CANOES OF OCEANIA

By
A. C. HADDON and JAMES HORNELL

VOLUME III
DEFINITION OF TERMS, GENERAL SURVEY, AND CONCLUSIONS

By A. C. Haddon and James Hornell

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INTRODUCTION[1]

It has been possible to cover only a portion of the area discussed in these volumes by personal observations. One of us has visited a considerable part of the southern shore of Papua, while the other has covered most of Polynesia, together with Fiji and the northern coast of Netherlands New Guinea. We were both enabled to make these expeditions through the generosity of the Trustees of the Percy Sladen Memorial Fund, to whom we tender our sincere thanks.

For a considerable amount of our data we have had to rely on the accounts of the older voyagers and those of more recent scientific travelers as well as those of residents in various districts, mainly government officials and missionaries, and even of travelers who had no special training in science but who supply excellent illustrations. Whatever the source may have been, we have been careful to make due acknowledgment.

The illustrations in books vary a great deal in their usefulness for our present purpose. We do not know the conditions under which many of the older drawings were made; probably the draftsman at home was usually provided with sketches which he did his best to copy or interpret and his lack of technical or practical knowledge rendered him liable to make mistakes, some of which it is now impossible to rectify. It is nevertheless noteworthy that many of the plates of the older voyages show such accuracy of detail that they afford very good evidence of the then existing conditions, and we are on firmer ground when the accompanying descriptions of the craft are given by practical seamen. As a rule the detailed drawings given in more recent works are quite reliable and they have enabled us to gain a clear conception of the respective structures.

A considerable amount of our work has also been based on photographs in books or on those in public or private collections. A photograph is good evidence that a certain form of craft was present in a given spot at a given time, but it is not conclusive that the canoe was the usual or common type there, as any canoe may be a chance visitor. A photograph becomes authoritative only when it shows numerous examples of the same type, or when it agrees with other photographs taken on different occasions.

Of far greater value is the explicit statement of a resident or traveler, but unless he is a trained observer and knows what information should be recorded and what details should be noted, many omissions are apt to occur. For example, it is desirable to know whether any given form described by a traveler is typical

[1] 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.

of, or peculiar to, the particular locality in which it was noted, or whether he just happened to notice it without making specific inquiries.

We have also had recourse to models in various museums; these may be considered as representing the common type of vessel of the locality, but a model may be carelessly made, a lack of proportion in the parts is lamentably common, and certain details may be slurred over or even wrongly constructed to save trouble. On the other hand, the models as a rule seem to have been made by those thoroughly conversant with the canoes and probably many were made by those who actually built boats. The technical skill in model-making, which is characteristic of many maritime peoples, and the pride of the artificer in his work give us confidence in accepting most models as trustworthy evidence, even though the various parts may not be made exact as regards their relative proportions.

Numbers of books have been consulted which are not referred to, for if they gave any information on our subject it was of too general a character to be worth noting or the facts may have been stated more fully or more clearly in other works to which we allude. We have endeavored, as far as practicable, to do justice to priority of information and we have generally given numerous quotations from early and later voyagers and writers. We have also indicated those books and papers in which the author gives more detailed information than we have had space to transcribe.

Numerous friends have very generously given us the results of their own observations in the field and supplied us with photographs and sketches; these are all duly acknowledged in the text of volumes 1 and 2, but we desire to take this opportunity of thanking them most warmly for their disinterested help.

As all the voyages that resulted in the population of the wide spaces of Oceania were made in outrigger canoes, double canoes, or in fleets composed of both kinds of craft, it is interesting to attempt to discover what sort of vessels these were and to what extent the craft of the various migrations differed from each other.

Unfortunately it will never be possible to determine exact details concerning the various craft that entered Oceania from Indonesia. All that can be done is to make as complete a survey as possible of existing craft and to compare them with the accounts given by the early navigators which do not in every case represent existing types. Changes in form and rig have frequently taken place and are still taking place, and various types must inevitably have disappeared without leaving a trace. Old books allude to western Oceanic deep-sea sailing vessels about which we have no definite information. It would be most interesting if we could know the technical craftsmanship of these adventurous sailors. In more recent times we know there were sailing vessels that are now but a memory or which may be represented to some extent by the existing types that we have recorded.

It is rather surprising that a survey of this nature has not hitherto been attempted as it is of peculiar intrinsic interest and of considerable ethnological value. We are well aware that our effort is incomplete in many directions, for example in the modifications that are taking place through contact with other types of craft and in an enumeration of the introduced types. We venture to hope that this memoir will form a basis for further exploration in this field of research.

DEFINITIONS OF TECHNICAL TERMS

Owing to the loose use of the terms employed in describing the construction of canoes, it is often difficult to determine in what precise sense they have been employed by various writers; the obscurity is not less when descriptions in foreign languages have to be translated into English. For example, the term "outrigger" has frequently been employed to designate the float or even the booms and sometimes also the balance-board or the lee platform of Micronesian craft. There is often ambiguity in describing sails and rigging and in the details of the construction of the hull.

There thus appears to be a distinct need for a precise definition of terms that can be applied to the craft of Oceania; the want of such a standardized definition has been a serious handicap to field workers in their technical descriptions and has led to a lack of uniformity in their accounts. We therefore offer the following list of terms as an attempt to meet this need. We have endeavored to adhere in the main to accepted usage of nautical terms, but the lack of similarity in, and the difference in origin of, the construction of European and Oceanic craft have made it necessary for us to employ some terms in a slightly different sense from that used in describing European craft.

TYPES OF CRAFT

Raft: a floating platform usually roughly made of logs or bamboos, without definite head and stern.

Catamaran: a shaped raft having a pointed head and truncate stern.

Dugout canoe: a log hollowed out on one side to form a primitive boat; the ends are more or less carefully shaped.

Five-part canoe: a canoe in which a board (washstrake) is fixed on edge along each side of a dugout underbody to give greater freeboard, and in which both the head and the stern are finished off by the addition of an end-piece.

Built-up canoe: a canoe in which the sides are built up of more than one strake and the dugout underbody is more or less reduced or even replaced by paired planks.

Outrigger canoe: a canoe having an "outrigger" on one or both sides; when on one side, it is a "single outrigger"; when on both, a "double outrigger".

Double canoe: a pontoon type of vessel in which two canoe hulls, laid parallel, are connected by a number of cross-beams or booms.

PARTS OF HULL

Hull: the body of a canoe or boat. It may consist either wholly of a hollowed-out log (dugout), or of one or more breadths (strakes) of planking raised on the edges of the dugout, or wholly of planking with or without a keel.

Off side: that side of a single outrigger canoe opposite the outrigger side; normally the lee side.

Outboard: outside the hull of a canoe; usually applied to something which projects beyond the side.

Inboard: within the hull or projecting into the cavity of the hull.

Sheer: the longitudinal curve of a vessel's deck or sides.

Head: the fore end of a vessel; here employed generally as a synonym for "stem".

Bow: technically the curved region of the hull on each side of the head.

Stern: the after end of the hull.

Quarter: the portion of the hull immediately forward of the stern on each side.

Underbody: the dugout base of a canoe that has planked sides.

Fore end-piece: the shaped block of wood which forms the fore end of a five-part canoe; its after end is typically cut V-shaped or winged, with the wings resting on the dugout underbody and their ends abutting against the ends of the washstrakes. It may also be present in built-up canoes.

After end-piece: the solid block at the after end corresponding to the fore end-piece.

Head-board: a shaped board, usually hewn from the solid, fitted over the fore part of the hull, forming a short fore decking and sometimes projecting beyond the head.

Stern-board: a board at the stern similar to the head-board.

Cutwater: the sharp fore edge of the hull which cleaves the waves; may be vertical, raked, or curved.

Forefoot: the angular turn found in some canoes at the junction of the keel line with the cutwater.

Bow-keel: a length of wood analogous to the stem post of a European boat.

Stern-keel: analogous to the stern post. A true keel may or may not be present connecting the bow-keel and the stern-keel.

Bow-terminal: a more or less horizontal piece, usually carved, added to and projecting from the bow of the dugout.

Bow-erection: a carved vertical fore-and-aft piece added to the upper surface of the solid fore end of the dugout; when a similar piece is added at the after end it is a "stern-erection"; when there is one at each end and the canoe sails either end foremost it may be called an "end-erection" (characteristic in the Massim area of New Guinea).

Prow-affix: an erection, usually carved, placed upon the apex of the fore end-piece.

Stern-affix: an erection placed upon the apex of the after end-piece.

Strake: a breadth of side planking running longitudinally the whole or part of the length of the hull.

Wale strake: a thick sidestrake used to stiffen the hull longitudinally.

Garboard strake: the lowest strake, attached on its lower edge to the keel.

Washstrake: the uppermost strake of the hull; sometimes called the topstrake. In small canoes it is a vertical or slightly outwardly inclined plank added to the edge of the dugout to give greater freeboard.

Carvel-built: construction in which the planks are laid edge to edge so as to produce a flush and smooth surface.

Clinker-built: construction in which the lower border of each plank overlaps the upper border of the plank below it, thus presenting a series of longitudinal ridges.

Fore washboard: a board at the bow on each side above the washstrake, when this is present, to give greater elevation and protection from spray. There may also be an after washboard.

Breakwater: a transverse vertical board closing in the space between the ends of opposite washstrakes or washboards.

Weather-screen: a protection of matting or other material fitted upon the gunwale to keep out spray.

Tumble-home: an inward curve of the sides.

Gunwale: strictly defined, the horizontal plank covering the heads of the timbers and the upper edge of the topstrake as a binder; commonly used, in describ-

ing small craft such as canoes, to mean the margin or edge of the hull, and in this sense it is here employed.

Freeboard: the vertical height of a vessel from the water line to the gunwale.

Hold: the cavity or interior of a hull.

Bulkhead: a transverse partition across the interior of the hull.

Frames: the bends of timber forming the skeleton of the hull in built-up vessels.

Inserted frames: frames inserted after the hull has been planked-up; they may be (1) U- or V-shaped; (2) the limbs and ends may be united by bars in various ways, typically they are cut out of a single piece of wood; or (3) they may be solid and then are termed "bulkheads".

Ribs: the curved sections of the frames which rise from the keel in a vertical and transverse direction on each side; upon them the skin planking is fastened.

Inserted ribs: ribs placed in position after the hull planking has been fitted together. They may be either sewn to the strakes or, more commonly, to comb-cleats projecting therefrom.

Cleats: projecting pieces of wood of different shapes; one type has two "ears" or "thumbs" and is used for belaying ropes; another type, the comb-cleat, is a perforated or "eyed" projection.

Thwarts: planks or sticks fitted between or upon the sides of a canoe on which the paddlers or rowers sit.

Strut: a stiff rod or prop introduced as a tie or support to keep other members rigid. A strut is also a strong rod, horizontal or inclined, that passes within the hull from one side to the other; when two struts slant crosswise, they are "cross-struts".

Brace: a single or multiple rope or cord serving as a stay to maintain the rigidity of certain parts.

Stanchion: a straight rod, usually vertical in position, used as a support.

Weather platform or outrigger platform: a platform built upon the booms of a single outrigger canoe to accommodate crew, passengers, or cargo. The outrigger is normally placed on the weather side to counteract the pressure of the wind upon the sail.

Balance-spar: a spar laid athwart the hull and projecting outboard on one or both sides.

Balance-board: a board or a narrow platform projecting outboard at right angles on the off side of a single-outrigger canoe; used as a balance in conjunction with "live ballast" when sailing with the outrigger on the lee side.

Lee-platform, off-platform: a platform built outboard on the off or lee side of a single-outrigger canoe to balance the outrigger or the weather platform on the opposite side; used to increase the cargo-carrying capacity.

OUTRIGGER APPARATUS

Outrigger: the whole of the stabilizing framework of an outrigger canoe; its parts consist primarily of booms and a float or floats, with or without accessory parts.

Outrigger booms: spars laid athwart a canoe and projecting outboard on one or both sides. The distal extremities are attached directly or indirectly to the float. For the sake of brevity these are frequently referred to as "booms".

False booms: booms which are not attached to the float.

Stringer: a pole lashed in a fore-and-aft direction to the booms to keep them in position. Inner and outer stringers run respectively on the inner and outer aspect of the connectives.

Yoke: a stout convex or cambered wooden bar employed to hold the outer ends of the booms in position; cord braces connect its ends and the float.

Float: a log of wood or length of bamboo used as a counterpoise, boomed out on one or both sides of a canoe.

Connective: an intermediate element connecting the float with a boom.

Types of Outrigger Attachment

Direct attachment of booms to float.
- Lashed to float.
- Inserted into float.
- Attached by a combination of both methods.
- Attached by a curved or elbowed lengthening piece lashed or scarfed to the outer end of the boom and connecting it directly with the float (extension attachment), thereby approximating to a direct inserted attachment.

Indirect by means of connectives.
- Connectives inserted into float.
  - Vertical or slanting sticks: usually short sticks lashed to one or both sides of the boom; stout or long sticks may be termed stanchions.
  - Parallel sticks: a pair or several pairs of sticks which may be vertical or slanting, each pair adpressed to the boom. In the clamp connective variety of this type the upper portions of two parallel cylindrical or more commonly flattened sticks are lashed together.
  - Convergent or overcrossed pairs of sticks: whether the tops of the sticks are merely adpressed to the sides of the boom or whether they project so far as to be overcrossed depends upon the length of the connectives; each locality has its definite variety.
  - Undercrossed pairs of sticks: a single pair, two pairs, or in a few localities several pairs, of sticks cross under the boom which rests in their axil. In some attachments one stick of a pair is vertical and the other slanting. Sometimes the two pairs are vertical and thus parallel to each other, or they are more or less slanting, in which case they diverge to a lesser or greater extent from each other. In some localities the sticks extend high above the boom.
  - Perforated connective: the connective, which is inserted in the float, has a hole through the upper end to take the thinned-down end of the boom; the connective is a thick stake or stout peg (Madagascar and East Africa) or a small board (north Java).
  - Board connective: a short piece of plank, sunk into the float; the boom is supported in a deep notch in the upper edge of the board. (This type appears to have been common formerly in Indonesia.)
  - Crutch connective: a stout Y-shaped stake with short massive arms that clasp the end of the boom; the stem is inserted into the float.
  - Forked or Y connective: a Y-shaped stick, the arms of which are equally branched, straight, and usually moderately elongated. The boom may rest in their axil or more frequently the arms are lashed to one side of the boom. The stem is usually inserted into the float, but may in some instances have an expanded base which is lashed to the float.
  - Branched connective: similar to the Y connective but with an oblique arm given off from a straight vertical stem.

Rod or stanchion connective: a rod inserted into the float and apparently normally passing through the boom, but it may be lashed to the boom. (This type is confined to the aft boom in Madura and the Bawean Islands, north of the east end of Java.)

Spike connective: a thin stick or spike driven through the boom and into the float; usually a thin branch extends at a right angle from the stem and is lashed onto the boom.

Connectives lashed to the float.

⊥-connective: the connective is a ⊥-shaped stick or stanchion, or a bough with twigs, the foot of which is lashed to the float and the vertical portion fastened to the boom.

Elbow connective: the connective is a curved or angled bough or piece of timber lashed to the boom and float. This is the "Halmaheiran attachment" (Friederici and Haddon), a term we now discard.

Withy connective: a slender flexible rod bent into a U, an O, or other shape and lashed to the float; in Indonesia it is attached to the side of the boom. This is the "Moluccan attachment" (Friederici and Haddon), a term we now discard. In Melanesia there are three variations: 1, two separate loop connectives, the boom resting upon the crossing of a withy bent into a loop (northwest New Britain); 2, the boom rests on the crossings of a pair of U-withy connectives (northern New Britain); 3, the boom lies beneath the crossings of a pair of U-withy connectives (San Cristoval and Tonga); in Tonga the connectives are attached to pegs inserted into the float.

Mixed attachment: one or more booms have direct attachment and the other boom or booms have indirect attachment.

MASTS, SAILS, AND RIGGING

Mast: a spar used to support a sail.

Pole-mast: an unpaired spar to which the fore side of a sail is tied or laced, or from which it is slung.

Sheer-mast: two spars joined together at the top in the form of an inverted V (the lower ends usually fitted to a tabernacle in Indonesia).

Tripod mast: a sheer-mast with a third spar connected to the masthead, to function as a fore stay.

Mast-fork: either the forked end of the mast or a forked affix fastened to the mast.

Mast-prong: a projecting affix (a form of "truck") near the top of the mast; the base is lashed to the mast; the end of the prong may be perforated for the stays. A halyard is rove over the angle the prong makes with the mast. The prong is frequently carved.

Truck: a wooden block or board at the masthead in certain types of boats, having a sheave hole in it through which a halyard is rove. It often has a crescentic form, as in Tonga and Fiji.

Heel or Foot: the lower end of a mast or of a lateen yard when it is stepped.

Tabernacle: a mast-fitting on deck consisting of a "case" or "trunk", in or on which the mast works as on a pivot to enable it to be raised and lowered easily. It usually consists of two upright posts between which the mast is pivoted, and a cross bar or tie between the two posts.

Mast-shore: a side strut for the mast; an inclined, short, stout, straight or curved spar of which the upper end is made fast to the lower part of a mast at an angle of about 45 degrees.

Mast-step: a small, cup-shaped hollow cut in a boss on the bottom of a canoe, or in a board or block of wood (a shoe) that rests on or is attached to the bottom or, in many canoes, fitted upon some part of the superstructure. The heel of the mast rests in this hollow.

Shoe-spar: a long curved spar the lower end of which is a shoe or step for the mast; the distal end of the spar passes well above the outrigger platform. (It occurs in some canoes of the Massim district of Papua.)

Spars: poles on which sails are extended.

Yard: the spar extending the head of a quadrilateral sail or the fore side of a triangular sail.

Gaff: a form of yard which extends the head of a fore-and-aft sail where the luff is laced or hooped to the mast (not indigenous in Oceania).

Boom: the spar which extends the foot of a sail.

Bumpkin: a spar run out over the stern to which a vang or other rope is led.

Standing rigging: the shrouds at the sides, which, together with the forestay and sometimes a backstay, serve to support the mast.

Running rigging: all ropes employed to hoist and adjust the sails.

Stays: ropes supporting the mast; the forestay and the backstay (when present) run from or below the masthead to the fore end and the after end respectively of the hull.

Shrouds: ropes which steady the mast; they extend from below the masthead to the sides of the hull.

Halyard (or halliard): a rope used to hoist a sail.

Sheet: a rope attached to the clew of a sail or to the boom, when one is present, to adjust the sail to the requisite angle with the wind.

Guy: a rope used to steady any body and prevent it from swinging.

Vang: a rope attached to the yard and functioning as a guy.

Sails

Square sails. Square, oblong, or rectangular sails; in oblong sails the long axis of the sail may be vertical or horizontal. In certain primitive types, as at Port Moresby, Papua, and less typically in Torres Straits, there was no mast and the oblong sail was supported by a spar on each of its long vertical sides. In the more advanced types where the sail is supported by a mast, the head is attached to a yard and the foot to a boom.

Fore-and-aft sails. These are: spritsails, lateen sails, lug sails (unknown in Oceania), gaff sails, and leg-of-mutton sails (unknown in Oceania prior to European contact).

The principal terms applied to the parts of a quadrilateral fore-and-aft sail are:

Head: the upper margin.

Foot: the lower margin.

Luff: the anterior margin.

Leech: the posterior margin.

Throat: the anterior upper corner.

Peak: the posterior upper corner.

Tack: the anterior bottom corner.

Clew: the posterior bottom corner.

Bolt-rope: a rope or cord within the turned-in margin of a sail to give strength.

European spritsails: typically quadrilateral, this sail has neither yard nor boom, being extended by a diagonal spar, the sprit, tapered at each end. The upper end of the sprit fits into an eye in the peak, the lower into a rope loop, called a snotter, a form of grommet, hung from near the foot of the mast. This form has been adopted in some islands, but with modifications.

Oceanic spritsails: there are three main forms of the Oceanic spritsail:

1, Triangular sail, with apex downward, and a spar along the two long sides. One of these spars may be considered as a movable mast and the other as a sprit. The typical form is that which was formerly used in New Zealand.

2, Crab-claw sail. The fore side is tied to a fixed vertical mast and the after side to a strongly curved sprit, the lower end of which is attached close to the foot of the mast. The typical form is that which was used in Hawaii.

3, Boomsprit sail. In shape sub-quadrangular, the fore side is tied to a fixed vertical mast, the foot to a short curved boom and the after side to a slightly curved slender sprit. This was the characteristic sail of the Society Islands.

Lateen sail (Mediterranean): a triangular or sub-triangular fore-and-aft sail laced or tied along the head to a stout yard but without a boom. It is slung from the mast near the middle of the yard.

Proto-lateen: the earliest stage in the evolution of the Oceanic lateen. From mast, vertical or raked forward, a simple triangular sail is slung apex downward by a loop passed over a peg at the masthead. The two long sides are tied to sub-equal poles.

Primitive lateen: the mast always rakes forward and the masthead has a deep crutch in which the yard of a triangular sail rests. No halyard is present.

Oceanic lateen: a sail having the form of an isosceles triangle, set apex downward. The apex is typically stepped in a socket on the fore decking or on a thwart near one end. The two long sides are tied or laced to two spars, the yard and the boom. When the shorter margin, which forms the base of the triangle, has a deeply concave form, the sail is sometimes termed a "crab-claw" sail. It is normally slung from a mast which is stepped amidships and capable of being raked toward either end by means of running stays.

EQUIPMENT

Paddle: a variously shaped, broad or narrow blade at the end of a long or short shaft or loom; the other end of the shaft, the grip, may be simple, or expanded, or provided with a crossbar or crutch to give additional purchase. Paddlers face forward.

Oar: a long pole with a flattened or expanded distal end, the blade; it is worked against a fulcrum (rowlock, thole, thole pin, loop of rope, etc.) and the oarsman or rower faces the stern.

Scull: a long oar worked by a man in a standing position. In Oceania the sculler faces the direction in which he is going.

Thole pin: a wooden peg inserted in a hole in the gunwale to serve as a fulcrum for an oar when rowing.

Bailer: a scoop for bailing out bilge water.

Oceanic bailer: form of bailer in which the handle is within the cavity of the scoop, its free end directed forward; in some varieties the distal end of the handle is joined to the bottom of the scoop, or even to one or both sides of the scoop.

Spanish windlass: a wooden rod, operating on the principle of the tourniquet, for tightening and also securing ropes.

MISCELLANEOUS TERMS

Athwart: transverse to the longitudinal axis of the hull.

Coamings: raised ledges around such an opening as a hatch to prevent the entry of water.

Coir: the fiber of coconut husk used in making coir-cord and sennit.

Coir-cord: cord strands made from coir by twirling.

Double-banked: having two men rowing or paddling abreast on the same thwart.

Fore-and-aft: in the direction of a vessel's longitudinal axis.

Grommet: a ring of rope usually made by splicing together the ends of a short length of rope.

To lash: to bind objects together with rope, cord, or sennit.

To seize: to fasten two ropes or parts of one rope together with turns of twine or sennit.

To serve: to bind a rope or pole around with close turns of twine or sennit.

Scarf: a joint in timber made by overlapping the sloped-off ends which are then secured together by serving with sennit or twine; they may also be pegged together.

Sennit: strands of coconut fiber plaited into a braid.

Treenails: wooden pegs used in fastening planks together.

GENERAL SURVEY OF OCEANIC CANOES

METHOD

It may be taken as a general principle in considering distributions, whether of animals or men, that the more primitive types are generally to be found on the margins of a given area or in the less accessible or undesirable localities within that area. This principle is recognized as characteristic of the distribution of animals in the main; and to a less pronounced extent, it is also characteristic of human land migrations, though the process was complicated when the domestication of the horse gave increased facilities for rapid movement. A symmetrical expansion was hindered or restricted by geographical features—such as deserts, swamps, forests, mountain chains, great sheets of water—climatic conditions, and the like. This "Age and Area" theory of biologists has been adopted by certain ethnologists, particularly by Kroeber (1923)[2] and Wissler (1926), and it has been logically worked out for Australian social institutions by Davidson (1928). Whatever merits this "Geographical Distribution Theory" (as some of its exponents term it) may have for distributions on land surfaces, it is evident that it can not be applied mechanically to migrations by sea, whether of peoples, of customs, or of material objects, for it would be applicable only, and then but partially, if craft having the same rate of motion were employed in the transmission; more seaworthy and fast-sailing vessels would necessarily complicate the zonal diffusion. Haddon (1920, p. 131) points out that, "As a general rule one might expect to find that the earlier

[2] Reference to the Bibliography (p. 86) is made by date of publication.

types of canoes or of outriggers were those that went farthest, and those that started last would have a more limited distribution; but we must also remember that the later swarms would be more civilized and have a better technical equipment, and thus some of them may have passed over earlier layers and have reached a far destination."

The zonal diffusion theory has been critically discussed by Dixon (1928, p. 75) who takes " the case of the outrigger canoe, which illustrates excellently both the advantages and disadvantages of the method, as well as the dangers which a careless or merely mechanical application of it involves." Dixon based his deductions largely on the material supplied by Haddon (1913, 1918, 1920) and Hornell (1919, 1920-b, 1920-c).[3]

It is impossible to discuss the origin and migrations of the various types of sea craft met with in Oceania and New Guinea without references to those of Indonesia and to those of India, Madagascar, and East Africa. For obvious reasons the culture of Indonesia is very complex and, so far as canoes are concerned (and this applies to other elements of culture), it is extremely difficult to gain a clear conception of a relative chronology. A promising clue is to be found in the fact that migrations dispersed from Indonesia east and west at various times and that presumably each took place in a particular kind of craft or crafts. If a relative chronology for these successive drainings could be established, then we might hope to attain historical perspective for the whole problem.

RAFTS

It may be regarded as certain that rafts were the first definitely constructed appliances for traveling on water, and that even in their ruder forms they are safer on the sea than are simple dugouts. Some type of raft is found almost everywhere in the areas considered. We have alluded to rafts when we have found records of their occurrence or have observed them ourselves.

A simple type of shaped raft or catamaran consists of three logs or balks of timber of more or less definite form and arrangement. When more logs are used the number is usually uneven, often up to nine, but rarely more. In these rafts the central log is the longest and the others decrease in length laterally, thus presenting a wedge-like appearance at the fore end; the aft end of the raft is usually cut square. The elements of a raft may be tied or pegged together, and it is customary to strengthen it with crossbars. A staging or other contrivance may be added so as to render the passengers and cargo less liable to be swamped by the waves. Other rafts made of bamboos or logs of wood are quadrangular platforms, which may be rudely made.

A large, well-constructed raft is very stable and when provided with a sail or sails can travel long distances over the high seas with safety, but requires skillful management. Center-boards, let down through interstices between the logs, are sometimes employed.

A discussion of the South American balsas is given by Hornell (1931); he describes their form and copies an illustration of a large sailing raft from Benzoni (1565). Hornell dismisses a derivation from an African source, but considers a direct relationship with Polynesian and Melanesian rafts more probable. Every-

[3] Wissler based his map (1926, p. 29) on Haddon's (1920, p. 71), but transposed the distribution of the Moluccan and Halmaheiran attachments and confused the limit of the double outriggers for Torres Straits and Queensland; the "direct lash" canoe he illustrates is a North Queensland type, and not, as one might assume, an Indonesian one. More than three types of attachment were described by Haddon. Dixon (1928, p. 99) corrects these errors, making his map conform to the original.

where throughout Oceania there is evidence of the present or former use of rafts. In Mangareva, virtually the easternmost island of Polynesia, with the exception of Easter Island, sailing rafts are, or were until recently, used and approximate closely the form of the sailing balsa of Ecuador (fig. 1). Tongan and Samoan traditions tell of the use of large sailing rafts in old times; indeed in Tonga, rafts are said to have been employed for the conveyance from Uvea (Wallis Island), 500 miles to the northward, of the enormous blocks of stone used in the construction of their greatest megalithic monument, the Haamongaamaui, but McKern (1929, p. 65) says there is no reason to believe that this tradition is correct.

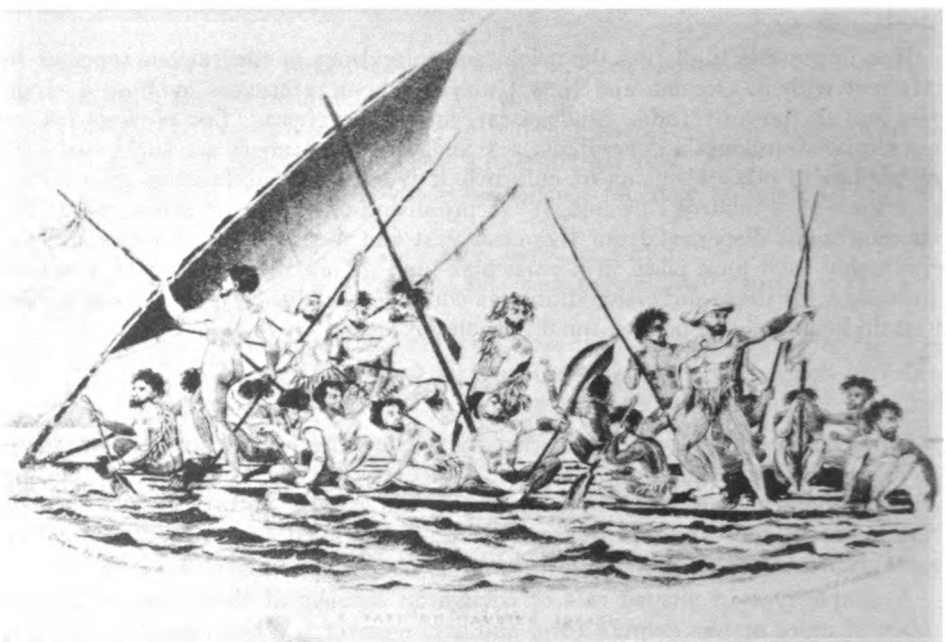


FIGURE 1.—Large Mangarevan catamaran under sail, sketched in 1826 (from Beechey, 1831, vol. 1).

We may here point out that the limestone discs used as currency in Yap were quarried and shaped in Babelthuap, one of the Palau Islands, 400 miles to the southward; these discs range in diameter from a foot to twelve feet; the smaller ones were brought across in canoes and the larger ones, which are of considerable weight, on rafts (Furness, 1910, p. 93).

Hornell (1928) concludes that the hypothesis that the South American raft has been transmitted coastwise from the Asiatic mainland has much to recommend it, and he enumerates some of the principal facts in favor of this view. However, we must not overlook the possibility that the invention of the balsa raft has been independent and without outside connection or introduction, and that it has followed a course of development parallel to that which has occurred in Polynesia and Formosa.

There is no reason to doubt that simple rafts may have been invented in different places and at various times, but it is interesting to note that some form or other of the terms *rakit* and *getek* have a wide distribution in Indonesia and Melanesia. (See p. 72.)

Friederici (1928, p. 29) says that large rafts of a developed type were used in the remotest times by the Malayo-Polynesians in their migrations. In the language of Madura, southeast Java, the obsolete word *pangghitik* for a village chief or the head of a *desa* signified "raft commander". In an analogous manner among the Tagalogs, Bisayas, Ibanags, Ilokanos, and Bagobos of the Philippines when the crew of a colonizing ship (*barangay*) founded a small village community, also called *barangay*, the captain of the vessel was the head or chief of the community. Among the Iloko the word *baranguay* has been maintained for raft.

A form of raft is reported from Tasmania, which, as Lane-Fox points out (1875, p. 427; 1906, p. 219), offers less resistance to the water than one with several logs. Two trunks were placed parallel to each other, a couple of yards apart and small crosspieces were laid on and lashed to these. "A stronger cross-timber, of greater thickness, was laid across the centre, and the whole was then covered by wicker-work. Such a float would be thirty feet long, and would hold from six to ten persons. In Fiji, Williams describes a kind of vessel called *ulatoka*, a raised platform, floating on two logs, which must evidently be a vessel of the same description as that used in Tasmania." Somewhat similar craft are recorded from Samoa and New Zealand.

Formerly there were no canoes, but only quadrangular bamboo rafts on part of the west coast of Malekula, and the Torres Islanders today have only bamboo rafts.

