

MARINE MOLLUSKS COLLECTED
DURING THE "ASKOY" EX-
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COLOMBIA, AND ECUA-
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LEO GEORGE HERTLEIN AND A. M. STRONG

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LEO GEORGE HERTLEIN AND A. M. STRONG
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INTRODUCTION

THE COLLECTION OF MARINE MOLLUSKS consisting of Pelecypoda, Scaphopoda, and Gastropoda on which the present report is based was assembled during the "Askoy" Expedition of the American Museum of Natural History under the direction of Dr. Robert Cushman Murphy between February 10 and May 26, 1941. The area covered during this expedition included the Pacific coast of Panama from Las Perlas Islands south, the west coast of Colombia, and south to Cape Santa Elena, Ecuador. The "Askoy" occupied approximately 113 stations, and mollusks were taken from 16 of them. At most of these stations mollusks were obtained by dredging in comparatively shallow water, but some were taken in coral heads by diving, and others were picked up on the beaches.

Included in the present report are a few specimens collected by Dr. R. C. Murphy at Las Perlas Islands in November, 1945, and a few specimens collected by Dr. C. M. Breder, Jr., while cruising off the coast on the "Wilpet" in December, 1942.

The itinerary, personnel, and sponsorship of the expedition have been recorded by Nichols and Murphy (1944) and by Murphy (1941). A report by Garth (1948) on the brachyuran crabs taken on the expedition includes a map and a list of many of the stations.

The marine mollusks taken on this expedition were submitted for identification to Prof. William J. Clench of the Museum of Comparative Zoölogy at Harvard College. The urgency of work connected with other projects already begun led Clench (February

17, 1949) to request the present authors to identify the collection and prepare a report for publication. This arrangement was agreed to by the present authors and approved by John C. Armstrong, then Assistant Curator of Marine Invertebrates, the American Museum of Natural History. The collection was sent to the California Academy of Sciences, and identification of the species was begun during the summer of 1949.

The information concerning the various stations and samples, number, depth, etc., has been taken from the labels accompanying the specimens, in some cases supplemented by additional information received from Clench. A few specimens were unaccompanied by the information from whence they came; in some cases the label bore only a field number or was blurred and unreadable.

The general systematic arrangement, with some modification, follows that used by Dall. Information concerning tropical west American species of mollusks is rather widely scattered through the literature; therefore we have supplied synonymic references to the literature to accompany each species which will aid others who study the molluscan fauna of this region. The gastropods have received a much fuller discussion in this report than have the pelecypods, because most of the latter have been discussed by the authors in a recent series of papers (1940-1951). Where more than one specimen from a station is represented in the collection, the measurements given are those of the largest or most typical or best preserved example.

ACKNOWLEDGMENTS

The authors wish to acknowledge assistance and advice received from several individuals. Mr. John C. Armstrong, formerly Assistant Curator of Invertebrates at the American Museum of Natural History, and Prof. William J. Clench of the Museum of Comparative Zoölogy cooperated in furnishing information concerning the collection and advice on the preparation of this report. Special acknowledgment is due Dr. G. Dallas Hanna, Curator, Department of Paleon-

tology, California Academy of Sciences, and Mr. Allyn G. Smith, Research Associate of the same institution. Dr. Hanna aided us with the identification of the Terebridae and Mr. Smith with the Turridae. Dr. A. Myra Keen, Department of Geology at Stanford University, verified some references for us and made available the large collection of mollusks in that institution. Dr. Harald A. Rehder and Dr. David Nicol of the United States National Museum furnished informa-

tion concerning some of the type specimens of mollusks in that institution. Dr. Nicol also verified references to certain rare books available to him. Dr. Leslie R. Cox, British Museum (Natural History), and Mr. William K. Emerson, Department of Paleontology, University of California, likewise checked references to certain publications in those respective institutions.

Through the courtesy of Dr. R. Wright Barker of the Caribbean Petroleum Company, Maracaibo, Venezuela, we have had available a manuscript by Drs. Barker and J. R. leB. Tomlin entitled "Notes on the

Mollusca of south west Ecuador." Many of the species cited by them from the Santa Elena Peninsula, Ecuador, also have been recorded from that same region in a recent paper by Hoffstetter (1952).

The photographs used to illustrate the species represented on the plates of this paper were made by Mr. Frank L. Rogers. The photographs used for figures 29 and 30 of plate 3 were obtained from the authorities of the British Museum (Natural History) by Dr. U. S. Grant, IV, who has kindly permitted their use.

EARLIER LITERATURE

Vasco Nuñez de Balboa, discoverer of the Pacific Ocean in 1513, noticed an abundance of pearls possessed by the natives along the west coast of Panama. These beautiful objects no doubt were obtained chiefly from the well-known pearl oyster *Pinctada mazatlanica*. The abundance of pearls yielded by fishing this species led to the appellation "Islas de las Perlas" (Pearl Islands) to the archipelago in the Gulf of Panama which is still known by that name.

Marine mollusks occasionally were casually mentioned in the accounts of some of the later voyagers. One of the early adventurers, Lionel Wafer, mentioned (1699, pp. 195-196; reprint, 1903, p. 178) oysters on Gorgona Island, Colombia, as follows: "Among other Places we were at the Island of Gorgonia, where we clean'd; and I took notice of several Monkeys there who liv'd partly upon Oysters [p. 196], which they got out of the Sea at low water. Their way was to take up an Oyster, and lay it upon a Stone; and with another Stone to keep beating it, till they had broke the shell to pieces." Dampier (1729, p. 123), too, recounted how small, black monkeys on this island fed upon "Pere-winkles and Muscles" at low water. He mentioned the abundance of pearl oysters at Gorgona Island, but remarked (1729, p. 125) that, oddly enough, he observed none of them in the Pearl Islands, although other kinds of oysters were found there. Noting the occurrence of mollusks at Punta Arena, Ecuador, the same author stated (1729, p. 111),

"At this Point there are abundance of Oysters, and other Shell-fish, as Cockles and Muscles; therefore the *Indians* of *Puna* often come hither to get these fish."

A general review of much of the literature dealing with marine mollusks of Panama appeared in a previous paper by Strong and Hertlein (1939, pp. 177-181). Most of the Pelecypoda represented in the present collection have been discussed by us in a series of papers (Hertlein and Strong, 1940-1951). Only a few of the most important papers dealing with the mollusks of the Panamic region need be mentioned here. These include papers by Broderip and Sowerby (1829), Broderip (1832-1836), Sowerby (1832-1835), d'Orbigny (1834-1847), Hinds (1843-1845), C. B. Adams (1852), Carpenter (1857, 1864), de Folin (1867, 1867-1876), Stearns (1891), Dall (1890a, 1908, 1909b), Zetek (1918), Olsson (1924), Bartsch (1924, 1926, 1928), Tomlin (1927-1929), Li (1930), Pilsbry (1931), Pilsbry and Lowe (1932), Lamy (1934), Pilsbry and Olsson (1935, 1941, 1943), and M. Smith (1944a, 1944b). A recent paper by Hoffstetter (1952) deals with subfossil or late Pleistocene mollusks found in saline deposits on the Santa Elena Peninsula. He discussed the range and habitat of many of those species, most of which occur now in marine waters along the coast of Ecuador.

Additional references to papers consulted during the course of our work on the mollusks in the present collection may be found in the bibliography at the end of this paper.

"ASKOY" STATIONS AT WHICH MOLLUSKS WERE COLLECTED

STATION	LOCATION	DATE
1	Pacheca Island, Las Perlas Islands	Feb. 10
2	Saboga Island, Las Perlas Islands	Feb. 11
7	South Passage, Las Perlas Islands	Feb. 13
8, 9	Santelmo Bay, Las Perlas Islands	Feb. 14-15
19	Piñas Bay, Panama	Feb. 24
20	Molino Cove, Piñas Bay, Panama	Feb. 25
30	Guayabo Chiquito, Panama	March 4
31	Ardita Bay, Colombia	March 5-6
32	Octavia Bay, Colombia	March 6-7
76	3 miles west of Cape Santa Elena, Ecuador	April 10
80	La Plata Island, Ecuador	April 12-13
81	Off Cape Pasado, Ecuador	April 14
93	Cuevita Bay, Colombia	May 11
102	Limon Bay, Gulf of Cupica, Colombia	May 17
109	Bayoneta Island, Las Perlas Islands	May 24

GENERAL REMARKS CONCERNING COMPOSITION AND SIGNIFICANCE OF THE COLLECTION

The mollusks that we have identified in the present collection represent but a portion of the known Panamic fauna. The collection is exceptional in that many of the species are represented by only one or by only a few specimens. There is a total of 211 species and subspecies. Of that total four are identified with doubt. One specimen is identified only as to genus.

A general summary of the major systematic categories represented in three classes are as follows:

	PELECYPODA	SCAPHOPODA	GASTROPODA	TOTAL
Orders	3	1	3	7
Families	25	1	33	59
Genera	40	1	66	107
Species and subspecies				211
Definitely identified	84	3	120	207
Doubtfully identified	—	—	4	4

Species in which the identification is uncertain are compared to species with which they appear to have their closest affinities.

The general assemblage is similar to that represented in other collections made in the same general region and is distinctly tropical west American in its affinities. One hundred and forty-three species and subspecies in the present collection have been recorded as ranging north to the Gulf of California region (including those ranging north to or beyond Cape San Lucas) and nine others as far north

as Mazatlan which probably also occur in the Gulf. Seventy-three species and subspecies have been recorded as ranging south to Peru. Five species are definitely known to occur in Caribbean waters, in addition to four others of which the occurrence in east American waters is less certain, and a number of other species are closely related to Caribbean forms. Many of the species bear a similarity to fossil forms occurring in the Caribbean region as well as to late Cenozoic fossils which occur along the Pacific coast. This

similarity of Caribbean and Pacific species indicates that the two bodies of water undoubtedly were connected by an open seaway which apparently existed as late as lower Miocene time.

Families in the present collection represented by the largest number of species are:

Turridae (12 genera)	21
Veneridae (4 genera)	15
Tellinidae (4 genera)	15
Terebridae (1 genus)	14

Genera represented by the largest number of species are:

<i>Terebra</i>	14
<i>Tellina</i>	9
<i>Cancellaria</i>	7
<i>Chione</i>	7
<i>Conus</i>	7
<i>Arca</i>	6
<i>Pitar</i>	6
<i>Cardium</i>	5
<i>Crucibulum</i>	4

An interesting discovery resulting from the study of this collection was the occurrence of two species of *Chione* previously known only from their original description as fossils, one in Pliocene strata in Ecuador, the other in the Pliocene of Ecuador and Pleistocene of Panama. Two species of *Terebra*, the identification of which is uncertain, also appear to

have affinities with species described as fossils in Ecuador. Another important addition to the knowledge of Panamic mollusks is the extension of the known range of 59 species and subspecies, in most cases southward, in a few northward, along the mainland.

The following are described as new in the present paper:

Tellina (Eurytellina) eburnea askoyana, new subspecies

Ensis tropicalis, new species

Cymatosyrinx roseola, new species

Hindsiclava, new genus; type *Pleurotoma militaris* Hinds in Reeve

Lioglyphostoma armstrongi, new species

Notocytharella, new genus; type *Cytharella niobe* Dall

Natica caneloensis, new species (not obtained by the "Askoy" Expedition)

SYSTEMATIC ACCOUNT

CLASS PELECYPODA

ORDER PRIONODESMACEA

SUPERFAMILY NUCULACEA

FAMILY NUCULIDAE

GENUS NUCULA LAMARCK

SUBGENUS NUCULA, SENSU STRICTO

Nucula (Nucula) exigua Sowerby

Nucula exigua SOWERBY, 1833, The conchological illustrations, Nuculae, p. 6, pl. 16, figs. 24, 24*; 1833, Proc. Zool. Soc. London, for 1832, p. 198, "Hab. ad Columbianam Occidentalem (Bay of Caraccas). A single specimen found in sandy mud at nine fathoms depth." HANLEY, 1860, in Sowerby, Thesaurus conchyliorum, vol. 3, p. 154, pl. 229 (Nuculidae pl. 4), fig. 136. SOWERBY, 1870, in Reeve, Conchologia iconica, vol. 18, *Nucula*, sp. 26, pl. 4, fig. 26.

Nucula (Nucula) exigua Sowerby, SCHENCK, 1939, Jour. Paleont., vol. 13, p. 36, pl. 6, figs. 1-8, 11. HERTLEIN AND STRONG, 1940, Zoologica, New York, vol. 25, p. 381, pl. 1, figs. 4, 5.

TYPE LOCALITY: "Bay of Caraccas. Mr. Cuming." [Ecuador.]

RANGE: San Bartolomé Bay (Turtle Bay), Baja California, to the Gulf of California (Carpenter) and south to the Santa Elena Peninsula, Ecuador. [?]To Magellan region (Dall).

MATERIAL EXAMINED: Two valves from off Cape Pasado, Ecuador, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, ± 15 fathoms.

MEASUREMENTS: Larger specimen: length, approximately 3.6 mm.; height, 3.2 mm.; convexity (one valve), 1.0 mm.

HABITAT: Bottom of mud and live shells.

REMARKS: Two single, somewhat worn valves of this species in the present collection possess the characteristic strong concentric ribs crossed by weaker but well-developed radial sculpture.

This species has been recorded by Pilsbry and Olsson as occurring in the Pliocene of Ecuador and from Quaternary terraces in Ecuador by Hoffstetter. Other records of its occurrence as a fossil were cited by the present authors in 1940.

GENUS NUCULANA LINK

SUBGENUS SACCELLA WOODRING

Nuculana (Saccella) eburnea Sowerby

Nucula eburnea SOWERBY, 1833, The conchological illustrations, Nuculae, pp. 4, 6, pl. 15, fig. 10; 1833, Proc. Zool. Soc. London, for 1832, p. 198, "Hab. ad oras Columbiae Occidentalis. Found in sandy mud, at a depth of from seven to nine fathoms, in the Bay of Caraccas." REEVE, 1841, Conchologia systematica, vol. 1, p. 111, pl. 85, fig. 10.

Nucula lyrata HINDS, 1843, Proc. Zool. Soc. London, p. 100, "Hab. Panama; from thirty fathoms."

Leda eburnea Sowerby, HANLEY, 1860, in Sowerby, Thesaurus conchyliorum, vol. 3, p. 124, pl. 228 (Nuculidae pl. 3), fig. 90.

Laeda eburnea Sowerby, SOWERBY, 1871, in Reeve, Conchologia iconica, vol. 18, *Laeda*, sp. 29, pl. 5, fig. 29.

Nuculana (Saccella) eburnea Sowerby, HERTLEIN AND STRONG, 1940, Zoologica, New York, vol. 25, p. 395, pl. 2, figs. 1-3.

TYPE LOCALITY: "Bay of Caraccas. Mr. Cuming." [Ecuador.]

RANGE: Meanguera Island, Gulf of Fonseca, El Salvador, to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: Forty specimens, mostly single valves from five stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 2 valves.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 2 valves.

Guayabo Chiquito, March 4, 1941, Station 30, 24-64 meters, 3 single valves.

