringers cross the many booms (13 and more) forming the basis of the outrigger, a fore and aft series of square apertures is provided, through any of which the sculls may be thrust. Aboard the Mbau *thamakau* measured, four scullers were the usual complement, two at each end of the platform. The scullers face forward, standing upright (fig. 231).

Thomson (1908, p. 295) states:

The sculler describes short semicircular sweeps with the blade, throwing his weight against the handle in front of him as he stands upon the deck. When two are sculling they swing in time, but in different directions, and there is no exercise that displays the grace of the human body in action to better advantage. A speed of 3 miles an hour is the maximum that can be attained with the *sua*, but the scullers maintain this speed for a long time without fatigue. The stroke is as difficult to acquire as that of the gondolier, but when you have once acquired it you wonder wherein the difficulty lay . . .

The craft of seamanship was hereditary, and every considerable chief had his fisher tribe to man his canoes. In wartime they were his navy, since many engagements were fought at sea. Manoeuvering to windward of the enemy was even more important in a war canoe than in a frigate, because by getting within striking distance of his outrigger you had him at your mercy. . . . One stroke of a hatchet at his mast-stay shroud would bring the whole of his rigging down about his ears, and you could club his head as it bobbed up under the sail.

A body of etiquette grew up about the canoe. The high chief's canoe was marked by a streamer or a fan floating from the tip of the lower yard. It was an insult to cross her bows, or to sail to windward of her. The custom which required the serf to stoop in passing or approaching a chief was extended to canoes passing or approaching chief villages such as Mbau. All had to lower their sails, and toil past with the *sua,* however fair the breeze.

In shallow water within the reef long poles (*ndoko*) made of *makita* wood are employed to propel canoes. According to Tonganivalu (1915, p. 14) the poles, after being cut in the bush, are roasted over fires to loosen the bark, which is always removed before the poles are put into use.

Dimensions

Detailed dimensions of the *Loatuithama* of Mbau, a typical *thamakau* of medium size, are as follows:

	Feet	Inches
Length over all	45	8.0
Beam inside at gunwale	2	1.0
Beam inside at turn of bilge	2	1.0
Depth of hull to base of *mbava*	1	8.0
Depth of *mbava*	1	8.0
Length of platform	14	7.0
Width of platform	4	9.0
Thickness of hull at gunwale	0	2.0
Length of fore deck (*tau*)	11	0.0
Length of after deck (*tau*)	11	0.0
Width of each at inner end	2	2.0
Bailing hatches		
Length	4	6.0
Width	2	3.0
Outrigger booms		
Length outboard	11	0.0
Circumference of middle boom		
At inner end	0	11.0
At outer end	0	9.5
Float		
Length	21	0.00
Circumference	3	6.00
Distance outboard	9	3.00
Length of stanchion connectives	3	3.00
Mast		
Length	27	6.00
Lower section	22	0.00
Upper section (*ndomondomo*)	5	6.00
Circumference at base	1	6.00
Circumference at splice	1	0.00
Height of crescentic truck	2	0.00
Width of opening between "horns"	0	6.00
Length of yard	39	4.00
Length of boom	38	9.00
Steering oar		
Length over all	16	6.00
Length of blade	7	3.00
Width of blade	1	0.50
Sculls		
Length	11	6.00
Length of blade	5	0.00
Width of blade	0	5.25

DOUBLE CANOE

The Fijian double canoe (*wangga ndrua*) was the largest and finest sea-going vessel ever designed and built by natives of Oceania before contact with Europeans. Its construction could be effected only by chiefs able to command the services of highly skilled hereditary canoe builders, a class restricted in numbers and location, or who by services of equivalent great value, could expect to receive one ready built as a present from friendly chiefs better situated to command the necessary labor and supplies of suitable timber. As a consequence the *ndrua* was also termed *wangga tambu* (sacred canoe), using "sacred" in its primary sense of something set apart and not for the use of commoners—the canoe tapu to the service of the chief (fig. 235).

The only double canoe existing when I visited Fiji in 1925 was a small one belonging to Mr. Percy Turner of Suva. It had been built to the order of his father, the late Mr. J. B. Turner, by one of the Lau chiefs in 1913. According to information received, this chief had offered to have a derelict double canoe repaired for the government for £50, but this was refused; Mr. Turner, hearing of this, arranged to pay for the repair if the canoe was given to him. When work was begun the hull was found too far gone to repair, so instead, the chief offered to

build a new one but rather smaller. When completed it was sailed to Suva and proved the fastest boat in the port. After that it was brought ashore and housed in a shed built for the purpose.

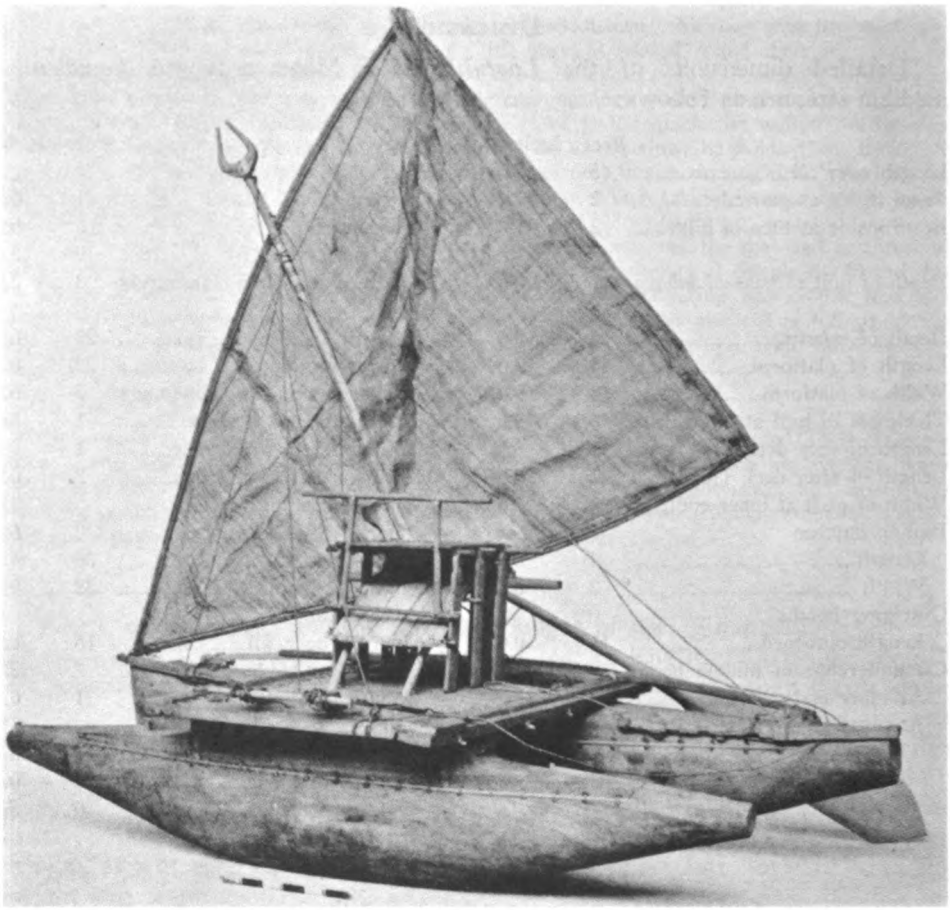


FIGURE 235.—Model of a Fijian *ndrua* (Science Museum, London), details unusually good except that rail on near side of platform (*rara*) is lying over on its side instead of being upright and that tack of sail is made fast too far forward instead of abreast of fore running stay immediately abaft heel of yard; at after end, running stay correctly shown passing through *ndarandara ni uthi mua* and thence through three *sau* cleats to be made fast at after end of platform; large steering paddle should be let down in space between lee side of larger hull and after strut connecting corner of platform with end of hull.

The vessel consists of two unequal hulls, 44 and 40 feet long respectively, connected at a distance of 5.5 feet apart by 17 cross beams; three stout stringers are lashed underneath to give rigidity. In canoes as small as this one, the hulls are dugouts with deep washstrakes (*mbava*) restricted to the median region. Athwart this are lashed the connecting booms supporting a large platform which extends over both hulls and the space between. (See fig. 236, *a*.)

The larger dugout hull (*kata*) is precisely similar in form to that of the *thamakau*. The head is brought to a wedge form, ending in a vertical cutwater. The stern has a fine run to a small truncate end roundly obovate when viewed from behind and about 5 inches deep by 4 inches wide. The shorter and smaller hull (*thama*) has both ends slender and truncate, similar to the stern of the *kata*.

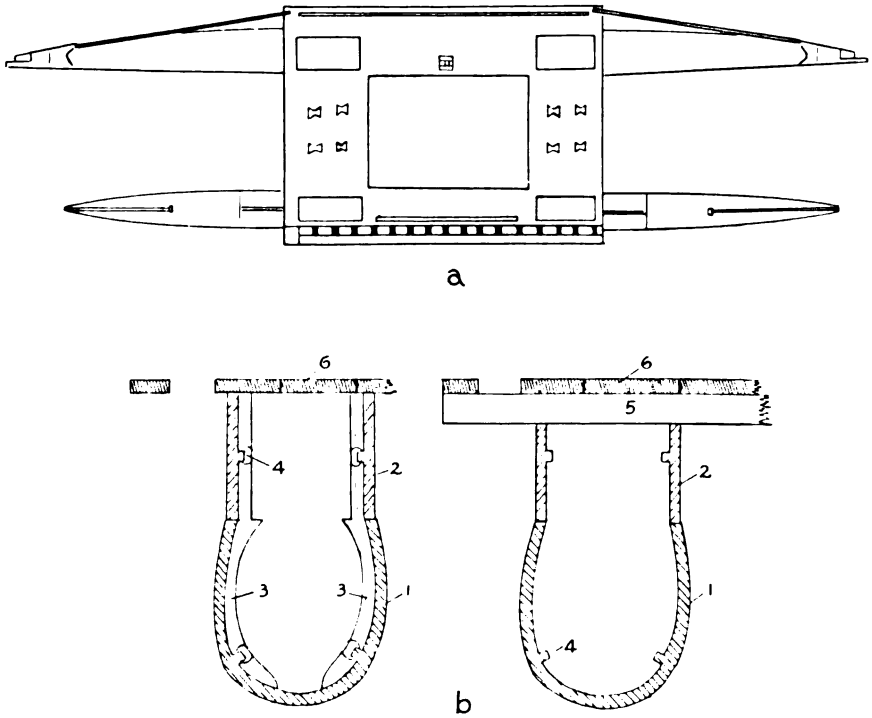


FIGURE 236.—Fijian *ndrua*. *a*, plan of canoe measured at Suva, 1925. *b*, diagrammatic cross sections through hull of small canoe taken at point between two cross beams where pair of ribs are inserted (left) and at point where connecting boom crosses and where there are no ribs (right); 1, dugout underbody; 2, washstrake; 3, inserted ribs, lashed to projecting longitudinal ridges (4) on inner side of hull; 5, connecting boom; 6, deck planking.

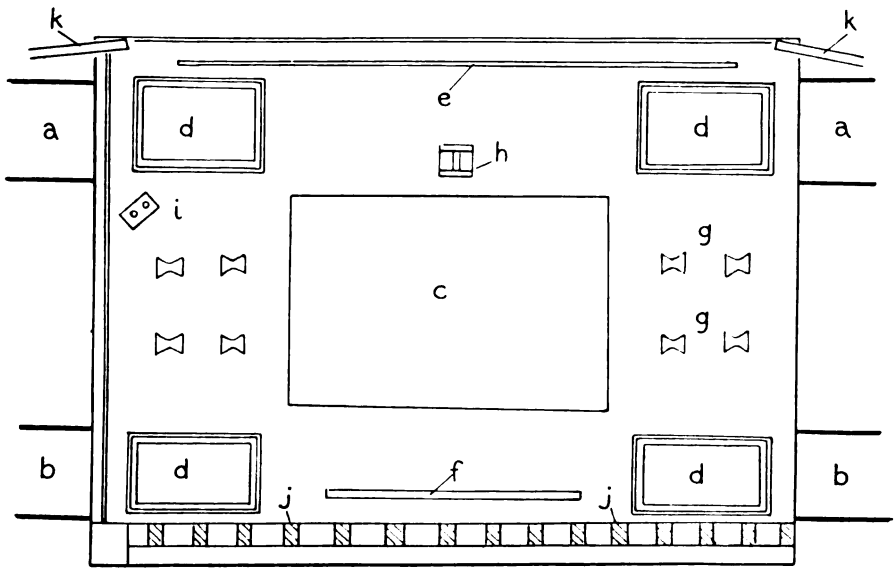


FIGURE 237.—Plan of deck platform (*rara*) of Fijian *ndrua*: *a*, larger hull (*kata*); *b*, smaller hull (*thama*); *c*, area occupied by deck hut; *d*, hatches; *e*, protection rail; *f*, belaying rail; *g*, sculling holes; *h*, mast shoe; *i*, holes for making fast lanyard of steering paddle; *j*, cross beams under platform left exposed for purpose of making fast ropes as occasion requires; *k*, inner ends of spars (*vavunda*) connecting lee corners of platform with ends of *kata* hull.

Both hulls are strengthened internally by 11 pairs of shaped ribs (fig. 236, *b*) fitted against the *mbava* above and against the interior of the dugout below, shaped as in the *thamakau*; to secure them in position a longitudinal ridge projecting 1 inch, with a width of 2 inches, is left on the inner side of each washstrake, running medianly, and a second of similar dimensions on the inside of the dugout on each side at the turn of the bilge. These ridges are let into notches cut in the ribs and then tied to them by sennit passed through vertical holes in the ridges on each side of the ribs. These do not extend much below the bilges, so the lower ends in each pair do not meet.

The interval between each end of the median platform and the near-by end of the larger hull is covered in by an end decking (*tau*) similar to but longer than in the *thamakau* and fitted with the same arrangement of perforated cleat leads along the inner or port side; close to the extreme end is a strong, curved, transverse ridge against which the heel of the yard is stepped.

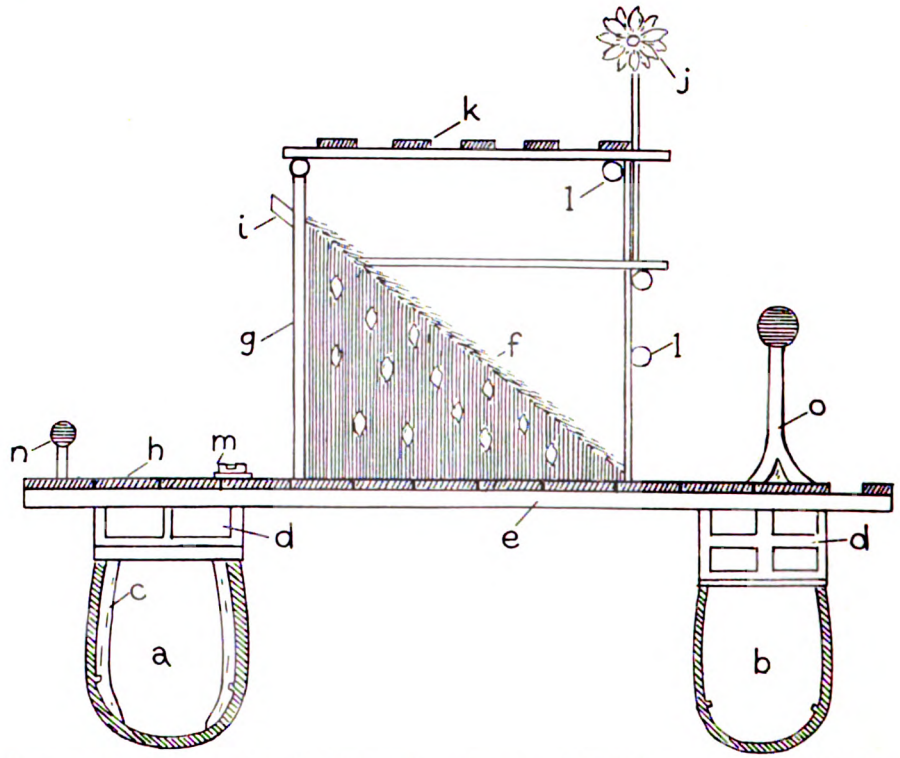


FIGURE 238.—Cross section of a Fijian *ndrua* at one end of platform: *a*, *kata* hull; *b*, *thama* hull; *c*, inserted ribs; *d*, breakwater closing ends of washstrakes; *e*, cross beam; *f*, end view of thatched deck hut, wall made of reeds decorated with egg cowries, sewn on; *g*, pilaster at side of open front of deck hut; *h*, planking of deck platform; *i*, rafter; *k*, top platform of narrow boards spaced fairly wide apart; *l*, sections of bamboo poles running longitudinally as stringers, end of topmost stringer decorated with thickly massed egg-cowries (*j*); *m*, mast step; *n*, protection rail; *o*, belaying rail.

The ends of the smaller hull are also decked in by a long triangular *tau*, but the only carving or fitting is a long and narrow median ridge extending from mid-length to the distal end; along this egg cowries are tied, a form of decoration homologous with that employed by the Samoans and Tongans on the ends of their bonito canoes, but reserved in Fiji for men of chiefly rank; to commoners it was *tambu* (tapu).

A transverse breakwater fills in the space between the ends of the deep median washstrake (*mbava*) in both hulls.

The platform, 18 feet long by 11 feet wide, laid upon the cross beams, is formed similarly to that of the *thamakau* by boards bound to the beams beneath (fig. 237). A marginal coaming

runs along the four sides, 2 inches high on the forward and after ends, 1.25 inches high on the lateral sides. Nearly in the center is built a small thatched lean-to hut, open on the *kata* side (figs. 237, *c*; 238). Over it at a height of 4 feet is a small platform for the use of the chief, made of narrow planks spaced about 3 inches apart, supported on one side by the cross pole above the open side of the deck hut (*valevale* or *vale wangga*) and on the other by a fore-and-aft rail supported upon upright posts at the outer corners of the rear limit of the hut. These uprights support, 3 feet above the rail, another fore-and-aft pole against which spears are rested; its ends are decorated with clustered egg cowries in the same fashion as the ends of the ridgepole of houses of Fijian chiefs (fig. 238, *j*).

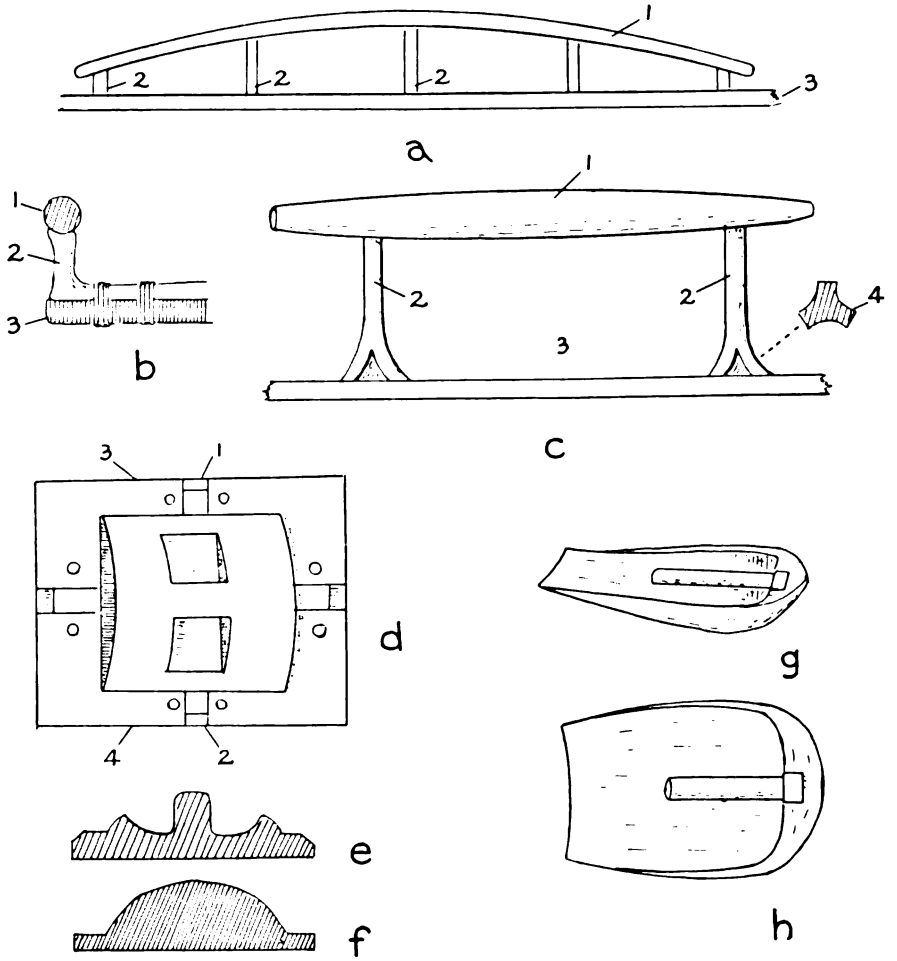


FIGURE 239.—Deck fittings of a Fijian *ndrua*. *a*, protection rail on lee side of platform: 1, rail; 2, supporting knees; 3, decking of platform. *b*, knee in detail: 1, rail; 2, knee; 3, decking. *c*, weather rail, used for belaying ropes: 1, rail; 2, its supporting standards; 3, deck; 4, section through base of standard. *d*, mast step or shoe. *e*, *f*, sections through mast shoe along lines connecting 1-2 and 3-4 of *d*; at center of (*e*) is ridge on which notched heel of mast is pivoted. *g*, *h*, side and top views of bailer.

Opening into the canoe hulls at each of the four corners of the *valevale* a bailing hatch 3 feet 3 inches long by 14 or 15 inches wide, surrounded by a low coaming, is cut in the platform. This small canoe is equipped with four bailers, one for each hatch (fig. 239, *g-h*); larger vessels had more, for sometimes two men were engaged in bailing from each hatch.

Between the bailing hatches on the *thama* a stout spindle-shaped rail 7 feet 6 inches long, 15 inches in diameter at the middle, and 10 inches at each end, and supported upon two upright

posts 21 inches high and 4 feet 6 inches apart, is placed 2 feet out from the back of the *valevale* (figs. 238, *o*; 239, *c*); around it are passed the loose ends of various ropes after being belayed —also used as a bar from which to suspend baskets and other luggage. Outside this rail and just beyond the weather side of the *thama* the width of a plank is left open in the platform, exposing the cross beams beneath (fig. 237, *j*); this is done in order that these beams may be used to make fast the shrouds and other ropes as required.

The remaining fittings are as in the *thamakau*: a heavy rectangular ridged chock for stepping the mast, amidships on the weather side of the *kata*, immediately above the median cross beam; a low curved rail along the lee side of the platform; and connecting poles between its corners and the two ends of the *kata*. (See figs. 237, 239.)

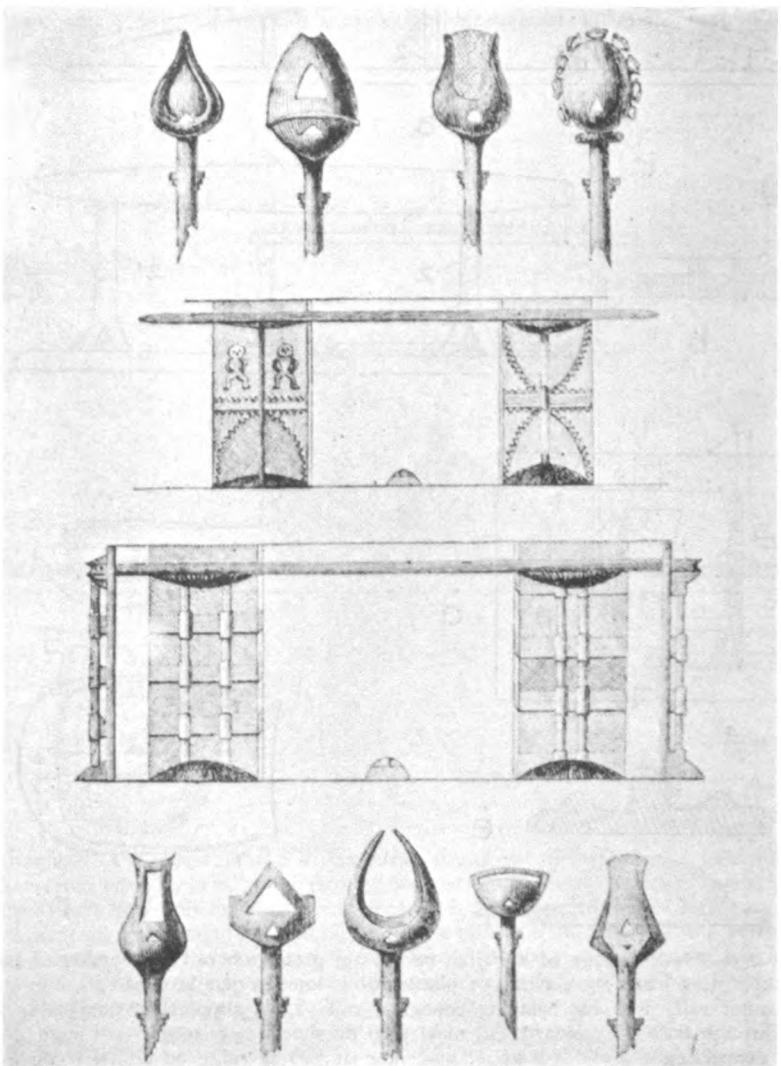


FIGURE 240.—Ornamental mastheads and pilasters of deckhouses of Fijian canoes (from Williams and Calvert, 1858).

The *ndrua* of former days boasted little ornamental carving; what there was, was confined to paneling on the exterior of the breakwaters, to a transverse fluting across the inner ends of the *tau* deckings, and to angular geometric carving on the wooden framing of the deck house, railing uprights, and masthead (fig. 240); cleat

leads on the sides of the *tau* were also carved in never varying conventional forms. Egg cowries were used profusely for decoration, particularly of the deck-house walls, the ends of the deck-house poles, and the median ridge along the end deckings (*tau*) of the smaller hull.

The mast, sail, and rigging were of the same form as those of the *thamakau*. Steering was effected in the same manner.

The *ndrua* is propelled during calms by sculling, but here the scull holes are cut in the deck platform midway between the two hulls, one set forward of the *valevale* and the other abaft it; in small canoes each set consists of two pairs of holes, in large ones of three or even four pairs. These scull holes, which are 9 inches wide, are peculiar in shape, being somewhat constricted in the middle after the fashion of an hourglass (fig. 237, *g*). Some informants stated that sculls were also used in the fore-and-aft row of apertures between the cross beams left uncovered by the absence of a plank on the weather side of the deck platform.

In the full-sized double canoes of former days, ranging to 100 feet in length, the hulls were so large that the dugout region shrank to little more than the equivalent of a broad, rounding keel (*takele*); usually it was made up of two lengths, less commonly of three, "carefully scarfed together" according to Williams (1858, p. 73). On this not less than three wide strakes (*vono*) were built up, exclusive of the deep *mbava*, which as already explained did not extend beyond the ends of the deck platform. The lowest or garboard strake was the *vono tambu*, the second the *laulalo*, and the uppermost the *vono mbati ni wangga* on which the *mbava* were sewn.

These strakes were connected to each other and to the *takele* in the same way as in the Samoan *va'a alo* canoes (figs. 161-162); the opposed edges had each a flange on the inner side, through which sennit binding was passed. Williams (1858, pp. 73-76) describes this building up and binding together:

> From the keel the sides are built up, without ribs, in a number of pieces varying in length from 3 to 20 feet. The edge of each plank has on the inside a flange; as the large pieces are worked in, openings of very irregular form are left to be filled in, as suitable pieces may be found. When it is recollected that the edges of the planks are by no means straight, it will be seen that considerable skill is required in securing neat joints; yet the native carpenters effect this with surprising success. After the edges are fitted together, holes of about three eighths of an inch in diameter are bored a hand-breadth apart in them, having an oblique direction inward, so as to have their outlet in the flange; the holes in the edge of the opposite board are made to answer these exactly. A white pitch from the breadfruit tree, prepared with an extract from the cocoanut kernel, is spread uniformly on both edges, and over this a strip of *masi* bark cloth is laid, which is burnt through with a small fire stick where it covers the holes. The piece or *vono* is now ready for fixing, which is done by what is commonly but wrongly called "sewing"; the native word better describes the process, and means "to bind". The *vono* being lifted to its place, well-plaited but not large sinnet is passed through the hole in the top flange so as to come out through the lower one; the end is then inserted in the sinnet further on, and the sinnet run rapidly through the hole until 8 or 12 loose turns are taken; the inserted end is then sought and laid on the round projection formed by the united flanges and fastened there by drawing one turn of the sinnet tightly over it; the other turns are then tightened, the last but one being made a tie to the last. The spare sinnet is now cut off close, and the operation repeated at the next hole. The bindings, already very strong, have this increased by fine wedges of hard wood, to the number of six or seven, being driven in opposite directions under the sinnet, whereby the greatest possible pressure is obtained. The ribs seen in canoes are not used to bring the planks into shape but are the last things inserted and are for securing the deep sideboards [*mbava*] described below and uniting the deck more firmly with the body of the canoe. The outside of the *vono* is now carefully adzed into form and the carpenter has often to look closely to find the joint. When the body of the canoe is cleaned off and rubbed down with pumice stone, the surface is beautifully smooth; of course no signs of the fastenings are seen outside. The process is not used in fixing the deep planks [*mbava*] which support the main deck, or the triangular coverings [*tau*] of the two ends. These, as seen in the section,

being on top of the gunwale and above the watermark, the sinnet is seen at regular intervals passing, like a band, over a flat bead which runs the whole length of the canoe, covering the joint and making a neat finish. . . . The projecting ends of the canoe are beautifully finished at the expense of immense labor and are sometimes thickly covered with white shells (*Ovula oviformis*). Any aperture inside not filled with the sinnet is tightly calked with cocoanut husk, and such as are next the water are flushed up with the white pitch or resin. . . .

Such canoes seldom exceed 100 feet in length. The following are the dimensions of the largest canoe I know. Its name was *Rusa i vanua*, "Perished inland", signifying that it would be impossible to launch it: Extreme length 118 feet, length of deck 50 feet, width of deck 24 feet, length of mast 68 feet, length of yards 90 feet.

The measurements of another *drua*, the *Lombi ki Tonga*, is as follows: length 99 feet 3 inches, length of deck 46 feet 4 inches, width of deck 20 feet 3 inches, height from keel to house top 14 feet, draught of water 2 feet 6 inches, length of mast 62 feet 3 inches, length of yards 83 feet.

A canoe in good condition makes very little water, and such as have just been described would safely convey 100 persons and several tons of goods over 1,000 miles of ocean.

In his journal (Henderson, 1931, p. 111) Williams gives "Cursed is the land" as the rendering of *Rusa i vanua* and says the length of the canoe was 108 feet and the height from keel to deck upward of 6 feet.

On wartime occasions many more than 100 persons were conveyed. Lawry (1850, p. 144) records on October 10, 1847, that "the fleet of Thakombau sailed out this morning with not less than 200 warriors on board each canoe". Lockerby (1925, p. 41), who was in Fiji in 1808-9, confirms this, for he states that the double canoe in which he sailed, one of the largest of its kind, carried a complement of sailors and warriors amounting to 200. This canoe, forming a unit of a war fleet, had a strong breastwork of bamboos erected round the sides of the platform, behind which the warriors sheltered when engaging the enemy. Coppinger (1883, p. 163) describes a *ndrua* which he saw at Mbau in 1880, 72 feet long, with a depth of hold of about 5 feet; it was intended to carry 250 men, and he entertained no doubt about the correctness of this number. He adds that what surprised him most was "the enormous size of the mast, which lay alongside the vessel. It was about the size of the *Alert's* spanker boom."

The reconstruction of a *ndrua* which has been inserted to illustrate Lockerby's remarks (1925, pl. 3) is incorrect in important features. The artist shows the hatchways into the interior of the hulls as outside the ends of the platform, whereas they were always cut in the flooring of the platform itself. It is only in the *thamakau* of the present day that the hatchways have the positions shown in the drawing, though, as already described, some of the larger ones of former times had the hatches opening on the platform as in the *ndrua*. The deck house is also much too small relatively to the length of the mast, and its open front is turned toward the exposed weather or *thama* side instead of toward the lee side. The deck fittings are similarly reversed.

In a double canoe about 100 feet long (Wall, 1916) the beam would be 6 to 8 feet and

. . . a man could easily walk in the hold without touching the deck. A pig could be roasted whole in the open cooking place, and the food and water were easily stowed away for long voyages. On one occasion a canoe carried 12 head of cattle in her holds from Natewa Bay in Vanua Levu to Levuka, a trip of 120 miles, and another carried on deck from Tailevu to Suva a cargo of bagged maize sufficient to load the *Alarm* ketch of 30 tons, and the *Xerifa* of 20 tons burden.

The steering paddles in these great vessels are proportionately large. In the small Suva canoe 44 feet long, they are 20 feet over all, the blade being 9 feet long by 16 inches wide. But in the Fiji Museum are several much larger; the largest

is 33 feet long, with a blade 14 feet 8 inches to the shoulder and 21 inches in width. One is fitted at each end of the larger hull on the lee side. Under ordinary conditions only that at the functional stern is in use at one time, the other being lifted clear of the water as in Sinhalese outrigger canoes. According to a Tongan carpenter 90 years or more old who furnished me with much information in 1925, both steering paddles had to be brought into use in bad weather.

The leverage of such a huge paddle was tremendous; when the wind was fresh, the efforts of several of the strongest of the crew were required to handle it. Even so, the effort to control its movements was apt to be so intense that not infrequently men got so strained that they either died or became crippled for life. A Fijian proverb, "ndua nomu wangga levu ndua nomu vusi levu", referring to a man who undertakes a task beyond his powers, says he is one who will get his back crippled if he builds a larger canoe. Williams (1858, vol. 1, p. 87) mentions "'rudder bands' attached to the handle of the oar, and carried towards the *thama*", as employed to relieve the strain. He adds: "Violent blows on the side are often received from the helm, and I have known them cause a man's death". A strong lanyard which served as a preventer stop, also contributed to ease the strain, one end made fast to the shoulder of the blade of the steering paddle, the other made fast round a cross beam of the platform.

These double canoes with a wind on the quarter could attain under favorable conditions a speed of about 12 miles an hour. West (1865, pp. 69-70) describes vividly a trip made in one of them:

> Up went the huge sail, down went the great steer oars, splashing into the sea, and away we shot like a racehorse. The breeze was strong. Every timber of the canoe creaked again, while the mast bent like a reed and cracked in its socket as if it would split the deck in two. . . . Owing to the great rate at which we were going, the sea was like a hissing cauldron on either side of our course, and the vessel, instead of having time to mount over the smaller waves, cut its way through them. . . . We reached Lifuka [in Tonga] safely in about 3 hours, having run a distance of 38 miles. . . . They [the *ndrua*] are highly adapted for sailing close upon a wind . . . within even three points of the wind.

The one course the *ndrua* could not sail on was with the wind directly aft; the great weight of the sail, held down at the tack to the head of the canoe, combined with the pressure of the wind upon it, caused the canoe to run under instantly when set square before the wind. It was to this disability that some of the crew of the *Glide,* wrecked in Fiji in 1831, owed their escape when pursued by Fijian canoes (Best, 1925, p. 246).

Thomson (1908, p. 292) gives the speed of the *ndrua* as from 10 to 15 knots with the wind on the quarter, adding that "though they could lie close to the wind, being keel-less, they made much leeway and were bad sea boats to windward or in a seaway, for the play of the twin hulls was apt to work the lashings loose". Wall (1909) estimates the speed as about the same and states that they could beat to windward at about 4 miles an hour.

CANOE SHEDS

The *ndrua* was housed in an immense shed, large enough to serve as the nave of a cathedral. The walls were low, supporting a great arched roof, heavily thatched. From the open seaward end a slipway led to the water (fig. 241). None now exists.

BUILDING A CANOE

Apart from the immense labor involved in building such a great vessel as the *ndrua* with no better tools than stone adzes and bone drills, it must be remembered that the most part of the carpenters' wages consisted in the feasts that signalized

the inception and accomplishment of every stage in its construction, hence they had no particular incentive to hurry themselves over the work. As a consequence, from start to finish the building of a large *ndrua* took from two to three years (Tonganivalu, 1915, p. 11) but might even extend to seven, inclusive of the time taken to search for timber of suitable size. The greater and more frequent the feasts, the quicker did the work progress, in accordance with the carpenters' proverb, "A tata tu i kete" (The chopping is in the belly). The Fijian notable, Deve Tonganivalu (1915, pp. 9-13), formerly Roko Tui Mbua, who supplies the proverb quoted, gives a good account of the building of a *ndrua* from which the following extracts are made, altered slightly in the translation wording:

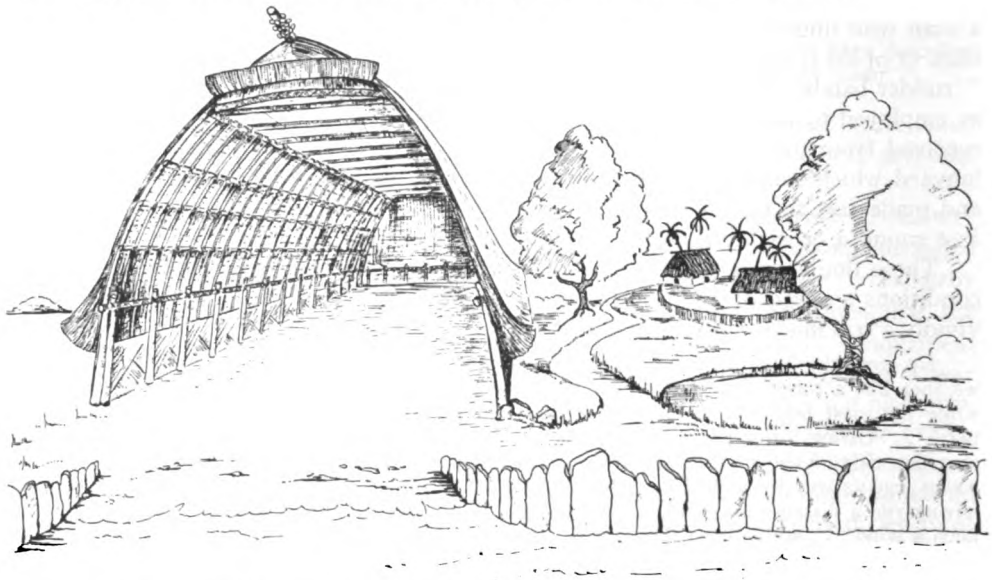


FIGURE 241.—Double canoe shed, one of the last in existence, after a sketch made at Mbau in 1868 by F. A. Franklin (courtesy of Ratu Popi E Seniloli of Mbau).

If a chief intends to have a *wangga tambu* built, he will first prepare presents (*butabuta*), consisting of whales' teeth and other property, for the carpenters; when that is done the various carpenter clans will assemble to talk the proposal over and will detail the property which the chief has presented. When their plans are settled they proceed to select and cut the timber for the *takele,* the dugout keel portion. On the day this is cut, the chief makes a feast called "the feast for the felling of the *takele*". For large canoes there are two *takele,* one for the large end and one for the small end. . . . On the day the *takele* are fitted together, the chief makes another feast for which a man would be killed. When the *takele* is finished, two planks are cut to be fitted as the garboard strakes (*vono tambu*), one on each side of the *takele* to hold its two sections in place. On this day another feast is held. After this the planks for the two remaining strakes are cut and fitted. . . . When all the strakes of both the large and the small hulls have been fitted together, the *bava* is cut, its breadth about 3 feet; the *bava* of the *thama* is always the broader as its hull is not so deep as that of the larger canoe. When the *bava* are tied in position, the two hulls are joined by cross beams, the median one (*kaso tu*) being of *vesi.* Much care was taken to assure the accurate spacing of the beams; if they were badly fitted or if the spacing were wider at one end than at the other, the canoe would be a slow sailer. The fitting of the cross beams being completed, the ribs would be fitted inside. After that the end covers (*tau*) were made and attached. Lastly the cross beams were decked over and a house built upon it.

When the vessel was to be launched, a man [sometimes several men] would be killed to serve as a roller over which to slide it into the water. Before launching, the outside was well smoothed with *imasi ndraundrau,* the leaves of a certain tree which take the place of sandpaper.

W'angga tambu were frequently built as memorials to the dead, and these were called *na lawa ni mate* with the name of the dead chief added, signifying "the memorial of the death of ————". When the building of a *lawa ni mate* was complete, a feast would be made; the chiefs who caused the canoe to be built would make it in honor of the dead person and at the same time present to them the canoe.

Canoes were often made use of as presents, and such were called *musa wangga* or "dedicated canoe": if a canoe was built at Thakaundrove it would be *musa* to Mbau; if built at Lau it would be *musa* to Thakaundrove; they would follow the way appropriate to their mutual relationship or tribal alliances. If the owners of a canoe wished to present it to their relatives at another place they would take the canoe and some whales' teeth to be presented ceremonially to those of the place to whom the canoe was being given; these whales' teeth were called "the token of the dedication of the canoe", and the others would take over the canoe after this ceremony. If the recipients had a canoe of their own they would give it to those who dedicated the new canoe to them and this would be called "the return present for the hull"; if they had no canoe they would make a present of property instead. Through this custom canoes were acquired by lands which had no carpenters of their own to build them.

PRESENTATION AND LAUNCHING RITUAL

An account of an actual presentation of a canoe is given by Williams (1858, p. 41). According to this writer, Tui Nayau, King of Lakemba, desiring to give a new canoe to Thakombau of Mbau, approached and knelt before him.

> From the folds of his huge dress he took a whale's tooth and then began his speech. The introduction was an expression of the pleasure which Thakombau's visit gave to Tui Nayau and his people. As he warmed, the speaker proceeded: "Before we were subject to Mbau, our lands were empty, and no coconuts grew on its shore; but since you have been our chief, the land is full of people and nuts and food abound. Our fathers were subject to Mbau and desired so to be; and my desire and that of my friends and subjects, is toward Mbau, and it is very intense". The sentences here strung together were picked out from a great number of petitions, praying that Tui Nayau and his people might [be permitted to] live. Neither was this omitted in the peroration. "Therefore let us live, that we may chop out canoes for you, and that we may live, I present this earnest (the whale's tooth) of the *Ta-ivei* (the name of the canoe) as our *soro,* and the *soro* of our friends".
>
> On receiving the tooth, Thakombau expressed a wish, almost like an imperial permission, that all might live; whereupon all present clapped their hands. Custom required of the receiver a form like this: "Woi! Woi! Woi! The Sacred Canoe! Yi! Yi! Yi!" and a long shrill shout in conclusion.
>
> All love to make as much display as possible on these occasions; food is provided in abundance and on all hands is seen a liberality approaching to a community of goods; but where there exists anything like equality between those who give and those who receive, the return of similar gifts and entertainment is anxiously expected and carefully calculated beforehand.

With regard to the human sacrifice associated with the launching ceremonies, Wilkes (1845, vol. 3, p. 97) records that when Tanoa launched a canoe 10 or more men were slaughtered on the deck in order that it might be washed with human blood. Wall (1916) also says:

> A new canoe was launched over men's bodies that mana might enter into it and make it swift and safe, but I can find no trace of living men ever having been used for this purpose; they were clubbed first. Certain small islands and districts enjoyed by hereditary right the doubtful honour of supplying the victims for these occasions, as for instance the island of Lauthala for the launching of the vessels of the Thakaundrove chiefs.

At the time of Cook's visit to Tonga in 1773, intercourse with Fiji had recently become frequent, and both Tongans and Samoans were busily engaged in discarding their own inferior type of double canoe for that of Fiji. Having little timber of suitable size and quality, the Tongans from then onward began to obtain their new canoes from Fiji, either as reward from those Fijian chiefs whose cause they espoused in war, or by temporary settlement in the Lau Islands of the Fiji Archipelago where they had them constructed by their own carpenters.

As the building of a canoe took several years, these temporary settlements tended to become permanent and in the course of time a colony of Tongan-speaking

half-breeds arose in most of the large windward islands. The skill of the Tongan carpenters appears to have surpassed that of the Fijian, and so the industry passed largely into the hands of the half-Tongan colonies of the Lau Islands. The islands of Koro and Kambara and the town of Koro Vono on Vanua Levu were the localities particularly famous for the skill of the indigenous Fijian canoe builders; mat sails were made chiefly in Kandavu and the Yasawas (Wall, 1916).

The disappearance of the double canoe from Fiji coincided with the close of the nineteenth century. Few if any were constructed after 1883, the year of the death of King Thakombau, for his grandson, Ratu Popi, informed me that the king's sons two or three years later broke his double canoes to pieces and buried them in a swamp that they might be preserved and kept from being used by anyone else. Thomson (1908, p. 292) estimates that by the year 1890 the number of *ndrua* in Fiji could be counted on the fingers.

RAFTS

On the lower reaches and estuaries of the larger rivers, shaped bamboo rafts are frequently encountered; they serve admirably for the local transport of fruit, vegetables, and light bulky cargo. Quite commonly they venture to sea on visits to coastal villages and islands within the shelter of the barrier reef. One of these rafts (fig. 242) was seen at Mbau in 1925, bringing gifts to the chief. Both single and double rafts exist or did till recently, and of the single there are two varieties.

Of the single type, that seen at Mbau and others seen on the Rewa have the shape of an elongated wedge, narrow and cylindrical at one end, whereas behind, as the stems of the bamboos thicken, the mass flattens out and widens gradually to the broad truncate after end, the functional stern.

> The forward section, about one fifth of the total length, where the bamboos are bunched together by their slender upper ends, is encircled at short intervals by three, four, or five hooped lashings of flexible vines. In the major portion of the raft composing the middle and after sections, the bamboos are arranged in several roughly horizontal layers, of which the uppermost is separated from those below by three or four lengths of stout bamboos laid transversely at widely separated intervals; strong lashings of vines and fibrous bark secure the raft bamboos to these cross bars.
>
> The uppermost layer of bamboos may be considered a primitive decking, for it raises the freeboard of the raft a few inches and so materially contributes to the protection from wet of passengers and goods housed in a large hut erected amidships. This hut is thickly thatched on its two sloping sides, which are formed of a framework of converging boughs secured to a fore-and-aft ridgepole about 4 feet above the center of the decking.

A variety observed by A. M. Hocart on a tributary of the Rewa River, smaller and less well adapted for cargo carrying, is made of a basal platform of bamboos arranged in a single layer, held in position by cross poles to which each bamboo is lashed by a lacing of vines. Along each side a bundle of four or five bamboos is attached, forming a broad, low railing and giving additional buoyancy. These bamboos, as well as those forming the flooring, converge toward one end to form a bluntly pointed prow. The after end is broad and truncate and without any rail protection. (See fig. 243.)

The double raft is described by Alexander (1902, p. 793) as consisting of two great bundles of bamboo poles lashed together in the shape of a double canoe:

> Each bunch of poles is about 40 feet long and 4 or 5 feet in diameter in the center, tapering at the ends. The bunches are placed side by side a few feet apart, and connected by a bridge of the same material; on this bridge is a platform housed in a manner somewhat similar to a native hut on shore, top and sides thatched. Under this cover are the living quarters. This style of canoe is frequently seen at the wharves at Suva.

All rafts are propelled by punting poles.

FIGURE 242.—Fijian cargo raft consisting of wedge-shaped mass of bamboos, over which, but separated by three or four stout bamboos laid transversely, a decking of a single layer of bamboos is placed, tied down with vines; on this a thatched hut is built for protection of passengers and cargo (photographed at Mbau, 1925).

The only other references to rafts in literature appear to be the bald statement by Williams (1858, p. 76) that "a queer thing, called *ulatoka*—a raised platform on two logs—and a catamaran made of bamboos, are used in the bays and rivers", together with a figure given by Krämer (1902-3, pt. 2, p. 269) of what he terms an *oaunga* (*wangga*) from Ovalau, a contrivance of the same design as the *ulatoka*.

A model of an *ulatoka* in the Fiji Museum, Suva, may be described as a miniature double canoe in which the hulls are solid instead of hollow:

As in the *ndrua*, one hull is longer than the other, with a long straight keel line, and has sharp, vertical cutwater ends, whereas its shorter companion is bowed on the under side or bottom, with slender, attenuate ends but with the extreme points cut off square, exactly as in the *thama* of a *ndrua*. The median region in each hull for about one third the over-all length is shaped to represent a narrow raised platform, truncate at the ends, evidently intended to represent the middle section of a Fijian canoe inclosed by the deep sides of the *mbava* boards (fig. 244, *a*).

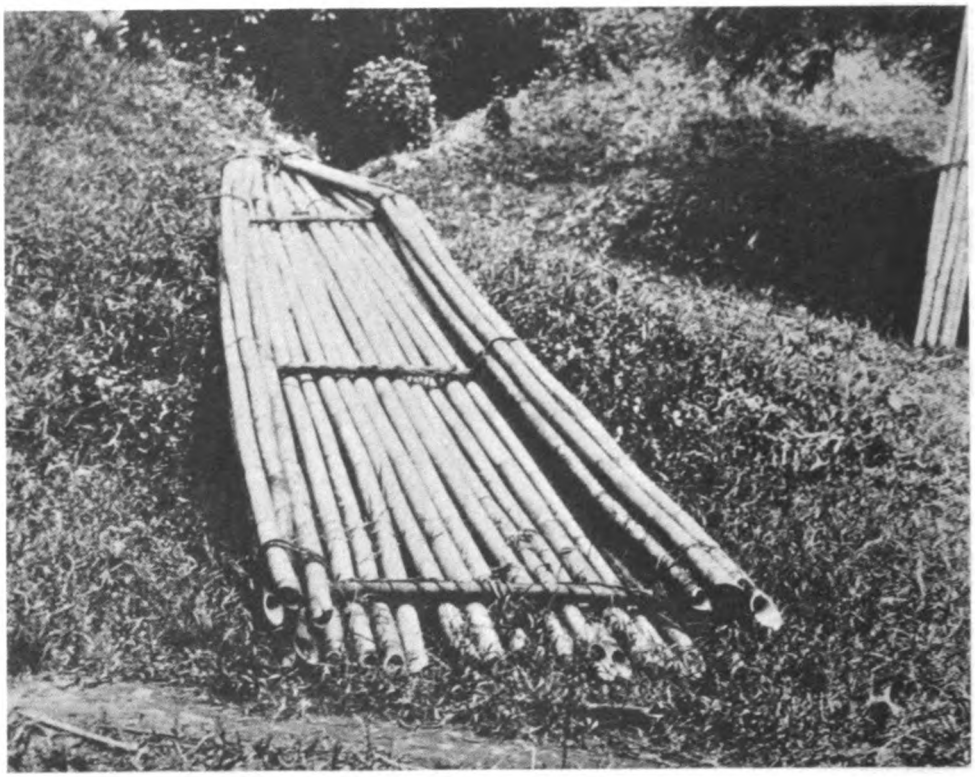


FIGURE 243.—Small Fijian river raft of bamboo, seen stern on (photograph by A. M. Hocart).

The median regions of the two log hulls are connected by a framework consisting of two horizontally crossed poles, the booms, attached to the opposed hulls by inserted unpaired stanchions. Each end of either boom is supported on two of these stanchions, an outer and an inner. Each outer one inclines toward the adjacent end of the hull, its head lashed to the extreme end of the boom to which it pertains. The inner, which is inserted some distance proximal to the base of the outer stanchion, is inclined inward toward the opposite hull, its head lashed to the boom about midway between the attachment of the outer stanchion and the point between the two hulls where the two booms cross one another and are lashed together. To stiffen the frame a stringer pole connects the ends of the booms above each of the two hulls and is lashed on at the points where the outer stanchions are made fast to the booms.

The "oaunga" figured by Krämer is considered by him to be not a model of a primitive means of water transport but merely a plaything used by youngsters in their water games. Except that it lacks the stringers connecting the ends of the crossed booms (fig. 244, *b*), it agrees in the details of its construction with the Suva model and with Williams' description of an *ulatoka;* all three must represent the same kind of primitive craft. On Williams' evidence it appears certain that it was one actually in use in Fiji up to the middle of last century, and not merely a toy as inferred by Krämer.

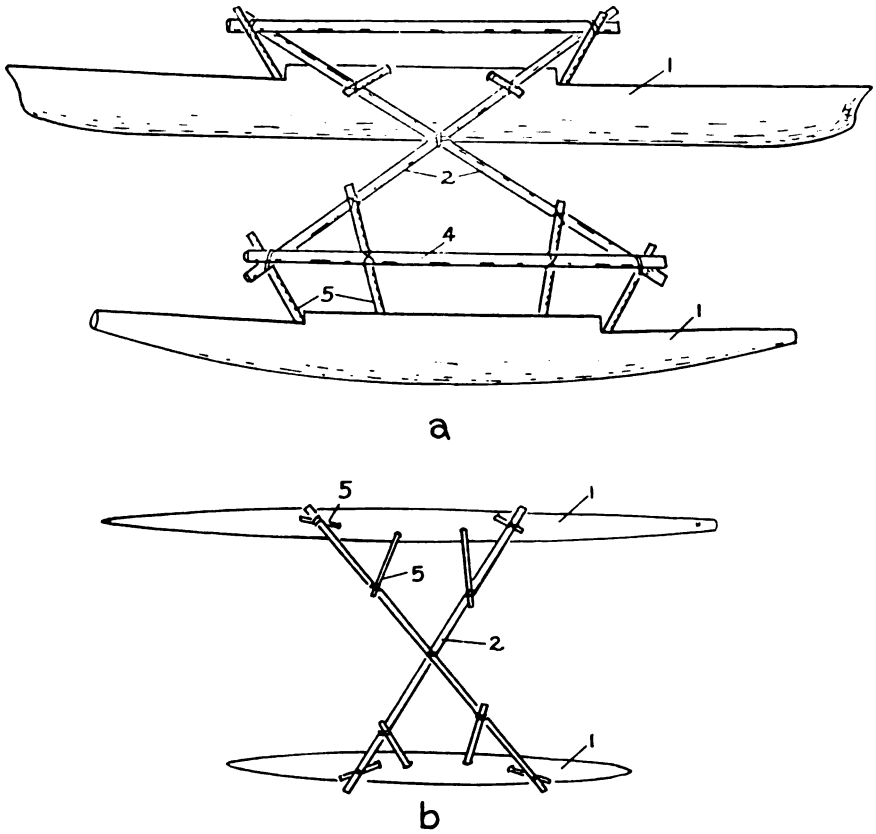


FIGURE 244.—Fijian double rafts: *a*, model of an *ulatoka* (Suva Museum, Fiji); *b*, *oaunga* or toy canoe, according to Krämer (1902-3, pt. 2, fig. 108); 1, solid twin hulls; 2, booms; 5, stanchion connectives; 4, stringers.