OUTRIGGER CANOES

The double outrigger with two booms occurs in: (1) the whole of Indonesia, except the Andamans, Nicobars, Nias, and the Mentawei Islands; (2) Madagascar, the Comoro Islands, and the east coast of Africa; (3) Nissan; (4) the Louisiades (on the evidence of a model); (5) the estuary of the Fly, Torres Straits, and North Queensland. In all these areas (except the East African) single-outrigger canoes also occur.

The superiority of the single outrigger over the double under certain conditions has been appreciated in Madagascar (Hornell, 1920-c): in the sixteenth and seventeenth centuries all the canoes appear to have had double outriggers; by the middle of the nineteenth century both forms occurred; now few double outriggers are found. On the other hand, the double outrigger is the only form found on the East African coast.

Dixon (1928, p. 77) says that the double outrigger is, or was, also found in such widely scattered regions as Easter Island, the Marquesas, New Zealand, Samoa, Ponape in the Carolines, and the Palau Islands. These reputed occurrences have been discussed when dealing in detail with these several regions.

There is no conclusive evidence that double-outrigger canoes were ever employed in Polynesia and Micronesia. Best (1923) discusses this problem. A more detailed discussion is given by Hornell (1932), who considers the weight of evidence to be against the presence of double outriggers in Polynesia and Micronesia.

At Nissan, the Louisiades, and in northern Queensland the single outrigger can not be regarded as a development from the double. In Torres Straits the double outrigger has been replaced by a single one within the last fifty years; this almost certainly was not an evolutionary process, but was due merely to the influence of South Sea men brought there by Europeans.

With regard to these western Oceanic areas the most reasonable view is that the double outrigger is due to ancient migrations, for the Nissan-Queensland (Ar-

cher-Claremont) type with the direct lashed attachment is quite distinct from the Louisiade or from the Torres Straits types. The single-outrigger canoe of Queensland (Cape Bedford type) is certainly derived from New Guinea or Melanesia, and there can be little doubt that it belongs to the latest of all these movements to the Queensland coasts. The persistence of the double-outrigger canoe in Nissan is due to the fact, as shown by Friederici (1928, p. 30), that it is now employed solely in the still water of the very shallow lagoon, whereas the single-outrigger canoe and the *mon* are used outside the lagoon where strong currents run.

The single outrigger occurs in: (1) Madagascar and the Comoro Islands coexistent with the double outrigger; (2) southern India, Ceylon, and the Maldives; (3) the Andamans, Nicobars, Nias, and Mentawei islands; (4) a few scattered spots in Indonesia; (5) New Guinea and Melanesia, with the sporadic occurrences of the double outrigger just referred to—there is an overlap of the two types in the Geelvink Bay area, where the double outriggers, like the single, have more than two booms; (6) Polynesia and Micronesia.

According to Folkard (1901, p. 481), the Sumatra sailing *jellore* sometimes has only one outrigger. Bickmore (1868, p. 56) saw in Madura Strait, Java, sailing boats with a single outrigger, but they do not appear to be numerous at the present day, if they still occur. Hornell (1919) says that "on the north coast of middle Java, in a locality where the outrigger has otherwise disappeared, there lingers, however, a small and degenerate type of outrigger of very primitive affinities." This has but a single outrigger consisting of one boom which passes through a hole in a small board inserted vertically into a bamboo float (Hornell, 1919, figs. 1,2). He discusses the relation of this type of attachment to those of East Africa. Nooteboom (1932, p. 134, fig. 14) illustrates this type; he quotes Hornell and Van Kampen and adds a variant, on the authority of Moehamad Jakoeb, in which the single boom pierces the bamboo float, thus becoming a direct inserted attachment. Toy canoes with a single outrigger from northwest Indonesia may be makeshifts and so can not be accepted as good evidence of former types.

Canoes with a single outrigger, two booms, and a direct lashed attachment occur on the Nias and Mentawei Islands off the west coast of Sumatra. It is generally admitted that the Mentawei Islanders exhibit many affinities with Polynesians, and it is tempting to suggest that they may be a relic of the proto-Polynesian population that took part in the migration to northern Polynesia. In this connection it is significant that they do not employ the double outrigger.

Dixon (1928, pp. 80-82) regards the booms with stringers that project beyond the off side of a single-outrigger canoe in Madura, Sangir (Haddon, 1920, p. 77, fig. 5), and elsewhere as being vestiges of a double outrigger. Friederici (1928, p. 30) also adopts this line of argument and refers to the *kiato* (booms) of the Tahitian canoes seen by Cook as projecting a long way on the off side. The description given by Porter (1822, vol. 2, p. 73) is explained by the Marquesan custom of making the proximal ends of the booms project some feet on the off side, as shown in Hodges' figure (Cook, 1777, pl. 33). Possibly these are the vestige of a double outrigger, but they are certainly not functional as such. They were useful for handling the canoe when being carried ashore, but their primary use was for the attachment of, or the making fast of, various shrouds and mast-stays in sailing canoes. In the Society Islands the outboard projection of the fore boom is necessary to the fitting upon it of a long extension, the balance-spar, for the attachment of several shrouds at points some distance outboard. The offside projection of the booms has therefore direct and functional value without calling for any hypothetical reason, such as being the vestigial remnant of a lost outrigger.

The oldest historical evidence of outrigger canoes from Indonesia consists of carvings of eight sailing ships from the sculptures of the Buddhist shrine of Boro Budur in Java, photographs of which are given by Van Erp (1923, pp. 227-255), the engineer who was charged with the restoration of the stupa. Three of these ships are without outriggers. The other five have outriggers which we consider to be double, as four show a port outrigger and one a starboard outrigger, and as their lineal descendants, the large cargo vessels of Grisei near Sourabaya, all have double outriggers with compound floats, a feature which occurs also in the Boro Budur sculptures. Van Erp is of the same opinion; he gives diagrams (1923, pl. 11, figs. 1-3) of reconstructions of several vessels which show that the type of outrigger attachment was a highly developed and complex form of what, in a much simpler form, has been termed "Halmaheiran" (Friederici) or "East Indonesian" (Hornell) but which we now call the "elbow attachment". The main differences are that the Boro Budur ships have a compound float and that the attachment, instead of being merely a short curved or elbowed stick connecting the end of the true boom to the float, is in itself an accessory boom of which the down-turned end functions as a connective while the proximal end penetrates the side of the vessel a little above the true or main boom. The straight booms are attached to the float by means of stick connectives; we consider these the primary booms, as they are in the Marshall and Caroline Islands. Thus the booms are duplicated as well as the floats. In addition, massive fore-and-aft stringers strengthen the outrigger frame with short crossbars bracing the stringers together. The canoes of Nonuti and Tapiteuea, Gilbert Islands, have a single outrigger with three curved booms lashed to the float and two straight booms with stick connectives. Typical Marshall Islands canoes have a closely related arrangement but with six curved booms, three to each side of the two straight, indirectly attached booms. Pritchett (1899, p. 183) illustrates a "Pirate craft off north point of Borneo" with a double outrigger consisting of three downwardly curved booms lashed to the float; it was probably a Sulu vessel.

From Van Erp's fine photographs it appears that these ships usually had two masts for four out of five are so rigged, the fifth having only one mast. So far as we can judge they were bipedal (sheer-masts) with ladder rungs, like ratlines, between them; it is possible, but not probable, that what seems to be a fore stay in some of them may be the third limb of a tripod mast; of this we can not be sure owing to the coarseness of the sculptured lines.

Leemans (1874, pp. 541, 537) states that according to the annals of Java, Brawidjaja of Kalinga founded the empire of Mendang Kamoulan in Java in 603 A.D., and that the religion of Hindustan was not transferred to Java by war and conquest but by commerce and navigation. The fall of the empire of Boro Budur took place toward the end of the tenth century. Assuming that there was a large organized expedition from India to Java in 603 A.D., a knowledge of the island and of its suitability for colonization is presupposed; for an undetermined time previously there certainly were voyages to and fro. Indeed, the Javanese chronicles claim that Buddhist influence from India began at least as early as 75 A.D. when an expedition arrived in Java from that country under a leader called Adi or Aji Saka (Hornell, 1920-d, p. 213). Ferrand (1919) gives texts proving very early intercourse with India. As early as 132 A.D. we find a Sumatran king with an Indian name sending an embassy to China. Ferrand is certain that the peaceful penetration of Sumatra and Java by Indians antedated our era; indeed, he considers this began not later than the fourth century B.C. (1919, vol. 14, p. 37).

At all events the sculptures of the ships are dated, at the latest, within the eighth and ninth centuries and the types of the ships must have been common much earlier, as they are so highly developed. These carvings are of special value, as they are the earliest records of outriggers, of which several varieties were fitted to these ocean-faring, plank-built ships.

Hornell (1919) has shown that the peculiar connective of the double-outrigger canoe of East Africa and Madagascar was derived from a type now used in northern Java. This migration to Madagascar occurred soon after Indians settled in Java in the early centuries of our era, because few Sanskrit words are found in the old Malagasy dialects, whereas in modern Javanese many are incorporated, introduced by the long-continued activities of the Indian Buddhist and Brahman missionaries.

Dixon (1928, p. 84), after an examination of the illustrations of the old Dutch voyages, has come to the conclusion that in the Moluccan region "there is some reason to believe that in the sixteenth century the single outrigger was possibly the prevailing form except in the case of the large war canoes, and that the double outrigger has become general and displaced the single form since that time."

On reconsulting the Dutch authorities we find that at "l'isle Pugniatan [Panitan or Princes Island] they have skiffs or little canoes, not a foot wide, with 'raseaux' on both sides" (Nicolas, 1598, p. 16). "They have one kind of little 'chaloupes' which sail with so great a speed that it is marvellous . . . being hollowed out of a single tree, very sharp in front and quite round underneath, and so that they may not overturn there are on both sides two large bamboos, one fathom from the vessel tied to two 'bastons' which are strongly attached to the vessel . . . if some having no bamboos [floats] at the side capsize they [the crew] can swim for a long time until the vessel is dry and then sail as before" (p. 36). Nicolas (p. 35) figures one of the "barques volantes" showing a double outrigger with two booms and long floats. The attachment is not shown but appears to be direct. The same vessel, but reversed, is illustrated by De Bry (1601, vol. 3, pl. xxiix). Nicolas (1601, pl. 9, p. 11b) has described and drawn a "coracora" of Banda with a double outrigger, which is the same as that given by De Bry (1601, vol. 5, pl. 16, *A*; Haddon, 1920, fig. 12), but less clearly. There can be little doubt that the large sailing boats of this kind, like their modern representatives, had a double outrigger, and Dixon admits this. The Dutch authors habitually copied from one another or from the same original drawings, and thus their evidence is not multiplied. In the plates a large number of small canoes are shown without an outrigger, as well as small and large ones with a single outrigger. In some illustrations, as in those of the larger canoes, a double outrigger, if present, could not be seen in a side view, but there are numerous representations in which a double outrigger could have been depicted. From their general appearance many of the illustrations appear to have been worked up at home, and the small canoes were conventional representations copied again and again. We do not deny that there may have been canoes with single outriggers in the Moluccas at this time, but we are not prepared to accept the plates as evidence that double outriggers were entirely supplanted by single outriggers. It is significant that in the only end-on view of a canoe, a double outrigger is shown, although the numerous other canoes have but a single one (De Bry, 1601, vol. 5, pl. 12; Valentijn, 1726). If this be so, it appears to invalidate the conclusions drawn by Dixon from his interpretation of the Dutch illustrations.

Two alternatives are possible: 1. Double canoes have never been absent from the Moluccas or probably from Indonesia as a whole, and they spread from Indo-

nesia at various times westward and eastward. The single outrigger, at the present time, is almost unknown in Indonesia proper, though there seems to have been a tendency toward single outriggers in the neighborhood of Sumatra, Java, and Borneo. The single outrigger predominates in Oceania. 2. If the single outrigger was the older form, as its distribution marginal to Indonesia might suggest, it must be admitted that the double outrigger replaced it in Indonesia, though elsewhere the tendency has been the other way.

We consider that the evidence points to the conclusion that the double outrigger was in use in Indonesia at least as early as the beginning of the Christian era and that notwithstanding its present central distribution in Indonesia it is the older and not the newer type as Wissler (1926, p. 28) holds from his somewhat mechanical and limited survey.

Origin of the Outrigger

As has been mentioned, rafts and catamarans may consist of a variable number of logs or bamboos fastened together, on which a platform may be constructed. Or it is conceivable that a platform may be laid over only two logs separated from each other; should such logs be hollowed out they would be dugout canoes and the raft could be regarded as a double canoe. Two dugout canoes separate from each other and connected by poles or some sort of platform as on the south coast of Papua and in parts of Polynesia are, however, true double canoes and can not be designated rafts.

The hypothesis has been proposed that the double-outrigger canoe may have been derived from a three-log raft. A rudiment of such a canoe would occur if the spaces between the central and lateral logs were increased. It is further supposed that the central log was made of larger size, though the practical advantage of this is not very evident, and finally that the central log was hollowed out to form a canoe. The last process could not have been the origin of the dugout in regions other than Oceania; outrigger canoes are absent from Europe, Asia, Africa, and America with the few exceptions previously noted for south India, East Africa, and western South America, which in the case of the two latter can be accounted for by diffusion from Indonesia. It seems most probable that the dugout was known in Indonesia, and doubtless in New Guinea, before the adoption of outriggers and that, accepting this raft theory, the hollowing out of the central log might have been in imitation of a contrivance already in use. Friederici holds that the argument for this evolution is supported by the terms *rakit*, *getek*, etc. (p. 72).

It has been suggested by Lane-Fox (1875, p. 427) that from the two logs of such a raft as that reported from Tasmania and the *ulatoka* of Fiji, the canoe with a single outrigger and the double canoe could be derived by hollowing out one of the logs for the single outrigger or both of them for the double. This seems highly improbable.

There is also a possibility that the single-outrigger canoe was developed from a double canoe by the reduction of one hull to a float. If this were true, it would follow that the double canoe is the older type. This hypothesis might give support to the supposition that the double outrigger arose as a duplication of the single one, and the double outrigger would thus be a more recent type. We have no historical evidence for the priority of either type of outrigger.

Another possibility is that single and double outriggers originally had no evolutionary relation to one another, but that they had independent origins and developed

on separate lines. This does not preclude a subsequent modification of the double into the single outrigger in some localities.

In connection with the comparative study of outrigger canoes it is interesting to find that in Colombia, South America, canoes are fitted with an outrigged balance (Hornell, 1928). The simplest type occurs in the craft which ply between the mainland and the island of Gorgona. It consists of a balsa log on each side of the hull, lashed at each end to the hull; the center of each log is lashed to one end of a short pole (*barrote*) laid across the hull to which it is secured; a chunk of balsa wood is interposed between the *barrote* and each balance in order to hold the middle of the balsa permanently depressed to the proper level. At Charcas the balsa logs are tied in true outrigger fashion to the outboard ends of two stout bamboo outrigger booms. The balsa logs are depressed a few inches below the gunwale by means of the intercalation of a small disc of wood between the boom and the float, the joint being securely lashed up by stout bark-fiber straps. The booms are tied to the gunwales by cord passing over the boom and through two holes bored through the side of the hull. The distance of each float (balsa log) from the side of the canoe is only about eight inches, otherwise this arrangement is that of the typical double-outrigger canoe in almost its simplest form.

The *imbabura* of Charcas is a built-up vessel and is furnished with three booms projecting outboard eight or twelve inches on each side (Hornell, 1931, p. 347). The construction is similar to that of the Gorgona type. Paris (1841) describes a canoe at Valparaiso which had the Gorgona type of balances, but not the central boom. Hornell (1931) discusses the origin of this peculiarly primitive type of outrigger. He dismisses the obvious diffusion from Polynesia for the reason that the Polynesians must have outgrown the double outrigger at a very early stage in their migrations into the Pacific, for the double form is far less seaworthy than the single; besides, with very few doubtful exceptions, no Polynesians have been known to make use of the double outrigger within historic times. The American design is cruder and less serviceable than the simplest and rudest of Polynesian ones, for in every Polynesian outrigger the float is boomed out to a considerable distance and always rests upon the surface of the water under normal conditions. In its highest development, the American design has not passed completely out of the balance-log stage, for the float is not ordinarily immersed, coming into action only when the canoe heels over considerably. If the balanced canoe occurs in Colombia and in Chile, we may reasonably presume that it was also known at intermediate points.

There is, however, strong presumptive evidence in favor of Spanish contact as the agent in diffusion. By reason of Magellan's fortuitous choice of a northern latitude for the western part of his voyage across the Pacific, and the virtual restriction of effective Spanish power in Oceania to the Philippines, her navigators missed discovering Polynesia; thus it happened that the thousands of Spaniards, who voyaged across the Pacific in the golden days of the Manila-Acapulco treasure ships, knew little or nothing of outriggers save what they saw in Manila harbor. There existed, however, side by side with them a different type of canoe used extensively for passenger and light cargo traffic on the river and harbor of Manila. Paris (1841, p. 59) describes these as having two great bamboos attached to the sides a little above the water, which support the canoe when it heels over and prevent the water from entering when the sea is a little rough, the freeboard being low. His illustrations show that the bamboos are tied directly to the sides of the dugout, and not to booms. Paris calls this craft *banka*; the small schooner-rigged market craft of Panama is called *bongo*. Hornell (1931) writes: "Many of the

Spanish soldiers and sailors who eventually settled in America had assuredly seen service in the Philippines where they would become familiar both with the balanced canoe and the double outrigger . . . It has also to be noted that the present users of these balanced canoes are all Spanish speaking and that the majority are of mixed Spanish and Indian descent."

The inference is forced upon us that the addition of balance logs to the indigenous Indian dugout has been due to the initiative of Spanish settlers who had seen the utility of the contrivance in the Philippines. The dugout by itself is so unstable that native ingenuity might be expected to discover means to stabilize it, and this method gives one feasible origin of the double outrigger.

Hornell (1928) says:

"It is probable that the device, as originally introduced, consisted of the attachment of a *balsa* log directly to each side of a dugout. The advanced stage seen in the ferry boat and the *imbabura*, where the logs are boomed out some little distance on each side, would appear to be an improvement devised on the American coast . . . the very imperfection of the design, and the incompleteness of the invention, is of extremely great importance to us, for it is the only instance known that furnishes direct evidence towards the elucidation of the problem of the origin and invention of double outrigger canoes. It proves that, in one part of the world, the double outrigger has developed, or rather is developing, from balance logs tied to the upper part of the sides of dugout canoes. That double outriggers in other regions have had a similar origin and development is probable, but does not necessarily follow."

Recently Heine-Geldern (1932, pp. 506, 602) has pointed out that in the region of the upper waters of the Irawaddy and Mekong double-outrigged balances are fitted to river craft. The floats are of bamboo or of bundles of reeds which are lashed to very short booms laid athwart the hull. In his figure 88, a boat on the Shweli in the north Shan States has a float of two bamboos on each side; he says that such floats are intended not only to make the canoe more stable, but also to serve as breakwaters in the dangerous, rapidly rising storms of the Mekong and at the same time to act as airchambers, which keep the canoe afloat even when it is full of water.

Heine-Geldern maintains that the primitive Austronesians arose in these regions and migrated into the south of the Malay Peninsula and perhaps even into Indonesia sometime about 1500 B.C.; he further suggests that when they reached the sea they lengthened the booms and so evolved a double-outrigger canoe and that these pronounced inland people developed into the boldest navigators in the world. He also notes that the construction and sailing of rafts have developed highly in Upper Laos on the Mekong and its tributaries and that it is in this region, and probably only here within southeastern Asia, that double canoes are used.

Outrigger Booms

Number of outrigger booms

In the East African region, southern India, and Ceylon there are only two booms, though in India occasionally there may be only one (Hornell, 1920-d, p. 161).

Toy canoes with a single outrigger and but one boom are not uncommon. Hornell has seen them in northwest India and Mauritius, and used by Malay boys in Singapore. They have been recorded from the Maldives, Borneo, Yap in the Carolines (Müller), Palau and the Gilberts (Krämer), and Nauru (Hambruch). (See Haddon, 1920, p. 82 for these references.) Hornell (1919, figs. 1, 2) illustrates a degenerate type of single outrigger with but one boom, as does Noote-

boom (1932), from the north coast of middle Java. Another example of a single boom, but with a double outrigger, is a model from the Pasig River, Manila (Haddon, 1920, figs. 30, 31).

In Indonesia, south of a line passing north of Borneo, Celebes, Halmaheira, and Ceram the outriggers almost invariably have but two booms, whereas north of that line they usually have four, rarely more, sometimes three, and occasionally only two booms. The early Dutch voyagers in the East Indian seas frequently represented large sailing war vessels with three booms, though two was the normal number for small boats.

Two straight booms are found in the Palau, Marianas, and typically in the Caroline groups. Characteristic of the Marshall Islands canoes are two straight booms, on each side of which are three curved booms which are attached to the float. A simpler form of the same general type with three curved booms, one below and one on each side of the two straight booms occurs at Nonuti in the Gilberts (Haddon, 1920, fig. 29). A single boom is found sporadically in Micronesia, but probably only in toy canoes (Haddon, 1920, p. 82).

Throughout Polynesia the canoes commonly have but two booms, though formerly in the Marquesas there were several and in New Zealand the Moncks Cave float shows that there were three booms in that canoe. More than two booms are found (coexistent with the two-boom type) in Tonga, Samoa, Tokelau, and the Ellice Islands, doubtless due to contact with Fiji, directly in the first two areas and indirectly in the last two. We are not in a position to say how the multi-boom arrangement was acquired in the Marquesas and in New Zealand, but a Melanesian source seems indicated.

In Melanesia and New Guinea all the canoes have a single outrigger with the partial exceptions of Nissan, Geelvink Bay, a Louisiade model, and the Torres Straits area, to which North Queensland (except the Cape Bedford type) may be added. In these places where the outrigger is double there are but two booms.

Characteristic of Melanesia is the employment of three or four booms, but there are only two true booms in the Santa Cruz Islands. The canoes with a double-U attachment in San Cristoval and those with stick connectives at Wanderer Bay in Guadalcanal have only two booms. The "Buka platform" consists essentially of two booms between which are several similar spars. In Nissan, the *kop* has two booms with a direct tied attachment and the *tsine* has two to four booms, more frequently two, with varying simple and Y-stick connectives. In northern New Britain the canoes have two booms with a double-U attachment, but in some canoes there is locally a loop attachment. In the south and at the western end of New Britain the two booms have undercrossed stick connectives.

In New Guinea canoes there is a variable number of booms. On the north coast from Cape D'Urville eastward to Cape Nelson most canoes have two booms, though in the large sailing canoes there may be as many as four booms; all canoes from Cape D'Urville to Huon Gulf have undercrossed stick connectives. From Huon Gulf to Cape Nelson, the two booms have two pairs of undercrossed sticks combined with simple stick connectives. In Collingwood Bay there are usually three booms with vertical or overcrossed stick connectives. In Goodenough Bay there are three booms with either convergent stick connectives or two pairs of undercrossed sticks. In the Massim, Central, and Gulf Divisions of Papua there is a variable number of booms, usually from three to ten with undercrossed pairs of sticks, except in the Keapara area where there are clamp connectives and the booms are forked. The large canoes of the D'Entrecasteaux and Trobriand Islands appear to have a greater number of booms than the canoes of other parts

of the Massim area. In the Delta Division of Papua the canoes have no outrigger. In the estuary of the Fly and in Torres Straits there are two booms with vertical or slanting, adpressed stick connectives.

The foregoing facts seem to indicate that canoes with two outrigger booms may be regarded as the most ancient type and, whether they have double or single outriggers, the attachments consist of vertical, slanting, adpressed, or converging sticks. When there are more than three or four booms, the attachment most frequently consists of two pairs of undercrossed sticks. We may therefore come to the conclusion that canoes with several outrigger booms and undercrossed sticks belong to a later period than the other type.

FORKED BOOMS

In the Maty Islands there are usually four booms of which the two outer booms typically have a forked ending, either a natural branch or more often a bent stick which is lashed to the boom (fig. 2). In other canoes all the booms are forked, or, more rarely, they are simple. For each attachment there are two, or rarely three, pairs of undercrossed sticks; the fork or the stick added to the boom passes below the crossings. In the Hermit Islands the four booms, or in some cases three, are attached to the float by four or more pairs of undercrossed sticks. A spar underlies and is lashed to the boom for half its length, then bends down and passes under the crossings of the connectives; it may therefore be considered as a fork added to the boom, comparable with the added fork of the Maty Islands.

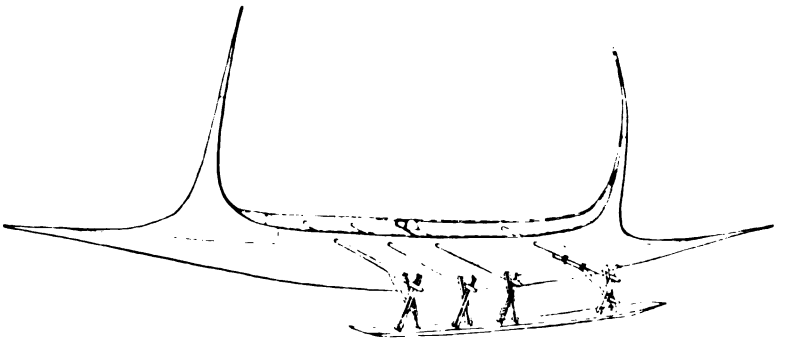


FIGURE 2.—Forked booms with two pairs of undercrossed stick connectives, Aua, Maty Islands (after a photograph by E. W. P. Chinnery).

Forked booms characterize the whole of New Ireland, except the extreme north; the following localities may be considered in this respect as one province: the Tabar and Lihir Islands, east of New Ireland; Blanche Bay, Gazelle Peninsula, and Watom Island, northeast of New Britain. At the southern end of New Ireland all the booms appear to have a clamp connective. Throughout the rest of the province it is usual for the outer booms to have a stanchion, that is a ⊥-shaped connective, and the inner booms to have a clamp connective; but even so far west as Lemusmus, opposite Dyaul (Sandwich Island), all the booms may have clamp connectives.

In Papua there are two areas on the south coast in which forked booms are found. In the Keapara area which extends from Tupuselei to Keapara the canoes typically have six forked booms, but they may range in number from four to ten. Each attachment consists of two vertical sticks, one on each side of the fork, to

which they are lashed (fig. 3). As the upper ends of the sticks are frequently lashed together, this may be described as a clamp connective. In the Gulf of Papua from Orokolo eastward the canoes usually have five booms with forked ends. The attachment consists of one pair of undercrossed sticks, with the stem of the boom usually passing above the crossing and the branch below it, but the reverse is not uncommon. It has been recorded that in many canoes from Cape Cupola to Lakekamu River the fork is lashed to the side of one crossed stick below the crossing.

FIGURE 3.—Forked booms with parallel stick or clamp connectives, Tupuselei, Keapara area, Central Division, Papua (photograph by Kathleen Haddon).

The Cape Bedford type of canoe, northeast Queensland, has four to eight twin booms (two booms lying close together). The attachment consists of one pair of undercrossed sticks. One element of the twin boom passes above the crossing and the other below it. Although this arrangement is not, strictly speaking, a forked boom the final result is similar. If the added spar of the boom of the Hermit Islands canoe were prolonged so as to arise from the hull, an arrangement comparable with the Cape Bedford type would arise.

FIGURE 4.—Double outrigger canoe, *kop*, with two booms and direct lashed attachment, Nissan (drawn by Georg Friederici).

ATTACHMENT OF FLOAT TO BOOMS IN OCEANIA

DIRECT ATTACHMENTS

Lashed Attachments

This type is very widely but sparsely distributed throughout Indonesia, which may indicate that it is an ancient form. It is interesting to note that it crops up in various lake and river canoes where its appearance may mean that it is an old type or simply that in those calmer waters it suffices for the needs of the fisher-

folk. It is significant that this type is very prevalent in the Sulu Islands and in the southern and central Philippines.

The direct lashed attachment (with a single outrigger) alone occurs in south India and Ceylon. It is very rarely found in western Oceania, where it is associated with a double outrigger of two booms as in the *kop* of Nissan (fig. 4) and the Archer River and Claremont types of Cape York Peninsula, Queensland. There are three uncertain records of its occurrence at Geelvink Bay and another at Waigiu, northwest New Guinea. A solitary canoe with a single outrigger was seen by Haddon at Buniki, Bamu estuary, Papua, to which no importance can be attached. It is found universally in the Hawaiian islands (fig. 5); it has been recorded from the Marquesas (in a model); Easter Island (with a single or with a very doubtful double outrigger); and the outer Tuamotus, but there is a mixed attachment in the inner Tuamotus.

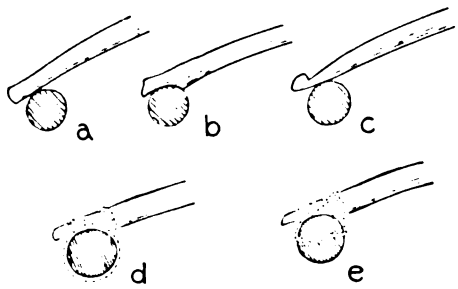


FIGURE 5.—Direct lashed attachments of outrigger boom to float, Hawaii: *a*, *b*, *c*, three forms of boom ends; *d*, fastening of boom to float by passing lashing around float; *e*, fastening of boom to float by passing lashing through transverse perforation.

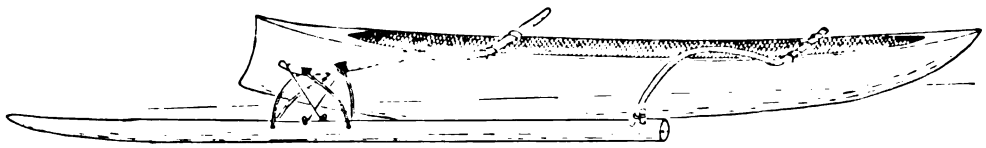


FIGURE 6.—Mixed outrigger attachment, Raiatea, Society Islands.

The slender after boom in the canoes of Tahiti and probably in those of other islands of the Society group has a direct attachment. It may be (1) lashed to the float, (2) directly inserted into the float, or (3) lashed to a peg driven into the float (fig. 6). There are several variations of these three methods of attachment (Buck, 1929, pp. 200-204); the method employed is apparently a matter of individual preference. We would suggest that the third method may be a modification of the first. In the Archer River type of the double-outrigger canoes of Cape York Peninsula, Queensland, there is a direct lashed attachment to the two booms, but to keep the lashing from slipping, a peg or nail is inserted at that spot into the float to which the boom is also lashed. A tendency for the lashing to slip may have led to the employment of the peg in the Society Islands, but here the fore boom always has stick connectives, so the utilization of a peg is obvious.

In the Ellice Islands most canoes have booms with a downwardly projecting branch, the end of which appears to be inserted into the float but actually is lashed to two or to three small pegs. In some canoes the boom, instead of being branched,

is straight and a bent spar is scarfed and bound onto the boom as a substitute for the branch (Haddon, 1920, fig. 33, *d*). Grimble (1924, p. 123) records an "exactly similar" attachment and added bent spar "in the extreme southerly islands of the Group [Gilbert Islands]—Tamana, Arorae and Nikunau". The Ellice attachment is thus very similar to type 3 of the Society Islands.

Inserted Attachments

The direct inserted attachment appears to be most prevalent in southern Polynesia. There are records of such an attachment in Tutuila, Samoa; it is found in all the Cook Islands except Aitutaki and in Rimatara of the Australs; in Rarotongan canoes and in some of the smaller Samoan canoes (fig. 7) the straight boom has a downward-directed branch, the end of which is inserted into the float (Buck, 1929, p. 184); the same type is found in the Society Islands for the aft boom.

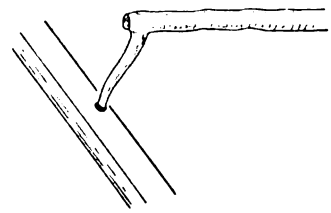


FIGURE 7.—Direct inserted outrigger attachment, Tutuila, Samoa (after Krämer, 1906).