COLOMBIA

Ardita Bay, in and out of center of bay, March 6, 1941, Station 31, sample 81, 34-43 meters, 30 specimens, mostly single valves.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., Station 81, sample 306, ± 10 fathoms, 1 valve.

Latitude 00° 31' 00" S., longitude 80° 35' 00" W., Station 81, sample, 307, ±15 fathoms, 2 valves.

MEASUREMENTS: One of largest valves: length, 13.8 mm.; height, 7.5 mm.; convexity, 3.3 mm.

HABITAT: Mostly sandy bottom, occasionally shell fragments, mud and live shells.

REMARKS: The shell of this species is rather long in proportion to the height, and the umbos are nearly centrally situated. The exterior is finely, evenly concentrically sculptured.

This species also occurs as a fossil on terraces on the coast of Ecuador.

SUBGENUS COSTELLOLEDA HERTLEIN AND STRONG

***Nuculana (Costelloleda) costellata* Sowerby**

Nucula costellata SOWERBY, 1833, The conchological illustrations, Nuculae, pp. 4, 6, pl. 15, fig. 8; 1833, Proc. Zool. Soc. London, for 1832, p. 198, "Hab ad Panamam. Two specimens were taken in sandy mud at a depth of ten fathoms." REEVE, 1841, Conchologia systematica, vol. 1, p. 110, pl. 85, fig. 8.

Leda costellata Sowerby, HANLEY, 1860, in Sowerby, Thesaurus conchyliorum, vol. 3, p. 111, pl. 228 (Nuculidae pl. 3), fig. 59.

Laeda costellata Sowerby, SOWERBY, 1871, in Reeve, Conchologia iconica, vol. 18, *Laeda*, sp. 24, pl. 4, fig. 24.

Nuculana (Costelloleda) costellata Sowerby, HERTLEIN AND STRONG, 1940, Zoologica, New York, vol. 25, p. 398, pl. 2, fig. 10.

Nuculana costellata Sowerby, M. SMITH, 1944, Panamic marine shells, p. 48, fig. 626.

TYPE LOCALITY: "Panama. Mr. Cuming."

RANGE: Santa Inez Bay, Gulf of California, to Cuevita Bay, Colombia.

MATERIAL EXAMINED: Three valves from two stations:

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 2 valves.

Bahia de Cuevita, May 11, 1941, Station 93, sample 359, dredged east-southeast across bay, 5–20 fathoms, 1 valve.

MEASUREMENTS: A valve from Station 93: length, 21.6 mm.; height, 8.6 mm.; convexity, 2.8 mm.

HABITAT: Gray sand and mud bottom.

REMARKS: The occurrence of this species

in the waters off Colombia furnishes a slight extension south of the known range.

GENUS ADRANA H. AND A. ADAMS

***Adrana elongata* Sowerby**

Nucula elongata SOWERBY, 1833, The conchological illustrations, Nuculae, pp. 3, 6, pl. 14, fig. 2; 1833, Proc. Zool. Soc. London, for 1832, p. 197, "Hab. in Columbiâ Occidentali. Dredged in sandy mud, at a depth of twelve fathoms, at Xipixapi." REEVE, 1841, Conchologia systematica, vol. 1, p. 110, pl. 84, fig. 2.

Leda elongata Sowerby, HANLEY, 1860, in Sowerby, Thesaurus conchyliorum, vol. 3, p. 106, pl. 227 (Nuculidae pl. 2), fig. 39.

Laeda elongata Sowerby, SOWERBY, 1871, in Reeve, Conchologia iconica, vol. 18, *Laeda*, sp. 4, pl. 1, fig. 4.

Adrana elongata Sowerby, HERTLEIN AND STRONG, 1940, Zoologica, New York, vol. 25, p. 409, pl. 2, fig. 16.

TYPE LOCALITY: "Salango. Mr. Cuming." [Ecuador.]

RANGE: Acapulco, Mexico, to Salango, Ecuador.

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, [sample 306], ±10 fathoms.

MEASUREMENTS: Length, approximately 56.5 mm.; height, 14 mm.; convexity (both valves together), approximately 4 mm.

HABITAT: Sand bottom.

REMARKS: The present specimen is typical of this species.

***Adrana exoptata* Pilsbry and Lowe**

Plate 3, figures 6 and 7

Leda (Adrana) exoptata PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 107, pl. 17, figs. 8, 9.

Adrana exoptata Pilsbry and Lowe, HERTLEIN AND STRONG, 1940, Zoologica, New York, vol. 25, p. 409, pl. 2, fig. 11.

TYPE LOCALITY: "Mexico: Guaymas, 20 fathoms."

RANGE: Guaymas, Mexico, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Twenty specimens from six stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 2 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 7 specimens.

Ensenada de Guayabo Chiquito, March 4, 1941, Station 30, 25–64 meters, 3 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34–43 meters, 6 specimens.

Aquacate (Octavia) Bay, March 7, 1941, Station 32, 12–14 fathoms, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, [sample 306], ±10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen, typical for the species: length, 20 mm.; height, 6.8 mm.; convexity (both valves together), approximately 2.8 mm.

HABITAT: Bottom of sandy mud, sand, and shell.

REMARKS: Most of the specimens in the present collection are small, single valves. The sculpture of the specimens varies, on some smoother than on others. A specimen from Station 81, off Cape Pasado, Ecuador, 19 mm. in length, has fine, even, concentric sculpture. The presence of a smooth area along the posterior dorsal margin as well as the shape of the shells has led us to assign them all to *Adrana sowerbyana*.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

Adrana sowerbyana d'Orbigny

Nucula lanceolata Lamarck, SOWERBY, 1825, The genera of recent and fossil shells, vol. 1, no. 17, *Nucula*, pl. 102, fig. 1; 1833, The conchological illustrations, *Nuculae*, p. 3, pl. 14, fig. 1. REEVE, 1841, *Conchologia systematica*, vol. 1, p. 110, pl. 84, fig. 1.

Not *Nucula lanceolata* J. Sowerby, 1817.

Not *Nucula lanceolata* Lamarck, 1819.

Leda sowerbyana D'ORBIGNY, 1846, *Voyage dans l'Amérique Méridionale*, vol. 5, p. 544. Reference cited: "*Nucula lanceolata*, Sow., 1831, Gen. of Shells, no. 17, fig. 1 (non *Lanceolata*, Lamk., 1819)." HANLEY, 1860, in Sowerby, *Thesaurus conchyliorum*, vol. 3, p. 107, pl. 227 (*Nuculidae* pl. 2, fig. 33 (as *L. sowerbiana*)).

Adrana sowerbyana d'Orbigny, HERTLEIN AND STRONG, 1940, *Zoologica*, New York, vol. 25, p. 410.

TYPE LOCALITY: No locality originally cited, but "Xipixapi" cited in 1833 [Jipijapa, Ecuador].

RANGE: Panama to Jipijapa, Ecuador.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 31, 14–33 meters.

MEASUREMENTS: Length, 29.9 mm.; height 6 mm.; convexity (both valves together), 2 mm.

HABITAT: Not indicated for the present specimen.

REMARKS: A single specimen from Piñas Bay, Panama, although small, possesses the characteristic features of *Adrana sowerbyana*, in which the umbos are anterior to the center and the valves are narrowly attenuated at the ends.

SUPERFAMILY ARCACEA

FAMILY ARCIDAE

GENUS ARCA LINNAEUS

SUBGENUS ARCA, SENSU STRICTO

Arca (Arca) mutabilis Sowerby

Byssoarca mutabilis SOWERBY, 1833, *Proc. Zool. Soc. London*, p. 17.

Arca mutabilis Sowerby, REEVE, 1844, *Conchologia iconica*, vol. 2, *Arca*, sp. 85, pl. 13, fig. 85. MAURY, 1922, *Palaeontogr. Amer.*, vol. 1, p. 167, pl. 29, fig. 5. M. SMITH, 1944, *Panamic marine shells*, p. 49, fig. 648.

Arca (Arca) mutabilis Sowerby, REINHART, 1943, *Special Papers Geol. Soc. Amer.*, no. 47, p. 26, pl. 11, figs. 8–10. HERTLEIN AND STRONG, 1943, *Zoologica*, New York, vol. 28, p. 154.

TYPE LOCALITY: "Hab. in Columbia occidentali. Found under stones at the Isle of Plata." [Island of La Plata, Ecuador.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco and San Felipe in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: Two specimens from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach on northern side of island. Four specimens, lacking locality data.

MEASUREMENTS: Larger specimen from Station 1: length, 24.4 mm.; height, 18 mm.; convexity (both valves together), 14 mm. Specimen lacking information as to locality: length, 30 mm.; height, 17.4 mm.; convexity (both valves together), 14.2 mm.

HABITAT: In crevices of rock.

REMARKS: The present specimens are similar to others of this species occurring in tropical west American waters.

The shell of this species may be readily recognized by the presence of three or four radial ribs on the posterior end, coarser than the others and usually black. The inner margin of the shell is usually brownish black.

SUBGENUS SCAPHARCA GRAY

Arca (*Scapharca*) *concinna* Sowerby

Plate 2, figure 20

Arca concinna SOWERBY, 1833, Proc. Zool. Soc. London, p. 20. REEVE, 1844, Conchologia iconica, vol. 2, *Arca*, sp. 34, pl. 6, fig. 34.

Arca cumingiana NYST, 1848, Mem. Acad. Roy. Sci. Lett. Beaux-Arts Belgique, vol. 22, p. 22.

Scapharca (*Scapharca*) *concinna* Sowerby, MAURY, 1922, Palaeontogr. Amer., vol. 1, p. 187, pl. 29, fig. 10.

Arca (*Scapharca*) *cumingiana* Nyst, REINHART, 1943, Special Papers Geol. Soc. Amer., no. 47, p. 73.

Arca (*Scapharca*) *concinna* Sowerby, HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 162.

TYPE LOCALITY: "Hab. in Americâ Centrali. Found in coarse sand, at a depth of twelve fathoms, in the Gulf of Nocoioy." [Costa Rica.]

RANGE: Santa Inez Bay, Gulf of California, to Esmeraldas, Ecuador.

MATERIAL EXAMINED: Sixteen specimens from seven samples from five stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 2 specimens.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, along beach, 1 specimen. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34-43 meters, 3 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24-28 meters, 4 specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24-28 meters, 4 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 41 mm.; height, 23 mm.; convexity (both valves together), 23.5 mm.

HABITAT: Mostly gray sandy bottom, occasionally black mud and shells.

REMARKS: Most of these specimens are single valves. They are typical of the species and possess about 30 radial ribs, of which the anterior ones are divided by a medial groove.

Nyst proposed the name *Arca cumingiana* for this species because of *Cucullaea concinna* Phillips, 1829. This change was accepted by Reinhart. However, *Arca concinna* was only a secondary homonym when proposed, and *Arca* and *Cucullaea* are now considered to be distinct genera. Therefore, we have, at least for the present, retained the specific name *concinna* which was applied to the present species by Sowerby.

This species has been recorded by Olsson as occurring in the Pleistocene of Panama.

A species from the Gulf of Mexico described as *Anadara baughmani* Hertlein (1951, p. 487, pl. A, figs. 1-7) is a similar form.

SUBGENUS CUNEARCA DALL

Arca (*Cunearca*) *esmeralda* Pilsbry and Olsson

Arca (*Cunearca*) *esmeralda* PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 53, pl. 13, figs. 4, 5. HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 160.

TYPE LOCALITY: "Canoa formation, Punta Blanca." Ecuador, Pliocene.

RANGE: Isabel Island, Mexico, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Forty three specimens from six samples from five stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 10 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-43 meters, 9 specimens.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, 7 specimens. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34-43 meters, 15 specimens.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24-28 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, approximately 12.7 mm.; height, 12.5 mm.; convexity (one valve), 5.6 mm.

HABITAT: Mostly gray sandy bottom, occasionally black mud and live shells.

REMARKS: The specimens here referred to *Arca esmeralda* are small. They bear considerable resemblance to *A. nux* but differ in the greater number of ribs, 26–28 rather than 22–23, and in that the cardinal area is less steeply sloping and is marked by chevron grooves. On smaller shells, the anterior groove of a chevron extends obliquely from just back of the beaks to the base, whereas in *A. nux* a groove, if present, extends very near the anterior side of the cardinal margin. Furthermore, a slight radial depression is often present on the exterior of the shell of *A. esmeralda* just anterior to the middle of the beaks.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

***Arca (Cunearca) nux* Sowerby**

Arca nux SOWERBY, 1833, Proc. Zool. Soc. London, p. 19. REEVE, 1844, Conchologia iconica, vol. 2, *Arca*, sp. 1, pl. 1, fig. 1.

Scapharca (Cunearca) nux Sowerby, MAURY, 1922, Palaeontogr. Amer., vol. 1, p. 196, pl. 31, figs. 7, 8.

Arca (Cunearca) nux Sowerby, HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 161.

TYPE LOCALITY: "Hab. ad Xipixapi. Found in sandy mud at a depth of twelve fathoms." [Jipijapa, Ecuador.]

RANGE: Concepcion Bay, Gulf of California, to Zorritos, Peru.

MATERIAL EXAMINED: One valve from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 24–33 meters.

MEASUREMENTS: Length, approximately 12.2 mm.; height (incomplete), 13.2 mm.; convexity (one valve), 6.4 mm.

HABITAT: Sandy mud bottom.

REMARKS: The single specimen in this collection is sculptured with about 23 finely noded radial ribs.

Tomlin (1927–1929, p. 308) cited this

species as occurring in the Caribbean. We have not seen specimens from that region.

SUBGENUS **BARBATIA** GRAY***Arca (Barbatia) reeveana* d'Orbigny**

Arca helblingii Bruguière, REEVE, 1844, Conchologia iconica, vol. 2, *Arca*, sp. 90, pl. 14, fig. 90. Not *Arca helblingii* Bruguière, 1789.

Arca reeveana D'ORBIGNY, 1846, Voyage dans l'Amérique Méridionale, vol. 5, p. 635. New name for *Arca helblingii* Reeve, 1844, not *Arca helblingii* Bruguière, 1789. M. SMITH, 1944, Panamic marine shells, p. 49 (as *Arca reeviana*), fig. 656.

Barbatia (Calloarca) reeveana d'Orbigny, MAURY, 1922, Palaeontogr. Amer., vol. 1, p. 175, pl. 30, fig. 13.

Barbatia (Cucullaearca) reeveana subsp. *reeveana* d'Orbigny, REINHART, 1943, Special Papers Geol. Soc. Amer., no. 47, p. 33, pl. 15, figs. 1–3.

Arca (Barbatia) reeveana d'Orbigny, HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 158.

Barbatia (Cucullaearca) reeveana d'Orbigny, DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 56, pl. 1, figs. 3, 4, 8.

TYPE LOCALITY: "Hab. St. Elena and Monte Christi; West Columbia, and island of Corrigidor, Philippines (found under stones at low water); Cuming" (Reeve). Santa Elena, Ecuador, designated as type locality by Hertlein and Strong, 1943.

RANGE: Manuela Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Zorritos, Peru.

MATERIAL EXAMINED: Five specimens from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, on northeast end of island in 3 fathoms.

MEASUREMENTS: Largest specimen: length, approximately 45 mm.; height, 31.8 mm.; convexity (both valves together), 22.7 mm.

