NEW SPECIES OF AMASTRIDAE

By

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BERNICE P. BISHOP MUSEUM
OCCASIONAL PAPERS
VOLUME X, NUMBER 6

HONOLULU, HAWAII
PUBLISHED BY THE MUSEUM
1933

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Most of the material on which this paper is based has been added to the Bernice P. Bishop Museum collection since the publication of my paper dealing with a few new species of *Amastra* in 1917.[1]

The genus *Amastra* is still open for much further study, as the field is by no means fully explored, especially on the islands of Maui and Hawaii. From what is known of species that have already been collected and of their distribution, much new material should be found on east Maui, especially representatives belonging to *Heteramastra.* The Kohala and Waimea districts on Hawaii should prove to be rather rich in isolated species or subspecies.

Kauai and Molokai should undoubtedly yield a number of new forms. Oswald's collecting on Oahu during the last three years has added a number of hitherto unknown species and subspecies or geographical races. From his collecting, it would seem that with more intensive work on Oahu many new types could be added. There is no doubt that the Pleistocene deposits will be a continual source of many new and very distinct types of this most interesting genus.

The color terms used in the descriptions of the living species are taken from Ridgway's "Color Standards and Nomenclature" (1912).

My thanks are due to the many friends of the Museum who are continually adding new material to the collection.

Genus PLANAMASTRA

Planamastra spaldingi, new species (pl. 2, figs. 1, 2).

The shell is broadly umbilicate, subdiscoidal, very thin, dull, of a uniform tawny-olive color. The spire is very slightly elevated, so that all the whorls are visible when the shell is viewed from the front. The embryonic whorls are somewhat convex, the post-embryonic are strongly convex, separated by a deep, simple suture, finely, irregularly and closely striate, with a distinct narrow sulcus just above and accompanying the suture; last whorl flattened above, bluntly angular at the periphery. The periphery, except for its last one-sixth, is accompanied both above and below by distinct, narrowed sulci. Aperture nearly quadrilateral, with rounded corners, its outer margin thin. Umbilicus large, perspective, a little more than one-third the total diameter, its outer margin not distinctly angular. Height, 2.7 mm.; diameter, 6.2 mm.; whorls, 4.

[1] Cooke, C. M., Jr., Some new species of Amastra: B. P. Bishop Mus. Occ. Papers, vol. 3, no. 3, 1917.

Oahu, Waianae Mountains: Pukaloa (I. Spalding, W. Meinecke, C. M. Cooke Jr.; Haleanau [Haleauau] (D. Thaanum, W. Wilder); Lualualei (O. Oswald). Type no. 10755.

Planamastra spaldingi should be considered a very rare species. In the Museum collection are eight lots; five are from the small valley of Pukaloa. In only one of the lots are there more than two specimens, and not more than 25 to 30 shells have come to my notice.

The first specimens of *P. spaldingi* which were recognized as distinct from *P. digonophora* were collected by Spalding, and one of these, a recently dead shell, is selected for the type. The first and only live shell of the species which I have examined was given by Oswald to the Museum from his collection made in 1928 in the valley of Lualualei, where one live and two or three dead specimens were taken.

During 1926 Meinecke collected a small series of recently dead juveniles from Pukaloa, but found no adults. Oswald's specimen is somewhat darker in color than the type, being of a uniform russet. The shell has a few small, scattered, agglutinated deposits near and on the periphery. Like the deposits on living examples of *P. digonophora* these are not alate, as is common in the species of *Pterodiscus*. A juvenile collected by Meinecke has somewhat stronger deposits. In another juvenile with slightly more than two and one-half whorls, there is not the slightest indication of a columellar fold.

P. spaldingi is easily distinguished from *P. digonophora* by its higher spire (in *P. digonophora* the spire is flat or immersed), its more convex embryonic whorls, and its proportionately narrower umbilicus, the outer margin of which is not as sharply angled. Another distinctive characteristic is that the inner walls of whorls forming the umbilicus are convex, whereas the corresponding walls of *P. digonophora* are flattened.

Planamastra spaldingi koolauensis, new subspecies (pl. 2, figs. 3, 4).

Above the periphery this subspecies is nearly similar in its characters to typical *P. spaldingi*. Its most important differences are found below the periphery. The umbilicus of this subspecies is proportionately much smaller, being slightly more than one-fourth the total diameter of the shell, its outer margin rounded and with the last whorl uniformly convex when viewed from below. Height, 3.0 mm.; diameter, 6.3 mm.; whorls, 4.

Oahu: Pleistocene or later deposit, Kahuku, in deposit on limestone bluff above pumping station 1.2 miles northeast of Kahuku Mill (C. M. Cooke Jr.); Punaluu, in Pleistocene deposit on flat at foot of northern ridge of valley in ploughed field (C. M. Cooke Jr.). Type, no. 10754; paratypes, no. 60079.

It is remarkable that neither in the very rich fossil deposits nor among the large series of contemporary material has a single specimen of *Planamastra* ever been recorded from the region between Kahuku and the Waianae Mountains. It probably inhabited the sides of the bluffs and the coastal plains when these were wooded. Either living or recently dead specimens would certainly have been recorded long before this if the genus had ever been an inhabitant of the damper rain forests.

A juvenile with slightly more than two and one-half whorls has no indication of a columellar fold.

The type lot from Kahuku consists of one whole adult, one badly broken, and two very young shells. The lot from Punaluu contains nine shells, none of which have as many as four whorls.

Genus AMASTRA

Subgenus CYCLAMASTRA

Series of *Amastra sphaerica*

1. Amastra (Cyclamastra) cyclostoma gregoryi, new subspecies, (pl. 1, fig. 1).

The shell is narrowly umbilicate, conically heliciform, solid, strongly carinate at the periphery, in its fossil state white below, shading gradually to apricot orange on the embryonic whorls. Spire broadly conic, with slightly concave outlines. The embryonic whorls are nearly smooth, slightly convex. The last two whorls have weak, irregular growth-lines. The last whorl is swollen, strongly carinate at the periphery, flattened above, convex below the carina, and shouldered just below the suture, its last third descending. The carina, beginning almost at the inception of the penultimate whorl, is strong and distinctly margined above and below with deeply incised sulci, extending to, but becoming less defined, on approaching the margin of the aperture, which is but slightly modified. The aperture is irregularly circular. Peristome slightly thickened within, indistinctly duplicate without. Columella oblique, narrowly triangular, furnished near its middle with a low, rounded fold which scarcely reaches the outer margin. Umbilicus nearly circular, about one-ninth of the diameter, with rounded margin. Length, 20.6 mm.; diameter, 24.4 mm.; aperture diagonal, 12.2 mm.; whorls, 6. Type, no. 100492.

Kauai: limestone bluff about 0.5 mile east of Aweoweonui Bay, in Mahaulepu, 50 to 75 feet above sea level (C. M. Cooke Jr.).

One whole adult and fragments of three additional specimens of this subspecies have been examined. From the fragments, it is evident that shells may be found which are somewhat wider than the type.

The most important difference between the species *Amastra cyclostoma* and the form here considered a subspecies is one of size, as the dimensions of the subspecies are about 40 to 50 per cent larger than those of the species. In *A. c. gregoryi* the peripheral carina is much more pronounced than in most specimens of *A. cyclostoma,* and it extends to and modifies, to a slight degree, the outer margin of the aperture.

The habitats of the two forms are separated by a little more than 13 miles. The original specimens of *A. cyclostoma* were taken by A. F. Judd at Makaweli. Since then, the only additional material of which I have any knowledge was found by Mr. Perkins at "Makaweli, 2,000 feet elevation." *A. c. gregoryi* was taken near sea level in a Pleistocene limestone deposit. No specimen of a related form of *Amastra* has been reported from an intermediate locality.