As Williams describes the full-sized *ulatoka* as having a raised platform, it is probable that this consisted of parallel battens or poles laid across the X-shaped boom frame in the same way as is seen in the figure of the Samoan model (fig. 173) described by Thilenius (1901, fig. 3, p. 170) as an *amatasi.*

FIJIANS AS NAVIGATORS AND CANOE-BUILDERS

Considerable difference of opinion has been expressed regarding the enterprise and courage of the Fijians as navigators, but none may doubt their exceeding ingenuity and ability as canoe designers and their skill in handling their vessels. They evolved the largest, swiftest, and most seaworthy double canoes ever constructed and it is a moot point whether their sailing outrigger is not superior in

speed and weatherly qualities to those marvels of design, the "flying proas" of the Carolines—by many considered the swiftest and most beautiful sailing canoes ever built.

It is sometimes assumed that the Fijians never ventured beyond the limits of their own archipelago (Williams, 1858, p. 85), but against this opinion is that of Lawry (1850, p. 270), who says:

> These islanders are bold navigators, and make somewhat distant voyages; but being unacquainted with the use of the compass, they are sometimes in danger of missing the place of their destination. They steer by the stars, and when these are obscured, by the direction of the wind, which in tropical climates is pretty constant.

Commodore Wilkes, who was in the islands about the same time (1840), characterized the Fijians as "daring navigators" and their canoes as "superior to those of the other islands"; he described them (1845, vol. 3, p. 366) as making "very long voyages—to Tonga, Rotuma, and the Samoan islands". Speiser (1923, p. 250) refers to Fijian voyages to the New Hebrides.

The Tongans, conversely, have been lauded as bolder navigators and the presence of Tongan settlements and culture in far distant islands of Melanesia is instanced in support. Without calling in question the seafaring intrepidity of the Tongans, it must be pointed out that much of this seeming activity was involuntary and due as much to the inferiority of their sailing craft as to their innate enterprise and skill. Their sailing double canoe, the *tongiaki,* was a craft so clumsy and ill-designed that it could not beat to windward; when a favorable wind failed, there was no alternative but to change course or drift with the sail down, with one of two results—either the crew perished or they landed as castaways on some distant island.

We hear nothing of such involuntary settlements on the part of the Fijians; owing to the superior sailing qualities of their canoes, they were normally able to continue a given course, even against a head wind. Doubtless some lost their bearings and went astray when the sun and stars were obscured, but these must have been few compared with the numbers of Tongan canoes blown out of their course on voyages to and from outlying and distant island dependencies of Tongatabu.

ORIGIN OF FIJIAN CANOE DESIGN

The affinities of the *thamakau* are distinctly Micronesian. The rig is identical with the highly specialized type characteristic of that region: the sail is a typical Oceanic lateen and the mast is stepped amidships, thereby allowing of arrangements whereby the canoe may sail either end forward; the rigging is also similar, with weather shrouds led outboard to the booms, and with the fore stay and the back stay arranged as running stays to permit the mast to be raked toward either end at will; the suggestion of a lee platform is present and the great steering oar is well on the way to become a quarter rudder.

In regard to hull construction, the form of the ribs suggests Micronesian influence rather than Melanesian. The internal framework agrees closely with that of Gilbert Islands canoes in being half timbers in direct contact with the side strakes, in contrast to the full framing of Solomon Islands canoes, in which each timber is continuous from gunwale to gunwale of the hull and separated from the strakes by the thickness of the cleats to which they are tied. Distinctly and characteristically Micronesian is the maneuver of Fijian canoemen to get extra speed, namely, the counterpoise of the outrigger so nicely adjusted that the float skims the water, barely touching it, instead of being partly immersed.

These features appear as grafts upon an orginally Melanesian design characterized by adherence to the low extremities of the primitive dugout and the retention of a typical Melanesian stanchion attachment.

The affinities of the double canoe are more difficult to unravel. The nearest relative to the *ndrua* is the indigenous double canoe of New Caledonia, a type displaced within historic times in the Isle of Pines, the south coast of the mainland, and in some of the Loyalty Islands by a rude copy of the *ndrua* itself, introduced by Tongans after they had begun to adopt this design toward the end of the eighteenth century. The relationship is, however, a distant one and must go back to a common ancestor.

The ancient New Caledonian design is characterized by hulls of approximately equal dimensions, with the broad and overhanging ends associated with the craftsmanship of the most primitive of canoe builders—the Andaman Islanders and the African negroes; their sails were equally primitive and frequently two in number, one in each hull. In Fiji these features disappeared under the same influence that shaped the eventual design of the *thamakau*. The ends of the hulls were refined and the Micronesian rig adopted. To Micronesia must be traced the central or bridge position of the deck platform as opposed to the end-to-end decking of New Caledonia and the longitudinal and median one placed between the hulls which is characteristic of the majority of Polynesian double canoes.

Without careful consideration of the very primitive features retained by the ancient double canoes of New Caledonia, it might be decided that in the Fijian *ndrua* the smaller hull has been evolved from the float of an outrigger. In favor of this view may be adduced the marked inferiority in size of one hull, the similarity of its longitudinal curvature, and the slender subacuminate form of its extremities, as well as the fact that it goes by the same name, *thama*, as the float of an outrigger canoe. But these similarities are more apparent than real. In view of the fact that the Fijians modified their outrigger type under the influence of Micronesian contact, we may be sure that this influence would extend also to the design of their double canoe; the Fijians as expert canoemen would soon realize the advantage of modifying one of their originally equal-sized and clumsy hulls into the enlarged and hollowed counterpart of an outrigger float, and if so, it would be natural to transfer to it the name by which the float had come to be known. This conclusion receives confirmation from the fact that all other double canoes in Oceania, apart from the later ones of Samoa, Tonga, Rotuma, and other islands which are known to have been copied from the Fijian design, have the two hulls approximately equal in size and shape. We have also to remember that *ama* (*thama*) may equally well have been an original term for the weather hull of a double canoe, and that it may have been from this source that the float of an outrigger canoe derived its name, rather than conversely.

TECHNICAL TERMS

Imbe ni latha: matting of sail.
Ironggele: streamers attached at intervals along boom.
Karikari sila: boom of sail.
Karikari tu: yard of sail.
Kaso: cross beams supporting *rara;* true *kaso* in outrigger canoes are not attached by stanchions to float.
Kaso tu: median and strongest boom connecting canoe hull with float.
Kaso tu mata: outer booms connecting hull and float, one on each side of *kaso tu.*
Kaso rara: plank laid transversely across front of deck platform, usually carved.
Kata: larger hull in double canoe.
Kola: wedges inserted under lashings to tighten them.
Latha: sail.
Latitumbu: breakwater closing in ends of *mbava.*

Lomba: shroud.
Lomba ni ndamanu: lower shroud attached at upper end of main section of mast.
Lomba ni vesi: upper shroud attached to *ndomondomo* which is made of *vesi* wood.
Lotho: middle joint or section of either yard or boom.
Mangimangi: sennit; plaited coconut braid.
Mbati ni lairo: deeply notched heel of mast; literally "crab's claw".
Mbava: deep median board between deck platform and washstrake.
Mboto: marlin spike.
Mua: either end of canoe.
Mua lailai: small end of canoe; stern.
Mua levu: large end of canoe; fore end.
Ndamanu: lower and main section of mast, made of *ndamanu* wood.
Ndarandara ni tauoko or tautauoko: hole in cleat on inner side of *tau* through which rope attached to tack of sail is passed to hold heel of yard in its step.
Ndarandara ni uthu i mua: vertical hole in lead at fore end of *tau* through which running mast stay passes.
Ndarandara ni vaka rewa: sheave hole in *ndomondomo* through which main halyard is rove.
Ndoko: poling stick or quant.
Ndomondomo: topmast, with "truck" through which halyards pass.
Ndreke: interior or well of canoe.
Nduru: L-shaped knees supporting lee rail of *rara*.
Nima: bailer.
Rara: platform or deck of canoe, formed of planks laid longitudinally over booms.
Rokoroko: mast strut or shore.
Roroi: slender rods lashed to one side of *lotho* (middle section of mast) to strengthen it.
Rukuruku: space between *kata* and *thama* under the platform, in double canoe.
Sau: horizontal leads for running stay along weather side of each *tau*.
Saulatha: sail needle.
Sausau mbulu ni wangga: calking tool.
Semakina: scarfed joint.
Soka: rib or half frame within hull.
Sua: scull.
Sukui: distal section of either yard or boom.
Takele: dugout basal part of double canoe hull; equivalent to keel.
Takia: dugout outrigger canoe of simplest sort.
Tamba marawa: outermost stringer in outrigger frame.
Tanganga: a *ndomondomo* surmounted by crescentic "truck".
Tau: triangular decking at each end of canoe.
Tauoko or tautauoko: perforated cleat at fore end of each *tau* to which heel of yard is made fast.
Tawake: long flag or ensign flown by high chiefs at yard arm.
Thama: float of outrigger canoe and also smaller hull in double canoe.
Thamakau: large sailing outrigger canoe.
Tokatoka ni vu: curved ridge at fore end of each *tau* forming step for heel of yard.
Tuki: Carpenter's mallet.
Tuku: running stays; see *uthu-i-mua*.
Uli: steering paddle.
Umbi ni ndreke: hatch cover.
Uso ni uli: hole in shoulder of steering paddle for attaching preventer lanyard.
Uthu i mua: running stays which form respectively fore stay and back stay of mast; also *tuku*.
Vakavu; proximal of three main sections of either yard or boom.
Valevale or vale wangga: deck hut.
Vana: mast.
Vanga ni ua: low rail along lee side of *rara*.
Vatoto: stanchion connectives between float and outrigger booms.
Vavanda: curved wooden strut from each corner of *rara* to near end of hull on lee side.
Veikuku: short butt piece spliced to lower end of yard, fits into sail step.
Velovelo: any small outrigger, either *takia* or *wangga vakatau*.
Virimbale: halyard; upper one.
Voivoi: lauhala used in making mat sail.
Vono: strake or run of planking in canoe hull.
Vono laulalo: second strake.
Vono mbati ni wangga: topmost strake or washstrake.
Vono tambu or ivatui: garboard or lowest strake.
Vothe: paddle.
Vungakoto or vunganggele: mast step or chock.
Wangga ndrua: double canoe.
Wangga tambu: "sacred canoe"; a double canoe reserved for the use of those of chiefly rank.
Wangga vakatau: *takia* with ends covered and made fit for work at sea.

NOTE: To be grammatically correct some of the above terms require the particle *i*, to distinguish the noun from the verb; to prevent misunderstanding it appears preferable to omit it here.

CULTURAL DIFFUSION IN POLYNESIA AND FIJI

In any review of the evidence bearing upon the major population movements in and into Polynesia to be deduced from a study of the canoe designs found in the island groups in the Pacific, cognizance must be taken of two distinct classes of vessel—outrigger canoes and double canoes. In the outrigger canoes, besides the hull form and the sail rig, the number of outrigger booms and the method of their attachment to the float claim particular attention. In the double canoes the form and relative proportions of the hulls are to be noted.

OUTRIGGER CANOES

In Polynesia two main types of the single outrigger canoe are found, characterized respectively by: 1, direct attachment of the outrigger booms to the float; and 2, the intercalation between the booms and the float of connectives which consist typically of overcrossed stanchions.

Direct attachment is found in two varieties, the lashed and the inserted. The lashed form is used generally in the more remote or peripheral areas: typically in Hawaii, generally in the Tuamotus, and formerly in Easter Island. In the Society Islands the direct type of outrigger attachment, which may be either lashed or inserted, is used, in combination with but subordinate to the indirect, stanchion attachment. Westward and southward of the Society Islands direct attachment when present is of the inserted type: it appears in several islands of the Cook and Austral archipelagoes, in Tutuila (Samoa), and in the Ellice Islands. Everywhere else the stanchion attachment is found—in Samoa (except partly in Tutuila), Tonga, Tokelau, New Zealand, and the Marquesas (old type).

Associated with the direct system of attachment is a limitation in the number of the outrigger booms. In Hawaii, the Tuamotus, Easter Island, and the Cook and Austral archipelagoes the number is limited to two. Two is also the invariable number in the Society Islands.

Conversely, those canoes with stanchion connectives are normally multiboom canoes. Except in the smaller canoes, which usually retain primitive features longer than those of large size, the outriggers of Samoa, Tonga, and the Tokelaus have more than two booms; the old type, now extinct, of Marquesan canoe was similarly multiboom in the larger sizes and those of Fiji are invariably so equipped. Only in the Ellice Islands is direct attachment linked with the use of three or more booms.

Of these two types, that with direct attachment and few (two) booms is the one to which the available evidence points as belonging to the non-Melanesian people who first migrated, doubtless in repeated waves, into the Polynesian area—the proto-Polynesians. The peripheral or remotely marginal location of these two associated features furnishes extremely strong evidence of the superiority of its antiquity over the stanchion and multiboom type in this region; the simple and primitive character of its design indicates that it was brought into Polynesia by a northern route which did not make contact with Melanesians until it met these people in areas which are now included in southern and western Polynesia.

The multiboom type and stanchion attachment are characteristic of Melanesia, being general there except in the Solomons, where outriggers are all but absent; the attachment may be either undercrossed or overcrossed. In Polynesia this type is most strongly in evidence in the islands that lie nearest to Fiji, the present-day outlier of Melanesia; in Tonga, Samoa, and the Tokelaus this connection is all but universal apart from the U type of Tonga which may be either a modern and local

modification or an introduction from outside in comparatively recent times. The only exceptions are found in the Ellice Islands and in Tutuila in Samoa. In the Society Islands, as already noted, the stanchion type is characteristic of the fore-boom attachment, whereas the after boom, the less important of the two, is attached directly or semidirectly to the float.

DOUBLE CANOES

The primitive Polynesian double canoe was typically a vessel with twin hulls as nearly alike in size as possible; when there was any difference it was confined within narrow limits and there was never any great disparity as in the Fijian design.

The simplest was that of Hawaii, where the hulls were long dugouts of equal or subequal size, provided with bipartite end pieces and low, inconspicuous extremities. In the type known to Cook, Freycinet, and Paris, the connecting booms were bowed above the space between the hulls; but, according to Malo (1903, p. 173), this was a comparatively modern alteration, the older type having had straight booms, thereby falling into line with the double-canoe design found in all other Polynesian islands apart from that copied in recent times from Fiji by the Tongans and Samoans. A median longitudinal platform which rested upon the booms where they spanned the interval between the hulls accommodated the passengers and cargo, leaving the two hulls clear for the use of numerous paddlers. A triangular sail tied to an upright mast had a curved boom, or boom sprit, along the lower and after side, but possessed no yard.

In the Tuamotus the Polynesian type of double canoe attained high development. Owing to the scarcity of large timber on these low islands, the hulls could no longer be fashioned out of entire tree trunks, supposing this to have been the original type, which it may not have been. Necessity drove the islanders to construct the hulls of many irregularly shaped pieces of plank, neatly sewn together, edge to edge. This had, however, a compensatory benefit, for it enabled them to build vessels more beamy and of greater depth; these vessels had, in consequence, greater freeboard, whereby the provision of wider and more convenient decking became possible, completely covering in the space between the hulls. Another consequence was the development of sailing power. The larger vessels were two-masted and some appear to have carried an early form of the Oceanic lateen fitted with both boom and yard but slung from a fixed mast which might be either a vertical pole or two converging spars forming a sheer mast.

A notable feature was the presence of inserted frames to strengthen and stiffen the hulls, analogous to those seen in the Moluccan *orembai* and the Solomon Islands *mon,* but sewn directly to the hull planking with sennit passed through holes bored through the planks, whereas in the *orembai* and the *mon* the frames are lashed to comb cleats projecting from the inner side of the hull planking. The Polynesian hulls differed further in being keeled instead of round-bottomed as in the *orembai-mon* type.

As in Hawaii the ends were low, but do not appear to have been covered with end-deckings, their high freeboard enabling them to dispense with this protection.

The only other Polynesian areas where the ends of double canoes remained low were Samoa, Tonga, Tokelau, and the Ellice Islands. Apart from this feature the design was altogether different in these islands; the ends were covered in as in Hawaii but by a different method, and the median decking became an extensive raised platform on which the crew as well as the passengers were accommodated.

The sailing rig in these other islands was a primitive form of the true Oceanic lateen, the yard resting within the jaws of a masthead crutch; the mast itself raked forward permanently. So far as can be judged, this design was influenced by Micronesian contact.

In the Society Islands the double canoe had two fundamentally different types. One, used for deep-sea voyaging, approximated to that of the Tuamotus, from which it was distinguished merely by local and secondary differences. The second type was of two forms: one, used for local and coasting traffic, was low at the head and curved high at the stern; the other, the war canoe possessed only by the greater chiefs and the priesthood, was distinguished by the upward curvature of the head, though to a much less degree than the stern. Of these types the first, in the low form of the ends, was most closely related to the proto-Polynesian design, whereas the inserted frames, tied directly to the skin planking, were a modification of a method similar to that seen in the *orembai-mon* type of vessel, resorted to in order to economize timber and reduce the amount of labor required when transforming it into planks. The second type, in its usually low head and tall, upcurved, and ornamented stern, incorporated features characteristic of the canoe design of the Marquesas, New Zealand, and the Cook Islands, where the hulls of canoes whether outriggers or twins were typically low at the head with the stern curved up high. Both the heads and the sterns were richly ornamented with carving, exceedingly profuse in the Maori canoes. The resemblances between the vessels of the Marquesas and New Zealand are so numerous and close—they extend to the method of joining two or three sections end to end to form one hull, to the decoration of the seams with feathers, and to other notable characteristics—that it is certain they arose from a common source; from the character and motives of the carved ornament it can not be doubted that this was due originally to Melanesian influence or contact. The Cook Islands canoes have close relationship with those of New Zealand and of the Marquesas and serve to connect the designs of the two localities.

SUMMARY OF CONCLUSIONS

Summarizing the facts enumerated above, the fundamental canoe types of Polynesia, whether outrigger or double, are reducible to three in number:

1. Proto-Polynesian. The hull with pointed ends, inclined upward but little emphasized; possibly plank-built and keeled originally; strengthened by inserted ribs which may be either functional (Tuamotus) or vestigial (Hawaii); sail rig, a primitive spritsail; outrigger canoes with direct attachment.

2. Melanesoid-Polynesian. Canoes with the head low and the stern curved up high and profusely ornamented with carving; without a keel; outrigger attachment consisting of overcrossed stanchions; sail, a primitive spritsail, triangular or sub-triangular.

3. Tangaroan. Hull plank-built, with ribs tied to ridges or to comb cleats, the planks sewn together through holes bored in marginal ridges on the inner side; sail, a primitive lateen.

The third type was introduced in all probability by an Indonesian people who worshipped Tangaroa as their principal god and who raised Polynesian civilization to its highest pitch. They are the Tongafiti of Smith and the Arii of Handy.

If, as I believe, the evidence points to the Hawaiian canoe types as having retained more characters distinctive of the craft used by the proto-Polynesians than the canoes of any other area, the Tuamotus being the next most nearly related, we are faced with the problem of why this should be so. Three alternative explanations are possible: either that the proto-Polynesians arrived in and colonized all the Polynesian island groups via Hawaii; or that Hawaii alone was reached by this

direct route, the rest of the migration passing by a different and more lengthy one; or that all of the incomers, probably in several successive swarms, arrived after coasting along the shores of the Melanesian islands stretching from New Guinea to Fiji and that Hawaii was colonized by way of the Society Islands.

The last of these hypotheses is the one generally accepted, but some writers, including Smith (1921, pp. 125-131), credit a tradition which traces the original colonization of Hawaii to a party of adventurers under the leadership of one Ira-panga, who is believed to have sailed direct from Indonesia by way of Micronesia to Hawaii about the year 450 A.D., as deduced by Smith from genealogical data. Possibly the first settlement was earlier than this, for skulls and human artifacts have been dug from under ancient lava flows in Hawaii (Fornander, 1878, vol. 1, pp. 164-165) that date to a period judged to be earlier than the fifth century.

Leaving this question of the date of the first settlement aside, the evidence afforded by the simplicity and primitive design of Hawaiian canoes, both outriggers and double canoes, favors the hypothesis that the earliest settlers reached the islands by a route which did not bring them into contact with Melanesians, a route through or from the Carolines such as that envisaged for Ira-panga.

The conditions prevailing in what is now Polynesia at the time of settlement by the proto-Polynesians, as deduced from a study of their canoes, leads to the conclusion that all the northern and eastern island groups were uninhabited, whereas probably Tonga and some of the Cook Islands, together with Fiji, were inhabited by Melanesians. The fact that the peripheral region, Hawaii and the Tuamotus, shows no Melanesian features in canoe design, indicates that the inhabitants could not have been in contact with Melanesians in the course of their movement from place to place. If this be granted, it follows that this route could not have been a southerly one skirting the Melanesian chain of islands. Eliminating this route, the alternatives are by way of Micronesia southeastward to Samoa, or else by way of Hawaii. Either is possible; by both routes the passage of the migrants would traverse a large part of Micronesia but differ in degree and direction. Even now no strong Melanesian influence is traceable in the canoe designs of the Micronesian region, where the present characteristic type must have evolved subsequent to the passage through or sojourn in the archipelago of the proto-Polynesians.

Certain features in the design of Micronesian outriggers possess distinctly Polynesian affinity in spite of the adoption of specialized features which tend to obscure this fundamental relationship. The principal of these features common to both areas is the limitation of the number of main or true outrigger booms to two (the Carolines generally and the Marshalls). Still more significant is the fact that in addition to the record of the use of double canoes in Micronesia (Morrell, 1832), the Truk Islanders attach peculiar religious significance to certain models of the double canoe which they keep in their clubhouses; this suggests a memory of a time when the double canoe was in use in the islands and when this form of craft held a position there more or less analogous to that of the *va'a atua* of the Society Islands or to the *wangga tambu* of the coastal Fijians influenced from Polynesia. However this may be, in the central Carolines there is evidence, both presumptive and direct, of the former employment of a form of double canoe directly comparable with that of Hawaii, the hulls being equal in size.

What renders the route of the proto-Polynesians through Micronesia the more probable is that their fundamental canoe design, as seen in Hawaii, of unornamented hull, with low ends, and, in the outrigger canoes of direct attachment of the float, is equally characteristic of the Philippine Islands, the most suitable place of departure for voyages into Micronesia (Hornell, 1920, *a*, p. 76).

The same features are found sporadically throughout Indonesia, and peripherally in Ceylon and southern India, which suggests that a design embodying these characteristics was the original from which all others in this region have been derived.

If it is allowed that the Ira-panga tradition and other evidence that the proto-Polynesians reached Hawaii direct from the Carolines and the Marshall Islands is reasonably conclusive, what of the colonization of the other areas? Did the Hawaiians go south to the Tuamotus and the Society Islands and thence westward to Samoa or Tonga, or was the remainder of the colonization independent and in the reverse direction—from west to east—from Fiji to the Society Islands? The first theory conflicts with generally accepted ideas, but from study of the canoe designs of the Pacific it has much in its favor.

An insuperable objection to the alternative that the fleets of the proto-Polynesians coasted successfully the great length of the Melanesian chain, inhabited by a savage and hostile population, is the fact that there is no trace, in the presence of double canoes or of outriggers with direct attachment, of their sojourn in any of the Melanesian islands where they would have halted for lengthy periods in the course of such a migration. Conversely, a much later Moluccan movement which reached the Solomons left emphatic evidence of its presence there in the gift of the *orembai* design to the natives of that archipelago, a design which supplanted the indigenous type and has survived to the present day.

The theory of the direct colonization of Hawaii is not a new one. Ellis (1832, vol. 1, p. 123) regarded the Tahitians as offspring of the Hawaiian stock; the longer genealogies of the Hawaiians indicated in his opinion a higher antiquity. Hedley (1897, pp. 230-231) favored a related hypothesis and his remarks are so pertinent and clearsighted that it is useful to quote them at length:

> The route of the Polynesian from southeast Asia to his present abode is generally held to have been through Papua, southeastward through the larger islands of the western Pacific, by Fiji to Samoa, thence to Rarotonga, and finally to Hawaii. Against this it seems to me an insuperable objection that the Samoans and eastern Polynesians were without any Papuan strain physically, and had acquired none of the Papuan manners and customs, such as the art of pottery, which a transit through Papuan lands could not fail to impress upon them. Besides, at the point of contact between the two races we now see a contrary wave of Polynesian blood and influence actually in motion from east to west. In the Fijian archipelago there is a gradual transition from a preponderance of Polynesian in the east to a preponderance of Melanesian in the west. Less marked but perceptible is the change in the New Hebrides, and in the Solomons it can again be faintly seen, while New Caledonia farthest west appears purest Melanesian. Even in the east of New Guinea, Polynesian influence is traceable, though here once more it declines westward. . . . Had the Polynesian migration taken the route usually ascribed to it, why should not its influence have been as strongly impressed on the west as it is on the east of the Melanesian tribes; why should that influence rapidly increase eastward, and above all why should the brown man, while leaving his mark on the susceptible black, yet have entirely escaped reciprocal treatment?
>
> An alternative hypothesis which would avoid these objections but which does not seem to have been examined, is that the Polynesians traveled from Asia, first to the Hawaiian group and after, perhaps, considerable sojourn there, migrated to Tahiti and thence to Samoa. Two suggestive facts may here be mentioned; one is that Hillebrand considers the *Broussonetia*, or tappa plant, the most peculiar possession of the Polynesian, to be a native of Japan; the other that Japanese junks have drifted to Hawaii with occupants still living.

If it be objected that it is most unlikely that the proto-Polynesians after reaching Hawaii should find their way to eastern Polynesia, I would answer that the migration of birds, notably that of the golden plover, which takes place periodically from Alaska to central and eastern Polynesia, with Hawaii as a half-way resting place, would sufficiently impress the proto-Polynesians as to induce them to follow

in their canoes the southward flight of these birds in the certainty that land lay in that direction. (See Cartwright, 1929, pp. 105-121). The discovery of New Zealand by Polynesians is attributed by Smith (1921, p. 216) to observation of the annual migration of the *kohoperoa* (long-tailed cuckoo) of New Zealand to and from the islands of the central Pacific. To people who had reached Hawaii from Micronesia, the voyage to the Society Islands, in the wake of the birds, with Palmyra, Fanning, and Christmas islands and others as intermediate resting places, would present no insuperable difficulty. In this way I conceive the movement into nuclear Polynesia came about.

From the Society Islands with Raiatea as their religious headquarters, it would be easy for the newcomers to radiate eastward and southward to the Tuamotus and the Australs, and westward to Tonga and Samoa and thence on to Fiji, where their colonizing progress would be checked by a barrier of powerful Melanesian tribes. With this contact would begin in varying degree a mingling of certain forms of material culture, among which canoe design would play a great part.

As Melanesians succeeded in reaching a point so far east in the Pacific as Fiji, where they still form the predominant and aboriginal part of the population, there is no inherent reason why they should not have reached Tonga and the Cook Islands. Indeed, Balfour (1917, pp. 356-381) has shown that there was a strong Melanesian influence in the culture of Easter Island, but whether Melanesians settled there or were taken there in numbers by Polynesians can not be determined. If, therefore, Melanesian influence at one time extended farther eastward than at the present time, Melanesian traits in the outrigger attachment of the canoes of the Tongans, Samoans, and Society Islanders, and, more particularly, in the design and ornamentation of the canoes of the Marquesans and New Zealanders, may best be explained by a fusion between the two races consequent upon the Polynesian conquest of islands inhabited originally by Melanesians. After the conquest it is probable that the Melanesians by reason of their servile condition and superior local knowledge would be employed as fishermen and canoe paddlers. In this way certain of the Melanesian canoe features, if found of superior value to the equivalent Polynesian ones, would tend to find their way into the design of the craft employed by the conquerors.

Inequalities now found in the proportion of Melanesian culture (as shown in canoe design) incorporated with the original proto-Polynesian culture would arise from differences in the proportions of the two races amalgamated in the population of the respective islands. In small islands, sparsely inhabited, submission would be made to a strong force of invaders more readily than in large, well-populated ones; in the small islands the original inhabitants or what were left of them would become the slaves of the incomers and gradually fuse with them; in the large islands resistance and warfare would tend to keep the races apart and so embitter their relations that when ultimately vanquished the Melanesian inhabitants would be either exterminated or driven out.

The mixed attachment of the Society Islands outrigger is also due to a mingling of Melanesian with proto-Polynesian culture, but this probably originated through diffusion and not by adoption from a conquered indigenous Melanesian population.

Handy (1930) has attributed certain elements of Society Islands culture to a late incoming ruling caste, the Hui Arii, of Indonesian origin, who are to be equated with the Tangaroans of Williamson (1924) and to the Tonga-fiti of Smith. To these people, who, unlike the proto-Polynesians, came into the central Pacific by way of the Melanesian archipelago, may perhaps be attributed the form of

Tahitian war canoe with upturned ends pictured by Cook's artist, as well as the crescentic canoe from Rurutu seen by Ellis. Against this conclusion has, however, to be set the fact that in Samoa and Tonga, which were strongholds of the Tangaroans, canoes of crescentic hull type are entirely wanting, although the *mon*-like *taumualua,* really a modern innovation, has been suggested by Thilenius (1901, pp. 167-172) to be a revival of a type anciently in use.

The cultural influence of the Indonesoid Tangaroans, and indeed the whole of their relationship to the island communities which they succeeded in dominating, are comparable with those of the Normans toward the Saxon inhabitants of England after the Norman conquest; the results must have differed greatly from area to area according to the measure of their success in impressing their personality and customs upon the mass of the old population. In this way many differences would follow in the degree to which their designs of canoe construction became merged with the indigenous ones and especially in the extent to which the characteristics of their plank-built type of hull construction were incorporated in or rather grafted upon the older ones of the proto-Polynesians.

At the same time the possibility, or rather the probability, can not be overlooked that the use of plank-built canoes having inserted ribs with attachment to comb cleats may have been original features of proto-Polynseian canoe construction. There is evidence that inserted ribs tied to cleats is a very ancient method. The Vikings had it highly developed in the eighth century A.D. in association with nailed or spiked hull planking, and I have seen in the Bergen Museum an ancient plank, dug out of a bog, with similar cleats but with marginal holes for sewing the edges of the planks together, clinker fashion, which must be much older than the Viking period—probably dating back to the beginning of the Christian era (Hornell, 1932*a*, pp. 463-465). Still older is the Als boat in the Copenhagen Museum which dates back to the beginning of the Iron Age (*c.* 400 B.C.); in this the cleat attachment of each rib is multiple on each strake (Hornell, 1935). If such high antiquity can be claimed for this method of boat-building in Europe, there is no difficulty in envisaging a very early date for its original introduction into Polynesia, where it is found in several variations, some degenerative or vestigial (Hawaii and Niue), some developed and improved into direct attachment to the hull planking (Tuamotus), and some perhaps even adapted to new purposes (Manihiki, Tongareva, and possibly New Zealand). The inference from this wide peripheral and sporadic distribution of inserted ribs would be that plank-built canoes were originally taken by the proto-Polynesians in their migration into Polynesia, where the design suffered degeneration (except in the Tuamotus), as for example in Hawaii, where it was easier to dub out a big dugout than to build a vessel with planks, owing to the large dimensions of the timber available for the purpose.

If this view be correct, the contribution of the Tonga-fiti or Tangaroan Arii to canoe design in Polynesia would be little more than the revival of the employment of inserted frames lashed to ridges and comb cleats in Fiji, Tonga, and Samoa. Except on the hypothesis that inserted ribs or frames were twice introduced into Polynesia, it is difficult to explain the peripheral and sporadic distribution of this feature in a degenerative condition and to reconcile this with its high development in western Polynesia and Fiji. The alternative is that a combination of circumstances—the conservatism of the older or proto-Polynesian population and preference for the dugout underbody design in localities where an abundance of suitably large timber was available—led to the non-adoption of the Tangaroan

inserted frame in many areas, and in a few to its utilization in vestigial or in degenerative form as a mere hull spreader or as a floor-grating support. Whichever hypothesis be correct, it is certain that at some period of time the Hawaiians employed inserted frames in their canoe hulls.

The preceding paragraphs deal with major movements of population into Polynesia. Minor movements between the islands, especially those from east to west, have been innumerable and many were without intention; involuntary voyages account in the main for the presence of Polynesian populations in islands scattered through Melanesia (always be it noted on the eastern side of islands when they are large), from the Loyalty Islands off the east of New Caledonia, to Ongtong Java east of the Solomons, as well as in Nukuoro in the Carolines.

INFLUENCES IN FIJI

As the people of Fiji belong physically to the Melanesian race, although modified here and there on the coast through intermarriage with Polynesians, so is the design of their outrigger canoes essentially Melanesian in its employment of multiple booms and the stanchion attachment. It is otherwise in respect to the double-canoe design. This is characterized by great inequality in the size and shape of the two hulls.

In eastern Melanesia, apart from Fiji, double canoes are common only in New Caledonia, where there are two types. One of these is unequal-hulled and has certainly been introduced by Tongan settlers or castaways using the Fijian design of the *ndrua*. The other, more clumsy and equal-hulled, represents an earlier and more primitive type, borrowed possibly from the proto-Polynesians. There is little doubt that the modern Fijian double canoe is a hybrid between this old type and the large sailing outrigger of Micronesia. The design may be described as a compromise in which the sailing advantages of the single outrigger canoe have been adapted to and combined with the cargo-carrying capacity of the double canoe. The float and the lee platform of the one became respectively the smaller hull and the platform of the other, the Micronesian sail rig being adopted at the same time. The influence of the Tangaroan Arii is also evidenced by the use of inserted ribs attached to comb cleats or to longitudinal rectangular ridges on the inside of the hull.

Pacific islanders of whatever race are particularly keen on improving the construction of their canoes; there are several historical records of such changes. Among these are the adoption of the Fijian double canoe design by Tongans and Samoans toward the end of the eighteenth century, the change over to a new type of outrigger attachment during the last century in the Marquesas Islands and in Rotuma, and also the general adoption at the present day of the schooner type of vessel in place of their own sailing craft throughout Polynesia. How the Fijians came to seize upon the Micronesian design and modify an outrigger type into a double canoe one we shall never know, but they certainly did accomplish this feat. At the same time they adopted the Oceanic lateen in its entirety, retaining, however, the crutch form of the masthead, which as is known from the reports of Schouten and Cook originally held the yard between its crescentic horns. The voyaging of the Marshall and Gilbert Islanders, noted navigators and confirmed wanderers, almost certainly went as far south as Fiji, and it was in all probability from these people that the Fijians gained the knowledge which led to the designing of that magnificent vessel, the *ndrua*.

MICRONESIA

RACIAL ADMIXTURE

The groups of islands comprising Micronesia stretch in a loosely spread crescent from Palau in the west, through the Caroline Islands, to the Marshall and Gilbert Islands in the east, with the Marianas as an outlier archipelago strung out northward from the western Caroline Islands. The physical characteristics of the inhabitants show evidence of varied racial admixture over a prolonged period. Eastward, where contact is made with Polynesia, a strong Polynesian admixture is apparent in the population; westward, Indonesian and negrito elements are marked. To these has to be added a faint Melanesian strain, varying in degree in the different archipelagoes.

This mixture of races has, however, been so long in the melting pot that in all that concerns canoe design, Micronesia is fully as homogeneous as Polynesia. What differences exist are due to local factors, and even these are confined in the main to the inshore craft. The voyaging canoes have a remarkably close family resemblance, bespeaking regular or frequent intercourse between the constituent island groups.

GILBERT ISLANDS

GENERAL CHARACTERISTICS

Apart from very small dugouts (*wa*) used for paddling about the lagoons, all canoes in the Gilbert Islands are built up of "patches" much after the fashion of the Tuamotuan canoes, and for the same reason—the lack of large timber other than the coconut palm.

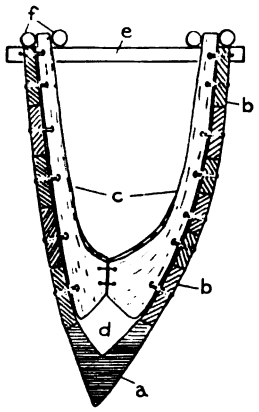


FIGURE 245.—Hull of a Gilbert Islands canoe, cross section: *a*, sharp, channeled keel; *b*, numerous narrow strakes building up sides; *c*, transverse frame made of two ribs sewn directly to sides and to each other at base; *d*, space left below for passage of bilge water; *e*, thwart countersunk in uppermost strake; *f*, poles forming gunwale.

The construction of the hull (fig. 245) is characteristic, and fairly consistent throughout the islands, proving that a homogeneous culture has prevailed for a long period of time. Great local variations in the outrigger designs, however, indicate the impact of other cultures and the meeting place here of Micronesian and Polynesian. In the extreme southeast, the outriggers of Nukunau, Tamana, and Arorai are definitely of the same design as that in the Ellice Islands. Those of Nonuti and Taputeuea are as clearly related closely to those of the Marshall

Islands. The central islands have two forms of canoe attachment both allied intimately to Caroline types; the more common is related to that of the central Caroline Islands, the other, together with that of Tarawa in the north, to the type characteristic of Kusaie in the eastern Caroline Islands.

SAILING CANOES

Until comparatively recent times the sailing canoes were of two classes: the *wa-ririk,* used for fishing outside the reef and for coastal traffic, 15 to 24 feet long, 2 to 3 feet deep, and 15 to 24 inches beam; and the *baurua,* built on the same model but stronger and of much larger dimensions, great vessels that once maintained interisland communication and composed an island's war fleet when a foray was to be made upon a neighbor.

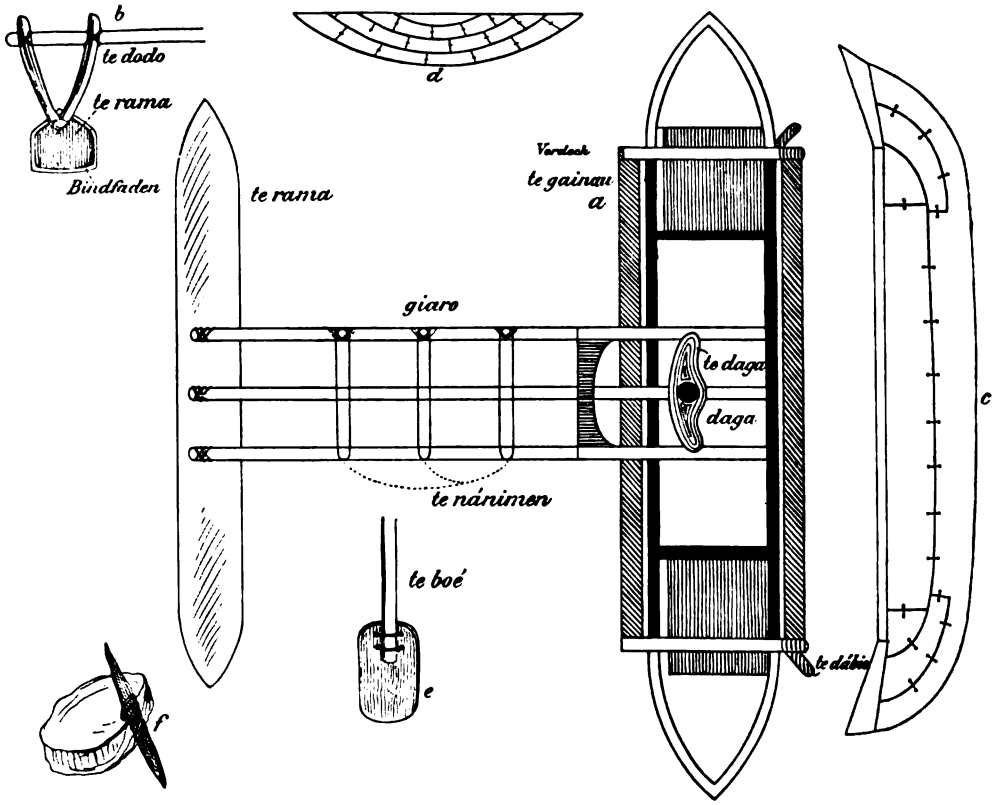


FIGURE 246.—Small canoe (*te doa*), Gilbert Islands: *a*, plan; *b*, connection of outrigger float to boom; *c*, plank patches; *d*, patches of a larger boat; *e*, paddle; *f*, anchor (from Krämer, 1906).

FISHING CANOE

Only the fishing canoe (*wa-ririk*) survives today. According to Grimble (1924, pp. 101-139), upon whose detailed account of the present-day canoes the following description is based unless otherwise noted, the hull of a typical fishing canoe is a double-ended, carvel-built vessel, built up of several strakes, strengthened by timbers inserted after the planked sides are completed. A narrow keel is typically present, about 3 inches wide, deeply channeled above, sharp below, and so appearing V-shaped in transverse section (fig. 245, *a*); its shape, however, appears subject to variation, for Alexander (1902, p. 801) says that the bottom

of the canoes of Maraki Island "is dug out of a solid piece of coconut wood and is round", and that in those of Butaritari, "the bottom is one solid piece of wood". The bottom of the canoes of Abemama and Tarawa he had previously described as very sharp, so it is probably to these that Grimble's account applies. Krämer figures a small canoe, *te doa* (fig. 246).

Whenever possible the keel is in a single length, but in large canoes it was often necessary in former days to butt two or even three lengths end to end to obtain sufficient length. At each end, which bends upward from mid length in the form of a gently bent bow, a strongly curved stempost is butted on and lashed in position through two holes in each of the opposed ends. A scarfed joint is never made, according to Grimble, though Alexander (1902, p. 797) describes "the stem and stern posts" of canoes seen at Arorai Island as neatly scarfed to the keel. Upon the beveled edges of the keel, the garboard strake is sewn with sennit laid in countersunk grooves on the outside between the holes bored through the opposite edges, a method similar to that employed by the New Zealand Maoris; each pair of holes is separated from the next by an interval of about 1 foot. This garboard strake in former days followed the curvature of the keel and the two stems right up to the stem head at each end. The succeeding strakes were sewn on in the same curvilinear manner, each becoming shorter than the one below, till the final one, in a canoe of several strakes, was alined horizontally. (See fig. 247). No battens were

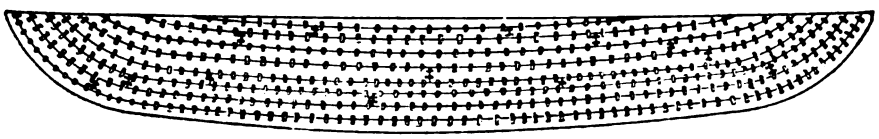


FIGURE 247.—Method of building up sides of canoe, Gilbert Islands, prior to use of imported timber, each side formed of numerous curved strakes made up of short lengths of narrow plank (from Alexander, 1902).

then or are now used to cover the seams on either the outer or the inner side. Each strake was made up of lengths of planking of greatly variable dimensions. Wilkes (1845, vol. 5, p. 51) describes them as cut from the coconut palm, from a few inches to 6 or 8 feet long and from 5 to 7 inches wide. According to Krämer (1906, p. 358) the planking is cut preferably from the wood of the breadfruit tree, coconut timber being used only for the outrigger booms. Canoes of better materials were built in certain of the islands, for Grimble, in describing the construction of a canoe during the war of 1914-18, when deal planking was unobtainable, gives the following particulars of the timber used as most suitable for the different parts:

For keel and stems *te itai* (*Calophyllum inophyllum*) or *te kanawa* (? *Cordia subcordata*); for the ribs, *te uri* (*Fragraea* species) or *te buka* (*Hernandia peltata*). For planks, preferably *Fragraea*, but any of the other woods mentioned was allowed as a substitute. For outrigger booms, only the hardest seasoned coconut timber is ever used by craftsmen.

Much naturally depended upon the varying timber resources of the different islands. At the present time the islanders are able to buy imported timber in long running lengths and the strakes run parallel and horizontal instead of following the curves of keel and stems. Many canoes are perfectly flush along the gunwale line (Grimble, 1924, p. 121), but others, like those of Tapeteuea seen by Wilkes (1845, vol. 5, p. 51), have considerable sheer, obtained by the addition of a weather board sloping downward toward midships for several feet, one on each side at both ends.

There is no ornamentation of the stem heads, save on some the tying of a few egg-cowry shells (Finsch, 1914, p. 486).

After the hull has been fully planked up, bipartite frames are inserted at intervals of about 20 inches (fig. 245, *c*). Each frame consists of two curved ribs sewn together at the broader lower end, and to the sides of the hull, by numerous lashings passing through the planks. Alexander (1902, p. 797) states that each of the Arorai Island canoes had seven sets of timbers and that those of Apamama canoes were "round, consisting of heavy withes bent to the desired shape". At the lower end of each frame a small interval is left to allow of the flow of bilge water to the bailing well. The upper ends of the ribs project above the gunwales of the hull; on either side, inboard and outboard, a served withy is lashed, extending from end to end of the canoe; these form the gunwale rail. A strong thwart, countersunk in the washstrakes, is inserted on one side of each frame and serves both to give additional stiffening to the hull and to maintain the ribs in position (fig. 245, *e*). In some canoes the thwarts are lengthened outboard on the lee side and overlaid by several longitudinal withies placed side by side which act as a dashboard similar to that which Anson (1748) noted in the Marianan "flying proa".

The sides of the hull are unequal or asymmetric in the characteristic Micronesian manner, the lee or off side steep and much less curved than the weather one (fig. 245). A calking of chewed and oiled lauhala is placed between the edges of the planks before sewing together, after the manner of coopers in flagging a cask. Alexander (1902, p. 797) describes the seams in Arorai canoes as made watertight by means of a thick coating of gum spread on both edges of opposed planks before being brought together.

The typical form of outrigger found in the Gilbert Islands consists of booms attached to the float by means of forked or Y-shaped connectives, seen characteristically in Apamama and Tarawa. In these islands the fishing canoes have generally three booms, the paddling canoes two, dressed from the hardest coconut timber available. Their proximal ends are countersunk in the washstrakes; inboard they serve also as thwarts. Their distal ends on the weather side are slightly curved downward and also converge slightly, being pulled toward one another and lashed in this position by five or six longitudinal stringers laid over them and spaced 15 to 18 inches apart. To stiffen the framework still more in well-made canoes, one or two sets of strong pole braces are run obliquely outward from the ends of the hull to the middle boom of the outrigger; the inner of these paired braces, when present, pass from the extreme ends of the canoe to mid length of the boom, the outer and longer pair from a point about the second end thwart to the distal end of the center boom, immediately over the float. Wherever these oblique braces cross other spars, they are lashed securely thereto. In small canoes one or both of these pairs of braces may be dispensed with. (See fig. 248, *a*.)

No wood sufficiently light and stout grows in the islands to provide satisfactory timber for the floats of the larger canoes; in former days the people relied upon drifted logs of cedar, pine, and other light wood occasionally cast up on their shores. A beam of such timber when found would be treasured perhaps for years against the building of the next canoe; to this end it was hung from the house rafters and oiled from time to time to save it from the ravages of the white ant.

A torpedo shape is generally favored, but for some floats the upper surface is flattened with a slight turn up at each end.

The attachment of the float in the three-boom type under consideration is by means of Y-shaped connectives:

> There is one to each boom, made from naturally forked branches. The lower end of the shank in each is trimmed into a circular foot; this is seated in a countersunk hollow on the upper side of the float and then lashed down by sennit passing several times successively

around the narrowed "neck" of the connective above the foot and around the circumference of the float (fig. 249, *a*). But in canoes of Apamama and Tarawa figured by Alexander (1902, p. 798) the sennit brace, instead of passing around the float and shank of the Y connective, appears to be passed through a V-shaped passage in the upper surface of the float on one side of the Y, then carried over the axil of the crutch to the opposite side, where it is passed through a second V hole and then returned for another turn in the reverse direction (fig. 250); this arrangement obviates chafing of the lashings whenever the canoe is beached or launched. Each Y connective is usually set obliquely to the longitudinal axis of its boom, which thereby passes through the fork; in consequence of this, the two prongs of the Y are lashed against opposite sides of the boom. To secure further these connections, a stringer is often lashed fore and aft in the forks of the three Y connectives and athwart the booms already resting there.

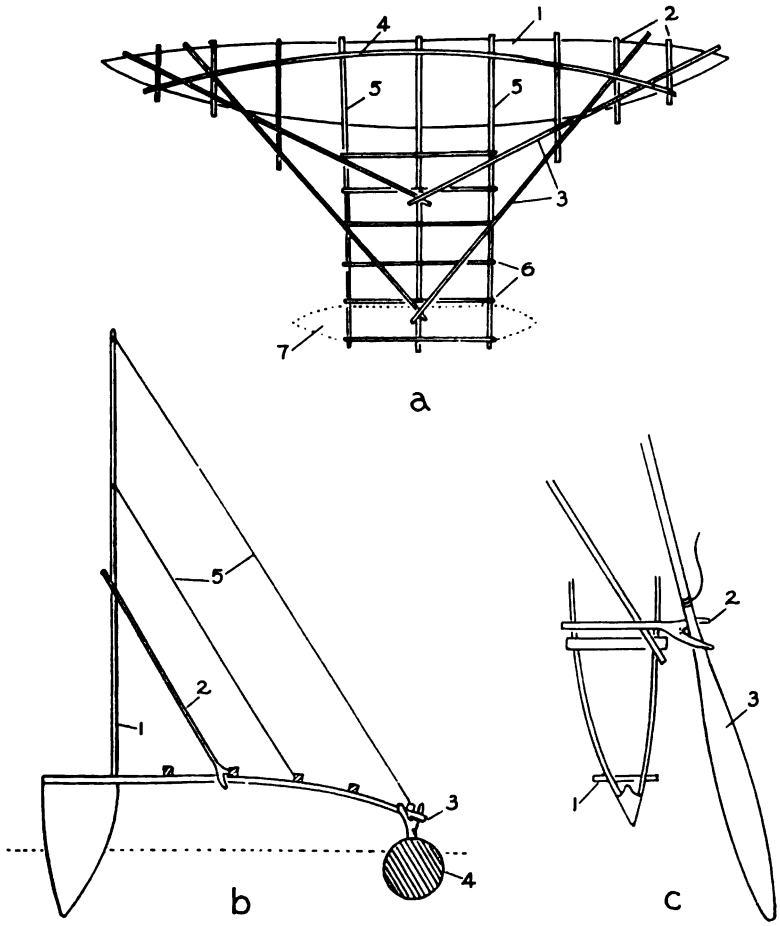


FIGURE 248.—Sailing canoe, Gilbert Islands. *a*, plan of canoe: 1, hull; 2, thwarts; 3, diagonal bracing struts of outrigger frame; 4, curved longitudinal strut; 5, booms; 6, stringers; 7, float. *b*, cross section amidships showing asymmetrical form of sides of hull and mast stepped on middle boom: 1, mast; 2, mast shore with bifid foot stayed against a stringer lashed athwart booms; 3, end of boom resting obliquely in fork of branched connective; 4, float; 5, two weather shrouds. *c*, end of hull showing end of outer diagonal spar: 1, cross pin to which tack of sail is secured; 2, crutch support of 3, steering paddle. (After Grimble, 1924.)

Alexander (1902, pp. 797-798) furnishes particulars of the dimensions of the canoes seen in the Gilbert Islands:

At Arorai, in the extreme south, the estimated length was 22 feet, width 4 feet, depth 20 inches, the material coconut wood; the keel was about 5 inches wide and the planking 4 to 6

inches wide. At Abamama [Apamama], the length of the average canoe was 15.5 feet, width 20 inches, depth 2 feet; very sharp on the bottom, the sides rising almost V-shaped. Float 7.5 feet outboard, length 8 feet, width 7 inches.

Grimble (1924, p. 115) gives exact measurements of a canoe which I infer refer to the northern islands, where sizes run larger than in the south: length over all 24 feet 2 inches, beam amidships 21 inches, depth amidships 2 feet 7 inches, length of booms outboard 10 feet 2 inches; length of float 10 feet 7 inches, circumference of float at middle 23 inches.

Voyaging Canoe

The large voyaging *baurua* were built in precisely the same manner as the small *wa-ririk*, the only notable differences being that the number of booms and connectives was increased—in the last survivor there were five of each—and the ends of the hull were slightly sheered, generally by affixing a sheered weatherboard on each bow of the two stems or by sheering the strakes slightly toward each other.

In the great hulls of the *baurua* the asymmetry of the sides was much emphasized. As in the small canoes, further straightening of the lee side was effected by giving the keel line a decided longitudinal convex bend on the weather side during construction by drawing the ends slightly in toward the lee side (Grimble, 1924, p. 108).

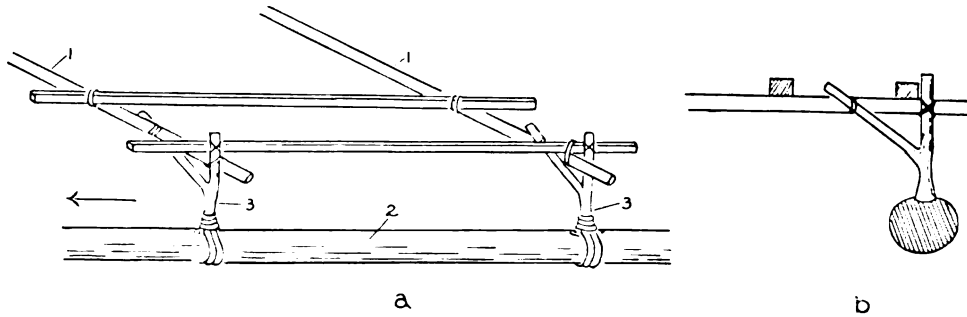


Figure 249.—Outrigger of Gilbert Islands canoe. *a*, side view: 1, booms; 2, float; 3, Y connectives, arms lashed to opposite sides of boom, each resting by a broad base upon float and secured by several turns of lashing around shank and around float. *b*, side view of forked connective as used in Tarawa, both arms tied to same side of boom; float seen in section.

The approximate dimensions of a *baurua* as given by Grimble are as follows: Length over all 60 feet, beam amidships 7 feet, height from keel to gunwale inside 5 feet 10 inches, length of outrigger booms outboard 20 feet, length of float 18 feet, breadth of float at middle 10 inches, depth of float at middle 9 inches.