HABITAT: With masses of coral.

REMARKS: Some of the specimens in the present collection are typical of this well-known species, *A. reeveana*, while others could equally well be referred to *A. reeveana lasperlensis* Sheldon and Maury (*in* Maury, 1922, p. 177, pl. 30, fig. 17). The figured specimen of the latter form was from "Viveros Island. Islas de las Perlas" and it also was cited as occurring at "Bucarn [Bucaru], the Port of Tonosi, Los Santos Province, Panama." *Arca reeveana* is often found attached to rocks in the intertidal zone and is quite variable in

form. As mentioned by Reinhart, it appears doubtful whether *A. reeveana lasperlensis* and *A. reeveana velataformis* Sheldon and Maury (in Maury, 1922, p. 177, pl. 30, fig. 15), the latter described from "Bucarn" [Bucaru], Los Santos Province, Panama, possess taxonomic value.

The species described as *Barbatia (Cucullaearca) bramkampi* Durham (1950, p. 55, pl. 1, figs. 5, 7, 9) from the upper Pliocene of Carmen Island in the Gulf of California is said to differ from *A. reeveana* in possessing finer and more numerous radial ribs.

Arca reeveana is known to occur from upper Pliocene to Recent.

SUBGENUS ACAR GRAY

Arca (Acar) gradata Broderip and Sowerby

Arca gradata BRODERIP AND SOWERBY, 1829, Zool. Jour., vol. 4, p. 365. SOWERBY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, p. 152, pl. 43, fig. 1. REEVE, 1844, Conchologia iconica, vol. 2, *Arca*, sp. 92, pl. 14, fig. 92.

Barbatia (Acar) gradata Broderip and Sowerby, MAURY, 1922, Palaeontogr. Amer., vol. 1, p. 180, pl. 30, figs. 4, 6, 9. REINHART, 1939, Trans. San Diego Soc. Nat. Hist., vol. 9, pp. 39-44, pl. 3, figs. 1a, 1b, 5a, 5b, 6a-6e; 1943, Special Papers Geol. Soc. Amer., no. 47, p. 35, pl. 11, figs. 11, 12. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 54, pl. 1, fig. 13.

Acar gradata Broderip and Sowerby, BARTSCH, 1931, Proc. U. S. Natl. Mus., vol. 80, art. 9, p. 2, pl. 1, 5 top figs.

Acar panamensis BARTSCH, 1931, Proc. U. S. Natl. Mus., vol. 80, art. 9, p. 3, pl. 1, 5 bottom figs., ". . . from Panama."

Arca (Acar) gradata Broderip and Sowerby, HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 155.

Arca panamensis Bartsch, M. SMITH, 1944, Panamic marine shells, p. 49, figs. 651, 664, 665.

TYPE LOCALITY: "Hab. ad littora Oceani Pacifici. . . From Mazatlan." [Mexico.]

RANGE: Point Abrejos, Baja California, to Punta Penasco in the Gulf of California and south to Negritos, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, on northeast side of island, 3 fathoms.

MEASUREMENTS: Length, 16.6 mm.; height, 8 mm.; convexity (both valves together), 7.6 mm.

HABITAT: With masses of corals.

REMARKS: The single specimen in the present collection is ornamented with the typical reticulate sculpture of this form which Broderip and Sowerby compared to a piece of Chinese carving. Reinhart, 1939, has given an adequate discussion of this species.

GENUS NOETIA GRAY

Noetia reversa Sowerby

Arca reversa SOWERBY, 1833, Proc. Zool. Soc. London, p. 20. REEVE, 1843, Conchologia iconica, vol. 2, *Arca*, sp. 5, pl. 1, fig. 5.

Arca hemiocardium KOCH, 1843, in Philippi, Abbildungen und Beschreibungen. . . Conchylien, vol. 1, no. 2, p. 43 (1), *Arca*, pl. 1, fig. 1, "Patria:—."

Noetia triangularis GRAY, 1857, Ann. Mag. Nat. Hist., ser. 2, vol. 19, p. 372, no locality cited.

Noetia reversa (Gray) Sowerby, MAURY, 1922, Palaeontogr. Amer. vol. 1, p. 171, pl. 29, figs. 7, 11. MACNEIL, 1938, Prof. Paper U. S. Geol. Surv., no. 189A, p. 38, pl. 6, figs. 7, 22, 23.

Noetia (Noetia) reversa Sowerby, REINHART, 1943, Special Papers Geol. Soc. Amer., no. 47, p. 77, pl. 14, figs. 5, 7, 8. FRIZZELL, 1946, Jour. Paleont., vol. 20, p. 40, fig. 5.

Arca (Noetia) reversa Sowerby, M. SMITH, 1944, Panamic marine shells, p. 49, fig. 645.

TYPE LOCALITY: "Hab. in Peruvia. Found in soft mud, at a depth of seven fathoms, at Tumbez."

RANGE: Altata in the Gulf of California to Tumbez, Peru.

MATERIAL EXAMINED: Five specimens from three stations:

PANAMA

Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 3 valves.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen, a right valve: length, 51.5 mm.; height, 45.4 mm.; convexity, 22.3 mm.

HABITAT: Sand, sandy mud, and dead shell bottom.

REMARKS: The present specimens, all

single valves, are similar to others of this species from the same region.

FAMILY GLYCYMERIDAE

A very useful paper citing references to the genera and subgenera of this family together with their respective types has been published by Nicol (1945). Another paper by the same author (1950) contains a discussion of the origin of this family of mollusks.

GENUS GLYCYMERIS DA COSTA

In an earlier paper [1943(1940-1951)], the present authors referred *Glycymeris tessellata* Sowerby and similar species to the subgenus *Tuceta* Bolten and cited as type *Tuceta pectunculus* Bolten in the synonymy of which Bolten placed *Arca pectunculus* Gmelin (= *Arca pectunculus* Linnaeus) illustrated by Chemnitz. However, as pointed out by Nicol, *Arca pilosa* Linnaeus was designated as type of *Tuceta* by Dall (1909a, p. 107).

A number of names have been proposed for radially ribbed species of *Glycymeris*. These include *Axinactis* Mörch, 1861, type, *Pectunculus inaequalis* G. B. Sowerby; *Grandaxinaea* Iredale, 1931, type *Glycymeris magnificens* Iredale; *Melaxinaea* Iredale, 1930, type *Melaxinaea labyrinthica* Iredale; *Tucetona* Iredale, 1931, type *Pectunculus flabellatus* Tension-Woods; and *Tucetilla* Iredale, 1939, type *Glycymeris capricornea* Hedley. According to Nicol (written communication), further study will be necessary to determine whether one of these supraspecific names is applicable to west American species such as *Glycymeris tessellata* and similar forms.

Glycymeris tessellata strigilata Sowerby

Plate 3, figures 25-28

Pectunculus strigilatus SOWERBY, 1833, Proc. Zool. Soc. London, for 1832, p. 196. REEVE, 1843, Conchologia iconica, vol. 1, *Pectunculus*, sp. 31, pl. 6, fig. 31.

Glycymeris (Tuceta) tessellata strigilata Sowerby, HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 152.

TYPE LOCALITY: "Hab. ad Sanctam Eleenam. Dredged from a depth of six to eight fathoms in sandy mud." [Santa Elena, Ecuador.]

RANGE: Manzanillo, Mexico, to Santa Elena, Ecuador.

MATERIAL EXAMINED: About 77 specimens from six samples from four stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 13 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to the entrance, 25-64 meters, about 45 specimens, mostly single valves.

COLOMBIA

Ardita Bay, March 5, 6, 1941, Station 31, sample 80 [probably beach], 2 single valves. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34-43 meters, 2 valves.

Octavia Bay, March 6, 1941, Station 32, sample 82, 24-28 meters, 12 specimens, mostly single valves. Also sample 83, March 7, 1941, dredged a little inside sample 82, 25 meters, 3 specimens.

MEASUREMENTS: A specimen from Station 30 measures: length, 25.4 mm.; height, 25.4 mm.; convexity (both valves together), 16 mm.

HABITAT: Gray sandy mud and black mud bottom.

REMARKS: The specimens in the present collection have been assigned to the subspecies *Glycymeris tessellata strigilata* rather than to *G. tessellata, sensu stricto*, on the basis of the acutely rounded to subangular hinge, smaller ligamental area, and general rusty coloration of the exterior. These features are shown in figures 25-28 on plate 3. These two forms were discussed by the present authors in an earlier paper [1943 (1940-1951)] in which it was pointed out that the two show a tendency to intergrade when a large series is examined.

SUPERFAMILY PTERIACEA

FAMILY PTERIIDAE

GENUS PINCTADA BOLTEN

Pinctada mazatlanica Hanley

Meleagrina mazatlanica HANLEY, 1856, Catalogue of recent bivalve shells, p. 388, suppl. pl. 24, fig. 40.

Avicula barbata REEVE, 1857, Conchologia iconica, vol. 10, *Avicula*, sp. 9, pl. 5, fig. 9, "Hab. Panama (under stones at low water); Cuming."

Avicula (Meleagrina) barbata Reeve, DUNKER, 1872, *Avicula, in* Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 7, div. 3, p. 48, pl. 16, fig. 3.

M[*margaritifera*]. *margaritifera mazatlanica* Hanley, JAMESON, 1901, Proc. Zool. Soc. London, p. 376.

Pinctada mazatlanica Hanley, STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 504, pl. 32, fig. 3. HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 164.

Margaritiphora (Pinctada) mazatlanica Hanley, M. SMITH, 1944, Panamic marine shells, p. 51, fig. 674.

TYPE LOCALITY: "Mazatlan." [Mexico.]

RANGE: Angel de la Guardia Island, Gulf of California, to Paita, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from Saboga Island, Pearl Islands, Panama, February 11, 1941, Station 2, sample 2.

MEASUREMENTS: Length, approximately 104 mm.; height, 103.5 mm.; convexity (both valves together), 35.9 mm.

HABITAT: No information with present specimen. Usually attached to rock or gravel in shallow water.

REMARKS: This species has been present in the Gulf of California region since at least as early as the Pliocene period. It appears to be related to *Pinctada margaritifera* Linnaeus (black lip pearl shell), one of the well-known pearl oysters of the Indo-Pacific region. Jameson believed that there is intergradation between the two species. Compared to *P. margaritifera* and similar forms, the shell of *P. mazatlanica* is characterized by its greater convexity, greater anterior projection, and light brown color. A line perpendicular to the anterior end of the hinge would cut off about one-third of the valve. The posterior margin of the nacre slopes forward from the hinge, resembling in this character *P. maxima* Jameson (gold lip pearl shell) described from New Guinea. The west American shell is sometimes known as "Panama shell" in Central America. Galtsoff (1950) has given a discussion of the pearl oyster resources of Panama.

There is uncertainty as to the identification of the species described under the name of *Avicula (Meleagrina) fimbriata* Dunker (1852, p. 79). The original locality is cited as "Patria America centralis dicitur." There is no indication as to whether or not it came from the east or west coast of Central America. Jameson pointed out that the illustrations of the species given by Dunker [1872 (1872-

1880), p. 13, pl. 3, figs. 2, 6] do not appear to be referable to *Pinctada mazatlanica*. In Dunker's later publication (1872-1880) the locality cited is "Habitat in America centrali fide mercatoris qui specimen venale habuit." It is possible that it may be referable to the east American species *P. radiata* Leach.

Pinctada cumingii Reeve [1857 (1843-1878), vol. 10, sp. 6, pl. 4, fig. 6] has been cited as occurring in tropical west American waters. It was originally described from "Lord Hood's Island, Pacific Ocean (attached to rocks, at the depth of ten fathoms); Cuming." Hedley (1899a, p. 495) stated, "Cuming procured the type at Marutea, Pautotus." It is a dark-colored shell covered with irregular scales and is not a member of the west American molluscan fauna.

FAMILY PINNIDAE

GENUS PINNA LINNAEUS

Pinna rugosa Sowerby

Pinna rugosa SOWERBY, 1835, Proc. Zool. Soc. London, p. 84. REEVE, 1858, Conchologia iconica, vol. 11, *Pinna*, sp. 50, pl. 26, fig. 50. CLESSIN, 1891, Malleacea, in Conchylien-Cabinet von Martini und Chemnitz, vol. 8, div. 1, p. 91, pl. 39, fig. 1. HERTLEIN AND STRONG, 1943, Zoologica, New York, vol. 28, p. 165. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 57, pl. 4, figs. 3, 4.

TYPE LOCALITY: "Hab. in Sinu Panamensi. (Isle of Rey). . . They were procured from sand banks."

RANGE: Manuela Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to the Gulf of Panama.

MATERIAL EXAMINED: One specimen from Saboga Island, Pearl Islands, Panama, February 11, 1941, Station 2, sample 1, on northern side of island.

MEASUREMENTS: Length (apex incomplete), approximately 175 mm.; width, approximately 94 mm.; convexity (both valves together), approximately 35.5 mm.

HABITAT: No information concerning the present specimen. This species usually occurs with the anterior portion in sandy mud attached by its byssus to some object.

REMARKS: The single specimen in the present collection is typical of this species. The shell is elongately triangular and is orna-

mented with about eight rows of foliaceous, tubular spines.

SUPERFAMILY ANOMIACEA

FAMILY ANOMIIDAE

GENUS ANOMIA LINNAEUS

Anomia peruviana d'Orbigny

Anomia peruviana D'ORBIGNY, 1846, Voyage dans l'Amérique Méridionale, vol. 5, p. 673. PHILIPPI, 1850, Abbildungen und Beschreibungen . . . Conchylien, vol. 3, no. 8, p. 131 (1), *Anomia*, pl. 1, figs. 2, 3. PACKARD, 1918, Univ. California Publ. Zool., vol. 14, p. 255, pl. 15, figs., 2a, 2b. GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 240, pl. 12, figs. 2, 5. M. SMITH, 1944, Panamic marine shells, p. 53, fig. 692F. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 68. FITCH, 1953, State California Dept. Fish and Game Mar. Fish. Branch, Fish Bull., no. 90, p. 46, fig. 12.

Anomia fidenas GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 116, "Hab. America, west coast. Panama; on *Pinna* at low water. Mus. Cuming, No. 2; three specimens"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 18. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 30, pl. 6, fig. 30.

Anomia pacilus GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 117, "Hab. Peru; Tambaz [Tumbez]; dredged from five fathoms in soft mud. Mus. Cuming, No. 9"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 18. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 19, pl. 4, fig. 19.

Anomia larchas GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 117, "Hab. Coast of Peru, Payta. Mus. Cuming"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 18. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 13, pl. 3, fig. 13.

Anomia alectus GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 117, "Hab. Peru, Bay of Guayaquil; *Hinds*, Mus. Brit., and Mus. Cuming, No. 7"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 19. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 28, pl. 6, fig. 28.

Anomia hamillus GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 117, "Hab. West Columbia, Bay of Cañes. Mus. Cuming, No. 6"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 19. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 32, pl. 7, fig. 32.