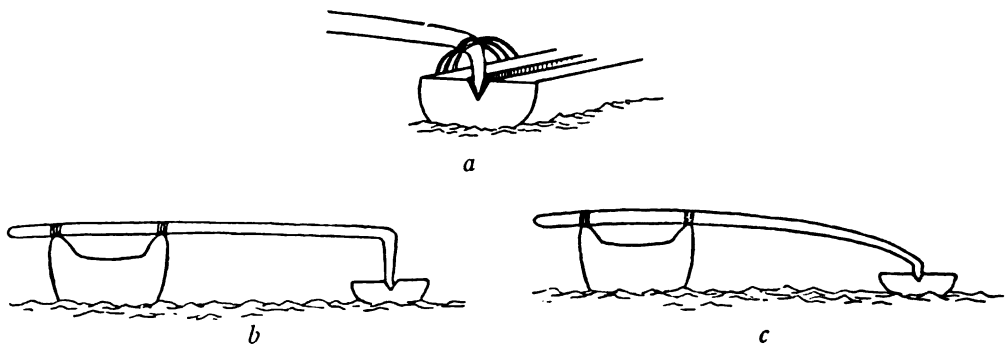


FIGURE 8.—Direct boom attachments, Eromanga, New Hebrides: *a*, attachment of boom to float; *b*, straight boom with right-angled bend (most common form); *c*, boom with downward curve (after Humphreys, 1926, p. 157).

The peculiar arrangement at Eromanga, New Hebrides, seems to be allied to one form of the Rarotongan attachments, but the bent-down ends of the booms fit into a groove in the float and the booms are kept in position by lashings from the angle of the boom to holes bored in the inner gunwale of the float (fig. 8). Hornell (1920-c, p. 136) records the inserted attachment for Madagascar on the authority of a model of a psuedo-double-outrigger canoe, but this instance is doubtful.

On the whole, direct attachments are marginal in distribution. The lashed attachment for both booms of a canoe is now found only in the Hawaiian islands, where it seems to have come from the Philippine Islands; the type has spread southward to other groups of islands in Polynesia where it is confined typically to the aft of the two booms and then only in some canoes. The inserted direct attach-

ment appears to have spread throughout southern Polynesia from the west together with stick attachments, and it also is confined to the after of the two booms of the canoes.

The bent spars which are directly attached to the float in Nonuti, Ponape, and Marshall Islands canoes, like the outer poles of the Santa Cruz craft, are not attached to the hull but to the sides of the outrigger platform. It is by no means certain that these spars can be regarded as true booms, comparable with the curved booms of the Hawaiian canoe.

The lashed type is the more common and widely spread and probably is more primitive than the inserted type.

INDIRECT ATTACHMENTS

When the freeboard of the hull of a canoe was heightened in any way the efficacy of the direct attachment of straight booms to the float was impaired, but this could be obviated by introducing an indirect attachment of some sort. In the Colombian balanced canoe (p. 20) the balsa logs or floats are depressed below the gunwales by the intercalation of a small disc of wood between the boom and the float; by this means an incipient indirect attachment is constituted.

There is a great variety of indirect attachments in which the connectives are either inserted into the float or lashed to it.

Connectives Inserted Into the Float

Stick or stanchion connectives are absent from the African and Indian areas and also from Indonesia except in the marginal Andaman and Nicobar Archipelagoes.

There appears to be no strict uniformity in the attachments of canoes in the Andamans. Most frequently an attachment consists of one pair of undercrossed sticks and one vertical stick, but in some canoes the two sticks converge over the boom; the third vertical stick may be present or absent. In the Little Andamans (Haddon, 1920, fig. 11, *c*) there are two vertical sticks on one side of the boom and one on the other. The boom may also be tied to the float at the attachment by a lashing or brace.

In the Nicobar Islands single-outrigger canoe (*duc*) with two booms, the attachment consists typically of a double set of three sticks (*heneme*) which are inserted into the float (*hentaha*) and lashed to the boom (*deia duc*) in such a way that two sticks generally cross each other below the boom, while the third may be vertical or oblique, and may be fore or aft of the boom. One set of three sticks diverges from the other away from the median line of the float. In some canoes there is also a central pair of undercrossed sticks inserted vertically between these two sets. In a model, one set consists of two sticks, which are almost parallel and converge slightly over the boom, and a third oblique stick. Haddon (1920, p. 85) gives additional details.

It is interesting to find that many of the arrangements of stick connectives met with in Melanesia and Polynesia occur in these two groups of small islands on the northwestern margin of Indonesia.

There are several different types of stick or stanchion connectives in Oceania, the details of which are fully described in volumes 1 and 2, but the following synopsis gives their several distributions.

1. Two or three vertical or slanting, usually short sticks lashed to one or both sides of the boom. This type is found in the Batavia River and the Cape

York areas of northern Queensland and apparently was employed in Torres Straits in former times. It is characteristic of many of the marginal islands; in Rennel, Sikaiana, Ontong Java, Nukumanu, Kilinailau and Nissan (if Nissan be included as one of the marginal islands) it is found in conjunction with other types of connectives. In Taku, Tanga, and Nuguria (fig. 9) it is the sole method of attachment, as perhaps it is in Ndai. This may be an ancient type.

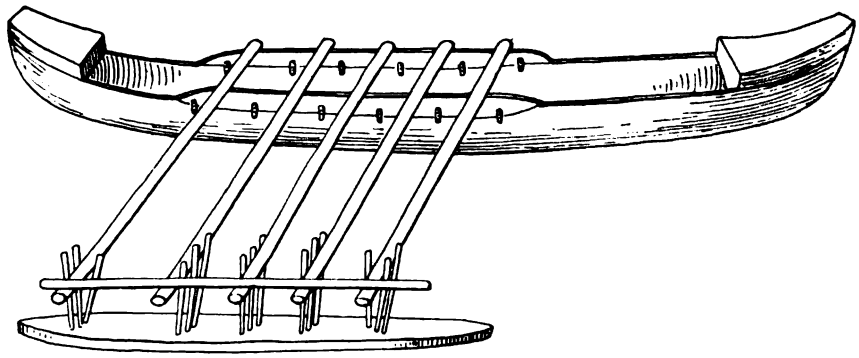


FIGURE 9.—Vertical stick connectives, Nuguria (after sketches by E. W. P. Chinnery).

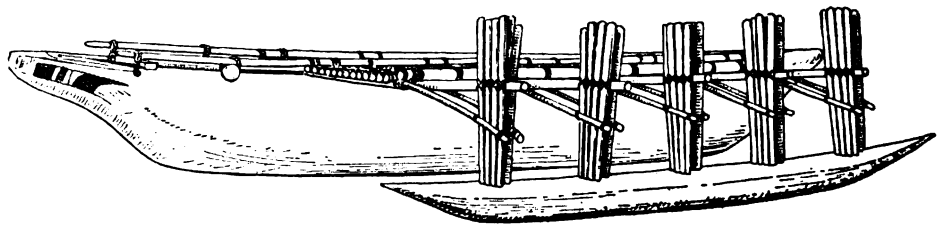


FIGURE 10.—Vertical paired stick connectives clamped by two spars, Kaniet (after Thilenius, 1903, pl. 20).

2. Parallel sticks. A pair or several pairs of parallel sticks or stanchions which may be vertical or slanting, each pair adpressed to the boom. This type is found in the western Carolines, but in the Truk and Mortlock Islands the two sticks diverge from each other, which may be regarded as a variant of the parallel type. In Kaniet there are several pairs of parallel sticks, and on each side of a boom is a spar which is attached to the hull in the same manner as a boom; the boom passes between two rows of vertical sticks and the spars clamp them lower down from the outside (fig. 10). In the small islands of northeast Malekula, and apparently in Ambrym, there is a special arrangement of several pairs of oblique parallel connectives (fig. 11). Parallel sticks are combined with overcrossed sticks in Bellona, Rennel, and Anuda. On the north coast of Papua from Cape Nelson to Huon Gulf, a pair of parallel sticks is combined with two pairs of undercrossed sticks. In Torres Straits, at Mawata, and in the estuary of the Fly, southwest Papua, some canoes have two pairs of parallel sticks, one pair diverging from the other. The clamp connective is the sole type in the Keapara area of the south coast of Papua and in south New Ireland; in central New Ireland and in Blanche Bay, Gazelle Peninsula, New Britain, it is associated with a stanchion connective. The clamp connective is always used in conjunction with a forked boom. Parallel sticks are found in the Andaman and Nicobar Islands associated with other types of stick connectives.

3. Convergent or overcrossed pairs of sticks. Convergent connectives are typical of Torres Straits, Mawata and the estuary of the Fly; they reappear at the mouth of the Wuwu River, Hercules Bay, a short distance west of the northern boundary of Papua, where there is the same complicated arrangement that is characteristic of the estuary of the Fly (fig. 12). Overcrossed sticks are found in

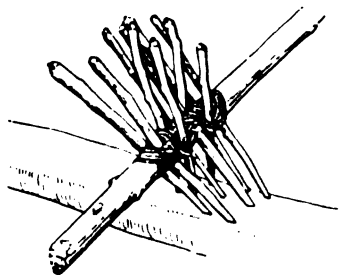


FIGURE 11.—Slanting parallel stick connectives, Atchin Island, northeast Malekula (after a photograph by John Layard).

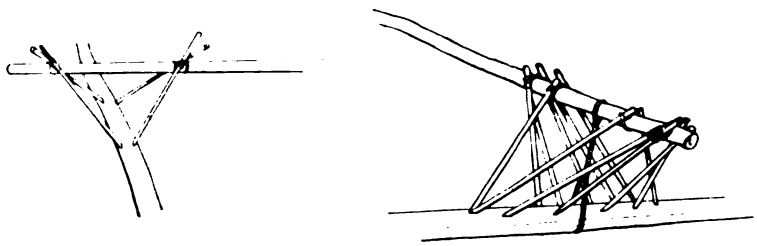


FIGURE 12.—Single overcrossed and complex adpressed stick connectives, estuary of the Fly River, Papua (sketched in 1914).

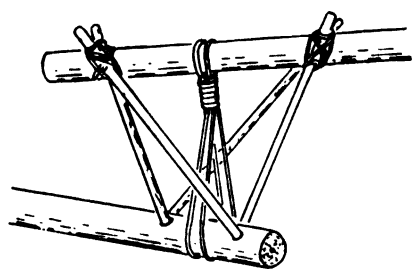


FIGURE 13.—Overcrossed stick connectives, Samoa.

the Bismarck Archipelago only in Jacquinot Bay, southeast New Britain, where they are very long. They predominate at Rennel, Bellona, Tikopia, and Anuda and constitute the primary attachment at Santa Cruz. This type is also found in Tangoa, an islet south of Espiritu Santo, and in Pentecost, and is characteristic of the southern New Hebrides from Aneityum to Aniwa.

Convergent or very slightly overcrossed connectives are found in Fiji and Samoa (fig. 13) and are the more common and probably the older of the two methods of attachment in Tonga. The same type was employed in New Zealand (ancient float found in Moncks Cave) and occurs in Rotuma, Niue, Tokelau, Manihiki, the inner Tuamotus, and in the Society Islands for the fore boom only.

It was the method employed in the Marquesas (fig. 14) until fifty or sixty years ago, when a new system was introduced which eventually replaced it. It is found with other types of stick connectives in the Andaman and Nicobar Islands. As the general distribution is marginal, we assume that this type was introduced into Oceania before the undercrossed connectives.

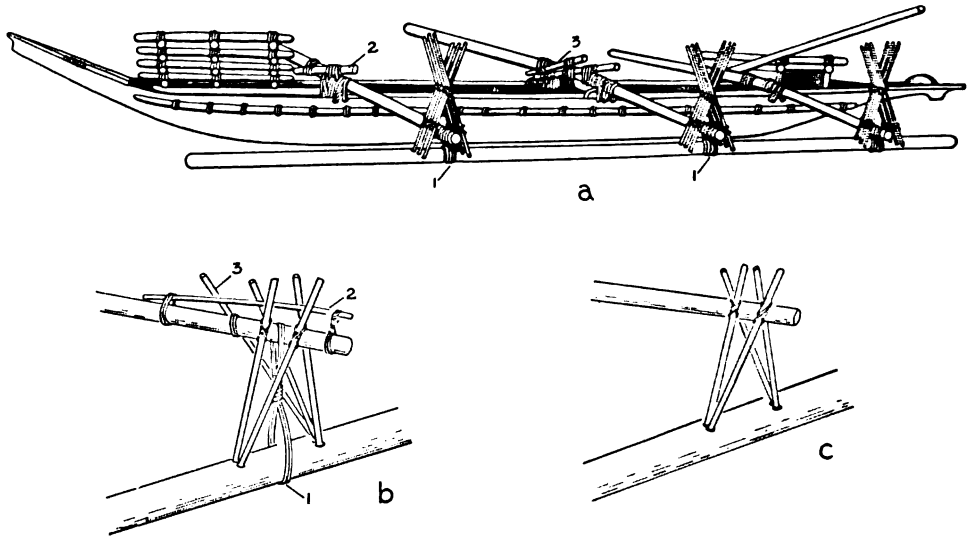


FIGURE 14.—Overcrossed stick connectives, Marquesas, ancient method of attachment. *a*, Nukuhiva canoe (after D'Urville, 1846, pl. 52, fig. 1), remarkable for low level at which booms are attached; number of paired stanchion connectives probably three to each boom: 1, vertical sennit brace around float supplementing each attachment; 2, 3, Spanish windlass. *b*, old form of attachment (after K. von Steinen, 1928, vol. 3, 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.*

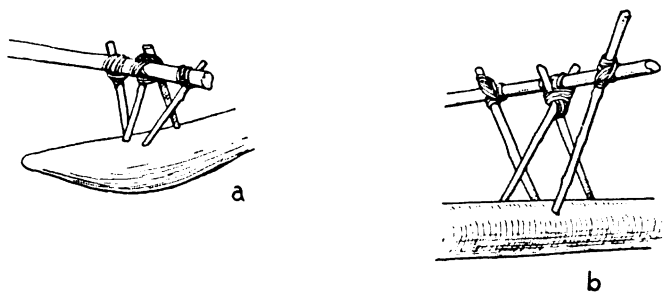


FIGURE 15.—Slanting stick connectives, Central Division, Papua: *a*, Delena; *b*, Port Moresby, single pair of undercrossed connectives with accessory slanting sticks.

4. Undercrossed pairs of sticks: (*a*) One pair of sticks: south coast of Papua from Orokolo in the Papuan Gulf to just east of Port Moresby (fig. 15, *b*): in the Gulf area the booms are forked, one branch passing above and the other below the crossing of the connectives; in the Cape Bedford type of north Queensland, the end of one of the twin booms passes over and the other below the crossing of the connectives. Model of a double-outrigger canoe from the Louisiades with two simple booms. (*b*) Two pairs of sticks: northern coast of New Guinea from

* In line 3 of the legend appended to fig. 21, p. 35, vol. 1, the word "probably" is to be deleted as (*b*) model came from Fatuhiva whereas (*c*) came from Nukuhiva.

Cape D'Urville to the north of Huon Gulf, except in the Dallmann Harbor district. From Huon Gulf to Cape Nelson the undercrossed stick connectives are combined with a pair of vertical sticks. The undercrossed sticks begin to reappear in Goodenough Bay and are universal in the Massim area and in the Mailu area, which extends from the middle of Orangerie Bay to Cape Rodney. Maty Islands, usually with a forked boom. Extreme west of New Britain and along the south coast to west of Jacquinot Bay; Blanche Bay and Watom Island, Gazelle Peninsula. Mota and Ureparapara (fig. 16) in the Banks Islands. New Hebrides: Espiritu Santo;

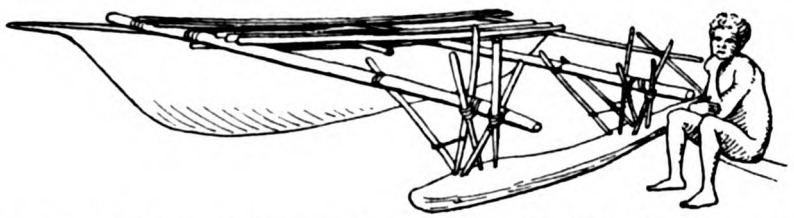


FIGURE 16.—Undercrossed stick connectives, Ureparapara, Banks Islands (after Speiser, 1923, pl. 63, fig. 3).

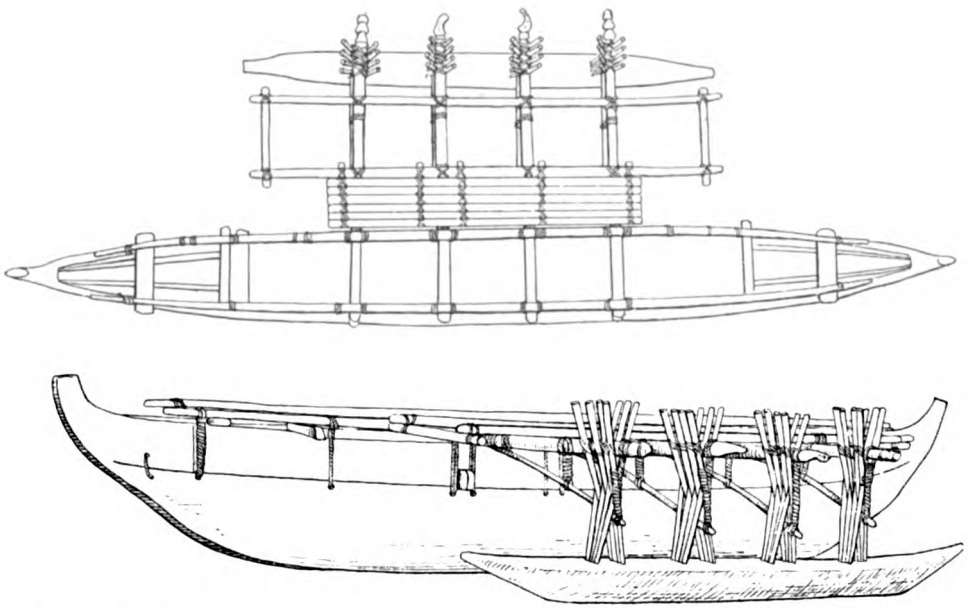


FIGURE 17.—Undercrossed stick connectives with fork added to boom, Hermit Islands (after Thilenius, 1903, pl. 15).

Oba; in Pentecost the attachments are irregular (slanting sticks, overcrossed and undercrossed sticks); Uripiv Island off the northeast coast of Malekula, south and southwest Malekula; and Efate. (*c*) More than two pairs of sticks: northwestern islands of the Bismarck Archipelago: Ninigo; Hermit Islands, with a spar lashed to the under side of the boom to form a fork which passes below the crossings of the connectives (fig. 17); Admiralty Islands. North coast of New Guinea in the Dallmann Harbor district and the Le Maire Islands.

An attachment of undercrossed sticks is characteristic of most parts of the eastern half of New Guinea; it is found in a few places in the Bismarck Archi-

pelago and in the Banks Islands and northern New Hebrides. The north Queensland example is undoubtedly a relatively recent arrival, its marginal position having no special significance. Undercrossed sticks are sometimes found in the attachments of the canoes of the Andaman and Nicobar Islands. With the doubtful exception of Nukuor in the Carolines undercrossed stick connectives are absent from Micronesia, and also from Polynesia.

5. Forked stick or Y connective and the branched connective. The base of the connective is inserted into the float, but in Nauru and the Gilbert Islands the base is expanded and lashed to the float. The diverging arms are usually lashed to the side of the boom but in some cases the boom rests in the axil. The Y stick has been discussed by Haddon (1918). It is characteristic of Sikaiana, Ontong Java (Luaniua), and Nukumanu, and is one of several types of connectives in Nissan.

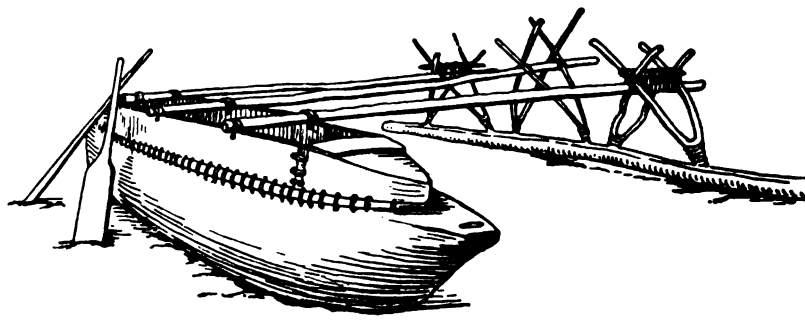


FIGURE 18.—Convergent Y-stick connective, Loyalty Islands (after Sarasin, 1929, pl. 8, fig. 2).

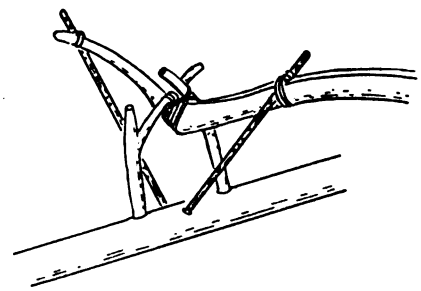


FIGURE 19.—Branched attachment, Huahine, Society Islands, boom lashed beneath crossed arms of H frame.

In New Caledonia and the Loyalty Islands the attachment consists of the two Y connectives that converge over the boom (fig. 18); this convergence of two Y connectives is not found elsewhere and it may be due to the influence of Tongans who have two U connectives that converge over the boom. This distribution suggests a spread from Micronesia to New Caledonia by way of the marginal islands. Some canoes of Astrolabe Bay, north coast of New Guinea, have an attachment of two converging Y connectives, and the boom rests within their forks. Forked connectives are unknown elsewhere in New Guinea so that their occurrence in Astrolabe Bay points to a special cultural drift.

In Huahine, the easternmost of the leeward group of the Society Islands, there is an attachment consisting of two branched connectives; the fore boom usually rests on the crossing of the branches of the sticks and thus lies midway between the stems of the sticks; in some canoes the boom is lashed below the crossed

branches (fig. 19). Hornell (1930, p. 90) says that the essential features of this type of connective "are seen nowhere else except in stray examples that have found their way to Tahiti, taken over by the Huahine native." Buck (1929, pp. 195-198) describes and illustrates three varieties of this type which he saw in Tahiti: a pair of branched connectives, the branches of which cross (1) over the fore boom or (2) under the boom, or (3) a single elbowed connective, the boom resting on the horizontal portion and the upturned free end supported by a vertical stick to which it is lashed. In some canoes paired or single slanting stick connectives are used in conjunction with these attachments. In many canoes the main attachment consists of a single or more usually of two pairs of sticks which converge at the fore boom though they do not cross over it to a visible extent; this is the original type which is similar to the attachment of all the booms in the canoes of Samoa. The aft boom has a direct attachment. We suggest that the Huahine branched-stick connective is a local mutation and has no necessary connection with the branched or Y stick of Micronesia and Melanesia.

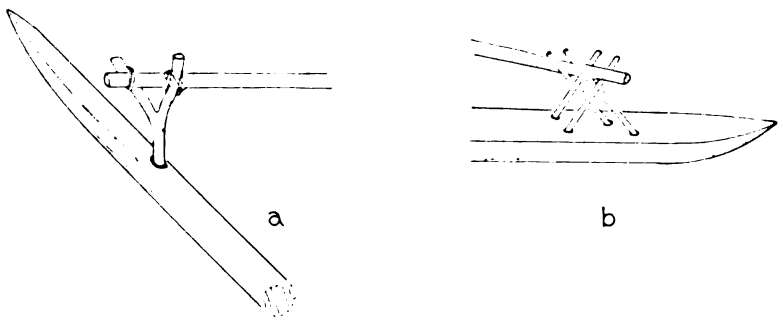


FIGURE 20.—Outrigger attachments, Aitutaki: *a*, modern Y form; *b*, traditional undercrossed stick type (after Buck, 1927, 1929).

Buck (1927, p. 266) refers to the Y connective used in Aitutaki in which the boom passes between the forks and is lashed to both of them (fig. 20). He also states that this form was used in Manihiki (1929, p. 214), but in his monograph on Manihiki (1932, p. 147) he does not refer to it, saying that the old form was by "four straight pegs". Buck (personal communication) states that his information concerning the presence of the Y connective in Manihiki was obtained in Rarotonga where he wrote the article on outrigger attachments (1929). Later, on visiting Manihiki, he found that the Y connectives were not used there, but he inadvertently omitted correcting his previous error in his subsequent work (1932). That the "four straight pegs" was the normal method for Manihiki receives confirmation from an examination of the old model of an outrigger canoe, the only one in existence, in the Peabody Museum, Salem, Massachusetts.

The Y connective has not been recorded for Indonesia. Formerly in the Moluccas some of the larger boats had a double outrigger with three stout, straight booms, each of which was supported in a deep notch in a short vertical board which apparently was inserted into the float, an arrangement which has been termed a "Y-board attachment" (Haddon, 1920, p. 87, fig. 12, taken from De Bry, title page, pls. 12, 16, 1601). Valentijn (1724, p. 363) shows these boards as lashed to the floats of Moluccan vessels. There is, however, no direct evidence that the Y stick was derived from the Y board, though the crutch connective may have been, and the forked stick may have been derived from the crutch.

6. Spike connective. This type is confined in Oceania to Geelvink Bay, northwest New Guinea, where the boom is pierced by the spiked connective (fig. 21).

A single rod or stanchion connective for the aft boom and a direct lashed attachment for the fore boom is characteristic of Madura and the Bawean Islands north of the east end of Java (Haddon 1920, pp. 92-94). Apparently the rod normally passes through the boom and is inserted into the float, but in some canoes it may be lashed to the boom. A perforated boom is found, according to Anson, in the Marianas and in model canoes from the Maty Islands.

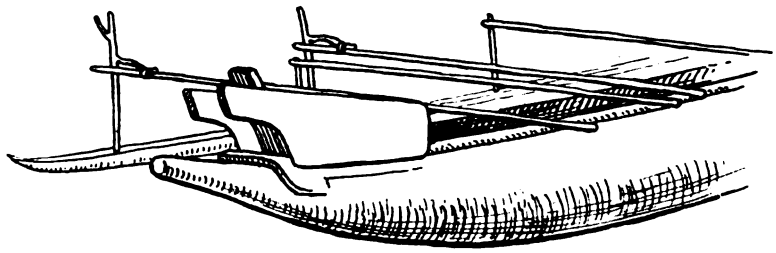


FIGURE 21.—Spike connective, Ansus, Geelvink Bay (after a photograph).

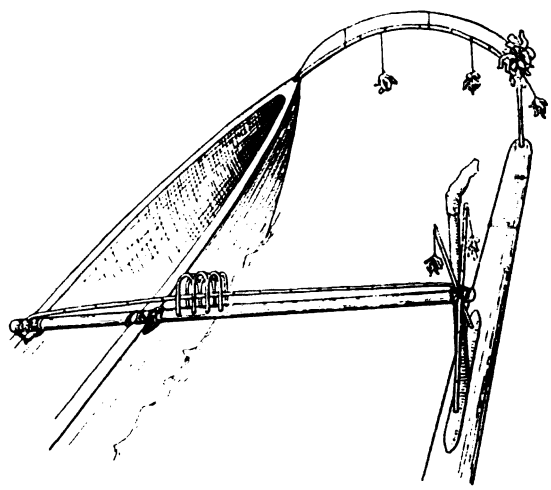


FIGURE 22.—⊥ connective, north coast, New Ireland (after Schellong, 1904, p. 179).

7. Accessory unpaired sticks or stanchions. There are one or two unpaired sticks associated with paired undercrossed sticks in various areas in Papua and with Y sticks or other forms of attachment in certain islands in Melanesia. They serve to strengthen the attachment but otherwise do not appear to have any special significance.

Connectives Lashed to the Float

1. A ⊥-shaped stanchion which is lashed to the boom and float is common in north and central New Ireland (fig. 22). Usually it is confined to the outer booms, the inner ones having a clamp connective, but in the north of the island and in New Hanover it is the only connective. It is subject to certain complications.

Paris (1841, p. 91) illustrates a *corocore* at Port Dorey, Geelvink Bay, which has a ⊥-stanchion connective, but it was certainly a visiting vessel. Müller (1912,

p. 244) states that at Sangir (Talaut Islands, between Celebes and Mindanao) the fore and the aft booms of the double-outrigger canoes have a direct attachment to the double floats, whereas the central booms have a ⊥ connective, the base of which is tied to the double floats. Riedel (1866, pl. 27) illustrates a sailing vessel of Tenimber or Timor Laut with a double outrigger which apparently has a somewhat similar connective for each of the two booms.

Until further investigations have been made in Indonesia it is not possible to trace the wider distribution of this peculiar connective.

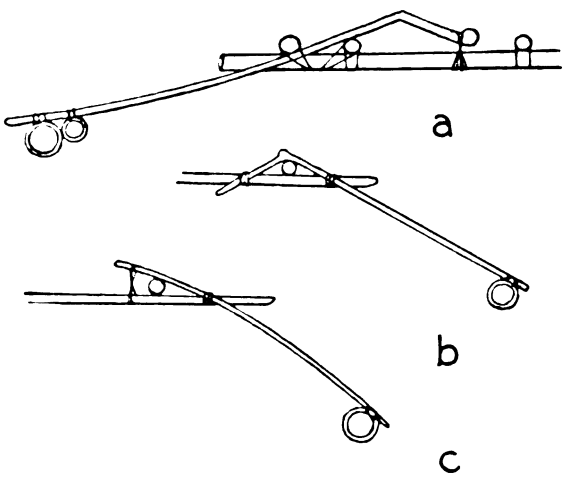


FIGURE 23.—Elbow connectives, northwest New Guinea: *a*, Saonek; *b*, *c*, Waigiu (*a* after Friederici, 1912, fig. 30; *b-c* after Hornell, 1920-a, figs. 15-16).

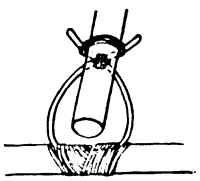


FIGURE 24.—Loop withy connective, Kaliai, northwest New Britain (after a sketch by V. H. Sherwin).

2. The elbow connective which also is lashed to the boom and float has been fully described by Friederici (1912), Hornell (1919, 1920-a), and Haddon (1920). Its occurrence in the extreme northwest of New Guinea (fig. 23) is certainly due to direct, local, and doubtless relatively recent Indonesian influence. The Boro Budur sculptures prove that the elbow connective was used in Indonesia some 1,200 years ago.

3. The withy or withe connective, of which there are three varieties, is of special interest.

(a) Loop, undercrossed. This type consists of two loops side by side for each attachment; the boom rests upon the crossing of each withy (fig. 24). This type is found only in northwest New Britain among the Kombe, Kaliai, Wariai, and Sahe.

(b) Double-U, undercrossed. This type consists of a pair of U withies which cross over each other; a short stick is usually laid over their crossings, upon which the boom rests (fig. 25). This type occurs along the north coast of New Britain and in the Witu Islands.

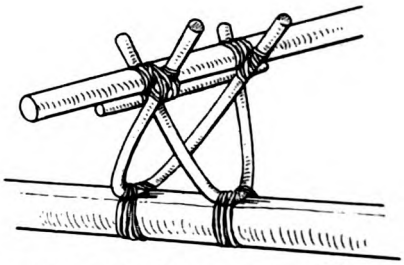


FIGURE 25.—Double-U undercrossed withy connective, Witu, northwest New Britain (after a sketch by V. H. Sherwin).

(c) Double-U, overcrossed. This type is found in San Cristoval, the southernmost of the Solomon Islands, and, together with the adpressed or overcrossed stick attachment, in Tonga (fig. 26). In these two areas the U connectives cross over the boom and in Tonga the withies are not directly lashed to the float but to two pegs inserted into it. In Tonga, this attachment is characteristic of the *tafa'anga* and is used in about fifty percent of the smaller canoes of the present day. All the old voyagers illustrated only stick connectives, so it would seem that the double-U was not the original Tongan attachment, but was introduced comparatively recently.