Larger sizes formerly existed; Burnett (1910, p. 105) states that in 1905 some measured as much as 75 feet in length by 6 feet beam, and Wilkes (1845, vol. 5, pp. 78, 79) records that the canoes "built in the northern islands are much the largest"; those of Makin, the most northerly, were made, he notes, of different wood and were better supplied with mast and paddles. Hale (1846, p. 103), who accompanied Wilkes, gives the dimensions of the Makin canoes as "not less than 60 feet in length by 6 feet in width. They sail very near the wind and move with a rapidity which has acquired for them the name of 'flying proas' ".

The observation of Wilkes regarding the different wood used in the northern islands supplies an explanation of the apparent contradictions in accounts of the materials used in construction; the northern islands were better supplied than the southern and it is to the northern that Grimble's description appears to apply.

Variant Types of Outrigger

Variant types of outrigger are found in the islands at each end of the archipelago. In the north, at Tarawa, a form of outrigger is employed which approaches the peculiar form found at Kusaie in the eastern Caroline Islands:

In this variety the float is connected primarily to two booms, the normal number here, by means of unequally forked, side-branched Y connectives, with both arms lashed to the same side of the boom (fig. 249, *b*). In addition, further support is provided by two auxiliary unbranched stanchions, each fixed vertically into the float between the adjacent Y connective and the near end of the float. At their upper ends these auxiliary stanchions are lashed to the prolonged ends of a yoke stringer that lies fore and aft in the forks of the Y connectives. To strengthen this connection, a pole brace is thrust out obliquely from each end of the hull. These

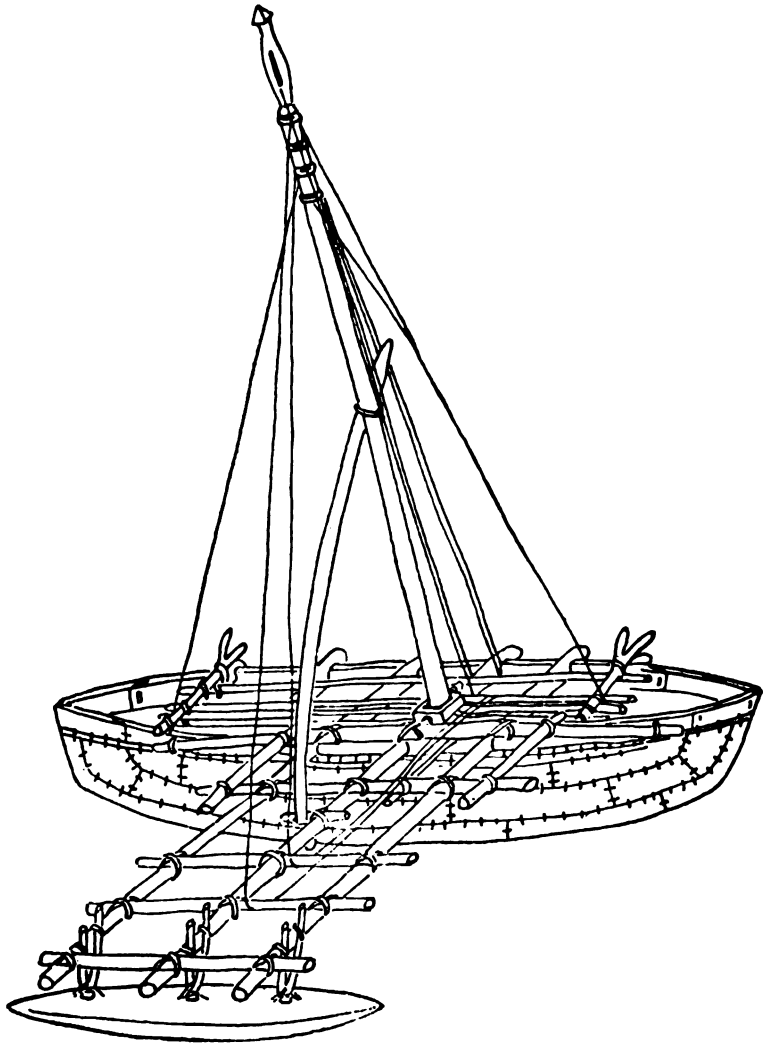


Figure 250.—Sailing canoe of Apamama and Tarawa, Gilbert Islands, showing characteristic low, equal ends of hull; central position of mast, stepped above weather gunwale on top of middle boom; three booms connected with float, here short and pointed, by forked connectives with both limbs lashed to same side of boom, shanks of connectives short and tied to float by lashing passed through holes in its upper surface and not by lashing passed around it as in northern islands; curved mast shore, pair of shrouds, and fore and after stays supporting mast (after Alexander, 1902).

two braces cross one another above the booms at mid length and are lashed at their outer ends to the upper part of the auxiliary stanchions (Grimble, 1924, p. 122).

In the southern section, the Kingsmill Islands, two varieties of outrigger entirely distinct from both of those above described are used:

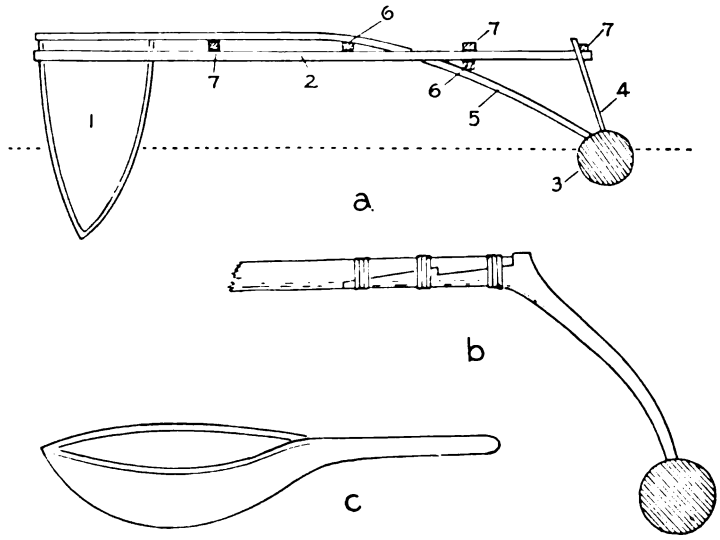


FIGURE 251.—Gilbert Islands canoes. *a*, cross section of outrigger found in Nonuti and Tapeteuea which closely approaches Marshall Islands type: 1, asymmetrical hull; 2, one of two main booms; 3, float; 4, inclined stanchion connective; 5, curved accessory boom, outer end lashed to the float; 6, two stringer booms placed between straight and curved booms to insure correct curvature of the latter; 7, other stringers. *b*, lock-jointed boom with direct attachment, found in the southernmost islands—Tamana, Arorai, and Nukunau; similar to an attachment found in some canoes of Funafuti, Ellice Islands. *c*, bailer. (After Grimble.)

The first variety, found in Nonuti and Tapeteuea, has a compound type of attachment definitely referable to a Marshall Islands origin. As in canoes from that area there are both straight and curved booms. According to a figure given by Grimble (1924, p. 122), supplemented by the information afforded by a model from Nonuti in the Peabody Museum, Salem, the ends of three curved booms are lashed distally to the float by sennit passed through holes mortised out of the ridged upper surface; they are not quite parallel, being drawn together slightly in the outboard region so that they converge somewhat toward the float. (See figs. 251, *a*; 252). Grimble's figure shows each straight boom as connected to the float by a short, slightly inclined stanchion lashed at its upper end to the side of the boom and plugged into a hole in the float at the lower end; in the Salem model, which is imperfect in some details, this is absent. The main functions of the straight booms are to strengthen the outrigger framework and to insure the permanence of the distal curvature of the curved booms by means of the insertion of a stout stringer bar below the straight booms and above the curved ones at a point near the distal ends of the straight booms in the same manner as is followed in the Marshall Islands (fig. 261). As in the typical Gilbert Islands canoes already described, the inner ends of the straight booms are countersunk in the washstrakes, whereas the curved ones are lashed upon the gunwales. As this type of outrigger is certainly derived from the Marshall Islands, the straight booms must be regarded as the primary ones and the curved ones as subsidiary. In the Salem model a lattice platform is constructed over the horizontal region of the outrigger frame by means of closely set transverse battens lashed on. A lee platform of planks, not shown in Grimble's figure, is also provided, canted slightly upward by the insertion between its planking and the lee gunwale of a block of wood set on edge; the whole structure is a simplified form of that found in the Marshall Islands and is a feature further differentiating these Nonuti canoes from the normal Gilbert Islands type and connecting with the type found farther north. (See fig. 252.)

At the extreme southeast, in Nukunau, Tamana, and Arorai, the canoes, though retaining the characteristic Gilbertese type of hull construction, have outriggers of the spliced boom form of direct attachment characteristic of one variety of outrigger found in the Ellice Islands. In this a curved end piece is scarfed to a straight boom by a lock joint served with sennit (fig. 251, *b*), the downturned free end of the curved section being attached to the float in the Ellice Islands manner (Grimble, 1924, p. 123). The hull remains the same as in others of the Gilbert Islands, as does also that in the canoes in which the outrigger varies from the normal local type.

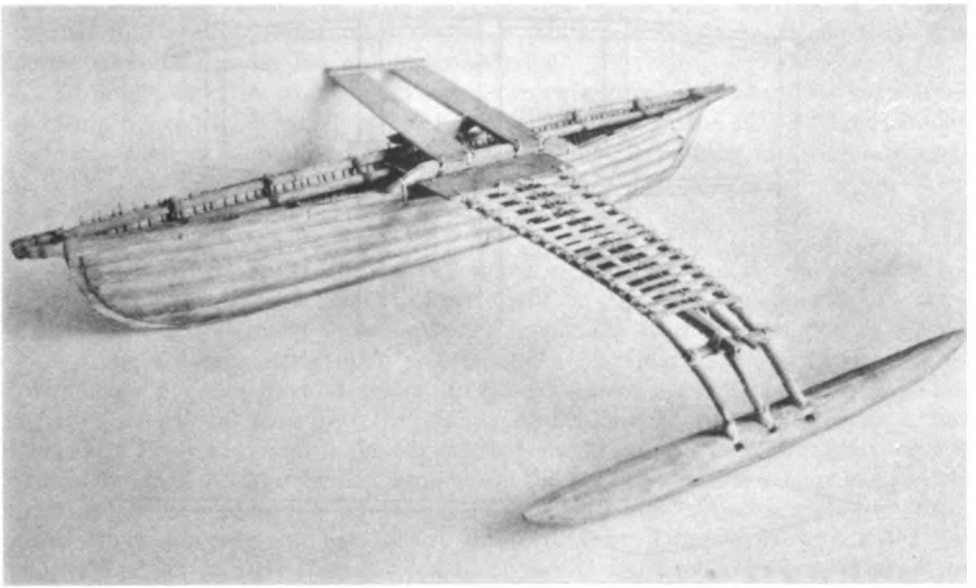


FIGURE 252.—Model of an outrigger canoe from Nonuti (Peabody Museum, Salem), hull of typical Gilbertese form, outrigger attachment of Marshall Islands pattern; model probably once had straight stanchion inserted between end of each straight boom and float; hull, being made of strips of palm leaf, fails to show peculiar curved run of strakes and way in which each is made up of "patches".

MAST AND SAIL

The sail rig is of the Micronesian pattern, consisting of a forwardly raked mast, stepped amidships, hoisting a large triangular sail, set apex downward. The two long sides are enclosed by a yard and boom respectively, the boom rather the longer of the two. The free upper margin is exceptionally long, usually equal in length to the side attached to the yard. The mast is generally braced on the windward (outrigger) side by a shore, curved or straight, in some canoes forked at the lower end (fig. 248, *b*, 2) as it is today in Fiji, the Trobriand Islands, and other Melanesian localities, and also formerly in the Marianas, to prevent the collapse of the mast if the canoe be suddenly taken aback. Further support is afforded by a fore and an aft stay and by one, or, more usually, two shrouds passing from the upper part of the mast to the outrigger frame (fig. 248, *b*, 5). Wilkes (1845, vol. 5, p. 52) mentions that the mast, boom, and yard were each in two or three sections.

The mast may be stepped in one of two ways, either in a single socketed wooden shoe made of a thick block of wood 3 by 4 inches, hollowed out in the center, set inboard on the outrigger side upon the median boom (Alexander, 1902, p. 799), or in one of a series of sockets, usually five, set in line fore and aft in a long, stout wooden bar, which may be 40 inches long by 6 inches wide, supported upon the

inboard ends of the three median outrigger booms close up against the windward gunwale (Grimble, 1924, p. 116). The heel of the mast may rest in any one of these sockets (fig. 253, *a*). This is a most unusual method of stepping the mast but it is not unknown elsewhere, for a related fitting, fixed in the bottom of canoes, is used in some of the outriggers of Madagascar and in the cobles of northeast England.

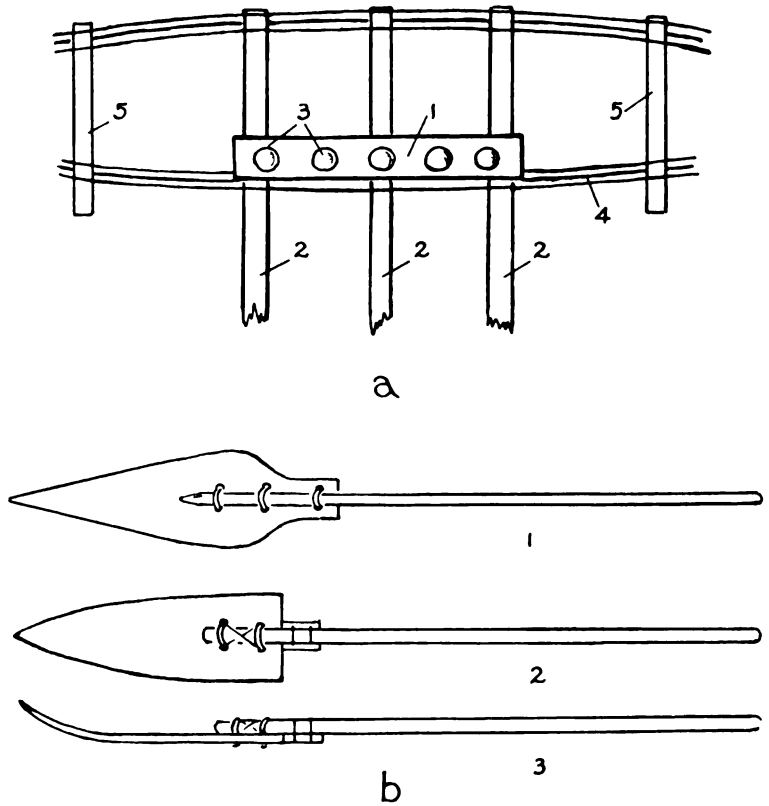


FIGURE 253.—Gilbert Islands canoe parts. *a*, plan of median part of hull: 1, stout wooden bar lashed over the three booms; 2, booms; 3, five cup-shaped sockets forming alternative steps for mast; 4, sides of hull; 5, thwarts (after Grimble). *b*, paddles: 1, after Grimble; 2, 3, after Alexander.

The heel of the yard is stepped either against a bar (fig. 248, *c*, 1) lashed athwart the bows (Grimble) or in the hollow of an excavated block, half the size of the mast shoe (Alexander); as the canoe sails either end forward according to the tack she is on, there is one of these steps at each end of the hull.

ACCESSORIES

The accessories consist of paddles, a steering oar, an anchor, and a bailer. The ordinary paddles, unusual in form, have the blade and loom in two pieces. The blade has a broad spearhead shape, usually made of coconut wood or even, in former days, of tortoise shell (Wilkes, 1845, vol. 5, p. 50); to this the rodlike loom is sewn on one side by several stitches (fig. 253, *b*), a method of making paddles practised also in Ceylon. The steering oar, wrought out of coconut wood, is in one piece, the cylindrical loom merging gradually into a broad spathulate blade with

rounded end. Near each extremity of the canoe the forked end of a strong wooden bar projects outboard on the lee side to give purchase to the steering oar; when under weigh the oar pivots within the Y fork (fig. 248, *c*).

A stone pierced at one end serves as an anchor; a wooden bar passed through the hole forms a shoulder on each side by which it is suspended, when not in use, between opposite gunwales at one end of the canoe.

The bailer as figured by Grimble (fig. 251, *c*) is of a narrow, ladle form unusual in Oceania. Alexander (1902, p. 800) specifically mentions that "the handle is on the outside, like a dory scoop".

To hold planks in position during the construction of a canoe the same kind of clamp figured by Kennedy (1931, fig. 37), as used in the Ellice Islands under the name *fakafiti* is employed in the Gilbert Islands, according to Grimble (1924, p. 123).

MODEL CANOE RACES

In the Gilbert Islands, and on Apamama in particular, model canoe races are popular. The craft used (*maggi*) have single, abnormally long booms. As they are rigged with relatively enormous sails, to prevent capsizing the float is loaded with young coconuts stuck upon pointed sticks (Krämer, 1906, p. 290). Major Swinburne, the Assistant Resident, informed me in 1925 that at the time the British Government took over the islands, model canoe racing on Apamama, Tarawa, and Peru so obsessed the people that gambling on the performance of the models had become a public danger; men in the excitement of the hour were liable to stake all they possessed on the result, their property, houses, and even their wives. The government, because of this evil, banned the sport soon after the annexation, but in 1917 they decided to allow the sport to be revived in order to give the people a renewed interest in life and so to counteract the aimless condition into which they were falling.

CANOE AFFINITIES

Apart from certain exceptional forms, the outriggers have many points of resemblance with those of the central Caroline Islands; affinity is also shown in the double-ended hull, the greater vertical and longitudinal curvature of the weather side over that of the lee side, the stepping of the mast amidships, the form of sail, and the method of steering. Intense love of canoe racing is another cultural link with central Micronesia.

The chief differences from other Micronesian canoes are the absence of a lee platform and of any prominence given to the stem heads together with the employment of inserted frames. The use of frames may be due either to Indonesian influence of a comparatively recent date, or may be of local evolution brought about by the necessity to strengthen the natural weakness of hull consequent upon the extreme narrowness of the basal keel piece and the great number of small patches of which the sides are built up.

The possibility of frame origin being due to Indonesian influence is strengthened by the presence of a compound form of mast step provided with a serial row of sockets. Compare with the use of an analogous device in certain canoes of Madagascar (Hornell, 1932).

RAFTS

Krämer records the use of a small outrigger raft (*ebeeb*) for fishing in the shallows. It consists of two piles of poles connected by a rude platform raised on stanchions as in the sailing outrigger canoes, which it indeed exactly resembles

except that the canoe hull has been replaced by another float (1906, p. 357). It has, or had, counterparts in Samoa and Fiji.

CANOE TERMS

The following technical terms in use for canoes and their gear are taken from the publications of Grimble and Krämer:

Aiai: mast shore.
Aniang: mast.
Baurua: deep-sea sailing canoe.
Bwe or boe: paddle.
Dagadaga: mast step.
Ie: sail.
Katea: leeward side.
Kiaro or giaro: outrigger boom.
Maggi: model canoe.
Oa or wa (*toa*, pronounced *te va* in the south according to Krämer): canoe.
Raama: windward side.
Rama: float.
Toto (*te dodo*, Krämer): outrigger connectives.
Wa-ririk: outrigger canoe.

Grimble (1924) gives a long list of canoe parts and sailing terms.

NAVIGATION

The principles of navigation as known in the Gilbert Islands formed the principal subject of instruction for those lads destined to become chiefs and pilots. Special attention was given to the use to which a knowledge of the positions and movements of the principal constellations could be put when shaping a course to particular islands. (See pp. 438-439.)

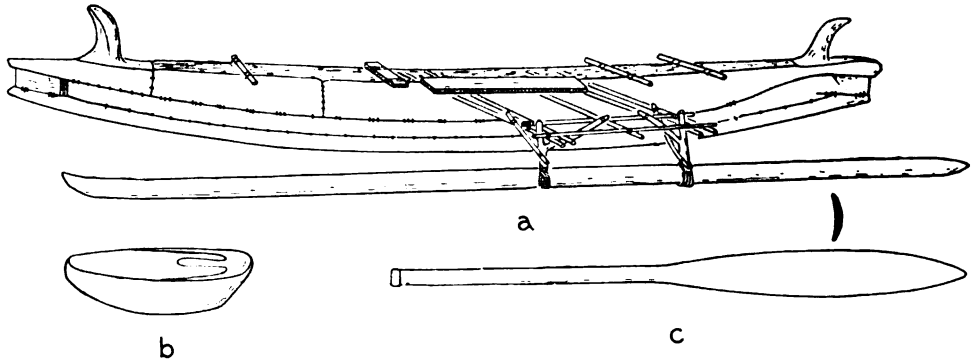


FIGURE 254.—Paddling canoe, Nauru: *a*, side view; *b*, bailer; *c*, paddle (after Hambruch, 1914-15).

NAURU

INTRODUCTION

Nauru is roughly equidistant—about 400 miles—from Kusaie at the eastern extremity of the Caroline Islands, Jaluit in the southern Marshall Islands, and Apamama and Tarawa in the central Gilbert Islands. It possesses handsome single outrigger canoes which, in their design, exhibit strong affinity with the Gilbert Islands canoes, modified through contact with the eastern Caroline Islands, and yet, withal, possessing distinctive locally evolved characteristics.

From examination of a full-sized paddling canoe in the Horniman Museum, London, and of another in the Museum für Völkerkunde, Hamburg, verified by reference to the monograph of Nauru by Hambruch (1914-15), the following description is written.

PADDLING CANOES

The hull of the small paddling canoes (*e kuo*), which alone exist at the present time (fig. 254), consists essentially of a narrow channeled keel extending the whole length of the canoe, and of sides formed of two wide strakes closed in at each extremity by two peculiarly shaped semisolid end pieces (fig. 255).

FIGURE 255.—Nauru canoe (*e kuo*), from photograph by Hambruch (courtesy of the Hamburg Museum für Völkerkunde).

The keel is hewn from the solid and represents the dugout body of the canoes of islands growing timber of large diameter; in breadth it is less than one fourth of the beam at the gunwale of the completed canoe. In section it appears a miniature of that of an ordinary dugout, the rounded bottom somewhat flattened medially, rounding sharply upward at each side forming small bilges (fig. 256, *e*, 1).

Upon each edge of this keel is sewn a wide, slightly curved garboard strake inclined outward at an angle of about 35 degrees; on this in turn is similarly attached a washstrake, almost vertical, but with a slight cant inward. The garboard strakes extend almost to the ends of the hull, but the washstrakes are considerably shorter and may be made up of two or more lengths sewn end to end.

To close in each of the open ends of the superstructure, two short, partially solid end pieces are employed, the lower or accessory one to connect the ends of the two garboard strakes, the upper to span the interval between the ends of the two washstrakes and at the same time form a short end cover, a minute whaleback decking, derived probably from the long and functionally important sewn-on end deckings of the Ellice Islands and Samoan canoes. A curious curved bollardlike projection shaped in the form of a stout horn rises from the upper surface of each of the end deckings and is in one with its base, being hewn from the same block of wood. (Compare the curved appendage on some models of Samoan canoes.)

The structure of these terminal pieces is illustrated in figure 256:

The decking piece is solid from its distal extremity to a point in the region of the "horn"; behind this it is hollowed out on the under side for a short distance, thereafter being prolonged

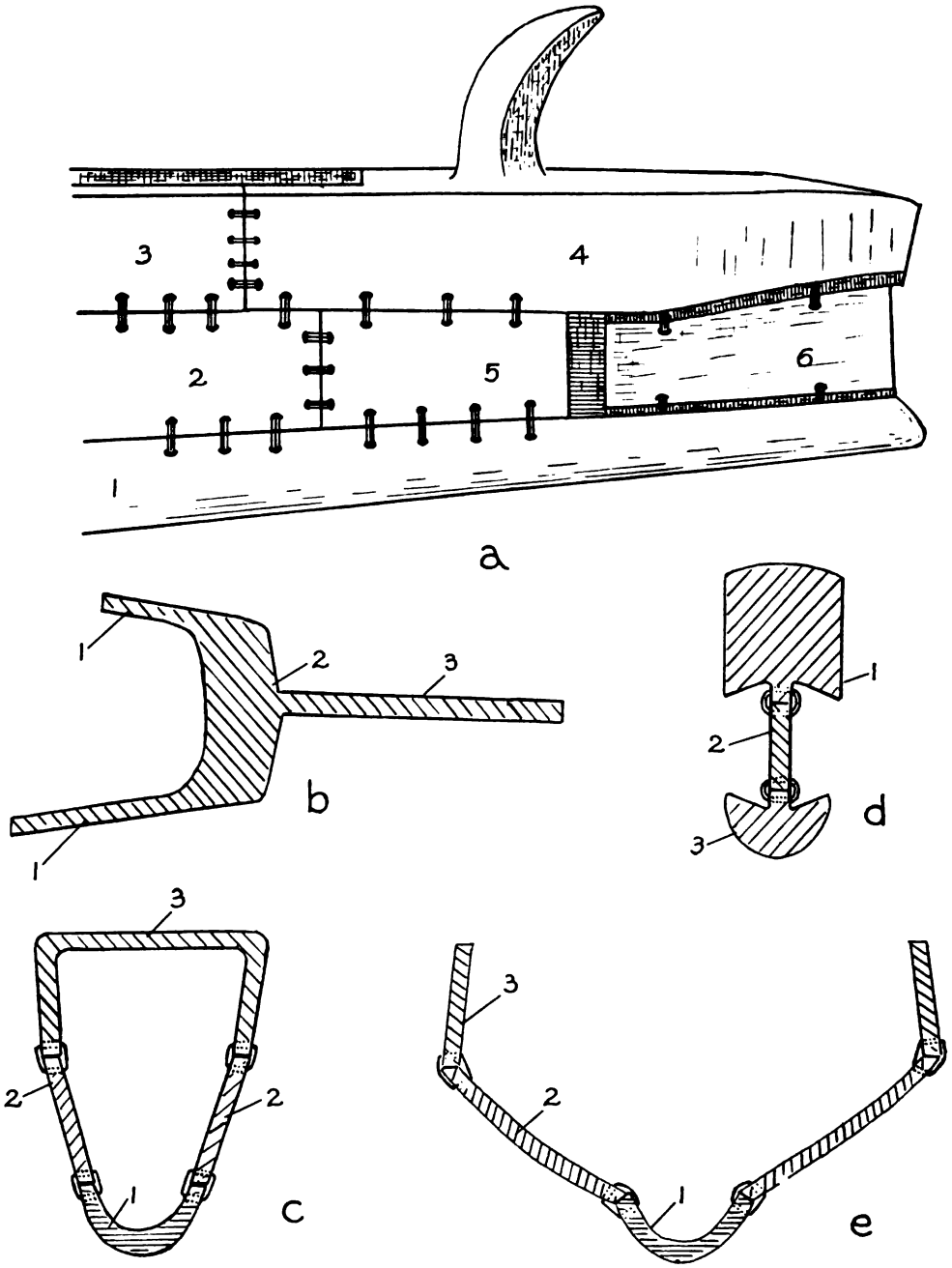


FIGURE 256.—Construction of a Nauru canoe. *a*, side view of one end: 1, keel; 2, garboard strake; 3, washstrake; 4, end piece surmounted by a characteristic "horn"; 5, hinder and winged region of accessory end piece, narrowed in front to a median vertical board (6). *b*, horizontal section through accessory end piece: 1, wings; 2, solid part below horn; 3, vertical board region. *c*, transverse section through hull immediately behind horn: 1, channeled keel; 2, wings of accessory end piece; 3, hollowed-out hinder region of end piece. *d*, vertical section through extreme end of canoe: 1, solid outer end of end piece; 2, vertical board region of accessory end piece; 3, solid end of keel. *e*, cross section amidships: 1, channeled keel; 2, garboard strake; 3, washstrake.

inward on each side by a vertical wing board joined on by sewing to the end of the washstrake. The lower piece at each end is interposed between the end cover and the extremity of the keel. The outer half of its length is reduced to a thin vertical board which is sewn above to a narrow median ridge on the under side of the end cover and below to a similar ridge along the central line of the keel. The after part is solid for a short distance and then gives off two vertical lateral wings to meet the ends of the garboard strakes.

The sewing of all the parts, including that connecting the strakes, is by separate lashings passing through opposed holes, the pairs spaced a moderate distance apart. No attempt is made to conceal the sennit sewing by countersinking or other device.

Light rods lashed across the gunwales represent thwarts (fig. 254).

A typical canoe measured by Hambruch was 5.38 meters long with a beam of 0.66 and depth of 0.40 meter. The booms were 2 meters long, the float 4.72 meters.

The outrigger is single with indirect attachment; it may be fitted upon either the port or the starboard side.

The booms (*ika*) consist of two twin or doubled thin poles which in the small canoes now in use are mere rods; a median false boom placed midway between the true booms is not connected with the float. The space separating the two sets of paired booms is unusually short, about 3 feet only in hulls 18 feet long. The two rods of each paired boom either pass through perforations in the washstrakes immediately below the gunwale, or are countersunk therein; they are set very closely together. In the full-sized canoe in the Horniman Museum, London, they pass only through the washstrake on the outrigger side; on the other, the ends of the booms, cut to a blunt point, fit into pits sunk from the inner side into the washstrake just below the gunwale. It is clearly intended that the booms should not project beyond the outer face of the washstrake, though one or two of the pits just pass through, showing a tiny exit aperture large enough to admit the point of a pencil. Each pair of booms is connected with the float (*egem*) by a forked stanchion (*eten*) having one arm vertical and the other given off at an angle of 30 to 40 degrees. The base of the Y stanchion is slightly expanded; this rests in a very shallow depression upon the upper surface of the float (fig. 257, *a*) and is held securely in position by a lashing which goes several times around the shank and around the float.

Across the distal extremities of the booms is lashed a light longitudinal stringer; a second one is similarly lashed a short distance on the inner side of the first. The vertical branch of each forked connective is lashed to and clipped between the two rods of the boom to which it pertains at a point immediately inside the outer stringer. The oblique arm is normally turned inward till it points directly toward the canoe hull; in this position it is imprisoned between and lashed to the two rods of the boom like the vertical arm (fig. 257, *a*). Another form sometimes seen in canoes of better construction has the oblique arm of each connective in a fore-and-aft position, turned toward its fellow belonging to the other connective, its extremity lashed to the inner stringer at a point close to the median or false boom. The attachment of each of the connectives is reinforced by a rod-shaped strut lashed at one end to its shank and at the other to the outer unit of the double boom at a point a short distance inside the inner stringer (fig. 257, *b*). A third stringer may lie across the booms at about mid length.

The float is cylindrical and almost as long as the hull; in a canoe 5.38 meters long, it measures 4.72 meters. As the outrigger or boom frame is narrow, barely 3 feet in a canoe 18 feet long, the free part of the float beyond the booms, both forward and abaft, is of unusual length. The ends are pointed, the forward one slightly upturned.

Across the inner end of the boom frame a deep V-shaped cradlelike frame is fitted to hold fishing spears, paddles, and other gear. It consists of two upright pairs of crossed sticks placed trestlewise, one pair rising from the fore pair of booms, the other from the after pair. The two pairs are braced together into a frame by a few light stringers. The lower ends of the crossed sticks are forked to enable them to straddle the booms, to which they are also made fast by lashings. (See fig. 255.)

The bailer is of the usual Oceanic type with a short free handle within (fig. 254, *b*). The paddles are elegantly formed, the blade long and lanceolate, convex on one face, concave on the other. The loom is about equal in length to the blade, with a small knob at the proximal end to serve as a grip (fig. 254, *c*).

CANOE AFFINITIES

The construction of the Nauru canoes links them on the one hand to the Gilbert Islands and on the other to the eastern Caroline Islands. The relationship with the Gilbert Islands is the stronger, particularly in features of the outrigger attachment. In both Nauru and the Gilbert Islands forked connectives are used, and though there are minor differences in the form of the forks and in the manner of their connection with the boom, those of the two localities agree in the unique way in which they are attached to the float, the expanded base of the connective resting in a shallow hollow in the upper side of the float, to which it is lashed by sennit passed around the float itself. Another unusual feature common to the canoes of Nauru and the Gilbert Islands is that the booms do not rest upon the gunwales but are countersunk in the washstrakes or even (in Nauru) pierce them.

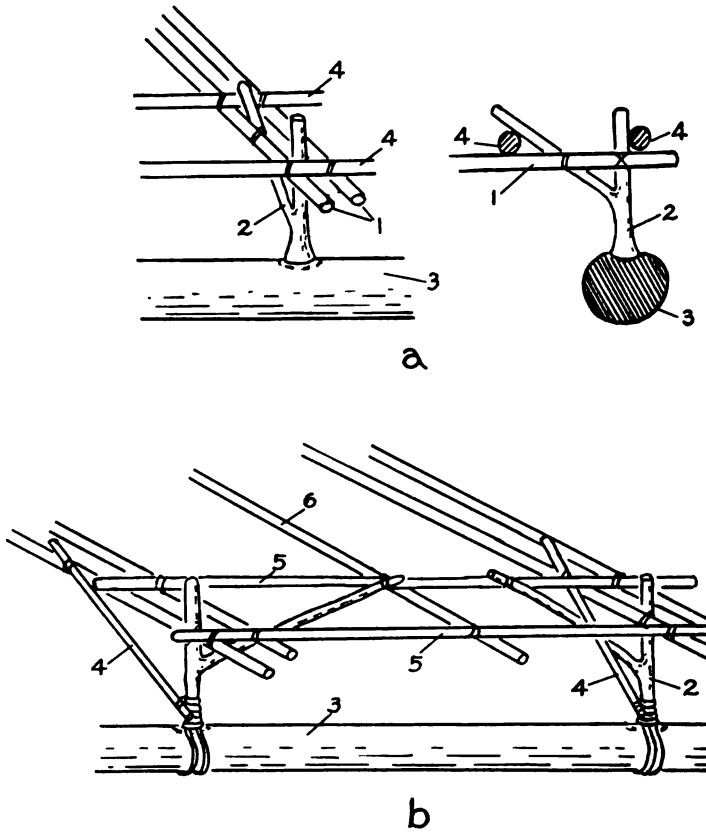


FIGURE 257.—Outrigger attachments, Nauru canoes. *a*, attachment seen in canoe in the Horniman Museum, London: 1, paired booms; 2, branched connective; 3, float, lashing omitted to expose expanded base of connective; 4, stringers. *b*, outrigger frame of a small canoe, Museum für Völkerkunde, Hamburg; 1, paired booms; 2, branched connective; 3, float; 4, side strut; 5, stringers; 6, false boom.

The Nauru canoe, because of its affinity in unique characteristics with the central Gilbert Islands type, was evidently derived from that locality. Numerous divergences in other particulars indicate that the settlement of Nauru from the Gilberts goes sufficiently far enough back in time for the evolution of several very specialized local peculiarities.

Resemblances to canoes of the eastern Caroline Islands—the great length of the float, the presence of a median false boom (Ponape), and the use of a symmetrically branched Y connective associated with two longitudinal stringers disposed in almost identical manner (Kusaie)—bespeak a lively intercourse, and probably the adoption of certain Nauru features by the canoe-builders of Kusaie and Ponape, whose canoe designs differ greatly from those of the central and western Carolines.

Nauru appears to have been a meeting and mingling place for the culture of the Caroline and Gilbert Islands.

TOY CANOES

As in other Oceanic islands, the sailing of toy canoes is a favorite pastime for the boys in Nauru. Hambruch (1914, vol. 1, p. 332) figures one termed *to mage,* the same name by which it is known in the Gilbert Islands. It is notable in that the outrigger does not conform to the type followed by full-sized canoes. The two outrigger booms with which it is equipped, instead of being parallel, are arranged diagonally, so that they cross one another about two thirds of the distance outboard toward the short float (fig. 258). In this peculiarity the outrigger bears a striking resemblance to that seen in the Fijian *ulatoka* of Williams and the *amatasi* models figured by Krämer and Thilenius from Samoa.

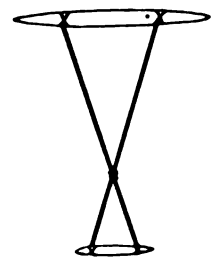


FIGURE 258.—Toy canoe (*to mage*) used by Nauru boys in their model canoe races (after Hambruch, 1914-15).

MARSHALL ISLANDS

INTRODUCTION

Today the Marshall Islanders are expert builders of canoes and boats and in the past they were clever and daring navigators. They build trading schooners of European model, of good size, and as well constructed as those of foreign origin. As a consequence the old-time great outriggers are no longer built; only paddling dugouts and medium-sized sailing canoes for fishing and coastwise trips have survived. The sailing canoes are built on precisely the same lines as the large ones now extinct, so no doubt exists respecting the details of their construction. A figure of a canoe seen by Choris (1822-26, pl. 12), except for a few inaccuracies, gives an excellent plan of the sailing outrigger and shows that no change in design has come in during the past century (fig. 259).

In common with other Micronesian areas—with the single exception of the Truk Islands—the double canoe was never in use in the Marshall Islands within the historic period.

SAILING CANOE

CONSTRUCTION

The characteristic old sailing canoe (*wa lap,* Krämer; *wa lab,* Finsch) has intimate relationship with the canoes of the central Caroline Islands. In both there

are the same double-ended hull, high ends, asymmetric sides, and sharp bottom. Both have the lee platform strongly developed, some of the larger carrying small palm-leaf huts, and both are rigged similarly and sail in the same fashion (fig. 259). Only in the construction of the outrigger is there divergence. In this structure the Marshall Islanders have either abandoned or have not adopted the forked Y connectives and the oblique spars used in the central Carolines to stiffen the outrigger frame.

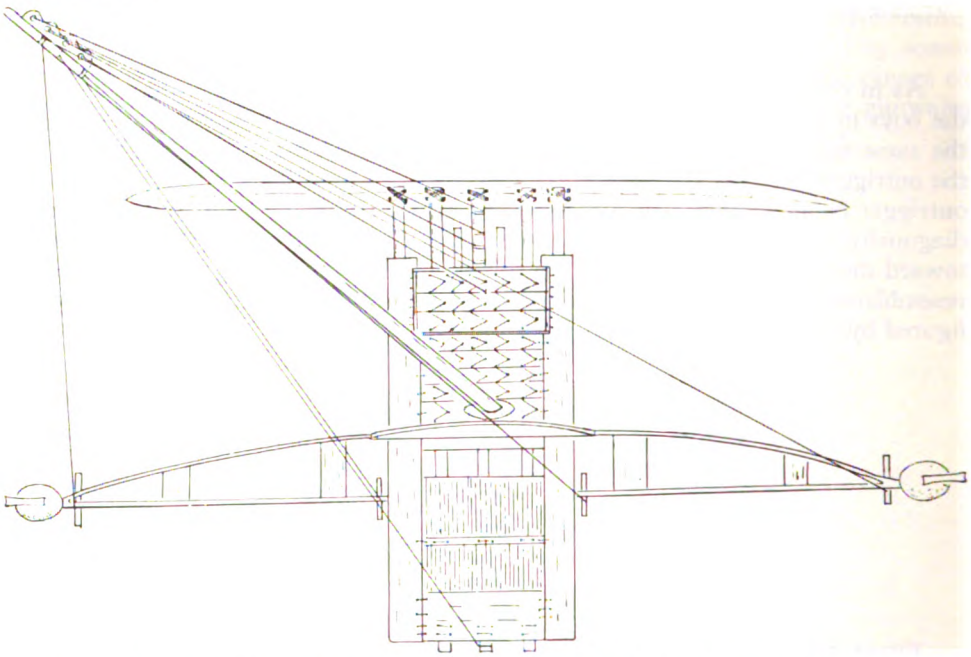


FIGURE 259.—Plan of a sailing outrigger of Marshall Islands, topmast omitted, also yoke and tension stringer; some details of boom fittings inaccurate (after Choris).

OUTRIGGER SYSTEM

The unique outrigger system which has been brought to relative perfection in the Marshall Islands relies upon the employment of a number of accessory booms connected directly to the float, in addition to a pair of main booms having indirect attachment. The details of this structure are as follows:

The main booms (*gie*), normally two in number, are stout, squared beams; these form the backbone of the framework, their proximal ends lashed athwart the hull. On the windward side they project horizontally to a point just beyond the center of the float. To this each is attached, ordinarily, by means of one vertical or slightly inclined stanchion of which the upper end is driven into a hole in the lower side of the boom, the bottom end being similarly plugged into the float. (Compare the related attachment employed in the Tuamotus, at Fakarava and Nukutavake.) In a few canoes there are two stanchions to each boom, tied to it, one on each side, their upper ends projecting above the boom (Krämer, 1906, fig. 42). To secure this connection further, on each side of the paired main booms is a series of three curved accessory booms (*abed*), each attached directly to the float by a sennit lashing passed through a roomy rectangular V-shaped hole mortised out from each side of the ridged upper surface of the float (fig. 260).

The curvature of the distal section of the lateral booms is obtained by forcing them under a wooden bar lashed fore and aft beneath the main booms near the outer ends and then seized to them in this position with sennit. Unlike the main booms, these do not cross the hull, their proximal ends being lashed upon a block fastened on the midships section of the weather

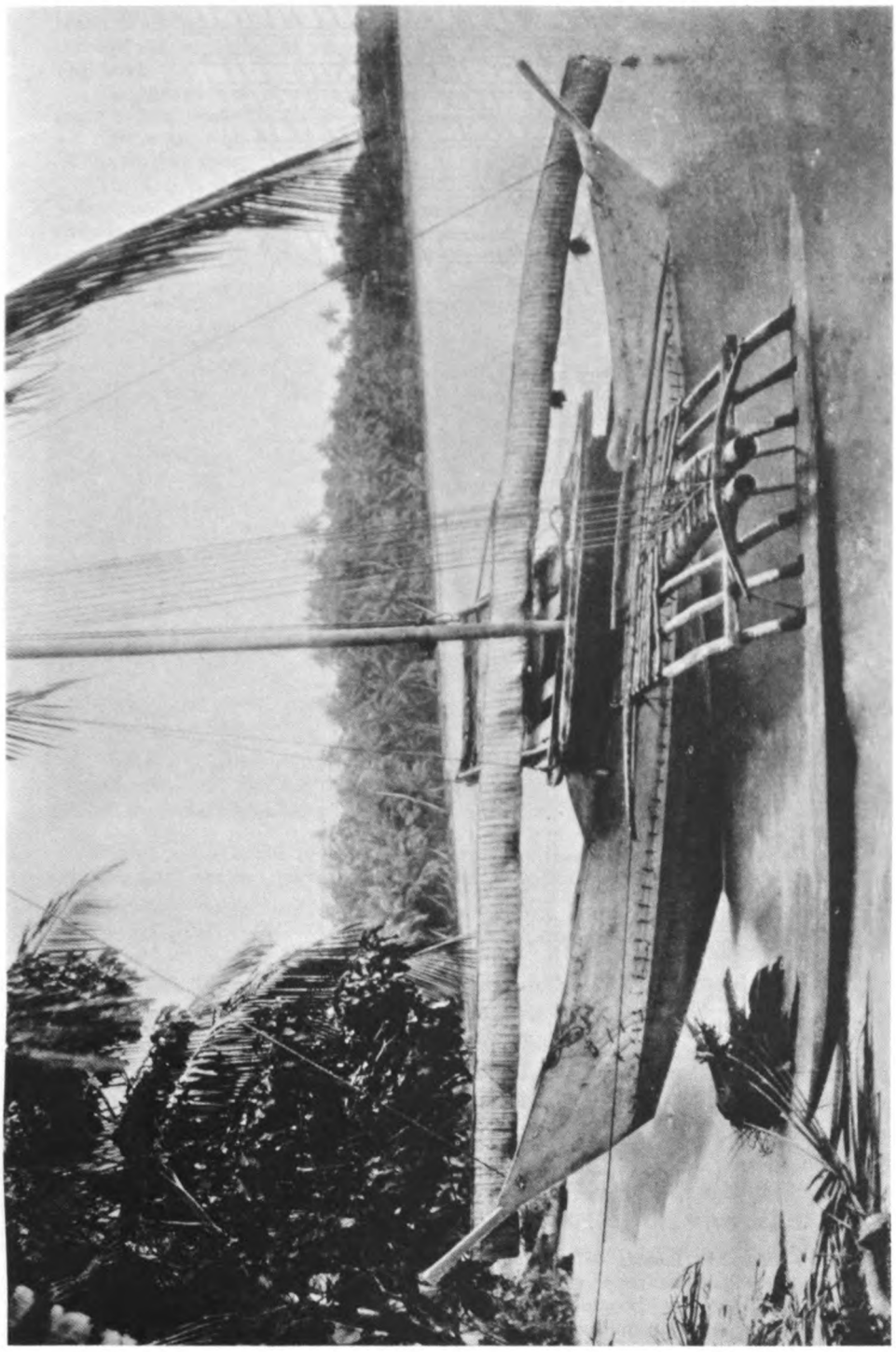
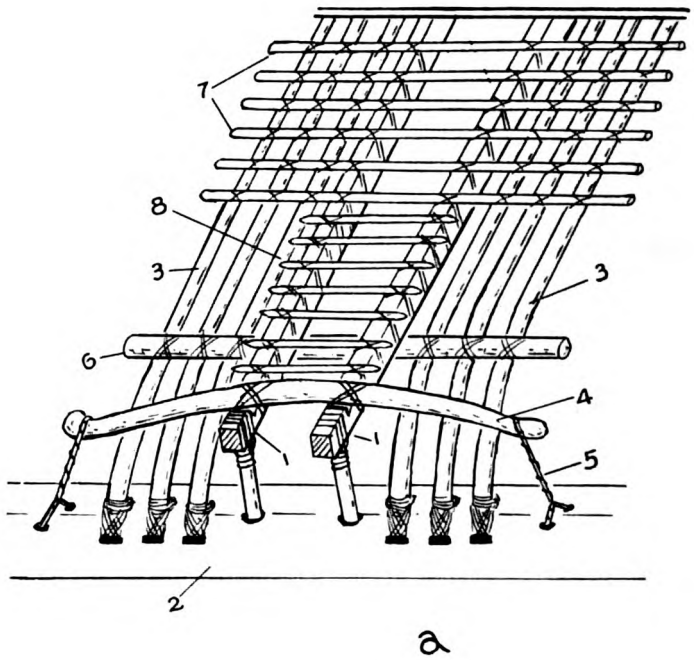


FIGURE 260.—Marshall Islands sailing canoe, side view, carved figureheads removed; nine weather shrouds present; protective palm-leaf cover shelters mat sail from sun and rain; defective portion of near end piece has been ingeniously patched at its junction with washstrake (photograph by Krämer, courtesy of Hamburg Museum für Völkerkunde).



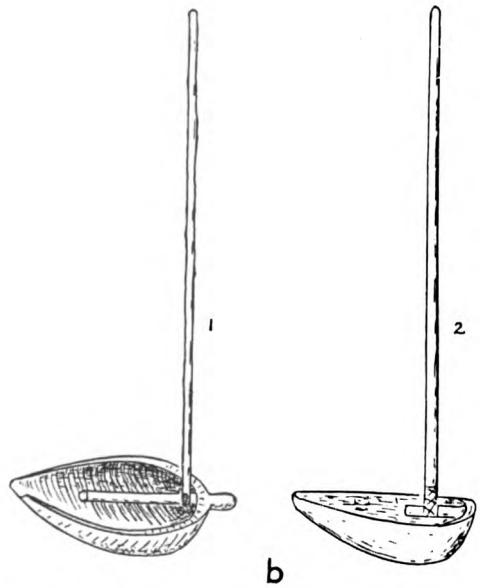


FIGURE 261.—Marshall Islands sailing canoe. *a*, details of outrigger: 1, two main booms, straight, with vertical stanchion supports inserted into ridged upper surface of float (2); 3, two sets of three curved accessory booms attached to float by lashing passed through V-shaped holes; 4, yoke lashed athwart main booms, its ends bent downward by pull of side stays (5); 6, stout stringer inserted between straight and curved booms; 7, long inner stringers; 8, short outer stringers to which numerous shrouds are attached. *b*, long-handled bailers: 1, after Alexander (1902); 2, after the Deutsches Kol. Lexikon.

gunwale. Across the extremities of the main booms lies a flexible yoke extending fore and aft the whole breadth of the outrigger frame. Each end is drawn down somewhat by a tightened sennit brace passed at its lower end through a transverse hole in the ridge of the float or through the outermost of those through which the lashing of the accessory booms is passed (fig. 261).

This mixed type of outrigger framing is related to the one characterizing the large seagoing sailing vessels employed in Javanese commerce in the eighth and ninth centuries which are represented with considerable detail in the sculptured panels of the Buddhist stupa of Boro Budur in that country. (See Hornell, 1920-a.)

The float is short and stout as is usual in typical Micronesian vessels; the ends are sharply pointed and slightly upturned. The under side is rounded in transverse section, the upper ridged axially.

FIGURE 262.—Details of outrigger platform and mast step of Marshall Islands canoe seen obliquely from one end, photographed at Jaluit, 1900 (courtesy of the U. S. National Museum).

WEATHER AND LEE PLATFORMS

Athwart the main booms in their outer section is lashed a set of runglike bars spaced at short intervals for the attachment of the numerous shrouds. On the inner side of these is a lattice decking of closely set poles which contributes additional strength to the structure and serves as an outer platform as it extends over all the booms. A space of 2 to 3 feet left between this rude outrigger decking and the side of the canoe is occupied by a substantial raised platform built of planking. It commences on the weather side of the mast and extends 2 to 3 feet outboard over the booms. When sailing, one or several of the crew, according to the strength of the wind, are stationed on this platform; watching the wind and the lift of the float, they move farther out or in upon the outrigger framework as gusts increase or die away, acting thus as live ballast (fig. 262). This custom prevails throughout Micronesia and is found as far afield as Ceylon, where, in the absence of a weather platform, members of the crew are sent out on one of the booms, the number required as a counterpoise denoting the strength of the wind; a gentle breeze is a "one-man wind", a fierce blow a "four-man wind".

On the lee side is another platform, larger than the first, used for the same purpose; it is built out at an upward sloping angle. Two stout bulkheads and a heavy fore-and-aft plank on the lee gunwale, between the bulkheads, give the necessary support, all being strongly lashed together.

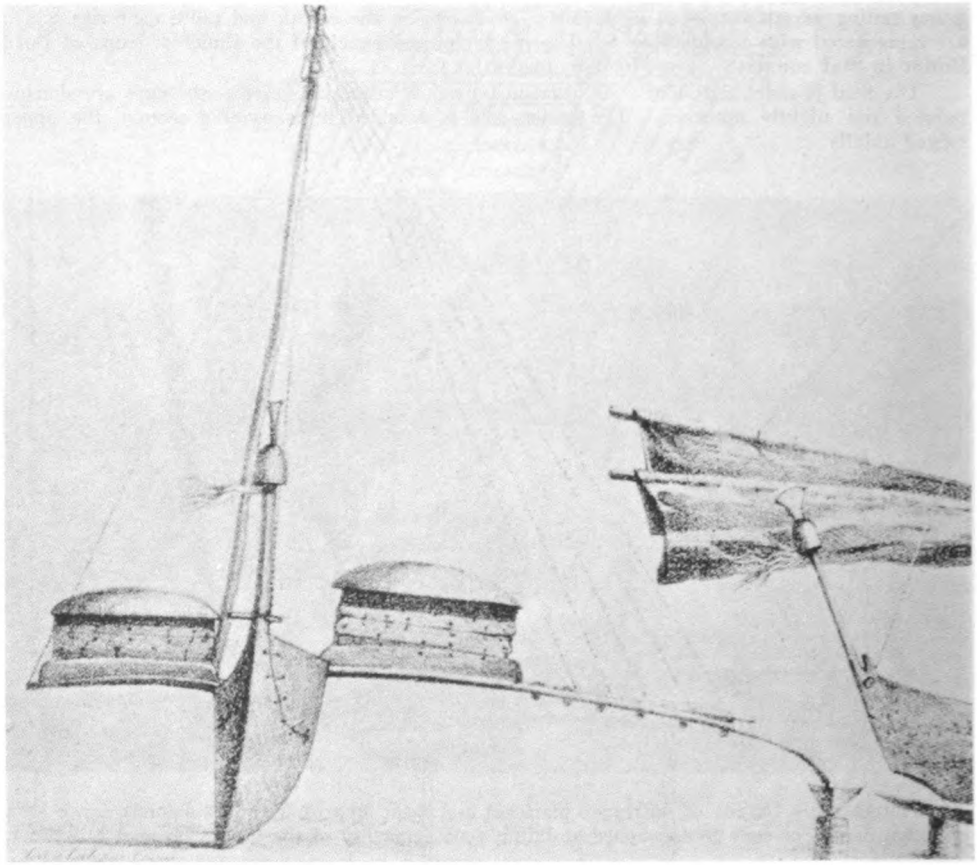


FIGURE 263.—End view of a large Marshall Islands sailing canoe showing curved outrigger on weather side, nearly vertical off or lee side, massive end piece, washstrake, ornamented figurehead, cross bar to which tack of sail is made fast, and covered store hut on each platform (after Choris). The mast is stepped wrongly; it should be upon or close to the weather gunwale.

HULL

The hull itself is built up upon a dugout keel portion made up of one or two or three lengths according to the timber available and the size of canoe desired. On this the sides are raised by the addition of several irregular strakes, the lower longer than the upper; when necessary the strake may be formed of two or more pieces or patches. The strakes run roughly parallel with the keel and finish off at each end by butting against a heavy prow piece, the equivalent of the Maori *haumi*, forming in itself cutwater, bows, and upcurved prow, all hewn out of a solid block (fig. 260). An intricate arrangement of small key pieces is usually employed, to the end of breaking joints and keying the parts together. All are secured together by sennit lashing passed through holes in the opposite edges.

The timber used is mostly breadfruit-tree wood; this swells in water, so calking

is seldom used. In spite of all care in fitting the planks, much water enters through the seams and one man has to be kept constantly bailing.

The gunwales, according to Alexander (1902, p. 808), are fitted somewhat like the deck of a vessel, with a waterway 4½ inches wide, and above, with what may be called a rail, 2⅜ inches high, all cut from one piece of wood. Considerable cargo can be carried in the hold, but it must consist of material that will not be injured by getting wet, for in a choppy sea a good deal of water is taken aboard.

FIGURE 264.—Marshall Islands canoe under sail, photographed at Jaluit, 1900 (courtesy of U. S. National Museum). Shows method of reducing the sail area by the use of a spiller line—the line held by the steersman.