A. c. gregoryi has the distinction of being by far the largest form belonging to the subgenus *Cyclamastra,* and it has a greater diameter than any species or subspecies of the genus *Amastra.*

Series of *Amastra umbilicata*

2. Amastra (Cyclamastra) juddii Cooke.

When this species was published,[2] the habitat of the three specimens collected by Mr. Judd was not known. Typical examples of this species have been taken by W. Meinecke (1926) and T. Dranga (1926). Both lots came from the same locality in Olokele Canyon "just above the bend in the trail above Rainbow Falls." Undoubtedly Mr. Judd's specimens are from a locality in or near the drainage basin of Waimea Canyon. In 1903 a single dead specimen of *A. juddii* was collected by me along the trail in Olokele. By some mischance, the specimen was overlooked when I was preparing the paper in 1917.

[2] B. P. Bishop Mus. Occ. Papers, vol. 3, no. 3, p. 5, 1917.

3. Amastra (Cyclamastra) delicata, new species (pl. 1, fig. 2).

The shell is narrowly but openly umbilicate, conic, very thin, translucent, scarcely shining, russet to Mars brown, shading to a lighter color near the umbilicus and in back of the peristome. The spire is conic, whorls uniformly convex. Embryonic whorls flatly convex, glossy, nearly smooth, under a very strong lens very finely striate; the post-embryonic whorls convex, separated by a simple suture, the surface distinctly marked by fine, slightly flexuous distinct growth-wrinkles, which are more or less unevenly spaced and become coarser and more widely spaced with the growth of the shell. Aperture broadly ovate, subcircular, its outer margin sharp, dark-edged, and furnished with a low, indistinct lip-rib. Columellar lamella distinct, high and thin, not reaching the outer margin of the columella. Umbilicus rather narrow, nearly semicircular in section.

Length	Diameter	Aperture Diagonal	Whorls
10.4 mm.	6.7 mm.	4.6 mm.	6½ (Cotype, pl. 1, fig. 2)
9.5 mm.	6.1 mm.	4.3 mm.	6¼ (Cotype)

Kauai: Nonou Mountains in high valley just west of peak, 700-900 feet elevation (D. Thaanum, 1919, T. and J. Dranga and C. M. Cooke Jr., 1925), type locality; Hii Mountains, foot of Kalihi Peak (C. N. Forbes, 1916). Cotypes, no. 10770; paratypes, nos. 80942-45; topotypes, in Thaanum collection.

Adult specimens are sparsely, immature specimens thickly, agglutinated. The shells collected by Forbes are very slightly larger than those from the type locality about 11 miles away. One of them measures: length, 10.7 mm.; diameter, 6.5 mm. The two lots agree in all essential characters.

A. delicata appears to be related to *A. rugolosa* Pease, but it differs in its thinner shell, larger umbilicus, and less pronounced striations. From these characters I have considered it as belonging to the subgenus *Cyclamastra.* Two of Pease's specimens of *rugolosa* in the Museum collection have the shells minutely perforate and the outlines of the spire more convex.

A. delicata is much nearer in size to *A. rugolosa normalis,* but differs in its very much thinner shell, more irregular sculpturing, color pattern, and relative size of the umbilicus.

4. Amastra (Cyclamastra) globosa, new species (pl. 1, fig. 3).

The shell is narrowly umbilicate, globose, glossy, in its fossil state the last two whorls are white, the two upper Sanford's brown, the two intermediate whorls shading to white with the growth of the shell. The spire is very short,

slightly less than the length of the aperture, broadly conic, with nearly straight outlines, not contracted toward the summit. The embryonic whorls are convex, nearly smooth even under a strong lens; the rest of the whorls are distinctly convex, separated by a deep suture, finely and irregularly striate with rather sharp growth-wrinkles. The aperture is slightly more than half the length of the shell, its outer margin regularly curved, furnished with a thick, heavy lip-rib. The columella is narrowly triangular, truncate near its base, with a blunt, low, columellar fold. There is a short low tooth on the parietal wall. The umbilicus is rounded. Length, 18.4 mm.; diameter, 12.7 mm.; aperture diagonal, 9.8 mm.; whorls, 6.

Oahu: Kahuku, in limestone bank above the sand beach, slightly northeast of wireless station (C. M. Cooke Jr., 1930). Type, no. 98238.

Unfortunately, but a single specimen of this species has been taken. It is undoubtedly descended from the same stock as *Amastra antiqua, A. antiqua kawaihapaiensis,* and *A. elephantina.* From these it differs principally in its more globose form and decidedly more convex whorls, especially the embryonic. The degree of sculpturing of the surface is about midway between *A. antiqua* and *A. a. kawaihapaiensis.* From *A. elephantina* it also differs in its more regular and more widely spaced, though fine, growth-wrinkles.

These four forms compose a rather compact group. They are characterized by their rather large size and, in old specimens, are furnished on the parietal wall with a well-defined tooth, or at least with a thickened swelling. The few specimens which have been taken would indicate that this group was widely dispersed over most of the lowlands of Oahu.

Since the publication of volume 23 of Pilsbry's Manual of Conchology (1915-1916) a number of what are apparently typical specimens of *A. antiqua,* all fossil, have been taken in the northwestern side of Manoa Valley in road cuttings and house sites from the beginning of Oahu Avenue to just below Awapuhi Street. A few specimens have also been taken from the southerly slope of Rocky Hill.

5. Amastra (Cyclamastra) thurstoni bembicodes,[3] new subspecies (pl. 1, fig. 4).

The shell is openly perforate, acuminately conic, and, in its fossil state, white. The outlines of the spire are concave, slightly contracted below the embryonic whorls, which are wide, slightly convex, faintly and regularly

[3] *βεμβικωδης* = like a top.

striate. The post-embryonic whorls are flatly convex, nearly smooth, with faint widely spaced irregular growth-wrinkles. The aperture is ovate, its outer margin regularly curved and furnished with a delicate lip-rib. The columella is narrowly triangular, its inner margin straight and furnished with a strong, subhorizontal fold which extends to the outer margin of the columella. The perforation is narrow, subcircular, compressed on one side by the free margin of the columella.

Length	Diameter	Aperture Diagonal	Whorls
11.3 mm.	6.1 mm.	5.0 mm.	6¼ (Cotype, pl. 1, fig. 4)
10.1 mm.	5.3 mm.	4.3 mm.	6¼ (Cotype)

Oahu: Manoa, fossil in road cuttings near the corner of Ferdinand Street and Adolphe Street, type locality (F. Girdler, C. M. Cooke, III, and C. M. Cooke, Jr., 1916), Round Top Road above Awapuhi Street (C. M. Cooke, Jr., 1915). Cotypes, no. 43100.

This is an exceedingly rare form of *Amastra.* The results of five findings are six whole and three broken specimens. Among the large number of Amastras that have been taken in the Manoa fossil deposits, from the beginning of Oahu Avenue to Awapuhi Street, this form was only taken from four "pockets."

From *A. thurstoni* it differs in its smaller size, compact and closely coiled spire, but especially in its smoother surface marked with finer and more distantly spaced growth-wrinkles.

The fine and regular striation of the embryonic whorls is similar in both the typical and subspecific forms, a character which decisively links them together; otherwise, it would not be inappropriate to consider them as distinct species. The umbilicus of *A. t. bembicodes* is proportionately slightly wider than that of *A. fragilis* from Molokai, and *A. metamorpha* and *A. m. debilis* from west Maui.

6. Amastra (Cyclamastra) problematica, new species (pl. 1, fig. 5).

The shell is minutely perforate, oblong-turrite, and, in its fossil state, white. Spire acuminately conic, with nearly straight outlines. The embryonic whorls are indistinctly striate, convex; the post-embryonic are marked with very fine, closely set, oblique growth-wrinkles. The upper post-embryonic whorls are distinctly convex, the penultimate and last slightly flatter; the last whorl is rather narrow, subcylindrical, tapering gradually to the base. The suture is simple and distinct. The aperture is ovate, rather broad in proportion to its length, its outer margin regularly curved and furnished with a strong lip-rib. The inner margin of the columella is straight, the outer margin slightly thickened and arched over the very narrow cleftlike umbilicus; columella furnished at its lower third with a strong columellar fold.