Anomia lampe GRAY, 1850, Proc. Zool. Soc. London, for 1849, p. 117, "Hab. California; *Lady Katherine Wigram*, Mus. Brit. Mus. Cuming;

three specimens"; 1850, Catalogue of the bivalve Mollusca in the . . . British Museum, pt. 1, p. 19. REEVE, 1859, Conchologia iconica, vol. 11, *Anomia*, sp. 16, pl. 4, figs. 16a-16c.

Anomya simplex MABILLE, 1895, Bull. Soc. Philom. Paris, ser. 8, vol. 7, p. 73, from "Basse Californie."

TYPE LOCALITY: "Environs de Payta (Pérou)," for *Anomia peruviana*.

RANGE: San Pedro, California, to Punta Penasco in the Gulf of California and south to Paita, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14-33 meters.

MEASUREMENTS: Length, approximately 9 mm.; height, 7.6 mm.; convexity (one valve), 3.2 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: The single small specimen (convex valve) of this common, variable, rock-dwelling bivalve is similar to others of this species from the same region.

SUPERFAMILY MYTILACEA

FAMILY MYTILIDAE

GENUS MODIOLUS LAMARCK

Modiolus eiseni Strong and Hertlein

Plate 2, figures 9, 11

Modiolus eiseni STRONG AND HERTLEIN, 1937, Proc. California Acad. Sci., ser. 4, vol. 22, p. 160, pl. 34, figs. 11, 14-16. HOFFSTETTER, 1948, Bol. Inform. Cien. Nac., Quito, vol. 2, nos. 13-14, p. 82.

TYPE LOCALITY: "Lat. 22° 44' N., Long. 105° 59' W., about 38 miles southeast of Mazatlan, Sinaloa, Mexico, and about 8 miles offshore, in 10 to 17 fathoms."

RANGE: Off Cape San Lucas, Baja California, to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms.

MEASUREMENTS: Length, 36.8 mm.; height 21.4 mm.; convexity (both valves together), 15.6 mm.

HABITAT: Mud and shell bottom.

REMARKS: The single specimen in the present collection is similar to the type of the species except that it is a little larger, the

anterior end is slightly more attenuated, and the coloration is shiny brown rather than reddish brown.

GENUS **LITHOPHAGA** BOLTEN

SUBGENUS **LABIS** DALL

Lithophaga (Labis) attenuata Deshayes

Modiola attenuata DESHAYES, 1836, Histoire naturelle des animaux sans vertèbres, ed. 2, vol. 7, p. 28. Reference: "Lithodomus caudigerus. var. Sow. genera of shells. [vol. 2, pl. 135] f. 3." PHILIPPI, 1846, Abbildungen und Beschreibungen . . . Conchylien, vol. 2, no. 5, *Modiola*, p. 148 (2), pl. 1, fig. 6.

Lithodomus caudigerus SOWERBY, REEVE, 1841, Conchologia systematica, vol. 1, p. 137, pl. 99, fig. 3 only.

Not *Lithodomus caudigerus* Sowerby, 1824, fig. 4.

Lithophaga attenuata Deshayes, I. S. OLDROYD, 1924, Stanford Univ. Publ. Univ. Ser. Geol. Sci., vol. 1, p. 73, pl. 39, fig. 10; under section *Labis*.

Lithophaga (Labis) attenuata Deshayes, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 74.

TYPE LOCALITY "Habite au Pérou, au Chili, dans les pierres."

RANGE: San Ignacio Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Chile; Cocos Island (Bartsch and Rehder).

MATERIAL EXAMINED: Two specimens from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, from northeast end of island, 3 fathoms.

MEASUREMENTS: Larger specimen: length (anterior end imperfect), 70.2 mm.; height, 17.6 mm.; convexity (both valves together), approximately 15 mm.

HABITAT: In masses of coral.

REMARKS: Two specimens of this elongate, semicylindrical, smooth species were taken from coral masses and are similar to other specimens from the same region.

SUBGENUS **MYOFORCEPS** FISCHER

Lithophaga (Myoforceps) aristata Dillwyn

Mytilus aristatus DILLWYN, 1817, A descriptive catalogue of Recent shells, vol. 1, p. 303. Reference: Adanson, 1757, Hist. Nat. Senegal, p. 267, pl. 19, fig. 2; Encyclop. Méthod., pl. 221, fig. 8; Linn. Trans., vol. 8, pl. 6, fig. 2.

Lithodomus caudigerus [Lamarck], SOWERBY, 1824, The genera of recent and fossil shells, pl. 135, fig. 4. REEVE, 1841, Conchologia systematica, vol. 1, p. 137, pl. 99, fig. 4.

Lithophaga aristata Dillwyn, I. S. OLDROYD, 1924, Stanford Univ. Publ. Univ. Ser. Geol. Sci., vol. 1, p. 73, pl. 39, fig. 2. PERRY, 1940, Bull. Amer. Paleont., vol. 26, p. 48, pl. 8, fig. 44. FISCHER-PIETTE AND OTHERS, 1942, Jour. Conchyl., vol. 85, p. 350, pl. 16, fig. 10 (illustration of Adanson's figured specimen).

Lithophaga (Myoforceps) aristata Dillwyn, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 74.

Lithophaga (Lithophaga) aristata Dillwyn, McLEAN, 1951, New York Acad. Sci. Sci. Surv. Porto Rico and Virgin Islands, vol. 17, pt. 1, p. 42, pl. 9, fig. 1.

TYPE LOCALITY: "Inhabits the coasts of Senegal burrowed in the shells of Balani. Adanson. In calcareous rocks. Sowerby."

RANGE: La Jolla, California, to the Gulf of California and south to Peru; also Atlantic; world wide.

MATERIAL EXAMINED: One specimen from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach on northern side of island.

MEASUREMENTS: Length, 21.2 mm.; height 6.6 mm.; convexity (both valves together), 7.7 mm.

HABITAT: Taken on beach.

REMARKS: The shell of this species may be easily recognized by the fact that the two posterior calcareous prolongations cross as do the blades of scissors.

SUBGENUS **DIBERUS** DALL

Diberus DALL, 1898, Trans. Wagner Free Inst. Sci., vol. 3, p. 799. "Type *L. plumula* Hanley."

The calcareous incrustation on and extending beyond the posterior portion of the valves of the type species of this subgenus, *Lithophaga plumula* Hanley, has a divaricate, plumose pattern.

Salebrolabis Iredale (1939, pp. 417, 418), type *Lithophaga divaricalx* Iredale, from northern Australia, is very similar to *Diberus*.

Lithophaga (Diberus) plumula Hanley

Lithodomus plumula HANLEY, 1844, Proc. Zool. Soc. London, p. 17. REEVE, 1857, Conchologia iconica, vol. 10, *Lithodomus*, sp. 23, pl. 4, fig. 23.

Modiola (Lithodomus) plumula Hanley, HANLEY, 1856, Catalogue of recent bivalve shells, pl. 24, fig. 23 (not the record on p. 240: "Philippines").

Lithophagus calyculatus CARPENTER, 1856, Catalogue of . . . Mazatlan shells, p. 124, "Hab.—Mazatlan; 1 sp. in Spondylus calcifer; L'pool. Col."

Lithophaga (Diberus) plumula Hanley, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 75, pl. 1, fig. 10.

TYPE LOCALITY: "Hab. Panama, in *Spondyli*. Mus. Cuming, Hanley."

RANGE: San Ignacio Lagoon, Baja California, to the Gulf of California and south to Peru.

MATERIAL EXAMINED: Two specimens from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, on the north-east end of island, 3 fathoms.

MEASUREMENTS: Larger specimen: length, 46.2 mm.; height, 14 mm.; convexity (both valves together), 12.2 mm.

HABITAT: With masses of coral.

REMARKS: We can add nothing to our previous discussion of this species.

SUPERFAMILY OSTRACEA

FAMILY OSTREIDAE

GENUS OSTREA LINNAEUS

Ostrea conchaphila Carpenter

Plate 3, figures 29, 30

Ostrea conchaphila CARPENTER, 1856, Catalogue of . . . Mazatlan shells, p. 161; 1864, Rept. Brit. Assoc. Adv. Sci., for 1863, pp. 552, 592, 646, 665, 666. SOWERBY, 1871, in Reeve, Conchologia iconica, vol. 18, *Ostraea*, sp. 69, pl. 28, figs. 69a-69c. LAMY, 1929, Jour. Conchyl., vol. 73, p. 152. CONTRERAS, 1932, An. Inst. Biol., Mexico, vol. 3, p. 205, fig. 17 (copy of Sowerby's fig. 69c).

TYPE LOCALITY: "Hab.—Mazatlan; not uncommon, on various shells, v. infra; L'pool. Col.—S.W. Mexico, do., P.P.C.—?Panama, attached to stones, rocks and shells, near half-tide level, C. B. Adams.—San Diego, very fine; Lieut. Green." [Not the records Oregon and West Africa.] Mazatlan, Mexico, here selected as type locality.

RANGE: Redondo, California, to the Gulf of California and south to the Pearl Islands in the Gulf of Panama.

MATERIAL EXAMINED: One valve from South Passage, Pearl Islands, Panama, February 13, 1941, Station 7, 15 fathoms.

MEASUREMENTS: Length, approximately 16.4 mm.; height, 15 mm.

HABITAT: Sandy bottom.

REMARKS: The specimen in the present collection referred to *Ostrea conchaphila* is small. The early portion is ovately inflated; then it expands laterally. Denticles occur along the margin for about one-half of the length of the valve. The exterior is colored yellowish white, with faint purplish radial rays.

The shell of typical *Ostrea conchaphila* is flat, often subcircular, moderately thin. The exterior of the upper valve is ornamented with blackish brown or purple and orange radial bands, or, in some cases, streaked with purplish lines. The ligamentary area is small. The interior of the shell is white or greenish, but in some specimens the banding on the exterior shows through on the inner side. Small denticles occur along the margin below the hinge for a third or a half of the length of the shell. Some specimens from Panama have the ventral margin of the lower valve upturned, crenulated, and the general shape resembles that of *O. palmula* Carpenter.

Ostrea conchaphila grades into *O. lurida expansa* Carpenter along the coast of southern California. Excellent specimens referable to *O. conchaphila* collected by Henry Hemphill at San Diego, California, are present in the collections of the California Academy of Sciences.

The general appearance of *Ostrea conchaphila* is similar to that of *O. bicolor* Hanley from West Africa, but the African shell is said to lack denticles.

A single small, oblong, upper valve of an oyster, measuring 11 mm. from beak to base, possibly may be referable to *Ostrea conchaphila*. The specimen came from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in 34-43 meters. The general shape is suggestive of that of *O. iridescens* Gray, but in that species denticles are present around the entire margin. The muscle impression is very high and situated on the posterior side.

SUPERFAMILY PECTINACEA

FAMILY PECTINIDAE

GENUS PECTEN MÜLLER

SUBGENUS PLAGIOCTENIUM DALL

Pecten (Plagioctenium) circularis Sowerby

Pecten tumidus SOWERBY, 1835, Proc. Zool. Soc.

London, p. 109, "Hab. ad Sanctam Elenam et ad Salango, Columbiae Occidentalis. Found in sandy mud at from six to ten fathoms."

Not *Pecten tumidus* Turton, 1822.

Not *Pecten tumidus* Hartmann in von Zieten, 1833.

Pecten circularis SOWERBY, 1835, Proc. Zool. Soc. London, p. 110; 1842, Thesaurus conchyliorum, vol. 1, *Pecten*, p. 51, pl. 12, fig. 23. M. SMITH, 1944, Panamic marine shells, p. 52, fig. 686.

Pecten ventricosus SOWERBY, 1842, Thesaurus conchyliorum, vol. 1, *Pecten*, p. 51, pl. 12, figs. 18, 19, 26. New name for *Pecten tumidus* Sowerby, 1835, not *Pecten tumidus* Turton, 1822, nor *Pecten tumidus* Hartmann in Zieten, 1833. REEVE, 1852, Conchologia iconica, vol. 8, *Pecten*, sp. 31, pl. 7, figs. 31a, 31b.

Pecten (Plagiocentium) circularis Sowerby, ARNOLD, 1906, Prof. Paper U. S. Geol. Surv., no. 47, p. 125, pl. 42, figs. 3-6, pl. 44, figs. 6, 6a, 6b, 7. HERTLEIN, 1935, Proc. California Acad. Sci., ser. 4, vol. 21, p. 311; with synonymy. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 57.

TYPE LOCALITY: "Hab. ad Sinum Californiae. (Guaymas). Found in sandy mud at a depth of seven fathoms." [Mexico.] For *Pecten circularis*.

RANGE: Cedros Island, Baja California, to Punta Penasco, in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: Five valves from four stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 1 valve.

Bahia Santelmo, Isla del Rey, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 1 valve.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 valve.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, ±10 fathoms, 2 valves.

MEASUREMENTS: Largest specimen: 30 mm. in length and height; convexity (one valve), 7.7 mm.

HABITAT: Sand, gray sandy mud, and dead shell fragments.

REMARKS: The five single valves of this well-known scallop do not differ from others of this species from the same region.

SUBGENUS LEPTOPECTEN VERRILL

Pecten (Leptopecten) tumbezensis d'Orbigny

Pecten aspersus SOWERBY, 1835, Proc. Zool. Soc. London, p. 110.

Not *Pecten aspersus* Lamarck, 1819.

Pecten tumbezensis D'ORBIGNY, 1846, Voyage dans l'Amérique Méridionale, vol. 5, p. 663. New name for *Pecten aspersus* Sowerby, 1835, not *Pecten aspersus* Lamarck, 1819. M. SMITH, 1944, Panamic marine shells, p. 52, fig. 692.

Pecten sowerbyi REEVE, 1852, Conchologia iconica, vol. 8, *Pecten*, sp. 4, pl. 1, fig. 4. New name for *Pecten aspersus* Sowerby, 1835, not *Pecten aspersus* Lamarck, 1819. M. SMITH, 1944, Panamic marine shells, p. 52, fig. 675A.

Pecten paucicostatus CARPENTER, 1864, Rept. Brit. Assoc. Adv. Sci., for 1863, p. 645, from neighborhood of Santa Barbara, California, and Santa Barbara Islands [locality erroneous].

Pecten (Plagiocentium) paucicostatus Carpenter, ARNOLD, 1906, Prof. Paper U. S. Geol. Surv., no. 47, p. 137, pl. 39, figs. 3, 3a, 4.

Pecten cf. latiauritus fucicolus Dall, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 255, pl. 2, fig. 11, "Brought up by marine dredge from depths varying from 10. ft. to 40. ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay" (from label on the material).

Pecten latiauritus Conrad indentus LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 256, pl. 2, fig. 13, same locality as for preceding subspecies.

Pecten latiauritus Conrad splendens LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 256, pl. 2, fig. 12, same locality as for preceding subspecies.

Pecten (Leptopecten) tumbezensis d'Orbigny, HERTLEIN, 1935, Proc. California Acad. Sci., ser. 4, vol. 21, p. 314, pl. 19, figs. 11, 12. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 60.

TYPE LOCALITY: "Hab. ad Tumbez, Peruvia. Dredged in soft mud at a depth of five fathoms." For *Pecten aspersus*.

RANGE: Gulf of California and east of San Jose del Cabo, Baja California, to Paita, Peru.