No frames are employed, for the two platform bulkheads and several inserted thwarts stiffen the hull adequately. The sides are asymmetric as usual in Micronesia, the outrigger side rounder and fuller than the other (fig. 263). The keel being sharp, the flatter and nearly perpendicular surface of the lee side functions in the same way as a lee board, preventing undue drift when under sail.

Canoes belonging to chiefs have specially ornamented ends (*bellik*). These commonly take the form of a hemisphere on the curved-up end of each prow, with a fan-shaped projection above (fig. 264); Finsch appropriately likens it to an

Uhlan's helmet. Other forms include one very like the lotus figurehead of ancient Egyptian boats. Frigate-bird feathers are used to decorate the masthead and the leech of the sail (fig. 265). Finsch (1914, p. 485) states that egg-cowry shells are not used in canoe decoration in the Marshall Islands.

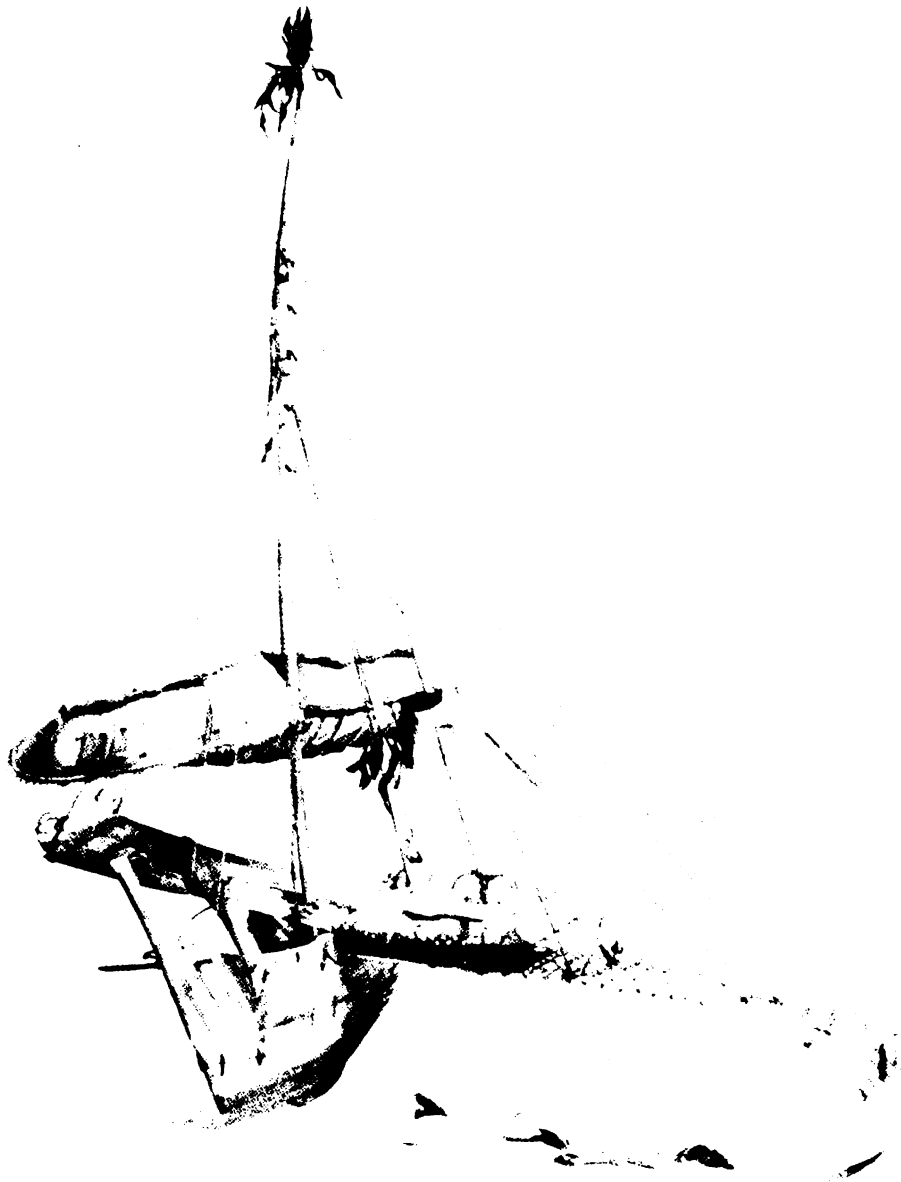


FIGURE 265.—Model of Marshall Islands sailing canoe (U. S. National Museum) showing relationship of the several parts; stem heads have lost their characteristic carved tops, one of which lies on the floor, together with three bailers.

Mast, Sail, and Rigging

The mast is stepped free in a strong socket immediately outside the weather gunwale and at the same level. It is supported by several shrouds which range in number from three to seven, according to the size of the canoe (figs. 260, 262).

When under sail only the shrouds on the weather or outrigger side are made fast. Of these one is led from the masthead to the flexible yoke at the outer end of the outrigger; the others are arranged on the mast at equal intervals below the first and are led in turn to the short bars across the two main booms (fig. 262). Besides these there are two masthead stays running to the two ends of the canoe where they are made fast to a stout pin transfixing the bows, used also as a sail step (fig. 259). The stays are not made fast permanently, as they have to be slacked away as in Fiji whenever a fresh tack has to be made; this allows the mast to be slewed around to rake toward that end which on the previous tack had functioned as the stern. At the same time the tack of the sail is hauled around and stepped at the end opposite the one where it was before.

The mast itself is a stout spar, exceeding by several feet the length of the hull. It is in two parts, the connecting ends formed into a scarfed joint, strongly seized.

The upper part of the mast comprises in one piece both masthead and topmast. This is made of much harder wood than the lower section, as the single halyard, in default of the use of blocks, has to be rove through a sheave hole in the head of the mast, in manner similar to that prevailing in Fijian sailing craft. Two other holes pass through the masthead to permit the passage of two spiller lines. As the wood is exceedingly hard, these holes become smooth with usage. When not in use canoes are always hauled up on the beach, accessory shrouds being then attached to the outer corners of the lee platform to prevent the mast from falling over on the weather platform. (See fig. 260.)

The sail is of matting and has the ordinary Caroline Islands triangular form, the long sides secured respectively to a boom and a yard, not by lacing around in the ordinary manner but by lashing passed through holes bored at intervals along one edge of each spar. It is set apex down, the tack resting against the pin step in the bows. When sail is set, the single halyard is belayed to a cleat some distance above the heel of the mast, the sheet being led to a short bridle on the boom.

The yard and boom are equal in length, about as long as or only slightly longer than the mast. In a canoe 21 feet long, the length of the mast is 23 feet and that of the yard and boom about 24 feet.

Considerable difficulty has been experienced by many writers in understanding how such a sail can be reduced when a squall strikes the canoe, seeing that there are no reef points or other means of reefing. It appears to be done generally in the manner described by Alexander (1902, pp. 809-810):

> When a strong breeze is blowing accompanied by occasional squalls . . . and the sail has to be handled quickly, it is triced up by means of a spiller. This brings the weight of the boom and sail near the masthead. The spiller consists of a line made fast to the boom in the center of the sheet bridle, passing up the lee side of the sail through a hole in the masthead a little above where the halyards reeve; thence to the forward side of the weather platform, where it is made fast. There are two of these spillers, but only one is used at a time. The second one is on the opposite side of the sail, also rove through the masthead and the end fastened to the other side of the weather platform. By this means there is always a spiller on the lee side of the sail ready for use. (See fig. 264.)
>
> Ordinarily three men are required to sail a canoe—one to steer, one to tend the tack of the sail, and the other stationed at the spilling line. When a squall strikes or a sudden gust of wind comes up, the boom is lifted by the spiller. This immediately decreases the sail area as much or as little as may be desired, regulated according to the strength of the wind. The force of the wind having passed, the spilling line is slacked away and the boom and sail dropped down. If the breeze be steady, but too strong to carry all sail, the boom is hauled up, reducing the sail to the required area that can be carried.
>
> When running free, or with the wind abeam, there is little difficulty in handling a canoe of this rig. In beating to windward, however, more or less complications are likely to arise,

such as getting the sail aback or the boom getting adrift, either of which might cause considerable disaster in a stiff breeze. Should the sail get aback in a strong wind, the mast would go over the weather side, there being no shrouds or stays on the lee side to prevent it.

An outrigger canoe in beating to windward does not come in stays and go about on the other tack, and it may be interesting to some to know how windward work is performed with the wind always blowing against the same side. This is done by the bow and stern changing places, as it were, in such a manner to permit first one end and then the other to point to windward. When a tack is to be made, or we might say a hitch made to windward, the sheet is eased off and the tack lashing on the lower end of the gaff removed, at the same time slacking up the forward masthead stay and hauling taut on the after one, until the masthead falls forward on a line with the stern. The tack of the sail is now swung aft, always on the lee side of the mast. As the tack is carried aft the bow swings off, and what was formerly the stern now becomes the bow, which now points to windward. The tack is lashed to the pin at the bow, the sheet hauled in, and the canoe is on her course, having made little or no leeway, the time occupied being not over a minute. While a canoe can not be put about as quickly as a sailboat, yet the quickness with which everything is performed is remarkable considering the number of things to be done.

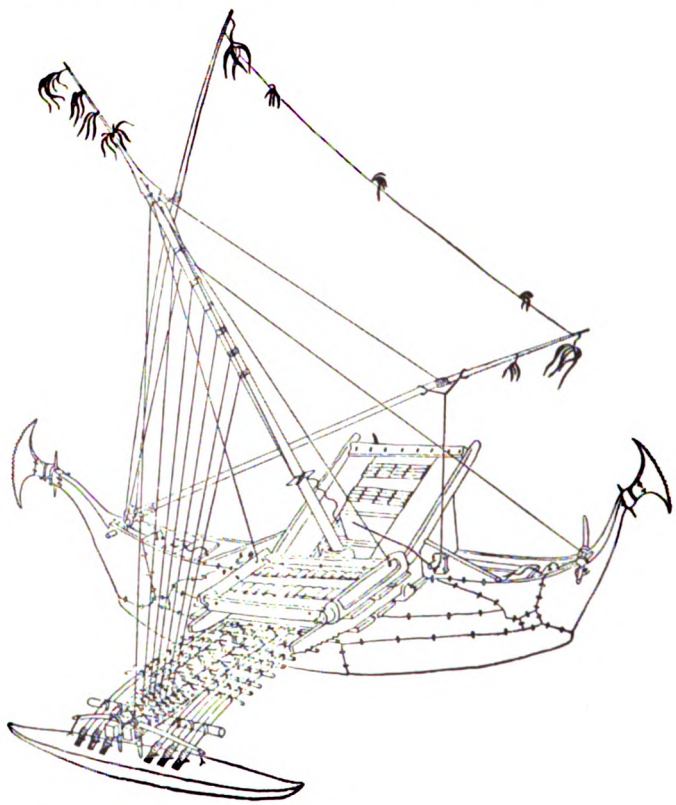


FIGURE 266.—Jaluit sailing canoe, showing all essential features of the design used in the Marshall Islands (from Alexander, 1902).

The steering is done with a paddle 10 feet long; near the upper part of the blade is attached a lanyard, half the length of the canoe, the end of which is made fast under the lee platform. When all is ready for tacking, the man steering drops the paddle overboard and stands by to receive the tack of the sail as it is swung to him. Having secured it in position he hauls tight the mast stay, sees that the spilling line is clear and ready for use, and then takes the part of a lookout. In the meantime the other man has hauled in the sheet, made it fast, picked up the paddle which has floated aft, and becomes steersman. Thus they alternate in positions.

The description given above refers particularly to the sailing craft of Jaluit (fig. 266) as described by Alexander, Krämer, and Finsch. According to Alexander the sailing canoes of Rongelab, Likieb, and Arno are similar, excepting that at Rongelab the weather platform carries a bunk house 6 feet long, 4.5 feet wide, and 2.5 feet high; the frame is made of withies and covered with coarse lauhala matting. This apartment is occupied by women and children when they are aboard, at other times by the men.

Dimensions

The present-day sailing canoes of the type described run about 20 to 22 feet in length, with a beam of 30 or 32 inches and a depth of less than 3 feet; the float is attached about 12 feet outboard (fig. 260). The sailing canoes of former times were much larger, but there are no authentic records of any of greater length than 50 feet (15 meters, Krämer). Alexander (1902, p. 806), however, mentions that "canoes 60 and 70 feet long are said to have been common". Fifty persons could be accommodated aboard, together with some cargo.

One old-type canoe measured by Alexander at Likieb was 13 feet 2 inches in length over all, 7.5 inches from the gunwale to the water line, and 16.5 inches from the water line to the keel, making a depth of 24 inches, width 15 inches; it was very sharp on the bottom, with the weather side rounding out—the usual Micronesian asymmetry. The outrigger float was 8.5 feet long. Two stout booms formed the backbone of the outrigger frame and were reinforced by five slighter accessory booms; the main booms were lashed proximally athwart both gunwales, the accessory booms to the weather gunwale only. On the outrigger side was a platform 24 inches square and on the lee side one 22 inches square, both raised 2.5 inches above the gunwale.

In 1899 when Alexander visited Likieb sailing canoes were being rapidly displaced by locally built boats of European pattern; a shipyard belonging to a Portuguese settler was busily engaged in turning out both boats and small schooners which compared favorably with similar craft built in California.

According to information received by Alexander concerning the comparative merits of the sailing outrigger and the average sailboat of equal length, the sailing outrigger is inferior in windward work when the sea is choppy, but with a beam wind and running before it she is superior. In beating to windward the canoe is somewhat handicapped by the large amount of water she takes in, and in a rough sea almost constant bailing is required. Formerly many canoes were lost in making passages to distant islands.

Fishing Canoes

The small canoes (*garagar*) used within the lagoons and close inshore for fishing are built invariably of five pieces, a round-bottomed dugout underbody, two plain end pieces of equal size and shape, rendering the canoe double-ended, and a washstrake on each side filling in the space between the end pieces. The outrigger is a simplified counterpart in shape of that of the larger canoes. Most of these small canoes, except at Jaluit, are equipped with mast and sail, set up only when required. The mast is unshipped each time the sail is taken in, and this is handled in the manner of a spritsail. Instead of five to seven shrouds, as in the large canoes, there is only one, set up with a toggle at the outer end of the outrigger frame.

At Rongelab, Alexander (1902, p. 812) noted that the small canoes, unlike those of Jaluit, always carry a sail.

At Likieb in the Ratak Chain, Alexander (1902, p. 814) found the small canoes to differ slightly from those seen at Rongelab and Jaluit. Some were fitted with

sails, and others of equal size were propelled wholly by paddles. There was not the noticeable difference between the lee and weather side as compared with the canoes at other islands in the Marshall Archipelago.

ACCESSORIES

The ordinary paddle as used for propulsion is figured by Choris as having a long narrow blade with parallel sides, angular shoulders, and a distal end cut to an angular point of about 70 degrees. The loom is fitted with a crossbar cut from the solid with the rest of the paddle.

The bailer used is of the regular scoop form with internal handle. As the hull of the large type of canoe is deep, a pole is usually lashed at right angles to the bailer handle for lowering it to the bottom of the bailing well (fig. 261).

TECHNICAL TERMS

According to Krämer, technical terms applied to canoes are as follows: *abed,* curved outrigger booms; *dibenill,* small sailing canoe; *gic,* straight outrigger booms; *garagar,* a paddling canoe; *wa lap,* large sailing canoe.

According to Finsch: *dschewe,* steering paddle; *gidju,* mast; *kubak,* float; *u-a, wa,* small canoe; *wa lab,* large sailing canoe; *wudjela,* sail.

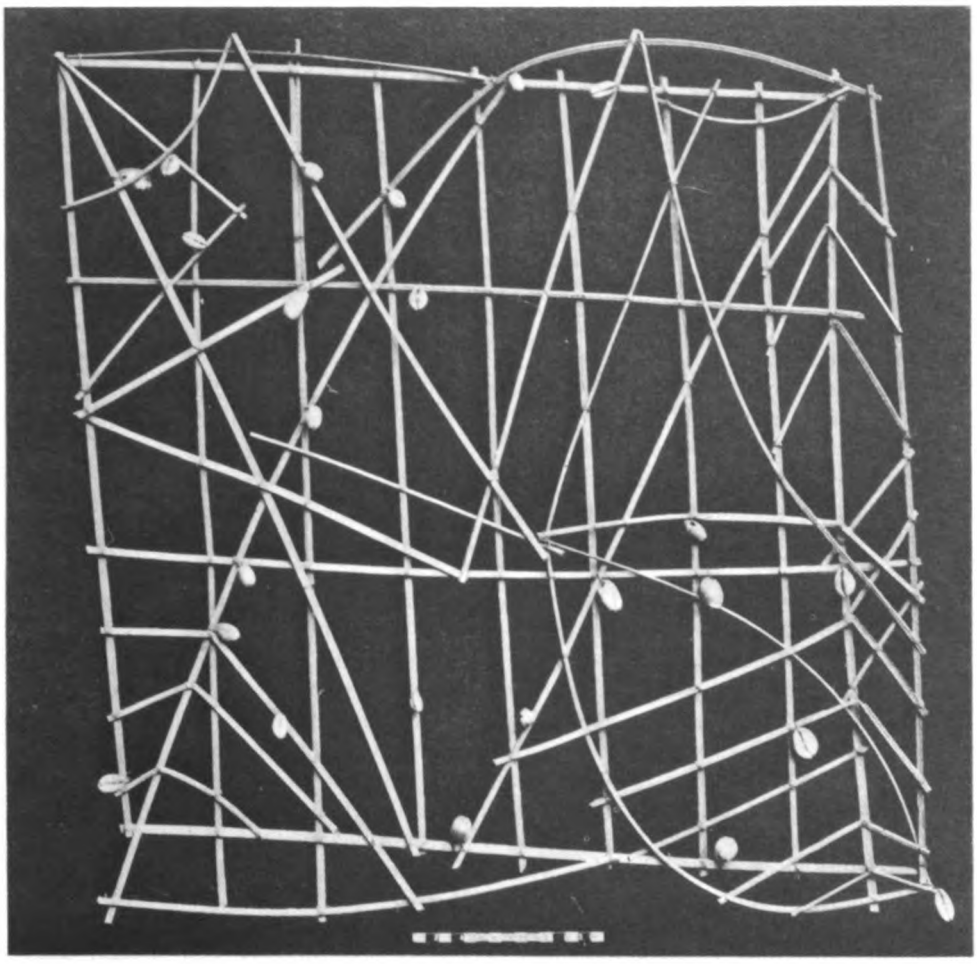
NAVIGATION

Fearless and adventurous voyagers as the Polynesians were in former centuries, they appear never to have studied ocean phenomena in their bearing on the science of navigation with anything like the painstaking and methodical skill which the Marshall Islanders devoted to this subject. Doubtless by observation their sailing experts could infer much from the run of the ocean swells, but this knowledge was comparatively elementary and was never detailed, tabulated, and set forth in the form of primitive charts. In the Marshall Islands, on the contrary, every chief and sea pilot possessed elaborate charts based upon his own experience and on knowledge handed down or gained from others.

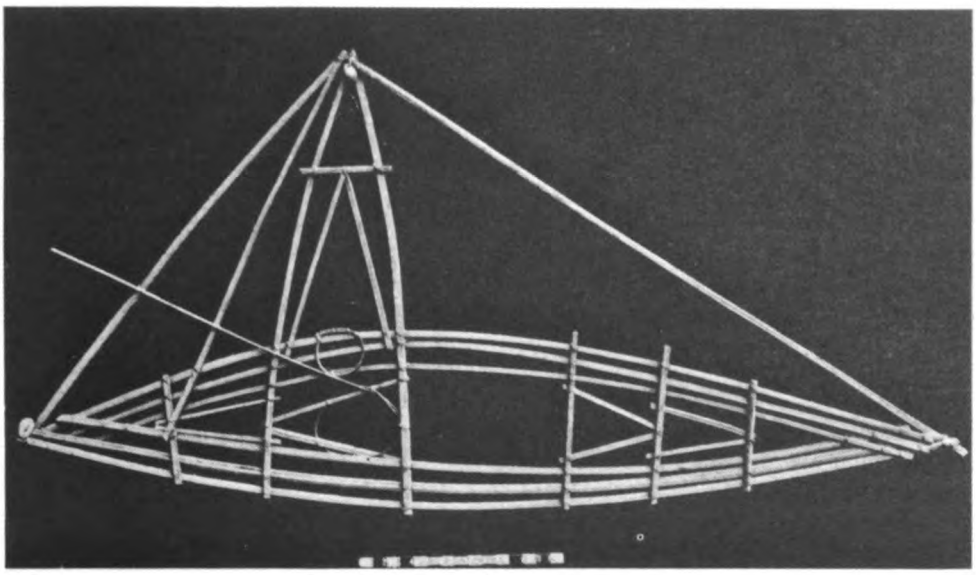
These sea charts (fig. 267) are made with thin strips of the midrib of the leaflets of coconut leaves, arranged on a frame usually rectangular in shape. The knowledge they record is indicated by the arrangement of the leaf strips relative to one another and by the forms given to them by bending and crossing. Curved strips indicate the altered direction taken by ocean swells when deflected by the presence of an island; their intersections are nodes where these meet and tend to produce a confused sea, which is regarded as a most valuable indication of the whereabouts of the voyager. Currents in the neighborhood of islands are sometimes shown by short straight strips, whereas long strips may indicate the direction in which certain islands are to be found. The islands themselves are indicated by small shells, usually the money cowry (*Cypraea moneta*), tied to the framework. Their position relative to one another is indicated with considerable accuracy, but the distances from island to island are only approximately suggested, for these "charts" are never made to scale and are, in fact, little more than mnemonics for the use of their owner and unintelligible to anyone who has not the maker's assistance.

Winkler (1901, p. 495), the only person except Hambruch who has studied them with adequate local and technical knowledge, states that the islanders recognized three classes of charts according to the purpose for which they were constructed:

1. *Mattang.* A chart prepared for instructional purposes only. It usually represents a simple problem such as that of a single island at the center of the chart, with curved swell



a



b

FIGURE 267.—Sea charts used in the Marshall Islands: *a*, a *rebbelib* chart of a portion of the archipelago, position of islands indicated by cowry shells sewn on at certain points of intersection; *b*, a *meddo* chart providing sailing directions relative to Jaluit, Ebon, and Namorik (Courtesy of the Science Museum, London).

fronts arranged in four quadrants. The construction is generally symmetrical in order to present a simple set of conditions.

2. *Medo* or *meddo*. A chart including a portion only of the archipelago, usually four or more islands.

3. *Rebbelib*. A form which includes the whole of the island group, or at least one of the two parts, the eastern or Ratak Chain or the western or Ralik Chain, into which the Marshall Archipelago is divided. Charts of this kind are of various forms and sizes and as they are neither made to scale nor even approximately correct in their orientation, it is impossible to interpret them unless the maker's explanation is available.

How far reliance on the behavior of the ocean swell and on the run of local currents was supplemented by stellar observations is uncertain. Winkler inferred that stars were not used to any great extent in navigation in these islands, but one informant gave a specific instance in which they were employed. As their neighbors on both sides, the Caroline Islanders to the west and the Gilbert Islanders to the south, were diligent students of the heavens as an aid to navigation, it would be incredible if this help had been ignored by so observant a people as the Marshall Islanders.

The possession of detailed knowledge of the altered behavior of the ocean swell when it meets known islands or groups of islands rendered the islanders confident navigators. Long voyages at the appropriate season were frequent between the islands of the archipelago itself and these were upon occasion extended to the Caroline Islands, the Gilbert Islands, and even the Ellice Islands. But be it understood, these voyages were performed in previously determined stages, from island to island. It must also be borne in mind that the voyaging season was strictly limited to that comparatively short period when the trade winds are not blowing or have little force. As a rule navigation began toward the end of June or the beginning of July and ended when the trades set in, the whole sailing period covering barely four months in the year (Winkler).

The islanders invariably waited for the advent of fine weather and sailed only when their weather experts promised a continuance thereof for several days. Another precaution taken was never to undertake long voyages unless a large flotilla of canoes participated under the pilotage of the ablest of their chiefs. Even then there have been terrible disasters when the voyagers were caught in sudden storms or lost their bearings. Winkler (1901, pp. 507-508) mentions several. The worst remembered occurred about 1830, when more than 100 canoes were overwhelmed, only one escaping to tell the tale. The year 1860 was another period of disaster. Of 35 canoes that set out from Jaluit to sail to Kili, a distance of 150 sea miles, none was ever heard of again, and of 22 canoes on a voyage from Majuro to Jaluit, about 480 miles distant, the only survivor was one that made land near Ponape in the Carolines. Again in 1885, of 10 canoes conveying a war party of 150 men, which left Majuro for Aurh, 300 miles away, all were lost.

CAROLINE ISLANDS

GEOGRAPHICAL ISOLATION

In spite of the great area over which the islands and atolls of the Caroline Archipelago are dispersed, an area more than 1,500 sea miles from east to west, and of the great distances separating many of them, so far as concerns the design of sea-going canoes—the "flying proas"—there is such fundamental similarity that the archipelago must be considered a primary unit wherein this design has been evolved during a long period of comparative isolation. Indeed the same fact and deduction are applicable, with slight reservations, to the whole of Micronesia, of

which the Carolines form the central and largest section, having no direct cultural contact with Polynesia and Indonesia save distantly at second hand through the peripheral islands of the Micronesian world.

The Carolines are generally divided into three main sections, western, central, and eastern. The first two have much in common in respect to canoe design. The eastern section, including Kusaie and Ponape, has special features differentiating it from the other two.

WESTERN AND CENTRAL CAROLINES

The canoes belonging to the region which extends from Yap in the west to the Mortlock Islands in the east fall into a number of types and classes sufficiently distinct to permit of the following classification:

Canoes with triangular outrigger platform
  With a lee platform in addition: sailing canoes
    "Flying proa" of *popo* design (central Carolines chiefly)
    "Crescent proa" or *tsukupin* (Yap)
  Without lee platform
    Popo type
    Local variants
      Western Carolines
      Sonsol Islands
      Tobi
      Mapia
Canoes without triangular outrigger platform, widely variant, mostly paddling canoes
  Western and central types
    Small paddling canoes
    Yap war canoe
    Truk *faten* canoe
  Southern types
    Nukuoro
    Kapingamarangi

FLYING PROA

Historical References

The Caroline sailing canoe used for long sea journeys and interisland communication is the real "flying proa". This term, unfortunately, has come to be linked more especially with the Marianas canoe, with which European navigators became familiar at a much earlier period. Magellan crossed the western Pacific at a higher latitude than the Carolines; his course in this region was followed by the Spanish captains in the trade between Manila and Acapulco which came into existence upon the Spanish conquest of the Philippines and Marianas. Early English circumnavigators and privateers followed the same track in the hope of meeting the Manila treasure ship. As a consequence, although a number of islands in the Carolines were laid down in old Spanish charts, they retained immunity from descriptive discovery till the final decade of the eighteenth century. The real era of discovery in the Carolines ranges from 1791 (Hunter) to 1828 (Lutke). The uninhabited Andema Islands were not discovered till 1832 (Fraser), and the small Grimes Island remained unknown till 1841 (Grimes). Knowledge of the "flying proa" of the Marianas goes back, however, to Magellan's voyage in 1521 and Dampier's enthusiastic description in 1686, to say nothing of the accounts given by Rogers and Anson in the next century. All this time the Carolines remained outside European influence, with the consequence that when the indigenous Marianas canoes had disappeared, civilized out of existence, those of the Carolines continued to hold the sea as they do today, though in sadly diminished numbers and of smaller size than a century ago.

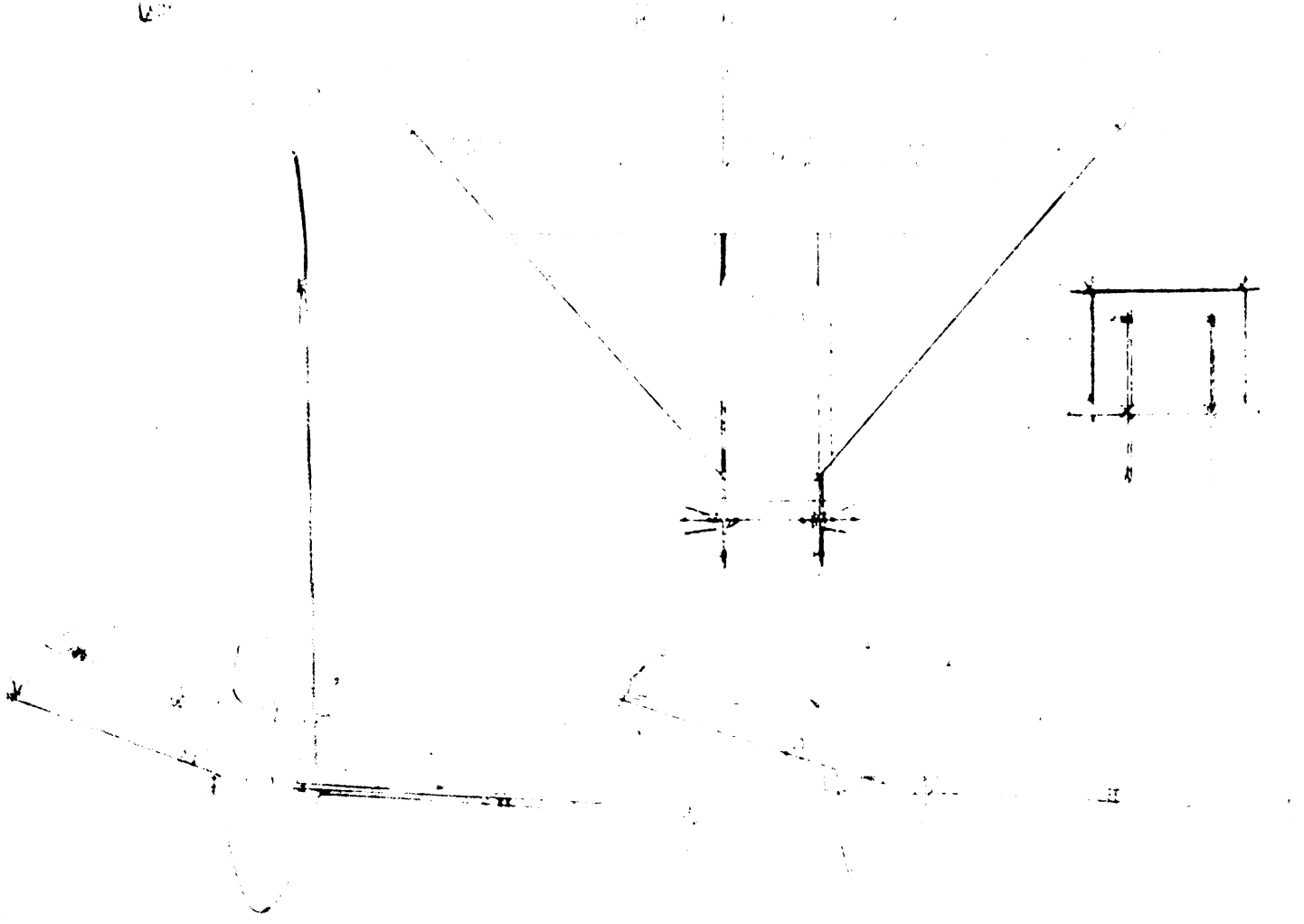


FIGURE 269.—Typical "flying proa" of the Caroline Islands: 1, side view, shading of hull represents areas painted black, white parts red, quarter rudder (6) and paddle (7) shown; outrigger attachment of boom on left consists of straight stanchions, that on right of two crutch stanchions; 2, plan; 3, end view; 4, transverse section, and 5, details of arrangement and lashings of outrigger booms (a) and lee-platform booms (b) in relation to gunwales (e, e') of hull. Other lettering: *d*, secondary boom above and parallel with primary one; *g*, notch for heel of yard; *i*, yoke; *k*, connectives; *l*, float; *m*, oblique spars of triangular platform; *n*, *o*, two thatched store huts; *p*, mast step; *r*, quarter-rudder fulcrum; *s*, outboard ends of thwarts, and *z*, bulkhead within hull (after Paris, 1841).

The earliest detailed reference to the canoes of the Carolines is a fleeting vision left by Sir Francis Drake, who sighted the Ngulu Islands, westernmost of the archipelago, on October 13, 1579. On that day (Alexander, 1916, p. 114) the crew of the *Golden Hind* were heartened by the sight of

> . . . certain islands 8 degrees to the northward of the line, from which islands came a great number of canoas, having in some of them 4, in some 6, and in some also 14 men, bringing with them cocos and other fruits. Their canoas were hollow within and cut with great art and cunning, being very smooth within and without and bearing a glass [gloss] as if it were a horn daintily burnished, having a prow and a stern of one sort, yielding inward circlewise, being of a great height, and full of certain white shells for a bravery, and on each side of them lie out two pieces of timber about a yard and a half long, more or less, according to the smallness or bigness of the boat.

That these islands belonged to the Carolines and not to Palau is attested by the statement that "two pieces of timber lay out on each side", whereby is clearly indicated the presence of the windward and lee platforms characteristic of the Caroline type of sailing canoe as opposed to that of the Palau Islands which has no lee platform or indeed any prominent lee projection of any kind. Other features equally distinctive of the Caroline Islands proa are also described in a few vivid and picturesque phrases which define them as clearly as if pages had been devoted to the task.

Caroline sea-going vessels are figured in the accounts of early nineteenth century voyages of discovery, notably Duperrey, Freycinet, and D'Urville; Paris (1841-43) reproduces many of these. Unfortunately, though giving a good general idea of their form and peculiarities, notably the great development to which a counterpoise to the outrigger frame has evolved in the shape of an ingenious lee platform, these sketches and the accompanying descriptions do not give sufficient details of the methods employed to connect the float to the outrigger booms. It is not till recent times when the Carolines came within the sphere of German influence that adequate information is given on this all-important point. To Kubary, Krämer, Müller, Sarfert, Hambruch, and other German ethnologists, is owed an immense debt of gratitude for the careful and detailed accounts they have supplied of the sea craft of the Caroline Islands. From their descriptions the bulk of the following details are drawn.

Popo Type

CONSTRUCTION

Freycinet has rightly pointed out that the art in which the people of the Carolines—he might well have included all Micronesians—display the greatest aptitude and skill is the construction of canoes. This applies more especially to the large sailing canoes used for interisland communication. The form used throughout the western and central sections is of a highly specialized design; this must have reached its fullest development long before the European discovery of the islands, seeing that in its essential features it reaches from Yap in the west to the Gilbert Islands in the southeast—over 40 degrees of latitude or approximately 2,400 sea miles. Within this great area the range of variation is considerable in detail, evidence that its introduction or adoption occurred sufficiently long ago to permit of local evolution, dependent mainly upon special requirements and the varying quality and size of the timber available for construction, and even upon the influence of cultural contact as in the Marshall and Gilbert archipelagoes.

The main features of the proa (fig. 268) as employed in the western and central Carolines are easily described and understood, but the small details, those in which variation is considerable and common, are intricate and difficult to follow

unless greater space be given to their description and illustration than their comparative importance justifies. They are just the differences noticeable between the fishing craft of neighboring ports on the same stretch of coast in Britain and most do not enter into the larger study of the origin and relationship of the type itself; variations, however, are noted wherever these have a bearing on the main problems.

The "flying proa" in essentials is a single outrigger of the same general form as that of the Marianas as figured by Anson, save that the outrigger connection is more complex and that, in addition, the canoe possesses a counterpoise platform built outboard on special booms projecting from the side opposite the outrigger. As the outrigger is always on the weather side, this second platform, balanced carefully on the cantilever principle against the weight of the outrigger and its decking, is termed the lee platform (fig. 269).

ASYMMETRY

The hull as in that of the Marianas canoe is typically axially asymmetric—that is, one side, the weather or outrigger side, is more rounding and fuller than the lee side. The exact form of the lee side varies somewhat. In some canoes it is nearly straight both longitudinally and vertically, in others to varying degree curved, but always much less than on the outrigger side. To illustrate the consequence of this: if a straight line be drawn from the center of one end to that of the other, it will be found to pass amidships several inches closer to the lee side than to the windward side; as a result, the ends of the hull are turned away from the outrigger side. Now, when under sail, the tendency of the outrigger is to exert a retarding influence on the weather side and so to pull the craft round and off her course. By giving more dead rise to the lee side than to the weather side, a flat and nearly perpendicular surface is presented to the water on the lee side and a counteracting impulse thereby imparted. When the relative proportions of the differing curvatures of the sides have been correctly adjusted, the canoe should travel in a perfectly straight line if given a push when afloat.

This hull form is essentially characteristic of Micronesian deep-sea canoes with the exception of those of the Palau Islands, where the lateral disparity in curvature is not found. In all the other Micronesian areas it has arrested the attention of most voyagers who have seen it; Anson noted it in the Marianas, Freycinet and Duperrey in Tamatam, Pulusuk, and various other central Caroline islands, Müller in Yap and Mogmog, Paris in Satawal, Alexander in the Truk Islands, Choris in the Marshall Islands, Grimble in the Gilberts, and Kennedy in the Ellice Islands of the Polynesian area. (See fig. 270.)

Although this asymmetry is typical of all these islands, canoes having symmetric hulls are recorded. Lütke (1835-36, vol. 2, p. 74), describing those of the Mortlock Islands on the southern border of the central Carolines, says: "I did not see a single canoe with unequal sides, that is, one side flat and vertical and the other curved". Paris (1841, p. 104) mentions that in the Truk Islands, although generally the lee side was flat, several canoes had perfectly symmetric hulls. These would be paddling canoes, in which asymmetry has no advantage but rather the converse.

HULL

The hull is built up of planking upon a dugout base, fairly straight along the bottom, curving upward at the ends. In islands where large trees are, or were, available, as in Yap, all but the upper part of the sides and the two curved heads are hewn from a single log. In atolls where no large timber is available the dug-

out portion shrinks to a wedge-shaped keel piece channeled longitudinally on the upper side so as to give two everted edges upon which the garboard strakes are sewn; the rest of the strakes are similarly added, each higher strake being sewn to the upper edge of the lower one; usually the shapes and sizes of the strake planks are irregular, suitable wood being too precious in atolls to permit either of long

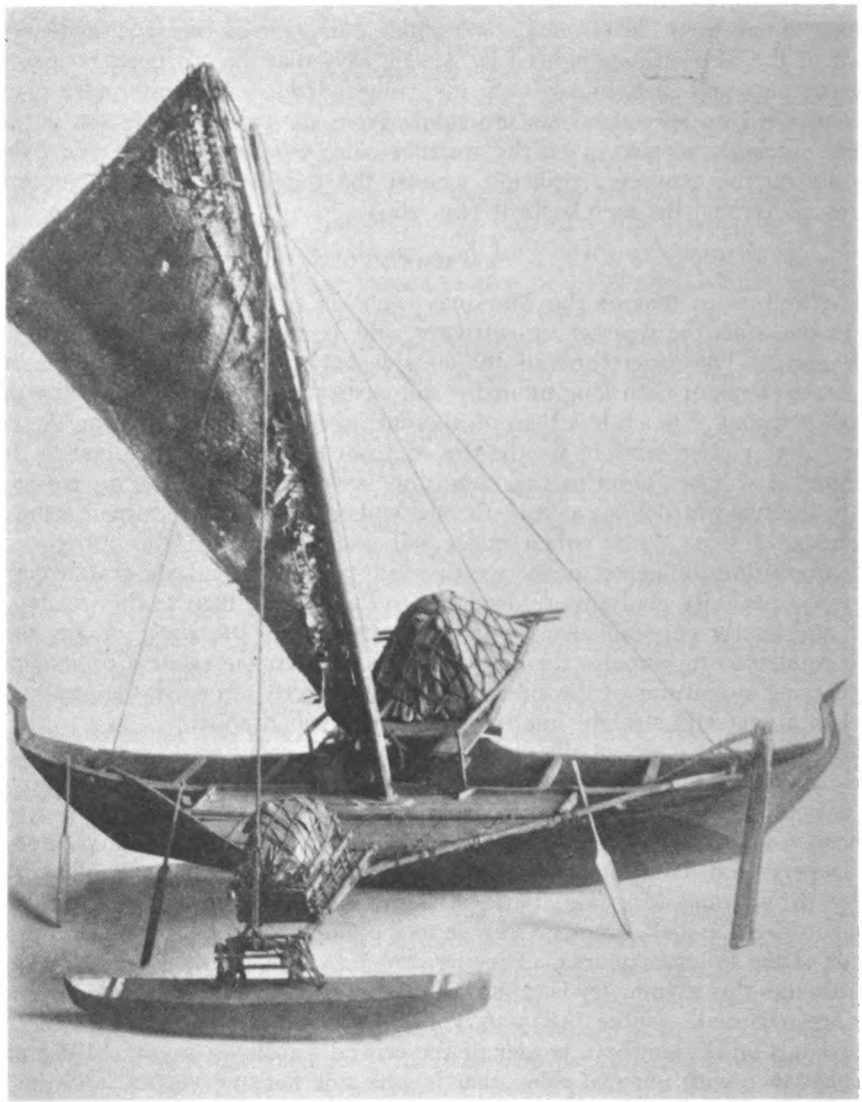


FIGURE 268.—Model of a "flying proa" of *popo* design from Yap, Caroline Islands (Cologne Museum).

running lengths or of adzing opposite edges parallel. So the hull in these islands is a mass of patchwork, all, however, fitted together with remarkable accuracy. Wherever the greater part of the hull has been hewn from a massive tree trunk, as it generally is in the Carolines, there is little or no need to fit strengthening frames and this is not the custom in the Carolines.

Adequate stiffness is obtained when necessary by the insertion of solid bulk-

heads or partitions fitted into the hollow of the hull beneath the transverse supports of the lee platform (fig. 269, 4, *b*, *z*). Paris (1841, p. 97) says each partition is a plank "placée sous les leviers et unie aux coutures par des amarrages". Stiffness is also acquired by the insertion of stout thwarts which hold the sides rigid. A stout gunwale rail is present in most canoes.

The cutwater and head at each end are in one, hewn from the solid; the head curves upward and ends throughout the western and central Carolines in a peculiar and most characteristic fork, broad and stout, sloped upward at a slight angle from the horizontal (figs. 268, 275).

The exterior of the hull is wrought to perfect smoothness and painted in varying patterns of red, black, and white. The bottom and the lower part of the sides are typically black, with black and white bands along the upper part of the sides and a large triangular panel of red on each bow; the gunwale is black. The bifid heads may be either entirely black or black with white extremities.

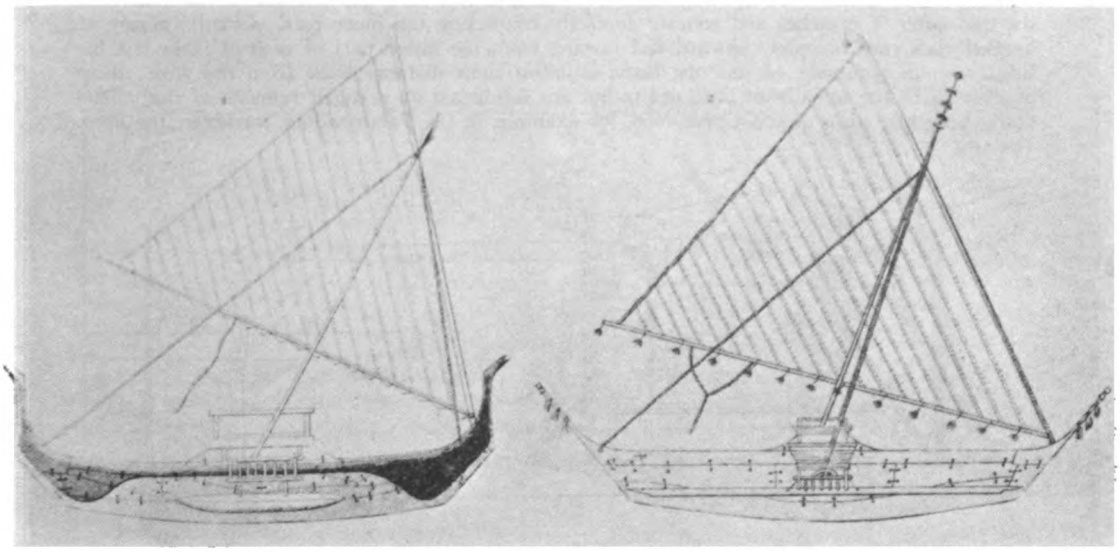


FIGURE 270.—Comparison of the sailing canoe of the western and central Carolines (left) with that of the Marshall Islands (right) (after Kubary, 1889-95, pt. 3).

OUTRIGGER SYSTEM

The outrigger framework consists essentially of two stout booms curving gently downward toward their outer ends, each connected primarily to the float by two crutch-shaped Y connectives placed tandem and by a cord brace made up of multiple lashings. The inner ends of the booms pierce both washstrakes of the hull in large canoes and project a few inches outboard on the lee side.

To brace the outrigger frame a strong spar runs obliquely out from a point on the weather gunwale some distance proximal to each end of the hull, the outer end connecting with the nearer outrigger boom about two thirds of its length outboard. This triangular frame is further strengthened by stringers, usually two in number, the inner and longer lashed to it about one third its length from the side of the canoe and the outer and shorter, when present, near the junction of the oblique braces; in addition a number of transversely disposed poles are laid athwart the frame at short intervals (fig. 269). The space between the hull and the inner longitudinal stringer is filled in with a stout plank decking having a beading along the inner margin. At the apex of the triangular frame a small lattice platform of rectangular shape is constructed upon the two booms by means of longtitudinal ties and bamboo flooring.

The float is usually canoe-shaped, sharp and pointed at each end, the upper surface sloping downward on each side from a median ridge. In transverse section it usually approximates the outline of an inverted top but with the lower part cut into a more or less angular form, as at Yap (Müller, 1917, pp. 171, 175). The median ridge facilitates the drilling or gouging out of the perforations needed for the passage of the connective lashing.

The crutch-shaped connectives are short and stout, the distal curvature of the booms being designed to permit of this shortness, for the shorter the connectives the less risk there is of fracture in heavy weather. The end of each boom is embraced by the two arms of each of the two crutches pertaining to it and secured by many turns of cord. As the crutches are inserted on opposite sides of the median ridge of the float, a space of a few inches separates them and permits a stout bow-shaped wooden bar, the yoke, to be laid athwart the ends of the booms, with each extremity between two crutch connectives. A light stringer is generally added just inside the yoke, further bracing the booms. The ends of the yoke are notched on the upper side and sometimes turn slightly upward to give better purchase for the lashing which is to connect them with the float. In the float a wide transverse V-shaped perforation is made through the median ridge directly under each end of the yoke to permit of the passage of numerous turns of strong cord, some of which pass up and cross over the notched end of the yoke, whereas others are passed between the yoke and the ends of each of the two crutch connectives. Further security is gained by lashing a rod fore and aft across the shanks of the two outer Y crutches and another similarly connecting the inner pair. Finally, a pair of bracket rods runs obliquely upward and inward from the lower part of each of these last fittings, one on each side, to join the boom adjacent some distance back from the yoke; these bracket spars are actually of little utility but are significant as vestigial remains of the unilaterally branched form of connective seen, for example, in the Palau sailing outrigger, the *kaep*. (See fig. 271.)

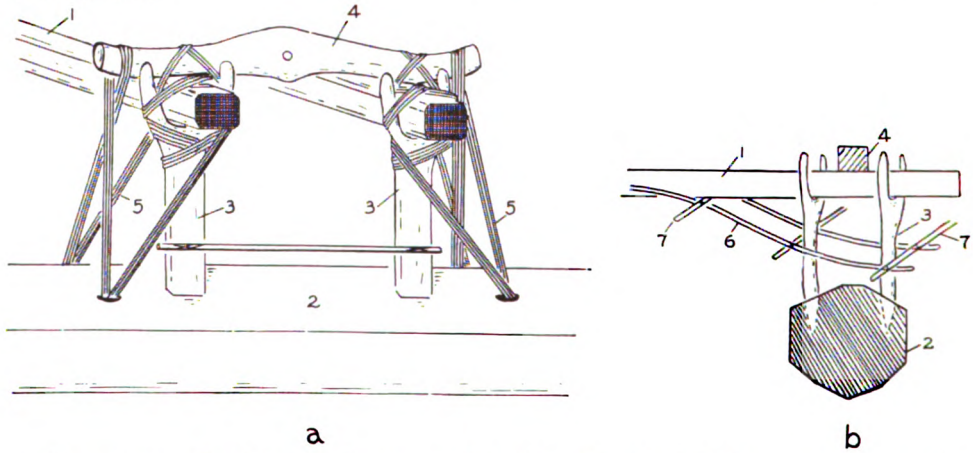


FIGURE 271.—Outrigger attachment used in Yap, Caroline Islands: *a*, attachment of a large *popo*, inner connections omitted for sake of clearness; *b*, diagram (after Müller-Wismar); 1, booms; 2, float; 3, crutch connectives; 4, yoke; 5, braces; 6, bracket rods; 7, stringers.

LEE PLATFORM

The lee platform is erected upon two main booms which slope upward and outward on the lee side from insertion under the weather gunwale (fig. 272, *a*) and just forward of or distal to the adjacent outrigger boom (each end of these canoes is a head, the two being alike in shape and function). To secure them in position, a stout bar is lashed fore and aft across the two sets of booms just inboard of the weather side. The outboard portions of the lee booms are similarly braced together by crossbars, on which a lightly floored platform is laid similar to the outer one on the outrigger frame. On these two, the rectangular platforms on the weather and lee sides, are erected light store huts with thatched roofs generally held down by netting (fig. 269); on the side of each, facing the hull, is a door. These characteristic structures, seen in all older illustrations of Caroline

Islands deep-sea canoes, serve to keep provisions and light cargo. A third platform, small and made of planking, sometimes covers the center of the waist. On the weather side it is raised to a horizontal position by vertical boards resting on edge upon the gunwale to a level with the lower margin of the lee platform. This affords limited accommodation for passengers, who are here out of the way in the working of the canoe.

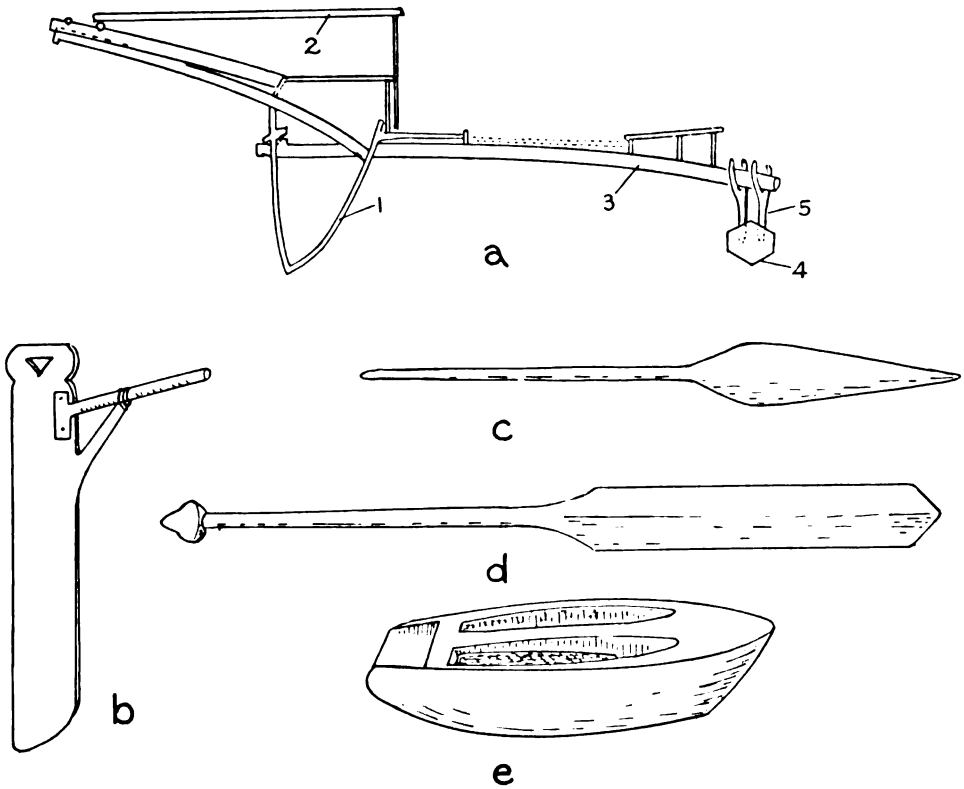


FIGURE 272.—Sailing canoe (*popo*) of Yap. *a*, cross section through hull, outrigger, and lee platform: 1, hull; 2, lee platform; 3, outrigger boom; 4, float; 5, crutch connectives. *b*, quarter rudder. *c*, ordinary paddle. *d*, steering paddle. *e*, bailer. (After Müller-Wismar.)

MAST, SAIL, AND RIGGING

The mast is stepped in a socket cut in a stout boss attached at mid length upon the inner planked portion of the outrigger platform. A shroud runs from near the masthead to the yoke, to which it is secured after passing through a hole bored through its center. There is also a fore-and-aft running stay made fast respectively to the endmost thwart at each end of the hull.

The sail has the form of an isosceles triangle and is set apex down, the long sides bounded by two spars, both sometimes called yards; it is preferable, however, to consider the fore edge of the sail as the head, the other as the foot, in order to make it comparable with European fore-and-aft sails; the fore spar alone should be termed a yard, and the other then properly a boom. When getting under weigh, the sail is hoisted by a peak halyard attached far out on the yard and rove through a sheave hole in the masthead; the heel of the yard rests against a sail step set on a short thwart right in the bows, to which the tack is made fast. Spilling lines are employed in the Marshall Islands, and for the same purpose.

RUDDER

Steering is by means of a quarter rudder (fig. 272, *b*) in the larger canoes; it is manipulated by means of an attached tiller and when in use is held in position against a wooden pin projecting outboard from the quarter. The steersman's duty is the heaviest aboard and on a journey he has to be relieved frequently. To maintain the rudder in position he must have one foot over the side pressed against the lower part of the rudder (fig. 269, 1). Freycinet states that on one occasion he saw the steersman throw it from him as he could not produce the desired effect; three of the crew at once seized their paddles and brought and held the canoe on the proper course. He concludes from the awkwardness with which the contrivance is handled that the use of a quarter rudder is probably a modern innovation, of European origin (1829, vol. 2, p. 131). This deduction can not, however, be correct; the form and manner of usage differ from European shape and practice. Furthermore it was already employed when the islands were first visited by Europeans. Its origin is to be sought in Indonesia, where movable quarter rudders of approximately the same form are in common use (Hornell, 1920).