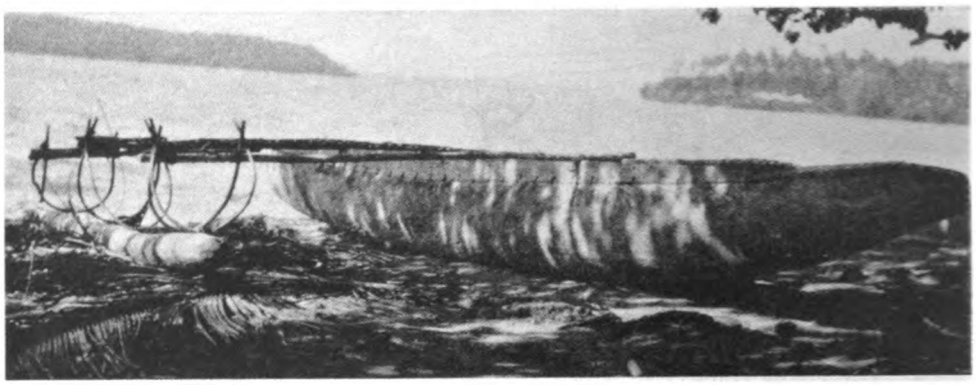


FIGURE 26.—Double-U overcrossed attachment, Vavao, Tonga (after a photograph taken in 1925).

There can be little doubt that these connectives are variants of the bent rattan connective of the Moluccas (from Halmaheira to Wetta and from Buton to the Kei Islands). This was termed the "Moluccan attachment" by Friederici (1912, pp. 235, 242), but we now call it the "withy attachment"; its distribution and varieties have been noted by Haddon (1918; 1920, pp. 89, 109, 129). Friederici believes that this attachment was carried to western Oceania by part of his Alfuran migration, though the double form does not occur in Indonesia. It appears to mark the route of a definite and probably somewhat late cultural drift.

It is significant that indirect attachments lashed to the float have a very limited distribution in Oceania. As the elbow connective extends only to the extreme northwest of New Guinea, we may infer that this type developed in Indonesia after all the great migrations thence into Oceania had taken place, and that its arrival in this corner of New Guinea is relatively recent.

MIXED ATTACHMENTS

What we have termed "mixed attachments" are those where both the direct and indirect methods of attachment have been used together in the same canoe to connect the float with the booms. They are not common, but in a few instances where they occur each type has a wide local distribution; it is noteworthy that in Polynesia and Micronesia this is associated with the elimination of those types which rely exclusively upon the employment of only one of the two methods of attachment.

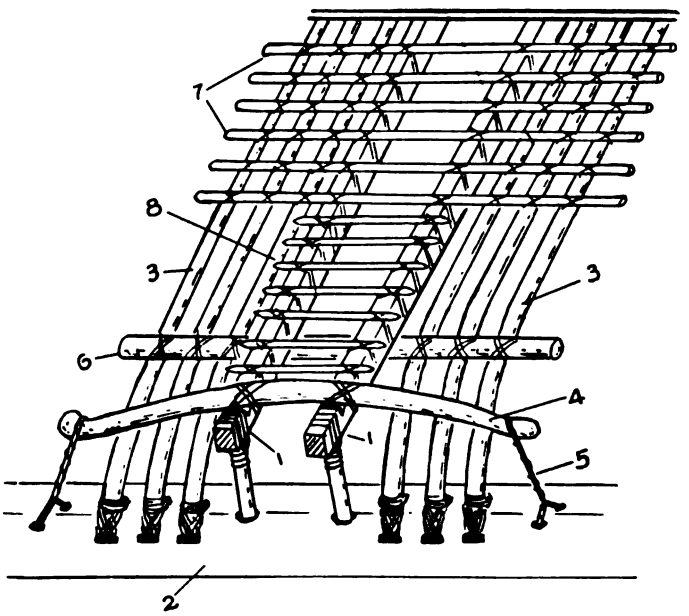


FIGURE 27.—Mixed outrigger attachment, Marshall Islands: 1, two main booms, straight, with vertical stanchion supports inserted into ridged upper surface of float (2); 3, two sets of three curved accessory booms attached to float by lashing passed through V-shaped holes; 4, yoke lashed athwart main booms, 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.

In Polynesia mixed attachments occur in the Society Islands, the northwestern Tuamotus, and latterly in Rapa and some of the Australs. All are the same general type, with the mutational exception of Huahine where the fore boom is connected with the float by means of overcrossed stick stanchions, whereas the after boom is attached directly.

In Micronesia a highly complicated mixed attachment is universal among the canoes of the Marshall Islands. Figure 27 illustrates the way in which the main and primary straight booms, connected with the float by straight stanchions, are strengthened on each side by a set of three curved accessory booms, having the

ends attached to the float by lashing passed through V-shaped holes in its upper surface.

In Nonuti and Tapiteuea, Gilbert Islands, the people have borrowed this type from the Marshall Islanders, in a somewhat simplified form.[4] Both in the Marshalls and the Gilberts the curved booms are purely secondary, for their inner ends do not cross the hull as do true outrigger booms.

In Indonesia a method somewhat similar to that of the Marshalls for augmenting the strength of the main booms is strikingly shown in certain of the sculptured figures of outrigged sailing ships upon the walls of the Buddhist stupa of Boro Budur in Java. In the largest of these (Hornell, 1920-a, fig. 1), a compound float is supported by three pairs of mixed booms, each pair made up of one straight and one curved boom.

The Indonesian, Micronesian, and Polynesian examples do not appear to have any mutual relationship. The first two are to be considered merely as two different, locally invented methods of solving the problem of how to strengthen the original booms to make them stand successfully the exceptional strains to which they may be subjected during stormy weather.

No such reason serves to explain the origin of the Polynesian mixed attachments. Outrigger canoes in that region were never so heavily masted and rigged as to make it impossible for a well-fitted, homogeneous outrigger attachment to withstand the ordinary stresses experienced during an ocean voyage. The significance of its mixed design is rather to be understood by reference to the geographical situation of the Society Islands where it originated, whence it spread south to Rapa and the Australs, and northward and eastward to the nearer islands of the Tuamotus. To the westward of the Society Islands lies an extensive Polynesian area (Tonga and Samoa) and a far greater Melanesian one where the characteristic and dominant type of outrigger attachment is by means of paired sticks or stanchions, usually overcrossed. Conversely, the islands to the northward (the Marquesas formerly, and Hawaii) and those to the eastward (Tuamotus) are characterized by direct attachment. The Society Islands are thus on the boundary between two outrigger "cultures" and in consequence have compromised by adopting a mixed or hybridized design, which has incorporated the good qualities of each—the strength conferred by the overcrossed stanchions of the fore boom attachment and the elasticity of the slender after boom, attached directly to the float.

Although a mixed attachment, as here defined, can not be said to be found in Melanesia and New Guinea, there are a few departures from uniformity that may be mentioned.

In the canoes of the Duke of York Islands and Blanche Bay, Gazelle Peninsula, New Britain, the fore and the aft attachments consist of a stanchion lashed on to the float, while the intermediate booms have a clamp connective inserted into the float; in most canoes the booms have forked ends. A somewhat similar arrangement is found in the Lihir Islands to the east of New Ireland where the fore and the after stanchions are lashed to the float and the intermediate ones are inserted into the float.

There are sporadic examples of two types of stick connectives occurring in the same attachment and for all the booms of the canoe. In Bellona and Rennell the attachment of many canoes consists of pairs of overcrossed and parallel sticks. The arrangement of the connectives is very variable in Nissan; there is much

[4] In the description of figure 251 (Hornell, 1936, p. 352) the curved accessory booms are said to be "inserted into the float". This should read, "lashed to the float".

irregularity in Pentecost and apparently in a few other islands of the New Hebrides. The typical attachment of the canoes of the north coast of Papua from Dyke Ackland Bay to the Waria River consists of two pairs of undercrossed sticks and a pair of vertical sticks adpressed to the boom.

Discarding the Outrigger

For practical reasons the double outrigger has been replaced by the single one in several areas, but the view that the single outrigger antedated the double form must be borne in mind.

Lane-Fox (1875, pp. 430-431; 1906, pp. 223-224) has made the following suggestion:

> In Indonesia as the dugout canoe began to be converted into a built-up vessel it acquired greater beam and depended less and less on the support of the two outriggers; these were then replaced by a balancing platform on each side, as was first noticed by Dampier (1729, p. 208) at Manila. As the vessels increased in beam the balancing platforms decreased in size and became the rude stages or balconies outside the gunwales of the larger vessels and thus they are the last vestiges of double outriggers.

We are not impressed by the view of Lane-Fox that the lateral platforms are vestiges of a double outrigger. These fittings are also found in southeastern Asia and seem there to have developed because of the necessity for an outboard platform on which men may walk when poling either a narrow canoe or one in which the hull is covered even to the gunwales with a wide penthouse roofing which prevents the crew from walking on the gunwales. Such a side platform is much used in China for the carrying of certain kinds of cargo—bamboos, firewood, and so forth.

We are of the opinion that the origin of the plank-built boats of Indonesia and Oceania which do not possess an outrigger may be sought in the increase of size in outrigger craft and not in a direct improvement of an outriggerless dugout. The stability which an outrigger affords would encourage an increase in carrying capacity by means of added strakes canted outward and when this was effected the need for an outrigger would diminish, since from its greater beam the hull would be more stable. An instance in point is the large sailing vessel of the Vahitahi area of the Tuamotus which retains the structural characteristic of the hulls of the sailing outrigger canoes formerly used there, but from which the outrigger has been discarded. Even at the present day there is in the Moluccas an *orembai* with a double outrigger, as well as one without outriggers, whereas in all the *orembai* of the Kei Islands the outriggers have been discarded; possibly the prototype of the *orembai* never had an outrigger and this feature may have been added locally.

Plank-built Boats with Inserted Frames

There are four main types of plank-built canoes without outriggers in the Solomon Islands: the *mon, ora, lisi,* and *binabina* (fig. 28).

The *mon* of Ysabel, Bougainville Strait, and south New Ireland may be double-banked, and thus is more stable than the typical *mon* of the Solomons. There is no reason to believe that the *mon* was independently invented in this region, but we regard it as a special development of some Indonesian form of a plank-built canoe, the outrigger of which had already been discarded.

Friederici (1913, p. 160) is unable to say whether the plank boat reached the Solomons with his Alfuran or Moluccan migration by Dampier and Vitiaz straits or with the Philippine migration round New Ireland. In the first case why is it

not found among the Barriai group of peoples? And in the second, why not in New Hanover (Lavongai) and north New Ireland? Neither the *orembai* nor the *mon* are good seagoing craft. On page 161 Friederici states his opinion that the plank boat came with a Moluccan migration by Dampier Strait and reached the south Solomons from Murua (Massim district, Papua).

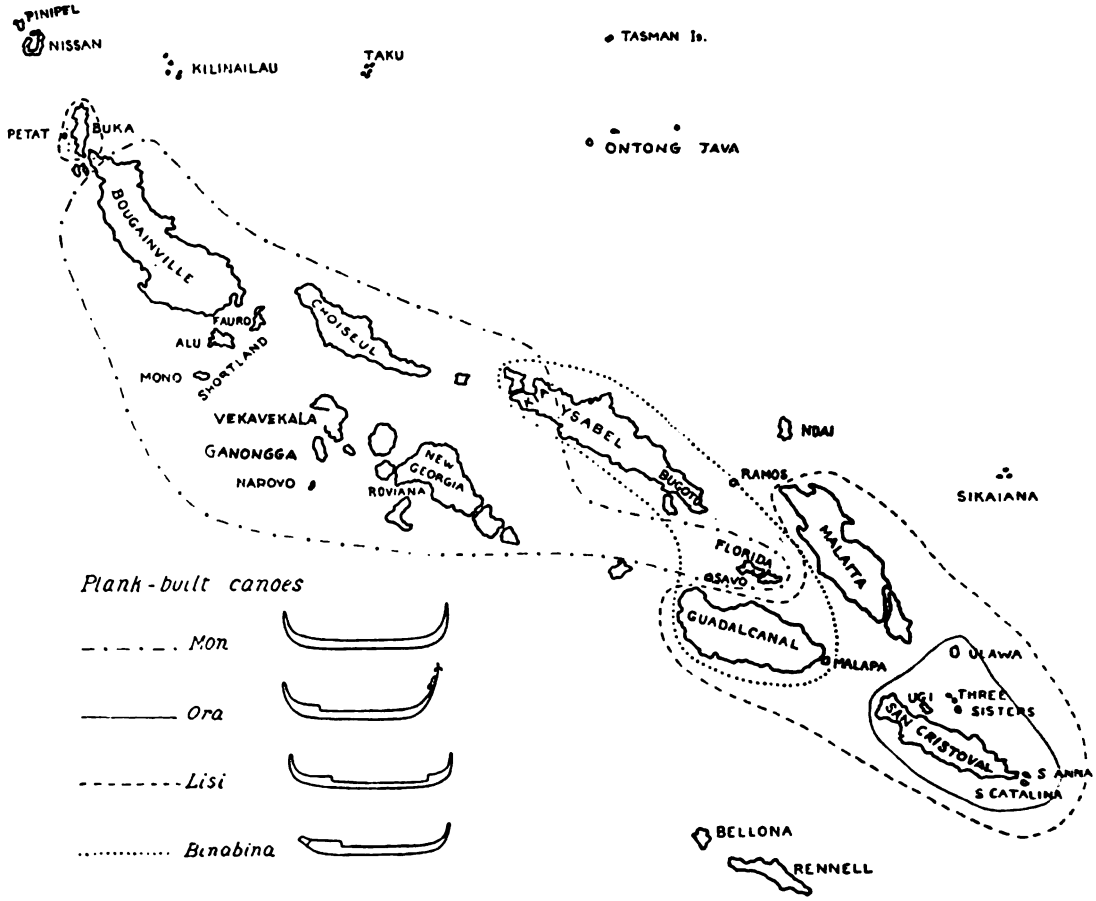


FIGURE 28.—Map of the Solomon Islands, showing distribution of the main types of plank-built canoes.

However, certain curious facts suggest that vessels used by the proto-Polynesians had frames and were plank-built, rather than ordinary dugout hulls with strakes. For example: the U-shaped inserted frames or spreaders of Hawaiian canoes tied to cleats on the inner side of the dugout hull; the V-shaped spreaders of Niue, which may or may not be sewn to the hull without cleats; the inserted ribs of large Fijian craft tied to cleats (possibly the Tongan and Samoan craft had the same prior to the adoption of Fijian designs, when, of course, they did use this device); finally, there are the true V-shaped frames of the canoes of the Tuamotus and the Gilberts, sewn directly to the hull planking. Some of the more important of these examples are truly marginal, as in Hawaii and the Tuamotus, and are thus presumably ancient, whereas the others are sporadic. But all these

instances are of outrigger canoes and double canoes; and although they suggest the former existence of a plank-built construction we do not suggest that they had anything to do directly with the *mon* type, which has no outrigger.

DOUBLE CANOES

The double canoes of Oceania have been considered in the various areas, and it need only be pointed out here that within historical times their use was universal among the Polynesians. The last one in Fiji was built in 1913. They were formerly used in New Caledonia, and are still used along the south coast of Papua from the Gulf to Mailu inclusive. A double canoe was reported for Truk (Ruk, Carolines) by Captain Morrell, and models of double canoes are still reverenced by these islanders.

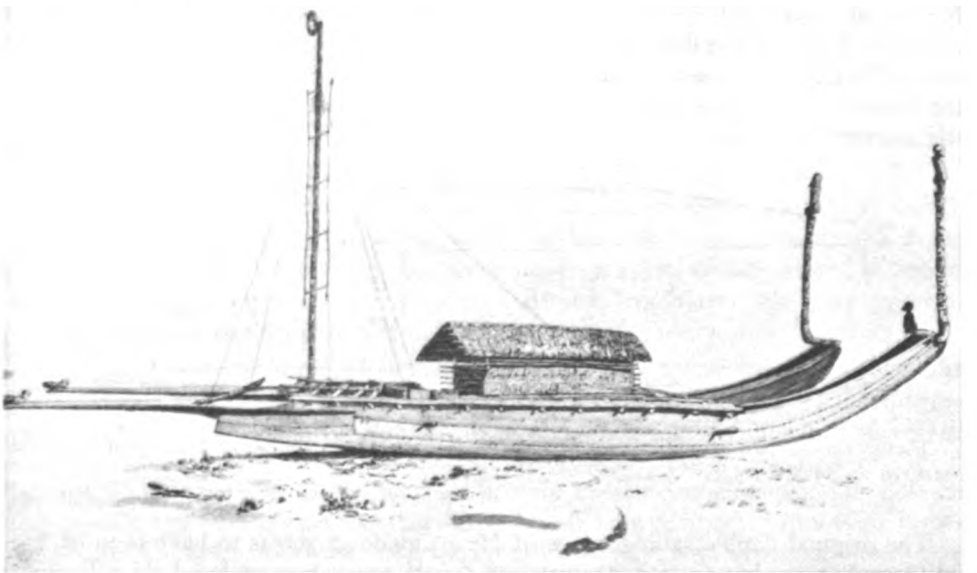


FIGURE 29.—Double traveling canoe (*tipairua*), Tahiti, Society Islands (sketched by J. Webber, British Mus., add. MS. no. 15515; best figure of this craft in existence).

There are two fundamentally different types of double canoe in Oceania: (1) those in which the hulls are equal or subequal in size, usually with the mast stepped forward of midships so that there is a definite head and stern; (2) those in which there is a disparity in size and form, with the mast stepped amidships and able to sail either end forward.

1. The first Oceanic type comprises the double canoes of Hawaii, the Tuamotus, Society Islands, Manihiki, the Marquesas, the Cook Islands, and New Zealand; it was also characteristic of the double canoes of Samoa, Tonga, Tokelau, and the Ellice Islands before these islands changed to the Fijian type in the latter half of the eighteenth century.

It seems certain that some of the Oceanic double canoes arose from the joining of two dugouts in pontoon form. To this class undoubtedly belonged the *tipairua* or traveling double canoe of the Society Islands, as two ordinary canoe hulls were usually requisitioned when wanted and lashed together at a convenient distance apart by means of cross beams or booms (fig. 29).

Two forms of double canoe were formerly used in New Zealand (Best, 1925, pp. 10, 11): the *waka hourua* consisting of two canoes fastened close together side by side, and the *mahanga*, with the hulls secured some 30 inches apart. Best also says (1925, p. 6): "There appear to have been two forms of this kind of craft [*mahanga*] . . . one . . . was a permanent type, two canoes from one foot to perhaps three feet apart being connected by cross beams, securely lashed; the other consisted of two vessels connected together in a temporary manner . . . called a *taurua*." The latter was the equivalent of the *tipairua* of the Society Islands.

2. The second Oceanic type appears to have developed in Fiji by the modification of a simple equal-hulled double canoe of the old New Caledonian type on principles adopted from the Micronesian sailing outrigger canoe, in order to enable the vessel to sail either end forward and be more handy in sailing, particularly to windward. The principal changes affected the size and shape of one of the two hulls, the position of the mast, and the type of sail employed. The ends of the second hull were made fine and pointed and the size reduced until it became functionally a float. The mast was stepped amidships on the larger hull as in Micronesia rather than between the hulls as was customary in most of the old Polynesian types; the sail rig was altered to the powerful Oceanic lateen developed by the Micronesians (fig. 30).

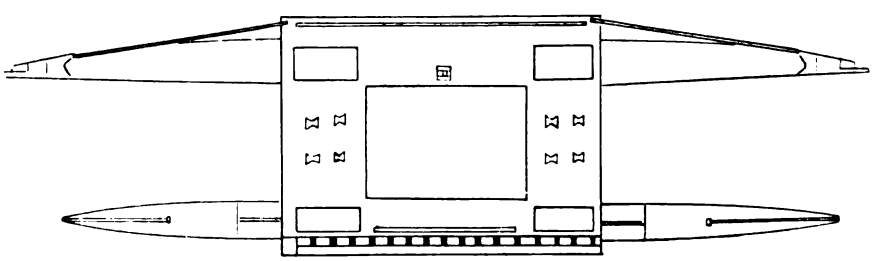


FIGURE 30.—Fijian double canoe (*ndrua*) showing mast-shoe on larger hull (plan of canoe measured at Suva, 1925).

The original double sailing canoe of New Caledonia seems to have been of the old Oceanic type, but about a century and a half ago it was replaced by a Tongan (Fijian) type.

The structure of the sailing double canoes, that almost certainly were employed formerly in the northern New Hebrides and southern Solomons, is unknown, though, as previously stated (pp. 13-15), they may have been rafts rather than canoes proper.

The hulls of the double canoes of the Papuan Gulf are usually of equal or subequal length, but rarely one may be much smaller than the other. The hulls are boomed some distance apart by several poles, which may support a platform; they are usually more massive and less carefully constructed than the ordinary canoes and are thus what the Motuans term *asi*.

The hulls of the double canoes from Port Moresby to Cape Rodney, west of Cloudy Bay, are of equal or subequal length; a few are of the *asi* type, but most are ordinary canoes.

The lumbering *lakatoi* are more like sailing pontoons than canoes, though their supports are several clumsy dugouts (*asi*) and not solid logs.

The Mailu have (1) small double canoes (*gebo*) composed of two ordinary canoes (*waona*); a platform is generally laid down over the cross-poles. Formerly they had (2) war canoes (*bobore*) built on the same plan as the *gebo* but

longer and more highly decorated and without a platform. They also make (3) a seaworthy sailing vessel (*orou*), the hulls of which are subequal in size, and the mast is stepped in the larger hull; this vessel appears to belong to a different stream of migration than that which reached southern Polynesia or that which came to Fiji.

The early voyagers record double canoes at the Tuamotus about 75 to 120 feet long and about 27 to 33 feet broad. On his second visit to Tahiti, Cook saw assembled 150 large double war canoes, 50 to 90 feet long and each carrying 50 to 120 passengers. Still larger ones had 144 passengers and a crew of 8 to 10. The large double canoe of King Kamehameha I of Hawaii was 108 feet long. The double canoes of Fiji and Tonga could hold from 200 to 300 men and a Fijian canoe built in Samoa carried 500 to 600 people. Friederici (1928, p. 32) makes an interesting comparison between the carrying capacity of these craft and that of vessels of antiquity. It is estimated that an old Egyptian ship could not take more than about 50 men. Herodotus reckoned 200 men on each large ship of the fleet of Xerxes, but this may have been too high. A large Viking ship carried 100 to 200 men; 200 would certainly be the maximum. It should also be mentioned that Europeans arrived in the second half of the eighteenth century, by which time the navigation and boat-building of the Polynesians was already declining.

An interesting account of the voyages of the Polynesians is given by Smith (1921-a), who tells how the canoes were victualed and how they traversed the ocean. That most of these voyages were undertaken in double canoes is highly probable, though large outrigger canoes were also employed. He says (1921-a, p. 125) that they could travel 145 miles a day.

The most obvious origin of the double canoe is that of two dugouts or simple canoes lashed either close together or a short distance apart. One would imagine that a contrivance so simple and practical for procuring stability and increased carrying capacity would have been adopted everywhere, but as a matter of fact it belongs almost exclusively to the Indo-Pacific area. For example, the Eskimo occasionally ties two kayaks together, though only as a temporary means of insuring stability, and on the west coast of Africa double canoes are sometimes used.

Lane-Fox (1875, p. 427) conjectures that from the two logs of such a raft as that reported from Tasmania or the *ulatoka* of Fiji, the canoe with a single outrigger on the one hand and the double canoe on the other could be derived by hollowing out one of the logs in the first case or both of them in the second. The linguistic evidence given in the following paragraphs renders it highly improbable that the double canoe arose in this manner.

There is also the possibility that the single outrigger canoe was derived from the double canoe by reducing the port hull to form a float; this hypothesis is supported by linguistic evidence. The port hull of a double canoe, which is the smaller when there is any difference, is called *ama* in Hawaii, some of the islands of the Cook archipelago, and Samoa; *hama* in Tonga; and *kuama* in the Tuamotus. Vocabularies of the Marquesas, Society Islands, and other groups give "outrigger float" as the sole translation for *ama*. Therefore we may infer that the term *ama* is employed throughout Polynesia for both the port hull of a double canoe and the float of a single-outrigger canoe. The float of the single outrigger continued to be called *ama* because it is normally on the port side. However, the name of the port hull in the Society Islands, Marquesas, Manihiki, and New Zealand must be known before definite conclusions can be reached.

The starboard hull is called *ekea* in Hawaii; *katea* in the Tuamotus, some of the islands of the Cook archipelago, and Tonga, and *'atea* in Samoa. Ray (personal communication) considers it unlikely that *katea* is derived from the Polynesian word for right hand: Maori, *katau;* Tuamotus, *kotau;* other parts of Polynesia, *atau, akau.* No separate names for the two hulls are known for Manihiki where the hulls are of equal size.

Friederici believes (1912, p. 246) that *ama* may be derived from the old Javanese *sama* ("like" or "together") in which case it may originally have been given to the second hull of a double canoe and thus its application to the float may be merely secondary. Ray (personal communication) disagrees with the suggested derivation of *ama* from old Javanese *sama.* This word is Sanskrit and is not used in Malay. The Melanesian is *saman* with a final *n,* and the final consonant drops off in Polynesian and other languages with a vocalic ending. It is found as *tam* in Micronesia. Ray thinks it improbable that the Sanskrit word for "like" would reach the far Pacific with the meaning of "outrigger float". For the use of the terms *seman, soman, sama,* and so on, in Indonesia for the float of an outrigger canoe see Haddon (1920, p. 119) who quotes from Friederici (1912).

Friederici (1928, p. 31), as well as others, has adopted the view that the double canoe of Oceania originated from a canoe with a single outrigger; this hypothesis applies to the second only of the two types of double canoe. He says that in very large canoes the float must be large and heavy in order to fulfill its function as a counterpoise, and broad so as to cling to the water; in some canoes its dimensions are such that passengers can sit on it. If such a float is further increased and hollowed out then a double canoe is obtained from the canoe with a single outrigger. He maintains that this development is proved (which we deny) by the facts that in all double canoes of our second Oceanic type one of the two hulls is smaller (but he does not take into account the fact that this was not the original type), that the smaller is called *hama* in Tonga, *'ama* in Samoa, and similar names elsewhere, which are the ordinary terms for a float, and finally that the word *kiato, 'iato,* and so forth, for the connecting poles is the usual term for an outrigger boom.

The same terms occur for the Mailu (Papua) vessel, where the slightly larger dugout, or at all events that upon which the mast is stepped, is termed *orou,* the other dugout *larima* (as the floats of the single outrigger canoes are also called), and cross poles *iado.*

The term *kiato* and its variants for booms, whether those of double canoes or of outrigger canoes, does not appear to be significant; the booms serve the same purpose in both forms and may well have a common name without this having any bearing on the problem of the origin of the double canoe. Williams (1917) gives *kiato,* thwart of a canoe (but this may merely indicate that the canoes formerly had an outrigger; the proximal part of a boom athwart the hull was used as a seat, this alone being retained along with its name); *whakakiato,* keep close together; *hiato,* be gathered together.

The foregoing hypotheses may be summarized as follows:

A two-logged raft may develop into a double canoe.

A two-logged raft may develop into a single-outrigger canoe.

A three-logged raft may develop into a double-outrigger canoe.

The double canoe may arise from the increase in size of the float of a single-outrigger canoe.

The double canoe may be made by connecting two dugouts by means of booms.

The single outrigger may originate from the diminution of one hull of a double canoe.

The single outrigger may result from the elimination of one outrigger of a double-outrigger canoe.

The double-outrigger canoe may be formed from the single-outrigger canoe by a duplication of the outrigger.

The double outrigger may be a development of a boomed-out balance on each side of a dugout.

RIGGING

Sails in Oceania

The several types of sail characteristic of Oceanic sea craft, with a few exceptions, are typically triangular. Whenever they deviate from this form there is usually evidence to show that the deviation results from modification of an originally triangular ancestor, except in a few quadrilateral sails in the New Guinea area which owe their origin to a different source.

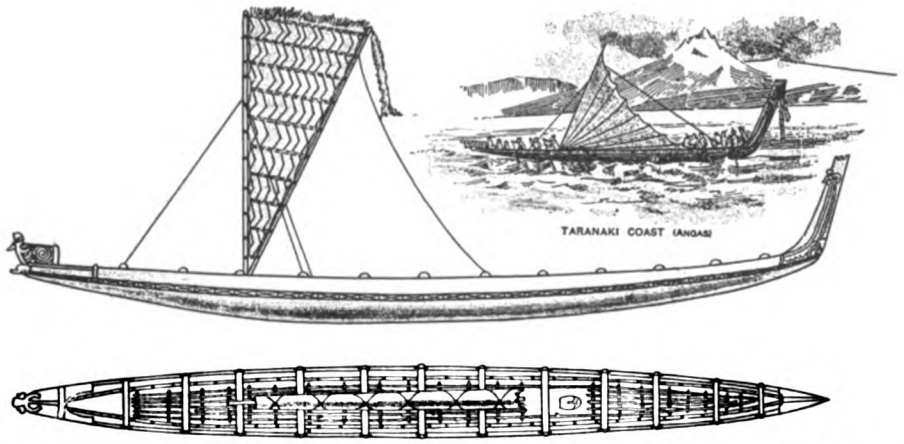


FIGURE 31.—Maori sailing canoes: sketch of war canoe under sail, carrying local variation of *raupo* mat sail, free edge vandyked, probably not fully spread; war canoe of *waka-pitau* class, Tolaga Bay, North Island, side view of canoe under sail and plan showing sail rolled around mast and lashed fore and aft amidships upon thwarts; floor grating covering whole bottom of hull except at bailing well indicated by figure of a bailer.

Triangular sails in Oceania have been derived from primarily tentative and temporary devices, formed of interplaited palm leaves, usually of the coconut palm. A good example of this primitive adaptation is that recorded by Lamont (1867, pp. 242, 243) from Tongareva. Here the butts of three coconut leaves were stepped together in the bottom of the canoe, the outer leaves divergent from the median one, with interlacing of the leaflets sufficient to hold the three together. No cordage was employed. Somewhat similar temporary sails made from one or two palm leaves have been recorded from a few places in Papua and Haddon has seen a nipa palm leaf used as a sail in a waterway of the Purari Delta.

OCEANIC SPRITSAIL

From a two-leaved form, in which the leaves diverged from the point where the two butts were stepped together in the bottom, appears to be derived that primitive form of sail which we have termed the Oceanic spritsail. Of this there are three main varieties:

1. A simple or primitive form with the two long sides bounded by straight spars, equal or subequal in length. One, which represents the mast, may either be vertical or slightly inclined to one side; the other, representing a sprit, is definitely inclined toward the opposite side. To these are tied respectively the two long sides of an inverted triangular sail, originally made of matting but later replaced by cotton sheeting or calico.

In Polynesia this was the characteristic sail of the Marquesas Islands and of New Zealand (figs. 31 and 32). It must be noted, however, that in New Zealand, the approximation to what appears to have been the orginal type of sail, used by the proto-Polynesians when they passed through Micronesia, was a consequence of degradation and not a direct inheritance. It resulted from the abandonment of overseas voyaging and the intensive use of paddle propulsion which was more suitable than a sail in long and narrow, round-bottomed dugouts with no outrigger. This is, or was, also the type of sail prevalent in the northern New Hebrides; it has been described for Atchin Island, northeast Malekula, and for Tongoa Islet, south of Espiritu Santo.

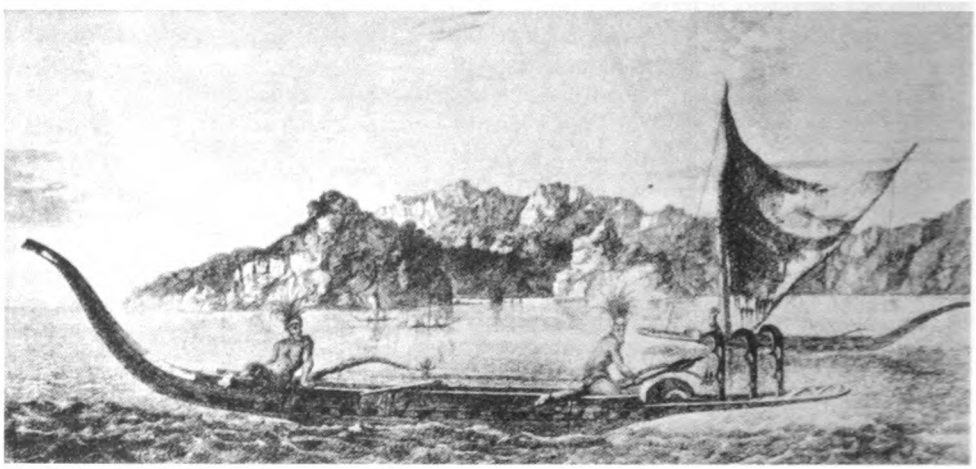


FIGURE 32.—Marquesan sailing canoe with primitive spritsail, the only extant sketch of an old type outrigger canoe under sail; drawn by Hodges in 1774 at Vaitahu, Tahuata (Cook, 1777, vol. 1, pl. 33).