MATERIAL EXAMINED: Six specimens from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 4 specimens.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 81, dredged in 34-43 meters in and out of center of bay, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: One of largest (right) valves: length, 16.5 mm.; height, 15.4 mm.; convexity, 3.4 mm.

HABITAT: Gray sand, sandy mud, and mud and live shell bottom.

REMARKS: The shell of this scallop is rather thick in proportion to its size. It is sculptured with about 14 radial ribs. The right valve is usually light colored, and the left one has bluish black dots on a brownish ground.

An exceptionally large left valve of this species in the collections of the California Academy of Sciences, collected at Altata, west Mexico, by R. J. Drake, measures 42 mm. in length and 39 mm. in height.

Pecten (Leptopecten) velero biolleyi
Hertlein and Strong

Pecten (Leptopecten) velero biolleyi HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 60, pl. 1, fig. 6.

TYPE LOCALITY: "Dredged in 12 fathoms (22 meters) in Lat. 10° 55' 45" N., Long. 85° 49' 05" W., Port Parker, Costa Rica, on bottom of sandy mud and crushed shells."

RANGE: Port Parker, Costa Rica, to Guayabo Chiquito Bay, Panama.

MATERIAL EXAMINED: Seven specimens from Guayabo Chiquito Bay, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25-64 meters.

MEASUREMENTS: A specimen with both valves: length, 10 mm.; height, 9.3 mm.; convexity (both valves together), 3.2 mm.

HABITAT: Gray mud bottom.

REMARKS: The present record of the occurrence of this subspecies in Guayabo Chiquito Bay, Panama, is an extension south of the known range.

ORDER ANOMALODESMACEA

FAMILY THRACIIDAE

GENUS CYATHODONTA CONRAD

Cyathodonta undulata Conrad

Plate 3, figures 1, 2

Cyathodonta undulata CONRAD, 1849, Proc.

Acad. Nat. Sci. Philadelphia, vol. 4, p. 156. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 96.

Thracia plicata Deshayes, REEVE, 1859, Conchologia iconica, vol. 12, *Thracia*, sp. 7, pl. 2, figs. 7b, 7c, not fig. 7a.

Thracia (Cyathodonta) undulata Conrad, LAMY, 1931, Jour. Conchyl., vol. 75, p. 285.

TYPE LOCALITY: The title of Conrad's paper is "Shells from the coast of Lower California and Peru"; the east coast of Baja California was designated as type locality by Hertlein and Strong.

RANGE: Kino Bay, Gulf of California, to Peru.

MATERIAL EXAMINED: One valve from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, 20 mm.; height, 16 mm.; convexity (one valve), 4.5 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species is fragile. It is characterized by concentric ripples and the presence of fine rows of granules radiating from the umbos. The posterior end of the shell is truncated.

Olsson has recorded the occurrence of this species in the Pleistocene of Panama.

Thracia tristani Olsson (1922, p. 383, pl. 23, fig. 3), described from the Miocene of Costa Rica, was compared by its author to *Cyathodonta undulata*. Another fossil species, *Thracia hitosaoensis* Nomura (1935a, p. 107, pl. 7, fig. 7), described from the upper Miocene or lower Pliocene of Japan, also was compared to *C. undulata* by Nomura.

ORDER TELEODESMACEA

SUPERFAMILY ASTARTACEA

FAMILY CRASSATELLITIDAE

GENUS CRASSATELLITES KRÜGER

SUBGENUS HYBOLOPHUS STEWART

Crassatellites (Hybolophus) gibbosus
Sowerby

Crassatilla gibbosa SOWERBY, 1832, Proc. Zool. Soc. London, p. 56. REEVE, 1841, Conchologia systematica, vol. 1, p. 63, pl. 44, fig. 2; 1843, Conchologia iconica, vol. 1, *Crassatella*, sp. 1, pl. 1, figs. 1a, 1b.

Crassatillites rudis LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 257, pl. 3, fig. 16, in Panama Bay in 10-40 feet, mud, at mouth of Rio Grande near La Boca, about 1 mile from the mainland.

Crassatellites gibbosus Sowerby, PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 429, pl. 41, figs. 9, 10.

Eucrassatella gibbosa Sowerby, M. SMITH, 1944, Panamic marine shells, p. 55, fig. 705.

Crassatellites (Hybolophus) gibbosus Sowerby, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 103.

TYPE LOCALITY: "Hab. ad oras Americae Meridionalis. (St. Elena and Xipixapi.) Dredged from sandy mud in eleven fathoms water." [Santa Elena and Jipijapa, Ecuador.]

RANGE: Punta Penasco in the Gulf of California to Paita, Peru.

MATERIAL EXAMINED: Ten specimens from four samples from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 8-18 fathoms, 3 specimens. Also dredged in side bay, 14-33 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 5 specimens. Also sample 307, April 14, 1941, ±15 fathoms, 1 valve.

MEASUREMENTS: Largest specimen: length, 51.8 mm.; height, 38 mm.; convexity (both valves together), 28.2 mm.

HABITAT: Gray sandy mud, sand, mud, and dead shells.

REMARKS: A few specimens in the present collection are referable to this subtrigonal, elongately rostrate species. Olsson has recorded this species from the Pliocene and Pleistocene of Central America. The same author (1932, p. 88, pl. 6, fig. 6) described *Eucrassatella (Hybolophus) gibbosa tucilla* from the Miocene of Peru. *Crassatellites subgibbosus* Hanna, described from the Pliocene of Imperial County, California, is a somewhat similar form.

SUPERFAMILY CHAMACEA

FAMILY CHAMIDAE

Nicol (1952a) has recently published a review of the genera and subgenera of the Chamidae.

GENUS CHAMA LINNAEUS

Chama echinata Broderip

Chama echinata BRODERIP, 1835, Proc. Zool. Soc. London, for 1834, p. 150; 1835, Trans. Zool.

Soc. London, vol. 1, p. 305, pl. 39, figs. 5-7. REEVE, 1847, Conchologia iconica, vol. 4, *Chama*, sp. 35, pl. 7, fig. 35. PILSBRY AND LOWE, 1934, Nautilus, vol. 47, p. 82. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 108. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 72, pl. 17, figs. 8, 11.

Chama coralloides REEVE, 1846, Conchologia iconica, vol. 4, *Chama*, sp. 18, pl. 4, fig. 18, "Hab. Porto Portrero, Central America (found attached to rocks at low water); Cuming." ODHNER, 1919, Svenska Vetensk.-Akad. Handl., vol. 59, no. 3, p. 57, pl. 8, figs. 70, 71 (anatomy).

TYPE LOCALITY: "Hab. in Americâ Centrali. (Puerto Portrero). . . Found at low water attached to rocks." [Costa Rica.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: One specimen from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach from north side of island.

MEASUREMENTS: Length, 30.8 mm.; height, 37.5 mm.; convexity (both valves together), 20.5 mm.

HABITAT: Crevices in rocks.

REMARKS: The single specimen in the present collection shows the coral red hinge as well as the purple interior that are so characteristic of this species.

GENUS ECHINOCHAMA FISCHER

Nicol (1952b) has recently published a review of this genus and its species.

Echinochama arcinella californica Dall

Echinochama californica DALL, 1903, Proc. U. S. Natl. Mus., vol. 26, p. 950, pl. 62, fig. 5; 1903, Trans. Wagner Free Inst. Sci., vol. 3, pp. 1404, 1406. PILSBRY AND LOWE, 1934, Nautilus, vol. 47, p. 85. M. SMITH, 1944, Panamic marine shells, p. 56, fig. 716. HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 111.

Echinochama arcinella californica Dall, NICOL, 1952, Jour. Paleont., vol. 26, p. 806, pl. 119, fig. 8.

TYPE LOCALITY: "From off Cerros Island, Lower California, in 25 fathoms." [Mexico.]

RANGE: Cedros Island, Baja California, to the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Two valves from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 1 valve.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 1 valve.

MEASUREMENTS: A specimen from Station 19: length, 21.4 mm.; height, 18.8 mm.; convexity (left valve), approximately 6.2 mm.

HABITAT: Gray sand, mud, and black mud bottom.

REMARKS: The two small valves of this subspecies in the present collection possess fewer radial rows of spines than do larger, perfect specimens.

The present record of occurrence of this subspecies at Octavia Bay, Colombia, is an extension south of the known range. Olsson recorded the occurrence of this form in the Pliocene of Costa Rica and Pleistocene of Panama. Nicol (1952b, p. 806, pl. 118, fig. 6), however, concluded that the specimens representing those records may be referred to a distinct subspecies, *Echinochama arcinella olssoni*, characterized by "the extreme development of large, flat, triangular, unrolled spines, which are noticed mainly on or near the ventral margin."

SUPERFAMILY LUCINACEA

FAMILY LUCINIDAE

GENUS LUCINA BRUGUIÈRE

SUBGENUS LUCINISCA DALL

Lucina (Lucinisca) fenestrata Hinds

Plate 1, figure 7

Lucina fenestrata HINDS, 1845, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 3, p. 66, pl. 19, fig. 2.

Lucina (Lucinisca) fenestrata Hinds, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 113.

TYPE LOCALITY: "Inhab. Monte Christi; San Blas. In seven to fourteen fathoms" (Hinds). Montechristi, Ecuador, in 7–14 fathoms designated as type locality by Hertlein and Strong, 1946.

RANGE: Cedros Island, Baja California, to the Gulf of California and south to Salinas, Ecuador. Peru (Carpenter; Dall).

MATERIAL EXAMINED: One valve from Ardita Bay, Colombia, March 6, 1941, Sta-

tion 31, sample 81, dredged in and out of bay, 34–43 meters.

MEASUREMENTS: A small valve: length, 13 mm.; height, 11.4 mm.; convexity (one valve), 2.3 mm.

HABITAT: Gray sand bottom.

REMARKS: A single small valve in the present collection agrees well with young specimens of *Lucina fenestrata*. Compared to *Lucina liana* Pilsbry, the shell of *L. fenestrata* is flatter and is ornamented with a greater number of more closely spaced radial ribs.

Lucina (Lucinisca) liana Pilsbry

Lucina muricata Chemnitz, REEVE, 1850, Conchologia iconica, vol. 6, *Lucina*, sp. 46, pl. 8, fig. 46.

Not *Lucina muricata* Chemnitz, 1795, an east American species.

Phacoides (Lucinisca) hispaniolana Maury, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 258, pl. 3, fig. 20.

Not *Phacoides (Lucinisca) hispaniolana* Maury, 1917.

Phacoides (Lucinisca) liana PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 435, pl. 41, fig. 3. M. SMITH, 1944, Panamic marine shells, p. 57, fig. 721.

Lucina (Lucinisca) liana Pilsbry, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 114.

TYPE LOCALITY: "Panama Bay, a mile out, in 10–40 ft."

RANGE: Santa Inez Bay in the Gulf of California, to Tumbes, Peru.

MATERIAL EXAMINED: Four specimens from Guayabo Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 24–64 meters.

MEASUREMENTS: One of the largest valves: length, 17 mm.; height, 15.5 mm.; convexity, approximately 4 mm.

HABITAT: Gray mud bottom.

REMARKS: The valves in the present collection referable to this form are similar to other specimens of this species from the same region. This species also has been recorded as occurring in the Pliocene of Panama and Ecuador.

GENUS CTENA MÖRCH

Ctena chiquita Dall

Codakia (Jagonia) chiquita DALL, 1901, Proc.

U. S. Natl. Mus., vol. 23, pp. 801, 823, pl. 39, fig. 1.

Ctena chiquita Dall, HERTLEIN AND STRONG, 1946, Zoologica, New York, vol. 31, p. 118.

TYPE LOCALITY: "On the west side of the lower end of the peninsula of Lower California, nearly abreast of La Paz, in 66 fathoms." [Mexico.]

RANGE: West coast of Baja California in about latitude 24° 18' 00" N., to the Gulf of California and south to Ardita Bay, Colombia.

MATERIAL EXAMINED: Thirty-seven valves from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 valve.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 31 valves.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 5 valves.

MEASUREMENTS: A valve from Ardita Bay, Colombia: length, 13.3 mm.; height, 12.6 mm.; convexity, 3.4 mm.

HABITAT: Gray sandy mud, gray sand, and gray mud.

REMARKS: The small, suborbicular, yellowish white shell of this species may be separated from that of the somewhat similar *Ctena mexicana* by the less elongate form and by the finer radial sculpture which is less prominent on the medial areas and lacking on or near the dorsal margins.

The present record of the occurrence of this species at Ardita Bay, Colombia, is an extension south of the known range.

FAMILY UNGULINIDAE

GENUS DIPLDONTA BRONN

SUBGENUS DIPLDONTA, SENSU STRICTO

Chavan (1952, pp. 121-122) has recently presented reasons for abandoning the name *Taras* Risso in favor of *Diplodonta* Bronn. He failed to find any type material of *Taras antiquata* Risso, the type species, in Risso's collection and therefore considers it to be a *nomen dubium*. He stated that *Taras antiquata* may have been based on a quite similar

species occurring in the same region, a venerid, *Mysia undata* Pennant, also known as *Lucinopsis undata*.

In view of the uncertainty concerning the identification of the type species of *Taras*, we have, at least for the present, applied the genus name *Diplodonta* to the present species.

Diplodonta (Diplodonta) inezensis Hertlein and Strong

Taras (Taras) inezensis HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 130, pl. 1, figs. 1, 4.

TYPE LOCALITY: "Station 146-D-1, Lat. 26° 54' 20" N., Long. 111° 48' 45" W., Santa Inez Bay, east coast of Lower California, dredged in 35 fathoms (64 meters)."

RANGE: Santa Inez Bay, Gulf of California, to the Pearl Islands, Panama.

MATERIAL EXAMINED: Five specimens from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, approximately 8 mm.; height, 6.9 mm.; convexity (one valve), 3 mm.

HABITAT: Sand bottom.

REMARKS: The general outline, as well as the details of the hinges of five small valves in the present collection, agrees well with that of *Diplodonta inezensis*. A characteristic feature of this species is the deeply cleft right posterior cardinal tooth which is well separated from the margin. The left valve has a bifid anterior cardinal tooth and a posterior cardinal which is in part fused with the margin.

The present record of the occurrence of this species at the Pearl Islands, Panama, is an extension south of the known range.

SUBGENUS FELANIELLA DALL

Diplodonta (Felaniella) cornea Reeve

Lucina cornea REEVE, 1850, Conchologia iconica, vol. 6, *Lucina*, sp. 25, pl. 9, fig. 25.

Lucina nitens REEVE, 1850, Conchologia iconica, vol. 6, *Lucina*, sp. 50, pl. 9, fig. 50, "Hab. Isle of Muerte, Bay of Guayaquil (in sandy mud at a depth of about eleven fathoms); Cuming."

Lucina sericata REEVE, 1850, Conchologia iconica, vol. 6, *Lucina*, sp. 55, pl. 9, fig. 55, "Hab.—?" ADAMS AND REEVE, 1850, in Adams, The zoology of the voyage of H.M.S. Samarang, Mollusca,

p. 80, pl. 24, fig. 6 (not the locality "Hab. Philippine Archipelago.")

Taras parilis Conrad variety *sericatus* Reeve, GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 295, pl. 14, figs. 12a, 12b,

Felaniella sericata Reeve, STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 507, pl. 39, fig. 3.