Length	Diameter	Aperture Diagonal	Whorls
11.2 mm.	5.2 mm.	4.8 mm.	6⅓ (Cotypes)
11.8 mm.	5.4 mm.	4.8 mm.	6½ (Cotypes, pl. 1, fig. 5)
9.5 mm.	4.9 mm.	4.3 mm.	5¾ (Cotypes)

Oahu: Kawailoa, 0.3 mile northeast of railway station in shallow railroad cutting, also in road bank 0.9 mile northeast of same railway station; Malaekahana just inland of government road 0.6 mile northwest of Laie bridge; Kahuku Point near wireless station; Waialei railroad cutting; Waimea, road cutting (C. M. Cooke, Jr., 1917). Type, no. 10772; paratypes, no. 44928.

The position of this species is at first glance rather doubtful, as the perforation is proportionately much smaller than in any other species belonging to the subgenus *Cyclamastra*. From the convexity and type of coiling of the embryonic and post-embryonic whorls up to and through the metaneanic stage, this species is closely related to *Amastra umbilicata*. In the characters of the adult whorl, *A. problematica* differs considerably from *A. umbilicata*. The shells of *A. umbilicata* are much broader in proportion to their length. The last whorl is slightly more convex and tapers more abruptly toward the base, and the umbilicus is more open. The aperture of *A. umbilicata* forms a distinct angle at the junction of the base of the columella and the peristome.

The distribution of these two species is rather interesting. Except at Malaekahana, they are not found together in any colony, although large colonies of *A. umbilicata* have been taken within the region between Kahuku and Malaekahana, from which scattered specimens of *A. problematica* have been found. No specimens of *A. umbilicata* have been reported from the Kawailoa region between the Waimea and the Waialua rivers, and it is in this area that most of the specimens of *A. problematica* have been taken. Probably the species represents a specialized form of the *umbilicata* series that originated in this area.

In none of the localities from which *A. problematica* has been taken is it an abundant species. It never has been taken in as large quantities as has *A. umbilicata* in some of its localities.

Shells from Malaekahana and Kahuku are proportionately broader and more solid than those from Kawailoa. Malaekahana, no. 44805: length, 11.4 mm.; diameter, 6.0 mm.; whorls, 6+. Kahuku Point, no. 77325: length, 11.2 mm.; diameter, 5.8 mm.; whorls, 6.

Subgenus **AMASTRA**

Section **AMASTRELLA**

Series of *Amastra rugulosa*

7. Amastra (Amastrella) rugulosa Pease.

A series of this species in the Pease collection (no. 45255, Museum of Comparative Zoology) has no record of the locality on the label, although in the original description the locality given is Kauai. Baldwin [4] gives Kapaa as a more exact locality without stating the source of his information. No specimens of this species came to Bernice P. Bishop Museum with the Baldwin collection, though three specimens of *A. rugulosa normalis* labelled "A. Brevis? Wahiawa, Kauai" in Baldwin's handwriting were included in his collection.

Sykes [5] gives Lihue as the habitat from the identification of specimens collected by Perkins. One of these is in the Bernice P. Bishop Museum collection and is a typical example of *Amastra rugulosa normalis,* which is an abundant species on the slopes of Haupu in Kipu on the southern boundary of the Lihue district, undoubtedly Perkins' locality.

In the Museum collection are two specimens of Pease's original series received from the Museum of Comparative Zoology. One of these measures: length, 12.1 mm.; diameter, 8.1 mm.; whorls, 6.

In the Museum collection is a small series of Amastras taken by Dr. H. St. John and E. P. Hume in 1931 from Hoolulu, a small precipitous valley on the northern side of Kauai. These shells agree in every essential character with those from the Pease collection, except that all are very slightly smaller. The largest, with six whorls, measures: length, 11.2 mm.; diameter, 7.7 mm.

Amastras referable to this species, though not abundant, are found in both the fossil deposits at Limahuli and Haena. Those from Limahuli were collected independently by A. F. Judd, C. S. Dole, W. Meinecke, and C. M. Cooke, Jr. These, like the Hoolulu shells, agree in all characters except size with the shells from the Pease collection. They are proportionately a little narrower than the Hoolulu shells. Three of them, adults, measure: length, 11.7 mm., 11.3 mm., 10.5 mm.; diameter, 7.1 mm., 7.2 mm., 7.2 mm.; whorls, $6\frac{1}{3}$, 6+, 6−.

Haena specimens collected by Cooke (1914) near the western

[4] Baldwin, D. D., Catalogue of land and fresh water shells of the Hawaiian islands, Honolulu, 1893.

[5] Sykes, E. R., Mollusca: Fauna Hawaiiensis, vol. 2, pt. 4, p. 354, Cambridge, 1901.

extremity of the Haena plain agree closely with those found at Limahuli. Two of them have the following measurements: length, 11.8 mm., 11.5 mm.; diameter, 6.9 mm., 7.4 mm.; whorls 6+, 6.

Because of the fairly close agreement of these shells with those of Pease, it is safe to assume that those from the Pease collection came from the northern side of Kauai between Wainiha on the east and Limahuli on the west, a portion of the island in which Pease is known to have collected.

7-a. Amastra rugulosa janeae, new subspecies (pl. 1, fig. 6).

The shell is longer and proportionately narrower than that of the species, with a longer and more acuminate spire and from one-half to one additional whorl. The perforation is narrow and compressed as in the typical form of the species. In surface texture and color pattern the species and subspecies agree closely. Length, 13.1 mm.; diameter, 7.6 mm.; aperture diagonal, 6.2 mm.; whorls, 6½.

Kauai: Ohia Valley, Anahola watershed west of the Kaneha Reservoir, along ditch trail near bottom of the valley (J. Dranga, T. Dranga, and C. M. Cooke, Jr., 1925). Type no. 10759; paratypes, no. 80793.

Only seven recently dead examples of this subspecies were taken, most of which were found by Mrs. Dranga. Although considerable search was made after finding the first shell, no live ones were obtained.

This subspecies is intermediate between the typical form of *A. rugulosa* and *A. rugulosa annosa* Cooke. *A. rugulosa annosa* is abundant in the coastal Pleistocene deposits 5 to 7 miles to the southeast. From this subspecies *A. rugulosa janeae* differs in its slightly more concave spire and smaller umbilicus. The columellar fold is quite distinct in both forms. In *A. r. annosa,* it is weak and deeply seated. In *A. r. janeae* it is strong and subtransverse and ends abruptly at the outer margin of the columella.

8. Amastra (Amastrella) anthonii Newcomb (pl. 1, figs. 8-10).

Achatinella anthonii Newcomb, Proc. California Academy of Nat. Sci. II, p. 93, 1861; American Journ. of Conchology, II, p. 210, pl. 13, fig. 2, 1866.

As the original locality of this species has never been reported, the following notes may be of interest for future collecting on the island of Kauai. Newcomb received his specimens from the Rev. E. Johnson, a missionary located at Waioli, on the northern side of

Kauai, from 1837 to about 1867. Newcomb gives no information except that the species came from Kauai. Bernice P. Bishop Museum is fortunate in having several series which are exactly located and which indicate that this species inhabits the northwestern sector of the island. In addition, there are several small lots which are unlocalized. One series of seven specimens came to the Museum with the J. S. Emerson collection. From the appearance of these shells, it is evident that they were collected several years ago. With one possible exception, all must have been dead when found. As most of the Kauaian land snails in Mr. Emerson's collection, which appear to have been collected 50 to 75 years ago, came from Mr. Johnson, it is fairly safe to assume that these specimens, though not definitely stated, were obtained from him. If my surmise is correct, these are probably a part of Mr. Johnson's original material, a portion of which went to Newcomb. Mr. Emerson's label reads, "Amas. anthonii, New., Kalalau, Napali, Kauai." The paper, the faded ink, in fact the whole appearance of the label, are exactly similar to the label of *Carelia cumingiana,* the specimens of which Mr. Emerson told me were obtained from Mr. Johnson, although this is not stated on the label.