2. The crab-claw spritsail, with the mast spar stepped vertically and the sprit curved throughout its length, with the peak pulled in close to the head of the mast by means of a guy. This was the only form of sail used by the Hawaiians (fig. 33). This must not be confounded with the kite-sail of the Santa Cruz outrigger canoes and the related form of lateen sail used sporadically in other parts of Melanesia. These may all be considered as specialized and rather aberrant forms of the Oceanic lateen as they are slung from the head of a separate and independent spar, which thus becomes a functional mast.

3. The boomsprit sail, in which the lower part of the sprit is stouter than the upper section and tends to lie horizontal. Usually it was separate from the upper and more slender section, the sprit proper, with connection made by means of a socket joint. This type of sail is known only from the Society Islands. As seen in figure 34 it is, or was, actually in process of convergent evolution into a quadrilateral spritsail closely akin to the European form. In its latest stage of develop-

ment it approximated so nearly to this that the Polynesians of the islands quickly appreciated the advantages of the foreign design and changed over to it; they retained, however, the boom by which they had been accustomed to extend the foot of the sail, a feature dispensed with in the true spritsail.

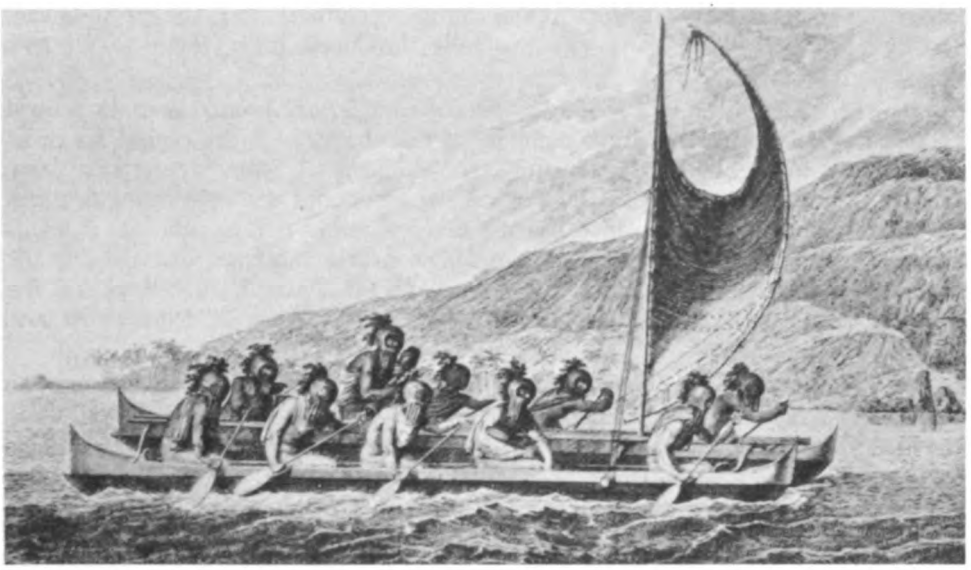


FIGURE 33.—Hawaiian double canoe with typical crab-claw spritsail (drawn in 1778 or 1779 by J. Webber during Captain James Cook's third voyage).

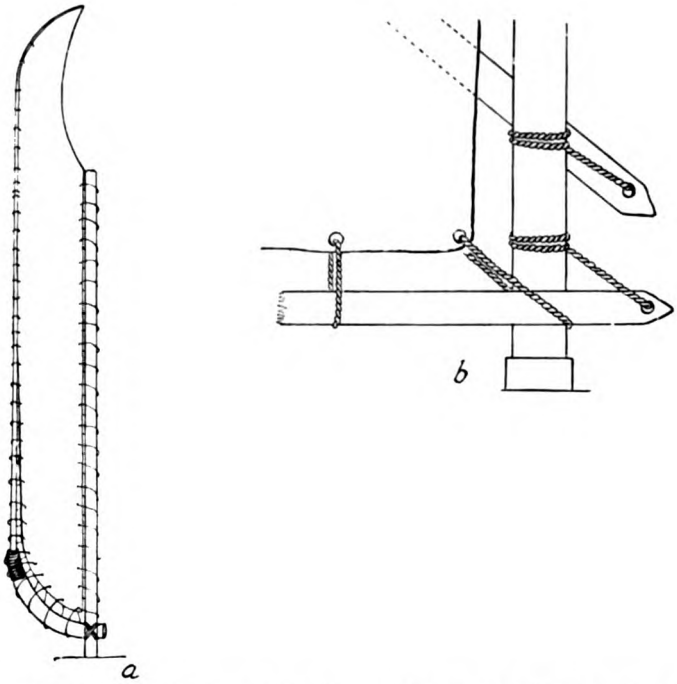


FIGURE 34.—Society Islands boomsprit sail: *a*, old form of sail as figured by Webber; *b*, details of sprit and boom attachment in modern sailing canoe.

OCEANIC LATEEN SAIL

While one line of development led from the primitive form of spritsail seen typically in the New Zealand type, to a form in the Society Islands comparable with the European spritsail, another line led toward the invention of the Oceanic lateen. This had three distinct stages in its evolution: (1) the proto-lateen, (2) the primitive lateen, and (3) the fully developed form, the true Oceanic lateen.

1. The proto-lateen sail is known today from a very limited area in central Indonesia with Bali as the focal point in its distribution. In its typical form, as seen in Bali and on the passenger and cargo sampans of Sourabaya in east Java, this rig consists of a mast, usually vertical, which carries a simple triangular sail, apex downward. The sail which has the two long sides tied to subequal poles, is slung from the mast by means of a loop passed over a short peg inserted into the masthead. (For a figure of this primitive type, see Hornell, 1920-a, pl. 13, fig. 24.) A related form is the *ndumu* rig of Fiji,[5] but this may be degenerative and not primitive in origin.

2. The primitive Oceanic lateen was characteristic of western Polynesia when Tasman and Schouten were exploring in the Tongan area. This consisted, as in the proto-lateen sail, of the primitive triangular spritsail to which had been added a supporting device in the shape of a short mast (fig. 35). Jaws at the masthead formed a crutch wherein the forward spar of the primitive spritsail rested, thereby becoming a functional yard. No halyard was present. Until the end of the eighteenth century this was the characteristic rig of the native craft of the Samoan and Tongan area; probably it was a legacy from the proto-Samoans who arrived in Polynesia at a later date than the allied proto-Polynesians whose sail was the Oceanic sprit; various considerations lead to the belief that their original Indonesian home lay south of the region whence the proto-Polynesians came.

3. The true Oceanic lateen was developed from the primitive lateen by removing the yard from the masthead crutch and slinging it from the same point by means of a halyard passed between its jaws. Probably its mast was originally stepped forward of midships but eventually it must have been found desirable to step it amidships and to add two running stays whereby the mast could be inclined at will toward either end of the vessel; this was of the utmost service when work-

[5] With reference to the remark made on page 306 of volume 1, I find that it is incorrect to liken the *ndumu* sail rig used by the Fijians to the Maori sprit-rig. According to detailed information kindly placed at my disposal by the Rev. Father Neyret of the R. C. Mission, Thawathi, the *ndumu* sail is similar to the *vakasave* sail but differs in the way it is rigged. Mast-shore, halyards, and running stays are all absent; only a single shroud is present, made fast at the lower end to the middle boom of the outrigger.

The mast, *ndumu*, is a simple pole without any kind of masthead fittings. When set it is very like that seen in the illustration of a Mangarevan catamaran (fig. 1). Indeed it may well be that it is identical. The simplicity of this rig in both instances may be considered either as representing a primitive forerunner of the Oceanic lateen or as a degenerative simplification thereof, probably the latter.

When a *ndumu* sail has to be hoisted, the tack is tied to the fore end of the hull by a short rope, *tauoko* or *tautauoko*, as in the *vakasave* rig. The free end of the shroud is then made fast close to the top of the mast and also around the yard at a point high up, whereby the yard is lashed against the top of the mast. This done, the "captain" takes hold of the mast and raises the upper end aloft until it stands, sloping obliquely forward, at the angle permitted by the length of the tack and shroud attachments. At the same time the mast-heel is dropped into a shoe set amidships on the deck. The same operation, reversed, lowers the sail; the "captain" lifts the mast out of its shoe and allows it to slide slowly down along the deck or into the water while he furls the sail loosely before laying the mast along the deck. The tack is left attached, ready against the next time the sail has to be set.

This sail is still in common use in Fiji. The fishermen of Mbau prefer it to the *vakasave* rig because of its simplicity and because by its use the *thavu* maneuver requires the services of two men only. The people of the Lau Islands on the contrary prefer the *vakasave* rig, for their canoes are generally larger and manned by a more numerous crew; they also go longer trips to sea where rough weather would make the handling of a *ndumu* sail extremely hazardous, seeing that the man who makes the *thavu* has to support both the mast and the sail whilst doing so, owing to the absence of running stays and mast-shore. When sailing outside the reefs only an exceptionally strong and skillful man can support the weight and pull of the large mat sail and withstand its violent slatting to and fro in the wind. Were he to slip on the wet deck, mast and sail would tumble into the sea, carrying the man with them. This consideration results in its virtual restriction to reef-protected areas.—J.H.

ing to windward, for, by hauling on the after stay and carrying the sail aft, the stern became the functional bow and the vessel went off on the new tack with wonderful celerity.

FIGURE 35.—Tongan double canoe (*tongiaki*) with primitive Oceanic lateen sail (from Schouten, 1619).

The true Oceanic lateen sail seems to have originated in Micronesia (fig. 36). The early navigators found it dominant throughout the length and breadth of this region, but it did not reach Polynesia until the second half of the eighteenth century, when it began to displace the clumsy primitive lateen type in western Polynesia. Cook found the change in progress when he visited Tonga in 1773, and by the end of the first quarter of the nineteenth century it was known and in general use throughout the Tongan, Samoan, and Tokelau groups. It never reached the Society Islands, but a variation, known only from a model in Bernice P. Bishop Museum, comes from Fagatau in the Tuamotus (fig. 37). As was common in this archipelago, the vessel is two-masted. Each mast is supported by an exceptionally

long strut or shore, forked at the lower end. The sail, hoisted by a halyard passing over a masthead crutch, is a modification of the ordinary spritsail, but by being slung from a short mast, it suggests that certain of the Tuamotuan Islanders were on the way to an independent invention of a form of Oceanic lateen. (For details of the peculiarities of this curious sail, see Hornell, 1936-a, vol. 1, p. 90.)

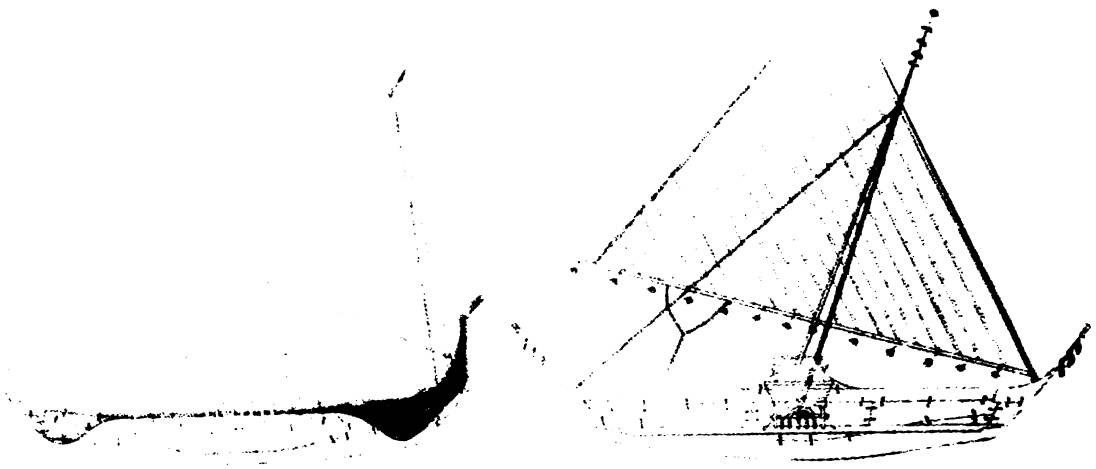


FIGURE 36.—Micronesian Oceanic lateen sail, from western and central Caroline Islands (left) and from Marshall Islands (right) (after Kubary, 1889-95, pl. 3).

The figure given by Paris of the Tuamotuan sail (Hornell, 1936-a, vol. 1, fig. 58) is based upon a description given by the natives. The description given fits the Fagatau form of sail equally well and this is presumably what his informants were attempting to explain. This suggests that the rig of the Fagatau model is incorrect in showing the heel of the yard lashed to the lower end of the mast, an error which might easily arise after the model had left the maker's hands. A similar error certainly occurred in the rigging of several models of the Manihiki double canoes.

From the foregoing it is clear that the sea craft of the proto-Polynesians were poorly equipped for sailing at the period when these people began to migrate into the Pacific. Their sails must have been of little use except with a favoring breeze. In the beginning the proto-Polynesians were essentially canoe men, when using either double canoes or outrigger canoes. They relied primarily upon their skill in the use of the paddle and upon their extraordinary powers of endurance during prolonged spells of paddling when the wind was contrary or absent. At that early time their maritime skill was probably more or less equivalent to the retrograde state into which Maori seafaring had fallen at the time when New Zealand first became known to Europeans.

The earliest form of the Oceanic lateen, the proto-lateen, appears to have been brought by the proto-Samoans from Indonesia. In Samoa and Tonga it survived in the more advanced form which we call the primitive lateen for a very long period during which time it was developed in Micronesia into the more advanced and final form. Because of the prolonged survival in Polynesia of the earlier

form, we may infer that, after the proto-Samoans arrived in Polynesia, intercourse between Micronesia and Polynesia was barred for centuries by events in Micronesia—such as the arrival in Micronesia of people hostile to the proto-Samoans.

Apart from the instance given by Lütke (1835) of a Ponape sail (see Hornell, 1936-a, vol. 1, p. 400, fig. 289), with the lateen used either in a makeshift or in a recessive condition, Micronesia, in all of its widespread area, is remarkable for the universal employment of the fully developed Oceanic lateen. No other sail was in use until outside influence began to be exercised in recent years.

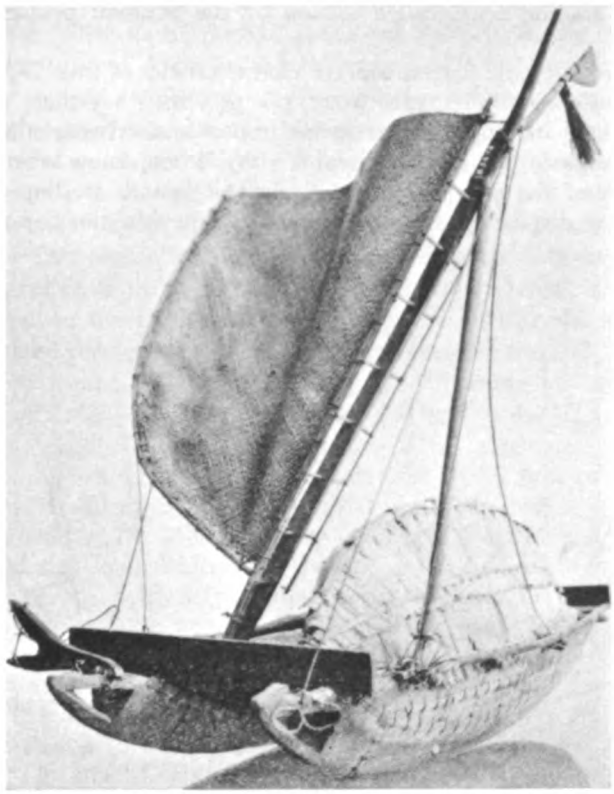


FIGURE 37.—Two-masted double voyaging canoe with Oceanic lateen sail, Fagatau, Tuamotu Archipelago, model made by native "about 1854" (B. P. Bishop Mus., no. 3474).

In Melanesia and New Guinea the use of sails is sporadic. The absence of sails in parts of Melanesia may be due to secondary causes. The absence of canoes from the Torres Islands is a striking example of the loss of a useful art. The absence of sails from the Solomon Islands need not necessarily be a primitive feature, and the replacement of outrigger canoes by various types of plank-built canoes without an outrigger must be credited to a relatively recent migration from Indonesia. Probably the reason for abandoning sails was the same as that which led the Maori of New Zealand either to abandon sail or to use the smallest size possible when they gave up the stabilizing outrigger device. The round-bottomed Solomon Islands canoe is much narrower and has less depth than the Indonesian planked boat and would be dangerous if used under sail in rough weather.

A simple or primitive form of spritsail was probably common to the Banks

Islands and the New Hebrides, where it is still found in many islands. It may formerly have had a wider extension.

The Oceanic lateen sail is found in Fiji, New Caledonia, Taku, and doubtless in other marginal islands. A modification of the typical triangular form of sail is found in the sail of the large outrigger canoes of Santa Cruz. The upper sections of the long lateral spars of the sail curve inward and the upper free margin of the sail forms a very deep bay. This is known as the "crab-claw sail" or "kite sail".

A similar sail is carried on the trading outrigger canoes of the Mailu and on the many-hulled trading craft called *lakatoi* of the Motuan peoples roundabout Port Moresby.

The triangular Oceanic lateen sail is characteristic of the D'Entrecasteaux Islands, and Jenness and Ballantyne (1920, pp. 186, 187) say that "the yard rests about half-way along its length in the forked top of a short mast that is set up in the bow" of the *waga* of Goodenough Island. We do not know whether this holds good for all craft of the group. In the Trobriand Islands trading canoes with a lateen sail are now displacing the older craft with the Massim flattened oval sail.

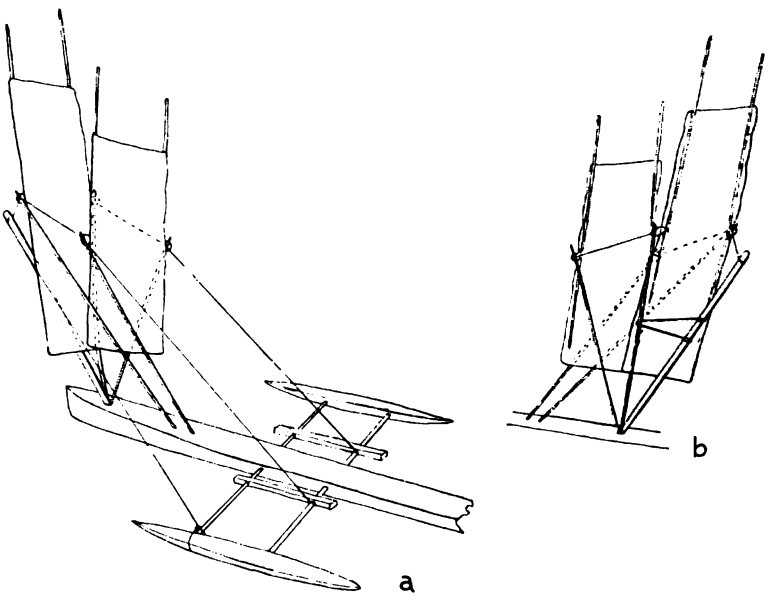


FIGURE 38.—Square sail and rig, Mabuiag, Torres Straits: *a*, seen from port side looking forward; *b*, seen from starboard bow (diagram based on temporary models).

MELANESIAN SQUARE SAIL

The square sails of the trading canoes of western New Britain have been introduced from the Siassi Islands which have cultural affinities with the neighboring coast of New Guinea. The square sails of the western Melanesian islands —the Admiralty and other islands to the west—may be due to the same series of cultural spreads that brought the square sail to New Guinea.

Sails are absent down the west and south coast of Netherlands New Guinea from about Triton Bay, 134° E. longitude, to the British boundary and thence as far as Torres Straits. They are also absent east of the Fly River to the Gulf of Papua. The canoes of the Delta and Gulf Divisions of Papua are essentially

river canoes and there is little doubt that all these coastal peoples came from the interior of New Guinea in relatively recent times, and some perhaps quite recently. The Gulf area has been visited to an increasing extent by the trading *lakatoi* of the Motuans and any sails that are found locally can be attributed to copying the sails of these visitors. There is another area without sails on the north coast of Papua from Goodenough Bay to Huon Gulf. There are also spots along the north coast of New Guinea in Mandated Territory where sails are not in evidence.

The quadrangular mat sail of Torres Straits is now obsolete; it was very tall, and each side was skewered to a long bamboo pole (fig. 38). A grommet was attached to each side pole of the sail about one third from the top, which enabled the sail to slide up and down on the backstays. On a board in the fore part of the hull were stepped two poles, which might be termed masts though they were not masts in the usual acceptance of the term. One mast slanted to port and the other was vertical or slanted slightly to starboard; a cord kept them from diverging too far apart. A guy passed from the head of the port mast to an outrigger boom. A backstay passed from the head of the port mast and through the port grommet to be fastened to an outrigger boom. Another backstay passed from the head of the starboard mast, through the starboard grommet, and was held by a man who stood on the platform of the canoe. In setting the sail the two backstays were passed through their respective grommets of the sail, which was pushed into position by means of two bamboo struts. When the sail was home, only the strut on the port side was retained. A sheet was tied to the starboard lower corner of the sail and made fast to the first thwart of the platform. When there were two sails one was behind the other and both were in the bow of the canoe.

A rectangular sail of matwork was used until very recently on canoes and on some of the *lakatoi* by the Motu-speaking peoples of Port Moresby and other places on the coast of the Central Division, Papua. Each side of the sail of a canoe was attached to a vertical spar or pole by a series of loops of a light rope, not by a continuous lacing. There was no fixture for stepping the spars; when the sail was set the spars were simply allowed to stand in the bottom of the hull. The use of the sails and spars was purely temporary and there was no fixed mast. The windward spar was secured by a long fore-and-aft stay and lower down by a strong stay fastened to an outrigger boom. The lee spar had a sheet tied about halfway up. The small temporary sail seen by Macgillivray (1852, vol. 1, p. 257) in the Brumer Islands evidently was of this type.

At the extreme southeast end of Papua a temporary oblong rectangular sail is made on occasion by interplaiting two coconut-palm leaves. Usually there is some kind of mast which, in some canoes, is supported by a mast-shore. There are variations in the method of setting up the sail. In one type in Goodenough Island, one side of the tall vertical sail is fastened to an improvised simple mast. In another type on the extreme south of the mainland the quadrangular sail is rigged with a yard and boom and a temporary mast. In yet another type of this sail there is an approach to an Oceanic lateen rig. It seems evident that in this region there was once a very primitive kind of sail, perhaps of the Port Moresby type, which has been influenced by the later introduced square sail and Oceanic lateen sail which were rigged in a more or less permanent manner.

The flattened oval or rounded oblong sail is found throughout the Massim area with the exception of the D'Entrecasteaux Islands; it may be regarded as a variety of the quadrangular or square sail. There is no reason to suppose that this type of sail has any immediate connection with the sails just referred to,

except in the extreme southeast of Papua where the primitive rectangular sail has been modified by the rounded oblong sail (fig. 39).

We suggest that part of the distinctive Massim culture was brought by Melanesian-speaking colonists from some area in which a typical, well-rigged, square or oblong sail was in common use. Such a sail with a permanently stepped mast is found at the extreme end of the Huon Peninsula, the Siassi and other islands, whence it has spread to the western portion of New Britain. The same type of sail characterizes the north coast of the Mandated Territory of the New Guinea mainland, the adjacent islands, and western Bismarck Archipelago. We are not at present in a position to assert that the Massim culture spread from these northern areas, though there is reason to believe it may have.

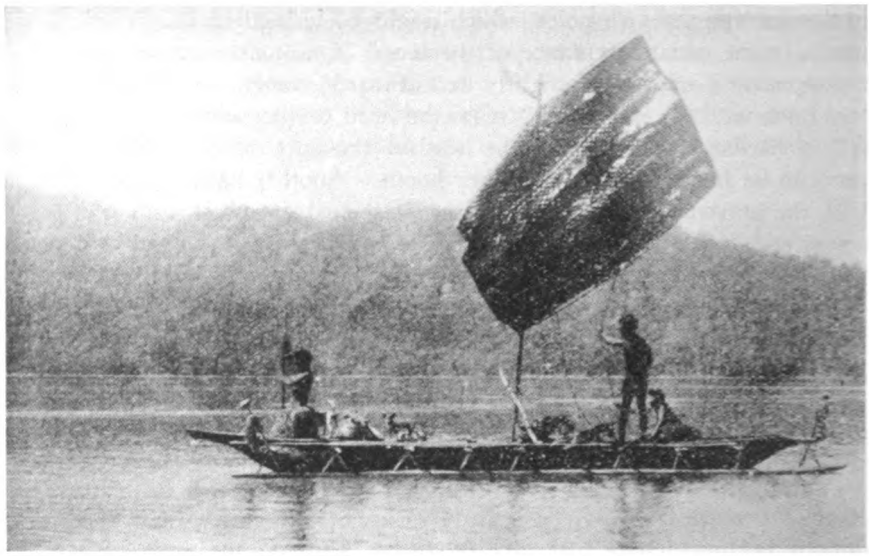


FIGURE 39.—Oblong sail, Daui, Massim area; interplaited coconut leaf sail fastened to a yard and boom and rigged in typical Massim manner (photograph by W. E. Armstrong).

OCEANIC MASTS

The variations in mast form and arrangement in Oceania were as great as those in sail form. In the most simple type, seen in the Maori craft of New Zealand, the mast was merely the stouter of the two divergent sprits; in the Marquesas this changed into a vertical pole mast. In double canoes there were frequently two masts, sometimes tandem, sometimes abreast; both positions appear to have been used in the Tuamotus and Manihiki. In all instances where a single mast was used it was stepped well forward.

When the earliest form of the Oceanic lateen was invented as an improvement upon the simple form of spritsail, the position of the mast-step continued to be restricted to forward of the mid-length of the hull. This mast in Oceania was short and stout; it raked forward and was crutched at the summit (Tonga and Samoa until the end of the eighteenth century). This in turn gave place to a midships position, whereby the mast could be raked toward either end of the hull as required (Micronesia and Fiji; Tonga, Samoa, and the Tokelaus from the end of the eighteenth century).

Usually this midships mast, hoisting an Oceanic lateen, was supported on one side by a shore or strut seen characteristically in all the groups named, and in an experimental manner in the Fagatau model already referred to (p. 50). It is noteworthy that in all these instances as well as in most of those where other forms of sail were employed, the mast was not stepped in the bottom of the hull but was stepped either on a pivot on one of the booms or, more generally, on the deck (Fiji, Samoa, Tonga, Society Islands, Tuamotus, and Hawaii); in Micronesia it was stepped in a socket on the gunwale or outside it.

The most noteworthy aberrant forms were those where a ladder-like fitting was added to the mast proper, as happened occasionally in the Tuamotus and the Society Islands, and those rare instances where the mast is the tripod form characteristic of eastern Indonesia at the present day and formerly of Java and Sumatra. The range of this tripod mast in Oceania is curiously discontinuous. One series of occurrences is confined to the northern section of Netherlands New Guinea, from Waigiu to Geelvink Bay. The second has been reported in two islands off the southeast coast of New Guinea. As tripod masts and oblong sails are the common rig of Moluccan vessels trading to Waigiu and other parts of northwest New Guinea, their occurrence there is readily accounted for; this explanation is scarcely adequate to account for the extension so far to the east as Wari (Teste Island) and Coral Haven in the Louisiades.

Macgillivray (1852, vol. 1, p. 204) describes the mast-leg of the tripod mast at Coral Haven as being stepped in a shifting board in the bottom of the canoe; Powell (1883, p. 10) says the mast-leg of the Wari canoe was stepped on the bottom of the canoe and that the other legs rested on the outrigger. So far as we are aware these are the only two records of a tripod mast in the Massim area and no drawing of them has been published. It may safely be inferred that this type of mast was brought by an unknown culture drift from Indonesia which was probably so small that it can hardly be termed a migration.

RELATIVE SEQUENCE IN THE INTRODUCTION OR INVENTION OF OCEANIC SAIL RIGS

There can be no doubt that when the proto-Polynesians entered the Polynesian area from Micronesia, probably soon after the beginning of the Christian era, their vessels were rigged with simple triangular spritsails. The presumption is strong that the type was closely related to that found by Cook in the Marquesas Islands. Its evolution into the more advanced forms, characteristic respectively of Hawaii, the Society Islands, and some of the Tuamotus, was certainly effected within these islands, where they were found by eighteenth-century navigators.

The true Oceanic lateen was already fully developed and widely established in Micronesia in the sixteenth century, while the primitive form of this lateen from which it had been evolved, was the only rig in use in the Tongan islands and their dependencies about the same time.

Both forms are absent from Indonesia where they are represented by the proto-lateen sail in Bali, Madura, and eastern Java as already described. The type is, however, comparatively local and would have little importance were it not that it represents the earliest phase in the evolution of the primitive spritsail into the Oceanic lateen.

It may be taken as reasonably certain that the Oceanic lateen in both its later forms was developed from the Indonesian proto-lateen after the migration of the proto-Samoans from the Indonesian area, consequent upon an influx of people from the mainland of Asia using a quadrilateral sail and either a tripod or a sheer mast.

From the simplicity of the spritsail designs of Hawaii, the Society and Marquesas Islands, it is clear that a better type of sail was never developed successfully in these localities; the nearest approach to something better was the curious rig of the Fagatau model already mentioned. Further development was probably due to the proto-Samoans who may have brought the proto-lateen sail with them from Indonesia. Later they seem to have improved it into a primitive lateen resting in a masthead crutch. This may have occurred in Micronesia, whence it spread to Tonga and Samoa.

The next change, whereby the sail became provided with a halyard giving it a flexibility wanting in the older type, also took place in Micronesia where eventually it was the only kind of sail in use, for we have historical evidence that this type did not reach Tonga and Samoa until the third quarter of the eighteenth century. It reached these groups by way of Fiji, which apparently borrowed it in turn from the Gilbert Islanders at a much earlier date. The new design rapidly ousted the older by reason of the facility it gave for tacking, whereby the vessel was enabled to beat to windward when this was necessary. Before this, the old Tongan rig was good only when the wind was favorable; whether a vessel with an old rig could tack is doubtful. Cook considered that it might be possible although a difficult and clumsy operation, whereas Thomson (1908, p. 295), who had more opportunity than Cook to write authoritatively, holds that if the wind changed there was nothing to be done but to run before it, wherever it might lead. Thomson considered that this was the reason for so many Tongans being cast away on remote islands and for the populating of outlying islands in the Melanesian areas by Polynesians and the mixture of Polynesians with Melanesians.

The Tangaroans seem to have exerted no influence upon the sail rig of the people whom they conquered in Polynesia. It is not unlikely that they found their predecessors in possession of a type of sail superior to their own.

Quadrangular mat or leaf sails without masts, used by the Torres Straits Islanders and by the Motu-speaking peoples of Papua, may be regarded as very early types, as there is no evidence of their being a degradation from a higher type. A temporary mast used to support improvised sails of interplaited palm leaves, in some parts of southeast Papua and adjacent islands, may or may not indicate outside influence; but outside influence is certain when such a sail is provided with makeshift yard and boom.

It is hazardous to speculate concerning the relative chronology of the various types of sail supported by a mast in Melanesia and New Guinea. There is some reason to suppose, so far as southeastern Papua is concerned, that the Melanesian ethnic migration that brought the main elements of Massim culture may have arrived earlier than the movement which brought the culture of the "Melanesian" Motuans and allied groups. The crab-claw sail may be equated with this latter cultural drift but the relation of this movement to that which introduced the triangular lateen sail of the D'Enrecasteaux is at present obscure.