LOCAL VARIATIONS

Local variations in this canoe design exist, chiefly details in the structure of the outrigger frame and the method of connecting the float to the booms; all are restricted within narrow limits. The most noteworthy and significant is that mentioned by Paris (1841, p. 98) when describing Satawal canoes of the *popo* class. He states that among these the connectives pertaining to each boom may be either two short crutches or four straight stanchions, the one form alternative and equivalent to the other. The upper ends of the straight stanchions are lashed against the sides of the boom, two on each side.

Other writers have noticed and described the same alternative in use in other islands of the western and central Carolines; there can be no doubt that the crutch type is a development from the more primitive stanchion type, two opposed stanchions having coalesced into one except at the summit, where they remain separate to form a crescent-shaped crutch. The separate stanchion type is much less common among Caroline "flying proas" than the crutch type but is much used as an alternative method among the smaller types of canoes.

DIMENSIONS

Müller (1917, p. 183) gives the measurements of a representative Yap *popo* as follows: over-all length 9.4 meters, keel length 7 meters, depth amidships 1.15 meters, length of the booms to the axis of the float 3.6 meters, length of float 4 meters.

PROAS OF THE LAST CENTURY

The foregoing account describes the large sailing canoe (*popo*) of the Carolines in the form it had in the opening years of the present century. How little changed it is from what it was a century ago may be seen from a translation of the excellent description given by Lütke (1835-36, vol. 2, p. 75) of a "flying proa" of Lukunor in the Mortlock Islands as observed in 1828:

> The canoe I examined, which was not their largest, was 26 feet long, 2¼ wide, and 4 deep in its middle. Across the canoe are tied, at a distance of 4 feet apart, two booms, *kio*, 10 feet long, joined at their extremities by diagonal braces, of which the inner ends are tied to the gunwale of the canoe at a distance of 4 feet from its two extremities. A spar, in the form of a canoe, *tam*, 6 feet long, is attached, parallel to the canoe at the ends of the outrigger booms, by some stanchions (*etançons*) called *eam*. . . . All the space between the diagonal braces is covered with light rods, except for an interval of 2 feet along the side of the hull, for the play

of the paddles. On the opposite side is a small platform, 4 feet square, surmounted by a roof under which they place provisions and baggage. Toward each end of the hull are five thwarts. The two ends are alike. The sides slope in wedge fashion toward the keel, which is about 10 inches wide and is rounded below. The sides consist of several planks bound together by coir cords. The seams are calked with a mastic made with burnt lime.

Lütke adds that the lower part of the hull is painted black, the upper part yellow or red, and that "they place on the prow a fantastic figure covered with various devices (*bigarrures*)".

Unlike those of other islands in the archipelago, these Mortlock canoes had the sides symmetric, according to Lütke.

Tsukupin

The *tsukupin* is a large and beautiful outrigger canoe characteristic of Yap, where its employment is restricted to the prosecution of the locally important flying-fish fishery. According to Dr. Paul Hambruch (personal communication), the islanders esteem and term it a "sacred canoe" in the same sense that the double canoe (*ndrua*) of Fiji was called *wangga tambu*, the canoe tapu or "set apart" for a specific purpose and the use of the chiefly class alone.

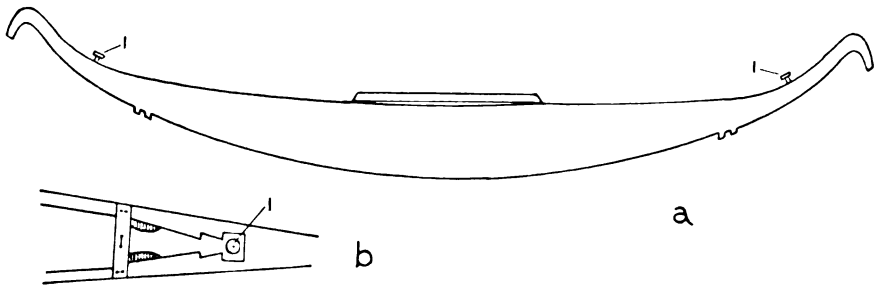


Figure 273.—Hull of a *tsukupin* of Yap, Caroline Islands: *a*, side view; *b*, end in plan; 1, socket (*rinam*) for stepping heel of yard (after Müller-Wismar).

The form of the hull has distinct and close resemblance to that of the Palau type in the boldly crescentic curvature of the keel, a connection emphasized by the presence of a pair of small projections on the up-curving part of the keel about the water-line level (fig. 273, *a*); these are obviously vestigial remains of the two larger cleatlike projections in a similar position on the Palau hull. Another point of resemblance with the Palau type is symmetry of the hull in transverse section, the lee side rounding equally with the weather side. In this characteristic the *tsukupin* differs from all others of the large sailing outriggers of the western and central Carolines. In width the *tsukupin* is notably broader than the *popo*.

The two ends, or rather heads, are similar, as in most Micronesian canoes. Each rises in a swan-neck form to a considerable height, turning downward at the end to form a rude representation of a frigate bird's beak. The hull is painted red with the exception of the beaks, which are white; from the tip of each beak are suspended one or two white egg-cowries, and others hang from the outer angles of the lee platform, a further suggestion of a Palau relationship. (See fig. 274.)

A lee platform is present. The construction of this and the general design of the outrigger are usually identical with those of the Caroline "flying proa"; both platforms are, however, left unencumbered and without their picturesque thatched provision huts. The crutch form of outrigger connective is usual, but the substi-

tution of paired upright stanchions, one or two pairs to each boom, appears to have been fairly common, a feature again reminiscent of the Palau war canoe, which is characterized by a similar arrangement.

The sailing rig is similar to that of the *popo*. Close to each end is fitted a broad peg-shaped sail step (*vinam*) to which the tack of the sail is made fast when occasion requires (fig. 273).

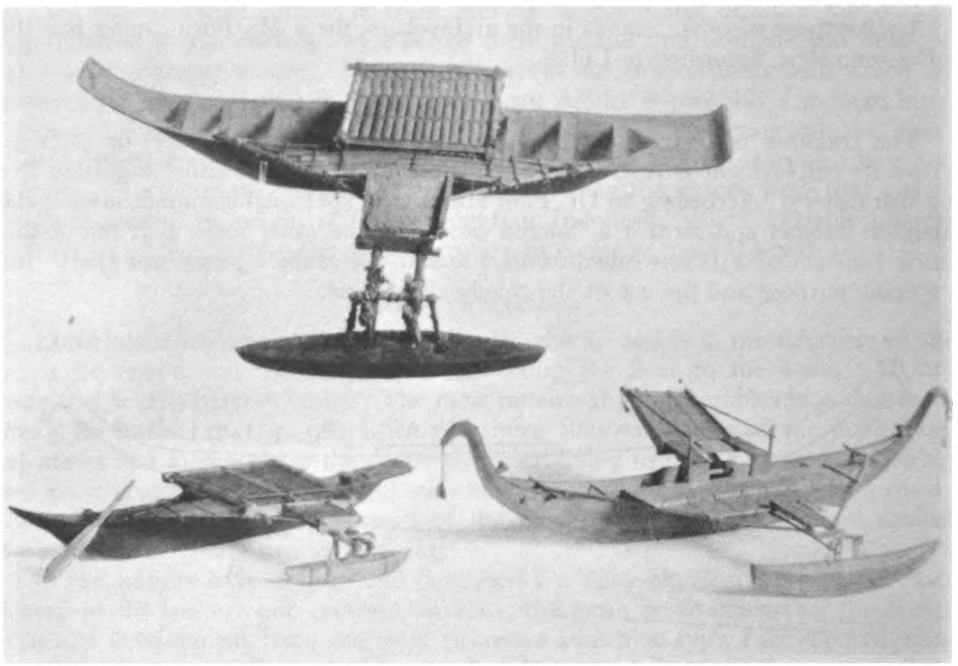


FIGURE 274.—Canoe models from Yap, Caroline Islands: top and left, cargo carriers of *thauav* type; right, a *tsukupin*; all outriggers have stanchion connectives but otherwise conform to type of attachment typical of the Carolines (Cologne Museum).

Müller (1917, vol. 1, pp. 181-182) remarks that there is nothing elsewhere in Micronesia like the *tsukupin*, which, he says, is used only during certain months. At the end of the fishing season the vessel is dismantled by the removal of the outrigger to enable it to be carried through the door into the clubhouse, where, after being loosely reassembled, it is kept till the fishing season comes round again.

CANOES WITHOUT LEE PLATFORM

CONSTRUCTION

Small editions of the *popo* without lee platform are found in local use in the western and central Carolines, and in these, which are put together with less care than the *popo* itself, the outrigger connectives are often reduced in number and as in Woleai (Ulie) paired vertical sticks commonly replace the typical crutch or Y form. A yoke, an outer stringer, and one or two bracket rods as in the *popo* are generally present (fig. 275). Owing to their smaller size, they are usually propelled by paddles, but most of them may be rigged for sailing when desired. These smaller canoes may have the lee side less full than the other, as in the *popo*, but

generally the two sides are symmetric. The booms rest upon the gunwales instead of piercing them. There may or may not be washstrakes and thwarts, and in very small canoes a platform over the booms may be wanting.

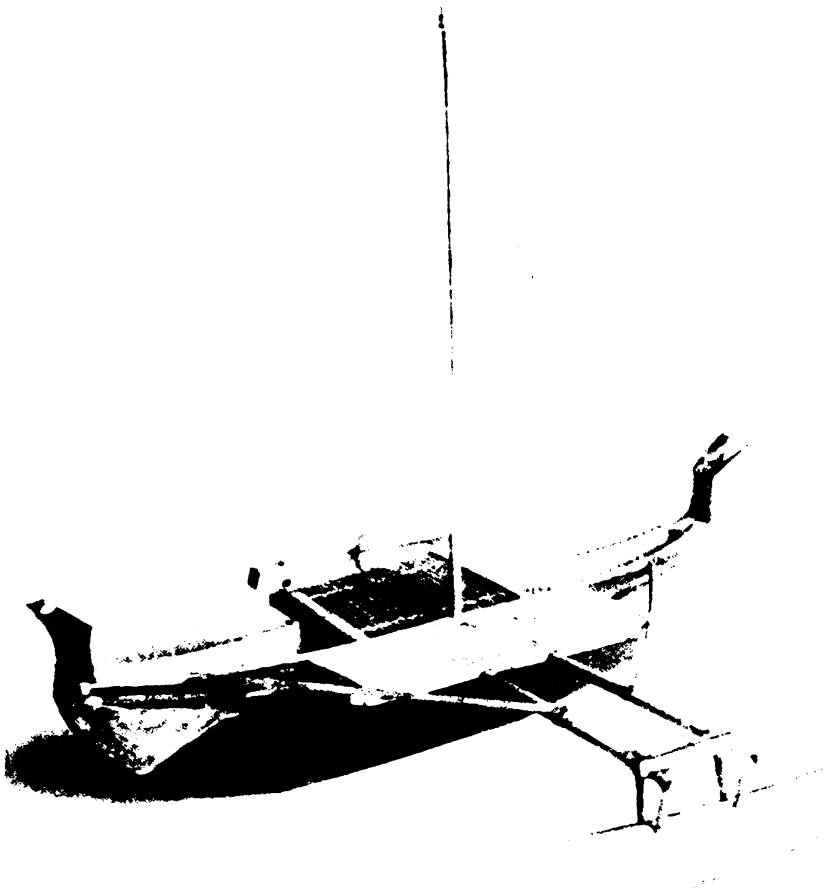


FIGURE 275.—Model of sailing canoe without lee platform, from Yap, Caroline Islands (Cologne Museum).

LOCAL VARIANTS

WESTERN CAROLINES

In Yap and the closely related western islands special canoes (*thauav*) are employed for coastal and lagoon transport. These differ in many particulars from the deep-sea *popo* and the *tsukupin:*

The hull is more stoutly built and broader in the beam. The keel at the central region is horizontal in both transverse and longitudinal section and it sheers steeply upward at each end. The extremities are not identical; the canoe has a recognized fore end, sheered sharply, ending generally in a broad truncate extremity. The after end, a true stern, is wider still and either nearly horizontal or with a slight inward curve at the truncate extremity (figs. 274, 276).

The sides are symmetric and there is no keel as in the *popo*; the bottom is flat. The largest timber is necessary for these vessels, many of which are longer and broader than the ordinary *popo*.

The *thauav* have no lee platform. Instead, a substantial platform of rectangular form is built over the central region of the hull. Laterally it projects a short distance outboard on each side, and its ends extend considerably beyond the outrigger booms on the forward and after sides respectively. The main supports are transverse beams laid athwart the gunwales; these are connected by long marginal bars, the decking being made of closely set split bamboos or other small timber.

The triangular outrigger frame over which the central platform partly projects is a somewhat simplified form of that seen in the *popo*.

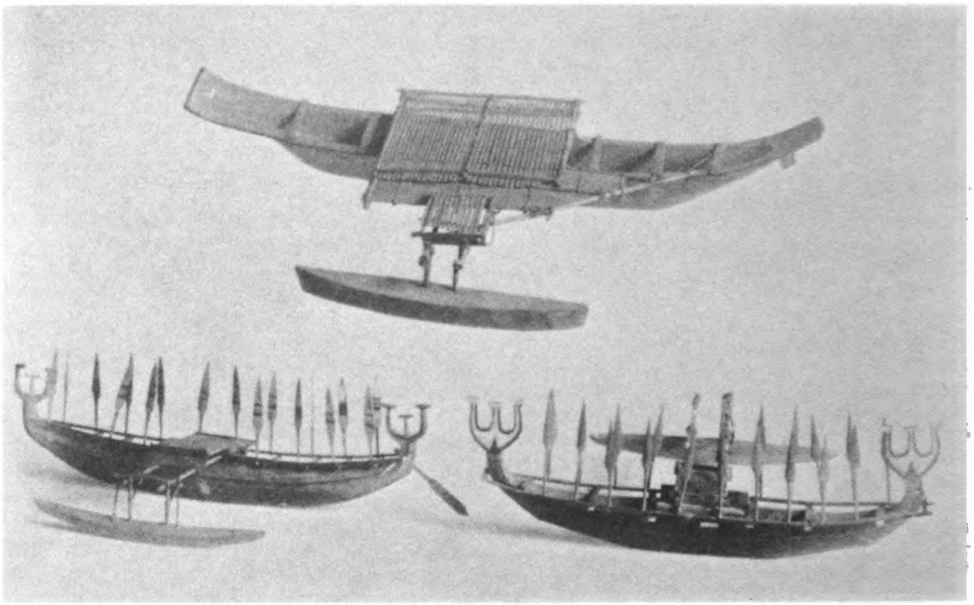


FIGURE 276.—Models of canoes from Yap, Caroline Islands: above, heavily built canoe (*thauav*) for cargo work; below, two paddling canoes with their characteristic trifid figureheads (*manugutsig*), outrigger connectives unequally forked (Cologne Museum).

In the form of boom and float connection there is considerable variation, judging from the models in museums. The crutch form is seldom employed but is replaced generally by paired divergent stanchions, one pair lashed to the inner side of each boom (fig. 277, *a*), or by a forked connective, the equivalent of one pair of divergent stanchions. A yoke brace is present, lashed upon the booms, between the ends of the connectives. As in the *popo*, a strong lashing connects the float with the ends of the yoke, the lower bights passing through a curved or a V-shaped perforation in the upper surface of the float. Strong thwarts are tied on across the gunwales for the accommodation of the paddlers.

The *thauav* is rigged to sail like the *popo*. Müller remarks that the Yap people are too lazy to paddle or pole except under necessity; possibly the real reason is that this is a custom crystallized into habit by inheritance from much-voyaging forefathers. On the foremost thwart the outlines of a frigate bird are cut in relief; at the place occupied by its head a socket is excavated to receive the heel of the yard. If the canoe has to sail stern foremost, the tack of the sail is brought to the broad stern board and there made fast.

Other forms of small craft are enumerated by Müller; they have little comparative importance and few details about them are known.

SONSOL ISLANDS

The Sonsol Islands lie to the south of the Palau Archipelago and are by many writers included therein. The inhabitants are stated to resemble those of the cen-

tral Carolines (Brigham, 1900, p. 143); the structure of their canoes (*wa*) definitely supports this conclusion. Information regarding the canoes of Sonsol and Mapia is limited almost entirely to the figures given by Kubary (1889, pls. 13, 14), who unfortunately did not furnish detailed descriptions or explanations.

The hull of the Sonsol canoe is long and narrow, without asymmetry in the sides as in some of the smaller of the *popo* type, of which it is clearly a local variant. The main differences are in the form of the two extremities; these are lower and less prominent, and end in a slightly everted sharp point (*pagit*) instead of being bifid.

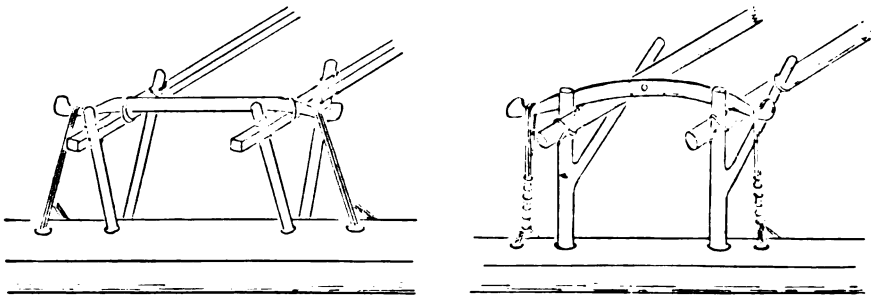


FIGURE 277.—Outrigger attachments, Yap, Caroline Islands: *a*, from model of a cargo canoe; *b*, from model of a paddling canoe (Cologne Museum).

The hull is very sharp on the keel and in transverse section is wedge-shaped; it consists of a dugout base, the sides raised by a washstrake; winged end pieces of merrythought shape form the upper part of each extremity of the canoe. At the junction of the slightly sloped and nearly straight cutwater with the keel line (*kapit*) is a small angular forefoot projection, reminiscent of the same region in Truk Islands and Nukuor canoes. Numerous thwarts are lashed upon the gunwales (fig. 278).

The outrigger consists of a triangular platform supported upon two straight booms. The float (*tamar*) is short, sharp-pointed at the ends, the upper surface axially ridged. The connectives (*rator*) are two pairs of typical Caroline crutches to each boom, but the usual horizontal braces connecting the shanks of the crutches are replaced by a pair of slight poles which cross one another between the booms, the upper end of each being lashed to the boom on the opposite side some distance inside the yoke. The usual cord braces passed through V-shaped holes in the float connect with the slightly curved-up ends of the yoke. Further support is afforded to the outrigger attachment by a pair of bracing rods which run obliquely up and inward from the bases of the Y crutches, one on each side, to a fore-and-aft stringer lashed to the booms near the inner margin of the outrigger platform.

The strong oblique spars (*tegefayni*) which form the two free sides of the triangular outrigger platform are reinforced by a second and shorter pair (*autap*), each unit of which is attached at the inner end to the corresponding unit of the longer pair at about its mid length, the outer end connecting with the adjacent end of the float. (See fig. 278.)

The paddle has a peculiarly wide, diamond-shaped blade, flat on one side, ridged axially on the other.

The essential features of the outrigger of this canoe connect it decisively with the central Carolines, but in other details—the form of the hull, the lack of a lee platform, and the crossed braces between the booms—there is evidence of Palau influence.

TOBI

This small island, 1.5 miles long, is of much interest as being the westernmost outlier of the Micronesian people. Geographically it is an Indonesian island, as it lies only about 2 degrees from the north end of Morotai in the Moluccas.

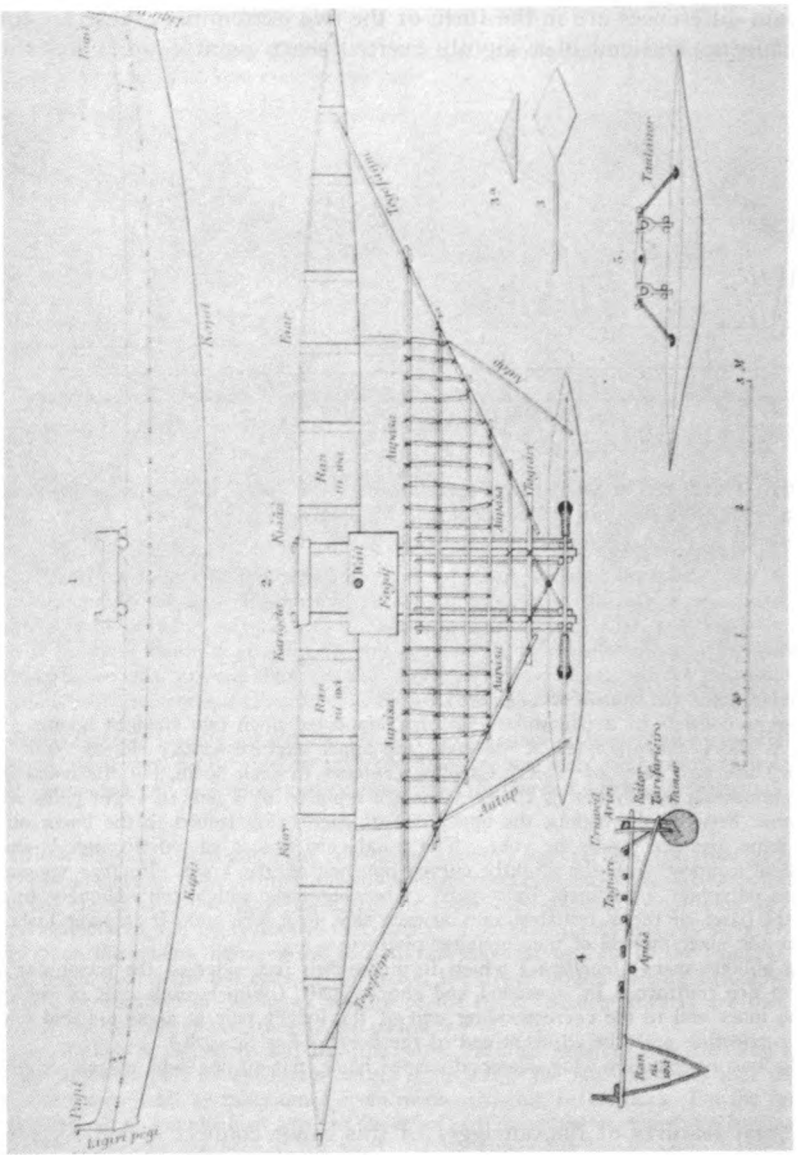


FIGURE 278.—Sailing canoe of Sonsol: 1, view of lee side; 2, plan; 3, paddle; 3, *a*, cross section of blade; 4, cross section through hull and outrigger; 5, outrigger attachment in face view (from Kubary, 1889).

The outrigger canoe of Tobi is closely related to that of Sonsol, the nearest island inhabited by Micronesians. In the Hamburg Museum für Volkerkunde is a splendid model, from which the present description is made.

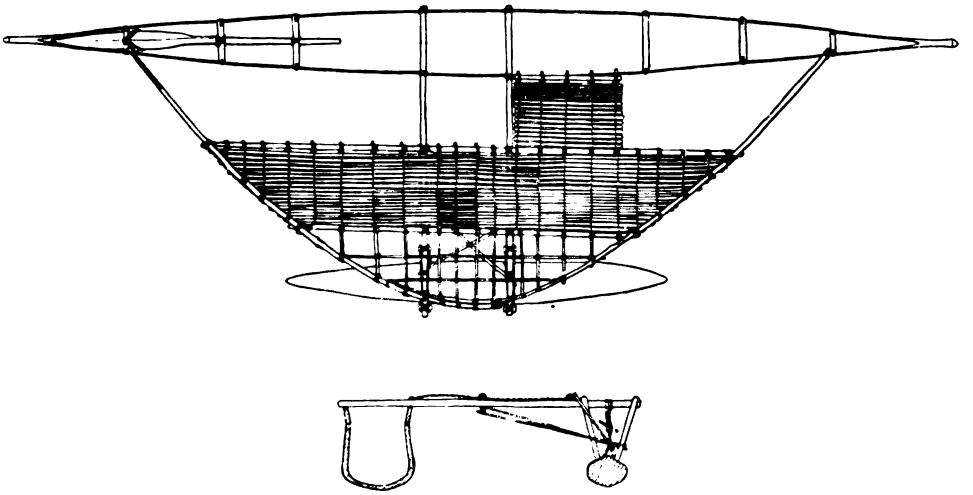


FIGURE 279.—Outrigger canoe of Tobi, plan and cross section (Hamburg Museum für Volkerkunde).

The hull in general form approaches that of the Sonsol canoe, but the upturned ends are stouter and terminate in blunt knobs. It is made up of a deep-sided, round-keeled dugout base, provided with a narrow and irregular washstrake on each side and two end pieces lashed upon the extremities of the dugout (fig. 279).

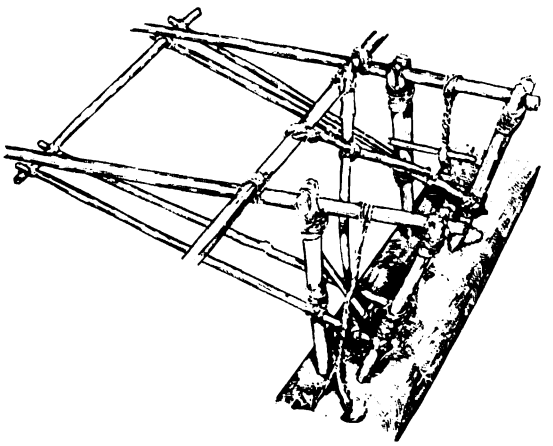


FIGURE 280—Details of outrigger attachment of a Tobi canoe (Hamburg Museum für Volkerkunde).

The outrigger and its platform are also very like those of Sonsol. Each of two stout booms is connected to the rather short, sharp-ended float by means of two Y-crutch stanchions and a cord brace. No yoke to which the stanchions may be attached is present, so instead the lashing is carried around that part of the boom lying between the two crutch heads and thence down to the float where it is rove through the usual V-shaped hole. A Spanish windlass, an

ancient device widely spread throughout the eastern world, from southern India, Ceylon, and China, to the Marquesas and the Society Islands, is used to tighten the cords.

A pair of obliquely running rods, forming side stays, strengthens the connection of each boom, one rod passing inward from each side of the Y crutches to attachment to a longitudinal stringer lashed below the booms exactly as in Sonsol. The units of another pair of rod stays cross one another between the booms, their lower ends attached between the points where the side stays are lashed to the stanchions, their upper ones to a stringer at the outer edge of the covered part of the platform (fig. 280).

The platform is semicircular rather than triangular, the oblique spars from each end of the hull curved instead of straight; their distal ends join midway between the ends of the booms as in the modern Ponape canoes. The platform is stiffened by two stout longitudinal stringers placed respectively at about one third and two thirds the length outboard of the booms. The space between them is covered with a light decking of closely lashed rods, also present in the Sonsol canoes.

MAPIA

Mapia (Bunaj) lies in latitude 0° 57′ N. and longitude 134° 21′ E., far distant from the Carolines but relatively close to New Guinea, only some 130 miles to the north of Manokwari in Geelvink Bay. The population of the atoll is stated to have sprung from a Micronesian colony; the form and nomenclature of their canoes as given by Kubary confirm this conclusion.

The hull form is related to the *tsukupin* of Yap, being subcrescentic in keel profile; but the high heads, instead of curving outward, curve in (fig. 281).

The hull, as in the *tsukupin*, from which it is probably derived, is symmetric, the sides curving and ending below in a distinct keel. The dugout underbody (*bul*) is fairly deep; two strakes (*bab*) are sufficient to give adequate freeboard. The end pieces join the extremities of keel and strakes from each side and perform the part of the stem timber in European boats. Slender incurving terminals are sewn upright upon the distal extremities of the end pieces and terminate in a small blind notch related probably to the bifid ends of central Caroline canoes.

The proximal ends of the two straight outrigger booms (*kio*) rest in recessed grooves in the gunwale. The oblique brace spars forming the outer sides of the triangular outrigger frame extend out farther relatively than in the *tsukupin*, and the outer ends instead of resting on the distal region of the booms are attached to the projecting ends of a longitudinal stringer lying over the booms just inward to the Y-crutch connectives.

The Y-crutch connectives appear to be of a most extraordinary variety. The two shanks of each pair have apparently coalesced into a single stout trunk from which arise two secondary stems, each of which ends in a U-shaped bifurcation wherein rests the end of one of the two booms (fig. 281, nos. 4, 5). It is difficult to believe that such an unnecessarily complex form would be employed. No natural doubly forked timber of this shape could be had, particularly as a pair of the same shape would be required. It seems probable, and Hambruch, whom I consulted, agreed with this view, that Kubary's artist had misinterpreted the original sketches and that the connectives supporting each boom consist in reality of two straight stanchions crutched at the upper end, as is the construction seen both at Sonsol and at Tobi, the two nearest islands peopled by Micronesians.

A yoke brace of typical form passes over the two booms, each end fixed between and separating the two U ends of the stanchions. Light crossed bracing rods and the usual cord braces running between float and yoke are present as in the Sonsol canoe; a long oblique rod also runs inward from the lower part of each stanchion shank to attachment to its own boom close to the hull.

The float (*tam*) is sharp-ended, rather long, and slightly excavated on the upper surface at the ends (fig. 281).

PADDLING CANOES (WESTERN AREA)

Apart from those of the eastern section of the Carolines, of which scanty knowledge has survived, large sailing canoes throughout the archipelago are remarkably homogeneous in type. It is otherwise with the small paddling canoes used in the lagoons or for inshore work; of these several types can be distinguished, each with a definite geographical range characterizing respectively the western,

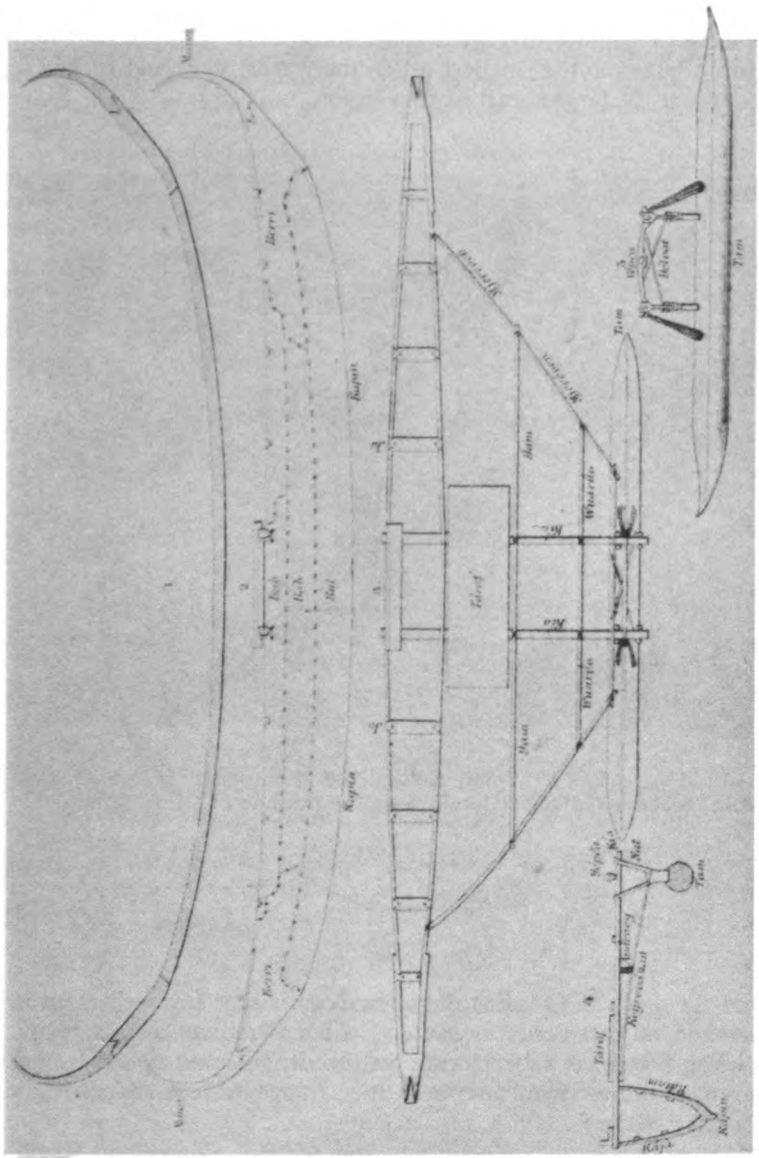


FIGURE 281.—Outrigger canoe of Mapia: 1, median longitudinal section through hull; 2, view of lee side; 3, plan; 4, cross section; 5, outrigger attachment, face view (from Kubary, 1889).

central, eastern, and southern sections. All are dugouts, but in some of these there is a well-marked gunwale rail sewn on. Many are highly ornamented and are brightened by striking patterns in red, black and white.

The small paddling canoes of the present day are well represented by two (fig. 282) from Woleai (Ulie). The outrigger attachment is a simplified form of that found in large canoes, but without neatness; the branched connective is sometimes reduced to a couple of slightly divergent short stanchions. The dugout hulls are symmetric in form, but even the smallest retain the washstrakes and forked figureheads characteristic of the larger craft of this region.

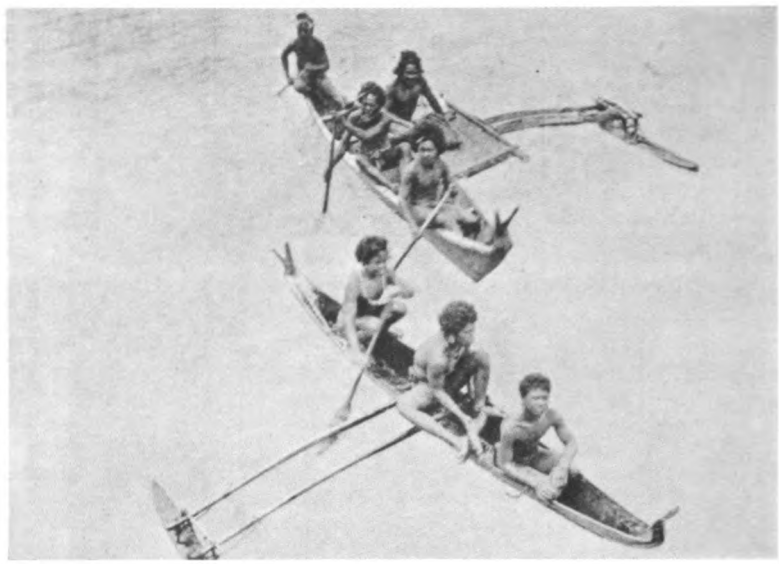


FIGURE 282.—Paddling canoes of Woleai (Uliei), Caroline Islands, from a photograph by J. Macmillan Brown (courtesy of Royal Anthropological Institute of Great Britain).

WAR CANOES

YAP TYPE

The finest of the western Caroline dugout canoes is that formerly used in Yap in local warfare and on ceremonial occasions. Like all others in this region it is double-ended. The bottom is subcrescentic in profile, sheering upward quickly at the ends. The outstanding characteristic is the strange trident shape of the two curved-up ends (fig. 283, *a*).

Each end is surmounted by an ornamental trifid figurehead (*manugutsig*), the prongs turned upward and in line with the longitudinal axis of the dugout body. The carved figure of a bird perched upon the central prong appears to have been added in time of war; museum models do not usually show this war emblem. By analogy with the Truk custom, this symbol was probably fixed on or taken down according as the journey was peaceful or hostile. Müller-Wismar (1912, p. 247) considers that this bird ornament is derived directly from the Malay Archipelago, where a bird motive is commonly associated with the figureheads of boats. I have also observed this custom in India; the Kuch *kotia*, the large sailing coaster of the west coast, invariably has the stem head carved into the likeness of a bird's head.

Numerous thwarts are lashed across the gunwales. On each side they project sufficiently to permit a squared spar to be fitted over their ends parallel with the gunwales, according to models in Cologne Museum (fig. 276).

The outrigger frame is a simplified form of that of the Yap *thauar*, in which the only platform left is the central one over the midships part of the waist. On this sat the chief in command of the canoe. The outrigger connections are as in the *thauar*, generally by means of a forked connective to each boom as in Palau canoes. A simple yoke brace and rope lashing from its ends to the float complete the arrangement. No accessory stays are employed. (See fig. 277, *b*.)

The paddlers sit double-banked; steering is by means of a hand paddle on the quarter. The paddle blade is lanceolate and nearly equal in length to the loom, which has no terminal grip.

Canoes with the *manugutsig* figurehead are characteristic of Yap (Müller, 1917, p. 180). At the present time the type is obsolete, but remembrance is kept alive in certain of the great clubhouses, where massive beams have their ends carved into oversize representations of the *manugutsig* (Müller, 1917).

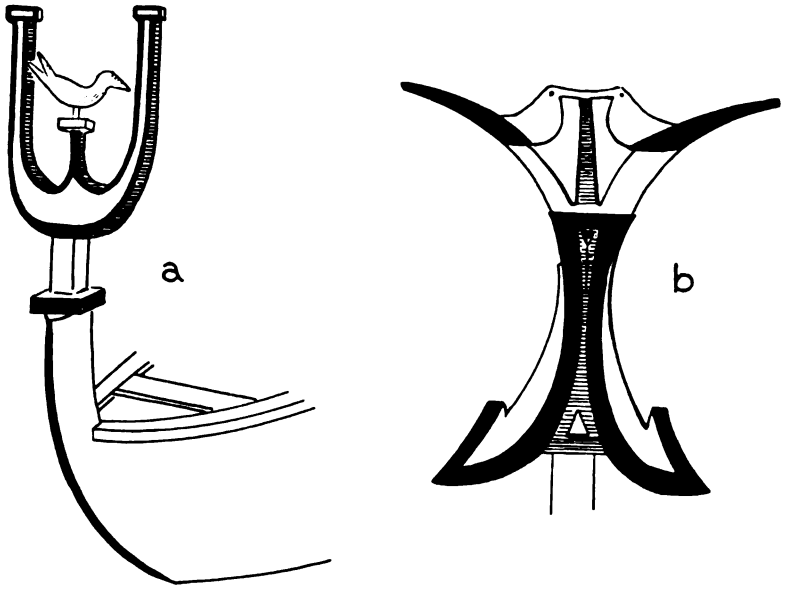


FIGURE 283.—Bird motive in canoe figureheads of the Carolines: *a*, head ornament of the *manugutsig* of Yap; *b*, the *faten* figurehead of a paddling canoe, Truk Islands (after Müller-Wismar, 1912).

TRUK TYPE

What is probably a very ancient type of outrigger canoe persists in the Truk and Mortlock Islands. Alexander (1902, p. 826) was so struck with the wide difference in design between the sailing canoes (*melyuk*) and paddling canoes (*va faten*) of the Truk islanders that he remarks: "Without knowing that both styles of canoes were made by the same people, one would naturally suppose that each had been made by a people entirely unlike in taste and separated by a long distance."

As described by Alexander, with details from models in Cologne and Berlin museums, the paddling canoes have the following characteristics:

The hull is an elegantly shaped dugout; there is a slight difference in the form of the two ends so that a head and a stern are distinguishable and the outrigger is always attached on the port side. However, for all practical purposes the canoe may be regarded as double-ended. It is well-curved along the rounded keel line and has a prominent finlike projection half-way up the curved cutwater at each end, which is sharp and upturned after the fashion of a gondola. Both extremities of the canoe are solid for about a foot from the end, on which is fitted a ver-

tically tapered headpiece bearing on the summit a figurehead (*aten* or *faten*) carved into what is supposed to be a conventionalized representation of two sandpipers or sea swallows, with tails outstretched (fig. 283, *b*). According to Kubary (1889, p. 53) the natives attach great importance to these figureheads; when a canoe is beached they are removed, to be fastened in position again when next it is launched. With a cord the figurehead can be raised or lowered. It is a war symbol; if lowered when meeting other canoes or approaching other islands, it signifies peaceful intentions.

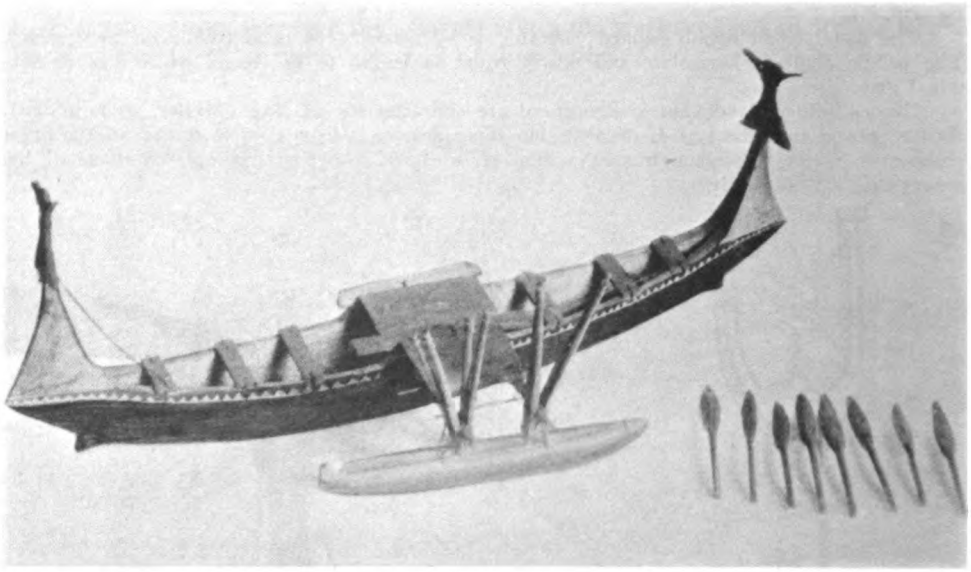


FIGURE 284.—Model of a paddling canoe from Truk Islands (Cologne Museum), showing *faten* figureheads, characteristic divergent stanchion connectives prolonged above booms, spur at turn of keel, and ridge-tipped paddles.

Thwarts are tied upon the gunwales and a central platform covers part of the middle of the dugout, extending also outboard upon the outrigger booms a short distance (fig. 284).

The outrigger consists of two straight booms, each connected with the float by two pairs of inserted stanchions, an outer and an inner, which project upward beyond the booms on both sides relatively to an extraordinary height. They are covered usually with closely set incised patterns, the summit carved into a knob shaped like a girdled hourglass, the whole painted black and white (fig. 285). The lower ends of the outer pair of stanchions are inserted close together into the float immediately under the boom in a slightly divergent direction, so that

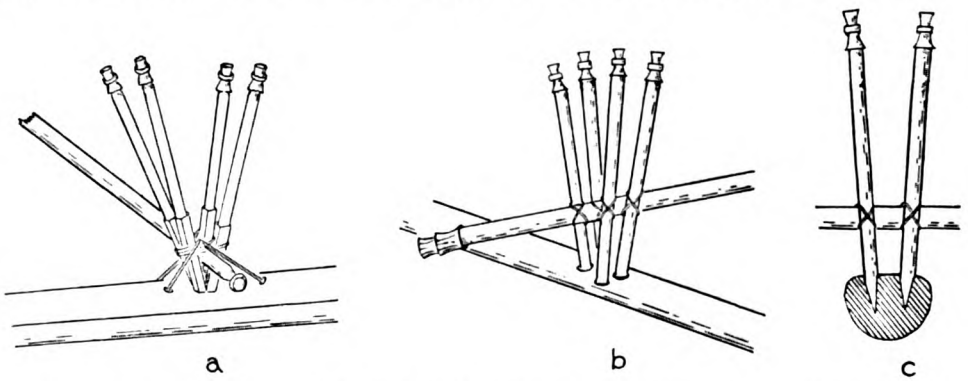


FIGURE 285.—Outrigger attachment of Truk Islands canoes: *a*, from model in Cologne Museum; *b*, after Alexander (1902); *c*, end view of *b* with float in cross section.

the boom comes to lie between them and is then lashed to them and to the inner pair, which have a similar arrangement. The distance between the boom attachment and the float is very short, and wholly disproportionate to the length to which the stanchions project above; there appears to be no utility in this extra length, but without it and the ornamental *faten* figureheads no owner would consider his canoe properly finished.

The float is canoe-shaped, the ends slightly upturned in keeping with the high ends of the dugout hull.

The paddles have the elegant lanceolate blade usual in the Carolines. The point is acuminate and has a peculiar thickening which is characteristic of the Truk Islands and probably related to the ridged point of the Hawaiian paddle. (See fig. 299, *c*.) The loom is plain and without a grip. A short mast and small sail are sometimes used.

These canoes, which in the larger sizes are to be classed as war canoes, are the local equivalent of the Yap war canoe with *manugutsig* figureheads. Both, it has to be noted, include a bird motive in the figurehead design.

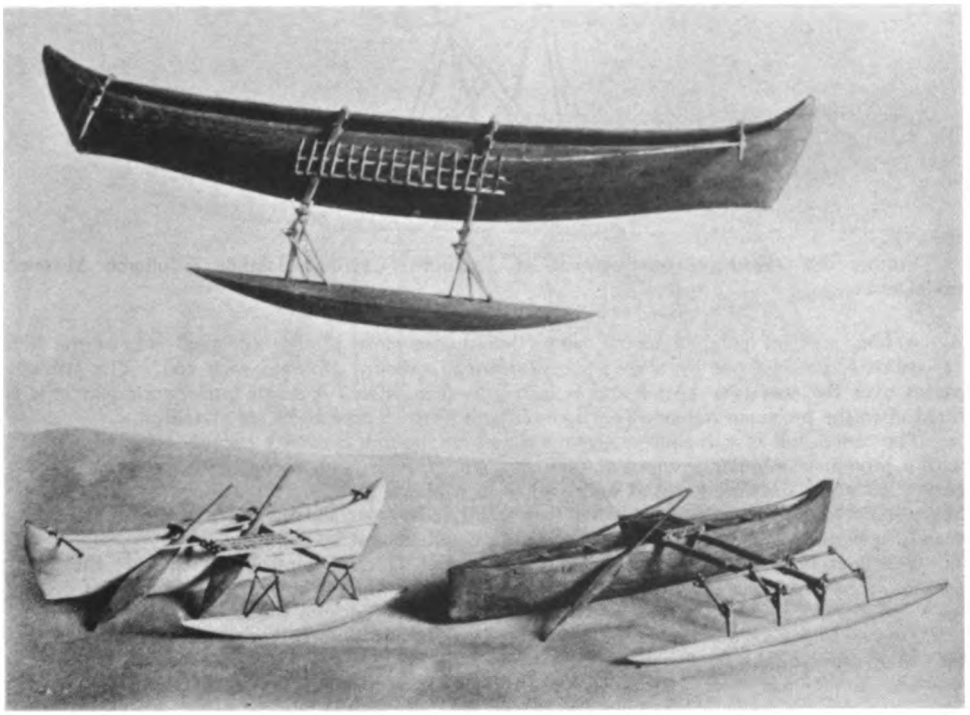


FIGURE 286.—Model canoes of Nukuoro and Kusaie, Caroline Islands (Cologne Museum): top and left below, Nukuoro canoes of type foreign to Micronesia; right below, modern Kusaie paddling canoe.

PADDLING CANOES (SOUTHERN AREA)

NUKUORO

A type of outrigger canoe foreign to Micronesia is found in Nukuoro, small and lonely islands about 200 miles to the southwest of the Mortlock Islands and the southernmost islands in the central Carolines, with the exception of the isolated reef of Kapingamarangi, far to the south. The canoes in use by the inhabitants are double-ended single outriggers (*paopao*) fitted with two booms (*kiato*) each connected to the float (*te ama*) by two pairs, an outer and an inner, of fairly long stanchions (*atoto*) and a bipartite cord brace (*soa soa*). These elements (fig.

286) are arranged in a manner closely related to that characteristic of the fore-boom attachment in typical Tahitian canoes.

The anterior units of the two pairs of stanchions are inserted into the float close together, some distance forward of the boom, the posterior units of the same pairs at an equal distance on the other side; from their insertion the units of each pair diverge, at the same time inclining toward the boom till they cross their opposite numbers immediately below the boom, to which they are then lashed. The connection (fig. 287) is reinforced by a divergent bipartite cord or sennit brace that runs a V-shaped course between the float and the boom; each upper end is lashed around the boom at the attachment of one of the two pairs of stanchions; below, the brace passes through a transverse hole in the float midway between the bases of the anterior and posterior stanchions. The diagram given by Kubary (1895, pl. 53, fig. 20) appears, like some others in his plates, to have suffered at the hand of the lithographer. As it stands, it is obscure and constructionally defective in the details of the float attachment.

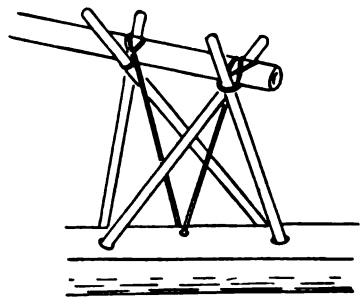


FIGURE 287.—Outrigger attachment of Nukuoro, Caroline Islands (Cologne Museum model).

A long stringer pole (*kesama*) passes lengthwise close to the outrigger side of the hull (*te wakha*), boomed out by a crossbar projecting outboard close to each end. The stringer passes over the outrigger booms and is lashed to them also. A small latticework platform is fitted upon the proximal outboard portion of the booms. There is no lee platform.

The canoe hull is a dugout of elegant shape, the bottom convexly curved longitudinally but with a prominent angular forefoot at each end, where it turns up abruptly into a sharp, slightly curved cutwater, markedly raked and ending in a short, stout upturned point. The gunwale line sheers very gently throughout its length till it approaches the ends, where it sheers up shortly and quickly. The keel line is sharp and not rounded.

The float is of moderate length, fairly stout and sharply pointed at each end; the upper surface is nearly horizontal longitudinally, the lower distinctly bowed. In transverse section both surfaces are convex, the upper weakly rounded compared with the lower.

Two excellent models are in the Cologne Museum, one slightly imperfect (fig. 286) in that the sennit brace of the outrigger connection is missing.

The paddles have a broadly lanceolate blade as in the Truk Islands but there is no thickening of the tip; the loom is without a hand grip.

The people of Nukuoro and Kapingamarangi are described by Christian (1897) as of a light-brown color and as speaking "a remarkably pure Polynesian dialect akin to the Maori, Tahitian, and ancient Samoan. . . . The grammar is pure Polynesian, and the numerals also". The type of their outrigger fully confirms this Polynesian relationship. It has no Micronesian affinity whatever except the presence of a small weather platform and of a longitudinal stringer outside the hull.

Except that the stanchions cross below the boom as shown in the Cologne models, the type of float and boom attachment is a replica of that which characterizes the fore boom in typical Tahitian canoes. The attachment is also closely related to the Samoan and Tokelau system, varying therefrom merely in the undercrossing of the stanchions and in a minor detail of the cord braces. Melanesian influence appears to be present in the undercrossing of connectives—a Melanesian characteristic particularly distinctive of the canoes of the northern New Hebrides.

The Nukuoro canoe type, then, is essentially Polynesian in design but modified in details by Micronesian and Melanesian contacts. The possibility must not be overlooked, however, that the undercrossing of the connectives in the Cologne models (the chief source of information at present available) may be due to an error in the assembling of the parts after the models reached Europe.

Kapingamarangi

An entirely different type of outrigger characterizes the canoes of Kapingamarangi, a low atoll of 28 islets in latitude 1° 4′ N., longitude 154° 45′ E., lying roughly midway between the central Carolines and northern Melanesia. As in Nukuoro, the language of the people is essentially Polynesian.

A fine specimen of the paddling canoe of the island brought home by Hambruch is deposited in the Hamburg Museum für Völkerkunde and it is from this that the present description is written (fig. 288).

Figure 288.—Canoe of Kapingamarangi, Caroline Islands, side view, cross section, and view of one end (courtesy of Hamburg Museum für Völkerkunde).

The hull, which measures 4.33 meters over all, is a typical five-part canoe, formed of a dugout underbody fitted with stout, slightly upturned end pieces, winged at each side to make connection with a washstrake on each side. The whole hull is painted red, ornamented with large, roughly daubed white St. Andrew's crosses in longitudinal series; one row occupies the whole length and width of the washstrake and two others are painted fore and aft upon the underbody. The sides and upper surface of the end pieces are similarly ornamented.

The underbody is equal-ended, the bottom straight in the long median region, rounding up in a sweeping curve at each end to meet the end piece, but with the curve broken near the upper end by a deep return angle which forms a prominent "heel" at this point. Transversely, the bottom slopes sharply upward from a median keel ridge into vertical sides, the bilges high and weakly developed.

The end pieces are dissimilar, that which I take to be the head the higher and more massive. Each is scarfed to an end of the underbody by a lock joint. The heavy basal part of the head piece is partially hollowed out; anteriorly it rises into a short and stout figurehead, rectangular in section and horizontally truncate. Posteriorly a wing is given off on each side in the manner of the headboard of Society Islands canoes and for the same purpose.

The stern piece is on the same model but with the upturned end smaller and nearly vertical.

Filling in the space on each side between the winged extremities of the two end pieces is the nearly vertical washstrake, surmounted by a narrow, rounded gunwale rail. All parts are sewn together with sennit in the ordinary unconcealed method.

The gunwale rails are continued outboard at the stern to a point level with the after end of the stern piece, to which they are connected by a transverse stiffening brace consisting of a

bow-shaped withy. Anteriorly they are joined together by a short thwart bar lashed over their fore ends.

The hull is crossed, in addition, by three outrigger booms, four false booms, and six thwart bars. All pass through the upper part of the washstrake, the booms let into its edges, the thwarts passing right through at a slightly lower level. The thwart ends project about 2 inches outboard. The main and the false booms are spaced apart at regular intervals, each immediately to the fore side of one of the thwart bars except the last false boom which is on the fore side of the stern piece. Two of the false booms are fitted between the outrigger frame and the head of the canoe, the other two aft of the outrigger. They project outboard on the outrigger side about 2 feet, their outer ends slightly upcurved; over them, 12 to 15 inches from the side of the canoe, is lashed a long stringer pole.