This lot of shells contains specimens which agree fairly closely with those mentioned by Newcomb in his description and notes, and also with Newcomb's figure of the species, which he states "is more obese than usual and less elongated."

Three of Mr. Emerson's specimens have the following measurements:

Length	Diameter	Aperture Diagonal	Whorls
18.5 mm.	11.0 mm.	8.8 mm.	6¼
17.8 mm.	10.0 mm.	8.6 mm.	6
16.5 mm.	10.2 mm.	8.1 mm.	6

These measurements are slightly larger than those given by Newcomb (15 by 10 mm.). The apical whorls of some of the shells are slightly more conical and very slightly more flattened than has been observed in any of the localized specimens referred to this species. None of the snails have the coarsely costulate embryos which are characteristic of *Armiella.*

Specimens of *Amastra anthonii* collected by C. S. Dole, and C. N. Forbes (1909) on a spur of the southern side of Kalalau at an ele-

vation of about 1,000 feet agree so closely in size, form, and texture with Mr. Emerson's specimens that it is safe to assume that the type locality was somewhere on the southern slopes of the valley.

Three shells collected by Forbes and Dole (no. 19694) have the following measurements:

Length	Diameter	Aperture Diagonal	Whorls
18.5 mm.	10.6 mm.	8.8 mm.	6 (pl. 1, fig. 8)
16.8 mm.	10.2 mm.	8.2 mm.	6 (pl. 1, fig. 9)
16.3 mm.	9.9 mm.	8.2 mm.	5¾ (pl. 1, fig. 10)

In a few, there is an indistinct angling at the periphery which is distinct enough to modify the form of the aperture slightly.

From additional localities in Kalalau a single specimen taken by Knudsen (1907) at the head of the valley, and another found by Cooke (1907) in the small deep valley near the southwestern margin of the main valley can be included in the typical forms.

8-a. Amastra anthonii remota (Cooke).

Amastra remota Cooke: B. P. Bishop Mus. Occ. Papers, vol. 3, no. 3, p. 10, pl. *A*, fig. 3, 1917.

With the abundance of material now available for comparison and illustrating the wide local and consistent variation of *A. anthonii*, I think that it is appropriate to consider *A. remota* as a subspecies of *anthonii* rather than to accord it specific rank. The wider and flatter embryonic whorls, making a more rounded and less conical apex, form a constant differential character between this subspecies and all the other races, including typical specimens.

8-b. Amastra anthonii meineckei, new subspecies (pl. 1, figs. 7, 11-15).

The shell is consistently longer, more cylindrical in form and proportionately narrower than in typical *A. anthonii*. In surface texture and color pattern, both agree closely. In recent examples the body whorl is maroon, a small region around the umbilicus Naples yellow; the suture is bordered below by an indefinite, narrow, indistinctly yellowish band. The lip-rib is remarkably weak for a shell with its thick heavy texture. Length, 23.2 mm.; diameter, 11.2 mm.; aperture diagonal, 9.7 mm.; whorls, 6¾.

Kauai: Kalalau, on the northern side of the valley, east of double waterfall (Meinecke, 1925, 1927). Type, no. 10764 (pl. 1, fig. 7); paratypes, nos. 86493-5.

Both of Meinecke's series were collected in exactly the same locality on a steep, shrubby slope high up on the precipitous side of the valley. On his first visit only dead specimens were taken, but on the second a few live shells, in addition to several dead ones, were found. Nearly all the specimens agree closely; the only variants are three dead shells which have more conic outlines and are proportionately broader than the majority of specimens. One of these measures: length, 20.0 mm.; diameter, 10.5 mm. Embryos of this subspecies are very similar to embryos of the same age taken from the nearly typical examples collected by Forbes and Dole. In both forms the embryonic shells are narrowly umbilicate, and in addition to the fine, longitudinal striae, there are very faint microscopical spiral lines which are more noticeable below than above the periphery.

Amastra a. meineckei nearly equals *A. ricei* in size. From *A. ricei, A. meineckei* differs principally in its more convex and less distinctly sculptured embryonic whorls; and in the series of 21 examples before me there is not the slightest indication of a peripheral keel. In my former paper [6] I placed *A. ricei* and its variety *armillata* in the section *Armiella* of the subgenus *Kauaia.* Throughout the numerous series of *Amastra anthonii* from many localities the embryonic differences are constant. If these embryonic differences are not overemphasized, it would be appropriate to consider *A. ricei* a divergent species of *Amastrella* rather than a form of *Armiella. A. ricei* is apparently intermediate between these two sections of the genus *Amastra.*

Farther to the east, in the precipitous valley of Hanakoa, Meinecke discovered, in 1927, an interesting colony of what is apparently a local race of *A. anthonii meineckei.* The shells are proportionately much narrower than typical examples of *A. anthonii,* on the average somewhat smaller than *A. anthonii meineckei,* and they represent a race of the subspecies. The largest shells from this colony are nearly the same size as the shortest adults of this subspecies from Kalalau. Three adults (no. 10763) have the following measurements:

Length	Diameter	Aperture Diagonal	Whorls
20.0 mm.	9.7 mm.	8.9 mm.	6⅔ (pl. 1, fig. 14)
19.0 mm.	10.4 mm.	9.2 mm.	6½ (pl. 1, fig. 13)
17.4 mm.	9.6 mm.	8.2 mm.	6¼ (pl. 1, fig. 15)

[6] B. P. Bishop Mus. Occ. Papers, vol. 3, no. 3, p. 3, 1917.

Another race of *A. anthonii meineckei,* which was taken in abundance by Meinecke (1925, 1927) at Hoolulu, about a mile and a half east of Hanakoa, in a patch of woods located just above the trail, differs in being considerably smaller than any examples of the subspecies found farther to the west and south. The largest shell, however, is nearly 1½ mm. shorter than the smallest adult from Hanakoa, and the average difference in length between the representatives of these two races would be nearly 4 mm. Most of the shells have about one complete whorl less than the majority of the western representatives of this subspecies. Three shells (no. 10756) representing the extremes of variation in this colony have the following measurements:

Length	Diameter	Aperture Diagonal	Whorls
16.0 mm.	9.0 mm.	7.7 mm.	6 (pl. 1, fig. 11)
15.0 mm.	8.1 mm.	6.8 mm.	6+
13.3 mm.	7.6 mm.	6.7 mm.	5⅔ (pl. 1, fig. 12)

Unfortunately, none of Meinecke's material was taken alive. The smallest specimen, of which the measurements are given above, shows some approach in size to the form identified by nearly all authors and collectors as *A. nucleola* Gould. From specimens of *A. nucleola* this small example of the new subspecies differs in its more cylindrical form, thicker shell, and much more strongly striated surface.

8-c. Amastra anthonii subglobosa, new subspecies (pl. 1, fig. 16).

The shell is larger than typical examples of the species, with a more capacious and proportionately wider last whorl. The spire is much wider in proportion to its length than in any specimen of *A. anthonii* which has been examined, and it has slightly more convex and rapidly increasing whorls. The surface is less distinctly longitudinally sculptured and the spiral lines are very weak. Length, 17.9 mm.; diameter, 11.2 mm.; aperture diagonal, 9.0 mm.; whorls, 6.

Kauai: Waimea (A. F. Judd, 1892). Type, no. 10757; paratypes, no. 17973.

The original and only series of this subspecies which I have seen consists of three adults and two juveniles, all dead when collected. This series came with a number of other species labelled "Waimea, Kauai." Waimea is a more or less generic locality and includes the southwestern portion of Kauai. Several of the species can be defi-

nitely identified as coming from particular localities, as they are known to inhabit rather restricted areas. Other species are present which are found in many portions of Kauai and cannot be assigned to any particular locality. The exact habitats of two or three of the species in this lot are, at present, unknown, for they have not been rediscovered by any recent collector. *A. anthonii subglobosa* is one of these. From its rather intimate relationship to *A. anthonii* from the southern side of Kalalau, it is safe to assume that the specimens of *A. a. subglobosa* were taken from above the cliffs in one of the upland branches of the valleys of Honopu, Nualolo, or Milolii.