CULTURAL SPREADS FROM INDONESIA INTO OCEANIA

MIGRATIONS INTO AND THROUGH MELANESIA

Müller (1912) discusses the prow forms of certain canoes in Indonesia in which the keel of the dugout underbody at the fore end is prolonged into a more or less horizontal or obliquely rising spur and the upper part of the bow into a spur which is vertical or curved. The lower projection serves to fend the canoe off submarine reefs and is useful as a grip for hauling it on a flat shore. The upward projection prevents water from being shipped by cutting the wave at an angle to the line of the course. The proportion and relative position of both components are so variable that they may cease to be recognizable. The forking was originally alike at each end, but became differentiated at stem and stern or retained at the bow end only. In Indonesia this prow form is restricted almost entirely to outrigger canoes. A notable exception is the Madura *kolek*, in which the keel is prolonged characteristically into a stout, sharp-ended ram-form (Hornell, 1920-a, pl. XVI).

Müller (p. 243) says that the only unquestionable occurrence of the forked prow arrangement in Melanesia is along the eastern edge. He gives a figure from Paris showing this arrangement on a double canoe at Dorey, Geelvink Bay; it is most pronounced in the Maty canoes and is recognizable in the Watom and south New Ireland canoes, but here the vertical spur is reduced (Müller, figs. 45, 47). He copies (1912, fig. 44) a sketch by Edge-Partington (1890, pl. 202) of a model from the Solomons in which the two spurs are very marked and states that this can not be connected with Polynesia through Nuguria. Rivers (1914, vol. 2, p. 453) says this canoe is not one of the kind ordinarily found in the Solomons. In this Rivers is correct, but not in his further remarks. The spurs of the model have no relation to Müller's bifid prow. Müller suggests that perhaps the bifid end of the canoe model from the northern Solomons, described by Graebner (1913, p. 113), belongs here, but this is very improbable.

Müller (1912, p. 240, fig. 34) says that the Yap cargo canoe (*thauav*) has this type of prow; the spike (*gom*) is actually placed above the water line of the loaded canoe and so is completely divorced from its original purpose. In Truk (Müller, fig. 30) the stem tends to divide, as in Celebes and Dorey, but otherwise the bow closely resembles that of a canoe model from the Mortlocks.

It is noteworthy that the distribution of the forked bow in Polynesia does not coincide with one of the two outrigger types found there. It is clearly seen in Hawaii [at the stern and not at the bow].

A curious change took place in the canoes of the southern Philippines, resulting in a troughlike, flat-keeled hull and a horizontally projecting stem, beneath which is a reduced spike of minor importance; there is also a special development of bowed poles above the booms which are not connected with the float but serve to strengthen the outrigger apparatus. An aberrant form of this prow is characteristic of both the Palau canoes and the *thauav* of Yap.

In summarizing his investigation, which deals also with certain dance and ceremonial appliances, Müller (p. 249) concludes that the forked bow of Indonesian outrigger canoes has spread over Micronesia and northern Polynesia, and passes to the Nicobars and Madagascar in the west and to Geelvink Bay in the east. A secondary radiation from the north Oceanic zone goes to Melanesia, where it does not seem to exceed the sphere of Micro-Polynesian influence. The custom

of using parts of canoes as cult-symbols and insignia of war must belong to the older cultural wave.

Müller believes that Indonesian influence in Oceania can not be attributed to a single wave of culture, but that there were several impulses differing in time and place of origin. Rivers (1914, vol. 2, p. 454) suggests that the forked bow was introduced into Oceania by some special migration of the kava-people, perhaps by the late one which introduced, he believes, the cult of the sun and the use of megalithic monuments.

We are of the opinion that Müller tried to prove too much; some of his "instances" have no basis in fact and some of his conclusions are highly speculative.

Rivers (1914, vol. 2, p. 452) suggests that the first introducers of the Austronesian language into Melanesia buried their dead in a sitting position and fused with the original inhabitants to form a primitive Melanesian society, which was organized in two exogamous moities with matrilineal descent. He enumerates various elements of culture which were introduced by the sitting-interment people, among which were the outrigger canoe and the double canoe.

Other migrations into Melanesia brought the drinking of kava and other new customs and practices. Rivers supposes that the people who reduced the earlier inhabitants to complete subservience were not conquerors. They came in relatively small bodies, were peacefully received, and exercised great influence upon the dual-people on account of their higher culture and superior material equipment. The earlier immigrants practised mummification and those who came later, interment in the extended position [the effigies of Southwest Bay in Malekula, termed "mummies", belong to a culture associated with the Ambat culture-heroes who are equated with Kwat (Qat)]. Rivers considers that the kava-people once settled in the Solomons, despite the absence of the use of kava in that area (1914, vol. 2, p. 252). He argues that Polynesia was colonized by the dual-people and by the kava-people.

Rivers suggests that the kava-people brought with them the knowledge of the plank-built canoe, which, however, they succeeded in introducing in its complete form only into a few islands of Polynesia. Elsewhere the only sign of their knowledge is the raising of the sides of a dugout which is so common a feature of the Oceanic vessel of this kind (1914, vol. 2, p. 452).

Rivers (1914, vol. 2, p. 255) is confident that betel-chewing was brought into Melanesia by an immigrant people between whose culture and that of the kava-people there was no great difference; the differences are perhaps to be explained merely by the lapse of time between the two streams of migration. The betel-people did not extend in their southeasterly movement beyond the Solomon and Santa Cruz Islands, though it is, of course, possible that certain elements of their culture may have been carried directly or indirectly to southern Melanesia, Fiji, and Polynesia. He suggests that the betel-people were acquainted with a more highly developed form of plank-built canoe and introduced the special mode of using the canoe characteristic of the head-hunting people of the Solomons, whose principle was, at any rate in the western islands, never to go out of sight of land and never to pass the night at sea. The plank-built canoe of the Solomons is rarely if ever sailed, but is propelled entirely by means of paddles (vol. 2, pp. 451, 452).

Rivers (vol. 2, p. 583) says: "I have already used one item [the bow] of the large mass of linguistic evidence collected by Friederici in such a way as to suggest that one of his two currents of migration corresponds with the sitting-

interment people and the other with the kava-people, but it must be left for further inquiry to ascertain whether this is correct or whether Friederici's two currents are to be ascribed to the kava-people and some later migration."

Rivers (1914, vol. 2, p. 584) refers to Churchill (1911) and says: "If there is any correspondence between his scheme and mine, the Proto-Samoans should correspond with the people who interred their dead in the sitting position and the Tonga-fiti with the kava-people. Churchill is unable, however, to find any evidence for the influence of the Tonga-fiti upon Melanesian language." We may point out that it is admitted that the Tonga-fiti had the Tangaroa cult, and, as the Kwat mythology is intimately related to that of Tangaroa and is widely spread in the New Hebrides, the influence of the Tonga-fiti (or Tangaroans) was certainly felt in parts of Melanesia, if only in a secondary migratory movement.

In his discussion of the Malayo-Polynesian wanderings Friederici (1915, pp. 201-2) states that these migrations started at a remote period and probably continued, gradually for the most part, up to the present day. About the beginning of the first century A.D. the western part of Indonesia was Hinduized, and Sanskrit words were introduced into Indonesian languages. Thus the Malayo-Polynesian population whose languages are devoid of this Sanskrit element must have left Indonesia previous to Hindu influence. Indonesian migrations of the second to the fourth century A.D. and those from Sumatra to Madagascar in the tenth century had a considerable Sanskrit element in their language.

The Malayo-Polynesians going southeast met Papuan inhabitants on the islands skirting New Guinea and gave rise to the Alfurs of eastern Indonesia. Later Malay colonization drove them into the interior; their languages, so far as is known, are Malayo-Polynesian, except those of Weda, Patani, and Buli of the Halmaheira Islands, which are Indonesian. The languages of Ake-Salaka, Tobelo, Galela, Ternate, and Tidore belong to a separate north Halmaheiran linguistic group. Other Malayo-Polynesians reached the Philippines across Borneo and thence to Formosa. Others reached the northern Celebes and the islands between Menado and Mindanao, where they mingled with the aborigines and drove them inland; they retained their language but were in turn driven inland by subsequent Malayo-Polynesian arrivals.

According to Friederici (1913, p. 3) the Alfurs of the Moluccas and northeastern Celebes are not somatically uniform and their languages belong rather to one linguistic family; ethnologically they constitute a fairly uniform stratum, older than that of the coast people. They contributed chiefly to the Melanesian population of New Guinea and of the islands to the east. Language and tradition show that the Alfurs of western Ceram and the original inhabitants of Amboina (Ambon) and the Uliassers (three small islands to the east) were one tribe, an ethnological and somatic whole, with only dialectic differences of the common language, which in Amboina is known as *bahasa tanah*. The dialects of eastern Ceram are more remote. What must have been a sacred language of western Ceram has not been spoken for 250 years, but vestiges of it occur in old songs (Friederici, 1913, pp. 7, 8).

As the island of Ceram (Seran) is often mentioned by those interested in Melanesian origins, it is desirable to make some reference to it. The latest authority that we have consulted is Duyvendak (1926) who criticizes many of the conclusions of Tauern (1918).

The thesis of Tauern is that the Bonfia of the extreme east of Ceram are largely pre-Dravidian in origin and represent the original stock of the whole island, and that proceeding westward there are increasingly more recognizable traces of Melanesian influence till in the

Wemale district in the basin of the Tala River, there is an almost pure Melanesian stock, of which the purest representatives are found among the Nuetetu people at Lakubutui (Lakoeboetoei). The term Melanesian, as often employed, is evidently a synonym for Papuan and can not be taken to imply, as Tauern apparently does, that these people are definitely related to the Melanesians of the western Pacific. The Wemale are said to have a stronger build of body than other Alfurs, are taller, and have different features, a dark skin, and a mass of woolly hair. Their psychic characteristics are distinctly different; they are much more enterprising and aggressive, and are frank and honest. Duyvendak (1926) quotes other writers who admit that in this region there is a Papuan element though the type is not so homogeneous as Tauern represents it to be.

North of the Wemale people are the Makahala or Alune among whom Tauern says there are no Melanesians. The women wear a woven sarong made of sago fiber, whereas those of the other tribes of western Ceram wear only a narrow strip of bast-stuff which is held fast round the hips by a thin cord. The dead of the Makahala are deposited on an erection in the bush, the bones being removed later; this is not practised by the Wemale. Tauern also believes that the Makahala came from the interior of Halmaheira and adopted the Kakihan from the Wemale, but this origin is not accepted by Duyvendak. Deninger (1914) had previously noted distinctions between these two peoples, who shade into each other, and he believes that there has long been an indigenous people, neither Papuan nor Malayan in the west. He says that among the various tribes of the Manusela district, farther east and extending from Teluti Bay to the north coast, an immigration has taken place, probably from the northern Moluccas; but he believes there is Papuan influence in the east. Stresemann's linguistic studies (1918) show that there is a predominance of characteristics of Indonesian languages in the west and that in the east of Ceram there is a mixture of Indonesian and Papuan languages. He shows that there is an increasing foreign linguistic influence from west to east derived from the Papuans of Onin Peninsula of western New Guinea. Duyvendak remarks that Tauern's contention that the Wemale are an almost pure Melanesian tribe is not compatible with the linguistic evidence, for such an immigration of the strongest element in the population would not have failed to make its impression on the language, especially if these immigrants had brought with them such a characteristic element of culture as the Kakihan, as Tauern always maintains that they did.

Tauern (1918) states that the inhabitants of western Ceram, exclusive of the coastal population, fall into two groups: the Patalima toward the east and the Patasiwa in the west. The Patasiwa are divided into Patasiwa-putih (the white Patasiwa) and Patasiwa-hitam (the b'ack Patasiwa) so called because they bear tattooed on their breasts the sign of the Kakihan, which institution belongs to them though possibly some Patasiwa-putih may be admitted; they are the most renowned head-hunters in Ceram.

The men inhabiting one of the river basins of the Tala, Eti, and Sopalewa formed a Saniri group which was part of the Saniri organization of the "area of the three rivers" and was associated with the Kakihan. All the adult members of the Kakihan had to attend the Saniri assemblies, from which women were excluded. The resolutions which were passed decided quarrels between traders and all other matters of importance; it gives the impression of having been the secular administrative organ of the Kakihan. Duyvendak states that it was based on the men's-house organization, whereas the Kakihan was held in the bush.

The Kakihan, which has been described by many writers, was essentially an initiation ceremony of a community divided into two moieties in which all males of the Patasiwa-hitam took part, but it was not a secret society of the Melanesian type and it is to be noted that masks were not worn in the rites. Deacon (1925) has made some interesting comparisons between the Kakihan and New Guinea initiation cults on the one hand and the Melanesian societies on the other. He naturally accepted Tauern's ethnological conclusions, but it now seems evident that the Kakihan did not arise from "Melanesian" or Papuan sources, but that it belonged to the Indonesian area, whatever may have been its previous history. We may follow Deacon (1925) in considering the Kakihan as the closest representation of the common source of certain New Guinean and Melanesian initiation cults, since it combines features that are absent in one of these areas but which are present in the other.

It does not seem possible to discover in what kind of outrigger canoes the bearers of the Kakihan culture voyaged to New Guinea and Melanesia. Friederici (1913, p. 161) says that the Moluccan (withy) attachment is seen here and there on Buru, and is the predominant or exclusive form of attachment on Banda, Amboina and the Uliassers, and on Ceram with the exception of some places on the north coast. These conclusions may be compared with those of Haddon (1920,

p. 109). Tauern (1918, p. 42) says that in northern Ceram there are two types of double outrigger canoes: those with two booms and a withy (Moluccan) attachment, which belong to the Patasiwa, and those with two or three booms and an elbow (Halmaheiran) attachment which belong to the Patalima (Tauern, 1918, fig. 6, pls. 64, 111). The elbow attachment does not extend beyond the extreme northwest end of New Guinea, and though a form of withy attachment is found in northern New Britain and in San Cristoval, the transmitters of cults like the Kakihan do not seem to have voyaged in canoes with this form of attachment, for the present distribution of the withy attachment is too restricted. The possibility that such a craft has subsequently been replaced by other types is refuted by the certainty that the natives did not voyage in canoes with an elbow attachment. Two other types of canoe are simple dugouts (*kolek*) which may have strakes, and built-up plank boats (*paluta* and *arumbai*) which are roomy houseboats (Tauern, 1918, p. 43). According to Tauern the *arumbai*, the name of which may have come from Ternate and Tidore, is often erroneously called *orembai*.

Friederici (1913, pp. 9-19) makes the following statements and suggestions:

> The natives of the Aru and Kei Islands have a great common substratum with the Alfurs of the Moluccas and of Minahassa. The peoples of the Halmhera [Halmaheira] Islands form a separate linguistic group remote from Malayo-Polynesian languages and apparently, so far as is known, unconnected with Papuan languages. Ethnologically, and probably physically, the Alfurs of Halmhera form a great group with the Alfurs of the Moluccas and of northeast Celebes. The five dialects of the Alfurs of Minahassa, of Sangir, and of the Talaut Islands to the north belong to the great group of Philippine languages. The vocabulary of the Minahassa Alfurs shows so many elements related to the languages of the Barriai linguistic group and to the Melanesian languages of British New Guinea, that, despite grammatical differences, there seems closer affinity than with *bahasa tanah*. Further data show that *bahasa tanah* is much nearer to the Melanesian languages.
>
> Within the Barriai group the languages of Barriai, Kobe, and Kilenge are so closely akin that they may be termed dialects. There are few data about the language of the Nakanai; its base belongs to the Barriai peoples, but is modified by its relation with the Melanesians of Gazelle Peninsula, for example the post-position of the genitive. The dialects of Vitu (French Islands) are distantly related to the Barriai, but closer to those of Bilibili and Graget (Astrolabe Bay). However, they have the post-position of the genitive. The dialects of Rook Island, Siassi Islands, and of Tami are included with the Jabim, Bukaua, and Kelana in a sub-division of the Barriai.
>
> Dampier Strait in the north [and he adds "like Torres Strait in the south", which is very doubtful] was the great highway for the South Seas peoples; neither here nor elsewhere in the South Seas is there evidence of any migration on a large scale within the last 350 years.

Friederici considers western Papuo-Melanesians, so far as they speak Melanesian languages, as brought by a single stream of migration. With regard to the Solomons he is concerned only with the southern islands, the languages of which are related, that of Savo excepted.

In the New Hebrides, the languages of the southern islands of Aneityum to Eromanga are distinguishable from those of the north (Espiritu Santo, Oba, Maewo), and also from the languages of the Loyalties and New Caledonia. The languages of the central New Hebrides (Malekula to Efate) are on the whole like those of the southern Solomons. Friederici (1913, p. 15) thinks that Malekula and Ambrym were little affected by migration from the north, but the central islands were so influenced; the southern group was affected but slightly if at all.

The dialects of the Barriai peoples are much closer to those of the western Papuo-Melanesians of British New Guinea than are the dialects of Bugotu (in Ysabel), Vaturanga (in Guadalcanal), Gela (in Florida), Sa'a, Ulawa, Wango, and Fagani of the Solomons. The languages of the New Hebrides are still fur-

ther from the Melanesian dialects of the western Papuo-Melanesians. The Melanesian languages of the Solomons, New Hebrides, and western Papuo-Melanesia have elements not Malayo-Polynesian which probably are derived from indigenous languages encountered by the colonists (1913, p. 17).

The hypothesis enunciated by Friederici is that from the Moluccas a band of migrants, closely akin to the ancestors of the present Alfurs of Ceram and the neighboring islands and with some linguistic relationship to the present Alfurs of northeastern Celebes, passed eastward along the north coast of New Guinea until they reached the point where New Guinea and New Britain are closest together. Apparently no halt was made and no colonies founded, for the Melanesian colonies and influence in this part seem traceable to two or more other migrations which will be referred to later.

One line making for Long and Lottin Islands probably reached the north coast of Rook Island and the west end and the north coast of New Britain. Another, sailing near Rook Island, struck the Siassi Islands and the south coast of west New Britain and may have reached the Solomons and New Hebrides by way of the Trobriands and Murua. However, Friederici admits that he can not prove this to be so. A third branch made for Vincke Point and Cape King William. They left a colony in the Jabim district among the Papuans, occupied the Tami Islands, and, traveling along the coast of New Guinea, reached the district between the mainland and the D'Entrecasteaux Islands. In the Massim district perhaps they found an older stratum of Melanesians or Melanesianized Papuans in possession of the coast, a seafaring warrior stock, and so they prudently continued their course by rounding the east and south capes of New Guinea. They finally reached the present area of the western Papuo-Melanesians as far as Cape Possession, where they throve and developed. A portion of them, however, colonized in the Massim country and there still remain Massim stocks with linguistic affinities to the Barriai peoples.

The north coast of the Territory of New Guinea (Kaiser Wilhelms-Land) was partly colonized by subsequent movements. One of these movements may be that referred to by Hamy (1889)—the north coast of New Guinea, Dampier Strait to the Louisiades.

Other migrations, more numerous than those from the Moluccas, started in several distinct waves from the Philippines or from the sub-Philippine linguistic area. They passed along part of the north coast of New Guinea to reach the Admiralties, New Hanover, and New Ireland, and probably to pass south, mainly along the chain of islands to the east, where they encountered the Moluccan migration which they surpassed in strength. They also reached Fiji (Friederici 1915, p. 205).

Friederici (1913, p. 19) correctly observes that language, physique, or culture can not be taken singly as an adequate criterion of a people, especially in New Guinea. In the whole coastal strip between Humboldt Bay and the Le Maire Islands the tribes are much alike physically and culturally. Linguistically they show a mixture of Melanesian and non-Melanesian languages. The same holds true for the western Papuo-Melanesians of the south coast of Papua. If a language with its grammatical basis and the greater part of its vocabulary recurs in a remote region, it proves that the carriers of that language must have lived there; a whole language can not be borrowed. If immigrants settle in large numbers they hold their own, otherwise they are submerged. Thus if the language of the Alfurs of Ceram recurs in characteristic and sufficiently numerous traces in western New Britain, southeastern New Guinea, and also in the Solomons and in the New Hebrides, speakers of this language must have brought it with them.

Friederici (1913) examines various languages grammatically, but only a few points need be noted:

The dual is formed by the addition of the numeral "two" to the plural, and the triple by the addition of "three" in the languages of the Barriai and of the Papuo-Melanesians, and in the southern Solomons, and New Hebrides. In Indonesia a possessive suffix is added; in Polynesia a special pronominal form is prefixed; in Melanesia both forms are employed, the Indonesian for the parts of the body and relatives, the Polynesian for the rest. Friederici modifies this generalization by stating that the Masarete language of Buru uses only the Polynesian method and *bahasa tanah* both forms, thus entirely agreeing with the Melanesian group of his stratum.

Brandes' (1884, 1886) genitive line and Friederici's (1912, p. 177; 1913, pp. 33-38, and map) are now criticized by Dutch scholars, who maintain that the common possession of one of the two genitive forms is not a proof of common origin. Friederici (1913, p. 33) asserts that this linguistic line exists in Melanesia and is important as it may affect the question for Indonesia whence the Melanesians came.

In many of the languages and dialects from St. Matthias to southern Bougainville the particle *na* is interposed between the noun qualified and the post-posed genitive; this looks like the genitive particle *n* characteristic of the Philippine and sub-Philippine languages and gives evidence for the Philippine migration. All the Melanesian languages of the southern Solomons and the New Hebrides have the post-position. Thus the western Papuo-Melanesians who prepose did not go to New Guinea from these regions.

Friederici's map (1913) shows the genitive line from west to east as straight with only a few projections of the pre-posed genitive to the north and east, which may all belong to non-Melanesian languages.The Nakanai, however, instead of having the pre-posed genitive have the post-posed; very little is known of these people and Friederici (1913, p. 36) suggests that the influences that brought the post-posed genitive to the Witu Islands also gave it to Nakanai. But it is possible that the Nakanai have been influenced in this respect by the Melanesians of Gazelle Peninsula who have the post-posed form. The way in which the genitive line follows the coast of New Guinea as far as Vitiaz and Dampier Straits makes it look as if Melanesian and Indonesian languages owe the pre-position of the genitive to the influence of Papuan languages, but Friederici prefers to account for it as follows: The Melanesians in the main brought their pre-posed genitive construction from their home in eastern Indonesia. In Melanesia they were in places affected by dominant languages with a post-posed genitive.

A migration in several detachments and speaking different languages of the Philippine or sub-Philippine linguistic group reached New Hanover and New Ireland. They introduced yams (*tarac*), the sling (*barak*), bow (*hosul*), blowpipe (*teputepu*), and the boat with double outrigger (*guban*) into Melanesia. Offshoots of this migration perhaps reached the New Hebrides; they all brought the post-position of the genitive of the Philippine languages and some, the possessive *n*. These bands passed not far from the New Guinea coast. Friederici (1913, p. 37) believes that they colonized at some points between Humboldt Bay and Dallmann Harbor and in the vicinity of Astrolabe Bay, since there are correspondences in the vocabulary between north New Guinea, the Tabar Islands, and New Ireland. *Katig, katik* (outrigger float) is rare in Malayo-Polynesian languages, except for *katir* from Bali; it is known to Friederici only in the Philippine languages; finally it appears as *katei* (outrigger boom) in Bob near Bilibili, Astrolabe Bay. This would explain the survivals of the post-position of the genitive in Melanesian languages from Ser to Tumleo, which are greatly modified by indigenous Papuan.

The migration route suggested by Friederici brought a language akin to *bahasa tanah* with the pre-posed genitive. It passed along the north coast of New Guinea, but left less mark on that coast till it reached the district of the Le Maire Islands and especially the point where New Guinea approaches New Britain. By the time it reached the southern Solomons and the New Hebrides the migration was much reduced in numbers and split up among different islands. Thus the pre-posed genitive gave place to the post-posed of the more numerous Philippine migration, regardless of whether this arrived before or after.

Numerals are more readily interchangeable and are therefore less valuable as a criterion of the common origin of peoples. Linguistically the numerals of Friederici's named divisions correspond in the main, but numerals are largely the same over the whole Malayo-Polynesian linguistic area, although the methods of counting are entirely different. Colonizing tribes have been known to borrow the system of counting from the backward inland tribes with whom they traded (1913, pp. 38-40).

Grammatical examination shows that the language of the Alfurs of northeastern Celebes belongs to the Philippine linguistic group. Masarete is spoken by the Alfurs of Buru, but this fact stands outside the present consideration. On the other hand *bahasa tanah* of the Moluccas is in complete grammatical correspondence, as far as can be judged, with the languages of the Barriai and the Papuo-Melanesian peoples, and in rather less degree with those of the southern Solomons and New Hebrides (1913, p. 46).

The languages of northeastern Celebes, though distinct in grammar, are akin in vocabulary to Friederici's Melanesian group, in some localities more so than *bahasa tanah*. It looks therefore as if the Indonesian mother tongue of his Melanesian group, though closely akin to the present *bahasa tanah*, must have been closer to the languages of the Minahassa than it is now with *bahasa*. From a geographical standpoint this is quite possible. The intermediate Sula and Obi Islands have largely or entirely lost their native Alfur languages (1913, p. 46).

Friederici (1913, pp. 46-148) gives a list of 177 words in various languages with a discussion of each word and its distribution. Sanskrit appears in the eastern languages and affords some clue as to the date of the migration of the Alfur streams, proving it to be ethnologically recent. Some words from the Sanskrit are: *sama*, outrigger float; *dina*, fire; *hantu*, departed spirit; *hari*, sun (1913, p. 148).

This summary of the views held by Friederici has been given at some length as he is one of the few investigators of the problems of Melanesian ethnology who has had experience in the field in addition to a prolonged study of literature on the subject, but the problems seem to be more complicated than his statements would lead us to believe. His Moluccan wanderings will be considered first and then his Philippine migrations mainly from the point of view of canoe distributions.

1. The double-U form of the withy attachment of northern New Britain and of San Cristoval is obviously of Moluccan origin, though the canoe terminology is different. The origin of the Tongan attachment is less easy to understand, though Friederici (1915, p. 205) believes that one branch of the Moluccan migration perhaps reached Fiji, but it may have reached Tonga. There is now no trace elsewhere of this attachment, but everywhere there is some form of stick attachment. A simple stick attachment in Indonesia is seen only in the Nicobars and in the Andamans, if they may be included in the area (Haddon, 1920, p. 85). The natural conclusion to be drawn from these facts is that a stick attachment may be an ancient type which, with two exceptions, has been superseded over the whole Indonesian area by other types. The stick attachments of Melanesia must have been introduced from Indonesia at an early date.

Friederici (1913) is satisfied that the language of the western Papuo-Melanesians has affinities with that of the Barriai. This may be true, but the Papuo-Melanesians came to the south coast of Papua in outrigger canoes with undercrossed or other form of stick attachment as well as in double canoes. The *lakatoi* of the Motu is merely a development of the double canoe and has no special significance. Friederici suggests that the Moluccan-Barriai-western Papuo-Melan-

esians may have been prevented from an effectual colonization of the Massim area by pre-existing Melanesianized Papuan inhabitants, who doubtless had outrigger canoes with undercrossed stick attachments. Certainly the western Papuo-Melanesians are to be distinguished from other Papuo-Melanesians, and there is evidence that they are relatively recent immigrants to the region about Port Moresby. They may have pushed rapidly through the Massim area, but their canoes are so different from those of northwestern New Britain that they evidently belong to a different culture; they alone have double canoes.

Another complication appears in the area from Tupuselei to Aroma, which is characterized by canoes with forked booms and with a clamped stick attachment analogous to that found in the south and east of New Ireland and the Gazelle Peninsula. The forked boom of the Papuan Gulf canoe with an undercrossed stick attachment may be explained by a combination of the two types of attachment that are found to the east. More investigation is needed to prove a cultural connection between this limited area of southern New Guinea and southern New Ireland.

Modeled or beaten pottery is manufactured by the western Papuo-Melanesians and also by the Lae Womba and at Kelena on the Huon Peninsula, at Astrolabe Bay, at Tumleo, and at Tobadi in Humboldt Bay. No pottery is made by the Barriai-Nakanai tribes, nor indeed is pottery of modern make known from New Britain or from San Cristoval. This seems to indicate that the particular migrants from the Moluccas that brought the withy attachment were not potters. Apart from Friederici's linguistic evidence, which may perhaps bear a somewhat different explanation, there seems to be no indication that this movement reached southern New Guinea.

2. Friederici assumes that the Philippine or sub-Philippine migration started at various times and passed close to the north coast of New Guinea, which was colonized at some points between Humboldt Bay and Dallmann Harbor and in the vicinity of Astrolabe Bay. The migrants colonized the Admiralties, Witu, New Hanover, and New Ireland; thence they passed to the south along the islands to the east where they met a numerically inferior Moluccan migration. Ultimately they reached Fiji.

The characteristic feature of the canoes of the Philippines is the double outrigger with several booms and a direct lashed attachment. This type is entirely lacking throughout Melanesia, except for a few recorded in the northwest of New Guinea and for the *kop* of Nissan, which has a double outrigger, two booms only, and a direct lashed attachment. Friederici (1912, fig. 1, p. 235) saw a canoe of precisely this type at Bali, and he holds that the *kop* is a relic of the Philippine migration and that elsewhere this type of canoe has been replaced by other types. However, he did not know then of the strange reappearance in northern Queensland of this type with only two booms. His migration route at the present time is marked by various types of attachment. Between Humboldt Bay and Dallmann Harbor there is an undercrossed stick attachment and the same obtains in the Admiralties. At Vitu and northwest New Britain there is a double-withy attachment, which belongs to Friederici's Moluccan migration. Various other types of attachment occur at New Hanover and New Ireland. In the marginal "Polynesian" islands of Melanesia there are numerous forms of stick attachment. In the northern New Hebrides the prevailing form is undercrossed sticks, but parallel sticks and other varieties appear locally. In the southern New Hebrides, as in Fiji, adpressed or overcrossed sticks are prevalent. Not a single one of these varied types occurs in the Philippine or sub-Philippine linguistic area.

Unfortunately we can never know for a certainty in what sort of craft these early migrations took place. They may have been fine seaworthy outrigged vessels of which many existing canoes are degenerate survivals. The sailing craft used for trading by the Siassi Islanders and those of the Massim region of New Guinea give some indication of the type of vessels which may have traveled those seas. The large sailing canoes of the Matema Islands and Santa Cruz seem to combine at least two types of attachment; the tied attachment of the outer poles that occurs in the largest canoes may be significant. Voyages were no doubt undertaken in sailing double canoes.

Schurig, in her valuable survey (1930) of pottery-making in Indonesia and Oceania, comes to the conclusion that the two main methods, the modeled or beaten and the spiral technique, belong to separate streams of culture. This probability has been previously suggested by Haddon (1921, p. 15). She regards the spiral technique as autocthonous Papuan, and the beaten technique as a later spread from Indonesia. On the whole we accept her conclusions but consider that there is overwhelming evidence that the spiral technique is not Papuan, in the strict sense of that term, but was brought from Indonesia by an early migration of an Austric-speaking people. It seems probable that even at that time western Oceania was occupied by Austric-speaking peoples who had mixed with the indigenous Papuan-speaking tribes, or at all events non-Melanesian-speaking peoples, and thus had formed the primitive Melanesians. The absence of pottery-making from all true Papuan areas supports this conclusion. The only exceptions to this generalization, so far as we are aware, are the peoples of the Sepik and its tributaries, who make coiled pottery. It has been reported, however, that modeled pottery is made on the lower Sepik near its mouth. The Sepik tribes have such a rich ceremonial culture that there can be little doubt that a strong alien influence has permeated them, and this almost certainly came indirectly from Indonesia.

Layard (1928, p. 210) and Deacon (1933, pp. 597, 638) indicate that the introducers into Malekula of the elaborate ceremonies made spiral pottery, though that is now a lost art. Perhaps an analogous culture spread coiled pottery elsewhere in Melanesia.