The outrigger, fitted on the left side, is one of considerable complexity. The three strong booms which are its main support are each attached to the float by two pairs of long and slender stanchions. These are inserted into the upper surface of a short, stout float, flattened above, rounded below, and pointed sharply at each end. As the booms slant somewhat upward in their outboard length, the stanchions are more than usually long for the size of hull. Their upper ends are lashed against the sides of the boom and cut off immediately above. The units of the outer pairs converge upward to meet the boom in a plane nearly vertical to the long axis of the float; those of the inner pairs converge obliquely, their upper ends inclined toward the hull. Four suspensory braces stiffen the attachment of the float. Their upper ends pass around a stout stringer lashed athwart the booms midway between the outer and inner stanchion attachments, the lower through V-shaped perforations in the upper surface of the float. In their preparation, after sufficient turns have been made, these are seized throughout their length with the free end of the lashing. One brace is fitted at each end of the float. Of the other two, one is placed midway between the middle and the outer boom on each side.

The outrigger frame is further stiffened by a platform of light poles laid thwart the booms outside the long stringer lashed over the false booms, and by a stout, curved strut at each end of the outrigger frame, lashed at its inner extremity to the ends of the outer and inner marginal poles of the platform and at its lower and outer extremity to the base of one of the outer suspensory braces close to the end of the float.

Knowing that the language of the island is Polynesian, it occasions no surprise to find that the canoe type has no close resemblance either to the ordinary types of the Carolines or to those of Melanesia. Curiously enough, the type is also different from that of Nukuoro except remotely in the presence of a forefoot "heel" and of a long stringer boomed out from the gunwale, although this island is also inhabited by people of Polynesian speech. Neither has it affinity with the Ellice Islands, the nearest Polynesian area.

Only in the Tokelau Islands much farther east are found canoes with outriggers of a closely related design. The outriggers of both areas have paired connectives of the same type, reinforced by single accessory pieces running between float and boom stringer—slender stanchions in the Tokelau canoe, suspensory braces in that of Kapingamarangi. The canoe form is, however, quite different.

A suggestion of affinity with the Micronesian canoe type of the Santa Cruz Islands in Melanesia is also to be noted, for the stanchions in both have nearly the same arrangement and both have as a characteristic feature a stout curved strut connecting each end of the float with the ends of the outrigger platform.

Nothing is known of the sailing canoes which may have been possessed in former times by the people of Kapingamarangi.

EASTERN CAROLINES

Sailing Canoes

Deep-sea sailing canoes have long ceased to exist in the eastern Carolines. The few references to them are meager and wholly deficient in detail and there are no models in any museum to afford enlightenment. It is therefore difficult to decide how far they resembled the sea craft of the other parts of the archipelago.

Fraser (1834, pp. 74-75), who discovered Andema Island near Ponape in 1832, describes seeing there a "flying proa":

> These proas are formed the same at each end, thus having no occasion to tack. They have a large mat sail, easily shifted on changing the vessel's course, and by which they may sail within six points of the wind. The sails being large and the proas narrow, they are obliged to use double outriggers to give them sufficient stability. [From the context it is certain that these "double outriggers" were in reality the double outboard platforms—one on each side—so characteristic a feature of the canoes of the western and central Carolines, one more instance of the confusion caused by the loose use of this term.] Two of the crew were at this time sitting out on the weather outrigger. There were only four altogether in it, although it might have contained a dozen.

Cheyne (1852, p. 110), who was at Ponape in 1846, describing the sailing canoes of that island, says:

> [They] are hollowed out of a large tree and very neatly made. The outrigger is attached to the canoe by many projecting pieces of light wood, neatly squared and painted. [This suggests a design akin to that of the neighboring Marshall Islands.] They have a platform in the center for the chief to sit on. These canoes are painted red, looking exceedingly handsome, and are furnished with a mast and triangular sail. They sail very fast, and carry from 4 to 10 men.

Cheyne (1852, p. 100) states that Pakin Island, near Ponape, "is celebrated for its canoe sails, which are manufactured from the leaves of the pandanus tree and are eagerly sought after by the natives of Bornabi [Ponape]," adding that the Pakin natives frequently visit Ponape in their canoes for trading purposes.

Scherzer (1861-63, vol. 2, p. 552) describes the Ponape canoes similarly, adding:

> The sails . . . are triangular, the most acute angle being confined between two long bamboos, while a third serves as a mast, the whole capable of being shifted to either end of the boat by one of the crew according to the direction of the wind. . . . [The outrigger had] very peculiar scaffoldlike supports. . . . [The hulls were] elegant, streaked with red.

Mokil (Duperrey Islands) had also sailing canoes when visited by Duperrey in 1824. Duperrey (1827, pl. 50, figs. 1-3) gives figures of one, from which it is evident that the local type was more closely related to that of the Marshall Islands than to any of those peculiar to the central Caroline Islands.

> The booms are shown as multiple, consisting of two stout straight median spars, flanked on either side by a set of three curved poles attached directly to the float by lashings. The straight booms do not extend as far out as the float and are not connected therewith by vertical stanchions as in the Marshall Islands type. In spite of this want of connection with the float, these straight booms must be considered main or true booms, and the curved poles merely accessory ones.
>
> The two ends of the hull are similar; they turn up abruptly and end in crescentic lunar ornaments directly comparable with the prows of the Marshall Islands canoes. A median platform covers the center of the hull and projects outboard a short and equal distance on each side. Like the western and central Caroline type, this canoe was steered by a quarter paddle secured against the outboard end of a crossbar fitted across the hull close to each end.
>
> The mast as figured is stepped midway between the ends, but the position of the step is not defined. Two shrouds are led to the outboard ends of the booms and there is one stay. The sail is triangular and rigged in the usual Caroline Islands manner, the heel of the yard stepped in the bows as usual.

The modern small canoes of Mokil retain an identical outrigger construction, so it is evident that the connection, cultural or racial, between Mokil and the Marshall Islands is extremely intimate. This, linked with the dissimilarity between the Mokil design and those of other Caroline outriggers, would seem to indicate that Mokil was colonized from the Marshall Islands, just as Nukuoro and Kapingamarangi have been colonized from Polynesia.

The existing accounts, scanty as they are, are yet sufficient evidence that the sailing craft of the eastern Carolines were adequate for interisland communication and were rigged, the larger ones at least, after the manner of their western relatives. It is therefore disconcerting to find that Lütke (1835, vol. 2, pp. 27-28), who was in the islands in 1824, after stating that the Ponape canoes were dugouts, with the ends alike, the largest capable of carrying 14 men, refers to the canoes as "differing from all those known to me, in that they carry sails without masts". The description of the sail is accompanied by a diagram (fig. 289). Lütke states that the form of the sail renders it impossible to make it larger, and adds: "This is the true reason why the canoes of these islanders have not the same speed as those of the low (atoll) islands".

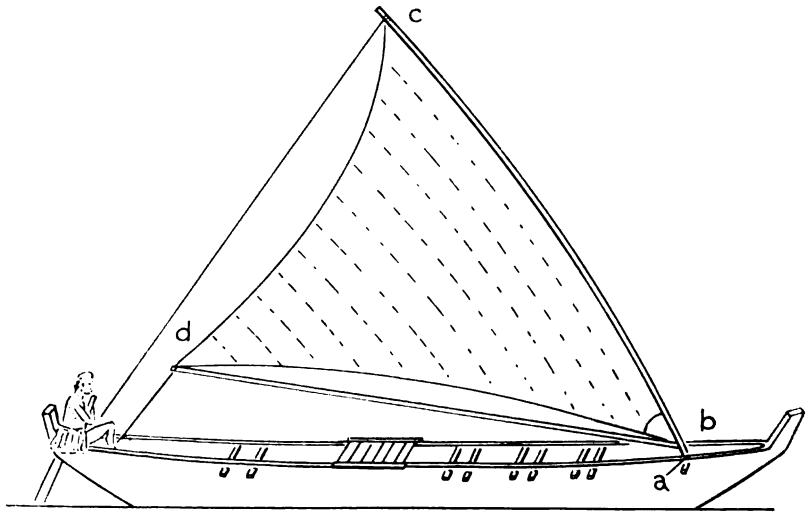


FIGURE 289.—Sail of Ponape canoe, Caroline Islands, made of matting. According to Lütke the two long sides *b-c* and *b-d* are attached to poles joined in free-moving manner at *b;* to set sail, the heel of the pole *b-c* is set downward at end of canoe intended to serve as the head, the poles *b-c* and *b-d* being raised at the same time. To change course the heel of the pole *b-c* is carried to the other end of the canoe. The sail is described as being furled by rolling it on the poles (after Lütke, 1835).

The sail itself does not appear to have differed from the usual Micronesian design in any essential respect, apart from its being set up without the support of a definite mast. It had its two long sides bounded as usual by two light poles which therefore converged toward one end and met at the apex; this apex, turned down, was stepped in the bows of the canoe without being hoisted upon a mast in the usual manner. Lütke pointedly avoids terming one of the poles a mast; he says that the outer corners of the sail were extended on the ends of the "two light poles".

This is the method that was formerly employed by the Maoris of New Zealand for extending the triangular sail which they used on both their single and double canoes, and to find it also in use in Micronesia is very remarkable. It was probably a local degenerative variation employed only during fine weather and on short or coastal trips.

A parallel use of two sprit poles, neither of which can be regarded as a mast, is the usual rig of all present-day outrigger canoes in Ceylon and also of many of the outriggers of Madagascar. In both localities, however, the sail extended is a high

rectangular one, having the upper corners raised aloft on the ends of two divergent poles, to neither of which is the sail laced.

It is probable that the sail described by Lütke was that used by inshore canoes, the masted type described by Fraser and Scherzer being employed by voyaging canoes, which Lütke appears not to have seen.

Apart from the difficulty presented by the form of sail figured by Lütke, a second one arises from the absence of any reference to an outrigger either in the description or in the sketch. With the information available it is impossible to decide whether the outrigger has been omitted by the artist or did not belong to this peculiar craft.

Paddling Canoes

As little definite information exists regarding the "flying proa" of the eastern Caroline Islands, apart from that of Mokil, except that it was a large double-ended dugout with triangular sail and a complicated outrigger frame, the details of the smaller craft which still survive must be studied for some insight into the type to which the larger craft conformed. Tradition is strong that these were numerous and weatherly vessels, as indeed they must have been to permit of the colonization of the many islands.

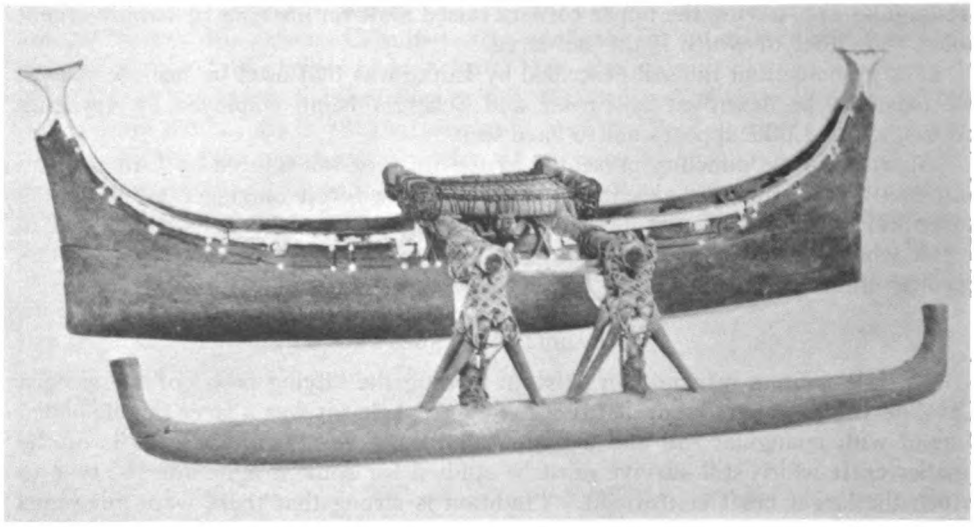
The modern paddling canoes in use in Ponape and Kusaie possess some peculiar features which it may be concluded with considerable confidence are survivals of similar and probably more complicated features characteristic of the extinct deep-sea sailing proas once used. Although the type of outrigger attachments in the two principal localities (Kusaie and Ponape) differ greatly, they agree in one notable feature. The float, instead of being comparatively short as elsewhere in the Carolines, and particularly in Palau, is here remakable for its great comparative length, not much shorter than that of the dugout itself; this and other peculiarities are probably due to Polynesian influence.

Ancient Kusaie Type

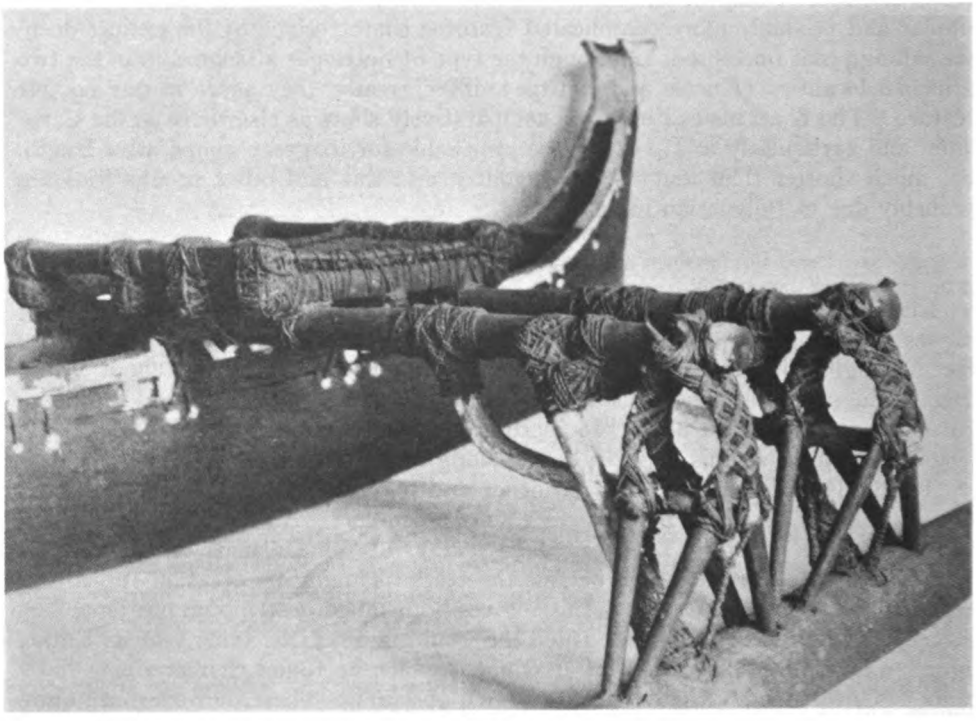
Lütke (1835-36, vol. 1, pp. 368-370) gives the dimensions of the large paddling canoes belonging to the chief of the island, then known as Ualan, as from 25 to 30 feet in length with a width of 1.5 foot. The single washstrake was about 1 foot deep in the midships region, rising to 2 feet at the ends, where it joined the triangular end pieces. Lütke adds: "Ils incrustent des coquilles blanches dans des petits trous". Presumably this decoration was along the gunwales of the canoe.

The hulls were colored with red ocher and highly polished. These "pirogues de parade", as Lütke calls them, carried 8 to 10 paddlers. All the canoes were light and drew little water. "The limited navigation of the Ualanais does not exact other qualities. They never go outside the reefs. Having no occasion for voyaging, they make no use of sails". Lütke gives no detailed description, but Duperrey (1827, pl. 49, figs. 14-17), who visited the island in 1824, the same year as Lütke, figures a specialized form of float attachment which he found characterizing these canoes. Unfortunately the details are drawn obscurely. These, however, are quite clear in certain old museum models, the best-preserved being one in the Peabody Museum, Salem, Massachusetts (fig. 290), and another, less perfect, in the Freiburg Museum figured by Sarfert (1919-20, vol. 1, pl. 35) in which the attachments appear to have come partially adrift.

A deep-sided, double-ended dugout, horizontal on the bottom as well as along the upper edge, forms the base of the hull. At each end the bottom joins the cutwater at a right angle. Upon each edge a washstrake is secured along the middle region or waist by sennit lashings



a



b

FIGURE 290.—Model of old type of outrigger canoe used in Kusaie, Caroline Islands (Peabody Museum, Salem), original lashings still in perfect condition: *a*, side view of entire model showing slight but definitely bifid shape of upturned heads, angular forefoot at each end of hull, strong and carefully made outrigger attachments, and characteristic turn-up of both ends of float; *b*, details of elaborate float attachment, cord and not braid employed.

passed through holes in the opposite margins. Both sides are symmetrically curved vertically. The bottom is distinctly keeled.

Each of the ends of the upper body is formed of a triangular end piece winged below at each side in order to make junction by means of a rabbet joint with the adjoining end of the washstrake. The fore margin of each end piece turns up vertically and terminates above in a bifid figurehead, each half being carved into a straight-sided, flat-topped expansion. The cutwater from below the "neck" which separates this peculiar ornament from the lower part is slightly concave (fig. 290).

Two straight booms cross the hull and are secured to the gunwales by lashings in the usual manner. They project outboard only on the outrigger side. The float is hexagonal in Duperrey's figure, cylindrical in the models, in which blunt, upturned ends have been pegged on by a similar rabbet joint to that characterizing the junction of the end pieces of the hull. In both illustration and models the float is remarkable among canoes of the Caroline Islands for its relatively great length, more than three fourths that of the hull.

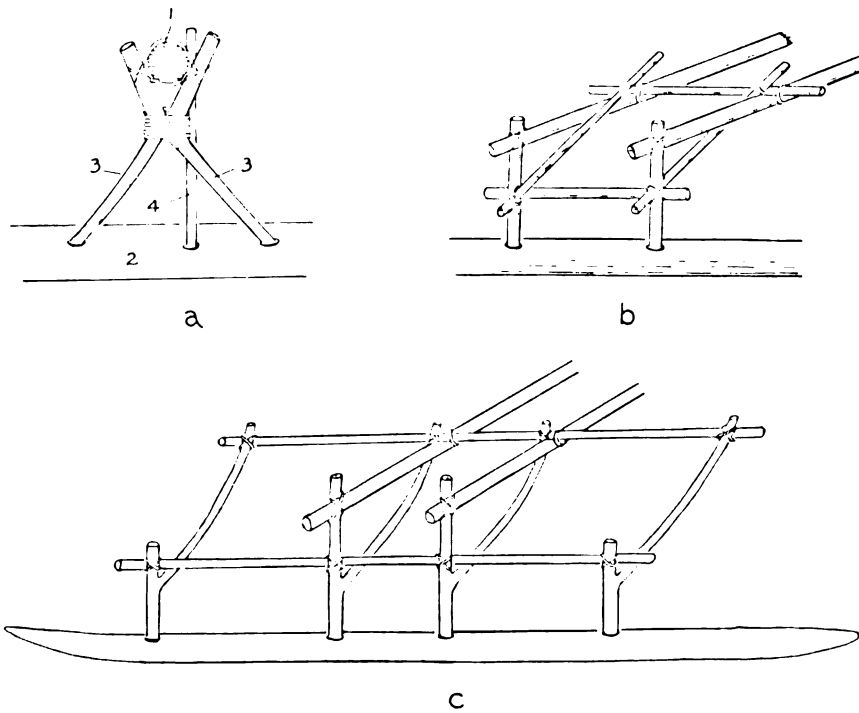


FIGURE 291.—Outrigger attachments, Kusaie, Caroline Islands. *a*, end-on view: 1, boom; 2, float; 3, pair of angled connectives lashed together at bend; 4, single vertical stanchion connective (after Sarfert). *b*, type seen in small present-day canoes (after Alexander). *c*, common type used in modern canoes of larger size (after Sarfert and Alexander).

The intricate connection as figured by Duperrey and elucidated by the excellent Salem model is formed as follows. Two diverging stick connectives (a pair) are inserted close together into the float some inches forward of the axis of each boom and a similar pair in the same relative position on the after side. The units of the two pairs are inclined toward one another and at about half the distance between the float and the boom meet the end of a stout curved bracket brace which passes outward from a lashed attachment to the under side of the boom at its mid length to a point half-way vertically between the end of the boom and the float, where the paired connectives are lashed to it on opposite sides (fig. 290, *b*). Above this point the units in each pair of stick connectives are reduced in thickness and are curved in toward one another, their ends coming together and crossing at the side of the boom. After passing the curved bracket, the opposite units in each pair of connectives are united by an extremely complicated system of lashing, the final result forming a particolored diamond pattern, as different-colored sennit braids are employed in fashioning it. In end view this explains

the peculiar ring or hoop covered with zigzag markings under the boom in Duperrey's figure (1827, pl. 49, fig. 16). The curved bracket also appears in the same figure, and it would seem that it also was ornamented with a binding of particolored lashing.

Additional strength is afforded by a stout straight wooden brace inserted into the float between the two pairs of connectives, whence it is inclined inward and upward to a junction with the boom above, to the fore side of which it is lashed near the attachment of the curved bracket. Finally a cord stay passes vertically down from the end of the curved bracket and is inserted in the float; the apertures in the float through which it passes are sealed with cement.

To bind together the parts of the framework still more securely, two longitudinal stringers are lashed athwart the booms close to the dugout and another pair near the outer ends, one over them, the other beneath. Duperrey (1827, pl. 49) shows another stringer which is prolonged some distance fore and aft beyond the boom frame, and from each end of this stringer a branch or false connective passes downward and outward to attachment to the float, not far from the end. This is not shown in the museum models, but has a homologue in the present-day shore canoes. Duperrey figures light rods, probably split bamboos, laid over the two booms forming an outboard platform for goods and passengers. The central space amidships in the canoe is not platformed in this illustration.

A variation on this extremely complicated attachment is seen in an apparently perfect model figured by Sarfert (1919-20, vol. 1, pl. 36) and numbered "Sammlung Sar. 1255". The form of hull and float are as in the models described above, but the float attachment is simplified somewhat. The upper halves of the elbowed connectives are not bent toward one another to form a round-topped arch and are merely lashed to the opposite units of the other pair, at a point below the boom, thus forming a false crutch with bifid trunk (fig. 291, *a*). This attachment is reinforced by a vertical inserted stanchion between the pairs of elbowed connectives, together with a cord stay between boom and float. Divested of obscuring details, this old type of Kusaie attachment resolves itself into a refinement of the crutch type, which here reaches its highest development.

Lütke (1836) gives a figure, reproduced by Sarfert (1919-20, vol. 1, pl. 35, fig. 2), which is so crude that it affords no further elucidation of details. Allowing for shortcomings in the drawing, it is evident, however, that the attachment represents the foregoing type.

This system of connecting the float to the boom is the most intricate with which I am acquainted, and bespeaks long experience in the construction of outriggers, coupled with intelligence and invention of a high order. The conclusion is forced upon the observer that these canoes must have had ancestors of great size and rigged with at least equal skill to that shown by their immediate neighbors, both east and west. The presence of ruined structures on Kusaie and the greater ones on Ponape bespeak a far higher degree of civilization than that existing when the islands were discovered a little more than a century ago and it appears certain that the people had formerly large sailing vessels with complex attachment of the type described above.

MODERN KUSAIE TYPES

Two modern canoe types exist. Both are dugout canoes (*waag* or *oak*) of inferior construction, used solely in the harbor, the streams, and the lagoons. When the people have occasion to visit other islands, passage is taken in a coasting vessel of European design.

The dugout hulls are round-bottomed, straight fore and aft, and a few inches wider at the turn of the bilge than at the gunwale. Both ends are sharp and either both are low or one is upturned and pointed and the other low. Most of the canoes are propelled by poles or paddles, but some of the larger—they reach 28 feet in length—are fitted for sailing. In the larger canoes a number of thwarts are

inserted below the gunwale and there is a central platform of the usual design, partly built out on and over the outrigger booms.

The smaller canoes have neither platform nor thwarts. In these the float is usually turned up at the forward end to prevent its catching under snags; it is connected to each boom by a single vertical stanchion, the upper end lashed to the side of the boom. In addition an obliquely running rod brace, the homologue of the side branch of an unequally forked Y connective, connects the upright stanchion with its boom (fig. 291, *b*), and a fore-and-aft stringer unites the two uprights at mid length and another connects the booms at the place where the oblique braces are lashed to the sides of the booms.

a

b

FIGURE 292.—Modern canoes of the eastern Caroline: *a*, Kusaie; *b*, Ponape (photographed in 1900, U. S. National Museum).

In the larger canoes described and figured by Sarfert (1919-20) and by Alexander (1902), unequally forked connectives with upright main stems actually survive, attached to the booms in the same way as the pseudo-forked connectives of the small canoes. The same two fore-and-aft stringers also are present, but instead of ending where they are lashed to the booms they are produced several feet, and

to each end are lashed the two branches of a supplementary forked connective (fig. 291, *c*); thus, although there are only two booms, there are four forked connectives (fig. 286). These larger canoes are usually rigged for sailing, but as the mast is stepped through a hole in a thwart, forward of the center, and as the sail used is of European type, it is evident that this is a modern innovation unrelated to indigenous custom. (See fig. 292, *a*.)

PONAPE TYPE

The present-day canoes (*wuar* or *var*) of Ponape and the neighboring islands are as degenerate as those of Kusaie but retain a highly specialized and exceptionally ingenious type of outrigger, undoubtedly a survival from days when seafaring in large vessels was an important feature of island life. The unique and involved design of the outrigger frame bespeaks comparative isolation through a long period during which its several component parts have developed on lines differing radically from those of the stock from which it originated. (See fig. 292, *b*.)

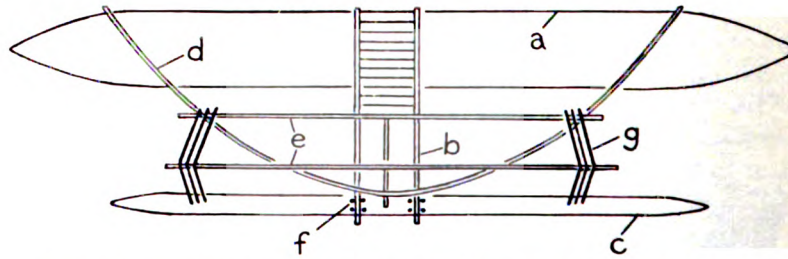


FIGURE 293.—Diagrammatic plan of Ponape outrigger canoe: *a*, hull; *b*, booms; *c*, float; *d*, curved *tokowar* spar; *e*, stringers; *f*, paired stanchion connectives; *g*, angled accessory connectives.

The hull as described by Alexander (1902) is a lightly constructed dugout averaging 26.5 feet in length, with a beam of 13.5 inches and a depth of 17.5 inches. Its model is good and finely proportioned. The bottom is straight for the greater part of its length; transversely it rounds sharply and is without keel. The stem commences to turn up abreast of the fore end of the long float, extending out gracefully, slightly flaring at the extreme end, but fairly sharp where it enters the water. The stern runs out in the same manner to form an overhang. The outside is painted, or rather stained, a reddish mahogany color. At the center is a platform about 2 feet long, continued outboard on the outrigger side over the booms about 18 inches. Six thwarts are usually provided, three forward and three aft of the platform; they are set flush with the gunwales and dovetailed in.

The outrigger as described by Alexander (1902) and figured by Kubary (1895) is single, consisting of two main booms (*kiai*) connected indirectly to an exceptionally long float (*tam*) fitted 18 to 20 inches from the side; in a canoe 26 feet long it measures about 20 feet. Midway between the two main booms is a third or false boom, parallel with them, similar to that of the Marianas figured by Anson (1748) and to that of Nauru. Each of the true booms is attached to the float by several obliquely running inserted stick stanchions (*rak*). According to Alexander (1902, p. 824) they are comparatively long, about 18 inches, and number six "placed together at the top and spread at the bottom"—that is, they consist of three pairs of overcrossed stanchions.

To brace the frame a strong pole (*tokowar*) stretches from near each end of the canoe in a sweeping curve (Alexander) to meet its fellow spar between the outer ends of the two main booms; strong lashing secures each *tokowar* to its respective boom. Additional support is given to the framework by two longitudinal stringers running parallel with the canoe. The ends of both are lashed to the two *tokowar* at the points where they cross.

The frame and its attachment are directly comparable in skeleton with those of the *popo* of the central and western Carolines. A novel feature has, however, been added, in the form of several, usually three, accessory connectives (fig. 293, *g*)

consisting of elbowed withies (*apic*) which connect each *tokowar* with the float. Each of these withies projects horizontally from the *tokowar* to which its inner end is lashed, immediately crosses the inner stringer near its end, is lashed also thereto, and thereafter extends, still horizontally, to a point directly over the float; here it is bent downward at a right angle and its pointed extremity is inserted into the upper surface of the float.

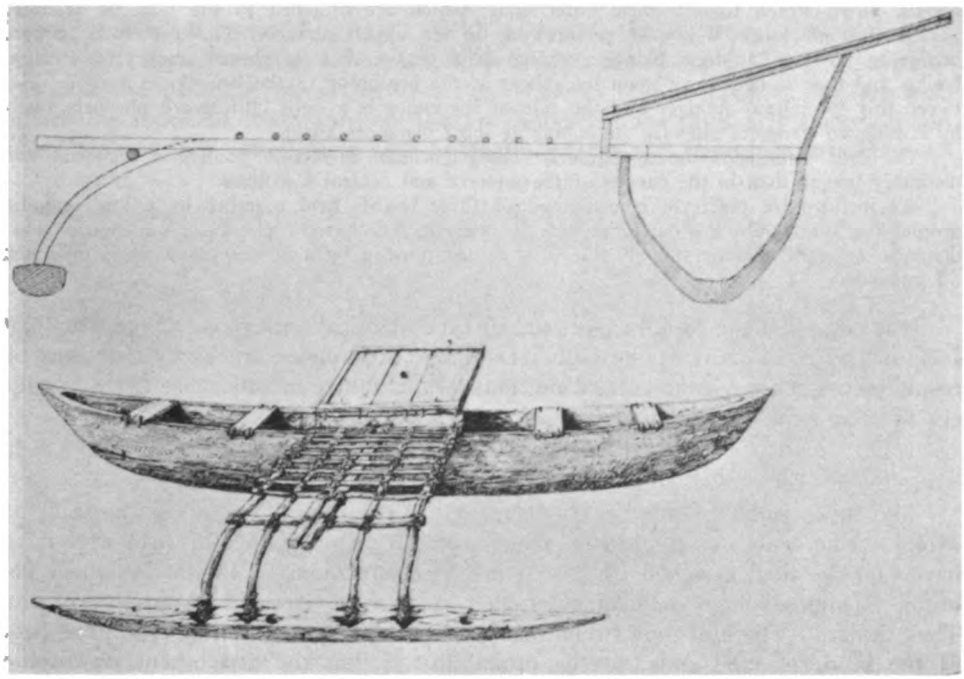


FIGURE 294.—Mokil outrigger canoe, side view and cross section (courtesy of Hamburg Museum für Völkerkunde).

Individual canoes show considerable variation in details. The number of the stick connectives to each boom is shown by Kubary as two only. In small canoes the elbowed withies at each end of the float may also be reduced to two. The central false boom may be wanting, as also the outer stringer. Of greater note is the peculiarity shown in a photograph of a canoe by Christian (1899, p. 130), as also in Kubary's figure, where the stout curved *tokowar* are replaced by straight spars, thereby producing a triangular outrigger frame which brings the Ponape type into direct correspondence with that of the central and western Carolines, so demonstrating the essential or fundamental unity of canoe design throughout the archipelago.

Kubary (1895) gives the following local terms for the outrigger parts in Ponape: *apic,* elbowed false connectives; *kiai,* boom; *parap,* platform; *rak,* stick connectives; *tam,* float; *tokowar,* curved braces.

MOKIL

Mokil is a small reef about 90 miles eastward of Ponape. It was discovered in 1824 by Duperrey. As exemplified by a full-sized canoe (fig. 294), the present-day type of paddling craft of Mokil agrees in the essential features of its outrigger design with the sailing canoes figured by Duperrey (1827, pl. 50).

The hull is a simple one-piece dugout curved up equally at the ends, which are pointed, slightly sheered, and without ornament. The bottom is bluntly angular along the median line, the bilges high, and the vertical section of the sides short. Four plank thwarts, spaced equidistant, are sewn upon the gunwales, two on each side of the midship platform.

The main booms of the outrigger, two in number, lie alongside one another. They are straight, and in transverse section are square. Their inner ends rest upon both gunwales, to which they are sewn; their outer ends are free and without direct connection with the float. On the off side is no projection. On each side of the straight main booms are two accessory booms, down-curved toward their outer ends, which are attached to the float by lashings passed through large V-shaped perforations in its upper surface. To keep these curved booms in position, a stout stringer, acting as a tension bar, is passed under the straight booms and then lashed down upon the others at the beginning of the bent-down section. Between this specialized stringer and the side of the canoe is a light latticework platform made by lashing 10 stringers athwart the booms at short distances apart.

The float is flattened above, angularly rounded beneath in section, pointed at each end, and distinctly longer than in the canoes of the western and central Carolines.

An inclined lee platform is composed of three boards held together by a low coaming around the sides. On the outrigger side it rests upon a narrow plank set on edge a short distance outboard, and on the off side it is canted upward by a deeper plank fitted upon the off gunwale.

It is clear that the Mokil canoes are of type identical with those of the Marshall Islands and of Nonuti in the Gilbert Islands; differences are local variations or result from such environmental conditions as the ability or otherwise of the builders to obtain timber of large dimensions.

Pingelap

The three small islands of Pingelap lie approximately 60 miles southeast of Mokil. The canoes as figured by Duperrey (1827, pl. 47, figs. 21-25) appear to have had the float attached by paired inserted stanchions as in the Ponape type, but it is impossible to determine whether they were of the Nukuoro or of the Truk design. The hull shows relationship with the central Caroline type in respect of the bifid reflected ends, so the probability is that the attachment was made after the Truk fashion.

Duperrey figures the sides of these canoes as ornamented with a painted band of continuous zigzags.

DOUBLE CANOES

It is generally stated that double canoes are notable by their absence throughout Micronesia and that there is neither record nor suggestion that the people of these island groups ever used this form of transport. However, a definite and detailed description of a typical double canoe belonging to the Truk Islands in the central Carolines is given by Morrell (1832). He begins by giving an account of the construction of the outrigger canoes:

[The canoes] are mostly of great length, carrying from 15 to 30 men. The bottom is of one log, generally from 30 to 50 feet in length, and got out in the form of a canoe . . . On this foundation they proceed to build the vessel. Each side is formed of a single plank, from 14 to 18 inches in width . . . These sides are sewed fast to the bottom with a strong cord made from the bark of a tree, and also to a beautifully carved head and stern resembling those of the ancient galleys which we often meet with in classical paintings . . .

Their double canoes are formed in the same manner as the one just described, with the exception of the outrigger, which, of course, is not necessary. Two canoes are fastened together abreast of each other, with bamboos extended across them, on the same principle of construction as our twin steam ferry boats. These canoes are generally about 40 feet in length, and the distance between them is from 8 to 10 feet. The bamboos which unite them are placed about 2 feet apart, and strongly secured to the gunwales by a lashing of their bark cord. Small sticks of bamboo are then extended fore and aft, secured to the cross pieces, thus forming a light platform from 20 to 25 feet in length and 8 or 10 feet wide. They paddle on

the two outsides and insides of the canoes, propelling them forward with astonishing speed, much swifter than our whaleboats with six oars pulled by our most vigorous tars. They are called war canoes, and many of them have very curiously carved heads and sterns which rise from 1 to 3 feet above the hull, not unlike the fashion of the New Zealanders. Their paddles are generally 4 feet in length, with blades about 6 inches wide, the whole very neatly finished off with carved work admirably executed.

It is noteworthy that these Truk double canoes are specifically termed "war canoes", propelled by paddles only. With regard to the statement that both ends were beautifully carved and raised several feet after the Maori fashion, it is significant that the paddling canoes of the Truk Islands of the present day are also remarkable above all other Caroline Islands canoes for the peculiarly elaborate and ornate fashion into which their high upstanding stem and stern are wrought.

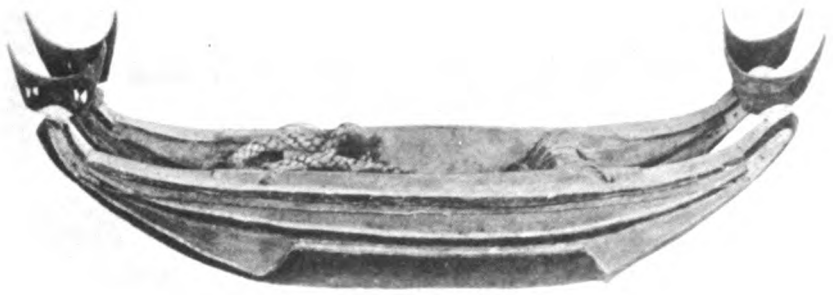


FIGURE 295.—Model of sacred double canoe from the Truk Islands, hulls painted red and black (Hamburg Museum für Völkerkunde).

Morrell appears to have been the only voyager to see and record this unique Micronesian type. It is therefore a fact of the utmost importance and significance that the Truk Islanders construct models of such craft, which they term their "sacred canoe" and preserve as articles of ritualistic value and service in the men's clubhouses. These models (*eauan*) vary greatly in size and in their design may either conform closely to that of the hull of the existing local single canoe or be crude and conventional representations thereof.

The Hamburg Museum für Völkerkunde possesses two of these models, one large and realistic and more than 3 feet in length, the other small and coarsely made. The larger (fig. 295) consists of two equal-sized hulls connected by cross beams. The hulls are carefully constructed upon the existing local design and are painted red and black in characteristic fashion. Each end of each hull terminates in a fore-and-aft crescentic ornament, painted black, the symbol of the moon. The smaller model appears degenerative.

A third of these "sacred double canoes" (fig. 296) is an exhibit in the Berlin Museum für Völkerkunde. It is about 20 inches long and is mounted on a wooden stand having four squat legs. The canoe has hulls of the same design and coloring in all respects as those of the larger Hamburg model but differs from it in having a substantial rectangular wooden superstructure erected upon the cross beams connecting the two hulls. This is decorated in red and black horizontal bands, with a row of white triangles running through the two upper black bands. At each corner of this square superstructure is stationed the figure of a bird, painted black and white, carved in the round, which Kubary (1889, p. 52) and Müller (1912, p. 247) identify as a sandpiper (*Strandläufer*).

In view of the present-day absence of the double canoe from Micronesian seas, even if Morrell had not recorded a detailed description of double canoes 40 feet long, this fact that double canoe models are constructed for ritual purposes in the religious observances of the natives would of itself suggest that they enshrine the memory of the former existence of large and highly valued vessels. It is noteworthy that the Yap *tsukupin* is also termed a "sacred canoe" by the people of that island although it has no ritualistic significance as have the Truk Islands models. Being a large and valuable canoe employed in a most important fishery, it is not improbable that, in the past, religious rites may have centered around it in order to insure the protection and favor of the gods in its fishing operations.

FIGURE 296.—Model of sacred double canoe, Truk Islands (Berlin Museum für Völkerkunde).

More closely analogous is the great Fijian double canoe set apart or tapu to the service of principal chiefs and specifically termed "sacred canoe" (*wangga tambu*). In the Truk Islands such great canoes as Morrell describes, being specifically war canoes, would similarly be set apart as a privileged possession of the chiefs and would share in whatever sacred attributes the chiefs might be endowed with in the prevailing religious system.

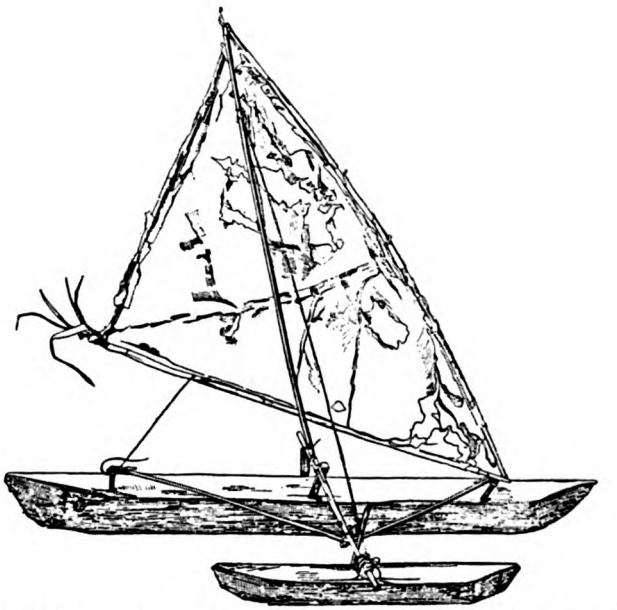


FIGURE 297.—Model canoe from Yap, Caroline Islands, used in racing (from Müller-Wismar).

MODEL RACING CANOES

Throughout the western and central Caroline Islands model canoe races are, or were, a favorite pastime with men and boys. The model in use is a single outrigger with but one boom connecting the hull with the float. It shows essential agreement in design throughout the islands; the boom is steadied by two oblique struts, one from each end of the hull, with their outer ends lashed to the boom. In the Yap play canoes (fig. 297) the boom is fairly short and the struts join close to the float; in the Truk Islands model (fig. 298) the boom is of extraordinary length outboard. In the Yap model the outer end of the boom is lashed to two stanchions inserted in the float, whereas in the Truk model the end is thrust into a hole bored through the outer of two vertical ridges at mid length of the float. In a photograph in the United States National Museum (no. 40070) five of these models can be counted aboard a number of canoes alongside the *Albatross* during her visit to the islands in 1900; all have the float detached.

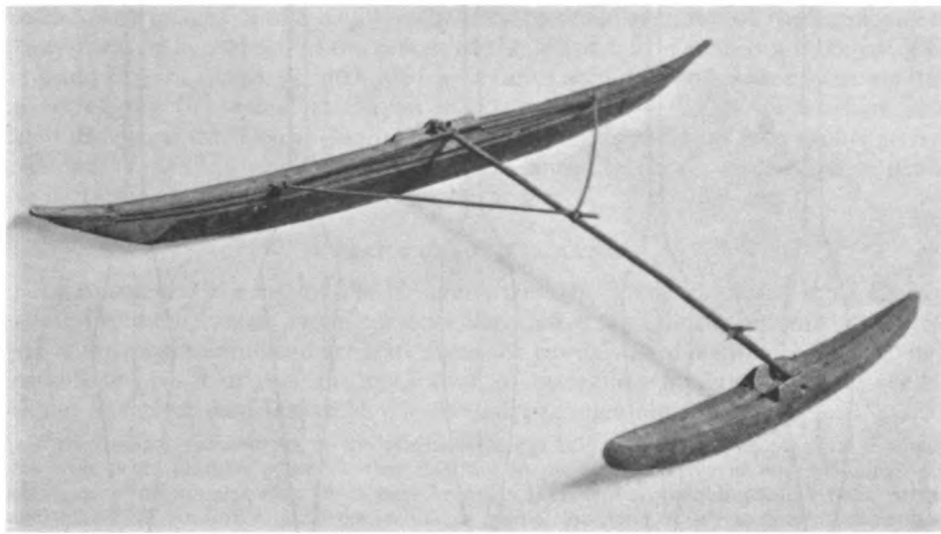


FIGURE 298.—Racing model canoe, Truk Islands, 4 feet 8 inches long, obtained in 1892 (Peabody Museum, Salem, Massachusetts).

The Yap variety (fig. 297) closely resembles that of the Palau Islands (fig. 312), but in the Palau model cords replace the oblique wooden struts and an additional pair connect the ends of the float to a point on the boom fairly near to the hull. The rig of both is identical; the mast is pivoted on the outrigger boom where it crosses the hull, and the sail is a typical Oceanic lateen, made from a taro leaf extended on yard and boom as in the full-sized sailing canoes of these islands.

PADDLES AND BAILERS

The paddles are of fairly uniform type, the blade elegantly lanceolate in shape with acuminate tip, in some paddles thickened as in those of the Truk Islands. The loom is cylindrical and without knob or crutch. (See figs. 272, 299.)

Bailers are generally of typical Oceanic form, but those of Yap, called *nim*, are figured by Müller with the distal end of the handle connected to each side of the scoop by a bar at right angles (fig. 272, *e*), a form almost identical with that of the

Society Islands. The same characteristic is present in the Palau bailer, furnishing another link in the chain of evidence which connects Yap and the Palau Islands in ancient cultural relationship.

RAFTS

A Yap raft called *fofod* or *virar* has been described by Müller. It is a rectangular bamboo float with a raised central platform as in the Palau *prer*. Rafts of still larger size are stated by Furness (1910, p. 93) to have been employed formerly for the transport of the larger sizes of the Yap stone money from Babelthuap, the island in the Palau Islands where it was quarried and fashioned to shape.

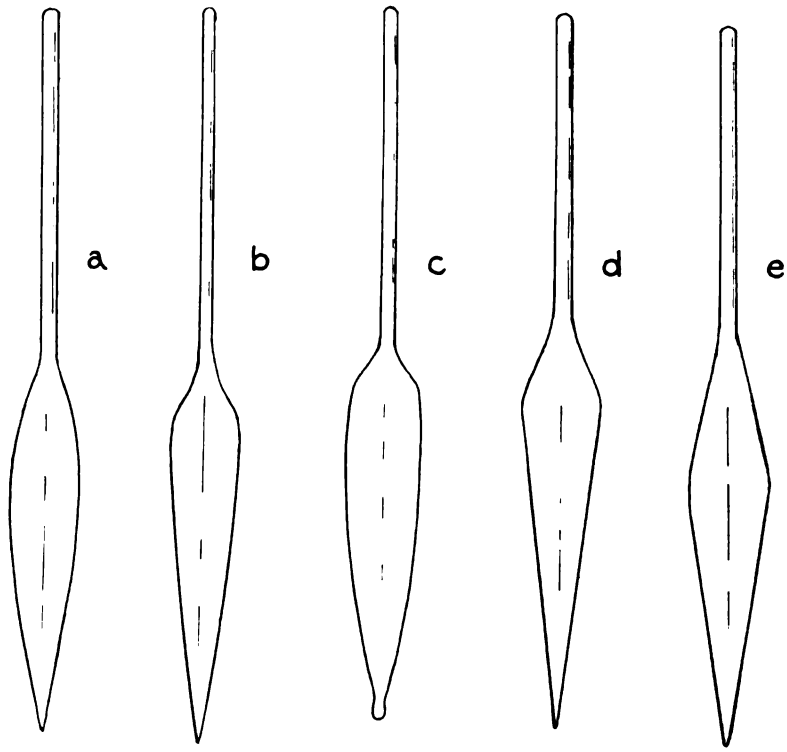


FIGURE 209.—Caroline Islands paddles: *a*, Pingelap (after Duperrey); *b*, Satowal (after Duperrey); *c*, Truk (Hamburg Museum für Völkerkunde); *d*, Kusaie; *e*, Nukuoro (*d*, *e*, Cologne Museum).

MARIANAS ISLANDS

FLYING PROA

HISTORICAL REFERENCES

More than those of any other island group, the sailing craft of the Marianas Islands, by reason of their swiftness and elegance, riveted the attention and aroused the admiration of every navigator who had the good fortune to see them. Their large sailing canoes came to be known as "flying proas" and one of the early names of the archipelago was "Islas de las Velas" from the great number of sails seen passing to and fro between the islands.

Magellan's chronicler, Pigafetta (1800, p. 53), who saw some of these vessels in 1521 at either Guam or Rota, likened them "to the gondolas of Fusine but narrower", and remarked that some of them were painted black and others red. He gave a fair general description and noted that the natives employed a lateen sail made of palm matting, and that, to keep the narrow hull from capsizing under the press of the great sail, they fastened on the opposite side (windward) a large pointed beam supported by poles laid across from the hull as an equipoise. He observed also that they made no difference between the head and the stern of the vessel, as there was a rudder at each end resembling in shape "a baker's shovel, that is to say, a staff with a board at one end".

Cavendish (1904, p. 328) saw these fine vessels in 1588. At that time they were still exceedingly numerous, for when the *Desire* and the *Content* were two leagues off Guam they were met by "60 to 70 sailes of canoas full of Savages . . . wearing their haire marveilous long; yet some of them have it made up and tyed with a knot on the crowne, and some with two knots, much like unto their images which we saw them have carved in wood and standing in the head of their boates like unto the images of the devill"—the only recorded mention of the employment of any form of figurehead in the canoes of the Marianas. Dampier (1906, pp. 308-311) and Rogers (1718, pp. 367-368) give fuller accounts, and Anson, who refitted his vessel, the *Centurion*, at Tinian in 1742, furnishes details, dimensions, and scaled drawings of a typical Guam "flying proa" captured by his men on his arrival at Tinian. One of Anson's officers took this canoe "to pieces, on purpose to delineate its fabric and dimensions with greater accuracy". (See fig. 300.)

Details of Construction

As Anson was the last of the voyagers, with the doubtful exception of Crozet, to describe these canoes from personal knowledge, and as his account (1748, p. 339) is the most minute and accurate from the circumstance mentioned by him, it is desirable to give it in full; his admiration of the sailing qualities of these vessels was not less great than that of those who had preceded him:

> These Indians [inhabitants of the Marianas] are a bold, well-limbed people; and it should seem from some of their practices, that they are in no way defective in understanding; for their flying proas in particular, which have been for ages the only vessels used by them, are so singular and extraordinary an invention that it would do honor to any nation, however dexterous and acute. For if we consider the aptitude of this proa to the particular navigation of these islands, which, lying all of them nearly under the same meridian and within the limits of the trade-wind, require the vessels made use of in passing from one to the other to be particularly fitted for sailing with the wind upon the beam; or, if we examine the uncommon simplicity and ingenuity of its fabric and contrivance, or the extraordinary velocity with which it moves, we shall, in each of these articles, find it worthy of our admiration and meriting a place amongst the mechanical productions of the most civilized nations, where art and sciences have most eminently flourished. As former navigators, though they have mentioned these vessels, have yet treated of them imperfectly, . . . I shall here insert a very exact description:
>
> The name of "flying proa" given to these vessels is owing to the swiftness with which they sail. . . . From some rude estimations made by our people of the velocity with which they crossed the horizon at a distance, while we lay at Tinian, I cannot help believing that with a brisk trade-wind they will run near 20 miles an hour, which, though greatly short of what the Spaniards report of them, is yet a prodigious degree of swiftness. . . .
>
> The construction of this proa is a direct contradiction to the practice of all the rest of mankind. For as the rest of the world make the head of their vessels different from the stern, but the two sides alike; the proa, on the contrary, has her head and stern exactly alike, but her two sides very different; the side intended to be always the lee side is flat, and the windward side is made rounding in the manner of other vessels: And, to prevent her oversetting, which from her small breadth and the straight run of her leeward side would, without this precaution, infallibly happen, there is a frame laid out from her to windward, to the end of which is fastened a log, fashioned into the shape of a small boat and made hollow.

The statement that the float is hollow is difficult to understand. Admiral Paris considered it to be incorrect, a view which certainly appears to be borne out by an examination of Anson's own drawings, for the shading of the float there gives no indication of any opening or the decking over of a hollow interior. Pigafetta calls the float "una grossa trave" (a great beam) and Rogers (1718, p. 367) describes it as "a large log, shaped like a boat". Nowhere else in the wide region wherein the outrigger canoe is used is there a suggestion of the use of any but a solid float, apart from the doubtful exception of the Bonin Islands.

Anson's drawing also shows what appear to be pulley blocks in use, though perhaps they are thimbles, but there is no reference to them in the text and so far as known such a device was never employed by any Micronesians till after long contact with Europeans. Anson continues:

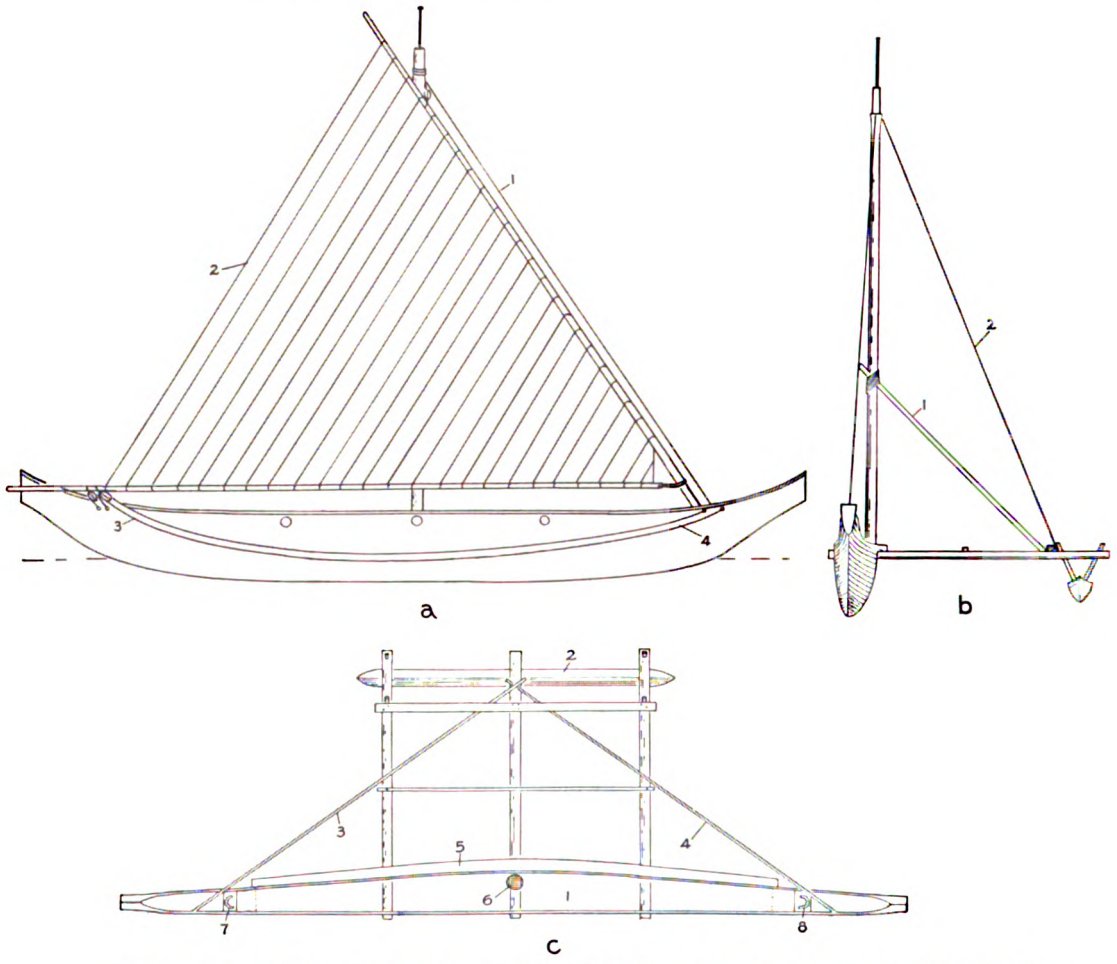


FIGURE 300.—"Flying proa" of the Marianas Islands. *a*, view from leeward with sail set: 1, one of two stays supporting mast, the other hidden behind sail; 2, matting sail; 3, 4, running stays. *b*, head view, outrigger to windward: 1, mast shore; 2, shroud. *c*, plan: 1, proa; 2, "boat" at end of outrigger frame; 3, 4, braces from the ends to steady frame; 5, thin plank placed to windward to prevent shipping of water, to serve as seat for native who bales, and sometimes as rest for goods transported; 6, part of middle outrigger boom on which mast is fixed; 7, 8, horseshoe sockets, in one of which yard is lodged according to tack (after Anson, 1748).