Diplodonta sericata Reeve, WOODRING, BRAMLETTE, AND KEW, 1946, Prof. Paper U. S. Geol. Surv., no. 207, p. 83, pl. 36, figs. 11-14.

Taras (Felaniella) sericatus Reeve, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 131, pl. 1, fig. 10.

TYPE LOCALITY: "Hab. Gulf of Nicoya (in coarse sand at a depth of ten to thirteen fathoms); Cuming." [Costa Rica.]

RANGE: San Ignacio Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Guayaquil, Ecuador.

MATERIAL EXAMINED: Two specimens from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Larger valve: approximately 10.6 mm. in length and 10.3 mm. from beak to base; convexity, 3 mm.

HABITAT: Sand bottom.

REMARKS: The present authors have discussed this species in an earlier paper [1947 (1940-1951)] under the name of *Taras (Felaniella) sericatus*.

The portion of the "Conchologia iconica" in which *Lucina sericata* was described by Reeve, without information as to the locality from which it came, bears the date June, 1850. This apparently has priority over the description of the same species by Adams and Reeve on page 80 of "The zoology of the voyage of H.M.S. Samarang"; according to Iredale (1939, p. 367) page 74 of that work was published in August, 1850.

Recently the International Commission on Zoological Nomenclature has adopted a rule that when one or more names for the same species occur in a publication, page, line, and word priority are to determine the name to be used, provided that such name is valid. Application of this rule in the present case determines *Lucina cornea* to be the earliest name proposed for this species by Reeve.

This species has been recorded as occurring north to Monterey, California, by Burch; and Woodring, Bramlette, and Kew cited it as occurring from San Diego, California, south-

ward. We have not seen specimens from north of San Ignacio Lagoon, Baja California.

SUBGENUS PHLYCTIDERMA DALL

Diplodonta (Phlyctiderma) semirugosa Dall

Plate 2, figures 12, 16, 17

Diplodonta semirugosa DALL, 1899, Jour. Conchol., vol. 9, no. 8, p. 246.

Diplodonta (Phlyctiderma) semirugosa Dall, DALL, 1901, Proc. U. S. Natl. Mus., vol. 23, p. 796.

Taras (Phlyctiderma) semirugosus Dall, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 132.

TYPE LOCALITY: "Range. Gulf of California."

RANGE: Punta Penasco in the Gulf of California to the Pearl Islands in the Gulf of Panama.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, approximately 8 mm.; height, 7.6 mm.; convexity (one valve), 2.4 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species bears a general resemblance to that of *Diplodonta semiaspera* Philippi, which occurs in the Caribbean region but is more globose. The entire surface of the exterior of perfect specimens is punctate. The type of *Diplodonta ? semiaspera* var. *discrepans* Carpenter (1855-1857, p. 103), described from Mazatlan, Mexico, has not been illustrated. According to Dall it is not recognizable with certainty.

SUPERFAMILY CARDIACEA

FAMILY CARDIIDAE

GENUS CARDIUM LINNAEUS

SUBGENUS LOPHOCARDIUM FISCHER

Cardium (Lophocardium) cumingii Broderip

Plate 2, figures 3, 4, 7, 8

Cardium cumingii BRODERIP, 1833, Proc. Zool. Soc. London, p. 82. REEVE, 1841, Conchologia systematica, vol. 1, p. 98, pl. 74, fig. 5; 1844, Conchologia iconica, vol. 2, *Cardium*, sp. 59, pl. 12, fig. 59. HANLEY, 1842-1856, Catalogue of recent bivalve shells, p. 135, suppl. pl. 17, fig. 4.

Cardium (Laevicardium) cumingii Sowerby, STRONG, HANNA, AND HERTLEIN, 1933, Proc. Cali-

fornia Acad. Sci., ser. 4, vol. 21, p. 118, Acapulco, Mexico.

Protocardia (Lophocardium) cumingii Sowerby, M. SMITH, 1944, Panamic marine shells, p. 58, fig. 738 (as *Protocardia comingi*).

Lophocardium cumingii Broderip, L. SMITH, 1945, Occas. Papers on Mollusks, Dept. Mollusks, Mus. Comp. Zoöl., no. 4, p. 31.

TYPE LOCALITY: "Hab. in America Centrali. (Gulf of Dulce.) . . . It was obtained from sandy mud, at a depth of twelve fathoms." [Costa Rica.]

RANGE: Acapulco, Mexico, to Octavia Bay, Colombia.

MATERIAL EXAMINED: Three specimens from Octavia Bay, Colombia, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters.

MEASUREMENTS: Largest specimen: length, approximately 27.8 mm.; height, 22 mm.; convexity (both valves together), approximately 18.6 mm.

HABITAT: Gray sand bottom.

REMARKS: The beautiful, fragile, pink shells of this species in the present collection have already been discussed by L. Smith. She pointed out that the radial rib along the posterior umbonal slope, which delimits a posterior area, is composed of periostracal material rather than of shelly material as stated by Broderip. The cardinal teeth are well developed, but there are no anterior lateral teeth. There is, however, a faint trace of a left posterior lateral. Exteriorly the shell is sculptured with fine radial riblets crossed by faint concentric lamellae.

Cardium (Lophocardium) annettae Dall, a generally more northern shell, is very similar to *C. cumingii* but differs in the greater thickness, slightly greater height in proportion to the length, darker color, and especially in the fact that the posterior dorsal area is sculptured with five to seven concentric ridges composed of periostracal material which run parallel to the lines of growth. Dall's species has been discussed and illustrated by the present writers [1947 (1940–1951), p. 138, pl. 1, figs. 3, 8, 13].

SUBGENUS PHLOGOCARDIA STEWART

Cardium (Phlogocardia) belcheri

Broderip and Sowerby

Cardium belcheri BRODERIP AND SOWERBY,

1829, Zool. Jour., vol. 4, p. 366, pl. 9, fig. 3. REEVE, 1844, Conchologia iconica, vol. 2, *Cardium*, sp. 5, pl. 1, fig. 5.

Cardium (Phlogocardia) belcheri Broderip and Sowerby, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 140.

TYPE LOCALITY: "Hab. in Oceano Pacifico." Dredged "to the northward of Isabella Island, at the entrance of the Gulf of California, in 15 fathoms."

RANGE: Cedros Island, Baja California, to Santa Inez Bay in the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: One specimen from Octavia Bay, Colombia, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters.

MEASUREMENTS: Length and height, approximately 9 mm.; convexity (both valves together), 7 mm.

HABITAT: Sand bottom.

REMARKS: The single specimen in the present collection is a very small one. The present record of the occurrence of this species at Octavia Bay, Colombia, is an extension south of the known range.

SUBGENUS TRIGONIOCARDIA DALL

Cardium (Trigoniocardia) graniferum

Broderip and Sowerby

Cardium graniferum BRODERIP AND SOWERBY, 1829, Zool. Jour., vol. 4, p. 367. SOWERBY, 1834, The conchological illustrations, *Cardium*, p. 3 (?1840), pl. 49, fig. 17. REEVE, 1841, Conchologia systematica, vol. 1, p. 99, pl. 76, fig. 17; 1844, Conchologia iconica, vol. 2, *Cardium*, sp. 43, pl. 8, fig. 43.

Cardium (Trigoniocardia) graniferum Broderip and Sowerby, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 143.

TYPE LOCALITY: "Hab. ad littora Oceani Pacifici. . . . Dug from a depth of about 6 inches in the mud of the Estero de Mazatlan." [Mexico.]

RANGE: Punta Penasco in the Gulf of California to Zorritos, Peru.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 8–18 fathoms.

MEASUREMENTS: Length, 6.5 mm.; height, approximately 7.9 mm.; convexity (one valve), 3 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: The single small valve of this species is similar to other specimens of the same size.

Cardium (Trigoniocardia) obovale Sowerby

Cardium obovale SOWERBY, 1833, Proc. Zool. Soc. London, p. 84; 1834, The conchological illustrations, *Cardium*, p. 7 (?1840), pl. 46, fig. 4. REEVE, 1841, Conchologia systematica, vol. 1, p. 98, pl. 73, fig. 4; 1845, Conchologica iconica, vol. 2, *Cardium*, sp. 117, pl. 21, fig. 117. HERTLEIN, 1934, Bull. Southern California Acad. Sci., vol. 33, p. 62, pl. 21, fig. 14.

Trigoniocardia obovale Sowerby, M. SMITH, 1944, Panamic marine shells, p. 59, fig. 736.

Cardium (Trigoniocardia) obovale Sowerby, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 144.

TYPE LOCALITY: "Hab. ad oras Americae Meridionalis. (Xipixapi). Found in sandy mud at eleven fathoms depth." [Jipijapa, Ecuador.]

RANGE: Magdalena Bay, Baja California, to the Gulf of California and south to Salinas, Ecuador.

MATERIAL EXAMINED: One valve from South Passage, Pearl Islands, Panama, February 13, 1941 [Station 7], 15 fathoms.

MEASUREMENTS: Length, 12 mm.; height, 17.6 mm.; convexity (one valve), 6.7 mm.

HABITAT: Sandy bottom.

REMARKS: The subovate, somewhat oblique shell sculptured with about 21 finely noded ribs is typical of this species. It has been recorded as occurring in the Pliocene of Panama and Ecuador and in the Pleistocene of Maria Magdalena Island, Tres Marias Islands, Mexico.

SUBGENUS **LAEVICARDIUM** SWAINSON

Cardium (Laevicardium) elenense Sowerby

Cardium elenense SOWERBY, 1834, The conchological illustrations, *Cardium*, p. 6 (?1840), (*elenensis*), p. 8 (*elenense*), pl. 181, fig. 58; 1841, Proc. Zool. Soc. London, for 1840, p. 109. REEVE, 1845, Conchologia iconica, vol. 2, *Cardium*, sp. 104, pl. 20, fig. 104.

Cardium (Laevicardium) elenense Sowerby, HERTLEIN AND STRONG, 1947, Zoologica, New York, vol. 31, p. 145.

TYPE LOCALITY: "St. Elena." [Ecuador.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco and San Felipe in the Gulf of California and south to Salinas, Ecuador, and the Galapagos Islands.

MATERIAL EXAMINED: Four specimens from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Largest valve: length, 16.7 mm.; height, 17.5 mm.; convexity (one valve), 5.5 mm.

HABITAT: Sand bottom.

REMARKS: Shells of this species are usually somewhat narrower in outline and more highly colored than those of the subspecies *Cardium elenense apicinum* Carpenter.

SUPERFAMILY **CYRENACEA**

FAMILY **CORBICULIDAE**

GENUS **POLYMESODA** RAFINESQUE

Polymesoda isocardioides Deshayes

Plate 2, figures 25, 28

Cyrena (anomala) isocardioides DESHAYES, 1855, Proc. Zool. Soc. London, for 1854, p. 22.

Cyrena isocardioides Deshayes, PRIME, 1865, Smithsonian Misc. Coll., vol. 7, art. 5, no. 145, p. 25. SOWERBY, 1878, Conchologia iconica, vol. 20, *Cyrena*, sp. 103, pl. 18, fig. 103. DALL, 1909, Proc. U. S. Natl. Mus., vol. 37, pp. 159, 260, pl. 26, fig. 4.

Polymesoda isocardioides Deshayes, M. SMITH, 1944, Panamic marine shells, p. 67.

TYPE LOCALITY: "Hab. Columbia."

RANGE: Pearl Islands, Panama, to Tumbez, Peru.

MATERIAL EXAMINED: One valve from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 15, 1941, Station 9, sample 5.

MEASUREMENTS: Length, 42.8 mm.; height, 41.8 mm.; convexity, 16.9 mm.

HABITAT: Single valve taken on sandy beach.

REMARKS: The single valve in the present collection agrees in general with the original description of *Cyrena isocardioides* given by Deshayes. It resembles Sowerby's illustration of that species except that the umbo appears to be less inflated and the beak smaller than that shown in the figure, and those differences appear even more accentuated in comparison with Dall's (1909) illustration of that species. Prime mentioned that the species described by Deshayes resembles "*Cyrena*" *recluzii* Prime (1865, p. 24, fig. 19) and stated, "it presents great affinity to *C. recluzii* in shape and bulk; it differs, however, in being much less heavy and solid; the hinge-margin

is narrower and the teeth are smaller and slighter." The same remarks appear to be applicable to the present specimen; however, the word "fragile" used by Prime in his general description of "*Cyrena isocardioides* is hardly applicable to the present valve. The shell at hand is more inequilateral than that of *Polymesoda reclusii*, the anterior side is shorter than the posterior, and the hinge is narrower.

There is an element of doubt concerning the identification of the present specimen, but, in view of its general agreement with the descriptions of earlier authors who studied the type specimen and because of its similarity to the illustration given by Sowerby, we refer it to the species described by Deshayes.

SUPERFAMILY VENERACEA

FAMILY VENERIDAE

GENUS DOSINIA SCOPOLI

Dosinia SCOPOLI, 1777, *Introductio ad historiam naturalem*, p. 399. Reference to: "*Cricompholos* Klein. CHAMA *Dosin*. Adans."

Dosinidia DALL, 1902, *Proc. U. S. Natl. Mus.*, vol. 26, p. 347. "Type, *Venus concentrica* Born." [1780, p. 71, pl. 5, fig. 5, "Habitat ad insulam Mauriti & Jamaicam, Lister." See also Palmer, 1927-1929, p. 278, pl. 49, figs. 2, 5, 10, pl. 51, fig. 4, Pleistocene and Recent.]

TYPE (BY MONOTYPY): Chama *Dosin* Adanson [1757, p. 225 (as "Le *Dosin*"), pl. 16, fig. 5 (caption to plate, "G.IV. La Came Chama"; to fig. 5, "*Dosin*"). "On la voit assez abondamment sur la côte de Portugal." See Fischer-Piette and others, 1942, p. 308, pl. 14, fig. 4, as *Dosinia (Dosinia) concentrica* Born.]

Many authors have considered "Le *Dosin*" of Adanson, the type of *Dosinia*, to represent *Arthemis africana* Gray (1838, p. 309; Reeve, 1843-1878, vol. 6, *Artemis*, sp. 27, pl. 5, fig. 27) originally described from "coast of Africa.—Capt. E. Owen, R.N." Fischer-Piette and his associates have recently made a study of Adanson's collection of mollusks and give reasons for considering the original specimen of "Le *Dosin*" to be identical with *Venus concentrica* Born, which species is the type of *Dosinidia* Dall. No trace of the dark radial line shown on Adanson's figure 5 was found on the specimen studied by Fischer-Piette *et alii*. However, all the evidence

available convinced these workers that the specimen in the Adanson collection is the original one on which "Le *Dosin*" (*Chama Dosin*) was based.

If the correctness of the identification¹ of Adanson's species be assumed, then it follows as indicated by Fischer-Piette and his associates that *Dosinidia* Dall, with the same type species, becomes a synonym of *Dosinia*, *sensu stricto*. Fischer-Piette and associates pointed out that the species belonging to the group of *Dosinia africana* can take the supra-specific group name *Asa* Basterot, the type of which is *Venus lincta* Pultney (= *Venus lupinus* Linnaeus) according to Fischer-Piette *et alii*.