According to Schurig (1930, pp. 196, 205) the only place where spiral pottery is now made in Indonesia is at Banda Lake in Amboina. In Java the old pottery was coiled, but it is a lost art. We must therefore presume that coiled pottery was prevalent in Indonesia but has now been practically replaced by the modeled technique. If it could be ascertained when this replacement of technique took place we might be able to form some idea as to the time when coiled pottery was made in Melanesia and the period of the introduction of modeled pottery. Pottery is made in several places in the Fiji Islands. A modeled technique is used in some localities, in others thick strips of clay are formed into rings, laid one on top of another, and then pressed into union prior to the patting of the pot into shape (Roth, 1935). A combination of these two techniques has been observed. According to Schurig (1930, p. 77), coiled pottery has been reported from one place only. A detailed survey of pottery making in Fiji has still to be done.

The *mon*-like boats of the island of Botel Tobago, lying off the south end of Formosa, have been described by Davidson (1903, p. 586) and Hornell (1936-b), who point out that in form and construction they resemble closely the plank-built canoes of the Solomons. Davidson says nothing about inserted frames tied to cleats projecting from the inner side of the hull planking, which is a fundamental characteristic of the *mon* and the *orembai*. He gives two indistinct illustrations of these beautiful craft; a better one is given by Heine-Geldern (1932, fig. 92). Hornell,

however, has given views and details of the interior of one of these boats which prove that the Botel Tobago boats possess inserted frames tied to comb-cleats in the *mon* and *orembai* fashion. Leach (1937), who recently spent several months on the island, has added materially to our knowledge of the constructional details.

Two types exist, the small *tatara* rowed with oars by one or two men seated on the floor, and the large *chinedkulan*, provided with accommodation for ten rowers and a steersman who stands, guiding the craft with an immensely powerful sweep pivoted in a massive crutch on the port quarter. The rowers are seated, double-banked, on lateral planks fitted upon cross tie-beams above the rib-frames.

Great variability is shown in the form of the rib-cleats and in the fitting of the ribs. In the small *tatara* described by Hornell, the rib-frames rest upon long cleats of the form seen in the *mon* and *orembai*; in the larger *chinedku'an* of Leach, half of each such cleat has disappeared, with the result that the ribs are tied against and to the vertical ends of the half-cleats instead of upon full-sized cleats of the *mon* type. This brings the ribs into contact with the skin of the boat at certain places. These are main variations; others of less importance show that standardization does not prevail. It may be that this variability indicates a tendency which may eventually end in the elimination of cleats and the nailing of the skin planking direct to frames as in the normal carvel-build. Contact with the Japanese may be counted upon to accelerate the change.

Leach mentions that very similar craft are constructed by the Batans of the northern Philippines, lying about 60 miles to the south; in Formosa he also noticed a boat of the same type said to have come from the Ami region on the east coast of Formosa.

The Yami inhabitants of Botel Tobago are predominantly "Malays", but Davidson saw traces of what he considered Papuan features.

Heine-Geldern (1932, p. 602) has no doubt that "the canoe of Botel Tobago, the *orembai* of east Indonesia and the plank-built boats of Melanesia form the last traces of an old migration [that of a pre-Austronesian culture]. But the route they indicate is exactly the same as that of the pre-historic "revolving-axe culture." It appears certain that they belong partly to Graebner's "two-class system." According to Heine-Geldern the culture characterized by this particular form of stone ax came either from China or from Japan, over Formosa, Celebes, the Moluccas, and other islands in the same area, to New Guinea and Melanesia. He considers (p. 609) that this migration was prior to that of the Ur-Austronesians into Indonesia from China, which he estimates took place during the first half or about the middle of the second millenium B.C.

One is thus asked to believe that the most highly developed canoe of Oceania, excluding Micronesia, is older than 1500 B.C. However, in common with other students, we regard the arrival of the *mon* type in the Solomons and New Ireland as relatively recent and certainly later than the earliest spread of the Austronesians into the Pacific, and also we consider that there may have been several waves of migration, cultural and racial, of Austronesians before the introduction of the *mon*. Assuming that the plank-built canoe of Botel Tobago is closely related to the *mon*, there seems no reason why its introduction into Botel Tobago should not date from the period of the spread of the *mon* into Melanesia.

The conclusions of Churchill must be very briefly considered. At the time when the proto-Polynesians occupied the whole of the East Indian Archipelago there appears to have been an older stratum of more primitive peoples (Churchill, 1916, p. 175). Then this area was invaded from the north by peoples termed by him Indonesians or Malayans. As proto-Polynesian resistance could not endure

against the knife-armed Malayans they perforce fled eastward. Churchill (1916, chart 16) postulates three main lines of flight: the Vitian, the Samoan, and the Polynesian.

1. The Viti stream, which he supposes passed to the south of New Guinea, founded the Motu and allied colonies on the south coast of New Guinea, went as far round the north coast as Cape Nelson, populated the Massim Archipelago, went from the Louisiades to the New Hebrides and to New Caledonia, and terminated in the eastern islands of the Fiji group.

So far as we are aware the only possible evidence for the passage through Torres Straits is the local canoe, which we believe most probably came from the opposite direction. Stress is laid by Churchill (1916, p. 168) on the relative purity of the Motu, Sinaugolo, and Galoma languages in which "exist many words which would pass muster for Samoan current to-day." However, Friederici (1913, p. 15) lays stress on the similarity of this linguistic area with that of the Barriai of New Britain. Forty-two years ago Ray (1895, p. 32) stated that "the stream of immigration flowed north of New Guinea and not via Torres Straits", and he has repeatedly endorsed this statement, thus he gives no support to Churchill's hypothesis; finally, our evidence from the canoes of the various regions traversed by the "Viti stream" also fails to corroborate it.

2. The proto-Samoan stream passed along the north coast of New Guinea; one stream branched off near Sissano to go to the Admiralties and skirted both sides of New Hanover and New Ireland, passed through the Solomons to the Santa Cruz group, Anuda and Tikopia, Rotuma, Futuna, Uvea, to the Samoan group. The other stream followed the coast of New Guinea, took in Karkar and the islands between Vitiaz and Dampier Straits; a southern branch went along the south coast of New Britain as far as South Cape, while the northern went round the Gazelle Peninsula and rejoined the original main stream on the west coast of Bougainville.

3. The pure Polynesian or Tongafiti stream emerged from Indonesia by the Philippines, thence went to the Palau Islands and the Carolines, passed eastward and entirely outside of the Melanesian islands, down the marginal "Polynesian" islands of Melanesia, sending a branch on its way to Rennel from Leuaniua, and then followed the Samoan stream from Tikopia onward, but excluded the Santa Cruz group. In his earlier book Churchill (1911) dates this stream as taking place about 1,000 years ago, and the proto-Samoan 2,000 years earlier.

The present distribution of canoe types does not afford any clear evidence in favor of the existence of streams 2 and 3, nor do other traits of material culture. We also doubt whether the social and religious culture is much more definitive.

Churchill (1916, pp. 121-144) gives a lengthy discussion of kava-drinking and betel- (or, as he prefers to call it, sirih-) chewing and criticizes the validity of the kava-people and betel-people advocated by Rivers. He holds that kava-drinking was introduced by his streams 2 and 3, denying that the Melanesians previously knew kava, the use of which he claims is distinctly Polynesian. "Sirih-chewing has its strong central body in Indonesia, it has in Melanesia an active and conquering advance guard. . . . We do not regard the Indonesians as necessary for the portage of Indonesian custom to the extreme limit of the sirih area, there can be no trace of Indonesian origin in the sirih of Tikopia. But habits have a way of spreading" (p. 142). Churchill does not take New Guinea into discussion, but we may point out that the use of kava, betel, and especially of tobacco appears to have spread in that island without any ethnic migrations.

The method we have adopted here is very different from the "Kulturkreise" theory of Graebner (1905; 1909). Lipps (1931) gives a restatement of this theory and some illustrations of canoe types. It is unnecessary to discuss these culture spreads and we merely give Graebner's view concerning the type of canoe associated with each of his cultures. The cultures and remarks are those given by Graebner in 1909:

1. Old Australian culture.
2. Totemic culture: the oldest boat was a piece of bent bark, a later wave brought the dugout.
3. Culture of mother-right two-class system: important for this is the plank boat without outriggers.
4. Melanesian bow culture: a paddle with a crutch grip.
5. Polynesian culture: a canoe with one outrigger is characteristic of the whole of Polynesia, Micronesia, and Austronesian parts of Melanesia. The sailing canoe always has a triangular sail except in west Melanesia. Plank boats occur as well in the Solomons, also a paddle with a lancet-shaped blade and the bailer with the handle running inward.
6. Second Polynesian culture: found in Micronesia and only in north and northeastern Polynesia. This migration brought the bent outrigger booms fastened directly to the float and a sail fastened to the mast by one side.
7. Micronesian culture: developed ship-building.
8. Indonesian culture: Indonesian influence brought the quadrangular sail to Finsch Harbor and Torres Straits, and the double outrigger as far as Tannah Merah and to Torres Straits; even Australia was influenced.

Graebner (1905, p. 49) says we must assume that the northeastern Polynesian culture was due to a migration over Micronesia and the southern Polynesian culture to one over Melanesia, his "East Papuan" district. Where in Melanesia the cultural elements which are related to the Polynesian deviate from the common Polynesian type, they show southern Polynesian, never northeastern Polynesian affinities. This is shown most clearly in the direct lashed and the simple stick attachment of the outriggers. Otherwise the attachment is of crossed sticks which are often bound in an extraordinarily strong framework which doubtless is no local development, since it spread in the north as far as the Mortlocks and in the southeast as far as the New Hebrides; also, though it is wanting in the whole of the rest of Indonesia, it occurs in the Nicobar Islands, where it can be explained as a relic of an older type, elsewhere vanished from the whole archipelago.

If we understand Graebner correctly, he regards the sequence of the types of canoes to be somewhat as follows: (1) bent bark canoes; (2) dugouts; (3) plank-built boats without outriggers; (4) canoes with a single outrigger, stick connectives, and the Oceanic lateen sail; (5) canoes with a single outrigger, direct attachment, and a special form of lateen sail (Micronesia, north and northeast Polynesia); (6) double-outrigger canoes with quadrangular sails. He evidently considers the double-outrigger canoe of Geelvink Bay as homologous with that of Torres Straits and the sail of the Finsch Harbor canoe as of the same type as that of Torres Straits. It appears to us that, so far as Melanesia is concerned, our investigations do not support his conclusions.

Evidence Afforded by Canoe Terms

Friederici has for so long a time occupied himself with canoe terms and the like that we give this summary of his latest pronouncement in order to draw the attention of others to this line of investigation without in any way committing ourselves. The main lines of the migrations from Indonesia into and through Melanesia are shown by Friederici on a map (1928), but it is evident that only the general direction could be given on such a small scale, and the numerous side tracks had to be omitted.

The *prahu* line arises in Siam, passes through south Sumatra and north Borneo to the Philippines; one branch goes to Formosa and another between New Britain and New Ireland, down the Solomons to the northern New Hebrides and thence by Fiji to Tonga, Samoa, Tahiti, Hawaii, and across to California.

The *aruk* and *biduk* line goes from Sumatra to Borneo, from there one branch passes to the Philippines and thence to the north coast of New Guinea, to New Ireland, and down the chain of islands to south New Hebrides. Another branch goes from Borneo, along north Celebes, down through the Moluccas to Timor.

The *gubang* line arises in Siam, goes down the Malay Peninsula, crosses Sumatra and passes along the west coast, thence to Sumba and Rotti; another line goes from Sumatra and along Borneo to the Philippines, thence one branch goes to the Marshall Islands and finally to Peru; a second branch goes from the Philippines to the north coast of New Guinea, north coast of New Britain, New Hanover, New Ireland, and down the islands to north New Hebrides; it passes to south New Caledonia and the Isle of Pines, thence past Tongatabu, through the Society Islands and the Tuamotus to Peru.

The *lepa* line arises in the south of the Malay Peninsula; one branch passes between Sumatra and Borneo, goes north of Java to the south of Ceram, and ends in north Australia; another branch passes from the Malay Peninsula to the Philippines and thence to the north coast of New Guinea.

The *teneh* line arises at the south point of the Malay Peninsula, passes between Sumatra and Borneo and north of Java to Sumbawa and Flores, thence between Buru and Ceram, through Gilolo (Halmaheira) passage to north New Ireland, along the east coast of New Ireland to Bougainville, and thence passes direct to California.

The *pelang* line arises in Sumatra, goes round the south coast of Borneo, passes along the north coast of Celebes to Amboina and round the south coast of Ceram, turns north to the north of Halmaheira, thence to the northern Philippines, turns southeast past the east coast of New Ireland, down the islands to the New Hebrides, and ends in Fiji.

The *rakit* line arises in Siam and goes through the south of the Malay Peninsula, crosses Sumatra, goes down its west coast to Java, thence to the south of Borneo, the south and east of Celebes to the northern Philippines, thence to the north coast of New Guinea, to the north of New Ireland, and passes along that island and the Melanesian chain to the Banks Islands.

The line of the *kiato* outrigger apparatus diverges from the southern end of the Philippines. One main line goes through Micronesia to the Marshall Islands, then through the Gilbert Islands and other islands to Samoa, whence one branch goes to the Marquesas and another through the Cook and Austral Islands to Rapa. The second main line goes along part of the north coast of New Guinea to the Admiralties and north of New Ireland, down the Melanesian chain to Tonga, and thence to the Cook and Austral Islands, Tahiti, and the Tuamotus, whence one

branch goes to Easter Island and another to the Marquesas. There is a line from the Marquesas to Hawaii, and one from Tahiti to New Zealand.

The following notes on the distribution of canoe words are taken mainly from Friederici (1928, pp. 33-35; 1912, pp. 244-246; 1914, pp. 20, 34-37):

The *wangka* or *waka* term is so general and so widely distributed over the whole Malayo-Polynesian area that it is unnecessary to go into details. It is found in Indonesia, the Philippines, Micronesia, Melanesia, Polynesia, and frequently as a loan word in Papuan languages. The variant *haka* of Amboina recurs in Abutumete (Arawe Islands, New Britain) as *hak*; and in the Duke of York Islands as *aka*. On east Bougainville: Popoko, *vakas*; Toboroi, *vakas*; Koromira, *bakati*; on west Bougainville, Buruwe and Iapa, *bakasi*; south Bougainville, Buin, *bakati, hakas*. Shortland Islands: *hakas* [slight variations occur in the southern Solomons and down to the New Hebrides; at Mota, *aka*, but the more usual forms in the Banks Islands are *ak* or *ok*. In the New Hebrides we find: Espiritu Santo, *aoro, ovo*; *aoba, anggc*; Maewo, *aka*; Raga (Pentecost), *wanga*; Malekula, *nawangk, nu-ak, rav, wala*, etc.; Epi, *wanga, rarua*; Efate, *tepake raru, rarua*; and lastly Futuna, *tavaka*].

The *prahu* term begins among the Tscham [Shans] of Siam, goes across the whole of Oceania and ends according to Rivet on the American coast. Shan, *ahauk*; Malay Peninsula, *pahuk, pahu, prahu*; Malays, *perahu, prahu*; Iban, *prau*; Philippines, *parao*; Formosa, *barroah*; Duke of York group, *parau*; Malaita and Ndai, *baru, porua*; Sesake (Api), *rarua*; Efate, *barau, borau*; Fiji, *volau, ndrua*; Tonga, Futuna, Uvea, Samoa, Tokelau group, *folau*; Tahiti, *farau*; Hawaii, *halau*. Friederici (p. 244) emphasizes the resemblance of the New Hebridean *rarua* to the *aruer* of Gebe, Moluccas.

The *gubang* term also extends from Siam, over Oceania to the American coast. Mon, *k'bang*; Silong (Mergui Archipelago), *kebang*; Malay Peninsula, *k'bang, kebang, kupon*; Malay, *gobang, gebeng, goba, top*; Sawu, *kowa*; Rotti, *ofak, ofa*; Sulu, *guban*; Papuan languages of Mandated New Guinea, *gobun, kobun*, etc.; Nakanai, *kube*; Melanesians of Gazelle Peninsula, *kube, kumbe;* Sali, Lemakot, *kuva*; Avelus, Lossuk, Mongai, etc., *kovo* (all northern New Ireland); Bougainville Strait, *obuna*; Nissan, *kop, kup*; Espiritu Santo, *ovo*; Nekete and Thyo (New Caledonia), *kuan, korba* (*korpa*); Marshall Islands, *kubak, kuba* (float). Friederici (1913, p. 161), believes that the *guban* boat with its original double outrigger came into Melanesia with a migration from the Philippines.

The *tench* term also extends from Indonesia to the American coast.* Sumba, *tench, tena*; Flores, *tena, tenah*; Simberi, *sum,* and Tatau, *tsim, sum* (Tabar Islands); Komalabu, Belik, Lamassong, Lampet, etc. (middle New Ireland), *sim*; Nissan, *tsine*; Buka, *tsine*; Tiob (Bougainville), *tsini, tsiniu*; Mono, *kinin,* Friederici is doubtful whether *etea* of San Cristoval belongs to this series.

The *biduk* term. (This evidently is associated with the term *aruk* in Indonesia; in the Philippine area the forms *baroto* and *biroco* occur. The term *aruk* does not appear to have reached Oceania.) Malay Peninsula, *bidah*; Malay, *biduq, biduk*; Timor, *berok*; Astrolabe Bay: Regatta (Graget), *bidal* (platform of canoe), *bidal* (raft), and Bilibili, *bidal* (raft); Ndai, *beroko*; Futuna, *boruku*. Friederici is convinced that the words *butui, mbutil, burul,* etc. for the outrigger apparatus and raft, which he found on north New Ireland and the Tabar Islands, also belong to this series (of which only some are here given) and thus the migration route of the *biduk* from the Malay Peninsula to the New Hebrides is clear.

* According to Friederici.

The *pelang* term begins among the Malays of the archipelago, goes over Minahassa (North Celebes), Amboina, the Malayo-Polynesian peoples of Buli on Halmaheira as *pelan*; to the Philippines under the form *balangay,* etc.; then found again on Mota (Banks Islands) as *welewele* [*bilibili* occurs at Espiritu Santo] and on Fiji as *velo-velo.* At Timor and its neighborhood we have *bero* and *belo,* and as a recent loan word in Atti-Atti (New Guinea), *belang.* Friederici says that it is questionable to what extent the *biduk* term has encroached on this series.

The *ro* term is found as *ro uak* and *roo* at Timor, as *ro* for a raft in middle New Ireland, and again as *lo* for a canoe in Eromanga.

The *sombu* term of the Toradjas of Celebes is found again as *sonbi* in Bondar (Simberi) of the Tabar Islands where it meets the *teneh* term.

The *lepa* term. Malay Peninsula, *lopch, lupek,* etc.; insular Malays, *lopi,* etc.; Amboina, *lepa, prahu lepalepa*; Bugi, Macassar (Celebes), and Tobelo (north Halmaheira), *lepalepa.* This branch which ends at Port Essington, northern Australia, *lipilipi,* according to Friederici is quite recent, perhaps not more than 100 years old. The old and important route goes over the Philippines to the north coast of New Guinea where it occurs in the Eitape district: Tumleo, *lapil*; Seleo, *lepil*; Angel, *lepil*; Paup, *lipiel*; Yakomul, *lepiel.*

The *kole* term. Malays of the archipelago, *kolik,* but also evidently borrowed in later times from the Moluccas as *cura-cura*; Moluccas, *corra-corra*; then throughout the whole of the Solomons, beginning in the south with San Cristoval under the forms *ora, mora, mola, mon,* etc.; over Bougainville, Buka, Kilinailau, Nissan, Anir, Tanga, to south New Ireland.

Friederici (1912, p. 245) thinks that to the *yel* of Weeda (Halmaheira) may belong: Wallis Island, north New Guinea, *yela*; Admiralties: Paluan and Lou, *kel,* and Pak, *kel* or *gel*; Anuda, northeast of Tikopia, *kelakela.*

The terms *rakit* and *getek* for raft or canoe and *kiato* for booms are distributed as follows:

1. The *rakit* raft begins in Siam as *rakik* and goes over the Malay Peninsula, the Malays, Sumatra, Nias, Java, the Iban, Macassar, Bugi, Minahassa, Sangir, and Sulu to the Philippines, partly under its old significance, partly in old and new forms as float and booms. The term, applied to canoe, raft, float, or booms, passes thence along the north coast of New Guinea and the Le Maire Islands, touches New Britain, north New Ireland, Nissan and ends in Mota of the Banks Islands.

2. The other form, *getek* and *ghitek,* is found as *kitek* (canoe) in Astrolabe Bay and as *mbetek* (raft) on the Tabar Islands.

3. In the Sulu-Magindanao region *rakit, gakit* becomes *ginakit, giakit,* and here, so far as Friederici knows, is the place where the Polynesian *giato, kiato, 'iato, iako,* etc. (boom) originated, a term which is always found where Polynesians are found or, where they are absent, points to their former presence or to that of kindred peoples. The word *saman* (float) is characteristic for all Malayo-Polynesians and *kiato* for all Polynesians. The word *kiato* and its variants passes over the Caroline, Marshall, and Gilbert Islands into central Polynesia. Another branch—and this appears to be the purer—travels along the north coast of New Guinea, from the Le Maire Islands to Jabim and Tami; to the Admiralties; round New Britain and New Ireland, through Nuguria, Nukumanu, Taku, Kilinailau, Leuaniua, Sikaiana, and through the New Hebrides into the nucleus of the Polynesians among whom the word is never absent.

MIGRATIONS INTO POLYNESIA

Basing his conclusions on the various Polynesian traditions, Smith (1921-a, p. 88) says "It appears that at least three distinct migrations have taken place into the Pacific from Indonesia, if not from India." These may be summarized briefly as follows:

1st migration—consisting of the Samoans, Tongans, and probably the many islanders occupying the outlying islands along the coasts of the Solomon and New Hebrides groups from Leuaniua (Ontong Java), Futuna, Uvea and Niue islands, to possibly New Zealand. [We have pointed out that marginal "Polynesian" islands of Melanesia are inhabited by Micronesians and Polynesians.]

2d migration—the so-called Tongafiti branch of the race, including Rarotongans, Tahitians, Tuamotuans, Marquesans, Mangarevans, and most of the Maoris of New Zealand.

3d migration—the east coast Maoris of New Zealand and many, if not all, the Hawaiians.

First migration: Smith does not venture to give even an approximate date for this but he is of the opinion (1921-a, p. 92) that the Samoans and some of the Tongans formed part of the first migration and that they have forgotten their early history.

Second migration: The first actual record of Polynesians residing in eastern Fiji, more particularly the Lau Islands, seems to occur in the time of Tu-tarangi about 450 A.D.; about that time they settled in Samoa and Tonga, where they found earlier Polynesians already settled (Smith, p. 162). About 1050 a migration took place from Samoa to Tonga and the newcomers built the celebrated Haamonga trilithon on Tongatabu which Thomson (1902, p. 83) says may be assigned to the latter half of the fourteenth century. McKern, who gives a description of Haamongaamaui (1929, pp. 63-66), was informed that it was built by Tuitatui "who ruled, according to genealogical data, in about the eleventh century" (1929, p. 75). Smith (1921-a, pp. 164-165), however, estimates the date at about 1275. Tu-tarangi was evidently a great leader of the Tongafiti (Tonga-Fiji) who soon spread over the great part of the Pacific, but after 650 colonizing appears practically to have ceased as mention is made of lands in the western Pacific only. About 950 a fresh impulse was given to navigation, which Smith attributes to the pressure of the half-caste element in the Lau group of Fiji, so that the Polynesians about this time again began to move eastward (pp. 210, 211), and it was at this time that Fiji ceased to play the important part it had done since the times of Tu-tarangi. Tahiti and the Marquesas were colonized about the period of the great navigator, Ui-te-rangiora, about 650 (p. 175). Although Tahiti and the Marquesas were settled before the closer connection of Polynesians and Melanesians took place in Fiji, or at any rate before this intercourse was sufficient to influence Polynesian customs, the prevalence of cannibalism in these groups was probably due to later and frequent migrations from Fiji (p. 212). Rarotonga, according to the genealogies, was first occupied about 875 (pp. 202, 208, 231) and a fresh settlement was made about 1250. New Zealand was discovered by Kupe, the navigator, who apparently was a native of Raiatea of the Society Islands, though he started on his voyage from Rarotonga about 925; the persistent statement is made in the account of Kupe's voyage that the New Zealand islands were uninhabited (p. 217) [but this seems doubtful]. It was not until about 1125, the period of Toi, that New Zealand was first colonized with Polynesians from Tahiti (p. 231). Later settlements took place, the final of which was the arrival of "The Fleet" from Tahiti in 1350, after touching at Rarotonga, and "since that time down to the arrival of Captain Cook in 1769 the Maoris, like the Hawaiians, remained isolated from the rest of the world" (p. 275).

Third migration: Smith (p. 102) says this may be called the Takitimu migration after the canoe that brought the descendants of this migration to New Zealand in the fourteenth century. In early times this branch arrived at "Tawhiti-roa", which has been identified as Sumatra (p. 111), where they settled; but owing to defeats in war, the people set out for the east, perhaps about 107 generations (of 25 years) ago. "It was at this period probably that this third migration separated off from the second, or Tonga-fiti migration, not to meet again until their descendants did so in Tahiti, in about the twelfth or thirteenth century" (pp. 118, 119). In going east they were following a course already made known by a voyager who had returned from there. They went to "Tawhiti-nui", which may be Borneo; after staying there for a long time, they departed "in six canoes and finally landed on Ahu [Oahu]—hence is the origin of the people of Hawaiki [Hawaii], of Maui and other islands in those parts" (p. 125).

Smith then discusses the possibility of this voyage, which he regards as nothing extraordinary in comparison with other Polynesian voyages, for the last resting place would be the Radick Chain which is some 2,100 nautical miles from Oahu, a distance less than that between Tahiti and New Zealand which was repeatedly sailed over. The old Polynesian *pahi* were excellent sailing boats and doubtless could make 150 miles in a day. He is convinced "that the migration was following in the footsteps of some former navigator, and that the islands of the groups they must have passed through were already occupied, as they are at present, by the Micronesian people. Theirs was not a mere exploring expedition, but a migration of men, women, and children" (p. 130) on a voyage to find a new home. He estimates the date to be 450 A.D. Fornander had previously determined "the date of the first settlement on the Hawaiian Islands at about the year A.D. 390" (Smith, p. 131). It seems that later a colonizing band went thence to Tahiti, but there appears to have been a period extending from about 650 to 1100 A.D. during which no communication took place between the southern islands and Hawaii, though voyages appear to have been frequent from the latter date to about 1350 A.D., after which times voyages from the south to Hawaii ceased and the islands remained unvisited until Captain Cook arrived in 1778.

In a summary of the Polynesian migrations, Smith (1921-b, p. 21) gives the date of the expulsion of the Polynesians from India at about the beginning of the fourth century B.C. and gathers that they dwelt in Indonesia some four or five centuries. He mentions the view that they evacuated Indonesia owing to the appearance of a Mongoloid people in the early centuries of our era—not the well-known and later irruption of the Malays from northern Sumatra, which took place in the thirteenth century.

The chronological estimates and views on migrations given by Smith have been carefully criticized by Williamson (1924, vol. 1, pp. 1-39) who points out that great caution must be exercised in dealing with them, with which we entirely agree; on the whole he accepts the sequence of the recorded events, but questions the actual lengths of periods and the dates of the events. It should, however, be noted that Williamson quotes from the 1910 edition of Smith's "Hawaiki", though he adds later information obtained from correspondence with Smith. He accepts the view that an early migration went to Samoa and Tonga. Smith has used various designations for his second migration; he often spoke of the people as Rarotongans, but later used the term "Tongafiti". As Williamson believes that the people of this migration brought the worship of the god Tangaroa into the Pacific, he adopts the term "Tangaroans" for them. Handy recognizes that the cult of

"Tangaloa" (the Taaroa of Tahiti) was later than that of Tane, Rongo, etc., and of the exploits of the culture hero Maui; he therefore speaks of this stratum as "Tangaloa-Polynesians" (1927, p. 321), and later (1930, pp. 60, 67) refers to these migrants as "Hui Arii". He (1930, p. 6) tentatively suggests that the Hui Arii of the Taaroa (Tangaloa) may have arrived at Raiatea in the late sixth or early seventh century A.D., and gives evidence to show that the earlier Polynesians were already settled in the Society Islands when they came.

Handy gives in tabular form the main differences between what he regards as the old Tahitian culture and that introduced by the Arii. The ancient type of canoe (*va'a*) was a dugout, with bow- and stern-pieces, a washstrake and a single outrigger with two booms. The Arii came in a plank-built boat (*pahi*) with a V-shaped keel. They were kava-drinkers and had the slit gong; their traditional ancestor, Taaroa, was a sea-god whose worship eclipsed that of Tu (the war-god), Tane (the god of procreation and woodcraft), and Roo (the god of agriculture and rain) of the older stratum. In speaking of the government and people, the chiefs employed the simile of a ship: the hull represented the population and country, the chief was the mast, the landed proprietors were the rigging, and the nobles the outrigger (1930, p. 42).

CONCLUSIONS

The complexity of the history of Oceania is very evident and we can here attempt only a sketch on broad lines of what we consider may have happened.

We are not here concerned with "racial" problems, but it is necessary to state that the variable group of peoples termed Papuans are woolly-haired (ulotrichous), have a dark brown skin-color, are usually short and may be very short, and generally have narrow heads. The Melanesians are fundamentally of Papuan stock but mixed to a variable extent with immigrants immediately from the East Indian Archipelago. These latter were lighter-skinned, had undulating or straight black hair, were of variable but not tall stature, and had various head-forms. At least two ethnic groups can be distinguished in Indonesia, the Nesiot or Indonesian and the proto-Malay branch of the Paroean or Southern Mongoloid. The Polynesians are also a mixed people; all the foregoing elements and perhaps some others may enter to a variable degree into their composition. The Micronesians are similarly of composite origin. (Further details will be found in Haddon, 1920, pp. 17, 22, 32, 121, 125.)

It may confidently be assumed that a Papuan group of peoples originally inhabited New Guinea and probably part of Melanesia, but it is very doubtful whether any of these peoples extended into Polynesia. It appears likely to us that the Papuans were acquainted with only the raft and the simple dugout; if so, we assume that it was by means of the former that they reached those islands that lie near New Guinea. If their dugouts were fitted with a sail it may have been a makeshift one of interplaited palm leaves, a vertical oblong sail rigged without a mast. We also assume that the Papuans did not occupy all the islands of Melanesia and that it was only when the earliest migrants came from Indonesia that the mixed population (the proto-Melanesians) occupied the whole of Melanesia.

It is known from tradition and cultural evidence that migrations took place from time to time from Indonesia into Melanesia, Micronesia, and Polynesia, though perhaps they very rarely reached Polynesia directly from Indonesia.

We may regard the first wave or waves of Indonesian migration into Melanesia as bringing the Austronesian language and various social and cultural traits and thus forming the proto-Melanesian stock and culture. These are the dual-people of Rivers (1914). Perhaps the immigrants brought with them the canoe with a double outrigger which had two booms and a simple attachment of vertical and slanting sticks or of pairs of parallel or convergent stick connectives. Probably they introduced the square sail rigged with a mast, yard, and boom.

It may be assumed that later immigrants came in large double sailing canoes and in sailing canoes with a single outrigger which also had simple and adpressed or overcrossed stick connectives for the two booms. The development of the raft into a seaworthy sailing craft may also be due to them, or even to the earlier wave. The craft of the later immigrants probably were rigged with some form of Oceanic spritsail. These apparently are the proto-Samoans of Churchill (1916, p. 143). At all events we may regard these people as constituting the most ancient ethnic stratum of the western and central Polynesians. It seems probable that these migrants were mixed to some extent with the proto-Melanesians and thus introduced into Polynesia some Melanesian cultural and physical traits. Rivers recognizes two main cultural streams of what he terms the kava-people, of which we suggest that this migration may be the first stream. If we accept the genealogical evidence, this migration or series of migrations arrived in Oceania before 450 A.D.

The later kava-people also had large sailing double canoes and large sailing canoes with a single outrigger which had some form of stick or stanchion connective. Their dugouts were doubtless often rendered more seaworthy by the addition of one or more strakes, and this improvement may have led to the evolution of a plank-built boat, in which the original dugout underbody has been reduced to a mere keel. The true plank-built boat with inserted rib-frames fastened to cleats on the strakes was employed only sporadically in western Oceania; it had its origin in Indonesia and so can not be regarded as a local development. We consider that it belonged to one of the later spreads from the west into Polynesia.