The shell chosen as the type differs slightly from the other two adults, as there is a faint, indistinct angle at the periphery which is not indicated in the other two, which unfortunately were in very poor condition when collected.

The separation of *A. a. subglobosa* is based largely on characters of juveniles. In comparison with *A. anthonii* of similar age, typical specimens of *A. a. subglobosa* have a proportionately wider and much shorter spire, with more convex outlines, and, in addition, much more convex individual whorls. Two juveniles have the following measurements:

Length	Diameter	Aperture Diagonal	Whorls
15.2 mm.	10.2 mm.	8.5 mm.	5½
13.5 mm.	10.2 mm.	8.1 mm.	5¼

A juvenile *A. anthonii* from the southern side of Kalalau (no. 19960) in the Museum collection measures: length, 15.9 mm.; diameter, 9.5 mm.; aperture diagonal, 8.1 mm.; whorls, 5¾.

9. Amastra (Amastrella) ovatula, new species (pl. 2, figs. 5-7).

The shell is distinctly though very narrowly perforate, ovately conic to conic, in its dead state dull white except for the embryonic whorls which are indistinctly bicolored whitish and cinnamon-rufous. The spire has slightly convex to nearly straight outlines, modified to a certain extent by the convex post-embryonic whorls, and has a rather narrow apical cone. The embryonic whorls are convex, nearly smooth, under a strong lens indistinctly striate; the post-embryonic whorls increase in convexity with the growth of the shell, their surfaces covered with strong, closely packed, irregular striae; the interstices between the striae marked with fine, close, spiral lines. The last whorl is oblong in some specimens to shortly ovate in others. The aperture is sub-ovate, its outer margin regularly curved and distinctly thickened. The colu-

mella is nearly straight, very narrowly triangular. Columellar lamella fine, low, oblique, ending gradually before reaching the outer margin of the columella. The umbilicus is very narrow, but open. The measurements of five adult cotypes are as follows:

Length	Diameter	Aperture Diagonal	Whorls
16.3 mm.	8.8 mm.	7.6 mm.	6¼ (pl. 2, fig. 5)
14.8 mm.	8.7 mm.	7.0 mm.	6
13.3 mm.	8.4 mm.	6.6 mm.	5¾ (pl. 2, fig. 6)
12.6 mm.	8.2 mm.	6.3 mm.	5¾ (pl. 2, fig. 7)
12.5 mm.	8.2 mm.	6.3 mm.	5¾

Kauai: abundant in Pleistocene deposits near the western edge of the Haena plain (C. M. Cooke, Jr., 1914-1923), comparatively rare in deposits of similar age at Limahuli (C. M. Cooke, Jr., 1907). Cotypes, no. 10758; paratypes, no. 37537.

Amastra ovatula, as represented in Bernice P. Bishop Museum from the type locality, shows a great deal of variability not only in size and form, but also in the degree of convexity of the post-embryonic whorls and in the outlines of the spire. From the presence of a distinct narrow umbilicus in all but a very few specimens, I was inclined to consider this species as an aberrant form of *Cyclamastra.* Except for this single character the species should be placed near *A. anthonii,* to which it has undoubtedly a close relationship. *A. ovatula* differs from *A. anthonii* not only in that most of its examples are perforate, whereas all *A. anthonii* are imperforate, but also in its somewhat narrower embryonic cone, the whorls of which are more convex. In addition, the post-embryonic whorls are decidedly more convex than in any shells which have been examined that could be attributed to *A. anthonii* or any of its races. There is, however, one character which is common to both species, namely, the presence of fine, spiral lines between the longitudinal striae of the last two and a half whorls. In common with *anthonii* and a few other Kauaian Amastras, the columellar fold is weak and does not extend to the outer margin of the columella.

Although a number of the shells from Limahuli agree closely with those from Haena, some have slightly flatter post-embryonic whorls.

Section METAMASTRA

Series of *Amastra reticulata*

10. Amastra (Metamastra) gulickiana dichroma, new subspecies, (pl. 2, fig. 8).

The shell is indistinctly perforate, ovately to globosely conic, thin, scarcely shining, above the periphery and in back of the aperture claret brown shading to lighter above, glossier and of an old gold to buffy citrine color below the periphery and in front of the aperture. The spire is broadly conic with convex outlines. The embryonic whorls are proportionately large, increasing rapidly, nearly smooth; post-embryonic whorls are slightly convex, regularly and closely marked with fine growth-wrinkles. The aperture is broad, its outer margin regularly curved, furnished within with a delicate lip-rib and forming, below, an angle with the base of the columella. The columella is nearly straight, furnished near its base with a rather strong slightly oblique fold which terminates near the outer margin of the columella.

Length	Diameter	Aperture Diagonal	Whorls
12.0 mm.	7.5 mm.	6.0 mm.	6 (Type, dead, adult)
11.3 mm.	7.3 mm.	5.8 mm.	5⅔ (Dead, adult)
11.1 mm.	7.4 mm.	5.5 mm.	5⅔ (Alive, nearly adult)

Oahu: on both sides near the crest of the ridge between Punaluu and Kaluanui (O. Oswald, 1929, 1930); on division ridge between Helemano, Waikane, and Kahana (O. Oswald, 1929). Type, no. 10748, and paratypes, nos. 100662, 100663, B. P. Bishop Museum collection; also paratypes in Oswald's collection.

This subspecies is evidently an extremely rare form, of which about 30 examples are the result of six findings. It is remarkable that this subspecies has not been taken by other collectors, as the trail along which Mr. Oswald found his specimens has been well known to most collectors and frequently visited for the last 25 years. This locality is separated by 4 or 5 miles from the habitat of *A. gulickiana,* which has only been taken on the southern side of the range. The subspecies *A. g. dichroma* agrees with typical *A. gulickiana* in the embryonic form and whorling. It differs in its slightly larger size, less globose form, the finer and more regular striation of the post-embryonic whorls, and the indistinct keel on the periphery. Two live shells taken by Oswald on the crest of the ridge between Punaluu and Kaluanui are not bicolored. One of them is of a nearly uniform bay color, the second is of nearly uniform antique brown; otherwise, they agree with the type specimens found a few hundred yards to

the south. The shells taken on the Punaluu side of the ridge, as well as those from the Waikane-Kahana ridge, agree in color pattern with those from the type locality. A few show a slight color variation in that the sutures of the last two whorls are accompanied below by an indistinct, rather broad, lighter colored band. Juveniles with about four and one-half whorls are narrowly umbilicate. The third specimen, which is not quite mature, as the thickening of the peristome has only taken place near its base, was pregnant with one embryo. This embryo is nearly globose, with about two and one-half whorls; the spire is low-convex. It is distinctly perforate and has, near the base of the columella, a very low, indistinct swelling indicating the position of the columellar fold.

In addition to the type specimen of *A. gulickiana,* the Museum collection contains three lots which have been acquired since the publication of volume 23 of Pilsbry's Manual of Conchology (1915). Two lots, containing three dead and worn specimens, are typical of *A. gulickiana.* The first was collected by W. Meinecke in 1930 at Opaeula, and the second was collected by O. Oswald at Helemano. The third lot contains four shells which in color pattern, size, and form are close to *A. g. dichroma.* These were collected by A. Gouveia in 1916. From the appearance of all of the specimens at hand, it is probable that *A. gulickiana* is an inhabitant of the somewhat dry forest zone on the south side of the Koolau Range. While *A. g. dichroma* inhabits the damp rain forest on both sides of this range, both the species and subspecies are limited to the northern or nearly northwestern end of the Koolau mountains.