The weight of the frame is intended to balance the proa, and the small boat is by its buoyancy (as it is always in the water) to prevent her oversetting to windward; and the frame is usually called an outrigger. The body of the proa (at least of that we took) is made of two pieces joined endways and sewed together with bark, for there is no iron used about her. She is about 2 inches thick at the bottom, which at the gunwale is reduced to less than 1 inch. The dimensions of each part will be better known from the uprights and views contained in the annexed plate, which were drawn from an exact mensuration [fig. 300] . . . When [the proa] alters her tack, they bear away a little to bring her stern up to the wind, then by easing the halyard and raising the yard and carrying the heel of it along the lee side of the proa, they fix it in the opposite socket [fig. 300, *c*, 7-8], whilst the boom at the same time, by letting fly [one] sheet [fig. 300, *a*, 3-4] and haling the [other], shifts into a contrary situation to what it had before, and that which was the stern of the proa now becomes the head, and she is trimmed on the other tack. When it is necessary to reef or furl the sail, this is done by rolling it round the boom. The proa generally carries six or seven Indians, two of whom are placed in the head and stern, who steer the vessel alternately with a paddle according to the tack she goes on, he in the stern being the steersman; the other Indians are employed either in baling out the water which she accidently ships, or in setting and trimming the sail. From the description of these vessels it is sufficiently obvious how dexterously they are fitted for ranging this collection of islands called the Ladrones. For as these islands bear nearly north and south of each other and are all within the limits of the trade wind, the proas, by sailing most excellently on a wind, and with either end foremost, can run from one of these islands to the other and back again, only by shifting the sail, without ever putting about; and, by the flatness of their lee side and their small breadth, they are capable of lying much nearer the wind than any other vessel hitherto known, and thereby have an advantage which no vessels that go large can ever pretend to: the advantage I mean is that of running with a velocity nearly as great, and perhaps sometimes greater than that with which the wind blows.

The canoe described by Anson appears to have been one of the largest size built; by the scale given it was 40 feet long with a beam about 2 feet and a depth of 3¼ feet, the float 16 feet long. The considerable length of the hull would account for the dugout underbody's being in two sections, joined together; in other smaller ones seen by Dampier, measuring 26 to 28 feet in length, the basal dugout portion was always in one piece. Dampier and Funnell give certain other particulars regarding the construction of the hull differing from those given by Anson, which indicate that there was considerable range of variation in the manner of building up the hull, due, as in other localities, to the size of timber available and the purpose wherefor required, some hulls being made from tree trunks of sufficient girth to dispense with the addition of built-up sides, whereas in others the dugout was little more than a keel with sides of planking raised upon the edges. Thus, according to Funnell's description of a 40-foot canoe, with a beam of 17 or 18 inches, seen in 1705 (1707, pp. 228-229), "The bottom to the water's edge was one entire piece, but hollow; upon which, for the side of the boat, was a piece of thin plank, about 3 feet broad and of the same length as the boat itself. It had its lower edge sewed with rattans to the bottom of the boat". (See fig. 301.) The float is given as 21 feet long and the outrigger booms 30 feet long. Funnell was a careless writer; this length of the booms is preposterous. Dampier, who was at Guam in 1686, gives 6 to 7 feet outboard, which is a reasonable distance. In such canoes as the one 26 or 28 feet long described by Dampier, the under part of the hull was also in one piece but so little excavated on the upper side as to function rather as a keel than as a dugout underbody. Dampier (1906, vol. 1, pp. 308-311) says:

[This bottom or keel] is made round, but inclining to a wedge and smooth; and the upper part is almost flat, having a very gentle hollow, and is about a foot broad. From hence both sides of the boat are carried up to about 5 feet high with narrow plank, not above 4 or 5 inches broad, and each end of the boat turns up round, very prettily. But what is very singular, one side of the boat is made perpendicular, like a wall, while the other side is rounding, made

as other vessels are, with a pretty full belly. Just in the middle, it is about 4 or 5 foot broad aloft, or more, according to the length of the boat. The mast stands exactly in the middle [of the length], with a long yard that peeks up and down like a mizzen yard [the vessels of the British Navy and Merchant Service of Dampier's time carried a true lateen sail on the mizzen; at a later date this was replaced by the gaff sail of modern days]. One end of it reacheth down to the end or head of the boat, where it is placed in a notch, that is made there purposely to receive it, and keep it fast. The other end hangs over the stern. To this yard the sail is fastened. At the foot of the sail there is another small yard, to keep the sail out square, and to roll up the sail on when it blows hard; for it serves instead of a reef to take up the sail to what degree they please, according to the strength of the wind.

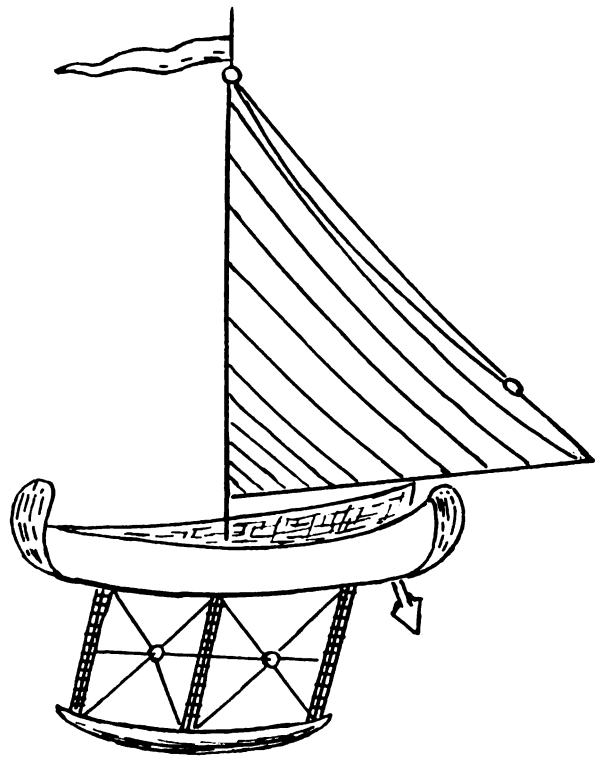


FIGURE 301.—Crude sketch of a Marianas "flying proa" (Funnell, 1707).

By "small" Dampier appears to mean a "slender" yard. Anson's sketches, made to scale, show the upper yard to be rather shorter than the lower one, the boom, and these proportions agree closely with those of the two spars seen in other authentic drawings of Micronesian sails. In the Gilbert Islands, for example, the yard should be equal in length to that of the hull, and the boom should be 1 fathom longer (Grimble, 1924, p. 116). As to the after end of the yard hanging over the stern, it may do so when lowered, but obviously can not do so when the canoe is under sail. Dampier continues:

Along the belly side of the boat, parallel with it, at about 6 or 7 foot distance, lies another small boat, or canoe, being a log of very light wood, almost as long as the great boat but not so wide, being not above a foot and a half wide at the upper part, and very sharp like a wedge at each end. And there are two bamboos of about 8 or 10 foot long, and as big as one's leg, placed over the great boat's side, one near each end of it, and reaching about 6 or 7 foot from the side of the boat: by the help of which, the little boat is made firm and contiguous to the other. These are generally called by the Dutch, and by the English from them, Outlayers.

The use of them is to keep the great boat upright from oversetting, because the wind here being in a manner constantly east (or if it were at west it would be the same thing), and the range of these islands, where their business lies to and fro, being mostly north and south, they turn the flat side of the boat against the wind, upon which they sail, and the belly side consequently with its little boat is upon the lee: and the vessel having a head at each end, so as to sail with either of them foremost [indifferently] they need not tack, or go about, as all our vessels do, but each end of the boat serves either for head or stern as they please. When they ply to windward and are minded to go about, he that steers bears away a little from the wind, by which means the stern comes to the wind, which is now become the head, only by shifting the end of the yard. This boat is steered with a broad paddle instead of a rudder. I have been the more particular describing these boats, because I do believe they sail the best of any boats in the world. I did here for my own satisfaction try the swiftness of one of them; sailing by our log, we had 12 knots on our reel, and she ran it all out before the half-minute glass was half out; which if it had been no more, is after the rate of 12 miles an hour; but I do believe she would have run 24 miles an hour. [This speed, though great, has been approached by the performance of similarly built and rigged canoes in modern times. Grimble (1924, p. 125) records having covered 18 sea miles in a 12-meter canoe in the Gilbert Islands in 5 minutes over the hour.] . . . It was very pleasant to see the little boat running along so swift by the other's side. The native Indians are no less dexterous in managing than in building these boats. By report, they will go from hence to another of the Ladrone Islands about 30 leagues off and then do their business and return again in less than 12 hours. I was told that one of these boats was sent express to Manila, which is above 400 leagues, and performed the voyage in four days' time [a rate which would require a mean speed of 12.5 miles to be maintained throughout the journey].

In the foregoing account Dampier falls into what, for him, as a seaman and careful observer, is an unaccountable mistake—the statement that the flat side of the hull is turned against the wind and that the outrigger and "belly side" are upon the lee side of the hull. Such an arrangement would be instantly disastrous if the wind were at all strong, for the float would bury itself in the sea and the canoe would capsize. Pigafetta, Anson, and Rogers correctly give the position of the outrigger and curved side as being windward and one can only account for Dampier's mistake by inferring that he wrote the account from memory some considerable time later.

Rogers, who visited Guam in 1710, was so pleased as a seaman with the speed and handiness of the island "proas" that he carried one of them to London, thinking it might be worth fitting up as a curiosity on the canal in St. James Park, "since we have none like it in this part of the world". He describes these vessels as about 30 feet long, not above 2 feet broad, and about 3 feet deep. Regarding their speed, Rogers (1718, pp. 367-368; 1928, pp. 268-269) confirms all that earlier voyagers had stated:

When they view'd our ships, they passed by us like a bird flying. By what I saw I verily believe they may run 20 miles or more in the time [one hour]. . . . The greatest incoveniency in sailing these boats is before the wind, for by the outlayer, which is built but on one side, if the wind presses anything heavy on the contrary side, the boat is overset, which often happens.

The last voyager to describe the Marianas type of "flying proa" was Crozet (1783, pp. 204-211), who visited Guam in the *Mascarin* in 1772 and left a full description of it which, however, coincides so closely with that of Dampier that it is impossible to resist the conclusion that Crozet had Dampier's account before him as he wrote and that he based his own almost entirely upon it. A consideration which may be taken as conclusive evidence of the truth of this inference is that Crozet repeats the extraordinary error found in Dampier's account whereby the outrigger side is repeatedly termed the lee side. He states (1783, p. 204) for example: "Ces bateaux n'ayant jamais le vent que d'un côté, ils ont donné à ce côté une forme platte; et à celui qui étant jamais sous le vent plonge plus dans la

mer, ils ont donné une forme courbe plus propre à diviser le fluide"—precisely the same errors as are made by Dampier. Crozet repeats the mistake in other passages. In the English translation edited by Roth (1891) the errors here referred to are perpetuated without comment.

After Crozet we lose sight of these magnificent sea craft. Native enterprise and art died out as Spanish influence increased. In the end the islands became depopulated and had to be colonized by immigrants from the Philippines and the Carolines. Communication with the Philippines increased but the craft employed were no longer "flying proas", their place being taken by Spanish vessels of European design, roomier and better fitted for cargo carrying.

In interisland communication outriggers continued to be employed, but these were large double outriggers of Philippine design (Haswell, 1917, p. 213) or else single outriggers of Caroline Islands construction, manned by natives of that area, according to Freycinet (1829, vol. 2, pt. 1, p. 458), who visited the Marianas in 1819. D'Urville (1833, vol. 5, p. 262) has the same tale to tell, for he mentions that on his first visit (1828) to the Marianas the natives were no longer able to make these canoes and that craft from the Carolines were used instead. Lütke (1835-36, vol. 2, p. 122) in the same year learned at Guam that the only communication with the islands to the north was through the enterprise of Caroline Islanders, of whom a certain number were always to be found in the Marianas.

Summary Description

The main features distinguishing the sailing craft of the Marianas Islands were, in sum, as follows:

A single outrigger canoe of supreme elegance of form, the "flying proa", was so perfect in design as to excel in swiftness and handiness in working every other vessel of its type known at the time when it was first seen by Europeans.

The hull was long and extremely narrow, ranging from 26 to 40 feet in length as recorded (probably larger ones did exist before the coming of the Spanish), with a beam of 1.5 to 2 feet and a depth of 3 to 5 feet. It might be formed either entirely of a dugout body in one or two lengths joined together by sewing, or built up of planks sewn together upon a shallow dugout base serving as a stout keel. There appears to have been no internal framework of ribs, as no writer makes any mention of this particular. The ends were sharp, pointed, and slightly sheered, and without the upturned form characteristic of the Carolines.

The side of the hull on the lee side, that opposite the one from which the outrigger projected, was nearly straight from end to end and almost vertical, rounding in but slightly on the bilge, the keel line being eccentrically placed and markedly closer to the lee side than to the starboard, which was rounded after the manner of ordinary vessels. The sides met below at an acute angle to form a sharp, wedgelike keel.

Along the windward side between the sail steps at the extremities a plank projected a few inches outboard horizontally, serving as a weather dashboard to keep out spray.

The outrigger frame consisted of either two or three booms according to the length of the hull, two at least being attached to a canoe-shaped float, each by two obliquely placed stanchion connectives of which the upper ends (fig. 300) passed through slots in the outer end of each boom. To strengthen and steady the outrigger frame, a wooden strut extended obliquely from each end of the canoe to the outer end of the center boom in three-boom canoes, with two fore-and-aft stretchers laid upon the booms themselves, one near the outer end, the other midway between its fellow and the hull of the canoe. Although not present in the canoe captured by Anson, which was evidently not adapted for cargo carrying, it is certain that those employed for the transport of goods and passengers between the islands in early Spanish times were provided with a light decking over the outrigger frame as customary in such canoes belonging to other island groups in Micronesia even at the present day. Rogers (1718, p. 367) definitely states that a stage was laid upon the outrigger booms "on a level with the side of the boat, upon which they carry goods or passengers".

A pole mast was stepped within the hull upon the windward side, its heel, according to Anson's figure and description, resting upon the median boom; there must have been a special step block fitted upon or over the boom, as all present-day Micronesian canoes have such a

fitting in this position or upon the weather platform close to the hull. Its omission is probably a minor error on the part of Anson's draughtsman, as is also the fixing of the mast in a perpendicular position instead of raking forward as it ought to do; such errors are doubtless due, as Paris remarks, to the sketches having been drawn from notes and measurements made after the canoe had been taken to pieces. The mast was supported by a short, stout prop or shore in the same manner as in Fijian and Gilbert Islands outriggers of the present day, but straight instead of curved. Its lower end rested upon the middle boom and against the outer longitudinal stretcher; the upper end was lashed to the mast. Further support was given by a shroud on the outrigger side and by two running stays, one fore and the other aft.

The sail was of lateen form and made of fine matting. Like all Oceanic lateens it was provided with a boom as well as a yard. The heel of the yard when hoisted rested in a socket—a sail step—fixed upon a thwart near the head of the hull; as the canoe sailed indifferently either end forward, a sail step had to be provided at each end.

In Anson's account a description of the way the sail was shifted when going on another tack is given and he states that reefing and furling were effected by rolling the sail round the boom. Paris contends, however, that this is incorrect. He points out that though it is easy to furl a rectangular sail around a boom or yard, it is impossible to do so when it has a triangular form. Probably Anson's statement is correct only in regard to reefing, for this certainly can be done in the manner described. Dampier specifically confirms this method of reducing sail, but it is more probable that a spilling line was employed as in the Marshall Islands.

Affinities

In its affinities the Marianas outrigger agrees with the Palau type in having no lee counterpoise platform, such a characteristic feature in the Caroline type. On the other hand it has close relationship with both Palau and Caroline Islands canoes in the triangular bracing of the outrigger platform; but in this it is more akin to the Caroline type, as the braces are stout bamboos and not cords as in that of Palau.

The method of attaching the float by means of inserted stanchions of which the heads pass through slots in the ends of the booms, as figured by Anson, is distinct from any employed in the neighboring archipelagoes; it is of a most unusual type, met with, so far as my experience extends, only in the outrigger canoes of Papuans on the northwest coast of New Guinea (Geelvink Bay). It is a weak and dangerous method and I am of the opinion that its representation in the drawing under discussion is due to an error on the part of Anson's draughtsman; I consider it almost certain that the stanchions were lashed to the sides of the booms and that some accessory pieces—cross stringers and perhaps bracket spars—have been omitted. Anson's canoe was dismantled before measurements were made, which would account also for any errors in rendering the mast and sail. Funnell's figure of a Marianas canoe is given for comparison (fig. 301). It is a childish drawing but corroborates the presence of three booms and suggests the presence of numerous braces to the outrigger frame.

Inshore Canoes

Although sufficient information is available for the reconstruction of the design of the large sea-going Marianas canoe, almost nothing is known concerning the inshore or lagoon types. The "flying proa" was all the chroniclers had eyes for, and the only indication of what these smaller canoes were like is an obscure account given by Careri, who saw them in 1696 and who, as quoted by Freycinet (1829, vol. 2, pt. 1, pp. 458-459), writes:

> The little boats of these islands are . . . made of two tree trunks, curved and hollowed, which are joined and sewn together with rattan. Their length is from 15 to 18 feet; their beam is four palms [*environ trois pieds*, Freycinet]; in order that they may turn very easily, they join to the sides pieces of solid wood which keep them in equilibrium. As to the passengers, the boat being able only to carry the three Indian sailors [who constitute the crew], they place a plank amidships which is prolonged on each side over the water, on which are placed those

who wish to be carried from one place to another. Of the three sailors one of them is always at the center occupied in baling out the water which is shipped or which enters through the joints; the two others are at the two ends to guide the boat. The sail is like that we call lateen, made of matting and as long as the hull.

Careri adds that they always try to avoid sailing dead before the wind as the canoe is then easily capsized, a disadvantage also stressed by Rogers; like the larger ones, these canoes are sailed either end forward. This account, although vaguely worded, would seem to point to the design of the boats seen by Careri as of a Caroline Islands type rather than like that described by Anson. Probably both types existed together, lee platforms, as in Careri's canoe, being fitted in some of those employed for carrying cargo or passengers. Anson's canoe was probably used in fishing or as a dispatch boat; it was, indeed, actually in use by a Spanish officer when captured by Anson and may well have been employed for the second purpose named. As the Caroline Islanders have been visiting the Marianas from time immemorial, it would be surprising if some of the largest Marianas type of cargo and passenger canoe had not possessed a lee platform, seeing how useful and practical the employment of such a device is.

In 1819, Freycinet (1829, p. 460) found that the only indigenous (?) type of canoe remaining at Guam was the *garaide*, a paddling outrigger never used under sail. He gives a figure of this type drawn by Duperrey (1825, pl. 80), together with a description, from which it appears that the *garaide* was a dugout with ends pointed and turned upward like a gondola and with a short deck at each end. It had a single float connected directly to the hull by two recurved arched booms in the manner typical of Philippine outriggers.

D'Urville (1830-33, vol. 5, pp. 262-267), who visited the islands in 1828, mentions that the natives were no longer able to make sailing canoes of the "flying proa" type, their place being taken by fast-sailing canoes belonging to the central Carolines, the majority hailing from Satawal.

Paris (1841, pl. 109) gives figures of two small canoes seen at Guam:

The hull of the larger is an angularly shaped dugout with a washboard nailed along the sides and having a transom stern also boarded across. It is rigged as a single outrigger with two curved booms having direct attachment by lashing with a float, nearly as long as the hull. The booms rest upon the gunwales and besides being lashed thereto are secured by a median lashing to a transverse bar wedged under ledges left when hewing out the interior, a distinctly Indonesian method. The canoe was propelled by ovate-bladed paddles working in grommets hung on thole pins as in India.

The smaller canoe is still simpler, merely a round-bottomed dugout with slightly sheered ends, fitted with a single outrigger of the same type as the larger one, but without its median boom lashings.

Probably none of the simple outriggers seen by Freycinet, D'Urville, and Paris were indigenous Marianas types. Direct attachment is practically unknown in Micronesia but is the characteristic method in the Philippines; its presence in the Marianas is readily accounted for when one reads in Paris (1841, p. 101):

The depopulation of these islands took place with such rapidity that in 1778 it was necessary to repopulate them from the Philippines; at present there are no more than three inhabited, for the Spaniards showed themselves there as cruel as in Mexico. The chiefs, whom they wished to reduce to slavery, preferred death and were almost all massacred, for they were armed only with slings and lances. The Spaniards . . . destroyed in less than 20 years a population active and robust, who . . . were distinguished especially for their seafaring enterprise; the canoes, which the chiefly class alone had the privilege of steering, sailed with a surprising swiftness, exaggerated by the early navigators who called them "flying proas". Their great speed similarly impressed Admiral Anson, whose account of them is the first exact description we have.

Though it is certain that the direct attachment of booms to float described by Freycinet and Paris has been carried by immigrant Filipinos into the Marianas, it is evident that the indigenous element or tradition in the population was still sufficiently strong to enforce a modification of the outrigger type from the double to the single form in the small canoes constructed in the islands; larger vessels, built in the Philippines, were fitted with double outriggers. In some described by Haswell (1917, p. 213) three long, curved, and continuous booms, laid athwart the hull, connected directly with a float on each side. Vessels of this description seen by Haswell at Guam in 1802 were 70 feet long with a beam of 10 feet and depth of 9 feet. They were rigged with large rectangular battened sails of Chinese type slung from two masts; in addition a bowsprit boomed out a foresail made of matting, as were also the other sails.

ERRORS IN ACCOUNTS

A curious fatality has attended the descriptions of the Marianas "flying proa." Almost every writer appears to have fallen into grievous error in one way or another. The mistakes made by Dampier and Crozet have already been mentioned and explained. Anson himself seems to have erred in describing the float as hollow, as Paris (1841, p. 101) has pointed out. Paris (1841, p. 103) also suggests that Anson is probably wrong in his description of the furling of the sail by rolling it round the boom. But Paris blunders in turn when he points out that Anson made another mistake in the way he stepped the mast in his figures. Paris' artist (1841, pl. 109), in copying Anson's figures, shows the mast as stepped in the bottom of the canoe, and Paris, relying presumably upon this reproduction, points out that this is an impossible position in canoes rigged for sailing either end forward. But Anson made no such error. He figures and describes quite correctly the mast as stepped upon the middle outrigger boom, just within the windward side of the canoe; the supposed mistake is actually due to an error invented by the artist who copied the figure for Paris!

The last error is particularly serious and one difficult to excuse. Mager (1902, p. 137) figures three outrigger canoes under sail, with the appended legend, "Anciennes pirogues à balancier des Iles Mariannes"; the source of the sketch is not given. Actually it is a reduced and poor photographic copy of a plate in Freycinet (1825, pl. 50) entitled "Vue de l'ile Tinian: Pirogues des Iles Carolines". Similarly Mager's figure (1902, p. 138) called "Coupe en profile d'une pirogue à balancier" is an unacknowledged copy of Freycinet's illustration (1825, pl. 52) of a "Pirogue des Iles Carolines".

The above by no means exhaust the catalog of errors connected with reference to the canoes of the Marianas Islands; others, appearing in footnotes to recent editions of the voyages above referred to, may be corrected in the light of the comments here given.

PALAU ISLANDS

OUTRIGGER TYPES

The Palau (Pelew) Islands form a compact archipelago strung out 85 miles north and south, about 380 miles eastward of Mindanao in the Philippines. They are the westernmost island group of Micronesia, being southwest from Yap and Ngulu, the nearest islands of the Carolines.

As in other Micronesian areas (except for the sacred model canoes of the Truk Islands), the double canoe is unknown in Palau, its place being taken by a highly

elaborated form of the sailing single outrigger which in many of its essential features is of the same basic type as those found throughout Micronesia. Fortunately, examples of the various classes in use by the inhabitants survived into recent times. Excellent descriptions, fully illustrated with figures, are given by Kubary (1895) and by Krämer (1917-26), and to these the reader is referred for the minute particulars of the complicated details of construction. I shall confine attention to the salient features, giving only those details necessary for comparison; these particulars are derived in the main from the works of Kubary and Krämer, supplemented by examination of hulls and models in museums.

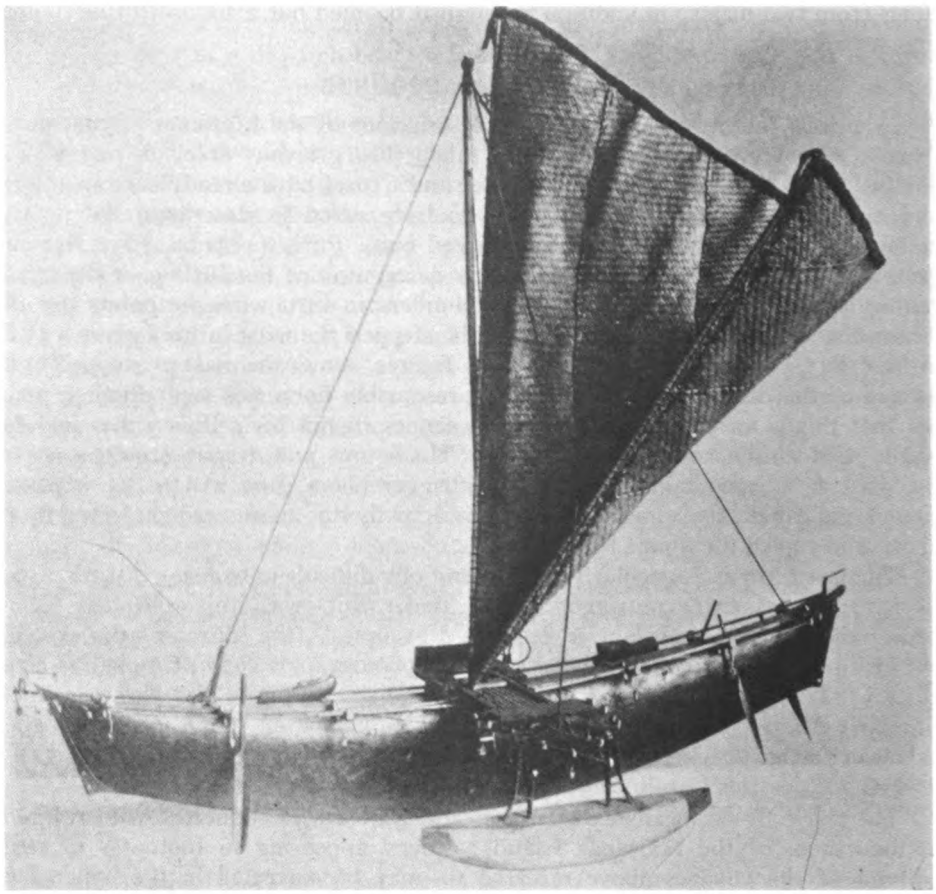


FIGURE 302.—Model of Palau *kaep* (Cologne Museum), heel of yard should not be stepped amidships but at one end of hull; two bailers rest upon side decking or waterway.

The Palau canoes as they existed at the beginning of this century, though essentially of similar type, were of two main varieties: 1, the racing, trading, and fishing canoes, of which the *kaep* was the largest and finest, and the beamier *kotraol* in general use for trading; 2, the elaborate war canoe (*kabekl*), a gigantic paddling canoe. In all of these, however long, the hull was hewn from a single tree trunk, preferably that of the magnificent *ukal'l* (*Serianthes grandiflora*), and must, therefore, be classed as dugouts. The islanders, no longer independent, have ceased to build the *kaep* and the *kabekl*; the *kotraol* and smaller craft alone remain.

RACING CANOE

Excellent models of the sailing and racing canoe (*kaep*) (fig. 302) are possessed by the British Museum, the Pitt-Rivers Museum at Oxford, and most of the great German museums. The British Museum also possesses a full-sized hull of a war canoe 37 feet long; unfortunately it has lost its outrigger, thwarts, and other fittings.

HULL

The hull of the *kaep* is extremely narrow for its length and breadth. Dimensions of a hull of average size are: length about 33 feet, beam 14 inches, depth 25

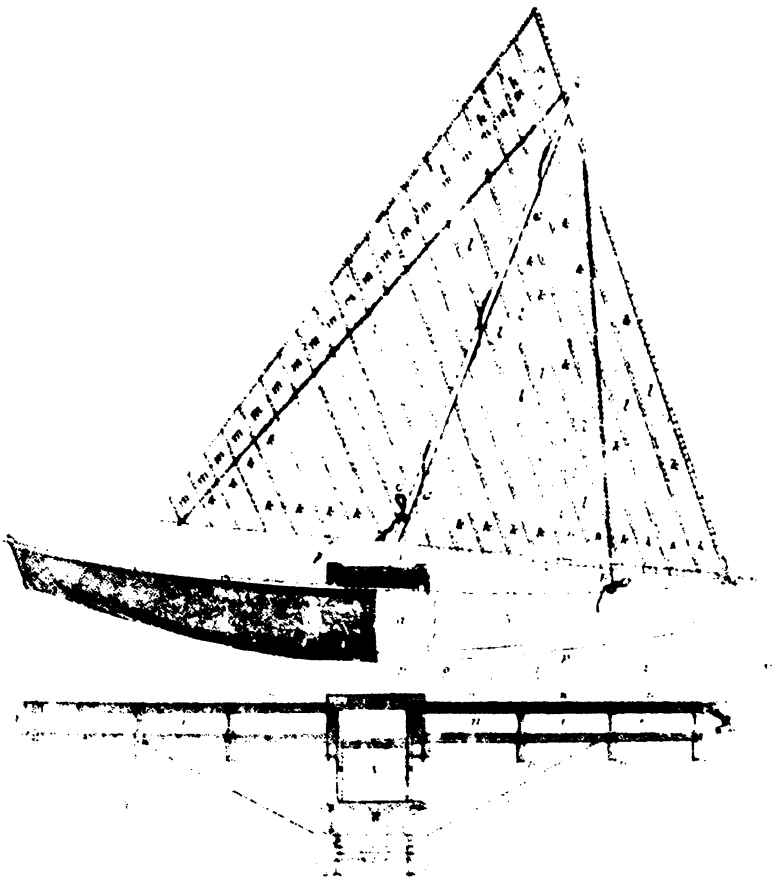


FIGURE 303.—Palau *kaep*, side view with sail up, part of one side removed to show interior, and plan: *A*, central platform or bridge (*blu*); *B*, sail (*ears*); *C*, hull (*a mlai*); *D*, head, same at each end; *E*, mast (*gorakl*); *F*, mast stays (*blades*); *G*, halyard; *H*, sheet; *a*, middle section of hold shut off from long end section (*b*) by vertical bulkhead (*i, i, i*); *c*, cutwater with two projections placed vertically; *d*, bamboo yard (*dengil*); *e*, boom of sail (*galag*); *f*, attachment of boom to yard; *g*, foot of yard stepped on fore deck; *h*, free side of sail bound with blue cloth, in former days binding made from leaf cover of coconut palm; *k, l, m*, strips of lauhala matting sewn together to form sail (after Kubary, 1895; native terms spelled according to Krämer).

inches amidships. In transverse section it is wedge-shaped, the keel wrought to a knife edge. The sides are slim, with flattened bilges, and are nearly vertical in the upper part; they exhibit none of that curious yet practical asymmetry which is a characteristic greatly emphasized in the sailing craft of all other Micronesian areas where the sailing distances are normally greater and the sailing conditions less favorable than in the closely set islands of the Palau Archipelago.

The bottom along the keel line is characterized by extreme convexity; the curvature is so strong as to be subcrescentic. In a canoe of the average length of 33 feet, the forefoot or turn of the keel is actually 24 to 30 inches higher than the mid point in the length of the keel. According to legend, the deep bow shape was copied from the claw of the flying fox.

When the canoe rides afloat, the whole fore part is out of the water and even a long section of keel is visible; the four men who form the crew, by keeping aft, cause the canoe's head to rise until the sheered after end of the gunwale lies almost horizontal with the water. The reduction of the area immersed thus brought about reduces friction and resistance when under sail, and, in combination with the slimness of the hull, enables these canoes to attain a speed which Krämer and Kubary claim to exceed that of the "flying proa" of the Carolines. So contemptuous are the Palau Islanders of the Caroline craft that they term it a "dish" (*debi*). Kubary thinks, however, that the sailing canoes of the Marshall Islands have a greater turn of speed, but this can not now be determined.

The gunwale line shows considerable sheer but nothing approaching the great curvature of the keel. These canoes sail either end forward indifferently; there is no structural difference between the two extremities, which are sharp and brought to an oblique cutwater edge an inch or so thick. The point where the cutwater joins the keel makes a sharp and prominent angle, forming a distinct forefoot with a certain amount of dead wood behind. Two rectangular, cleatlike projections, placed one above the other, break the line of the cutwater, the lower one merging into the forefoot.

In hewing out the hull, a wide horizontal ledge (*rukl*) is left projecting inward horizontally on each side of the opening into the interior of the dugout, forming a narrow waterway the whole length of the canoe on either side; this reduces the width of the hatchway to little more than one third of the beam. Below, the interior is divided into three holds or compartments by two vertical partitions, one placed immediately below each of the end beams of the central bridge platform. Into the short central hold thus formed runs whatever bilge water there may be, but this comes solely from water shipped through the hatchways, for the hull, a single-piece dugout, does not leak. (See figs. 303, 304.)

A thick and roughly triangular end piece forming a short fore deck is fitted at each extremity of the hull; at its pointed distal end it bears a characteristic median terminal in the form of a small rectangular block or cleat (fig. 311, *a*), its outer end projecting slightly beyond the cutwater. On its inner side is a hole which functions as a step for the foot of the yard. In the center of the fore deck is a small hatch provided with a cover (fig. 305).

Thwart Bars

In addition to two outrigger booms, a number of thwart bars (*bagad*) cross the hull at equal distances, varying in number with the class of canoe and being most numerous in the war canoes, in which they function primarily as seats for the paddlers. In the *kaep* and the *kotraol* they number six, three between each end of the hull and the central bridge. Each projects outboard on the outrigger side to a distance equal to rather more than half the width of the hull; on the off side the projection is only a few inches, just sufficient to permit a light pole, which runs the whole length of the canoe, to be lashed upon them, resting in a shallow groove cut in the upper surface of each. On the outrigger side they project free and their distal ends curve up slightly; in fishing canoes these outboard sections of the bars serve as rests for rods, spears, and other gear. Usually a white cowry is suspended from the outer end of each by a short cord. The first *bagad* from each end bears a rudely carved figure of a kingfisher (*tangadik;* Kubary, *tanatik*), a bird said to bring good luck on a voyage, from its association with the sea spirit Koreomel; the perching of a kingfisher on the masthead of his canoe announced the proximity of

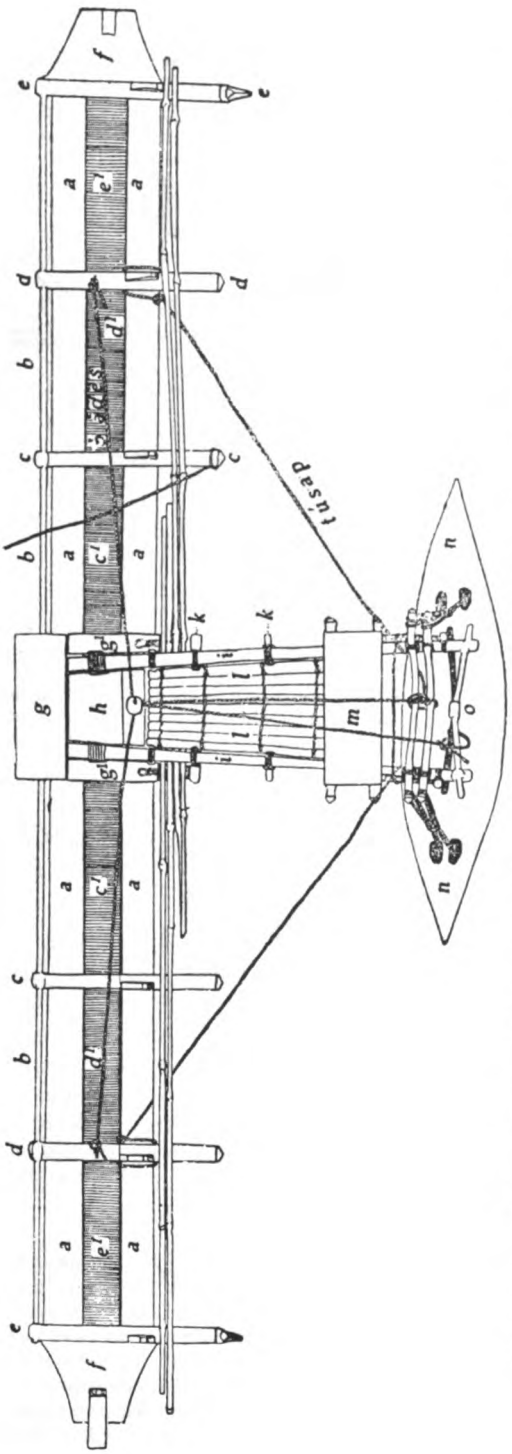


FIGURE 304.—Palau sail and paddle canoe (*kaep*) seen from above: *a*, inturned margins of hull (*rukl*) forming horizontal ledge or waterway on each side; *c*, *d*, *e*, thwart bars (*bagad*) projecting on weather side to provide rests for spears, paddles, and other gear; on lee side they carry the *goreal'l* (*b*), a lee stringer; *c'*, *d'*, *e'*, openings into hold; *f*, short foredeck (*ubid*); *g*, *g*, *h*, parts of the central platform (*blu*); *i*, outrigger booms (*soaies*); *k*, stringer; *l*, grating part of outrigger platform; *m*, broad board seat over booms (*golakasakl*); *n*, float (*desomel*); *o*, crossed bars (*torar*) between connectives (from Krämer, 1926).

land when this spirit came to the Palau Islands (Kubary, 1895, vol. 3, p. 272). (See fig. 311, *a*.)

The method of attachment of these thwart bars is unusual and ingenious (fig. 306):

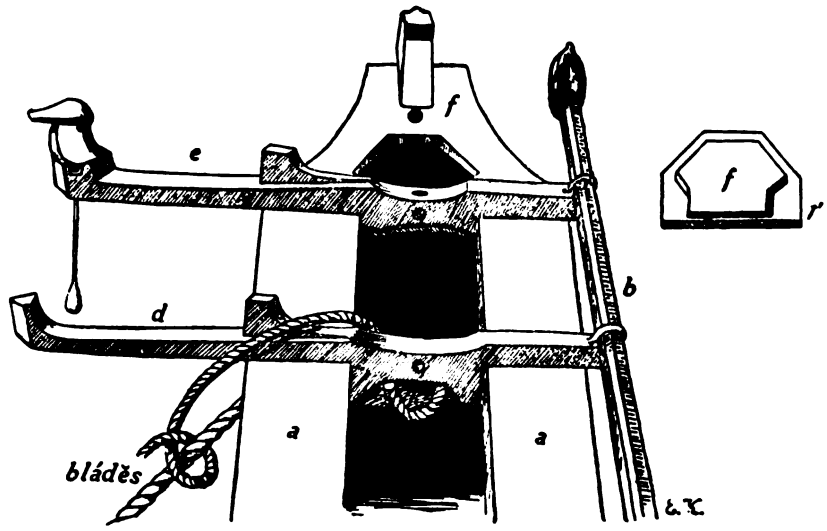


FIGURE 305.—Head of Palau *kaep*: *a*, side decking or waterway; *b*, lee stringer; *e*, endmost thwart bar (*bagad kutiling*) to which tack of sail is made fast; *d*, second *bagad* to which mast stay (*blades*) is secured; *f*, fore deck, its hatch closed with cover shown at side; the sail step shown as a hole (*reg*) on near side of median projection at fore end of deck (from Krämer, 1926).

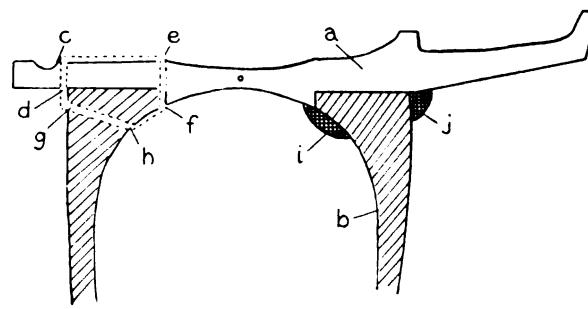


FIGURE 306.—Palau method of fitting thwart bar (*a*) across hull (*b*); *c-d*, *e-f*, *g-h*, holes through which several turns of lashing are passed; *i*, *j*, resin covering of exposed parts of lashing; groove to receive long lee stringer to left of letter *c*; extending to the right is rest for spears on weather side of thwart bar.

Each has a tenon-shaped median projection beneath, which fits transversely into the hatchway bounded by the opposed waterways. On each side, at a point in the thwart bar immediately above the outer side of the hull, a hole is bored vertically through it, and a second at another point directly above the inner edge of the underlying waterway; in the side of the hull a third hole is bored just under the thickened edge. Through these holes a cord is passed several times, the turns between the holes in the thwart bar laid in a shallow recessed groove made to receive them. This lashing, in conjunction with the mortise-and-tenon joint between the waterways or side deckings, serves admirably to secure the thwart bars in an immovable position. The lashing, where it emerges from the lower exits of the perforations, is covered thickly with a red resinous substance used also to cover the lashings which attach the *torar* to the outrigger connectives.

Outrigger System

The two stout outrigger booms are fitted as follows:

Two short squared wooden bars are first placed athwart the hull immediately under the place where the booms are to lie; each is a little longer than the breadth of the hull and is recessed below in such a way that it fits tightly upon the hull, each end sunk slightly below the gunwale on the outside. Extending over this pair of cross bars is a long one on each side, its under surface mortised near the ends to fit over the cross bars. These longitudinal beams are further secured in position by several lashings passed through holes bored transversely through them and through the hull of the canoe just under the gunwales. Finally the two squared outrigger booms are mortised upon and across these longitudinal beams and secured in position by stout lashings to the basal cross bars.

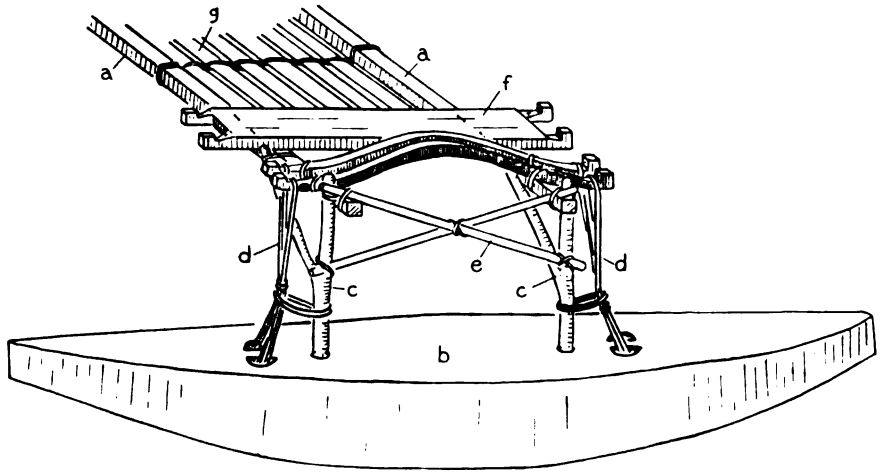


Figure 307.—Outrigger of a Palau *kaep*: *a*, booms (*soaies*); *b*, float (*desomel*); *c*, branched connectives (*ulai*); *d*, cord braces (*totau*) lashed above to notched ends of twin yokes (*kematal*) and below passing through wide holes in float; *e*, vertically crossed bars (*torar*) between *ulai*; *f*, board seat; *g*, grating platform.

The outriggers of the war canoe and of the *kaep*, though of the same general design, differ greatly in detail. That of the *kaep* is the more typical and the more closely related to the forms found in other areas, whereas that of the war canoe has undergone great local specialization.

The outrigger of the *kaep* (fig. 307) and the heavier canoes, the *kotraol* and *borotang*, consists essentially of two straight booms (*soaies*); the outboard end of each is supported by a single long, unequally branched Y stanchion (*ulai*) having the base inserted into the upper surface of an extremely short and stout float (*desomel*). The main branch of each stanchion is vertical, the other oblique, passing upward toward the hull till it rises to a point just above the boom (fig. 308, *a*). Both arms are lashed to the outer side of the boom which they have to support. Various accessory devices serve to strengthen and make rigid the outrigger framework:

Two pole braces (*torar*) cross one another between the vertical limbs of the two branched stanchions; two stout bow-shaped wooden yokes (*kematal*) lie parallel and close together upon the outer ends of the booms which they tie together, the ends upturned and bluntly hooked to afford purchase for the attachment of the upper ends of two stout rope braces (*totau*), one on each side of the pair of yokes, which provide further though indirect connection and stiffening between the booms and the float by stretching downward to the float where the cords of each of these braces are passed from side to side through a curved hole bored transversely through the upper part of the float. Each of the brace lashings bifurcates in its upper part, one section pass-

ing over the upturned end of the outer *kematal*, the other over that of the inner one. In addition, a rope stay (*tusap*) runs respectively from the second thwart bar (*bagad gometiel'l dei*) from either end of the hull to the farther end of the boom on the same side, being made fast thereto just inside the curved yokes. The inner end of each *tusap* is passed through a hole bored in the side of the hull abaft the second *bagad*.

Platforms

Over the midships frame, to which the booms are lashed, a boarded platform or bridge (*blu*) is laid, with a vertical protection plank or dashboard on the off side. On the outrigger side of the bridge, just outside the gunwale beneath, the mast step is fitted.

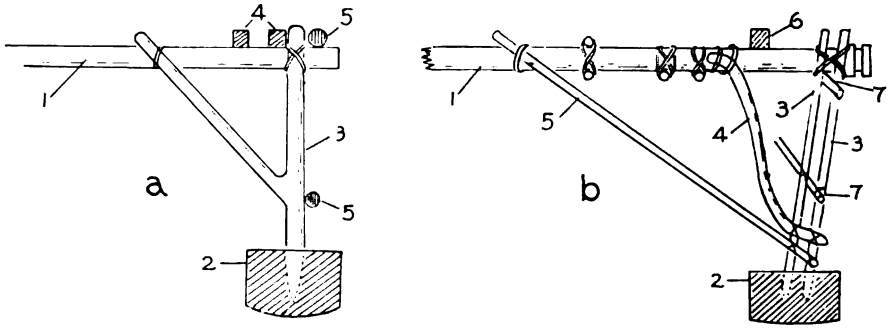


Figure 308.—Comparison of outrigger attachments of Palau *kaep* and *kabekl*. *a*, *kaep*: 1, boom; 2, float; 3, single branched connective; 4, two yokes; 5, ends of saltire braces (*torar*). *b*, *kabekl;* 1, boom; 2, float; 3, pair of straight stanchion connectives; 4, S-shaped side brace; 5, diagonal straight brace; 6, single yoke; 7, two horizontal stick braces taking place of crossed *torar* of the *kaep*. (After Kubary and Krämer).

Another platform, consisting of a broad board, is lashed athwart the outer ends of the booms just inside the paired yokes. This, according to Krämer, is the seat of the man tending the sheet, which may be belayed to any one of the four stout projections forming the corners. Between this and the bridge, the space between the booms is floored with bamboo slats to form a light grating on which gear may be stowed when necessary.

Ornamentation

Apart from the *tangadik* figures and the egg cowries hung by short cords from the thwart bars and various parts of the outrigger, the good taste of the islanders was shown by the all but total lack of extraneous ornament upon the beautifully modeled hull. The only exceptions were the carving of a peculiar and characteristic low-relief rib running up each side of the bows to bend at right angles near the gunwale and then run aft for a few inches (fig. 311, *a, b*), and in some canoes the inlay in pearl shell of three small crosses or three circular discs on the lower and larger of the two rectangular projections from the cutwater.

Sail Rig

The sail of the *kaep* as figured by Kubary was a typical Oceanic lateen, triangular and set apex downward, similar in all essentials to the sail used in the rest of Micronesia and the same as that of the present-day *kotraol*. It was slung by a halyard (*neret*) from a mast stepped amidships on the outrigger side of the bridge, in a chock just over the windward gunwale.

A sail step in the form of a hole in the fore part of the short decking board at each end of the hull was provided for the heel of the yard, thereby enabling the canoe to sail either end forward. Mast and spars were made of stout bamboos, with the masthead or truck and the

foot of both the yard and the boom shaped from solid blocks of wood and each provided with a cylindrical shank fitting into the hollow end of the bamboo spar to which each belonged respectively. (See fig. 309, *c*, *d*).

Besides a fore and an after stay (blades) running from the lower part of the masthead to the second *bagad* at each end of the hull, a single shroud (*daydosomel*) led from the top of the masthead to the middle of the yoke, where it was made fast between the outer ends of the booms. It is noteworthy that the form and arrangement of the rigging here described are identical with those of Yap.

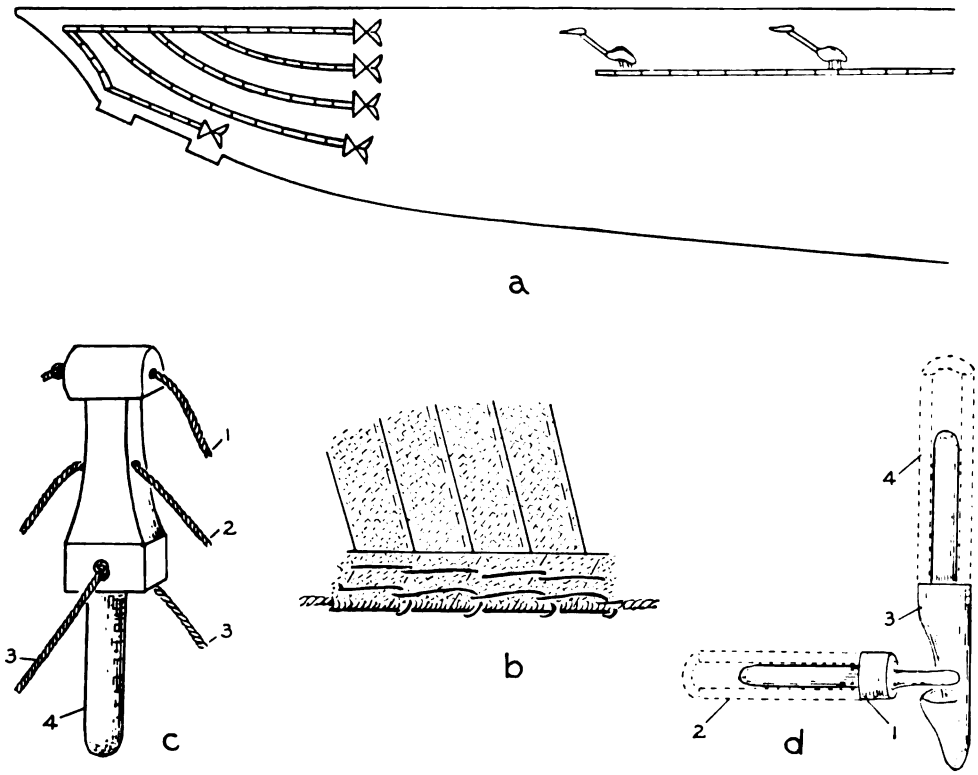


FIGURE 309.—Palau *kabekl* and *kaep*. *a*, side view of head of *kabekl* hull (British Museum) ornamented with pearl-shell inlay in five narrow bands on bow, with a lateral line on which a row of long-necked birds are spaced at regular intervals. *b*, part of the margin of a *kaep* sail showing edge turned in over a bolt rope. *c*, masthead joint of wood with peg (4) to fit into terminal hollow internode of bamboo mast: 1, single shroud; 2, halyard; 3, running stays used both to swing mast from one end to other when tacking and to serve as fore and back stays when in required position. *d*, wooden joint (1) fits into hollow end of bamboo boom (2); its forked jaws work on rounded side of similar joint (3) inserted in lower end of bamboo yard (4) to form solid heel to fit into sail step at either end of hull.

The sheet, attached to the boom three quarters out, was tended by one of the crew whose place was on the broad board (*golakasakl*) lashed athwart the outrigger frame on the inner side of the yoke.

The sail was made of lauhala matting arranged in strips parallel with the yard and sewn together with long running stitches. On the two long sides the margin was turned in over a strengthening bolt rope and hemmed down with long running sitches; it was also further reinforced by a series of loop stitches, each of which made a turn around the thickened margin (fig. 309, *b*). The sail was now ready to be attached to the yard and the boom. This was done by a form of lacing in which the cord, after encircling the spar, was passed through one of the marginal stitching loops which tightened the bolt rope within the border of the sail. The free edge of the sail, the after leech, instead of being strengthened by a bolt rope, was protected by

a wide cloth binding (*mantan*); the blue cotton so favored by the Chinese was generally employed for this purpose. Formerly, according to Kubary, the leaf sheath of the coconut palm was used.

Kaep Races

Krämer considers the *kaep* the supreme product of the canoe-builder's art in Oceania. Fine as are the sailing canoes of the Caroline Islands, none attain the slim elegance and beauty of line of this canoe, built as it was for speed. The *kaep* was the Oceanic equivalent of the large racing cutter of Europe and America: it had no cargo capacity and was used mainly by the chiefs (*rubak*) for display and in particular for long-distance races, exceedingly popular with these islanders before the intrusion of European power undermined their native culture. In former times a great *kaep* race was held nominally every year. The start was from *a* Irai, the sacred place of the god (*galid*) Medegeipelau, "the inventor of sailing" according to myth. The course led first westward, then up the west coast of the archipelago to Nggeiangel, and from there down the east coast back to *a* Irai. On the way the competitors halted three days in each of eight places. On the return to *a* Irai they went to Ngaragebukl in order to take the stone idol of Temdokl, which was then conveyed by way of Goreor to Peliliou. One of these races took place shortly before the arrival of the Spaniards (about 1875) and this is said to have been the last. Each vessel had its distinctive name; among the *kaep* names in the last race were Tukekli, Ngatpang, and Govakul (Krämer, 1917-26, vol. 3, p. 193).