SUBGENUS DOSINIA, SENSU STRICTO

Dosinia (Dosinia) ponderosa Gray

Arthemis ponderosa GRAY, 1838, *Analyst*, vol. 8, p. 309.

Cytherea (Artemis) gigantea SOWERBY, PHILIPPI, 1847, *Abbildungen und Beschreibungen . . . Conchylien*, vol. 2, no. 8, *Cytherea*, p. 231 (33), pl. 7, figs. 1a, 1b, "Patria: California?"

Artemis ponderosa GRAY, REEVE, 1850, *Conchologia iconica*, vol. 6, *Artemis*, sp. 4, pl. 1, fig. 4. SOWERBY, 1852, *Thesaurus conchyliorum*, vol. 2, p. 656, pl. 140, fig. 2.

Dosinia ponderosa GRAY, RÖMER, 1862, *Monographie der Molluskengattung Dosinia, Scopoli*, p. 12. GRANT AND GALE, 1931, *Mem. San Diego Soc. Nat. Hist.*, vol. 1, p. 351, pl. 15, figs. 1a-1c. M. SMITH, 1944, *Panamic marine shells*, p. 59, fig. 749.

Dosinia (Dosinidia) ponderosa GRAY, HERTLEIN AND STRONG, 1948, *Zoologica*, New York, vol. 33, p. 165.

TYPE LOCALITY: No locality cited originally. "Gulf of California" designated as type locality by Hertlein and Strong, 1948.

RANGE: Scammon Lagoon,² Baja California, to Punta Penasco and San Felipe in the Gulf of California and south to Paita, Peru, and the Galapagos Islands.

¹ It is interesting to note that in the copy of Adanson's work in the California Academy of Sciences, someone has written "*V. concentrica*" just above figure 5 on plate 16.

² Earlier records of the occurrence of this species at San Diego, California, apparently were based on Pleistocene fossils (Hertlein and Grant, 1944, p. 71; Woodring, 1945, p. 34; Woodring, Bramlette, and Kew, 1946, p. 84, footnote 81a).

MATERIAL EXAMINED: Seven valves from three stations:

PANAMA

Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 5 valves.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 valve.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, ±15 fathoms, fragment of valve.

MEASUREMENTS: One of the larger valves: length, 81.2 mm.; height, 72 mm.; convexity (one valve), 20 mm.

HABITAT: Bottom of gray sand, mud and live shells.

REMARKS: This species may be easily recognized by its large, orbicular shell which, when adult, is sculptured with even concentric grooves.

GENUS MEGAPITARIA GRANT AND GALE

Megapitaria squalida Sowerby

Cytherea squalida SOWERBY, 1835, Proc. Zool. Soc. London, p. 23. RÖMER, 1866, Monographie der Molluskengattung Venus, Linné, p. 48, pl. 13, figs. 2, 2a-c.

Cytheraea squalida Sowerby, SOWERBY, 1851, Thesaurus conchyliorum, vol. 2, *Cytheraea*, p. 629, pl. 131, figs. 87-89; not the record "from the Philippine Islands."

Dione squalida Sowerby, REEVE, 1863, Conchologia iconica, vol. 14, *Dione*, sp. 10, pl. 3, fig. 10.

Macrocallista (Chionella) squalida squalida Sowerby, M. SMITH, 1944, Panamic marine shells, p. 59, fig. 757 (as *Macrocallista s. squalida*).

Megapitaria squalida Sowerby, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 168.

Macrocallista squalida Sowerby, DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 84, pl. 23, figs. 4, 5, 8.

TYPE LOCALITY: "Hab. ad Sanctam Elenam. . . Found in sandy mud at a depth of six fathoms." [Santa Elena, Ecuador.]

RANGE: Scammon Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Mancora, Peru.

MATERIAL EXAMINED: Nineteen valves from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Largest valve: length, ap-

proximately 50 mm.; height, 40 mm.; convexity, 13 mm.

HABITAT: Sand bottom.

REMARKS: The valves of the shell of this well-known species are smooth, convex, and somewhat produced anteriorly and posteriorly. The exterior is brown covered with a shiny purplish brown periostracum which is often mottled or striped. It is known to occur as a fossil in the Pliocene and Pleistocene.

GENUS PITAR RÖMER

SUBGENUS PITAR, SENSU STRICTO

Pitar (Pitar) consanguineus C. B. Adams

Cytherea consanguinea C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 496, 545. RÖMER, 1867, Monographie der Molluskengattung Venus, Linné, p. 108, pl. 28, figs. 5, 5a, 5b.

Cytheraea consanguinea C. B. Adams, SOWERBY, 1853, Thesaurus conchyliorum, vol. 2, p. 743, pl. 163, fig. 203.

Pitar (Pitar) consanguineus C. B. Adams, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 170.

TYPE LOCALITY: "Panama. . . We found 8 specimens on the reef."

RANGE: Port Guatulco, Mexico, to Piñas Bay, Panama.

MATERIAL EXAMINED: One valve from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14-33 meters.

MEASUREMENTS: Length, 25.3 mm.; height, 21.4 mm.; convexity (one valve), 7.5 mm.

HABITAT: Gray sandy mud.

REMARKS: The shell of this species is characterized by its rather high, roundly trigonal outline and the fact that the anterior lateral of the left valve is higher than the cardinal teeth.

The present record of occurrence at Piñas Bay, Panama, apparently represents a slight extension south of the known range of this species.

Pitar (Pitar) fluctuatus Sowerby

Plate 2, figures 10, 15, 19

Cytheraea fluctuata SOWERBY, 1851, Thesaurus conchyliorum, vol. 2, p. 634, pl. 136, figs. 185, 186. RÖMER, 1867, Monographie der Molluskengattung Venus, Linné, p. 122.

Circe fluctuata Sowerby, REEVE, 1863, Conchologia iconica, vol. 14, *Circe*, sp. 36, pl. 9, fig. 36.

TYPE LOCALITY: "The larger specimen figured is in Mr. Cuming's collection, from St. Elena." [Ecuador.]

RANGE: Pearl Islands, Gulf of Panama, to Santa Elena, Ecuador.

MATERIAL EXAMINED: Two valves from two stations.

PANAMA

Bahia Santelmo, Isle del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 1 valve.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 1 valve.

MEASUREMENTS: Larger valve: length, 13 mm.; height, 10.9 mm.; convexity, 4 mm.

HABITAT: Sand and gray mud bottom.

DESCRIPTION: Shell of a somewhat rounded oval form, white, with angular markings, and a light greenish epidermis, concentrically striated; anterior side short, with a distinct lunule; posterior side rather squared, with the dorsal margin elevated, and the ligament nearly hidden. (Original description.)

REMARKS: Two left valves in the present collection agree well with Sowerby's figure 186 of *Cytheraea fluctuata*. The illustration shows a shell less ventricose and less broadly rounded posteriorly than that shown in figure 185. Sowerby stated, "the smaller, which, although less ventricose and more oval, resembles the younger portion of the other, is Mr. Hanley's."

The valves in the present collection are sculptured with fine, rounded, rather even, concentric ribs. The larger shell is ornamented with fine brown angular markings, and the smaller one has traces of such markings. These left valves have three cardinal teeth, the posterior one thin, lamella-like, on the base of the hinge plate, and a well-developed anterior lateral tooth.

The pallial sinus, pointed at the end and directed towards the anterior adductor impression, extends anteriorly a little less than one-half of the length of the shell.

The present record of the occurrence of this species at the Las Perlas Islands in the Gulf of Panama is an extension north of the known range.

Pitar (Pitar) tomeanus Dall

Plate 2, figures 1, 2, 5, 6

Pitaria tomeana DALL, 1902, Proc. U. S. Natl.

Mus., vol. 26, pp. 387, 402, pl. 15, fig. 2. RIVEROS-ZUÑIGA AND GONZALES REYES, 1950, Rev. Biol. Mar., Valparaiso, vol. 2, p. 130, fig. 24.

TYPE LOCALITY: "Brought up with mud on the anchor at Tomé, Chile, by the United States Fish Commission Steamer Albatross."

RANGE: Bay of Panama to Tomé, Chile. ?Galapagos Islands (Dall).

MATERIAL EXAMINED: One pair of, and four single, valves from three stations:

PANAMA

Bahia Santelmo, Isle del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 1 valve.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 3 valves.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24-28 meters, 1 valve.

MEASUREMENTS: Largest specimen, a left valve from Station 31: length, 26.2 mm.; height, 21.2 mm.; convexity, 6.9 mm.; pallial sinus extends anteriorly approximately 10 mm. from the posterior margin.

HABITAT: Gray sand bottom.

REMARKS: The specimens in the present collection agree so closely with Dall's description and illustration of *Pitar tomeanus* that we have referred them to that species. The rather earthy texture, the short ascending linguiform pallial sinus, and the subconical anterior lateral tooth described by Dall are true of the present specimens.

SUBGENUS PITARELLA PALMER

Pitar (Pitarella) catharius Dall

Plate 1, figures 5, 6, 8-10; plate 2, figure 24

Callocardia (Agriopoma) catharia DALL, 1902, Proc. U. S. Natl. Mus., vol. 26, pp. 387, 402, pl. 14, fig. 3 (as *Callocardia catharia*). M. SMITH, 1944, Panamic marine shells, p. 60. HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 177, pl. 2, figs. 14, 15.

TYPE LOCALITY: "Bay of Panama, in 30 fathoms, mud."

RANGE: Ballenas Bay, west coast of Baja California, to the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Five pairs of valves and four single valves from three samples from two stations:

PANAMA

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 1 valve.

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course in 24-28 meters, 3 pairs of valves and 2 single valves. Also March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, in 24-28 meters, 2 pairs of valves and 1 single valve.

MEASUREMENTS: Largest specimen: length, 57.8 mm.; height, 49.6 mm.; convexity (both valves together), 41.2 mm.; pallial sinus extends anteriorly 22 mm. from posterior margin.

HABITAT: Gray sand and mud and black mud bottom.

DESCRIPTION: Shell roundly trigonal, quite convex, thick, white, somewhat earthy; beaks prominent, anteriorly directed over a broad cordate lunule which is defined only by a fine impressed line; anterior dorsal margin only faintly convex, sloping, ends and ventral margin rounded; a shallow radial depression present back of the beaks, this gradually diverging from the arcuate dorsal margin and extending obliquely to the posterior margin; exterior surface sculptured with uneven concentric lines of growth; hinge and ligament well developed and normal for the genus and subgenus, the left middle posterior cardinal as well as the right middle and posterior cardinals quite thick; adductor impressions subpyriform, the anterior ones abruptly truncated posteriorly by calcareous shell material; pallial sinus fairly broad and extending gently upward from the base of the posterior impression, bluntly pointed at the end; margins of valves smooth.

REMARKS: This species was discussed by the authors in an earlier paper [1948 (1940-1951)]. It was recognized then that this species might not be referable to the genus *Callocardia* and subgenus *Agriopoma* to which it was originally assigned by Dall. Through the courtesy of Dr. Harald A. Rehder and Dr. David Nicol of the United States National Museum, we have received

information concerning the type specimen of Dall's species. Dr. Rehder stated that the type specimen possesses characters of both *Pitar* and of the subgenus *Pitarella*. The left anterior lateral of the hinge is large as in *Pitar*, *sensu stricto*, and the corresponding pit in the right valve is deep. The corresponding anterior lateral in *Pitarella* is smaller and lower. The hinge of the type specimen resembles that of *Pitarella* in possessing a rather broad, markedly bifid right posterior cardinal, and in the sculpture and relative thickness of the shell. The pallial line is similar in *Pitar*, *Pitarella*, and the present specimen.

The thick, rather elongated left middle cardinal in connection with other characters has led us to place the species in the genus *Pitar*, subgenus *Pitarella*.

There is variation in a series of specimens of this species. The shell of juvenile specimens is quite thin, and the elements of the hinge are delicate in comparison to those of the adult form in which the shell is quite thick and the hinge correspondingly coarse.

This species differs from *Pitar* (*Pitarella*) *mexicanus* Hertlein and Strong [1948 (1940-1951), p. 171, pl. 1, figs. 3, 8] in that the shell is more globose and is shorter in proportion to the height, the posterior end is correspondingly more broadly rounded, the radial depression below the posterior dorsal margin is much more pronounced, the left middle, right middle, and posterior cardinal teeth are much thicker, and the pallial sinus is more tapering to a bluntly rounded point. The differences enumerated here are more evident on adult shells.

Some large, worn specimens of the present species bear considerable resemblance to *Pitar* (*Hyphantosoma*) *alates* Hertlein and Strong [1948 (1940-1951), p. 172, pl. 1, figs. 9, 11-13], but none shows a trace of the divaricate sculpture which is present on that species.

The present record of the occurrence of this species in Octavia Bay, Colombia, is a slight extension south of the known range.

SUBGENUS LAMELLICONCHA DALL

***Pitar* (*Lamelliconcha*) *callicomatus* Dall**

Pitaria (*Lamelliconcha*) *callicomata* DALL, 1902, Proc. U. S. Natl. Mus., vol. 26, pp. 389, 402, pl. 16, fig. 8.

Pitar (Lamelliconcha) callicomatus Dall, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 175.

TYPE LOCALITY: "Bay of Panama, in 14 fathoms, mud." Also in 7-30 fathoms.

RANGE: Acapulco, Mexico, to Ardita Bay, Colombia.

MATERIAL EXAMINED: Six specimens from two stations:

PANAMA

Piñas Bay, February 15, 1941, Station 19, sample 35, 14-33 meters, 5 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 1 valve.

MEASUREMENTS: One of the largest valves: length, 38 mm.; height, 30.7 mm.; convexity, 11 mm.

HABITAT: Gray sand and gray sandy mud bottom.

REMARKS: The present record of the occurrence of this species at Ardita Bay, Colombia, is an extension south of the known range.

Pitar (Lamelliconcha) concinnus Sowerby

Cytherea concinna SOWERBY, 1835, Proc. Zool. Soc. London, p. 23.

Cytherea affinis BRODERIP, 1835, Proc. Zool. Soc. London, p. 45, "Hab. ad Colombiam Occidentalem. (Xipixapi.) . . . Dredged up from sandy mud at a depth of ten fathoms."

Not *Venus affinis* Gmelin, 1791.

Cytheraea tortuosa BRODERIP, 1835, Proc. Zool. Soc. London, p. 45, "Hab. ad Panamam, et ad Xipixapi. . . . Dredged up from sandy mud at a depth of six fathoms."

Venus paytensis D'ORBIGNY, 1846, Voyage dans Amérique Méridionale, vol. 5, p. 565. New name for *Cytherea affinis* Broderip, 1835, not *Venus affinis* Gmelin, 1789.

Cytheraea concinna Sowerby, SOWERBY, 1851, Thesaurus Conchyliorum, vol. 2, p. 630, pl. 132, figs. 99, 100.

Dione concinna Sowerby, REEVE, 1863, Conchologia iconica, vol. 14, *Dione*, sp. 31, pl. 8, figs. 31a, 31b. RÖMER, 1868, Monographie der Molluskengattung Venus, Linné, p. 137, pl. 37, figs. 1, 1a-c, e, 1d (*tortuosa*).