11. Amastra (Metamastra) subrostrata (Pfeiffer) (pl. 2, fig. 9).

Pilsbry has dealt rather fully with this species [7] and has reproduced a figure of the type specimen. As he had not examined localized material, the following notes may be of interest. During 1923 Oswald collected several fine series of a species which I did not recognize. They were found to agree closely with Pfeiffer's description, Pilsbry's figure, and also with one of Pease's specimens of *A. solida* received from the Museum of Comparative Zoology which, according to Pilsbry, equals *A. subrostrata.* With this clue as to the identity of *A. subrostrata,* a reëxamination of the *Amastra* material from this region was made and an additional lot of the species was

[7] Pilsbry, H. A., Manual of Conchology, vol. 23, p. 28, pl. 7, fig. 4, 1915.

found. This last lot I had collected in a small valley near the crest of the Waianae Mountains east of Mauna Kapu. Oswald's material, the result of three trips, was collected in Nanakuli Valley, the southernmost large valley on the western side of the Waianae Mountains. The shells were found on the precipitous slopes of the head of the valley between the two peaks of Mauna Kapu and Palikea, at from one-half to two-thirds of the altitude above the floor of the valley. In 1931 Cooke and Welch took this species about 200 to 300 feet below the crest of the range on the Nanakuli side, probably directly above Oswald's localities. All the live specimens were taken in "leaf trash" under trees and shrubs, in both dense and open forest.

From what is known at present of the distribution of *Amastra subrostrata,* the species is, for the most part, living today in the northeast corner of Nanakuli Valley with a few examples found on the eastern side of the range almost opposite the more abundant western colonies.

In fresh shells, one of which is figured, the whorls, except the last, are of a uniform russet to cinnamon-brown. In most shells the outer surface of the cuticle of the last whorl is indistinctly marked with vertical and spiral small grayish patches so that this whorl is almost Hay's brown in color. This shades into a chamois to honey yellow color on the last whorl in back of the peristome. A very few shells are almost uniformly colored similar to Pilsbry's figure of the type. A large majority are of about the dimensions given by Pfeiffer (length, 15 mm.; diameter, 8 mm.). A few dead shells are slightly larger. One of them measures: length, 17.0 mm.; diameter, 8.2 mm.; aperture diagonal, 7.2 mm. (pl. 2, fig. 9).

11-a. Amastra (Metamastra) subrostrata acuminata, new subspecies, (pl. 2, fig. 10).

The shell is elongate with a proportionately long spire which has convex outlines below, concave above. In color and form of aperture *A. s. acuminata* agrees fairly closely with typical *A. subrostrata.*

Length	Diameter	Aperture Diagonal	Whorls	
20.0 mm.	8.7 mm.	8.1 mm.	7+	
19.2 mm.	9.0 mm.	8.2 mm.	7	(pl. 2, fig. 10)

Oahu: Waianae Mountains, Lualualei, southeast side of valley, high up the sides in damp glen (O. Oswald, 1928). Cotypes,

no. 10773; paratypes, no. 91998. *A. s. acuminata* is considered of subspecific rank on account of its length and the differences in the outlines of the spire. In addition, it invariably has nearly a whole additional whorl.

In the three trips made by Oswald, nearly 100 living and dead examples of this form were taken. All agree closely in size and other characteristics, except one dead shell which has almost the same dimensions as the dead specimen of the typical *A. subrostrata* mentioned above.

12. Amastra (Metamastra) oswaldi, new species (pl. 2, fig. 13).

The shell is imperforate, sinistral, oblong-conic, somewhat solid, the post-embryonic whorls finely sculptured with oblique, slightly flexuous growth-striae. The embryonic whorls are warm blackish brown, post-embryonic whorls with tawny-olive ground color covered with a thin, nearly black cuticle arranged in narrow vertical stripes which coalesce on the back of the last whorl. There is is no cuticle in front of the aperture. Spire conic with nearly straight outlines, the apical whorls nearly flat, the rest only slightly convex, the last subcylindrical. Aperture rather narrow, subvertical, the outer margin narrow, distinctly edged with black and furnished with a narrow lip-rib. Columella short, terminated abruptly by a twisted fold. Length, 16.6 mm.; diameter, 8.6 mm.; aperture diagonal, 7.0 mm.; whorls, 6⅛.

Oahu: close to the crest of the Kualoa ridge east of Puu Kanehoalani (O. Oswald). Type, no. 10771; paratypes, no. 92276. This species is exceedingly rare and was taken by Oswald in the clumps of kukui trees near the crest of the ridge. The result of six trips to this difficult and dangerous locality netted about 30 specimens. No live shells were taken, and only three had the color and cuticle perfectly preserved. The great majority were bleached and white.

There can be no confusion between the identity of this species and that of *Amastra thaanumi* found under similar conditions on the opposite ridge of Kaaawa. *A. oswaldi* is longer, proportionately narrower with flatter and more closely-coiled whorls. It is, however, in the embryonic whorls that the two species are entirely unlike. Those of *Amastra thaanumi* increase rapidly, forming an obtuse apex, whereas those of *Amastra oswaldi* increase slowly and are flattened, forming a sharp cone.

Amastra oswaldi is probably on the verge of extinction, as the native forests of its habitat occupy only the apices of the steep hanging valleys on the northern side of the ridge. There is but very little variation in the form of the shells. A few are slightly more conical,

with slightly broader aperture than the type. Of the two additional shells with perfectly preserved cuticle, one is almost similar to the type. In the other, the alternating stripes are much broader.

Section AMASTRA, sensu stricto
Series of *Amastra assimilis*

13. Amastra inopinata, new species (pl. 2, figs. 11-12).

The shell is imperforate, subcylindrical, solid, and, in its dead state, white. The spire is narrowly ovate, with a rather blunt apex. The embryonic whorls increase rapidly, are nearly flat, and the first two are strongly engraved with the characteristic axial costae of *Amastra, sensu stricto.* In some examples, beginning on the third whorl and just before the embryo is fully formed, these costae are intercepted near their middle with a series of flattened planes. The surface of the post-embryonic whorls, especially of the lower, is distinctly and strongly malleate, the planes being slightly modified by growth-wrinkles. The post-embryonic whorls are flatly convex, separated by a simple, scarcely impressed suture. The last whorl is subcylindrical, tapering slowly toward the base. The aperture is longer than broad, its outer margin slightly curved, becoming more strongly curved below. Columella only slightly twisted, furnished near its middle with a strong oblique fold.

Length	Diameter	Aperture Diagonal	Whorls
18.6 mm.	9.1 mm.	8.1 mm.	6¼ (Cotype; pl. 2, fig. 11)
17.5 mm.	9.2 mm.	8.0 mm.	6⅓ (Cotype; pl. 2, fig. 12)

East Maui: Kula, near the division between the lands of Keokea and Kamaole (C. M. Cooke, Jr., 1922). Cotypes, no. 10769; paratypes, no. 52838. All the shells came from an extremely rocky pasture extending between the upper and lower roads. Scattered through this pasture are a few dying trees, the last remnants of the native forest of a few decades ago. Many dead land shells of several species and genera were found scattered among the loose surface stones. Under a single stone about two or three quarts of the richest fossiliferous earth were uncovered. From this mass of earth about 1,300 whole or nearly whole shells were picked out with representatives of about 70 species belonging to 23 genera. All the specimens of *A. inopinata* were found under this stone except one, which was taken about one-fourth of a mile directly above this locality on the previous day. Undoubtedly this region was inhabited by a rich land snail fauna sometime within the last hundred years. A large number of these species must be entirely extinct, as no native forest area is located within several miles.

The most distinctive characters of this species, characters in which it differs from the rest of the Amastras of Maui, are the width and rapid increase of embryonic whorls. These form a very wide cone at the apex of the shell. In all the other Mauian species of *Amastra* the apical cone is much narrower and decidedly more pointed. *Amastra inopinata* also differs from the other species from Maui in its cylindrical form. The malleate surface texture is not limited to this species, but is also found in a few others from Maui. In size and proportions *A. makawaoensis* about equals *A. inopinata,* but *A. makawaoensis* is easily separated by its more narrowly conic apical whorls and spire.