War Canoe

Hull

The Palau war canoes (*kabekl*) as described by Kubary and Krämer were giant paddling canoes, the hulls hewn from exceptionally large tree trunks; their length ranged from 48 to 58 feet, with a depth up to nearly 4 feet.

The war canoes had much less curvature than the *kaep* along the keel line, which was, indeed, nearly straight for a considerable distance in the middle region in order to render the canoe easier to propel by means of paddles; a sail was never used. The cutwater differed also, having a pronounced concave curvature in profile; it ended below in a sharp, angular forefoot. Another difference was in the position of the two tandem cleats; instead of projecting from the line of the cutwater as in the *kaep*, they broke the keel line, the forward one actually forming the apex of the fore foot.

In transverse section the hull was well-rounded, the depth only a trifle greater than the beam at the widest part, the bilges (fig. 310, nos. 8, 9). Above the bilge the sides rounded inward till the space between the gunwales was quite narrow. Because of this, no inwardly projecting ledge was required as in the *kaep* and *kotraol*, in which the sides at gunwale height are farther apart relatively (fig. 306).

The ends were distinguished from those of the *kaep* by a long headbar (*gongaiu*) placed transversely across the bows; it extended outboard a considerable distance on the outrigger side and to a short extent on the off side. It was painted white, richly decorated with shells and inlay, and was a conspicuous feature.

In order to accommodate a large number of paddlers, the number of thwart bars (*bagad*) was greatly increased and in the largest *kabekl* known comprised 20, 10 between the head and the bridge on each side (Krämer, 1917-26, vol. 3, p. 194), each seating one man. To enable most of the paddlers to work double-banked, an outboard paddling platform (*kamtai;* Kubary, *onomtul*) was formed on the outrigger side by lashing two to four bamboo poles longitudinally to the under sides of the thwart bars. At each end of the canoe their ends were finished off by thrusting them through holes in the headbar. The largest canoes, according to Kubary, were capable of carrying as many as 32 paddlers besides the steersman.

Outrigger System

The outrigger was larger and more complex than in the *kaep*. (See fig. 310.) The number of booms might either be two (Kubary) or it might be increased to three (Krämer); each was attached to the float by a pair of straight stanchions (*ulai*) which might, however, be slightly crutched above to carry the boom (Kubary, 1895, pl. 51).

The bases of each pair of *ulai* were inserted into the upper part of the float, their upper ends lashed to the extremity of the boom to which they belonged. In two-boom canoes, each pair of *ulai* was further secured to its boom a short distance from the end by means of two doubly curved, obliquely running bracket braces (*a rtkokl*) the upper of which passed downward to attachment to the outer side of the lower ends of the two *ulai;* the other went to the inner side. In three-boom canoes as figured by Krämer, each pair of *ulai* had the support of only one recurved bracket brace, the other being replaced by a straight one (fig. 308, *b*). These accessory fittings appear to represent the inner or oblique limb of such an attachment as seen in the *kaep* and the *kotraol*, the substitution being made to obtain greater strength in view of the increased length of the booms and stanchions.

The two *torar* in the two-boom *kabekl* figured by Kubary cross one another as in the *kaep*, but in that with three figured by Krämer they are parallel (fig. 308, *b*, 7), and instead of being lashed to the outer sides of the vertical portion of the branched connective are both imprisoned

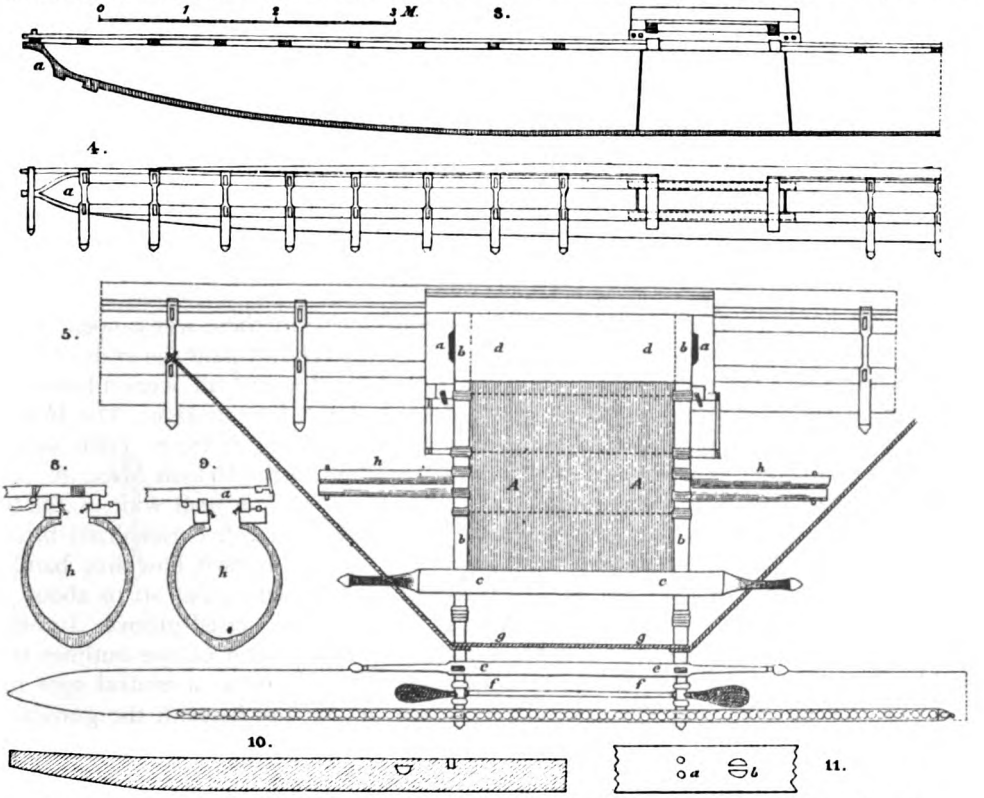


Figure 310.—Construction of Palau war canoe (*kabekl*). 3, 4, longitudinal section showing interior divided into three holds by two vertical bulkheads: *a*, curved cutwater with two tandem projections. 4, plan of same region. 5, plan of outrigger frame and of central platform or bridge (*a, d*): *A*, grating platform; *b*, booms; *c*, corresponds to board seat (*golokasakl*) of *kaep*; *e*, smaller duplicate of *c*; *f*, yoke; *g*, outrigger rope brace (*tusap*); *h*, narrow longitudinal platform attached below booms. 8, 9, sections through hull and central platform. 10, longitudinal section of one half of float. 11, view from above of part of float showing paired holes wherein *ulai* are fitted and the two wide openings of perforation through which cord brace is passed. (From Kubary, 1895.)

between the units of all three pairs of *ulai*, one immediately below the boom lashings and the other about halfway between the boom and the float.

Only one yoke (*kematal*) was lashed upon the booms a little inward of the attachment of the *ulai;* each end was connected to the float by a multiple cord brace in the same manner as in sailing canoes, in which, however, the yoke being double, the brace was bifurcated in its upper section. A strong *tusap* rope ran from near the outer end of each boom to be made fast to the second *bagad* from the bridge on the same side, an arrangement differing from that of the *kaep* owing to the greater length of the *kabekl*.

The float was considerably longer than in the *kaep* and comparatively slender, each end brought to a short, sharp vertical edge.

A wooden decking or bridge (*blu*) amidships (fig. 310, *d*) was continued outboard on the outrigger frame as a cane-floored platform, further supported upon several stringers lashed fore and aft beneath the booms. Across the outer end was the *golakasakl* board (fig. 310, *c*), longer and much narrower than in the *kaep*. About 18 inches farther out a more slender cross piece of the same type (*debardak*) was lashed, and it was between these two that spears were kept in readiness for an encounter with the enemy. The general custom was for a few spearsmen to stand at the middle of the canoe, while the greater number of those aboard were occupied with its handling and maneuvering under the direction of a *rubak* seated on the cane platform. The head man of the canoe, who was the principal warrior, was stationed on the bridge. Under the center of the cane-floored platform two stout bamboos were lashed fore and aft, forming a narrow gangway projecting some feet beyond the booms on either side; each projecting end was occupied by a warrior of noted courage, and it was the duty of these men not only to ply their spears but also to cut off the heads of those of the enemy who fell and to hang them on the ends of the *kematal* yoke. Another important fighting post was the head of the canoe where a spearman was usually posted.

Ornamentation

Infinite patience was lavished upon the ornamentation of these war canoes. The exterior of the hulls was wrought to the finest possible finish, and the ends of the booms, the yoke, the *golakasakl*, the *debardak*, and the thwart bars, were all carved into an ornamental form which usually represented the human face. The hulls, which were painted red both within and without (Wilson, 1788, p. 316), were further ornamented by means of shell inlay. In a hull in the British Museum, 37 feet in length, a band of inlaid shell, rather less than half an inch wide, extends from end to end below the gunwale, with the figure of a conventionalized bird, neck outstretched, disposed on it at regular intervals. On each bow five bands are inlaid, as seen in figure 309, *a*. The inlay consists of rectangular strips about 3 inches long by half an inch wide, countersunk in a shallow incised groove. In one figured by Kubary (1895, pl. 51), the pattern takes the form of the outlines of checkerboard squares, with the stony operculum of a *Turbo* as a central spot in each; a line of inlay also runs the whole length of the hull beneath the gunwale giving off short vertical branches at intervals (fig. 311, *c*). The beauty of the canoe in the native view was sometimes further enhanced by fantastic patterns in yellow paint.

Wilson (1788, p. 119), who was wrecked in the Palau Islands in 1783, reports that the king of the island where his ship went ashore made "a design of his own for ornamenting some canoes then building and this design was marked on a board with great accuracy, in different colors, to work from". Wilson (1788, p. 316) also writes that when the natives went out in state or on a warlike expedition the heads and sterns of their canoes were adorned with a variety of shells strung on cords and hung in festoons (Kubary, *argiyl*); shells of the snowy egg cowry

(*Ovum ovum*) were also suspended from various parts of the outrigger and from every end of the many thwart bars. Swaying to the rhythmic strokes of the paddlers or swinging to the wind and the motion of the sea, these snowy pendants against the tawny hull gave a bright touch to the picture. According to Kubary a special war symbol consisted of 90 to 100 of these shells arranged in a row along the upper side of a long and narrow plank (*bedekl*) fitted longitudinally athwart the ends of the booms. Each shell was half sunk in the plank which lay parallel with the float but was not quite so long (fig. 310, no. 5). Each extremity was carved to resemble the *kabekl* itself. Whenever the canoe was launched preparatory to a raid against another island, this plank was fitted in place; by its presence

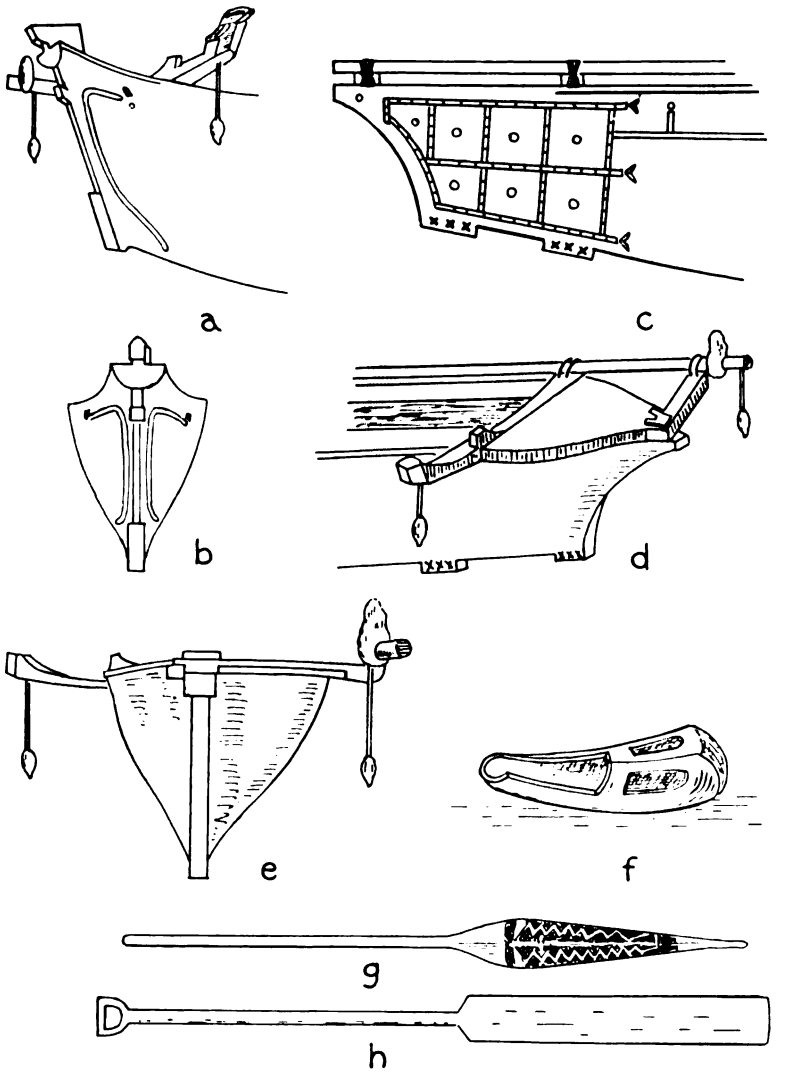


FIGURE 311.—Hull ends of principal canoe types, Palau Islands: *a*, *b*, side and end views of head of a *kaep*; a low relief ribbing up side of cutwater with short, horizontal arm at top is only ornament on hull; first *bagad* bar shown, its end carved to represent conventionalized kingfisher, egg cowry hangs below; *c*, head of a *kabekl* inlaid with pearl shell in checkers on bow and with three small crosses on each of keel projections; *d*, *e*, side and end views of head of a *kotraol*; *f*, bailer; *g*, ordinary paddle; *h*, steering oar. (After Krämer, *c* after Kubary.)

hostility was proclaimed—a form of etiquette paralleled in the Truk Islands. By the first decade of this century, consequent upon the suppression of the warlike propensities of the islanders by European overlords, this symbolic ornament had fallen into disuse; Krämer saw no example.

COASTING, FISHING AND SMALLER CRAFT

For light transport and for fishing the *kotraol* is employed. It is generally propelled by paddles, but a mast and sail are rigged when the wind is favorable; they are of the same pattern and fitting as in the *kaep*. Similarly the hull and outrigger are of the *kaep* type apart from a few details but are broader and more massive. Krämer (1926, vol. 3, p. 196) states that the lee or off side of the hull is larger —broader and more bellied—than the weather or outrigger side (fig. 311, *e*), a peculiarity which is the reverse of what otherwise is the universal custom in Micronesian sailing craft. According to Krämer the whole space forward of the first *bagad* is covered with a strong decking on which a low notched prominence carved at the fore end serves as a step for the heel of the yard. At each end of hull a small transversely fitted headboard (*gongaiu*) connects the end of the lee stringer (*goreal'l*) with the head; from this feature the decorated headbar of the *kabekl* was probably evolved. The only inlaid ornament consists of three small shell crosses on each of the two cleats projecting from the fore end of the keel (fig. 311, *d*).

For cargo work the still heavier *borotang*, of the same type, was employed; the hull was wider and deeper as befitted its employment.

The *dogu*, used in traffic between Peliliou and *a* Ngeaur and for fishing off *a* Ngeaur, is a strongly built canoe, compact and heavy, built for rough work. Its outrigger is of the same general type as that of the *katraol*.

Following Kubary (1889-95, vol. 3, p. 269), there also existed in former times a canoe called *kaberruuk* or *kaberuog*, similar to the fork-headed boats of the Caroline Islands. This is additional evidence of influence from the Caroline Islands at a now forgotten period.

VOTIVE CANOES

In the opinion of the Palau Islanders, the gods are propitiated most surely by votive offerings of sailing canoes, for the myth runs that the gods who came to the islands voyaging in that type of vessel are extremely fond of canoe racing. According to Krämer, when an important chief (*rubak*) is ill or a village threatened with disease, a large model canoe is built at the behest of the priests as an offering to the gods. When completed, the canoe, a faithful model of either a *kaep* or a *kotraol*, is placed on the floor of the village *bai* or clubhouse; large supplies of food are prepared and a song festival takes place, lasting a whole night. On the following morning the food is divided among the participants, and then the assemblage disperses.

TOY CANOES

In Palau as in nearly all other islands in Oceania, the building and sailing of model canoes is or was in great favor. These, called *blutek* (Krämer, 1926, vol. 3, p. 197), like others which I have seen at Singapore, the Maldive Islands, and Kathiawar in India in similar use, are notable for having only one outrigger boom (fig. 312). A single boom also characterizes the play canoes of the Caroline and Gilbert Islands, so this peculiarity has a wide distribution.

As a result of this Oceanic hobby, racing toys are often received in museums and considered to be models of actual workaday canoes, thereby giving rise to misconceptions regarding the construction and design of the real craft.

VESTIGES OF DOUBLE CANOES

Although there is no record of the former existence of double canoes in the islands, even in legendary form, Krämer believes that certain spirit altars (*ngot ri dmuiel*), on which offerings are laid to propitiate the family gods in connection with illness, furnish evidence that such craft did exist at some distant period. These sacred *ngot* are oblong, rectangular boards, hollowed in the center and commonly provided with two corner projections at each narrow end. They are hung by four cords and in shape resemble the ordinary pounding board (*ngot*) used for the pounding of taro.

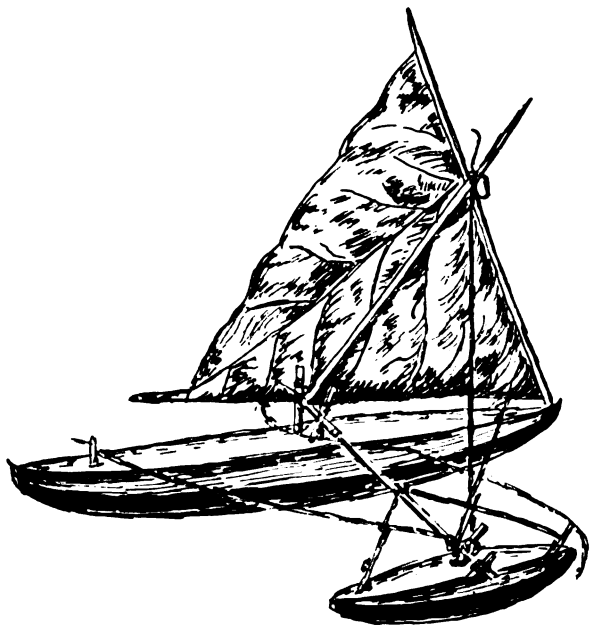


FIGURE 312.—Model canoe used for races, Palau Islands (after Krämer).

From their four-pointed form, their hollowed center, and the propitiatory use to which they are put, Krämer considers them to be the equivalents of the suspended spirit altars in the form of double canoes used in the Truk Islands (central Carolines), which are undoubted evidence of the former existence of double canoes in that locality. Krämer infers that the sacred *ngot* of Palau has a similar significance. This is confirmed by a myth in which the cannibal woman Diragamatal followed certain other women "on her *ngot*"—the meaning evidently being that she used her *ngot* as a canoe.

RAFTS

In addition to canoes, the islanders make much use of bamboo rafts, particularly for fishing in shallow water within the reef. Two kinds are employed, a small one (*prer*) and a larger one (*gologutul*; Kubary, *holhutol*).

The *prer* is usually about 3 feet wide and 20 to 26 feet long. It consists of nine or ten thick bamboos placed side by side and held in position partly by thin stakes driven transversely through them and partly by lashings made of the flexible stems of forest creepers. Such a raft is most useful for the single fisherman visiting the reefs at low tide in search of crabs and shellfish or in spearing fish, and is a great favorite with the poorer people. The more carefully made ones have erected over the center part an elevated platform on which the fisherman has a dry place for himself and his gear when line fishing; this is called the *klsokes*, the same name

as is applied to the cane-floored platform of canoe outriggers. This elevated stage has its counterpart on the Brizilian sea-going raft, the *jangada*.

The larger type of raft (*gologutul*) is broader and is made of the stoutest bamboos procurable. It seldom or never has a raised platform, for it is specifically designed for the transport of basket traps of exceptionally great size used for the capture of fish. Rafts are propelled by punting poles except when traveling in deep water, when, as noted by Krämer, a double-ended paddle is used.

PADDLES AND BAILERS

Ordinary paddles are termed *besos*; this is also a name given to spears which have long and narrow heads; the double use of the one term, though it connotes the shape of the paddle blades, suggests also the probability of a common origin—at a time when the paddle was used as an offensive weapon in addition to its own proper employment.

The loom is short, cylindrical, and without hand grip; the blade is elongate and lanceolate, tapering to an acuminate point, thereby approximating in form to those of the western and central Carolines. The length over all is about 4.5 feet. One side of the blade is flat, the other axially ridged; a characteristic peculiarity is that the extreme tip on the ridged side is thickened into a knoblike swelling which Krämer (1926, p. 182) compares in shape to an olive (fig. 311, *g*). According to him, the paddle gives out a singing sound as it swishes through water; the knob in consequence is called "the singing knob" (German, *Singknopf*). Enlargement of the tip is found also in the central Carolines and in a modified form in Hawaii as well as elsewhere. The larger steering paddle has a parallel-sided blade, sharply shouldered (fig. 311, *h*).

Like the canoe hulls, the Palau paddles are painted red. Since the introduction of oil paints they are generally ornamented with patterns drawn in white upon the red ground (fig. 311, *g*); the designs frequently take the form of a conventional representation of waves (Krämer).

Double paddles with a blade at each end like those used by certain Eskimos are employed to propel rafts in deep water, according to Krämer (1926, p. 182). In former times they seem also to have been used in canoes, for Delano (1817, p. 190) says, "In some of the eastern islands of the Pelews [Palau] there is a blade at each end, the hands are in the center, and the paddle is used alternately upon the sides of the canoe".

Ornamental double paddles of more elaborate form, painted with various designs and decorated with feathers, are also used in ceremonial dancing. These two double paddles in Palau suggest that this type may be a survival from a period when it was the one in general use. It is noteworthy that double dance paddles were also used in Easter Island, the Australs, and elsewhere in Polynesia.

The form of bailer in use (fig. 311, *f*) is unusual. It is a variety of the Oceanic type, having the grip above the scoop; but this grip, unlike the usual form, is not free. In this it agrees with the bailer used in Yap and the Society Islands and also with the peculiar bailer used in Aitutaki of the Cook Islands; from these the Palau form differs in being greatly compressed laterally, a characteristic due without doubt to the narrowness of the hatch openings in Palau canoes, particularly in the *kaep*, in which a bailer of the ordinary broad type would not be usable. It is probable that this narrow form originated from the use of the spathe of the coconut palm, often employed in Ceylon for bailing.

CANOE AFFINITIES

The canoes of the Palau Islands, though showing close kinship with those of the Caroline Islands in many fundamental features, have numerous minor and major peculiarities of local origin. Among the minor variations are the low, in-

conspicuous extremities of the hull, the angular forefoot, the narrowing of the waist by marginal waterways, the presence of numerous peculiarly shaped thwart bars, and the extreme shortness and stoutness of the float in the sailing canoes. The major peculiarities differentiating them from the canoes of the western and central Carolines are the absence of a lee platform and of any asymmetry between the two sides of the hull, except in the *kotraol,* in which, however, according to Krämer, the slight asymmetry present is reversed. These major differences are, to some extent, signs of the inferiority of the Palau islanders in deep-sea voyaging and the art of navigation as compared with the people of the Carolines; they are good canoemen but poor navigators, timid and seldom venturing outside the chain of reefs which encircles the islands. Wilson states that even within the reef they are reluctant to put out in their canoes whenever the sea is at all high.

It has been suggested that certain of the peculiarities distinguishing the Palau sailing canoes from those of the Carolines furnish evidence that the people originally came from the southern Philippines or the Sangir Islands lying south thereof. Müller-Wismar (1912, p. 245) has pointed out that the *bagad* thwart bars that project outboard on both sides of the hull may be the vestigial homologues of the conspicuous crescentic boom braces or tension bars seen at the present day in the canoes of these localities, the *goreal'l* rod connecting their ends on the lee side representing a stringer which connects them longitudinally. If this be so, it would follow that the Palau canoe must have been of the double outrigger type originally and definitely of Indonesian design. Such a conclusion is hypothetical and of doubtful validity. Against it must be placed the positive evidence of intimate cultural contact at an early period with the Carolines afforded by the combined weight of tradition, of fundamental resemblances in structural design, and of the persistence in Palau of terms ultimately referable to Caroline star names, which suggests a former knowledge of stellar navigation in the Palau Islands. This subject can not be dealt with adequately here; it must suffice if I point to the identity of the Palau branched connectives (*ulai*) with those of the Carolines, the homology of the *tusap* brace with the diagonal bracing spar of the western and central Carolines and with the *tokowar* of Ponape canoes. The sail and the rigging in Palau are also identical with those of the Caroline Islands, differing radically from any rig found in Indonesia.

Still more conclusive is the fact recorded by Kubary (1889-95, vol. 3, p. 268) of the former existence in Palau of a counterpart, called *kaberuog,* of the Yap *popo,* a sailing vessel with an up-turned forked head at each end and possessing a lee platform. Here, too, tradition affords assistance, for to the god Medegeipelau is attributed the invention or introduction into Palau of the sail as a propellant, or more probably of the Oceanic lateen type of sail. It is most significant that tradition avers that this god arrived from the east. These facts and traditions are conclusive of the Caroline origin of the Palau rig and *tusap* brace and of the great influence exerted in former times by Caroline Islands culture.

As to stellar navigation, now no longer practised in Palau, where indeed knowledge of astronomy and piloting has disappeared, it is significant, as pointed out by Kubary, that the Caroline Islands name Tumur for the constellation Antares is represented in Palau by Tumur, the name given to the first month of each of the two six-monthly year periods; that the Palau month Kalith or Maknit-an-klel has still a third name, Lak, which seems to represent the Caroline Islands La (α Andromedae and β, η, μ Pegasi); that the Palau word Mesikt seems to be derived from the Caroline Islands Meriker, the name of the Pleiades (compare Matariki, Polynesian).

SUMMARY—MICRONESIA

In all the Micronesian groups of islands the design of the outrigger canoe reached a higher level of development than in any part of Polynesia, as did also the knowledge of the science of navigation possessed by certain of the islanders. It is difficult to conceive of any possible great improvement upon the sailing canoe design of the Micronesians, for it combines three inventions of the utmost utility in sailing: 1, the flattened lee side of the hull, acting as a lee board to reduce drift to leeward and compensating to some extent for the pull to starboard of the outrigger float on the weather side; 2, the use of a lee platform on the cantilever system, enabling a greater quantity of cargo to be carried; 3, the midships pivoting of the mast, whereby the canoe was able to sail either end forward and so to keep the outrigger on the weather side, whichever course she was on.

The Polynesians did not invent or adopt any of these devices, although, as in the balance boom of the Society Islands and Samoan canoes, a few slight advances on the primitive crudity of the basal design were achieved.

The Micronesian sail, rigging, and steering apparatus were all similarly superior to those typical of Polynesia until the time when the Samoans and Tongans adopted the Fijian rig, which itself is derived directly from that of Micronesia.

The Polynesians undoubtedly possessed considerable knowledge of navigation, directing and controlling their desired course by the use of definite "starting points" having leading marks giving the direction in which to sail, by observation of the position of the sun and numerous conspicuous stars and constellations, and by noting the run of the waves and the swell and the direction of the prevailing wind. But such knowledge appears to have been limited usually to a small group of initiates belonging to the ruling caste, as, for example, the high priest Tupaea of Tahiti, who gave Cook material help and who might have given more had sufficient confidence been reposed in him.

In Micronesia the people are more democratic, and the knowledge of the principles of navigation was far more general and exact. Arago (1823, vol. 2, pp. 16,-11, 13), who accompanied Freycinet on his voyage around the world early in the nineteenth century, tells how Don Luis de Torres, the Major of Agagna, assured his guests

> . . . that in all the villages of this archipelago [Caroline Islands] there are schools of navigation, under the direction of the most skilful pilots; and that no Carolinian is allowed to marry until he has given proofs of his dexterity in steering a proa. For this examination a time is chosen when the sea is rather high, the candidate is placed at the sheet (for the Carolinians steer their vessels entirely by the sails), and there, surrounded by reefs, and in the midst of foaming waves, he must make his proa sail a certain distance without allowing his balancer to touch the waves. I could not have believed that they possessed so much skill, if I had not sailed in their vessels. . . . Every year the proas of the Carolinians made a voyage to the Mariannes. . . . One of the most celebrated pilots of the Caroline Islands . . . by means of grains of Indian corn contrived to represent all the islands of his archipelago, and to mark their relative positions with wonderful ingenuity. He named every one of them, designated such as were easy of access, and those which were surrounded by reefs of rocks, and told us what were the productions of each. . . . When we inquired of our pilot by what means they guided their vessels during their voyages, he cut some pieces of bamboo and made a compass of them, indicated the winds which blew most generally in his country, pointed out the places of the stars and constellations, and gave them names; adding, that when these guides failed them, they regulated themselves by the currents, the course of which was known to them by many years' experience. . . . According to them, the Great Bear has only five stars. By means of some grains of maize, he made us understand that they turned round an immovable point.

The Marshall Islanders, who were accustomed to make raiding expeditions against the adjacent island groups—to Kusaie on the west and to the Ellice Islands

on the south—had equally great knowledge of deep-sea navigation. They even constructed elaborate and permanent charts of open canework upon which various devices gave the owner sailing directions which enabled him to set a course from island to island. The prevailing winds, swells, and currents to be met with on these voyages were also indicated. Fine examples of these curious charts are possessed by several museums, the best being in the British Museum and the Science Museum, London, and in some of the greater German and American museums.

The Gilbert Islanders did not construct such charts, but, as Grimble (1924, p. 133) has recorded, boys selected to become the future pilots of the islands were put though a rigorous course of stellar instruction. The pupil was made to sit facing east at the base of the central pillar of a large house; the roof represented the canopy of the sky, and the summit of the central pillar represented Rigel, which is called Taubuki-ni-Karawa (Ridgepole-of-Heaven).

> Just as the roof was divided by the lines of rafters, so the heavens were plotted out to him in lines of principal stars; every constellation of the Gilbertese chart was alloted its imaginary place in the thatch, according to what we should call its angular distance from Rigel and its declination north or south of that line. . . . Before the pupil was allowed to identify a single star in heaven, he had to be word-perfect in this preliminary, theoretical groundwork, and in addition he had to know by heart long lists of stars by which courses might be steered to the various lands included in his instructor's geography. Then only was he taken to the eastern beach and introduced to the open heavens.
>
> One of the methods of memorizing the guiding stars on any specific course was to weave a tale about them, wherein they figured as persons or objects seen during the voyage of some fictitious character. Very often, the better-known folk stories of the race were adapted to this purpose.

In the Carolines the people of Puluwat (Poloat) and the neighboring islands were the most skillful navigators of Micronesia; there were established the chief navigation schools. The same people were the most notorious and bold pirates of the Pacific, their skill as navigators enabling them to carry out depredations far afield.

But in spite of a more generally diffused and probably more detailed knowledge of navigation and the possession of what were probably the finest outrigger canoes ever built, the Micronesians never performed, so far as is known, any exploratory voyages comparable with the well-authenticated expeditions carried out by Polynesians in every direction in the Pacific. Many voyages were made by the Polynesians southwest from Tahiti and Rarotonga to New Zealand, northward to Hawaii and back again, eastward to Easter Island, and southward to the Antarctic Circle into the region of floating ice and mountainous waves (Smith, 1921, pp. 216-275).

Micronesian voyages were, on the contrary, of relatively short duration and normally had definite destinations. Communication existed between Yap, where the Great God of the Micronesians abode, and the Gilbert Islands in the east—probably even to Samoa through the Ellice Archipelago—at annual seasons, but this was accomplished by relays of canoes passing from island to island or rather from archipelago to archipelago. In this way vessels from Tarawa in the Gilbert Islands carried their trade or tribute to Jaluit in the Marshall Islands, whence other craft conveyed the freight to Kusaie in the eastern Caroline Islands. There it was transhipped for Puluwat (Poloat), an island lying west of the Truk Islands in the central Carolines. From that island the local "flying proas" sailed with the massed offerings to Yap (Hambruch, 1912).

Regular trading voyages were also well-established between the central Carolines and the Marianas in Anson's time, and there is ground for belief that trading

trips were made to the Philippines both direct and by way of the Palau Islands to supply Chinese traders located in the Philippines with trepang and other island articles of Eastern commerce. Palau, as the source of the stone money used as currency in Yap, was also specifically visited from time to time by people of Yap desirous of adding to their wealth.

The Micronesians generally are possessed of more caution than the Polynesians, who, indeed, have never had their equal as venturesome explorers. So fearless were the Polynesians in times not so long past that their courage may be esteemed as of that foolhardy character that fails to count the cost in advance. To some extent also the Polynesian utilization of the double canoe design for the craft employed in deep-sea voyages goes far to account for the difference between the two peoples. The Micronesians preferred the outrigger canoe for their voyaging; fine sea craft though it be, at its best it is far less suitable for prolonged voyages than the double canoe of Polynesia, because of the limited accommodation it provides for passengers, provisions, and water.

In spite of this limitation, Micronesian culture as evidenced by canoe design has penetrated Melanesia at several points, the most notable being the Santa Cruz Islands, where outrigger canoes of large size are found equipped with lee platforms as in the Caroline "flying proa" and with outrigger fittings closely related to those of certain eastern Caroline canoes. The sailing canoes, both single and double, of Fiji exhibit the same influence in such outstanding particulars as the position and stepping of the mast, the form of sail, the arrangement of the rigging and, in consequence, the method employed for beating to windward. Culture contact carried the same design within the historic period from Fiji to Tonga and Samoa.

Small Micronesian colonies exist on the fringe of Indonesia and of Melanesia —Sonsol, Tobi, and neighboring small islands lying between Palau and the northern Moluccas, with Mapia situated due north less than 2 degrees from Manokwari in Netherlands New Guinea. Nui in the Ellice Islands is to be counted a Micronesian colony planted well within the Polynesian region.

Conversely, Polynesian colonists or castaways have given a definite Polynesian character to the population of Nukuoro and Kapinga-marangi, south of the central Carolines. The influence of Polynesian contact is also evident in varying degree in the Gilbert, Marshall, and eastern Caroline Islands.

The single outrigger is the characteristic type of canoe throughout Micronesia, but there is evidence that the double canoe, used probably only for war purposes, existed formerly in the central Carolines. From what little evidence is now possessed, the design was basically similar to that of the double canoe of Hawaii, with which a further link is furnished by the thickened tip of the Truk Islands paddle, a feature reproduced in that of Hawaii; probably both represent an early stage in the development of the beaked paddles of the Marquesas, the Tuamotus, and Mangareva.

Leaving out of consideration the stanchion type of outrigger seen in the paddling canoes of the Truk and Mortlock Islands, the sailing outriggers of Micronesia fall into two main classes: 1, those with branched connectives, Y or V (Carolines, Palau, and some of the Gilbert Islands); 2, those with mixed attachment (Marshall Islands and Nonuti and Tapeteuea in the Gilbert Islands).

Of these the second type is the older, with definite resemblance in essentials to those characterizing the eighth- and ninth-century two-masted outrigger vessels, of which excellent representations survive in the sculptured panels of Boro Budur in Java. Both are remarkable for the employment of two kinds of outrigger

booms, the one primary and straight with indirect attachment to the float, the other secondary or accessory with direct lashed attachment.

In the existing canoes of the Marshall Islands two primary straight booms, each connected by a single inserted stanchion to the float, are normally flanked on each side by three downwardly curved secondary booms attached directly to the float, whereas the related Gilbert Islands canoes (Nonuti and Taputeuea) have three curved booms only, placed alternate to the straight ones. Both varieties may be considered simplifications of the Boro Budur type in which several paired straight and curved booms are present, the straight placed vertically above the curved, instead of side by side as in Micronesia; as in Boro Budur each of the primary booms is straight with a straight stanchion as connective to the float, while the upper booms curve down distally to be lashed directly to the float, which is here compound. The difference between this ancient Javanese type and the existing Marshall Islands type is due to simplification of design in the Marshall Islands caused by reduction in the size of the hull and particularly by its lower freeboard as compared with the towering hulls of the great plank-built Javanese vessels.

The types with attachment by means of equal or subequal armed Y connectives are presumably later in time as judged by their geographical distribution; apparently they have developed locally, for with the exception of those of the Palau Islands they show no close relationship with any Indonesian type.

The Palau canoe type, as may be expected from the proximity of the islands to the Philippines and the Moluccas, is the only one with affinity to any present-day Indonesian type, though this is revealed only by the shape and length of the *bagad* bars, a form of thwart with carved ends projecting outboard on both sides and by a stringer (*goreal*) connecting their ends on the lee side. In Müller's opinion (1912, p. 245) the presence of these features links this design with those of the southern Philippines and Sangir Islands. In common with Indonesian canoe design, but alone among Micronesian sailing canoes, those of Palau have the sides of the hulls bilaterally symmetric.

Indonesian influence is also apparent in the large sailing outriggers of the Carolines by the employment of a true quarter rudder, of shape and manner of usage nearly identical with that of the large coasters, without outriggers, still numerous on the coast of Celebes.

GEOGRAPHICAL DISTRIBUTION OF SALIENT CANOE FEATURES IN POLYNESIA, FIJI, AND MICRONESIA

DOUBLE CANOES

With hulls equal or subequal and similar in form; mast forward of midships when present.

Sailing heads forward

Rig: an Oceanic spritsail set on a mast usually vertical—Hawaii, Marquesas Islands, New Zealand, probably the Cook Islands.

Rig: a primitive form of the Oceanic lateen set on a mast raked forward—Samoa, Tonga, Rotuma, and probably the Tokelaus and Ellice Islands; all prior to the adoption of the Fijian *ndrua* design at the end of eighteenth century.

Able to sail either end forward

Rig: usually two-masted; sail, a primitive lateen—Tuamotu Archipelago and Manihiki.

Paddling war canoes—Truk Islands (central Carolines).

Hulls dissimilar in size and shape

Rig: the Oceanic lateen—Fiji; adopted latterly by Tonga, Samoa, Rotuma, and other neighboring islands under Samoan and Tongan cultural influence.

Sail Rig

Oceanic sprit: Hawaii, Marquesas, Society Islands, New Zealand.

Primitive Oceanic lateen: yard resting in the jaws of a crutched masthead—Tonga, Samoa.

Oceanic lateen: truly so-called—Micronesia, Fiji; borrowed in later times by Samoa, Tonga, Rotuma, and probably the Tokelaus and Ellice Islands.

The Oceanic spritsail is triangular, set apex downward; the long fore side (luff) is tied or laced to a mast usually vertical, and the long after side (leech + foot) is attached to a boom sprit, usually curved; the mast is stepped forward of midships. The Oceanic lateen is also triangular and set apex downward; it is slung from a mast raked forward and stepped amidships; the head is attached to a yard, the foot to a boom.

OUTRIGGER CANOES

Hull form

- Both ends low—Tuamotus generally, Manihiki, Tonga, Samoa, Ellice and Tokelau Islands, Niue, Rotuma, Gilberts, Nauru, eastern Carolines in part, Palau Islands.
- Both ends upturned and pointed, height variable—Hawaii, Napuka and Reao in the Tuamotus, Easter Island, Australs, Cook Islands in part.
- Head low, stern elevated—Marquesas Islands, Society Islands, Cook Islands in part, and New Zealand.
- Ends equal, upcurved, forked or with figure head—Marshalls, Carolines generally.

Hulls with inserted transverse frames

- Functional
  - With ribs sewn directly to skin—Tuamotus, Society Islands, Gilberts.
  - Ribs lashed to comb cleats or to ridges on inner side of skin—Samoa, Tonga, Tokelaus probably, Fiji. Same method is found in the Solomon Islands, the Moluccan region of Indonesia, and anciently in Scandinavia.
- Degenerate or vestigial—Hawaii, Niue, Manihiki, Tongareva, (?) New Zealand.
- As solid bulkheads—Marquesas and all Micronesia except the Gilberts.

Forms of outrigger attachment

- Direct attachment of booms to float
  - Booms curved, with lashed attachment—Hawaii, (?) anciently in Marquesas, the outer Tuamotus, Easter Island (? straight booms); also found in the Philippines, Ceylon, and South India.
  - Booms elbowed, with inserted attachment—Rimatara and probably other Australs, the Cook Islands except Aitutaki, Tutuila (Samoa); in the Ellice Islands and southernmost Gilberts the boom end is lashed on.
- Indirect attachment
  - Paired stanchions overcrossed or lashed against the sides of the boom—Marquesas, Manihiki, New Zealand, Tonga typically, Samoa, Niue, Rotuma, Tokelaus, Fiji, occasional in the Carolines (Truk and Mortlock Islands and in the undercrossed condition in Nukuoro), the Marianas.
  - Paired U withies attached to pegs inserted in the float—Tonga in part.
  - Branched and Y connectives—Aitutaki (Cook Islands), Gilbert Islands, Nauru, Kusaie in the eastern Carolines (modern), western Carolines, Palau in part.
  - Crutch connectives; boom rests in a small crutch crescent—distinctive of the western and central Carolines, with Sonsol and Mapia (St. David), Palau in part.
- Mixed attachment
  - Two booms; attachment of one direct, of the other indirect—Society Islands, northwestern Tuamotus, some islands of the Australs (modern).
  - Multiple booms; several with direct attachment; usually two booms (the true ones) with indirect attachment by means of (usually) paired stanchions—Marshall Islands, Nonuti and Tapeteuea (Gilbert Islands), Ponape (eastern Carolines).
- Number of booms
  - Two booms; usual throughout Polynesia and Micronesia with the exception noted below.
  - Multiple booms; typical of Fiji, the Tokelau and Ellice Islands. Co-existent in Tonga and Samoa with the two-boom type. (? New Zealand.)

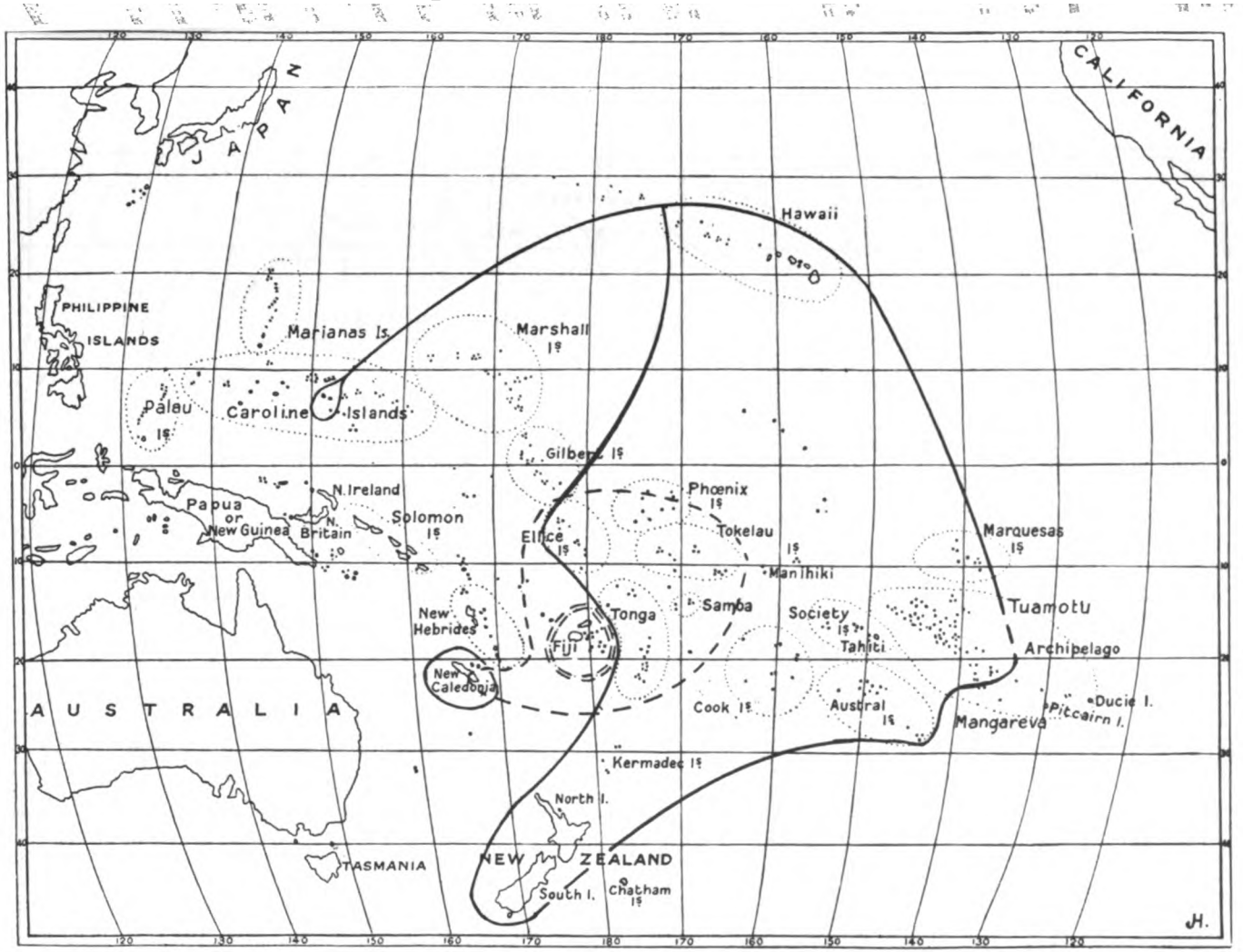
PADDLES

Form of blade

- Broad and short; cordate, ovate, obovate, or elliptical—all Polynesia except New Zealand, Cook and Ellice Islands.
- Lanceolate—New Zealand, Carolines, Palau.
- Intermediate; strongly shouldered—Ellice and Cook Islands, Gilberts.

Modifications of blade tip

- Tip swollen—Truk Islands in the Carolines; Palau; New Zealand, rare.
- Tip ribbed—Hawaii, Cook Islands.
- Tip beaked—Marquesas, Tuamotus, Mangareva.

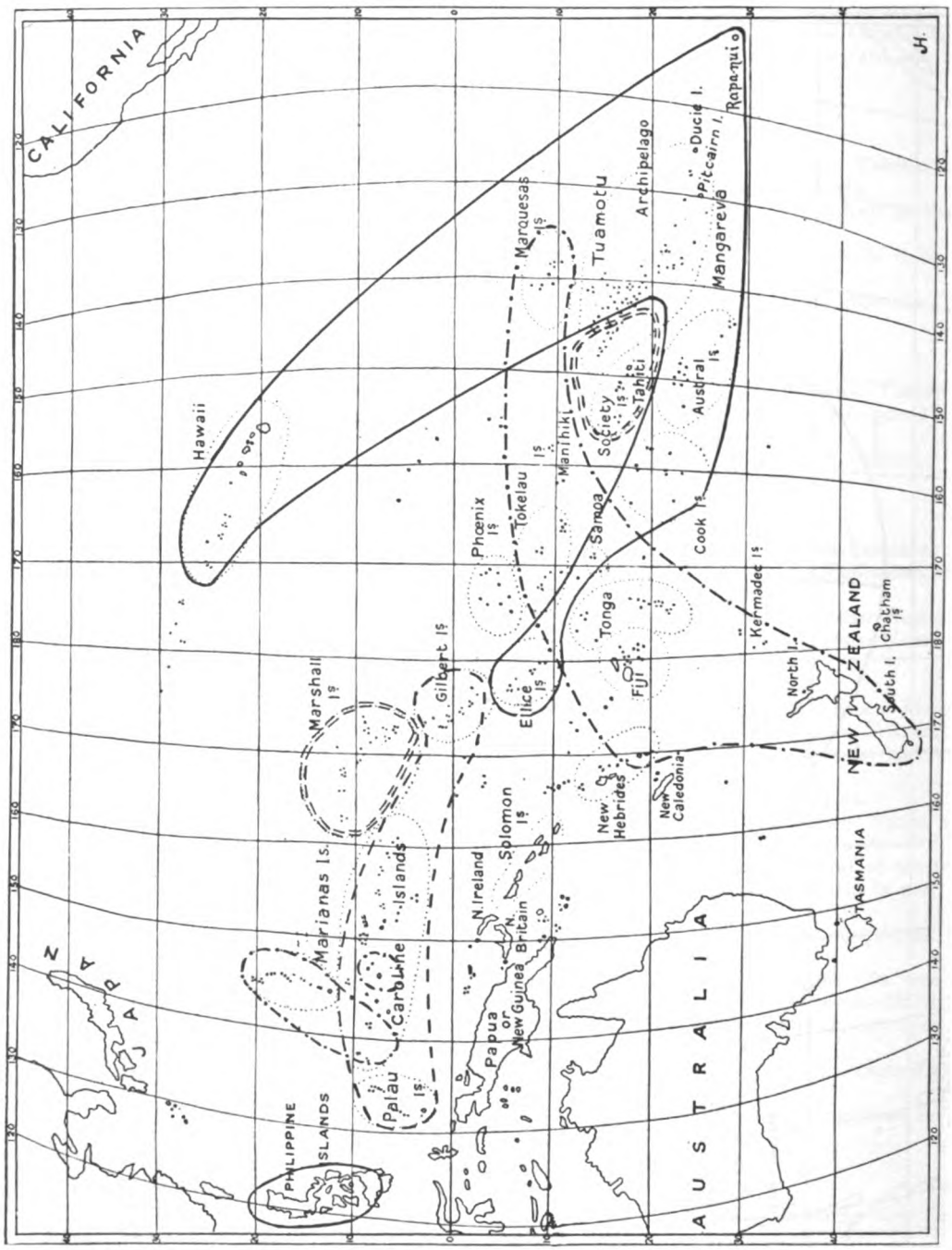


THE DISTRIBUTION OF DOUBLE CANOES

———— Area occupied by double canoes with equal or subequal hulls and with mast forward of midships, when first visited by Europeans.

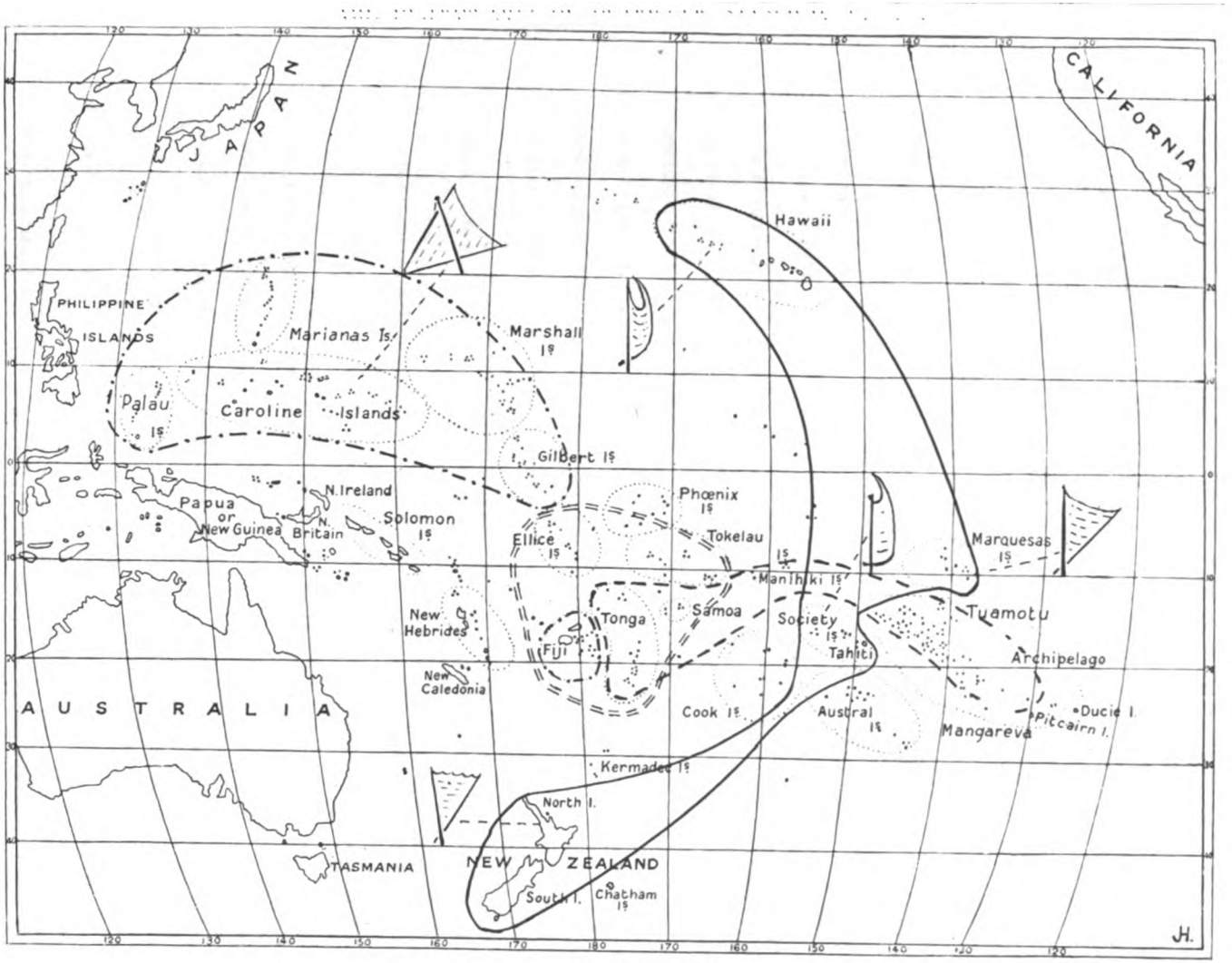
= = = = = Area occupied by double canoes with unequal and dissimilar hulls about the same time.

— — — — — Subsequent extension of the unequal hull area.



THE DISTRIBUTION OF OUTRIGGER ATTACHMENTS

——— Direct attachment. ═══ Mixed attachment.
—·—·— Stanchion attachment. — — — Y or V attachment.



THE DISTRIBUTION OF SAILS

——————— Area occupied by the Oceanic Spritsail.
— — — — — Area occupied by primitive lateen sails when first visited by Europeans.
—·—·—·— Area occupied by the Oceanic lateen about the same time.
═══════ Subsequent extension of the Oceanic lateen area.

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