A pair of parallel sticks, which may be vertical or slanting and are adpressed to the boom, are found in various places in Melanesia and Papua; generally they may be regarded as introduced by one or more of the earliest of the migrations that were made in outrigger canoes. The clamp connective variety is found only in New Ireland and in the Keapara area of the south coast of southeast Papua. It may have developed independently in each area, but, if so, its occurrence in both areas with a forked boom is remarkable. Further investigation on this problem is needed. The special arrangement of several pairs of oblique parallel connectives in the small islands of northeast Malekula and apparently in Ambrym is worth noting, as canoes with this attachment are related to the *maki*, a sacred society with numerous grades, and the rite of gong-raising; it may have a connection with the immigrants who introduced other elements of a culture associated with the mythical hero locally known as Tahar. The Malekulan culture hero (or heroes), Ambat or Kabat, can be identified with Kwat or Qat of the Banks Islands, and in the northern New Hebrides there is a Tagaro (Tagar in north Malekula) mythology which is the counterpart of the Kwat-Tangaro mythology of the Banks Islands. Tahar, Tagar, Tagaro, is the same personage as Tangaroa of the Polynesians.

The "Children of the Sun", who, according to Perry (1923) brought the archaic civilization into Oceania, evidently belonged to this general migration.

The later kava-people, or some of them, were the so-called Tangaroans or Hui Arii who were instrumental in raising Polynesian culture to its highest level. The

Tangaroans were also great navigators and it may have been under them that New Zealand was colonized by "The Fleet" in 1350 A.D.

The distribution of the attachment consisting of two pairs of undercrossed stick connectives suggests that it belongs to a particular migration or series of migrations. This type is absent from Micronesia (with the exception of Nukuor in the Carolines), Polynesia, and from the most southerly part of Melanesia. It is also absent from Indonesia, with the exception of the Nicobars and Andamans, where in a poor sort of way it is occasionally found with other forms of stick attachment. We are therefore forced to assume that a cultural spread took place from Indonesia at a time when stick connectives were prevalent throughout that archipelago, though it is impossible to say to what extent the undercrossed connectives were then employed there. Certainly this form of attachment attained a local vogue in parts of northern New Guinea and northern Melanesia, and thence spread by secondary migrations to other regions, such as the northern New Hebrides, the Massim and other areas in Papua and to part of the northeast coast of Queensland.

A distinction can be drawn between the two main areas on the southern coasts of Papua in which the canoes have undercrossed connectives: (1) from Port Moresby in the Central Division to Orokolo in the Gulf of Papua there is only a single pair of undercrossed connectives (We know, however, that the occurrence in the Gulf of single-outrigger canoes with this attachment is due to a relatively recent cultural influence that spread westward.); (2) in the Mailu and Massim areas there are two pairs of undercrossed connectives. In addition to the attachments there are numerous differences in details of construction and equipment of the canoes which serve to differentiate these two main areas. The Motu-speaking coastal Western Papuo-Melanesians of the Central Division make modeled pottery and there are many cultural differences between them and the Papuo-Melanesian Mailu and Massim peoples who make coiled pottery. It is thus quite clear that we have to deal with two independent migrations that came from the northern coast of New Guinea or from somewhere in northern Melanesia. (See Haddon, 1894, pp. 267-269; 1895, pp. 65, 66.) From their marginal position it would be expected that the Motu peoples were the earlier but on the other hand there are reasons for supposing that the Massim peoples were already settled in their area before the Motu peoples pressed through the Massim area to reach their present destination.

It seems probable that the canoes of the "Motu" migration were fitted with the crab-claw variety of the Oceanic lateen sail; at all events this type of sail is employed on the Motu *lakatoi* as well as on the trading canoes of the Mailu. A triangular lateen sail is characteristic of the northern D'Entrecasteaux Islands, and canoes with this type of sail are superseding those with the rounded oblong sail in the Trobriand Islands; in the other Massim islands the rounded oblong or flattened oval sail may be regarded as a variant of the rectangular sail. We consider it as an older type of sail in this area. In the Massim area there are complications in the stepping of the mast which appear to be local developments.

We are not able to explain the occurrences in two islands in the Massim area of a tripod mast which doubtless carried a square sail.

Variants of the crutch or the Y-stick connective are spread sporadically throughout western Micronesia and are there usually associated with other forms of attachment. The Y connective is found in the Gilberts, Nauru, and in Polynesia at Aitutaki. It occurs at Nukumanu, Leuaniua, and Sikaiana associated with irregular

additional stick connectives. In the form of two diverging Y sticks it has been noted at several spots in Astrolabe Bay (New Guinea), though in that bay the usual attachment consists of two pairs of undercrossed stick connectives. A double overcrossed Y connective is found only in New Caledonia and the Loyalty Islands; this variety may have resulted from the influence of the Tongan double-U overcrossed withy connective. The Y connective without doubt reached Melanesia from Micronesia. It is a form of the crutch connective of Micronesia, which in its turn may have had its origin from the notched board or Y-board attachment which was very common in large craft in the Moluccas at the end of the sixteenth century (Haddon, 1920, p. 87). The Y connective has not been reported from Indonesia. There is no difficulty about the derivation of the Y connective of the marginal islands from Micronesia, as we know that other elements of Micronesian culture, such as the loom, passed that way to the Santa Cruz Islands and probably Micronesian cultural influence extended also to the northernmost islands of the New Hebrides. The strange gap in the distribution of the Y connective between Sikaiana and New Caledonia may be due to the voyagers missing, intentionally or otherwise, all the islands lying between.

It is pointed out by Rivers (1914, vol. 2, p. 299) that in an archipelago, "islands or groups of islands may altogether escape the influence of an incoming people. Thus, the position of the Santa Cruz Islands might easily lead to their being passed without notice by people traveling southwards. It would be possible for a migration to pass from the Solomons to the New Hebrides without sighting Santa Cruz, and this island might thus escape the direct influence of a migration which became potent in the islands farther south. It would even be possible for a body of migrants to travel directly from southeastern New Guinea to New Caledonia without touching the greater part of Melanesia. There would thus be found at the two extremities of Melanesia common elements of culture from which the intervening islands would be entirely free. Similarities of culture would thus be found in widely separated places, and yet they might be the result of a relatively late migration."

We consider that the arrival of the Y connective in southwest Oceania was later than that of the other stick connectives; we do not yet know whether it arrived earlier or later than the withy connective.

We have no suggestions to offer concerning the restriction of the spike connective to Geelvink Bay, northwest New Guinea, where it is employed on canoes with double or single outriggers. The spike passes through the boom to be inserted into the float.

There is no doubt that the elbow connective, which is lashed to the boom and the float, is due to direct and relatively recent Indonesian influence upon the extreme northwest of New Guinea.

⊥-shaped stanchions which are lashed to the float are the only connectives of the north of New Ireland, Lavongai (New Hanover), Mussau (St. Matthias), and Emira (Squally Islands), though in Emira there are some two-boomed canoes with two pairs of undercrossed sticks. The ⊥-stanchions are usually associated with clamp connectives in other parts of New Ireland. We can not at present explain the history and distribution of this type of connective.

There are three varieties of withy attachment: (1) the attachment by two loops is confined to northwest New Britain; (2) a pair of undercrossed U connectives is found in the Witu Islands and along the north coast of New Britain; (3) a pair of overcrossed U connectives is found in San Cristoval in the Solomon Islands and

in Tonga. We have no doubt that these three types are modifications of the single U connective which, with its varieties, is characteristic of the Moluccas. We do not venture at present to make any suggestion as to the presence of a withy attachment in Tonga, where the withy is not lashed directly to the float but to two short pegs inserted into the float. The entrance of withy connectives into western Oceania was certainly subsequent to that of simple, parallel, overcrossed, or undercrossed stick connectives.

The migration of the betel-people into Melanesia was probably the last of the great movements, and to it, we assume, was due the introduction of the *mon* and allied types of plank canoes without an outrigger. This drift may be regarded as having come from the Moluccas, as probably did most of those previously referred to. This migration did not extend into Polynesia, though it is quite possible that some elements of its culture may have been borrowed by Polynesians who voyaged into the Melanesian region.

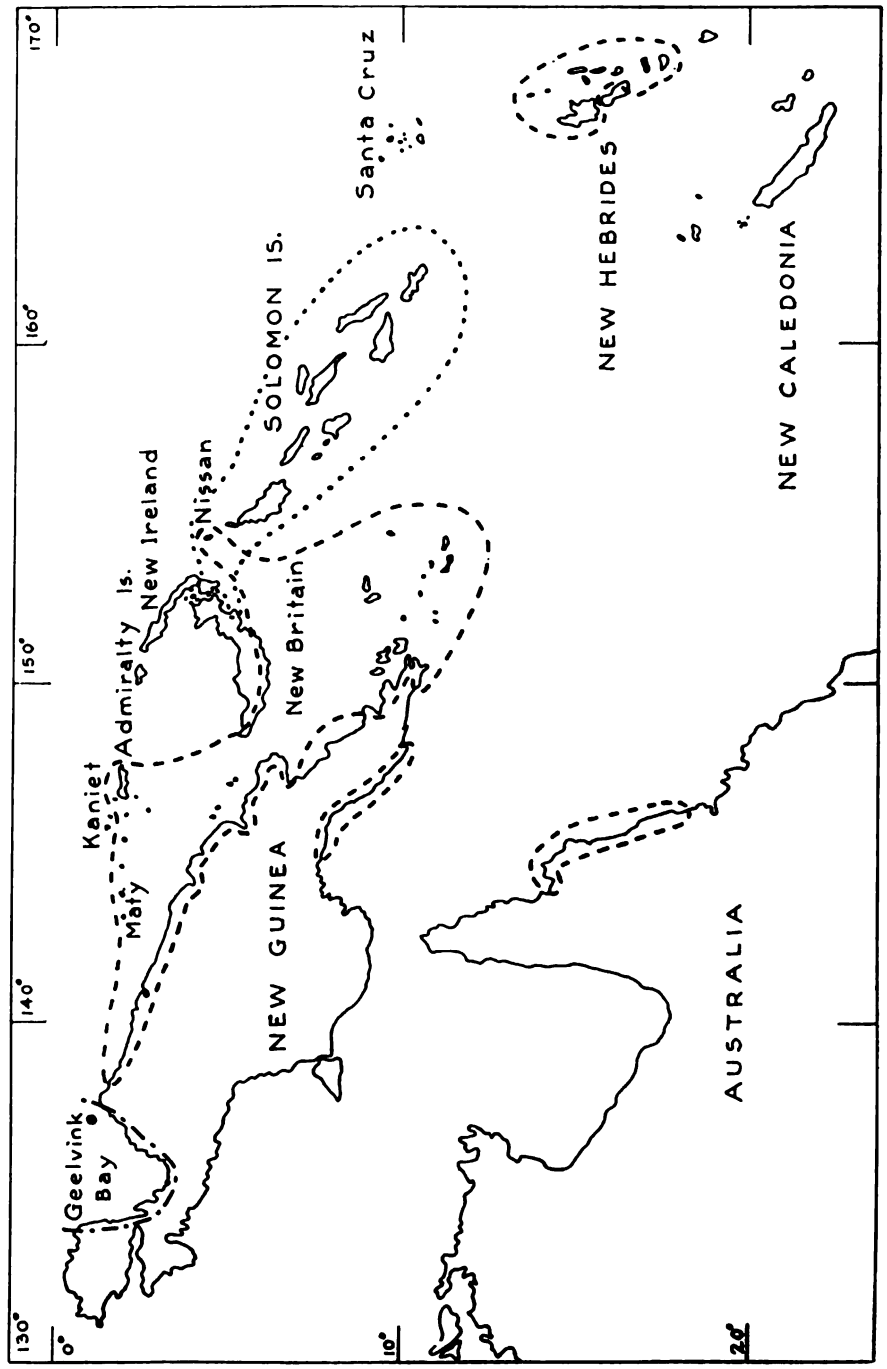
The abandonment of the outrigger by the Maori appears to have been a purely local development, but the similar discarding of the outrigger in the plank boats of Samoa was undoubtedly due to European influence.

We have yet to notice the first colonizers of the Hawaiian islands, who almost certainly took a direct route through Micronesia. The immigrants, who may be termed proto-Polynesians (the Indo-Polynesians of Handy, 1927), brought with them the double canoe and a canoe with a single outrigger which had a direct lashed attachment of the float to the two booms. This settlement of Hawaii seems to have taken place about 400 or 450 A. D.

The mixed forms of attachment that are found in the Society Islands, Rapa, and some islands of the Austral Archipelago, are due to the blending of the Hawaiian method with that of stick connectives. In other words, the descendants of the proto-Polynesians brought the direct lashed attachment from Hawaii to these islands, where they met with the descendants of the proto-Samoans who used stick connectives.

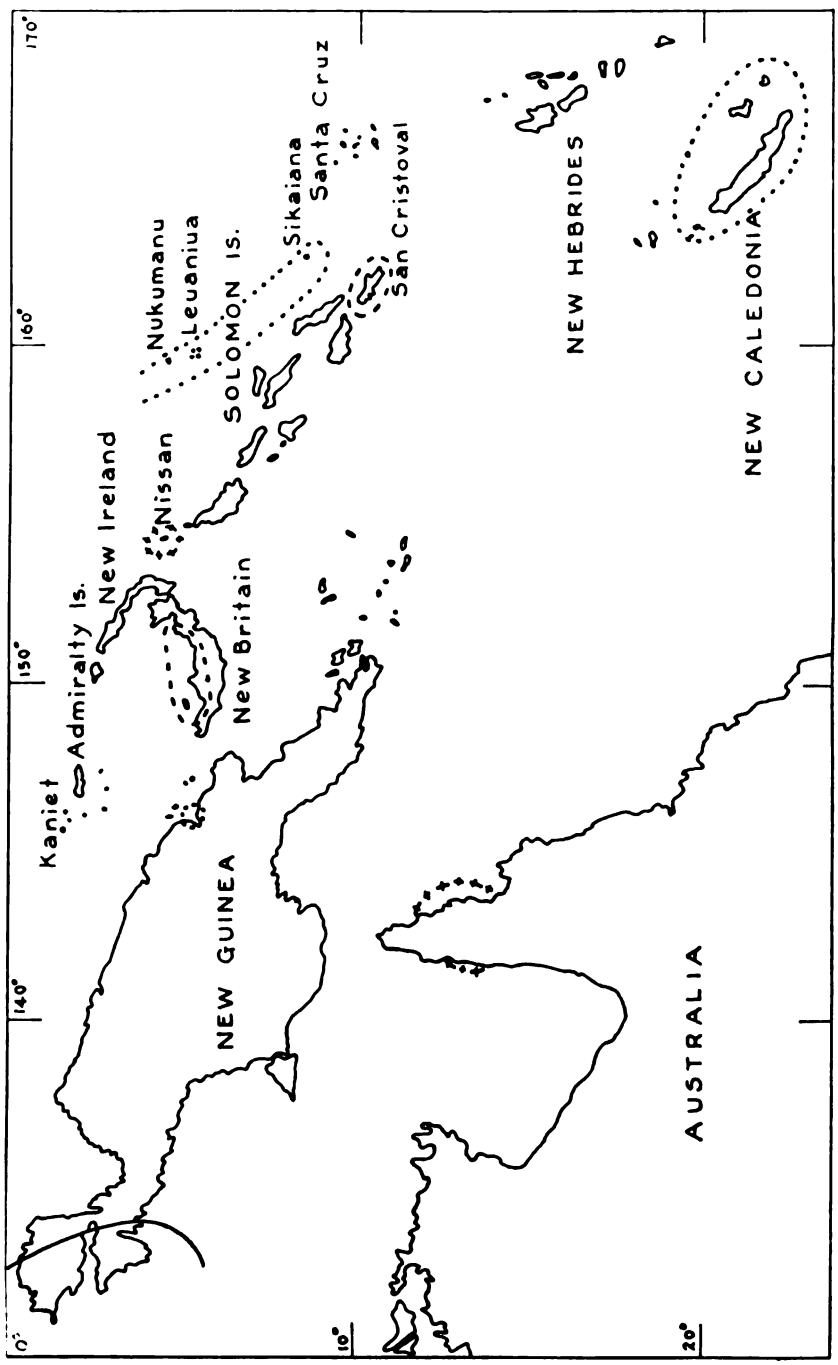
We have now come to the end of our self-imposed task. Our object in this memoir has been to describe the types of canoes that occur in Oceania and, so far as information is available, those that formerly occurred there. Mere descriptions of types have their value, but we have attempted also to give their geographical distribution and what sequence in time can be inferred from the very imperfect historical and traditional material at our disposal. In so doing we have avoided making definite pronouncements though we have not hesitated to make provisional suggestions or to state our views on certain matters.

Our knowledge of Oceanic ethnology is insufficient to resolve the complicated history of Oceania, but we have made a few tentative efforts in this direction and we hope that the data which we now offer to fellow students will enable others to make good our deficiencies.



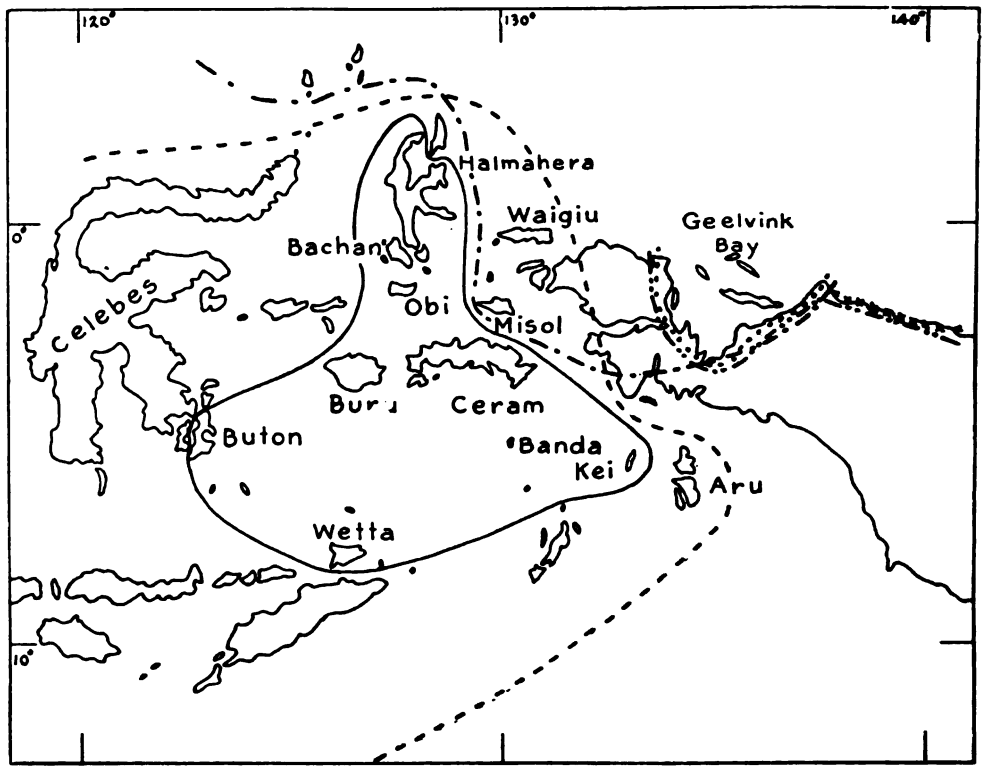
DISTRIBUTION OF OUTRIGGER ATTACHMENTS AND PLANK-BUILT CANOES WITHOUT OUTRIGGERS IN MELANESIA

— — — — — Undercrossed pairs of stick connectives.
. . . . . Plank-built canoe without outrigger.
- - - - - Spike connective.



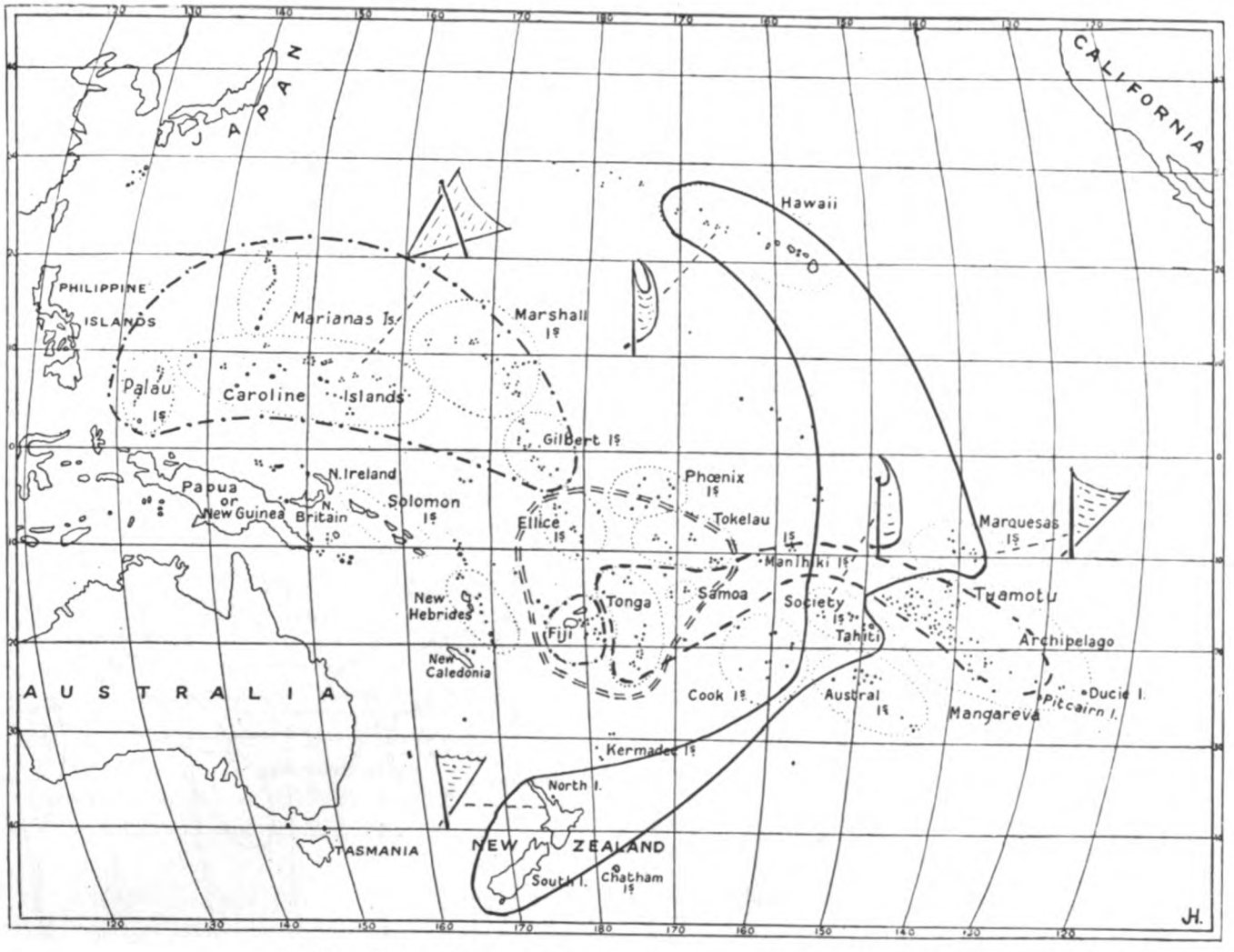
DISTRIBUTION OF OUTRIGGER ATTACHMENTS IN MELANESIA

++++++ Direct attachment (approximate for Queensland).
— — — — — Withy connective.
..... Y connective, forked, or branched connective.
———— Elbow connective (an extension from Indonesia).



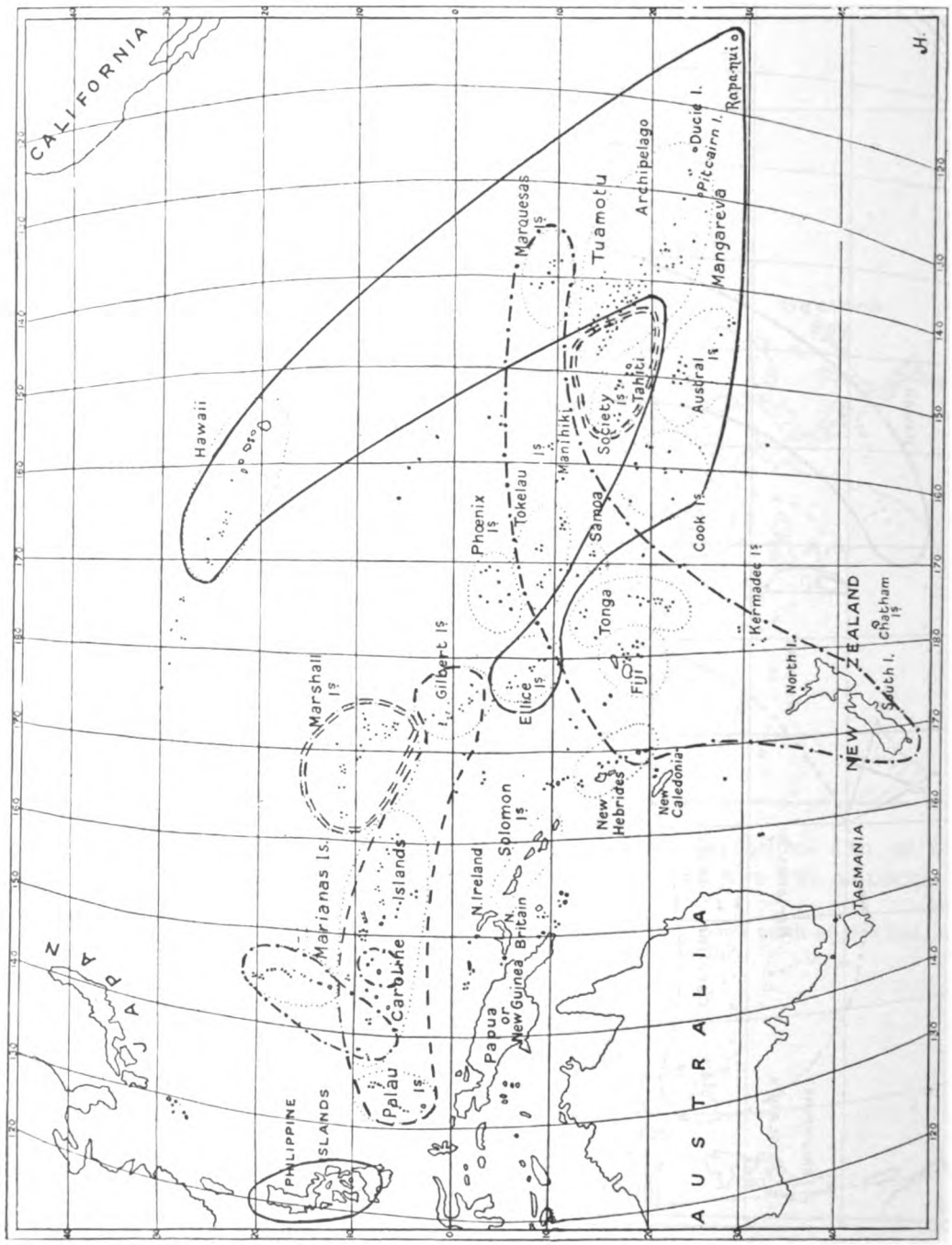
DISTRIBUTION OF DOUBLE AND SINGLE OUTRIGGER CANOES AND OF OUTRIGGER ATTACHMENTS IN WESTERN NEW GUINEA AND THE MOLUCCAS

—.—.—.—.—.— Double outriggers with more than two booms north of this line; double outriggers with two booms south of this line.
—..—..—..— Single outrigger.
— — — — — — Elbow (Halmaheiran) connective.
..... Spike connective.
———— Withy (Moluccan) connective.
++++++ Undercrossed pairs of stick connectives.



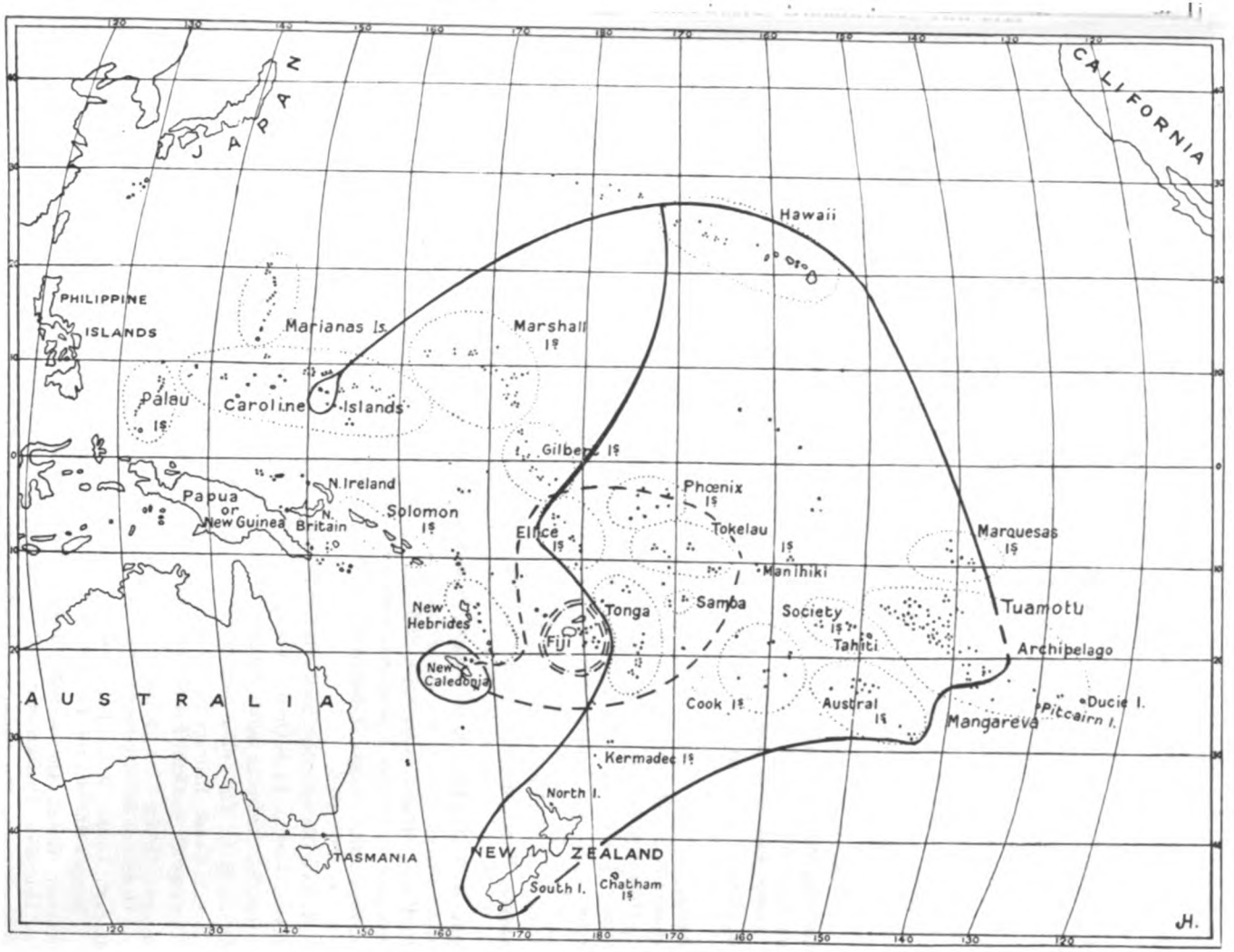
DISTRIBUTION OF SAILS IN POLYNESIA, MICRONESIA, AND FIJI

———— 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.



DISTRIBUTION OF OUTRIGGER ATTACHMENTS IN POLYNESIA, MICRONESIA, AND FIJI

——— Direct attachment.
= = = = = Mixed attachment.
—·—·—·— Stanchion attachment.
- - - - Y or V attachment.



DISTRIBUTION OF DOUBLE CANOES IN POLYNESIA, MICRONESIA, AND FIJI

———— 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.

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