Section HETERAMASTRA

14. Amastra (Heteramastra) dwightii, new species (pl. 2, fig. 14).

The shell is imperforate, sinistral, ovate-turrite, thin, dull, Saccardo's umber, more or less streaked with lighter color. Spire conic, with slightly concave outlines above. Embryonic whorls convexly flattened, somewhat carinate at the periphery, separated by a deep, narrow suture, regularly engraved with distinct close costae. Post-embryonic whorls slightly convex, separated by a distinct suture, marked with fine, uneven growth-striae, and slightly carinate at the periphery, the carination bounding the upper margin of the suture. Last whorl proportionately very large, ovate. Aperture narrowly ovate, its outer margin regularly curved and furnished with a distinct delicate lip-rib. Columella oblique, short, furnished near its middle with a stout oblique fold. Length, 9.3 mm.; diameter, 5.4 mm.; aperture diagonal, 4.3 mm.; whorls, 6.

East Maui: Hana (D. D. Baldwin collection). Type, no. 10766; paratypes, no. 55608. The series of this species consists of five specimens which came to Bernice P. Bishop Museum with the Baldwin collection. The original label in Baldwin's characteristic handwriting is "Amas. soror? Ne., Hana? Maui." There is no clue as to whether Baldwin collected the shells or received them from some one else, as the space for the name of the collector is left blank in his catalogue.

This is the smallest species of those that can be included under Pilsbry's section *Heteramastra.* There is no very distinctive character except the small size and strongly and evenly sculptured embryonic whorls. *Amastra dwightii* does not seem to belong to any known species as a subspecies or geographical race.

Of the five specimens making up the original series three are

adult, and two, in which the lip-rib shows a slight thickening along its lower margin, are nearly so. One of these two, which has five and one-half whorls, has a length of just 8 mm. All five shells agree in the evenness and degree of sculpturing of the embryonic whorls. In three there is an indication of a peripheral keel on the second embryonic whorl, whereas in two this keel is strongly developed. Each of the shells has a distinct, though not strongly developed, peripheral keel on all the post-embryonic whorls except the last.

In general form and proportions, *A. dwightii* has somewhat the appearance of a diminutive *A. fraterna* from Lanai or *A. subsoror awahiensis* from the southern slopes of east Maui. It differs from *A. fraterna* in its proportionately shorter and less attenuate spire and coarser embryonic sculpture, and from *A. subsoror awahiensis* in its less convex post-embryonic whorls and in the flatter and much more distinctly sculptured embryonic whorls.

15. Amastra (Heteramastra) implicata, new species (pl. 2, fig. 15).

The shell is imperforate or minutely rimate perforate, sinistral, oblong-conic, with convex outlines, deep olive buff, covered with a thin, Dresden brown to mummy brown epidermis. In most of the examples the cuticle is arranged in a fine, reticulate pattern on the spire, but in a few the cuticle forms a nearly uniform, slightly streaked covering. Spire narrowly conic, with slightly convex outlines, attenuate above and ending in a sharp apex. Embryonic whorls nearly flat, the initial whorl strongly marked with sharp, rather coarse costae. With the growth of the embryo, the costae become slightly weaker and more closely packed. The periphery of the embryonic whorls is marked with a strong, sharp, distinct keel which extends over the suture. Post-embryonic whorls are somewhat convex, the surface (under a lens) marked with fine, irregular, closely spaced growth-striae. The last whorl is sub-cylindrical, tapering gradually and evenly to the base, its last half descending slowly and regularly below the periphery of the penultimate whorl. Aperture slightly contracted, narrow, its outer margin regularly curved and furnished with a thin, hardly discernible lip-rib. Columella rather short, oblique, furnished near its middle with a strong, compressed oblique fold.

Length	Diameter	Aperture Diagonal	Whorls
13.0 mm.	6.8 mm.	5.8 mm.	6¼ (Cotype; pl. 2, fig. 15)
12.0 mm.	6.6 mm.	5.4 mm.	6+ (Cotype)

East Maui: Kipahulu, ridge on south side of valley (C. N. Forbes. 1919), type locality; also on the north side of the main valley in the branch valley of Alaenui (C. N. Forbes, 1919). Cotypes, no. 10767; paratypes, nos. 48971-2. In two embryonic specimens from different

individuals the shell is imperforate, the columella is straight, the columellar fold is long, very narrow and delicate, almost vertical, and forms the upper portion of the inner face of the columella. In a juvenile with slightly more than five whorls the periphery is rounded.

This species occupies a more uncertain position than that which is occupied by *Amastra pilsbryi.* In *A. pilsbryi* the apex is slightly rounded and the embryonic whorls are slightly convex, whereas in *A. implicata* the embryonic whorls form the sharp cone with flat embryonic whorls characteristic of typical *Amastra.* The resemblance to typical *Amastra* is also increased by the figured cuticle of the majority of the shells.

On account of the type of columellar fold I am considering this species as belonging to *Heteramastra,* as this character is constant in the embryos of at least four species typical of this section. Unfortunately, the Museum does not have embryos of all the species that have been included in *Heteramastra.* However, I have been able to examine embryonic specimens of *A. fraterna* from Lanai, of *A. nubigena* and *A. subsoror* from West Maui, and of *A. laeva* and *A. subsoror awahiensis* from east Maui. In all of these the columellar fold is delicate, thin, and placed almost vertically along the inner face of the columella.

A. implicata differs from *A. pilsbryi* in its narrower conical form and more attenuate spire and its flatter embryonic whorls. From *A. subsoror awahiensis* it differs in its larger size, more convex outlines, proportionately shorter and less acuminate spire.

16. Amastra (Heteramastra) nannodes,[8] new species (pl. 2, fig. 16).

The shell is usually imperforate, rarely minutely rimate-perforate, sinistral, narrowly ovate or elliptical, somewhat solid, and, in its dead state, white. The spire is narrowly ovate, with convex outlines ending above in a blunt apex. The embryonic whorls are wide, slightly convex, and increase rapidly. The initial whorl is engraved with coarse, curved, axial costae; the subsequent embryonic whorls are marked with fine, close, delicate striae. The post-embryonic whorls are marked with distinct growth-striae which are more or less modified by spirally descending, low ridges giving the surface a malleate appearance. The last whorl is elongate, subcylindrical, with convex outlines. The aperture is longer than broad, almost elliptical, its outer margin regularly curved and furnished with a wide, distinct lip-rib. The columella is obliquely inclined and furnished near its middle with a strong spirally ascending fold.

[8] *νανν*ωδης = like a dwarf.

Length	Diameter	Aperture Diagonal	Whorls
13.2 mm.	7.1 mm.	5.7 mm.	5⅓ (Cotype; pl. 2, fig. 16)
12.0 mm.	6.7 mm.	5.4 mm.	5¼ (Cotype)
11.9 mm.	6.7 mm.	5.4 mm.	5¼ (Cotype)

East Maui: Kula, near the division between the lands of Keokea and Kamaole (C. M. Cooke, Jr., 1922). Cotypes, no. 10768; paratypes, no. 52846. All the specimens (nearly 50) of this species were taken from under a single rock. (See *A. inopinata.*)

Amastra nannodes has almost the same size and proportions as *A. pilsbryi* from west Maui. It is easily distinguished from *A. pilsbryi* by its more elliptical and blunter spire and thicker shell, the surface of which is distinctly malleate in the best-preserved specimens.

Like *A. pilsbryi, A. nannodes* occupies an intermediate position between typical *Heteramastra* and *Amastra, sensu stricto.* My first thought was that it should be classed with typical *Amastra;* but although the embryos are distinctly costate none of them showed the peripheral keel characteristic of most of the species of *Amastra.* In addition, the columellar fold is more obliquely inclined than in most typical *Amastra,* but not as decidedly so as in many species of *Heteramastra.* In embryonic specimens of *A. nannodes* the shells are perforate, the columella fold is rather low and thickened and placed spirally on the columella. Further divergences from *Heteramastra* are the form of the embryo and the thicker shell, which has a distinctly malleate surface. This malleate surface is noticed in a few specimens of *A. laeva* received from Mr. Baldwin.

A. mirabilis, a sinistral species, in the form and sculpture of the embryonic whorls, is distinctly unlike any *Heteramastra* but similar to typical *Amastra.* The obliquity of the columellar fold is between that of typical *Amastra* and that of *A. nannodes.*

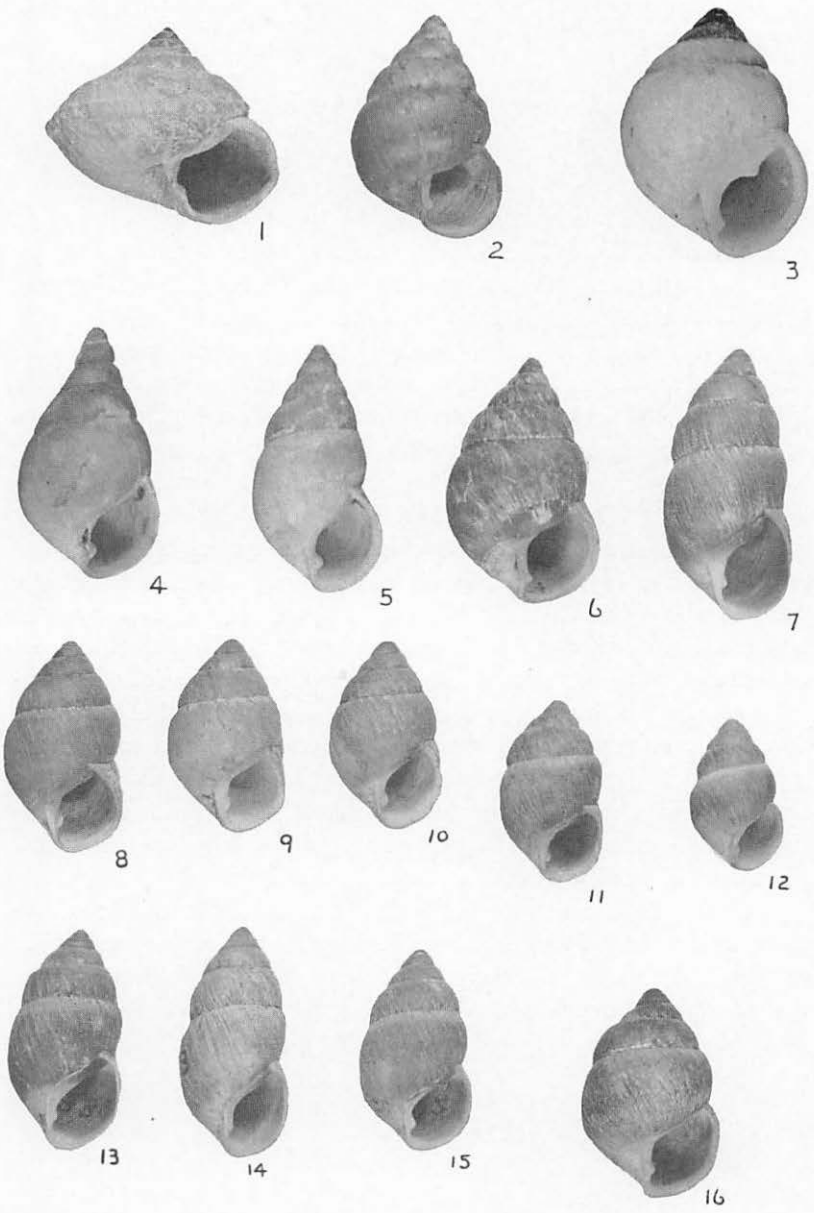
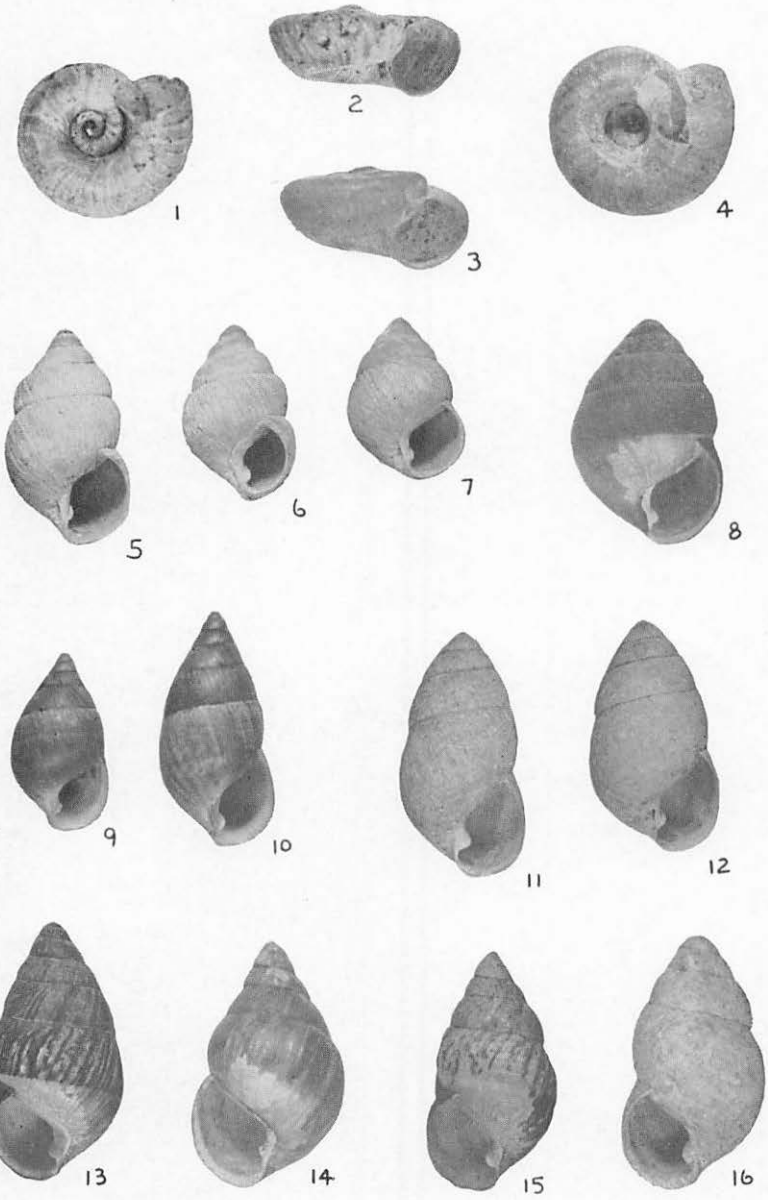


FIG. 1, Amastra cyclostoma gregoryi (natural size); FIG. 2, A. delicata (× 3); FIG. 3, A. globosa (× 1.8); FIG. 4, A. thurstoni bembicodes (× 3); FIG. 5, A. problematica (× 3); FIG. 6, A. rugulosa janeae (× 2.5); FIG. 7, A. anthonii meineckei (× 1.5); FIGS. 8-10, A. anthonii (× 1.5); FIGS. 11-15, A. anthonii meineckei (× 1.5); FIG. 16, A. anthonii subglobosa (× 1.5).



FIGS. 1, 2, Paramastra spaldingi (× 4); FIGS. 3, 4, P. spaldingi koolauensis (× 4); FIGS. 5-7, Amastra ovatula (× 1.8); FIG. 8, A. gulickiana dichroma (× 2.7); FIG. 9, A. subrostrata (× 1.6); FIG. 10, A. subrostrata acuminata (× 1.6); FIGS. 11, 12, A. inopinata (× 1.8); FIG. 13, A. oswaldi (× 2); FIG. 14, A. dwightii (× 3.4); FIG. 15, A. implicata (× 2.5); FIG 16, A. nannodes (× 2.7).