Pitar (Lamelliconcha) concinnus Sowerby, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 175; with synonymy.

TYPE LOCALITY: "Hab. ad Panamam.

Found at a depth of ten fathoms in fine sand."

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: Thirteen valves from two stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 11 valves.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 2 valves.

MEASUREMENTS: Largest valve: length, 34 mm.; height, 24.5 mm.; convexity, 8.4 mm.

HABITAT: Bottom of sand and shell fragments.

REMARKS: The shell of this species is ovately elongated, somewhat rostrate posteriorly, and is sculptured with concentric ridges, those on the posterior side a little flexuous. The color is chestnut-red or white.

The form with very irregular concentric ridges was originally named *Cytherea tortuosa* by Broderip.

Pitar concinnus has been recorded as occurring from Pliocene to Recent.

GENUS *CHIONE* MEGERLE VON MÜHLFELD

SUBGENUS *CHIONE*, SENSU STRICTO

Chione (Chione) compta Broderip

Venus compta BRODERIP, 1835, Proc. Zool. Soc. London, p. 43. SOWERBY, 1853, Thesaurus conchyliorum, vol. 2, p. 710, pl. 154, figs. 32-34. REEVE, 1863, Conchologia iconica, vol. 14, *Venus*, sp. 48, pl. 13, fig. 48.

Chione meridionalis I. S. OLDROYD, 1921, Nautilus, vol. 34, p. 93, pl. 4, figs. 3, 4, "Peru."

Not *Venus meridionalis* Sowerby, 1846.

Chione (Chione) compta Broderip, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 182. PARKER, 1949, Jour. Paleont., vol. 23, p. 581, pl. 89, fig. 3, pl. 90, figs. 6, 8.

Chione (Chione) compta var. *meridionalis* I. S. Oldroyd, PARKER, 1949, Jour. Paleont., vol. 23, p. 581, pl. 90, fig. 14.

TYPE LOCALITY: "Hab. ad Peruviam. (Bay of Sechura.) . . . It was dredged up in coarse sand and mud at a depth of seven fathoms."

RANGE: Gulf of California (Dall), to Bayovar, Peru.

MATERIAL EXAMINED: One valve from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14–33 meters.

MEASUREMENTS: A left valve: length, 45.6 mm.; height, 43 mm.; convexity, 12.8 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: One left valve in the present collection possesses the typical characteristic features of *Chione compta*. The shell is of a rather compressed, roundly triangular form, sculptured with even, widely separated concentric lamellae, flattened radial ribs, and with a riblet in the interspaces. Posteriorly the ribs become finer and divaricate. The pallial line is distant from the margin and is only slightly indented.

This species has been recorded as occurring in the Pleistocene of Ecuador and Peru.

SUBGENUS CHIONOPSIS OLSSON

Chione (Chionopsis) amathusia Philippi

Venus amathusia PHILIPPI, 1844, *Abbildungen und Beschreibungen . . . Conchylien*, vol. 1, no. 5, *Venus*, p. 129 (7), pl. 2, fig. 4. REEVE, 1863, *Conchologia iconica*, vol. 14, *Venus*, sp. 36, pl. 11, fig. 36b.

Chione (Chionopsis) amathusia Philippi, HERTLEIN AND STRONG, 1948, *Zoologica*, New York, vol. 33, p. 183.

Chione (Gnidiella) amathusia Philippi, PARKER, 1949, *Jour. Paleont.*, vol. 23, p. 582, pl. 89, fig. 8, pl. 91, figs. 10, 12, 14.

TYPE LOCALITY: "Patria?" originally cited. Panama Bay designated as type locality by Hertlein and Strong, 1948.

RANGE: Gulf of California (Dall), to Manacora, Peru.

MATERIAL EXAMINED: Four valves from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14–33 meters.

MEASUREMENTS: Largest valve: length, 26.4 mm.; height, 23 mm.; convexity, 9.8 mm.

HABITAT: Gray sandy mud.

REMARKS: Compared to that of *Chione gnidia*, the shell of the present species is more highly triangular, more highly rounded, the lunule is usually more cordate, the concentric lamellae are lower and more closely spaced, the adductor impressions are larger in propor-

tion to the size of the shell, and the pallial sinus is usually more upwardly directed.

Chione (Chionopsis) gnidia jamaniana Pilsbry and Olsson

Plate 1, figures 1, 3

Chione jamaniana PILSBRY AND OLSSON, 1941, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 93, p. 63, pl. 17, figs. 1, 2.

TYPE LOCALITY: "Jama formation, Puerto Jama." [Ecuador.] (Canoa formation also cited, on p. 64 but not on p. 10.)

RANGE: Off Punta Pasado, Ecuador. Also Pliocene of Ecuador.

MATERIAL EXAMINED: One valve from Punta Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms.

MEASUREMENTS: Length, 48.6 mm.; height, 42.8 mm.; convexity, 18.9 mm.

HABITAT: Sand and shell fragments.

REMARKS: According to Pilsbry and Olsson the form described under the name *Chione jamaniana* differs from *Chione gnidia* as follows: "In *Chione gnidia* the concentric lamellae remain very thin with erect tooth-like processes, while in the present species the ridges are solid, appressed, and the spaces between them tend to become smooth in old shells." Those differences are discernible on the single valve in the present collection.

We hesitate to apply the name *jamaniana*, which was based on a fossil from the Pliocene of Ecuador, to a Recent species, but the similarity is so great that we feel justified in referring the present shell to that form which we place as a subspecies of *Chione gnidia*.

Chione (Chionopsis) traftoni Pilsbry and Olsson

Plate 1, figures 2, 4; plate 3, figure 16

Chione traftoni PILSBRY AND OLSSON, 1941, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 93, p. 61, pl. 16, fig. 4, pl. 17, fig. 4.

TYPE LOCALITY: "Pleistocene of Quebrada Rabo de Puerco, near Puerto Armuelles, Chiriqui Province, western Panama."

RANGE: Piñas Bay, Panama, to Cape Pasado, Ecuador.

MATERIAL EXAMINED: Three specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 2 specimens.

ECUADOR

Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen, a single valve: length, 36.8 mm.; height, 34.3 mm.; convexity, 13 mm.

HABITAT: Gray sand and mud and live shells.

REMARKS: The specimens here referred to *Chione traftoni* offered the same problem in identification as that of *C. gnidia jamaniana* in that both were originally described from fossil specimens and had not previously been recognized among the species of the Recent fauna. Pilsbry and Olsson in their remarks on *C. traftoni* stated, "The species is somewhat variable, some shells being more circular, convex, and with a sculpture of finer ribs than the form here considered as typical. The concentric lamellae are thin, typically widely spaced and appear to be unprovided with the tooth-like extensions of *Chione gnidia* and its allies."

The present specimens agree so well with that description and with the illustrations of the type of *Chione traftoni* that we have referred them to that species. Furthermore, the type occurred in beds of Pleistocene age, and therefore the species might be expected to occur in the Recent fauna.

SUBGENUS LIROPHORA CONRAD

Chione (Lirophora) kellestii Hinds

Venus kellestii HINDS, 1845, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 3, p. 65, pl. 19, fig. 5. SOWERBY, 1853, Thesaurus conchyliorum, vol. 2, p. 721, pl. 155, fig. 64. HANLEY, 1856, Catalogue of recent bivalve shells, p. 359, suppl. pl. 16, fig. 47. REEVE, 1863, Conchologia iconica, vol. 14, *Venus*, sp. 82, pl. 18, fig. 82.

Chione (Lirophora) kellestii Hinds, PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 64, pl. 16, fig. 2. M. SMITH, 1944, Panamic marine shells, p. 61, fig. 776.

Chione (Lirophora) kellestii Hinds, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 185.

Chione (Anomalocardia) kellestii Hinds, PARKER,

1949, Jour. Paleont., vol. 23, p. 586, pl. 92, fig. 8, pl. 93, figs. 1, 2.

TYPE LOCALITY: "Inhab. Island of Quibo, West coast of Veragua. In adhesive mud of a low temperature, in between thirty and thirty-four fathoms." [Island of Coiba, Veragua, Panama.]

RANGE: Cedros Island, Baja California (Parker), to Santa Inez Bay in the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Eight specimens from three stations:

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, 1 specimen; also sample 81, March 6, 1941, dredged in and out of center of bay, 34–43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 4 specimens; also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 37 mm.; height, 31.4 mm.; convexity (both valves together), 19.8 mm.

HABITAT: Gray sand, black mud, and live shells. One empty valve taken on beach.

REMARKS: A characteristic feature of the shell of this species is the yellowish brown concentric ribs which are coalescent over much of the valves but develop into white lamellae along the anterior and posterior ends.

The present record of occurrence along the coast of Colombia furnishes a slight extension south of the known range of this species. It also has been recorded as occurring in the Pleistocene of Baja California and Costa Rica and the Pliocene of Panama and Costa Rica.

Chione (Lirophora) mariae d'Orbigny

Venus cypria SOWERBY, 1835, Proc. Zool. Soc. London, p. 43. HANLEY, 1843, 1856, Catalogue of recent bivalve shells, pp. 128, 358, suppl. pl. 16, fig. 3. SOWERBY, 1853, Thesaurus conchyliorum, vol. 2, p. 722, pl. 157, fig. 113. REEVE, 1863,

Conchologia iconica, vol. 14, *Venus*, sp. 116, pl. 23, figs. 116a, 116b.

Not *Venus Cypria* Brocchi, 1814; not *Venus cypria* Risso, 1826.

Venus mariae D'ORBIGNY, 1846, Voyage dans l'Amérique Méridionale, vol. 5, p. 563. New name for *Venus Cypria* Sowerby, 1835, not *Venus cypria* Brocchi, 1814; not *Venus cypria* Risso, 1826. (Sowerby's locality for *V. cypria* cited.)

Chione (Lirophora) mariae d'Orbigny, HERTLEIN AND STRONG, 1948, Zoologica, New York, vol. 33, p. 186.

Chione (Anomalocardia) mariae d'Orbigny, PARKER, 1949, Jour. Paleont., vol. 26, p. 586, pl. 92, figs. 7, 9, 10, 16.

TYPE LOCALITY: "Hab. ad Insulam Platae, Columbiae Occidentalis. Found among coral sand in seventeen fathoms." [Ecuador.] For *Venus cypria*.

RANGE: Cedros Island, Baja California, to Punta Penasco in the Gulf of California and south to Guayaquil, Ecuador.

MATERIAL EXAMINED: Thirty one specimens from five stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 5 specimens.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 14 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 4 specimens.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 6 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen. Also sample 307, April 14, 1941, 15 fathoms, 1 specimen.

MEASUREMENTS: One of the largest specimens: length, approximately 21.4 mm.; height, 17 mm.; convexity (both valves together including concentric lamellae), 11 mm.

HABITAT: Mostly gray sandy bottom, occasionally mud and live shells.

REMARKS: The shell of this species is roundly triangular in outline, somewhat attenuated posteriorly and sculptured with recurved concentric lamellose ribs which on the

ventral side are radiately striated. It is known to occur from Pliocene to Recent.

SUBGENUS UNCERTAIN

Chione antiqua King

Venus antiqua KING, 1829, Zool. Jour., vol. 5, p. 336. DESHAYES, 1853, Catalogue of Conchifera, pt. 1, p. 109. RÖMER, 1867, Malakozool. Blätter, vol. 14, p. 37.

Venus costellata SOWERBY, 1835, Proc. Zool. Soc. London, p. 42, "Hab. ad Valparaiso, Chilensium, et ad Callao, Peruviae. . . Found in coarse sand at a depth of from six to fifteen fathoms"; 1853, Thesaurus conchyliorum, vol. 2, p. 705, pl. 153, fig. 14. REEVE, 1859, Conchologia iconica, vol. 14, *Venus*, sp. 30, pl. 9, fig. 30.

Venus discrepans Sowerby, PHILIPPI, 1844, Abbildungen und Beschreibungen . . . Conchylien, vol. 1, no. 7, *Venus*, p. 175 (9), pl. 3, fig. 2.

Not *Venus discrepans* Sowerby, 1835.

Venus cineracea HUPÉ, 1854, in Gay, Historia física y política de Chile, Zoología, vol. 8, p. 334, atlas pl. 6, fig. 2, "Habita el norte de la República, y se halla tambien en el Callao."

[?] *Venus alvarezii* D'ORBIGNY, 1846, Voyage dans l'Amérique Méridionale, vol. 5, p. 557, pl. 83, figs. 1, 2, "Nous l'avons recueillie, jetée à la côte au sud de Rio Negro, en Patagonie, dans la baie dite Ensenada de Ros. Elle y paraît rare."

Protothaca antiqua King, RIVEROS-ZUÑIGA AND GONZALES REYES, 1950, Rev. Biol. Mar., Valparaiso, vol. 2 p. 144, fig. 35 (p. 145 as *Chione antiqua*), fig. 36 (as *Venus discrepans*).

TYPE LOCALITY: "Habitat ad littora occidentalia Patagoniae (Gulf of Peñas and its vicinity)." [Chile.]

RANGE: Bay of Panama to Rio Negro, Argentina.

MATERIAL EXAMINED: One valve from Bahia Santelmo, Panama, Isla del Rey, Pearl Islands, February 15, 1941, Station 9, sample 5.

MEASUREMENTS: A left valve: length, 29.2 mm.; height, 25 mm.; convexity, 18.5 mm.

HABITAT: Valve picked up on sandy beach.

REMARKS: The single left valve in the present collection agrees well with the young stages of specimens collected by Robert Hoffstetter along the Santa Elena Peninsula, Ecuador. Some specimens appear much more angulated at the posterior dorsal margin than others. Römer mentioned that young specimens of this species differ considerably from adult forms and in general characters re-

semble *Protothaca thaca* Molina, the type of *Protothaca*, which occurs along the coast of southern Peru and Chile. The finer, even, radial ribbing and strong concentric lamellae are characters which serve to separate the present species from *P. thaca*.

SUPERFAMILY TELLINACEA

FAMILY TELLINIDAE

GENUS TELLINA LINNAEUS

SUBGENUS MOERELLA FISCHER

Tellina (*Moerella*) *amianta* Dall

Tellina (*Moerella*) *amianta* DALL, 1900, Proc. U. S. Natl. Mus., vol. 23, pp. 303, 317, pl. 3, fig. 12. HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 67.

TYPE LOCALITY: "Dredged in 14 fathoms, sand, off Cape Tepoca, Lower California, near the head of the Gulf, by the U. S. Fish Commission at station 3019."

RANGE: Punta Penasco in the Gulf of California to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: Two valves from two stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 1 valve.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 1 valve.

MEASUREMENTS: Larger valve: length, 11.1 mm.; height, 5.5 mm.; convexity, 1.5 mm.

HABITAT: Sand and gray sandy mud bottom.

REMARKS: Two valves in the present collection appear referable to *Tellina amianta*. The shell of this species is elongated, the posterior end shorter than the anterior, obliquely truncated and somewhat pointed. We can add nothing to the discussion of this species given by the present authors in an earlier paper [1949 (1940–1951)].

Tellina (*Moerella*) *recurvata*

Hertlein and Strong

Tellina (*Angulus*) *recurva* DALL, 1900, Proc. U. S. Natl. Mus., vol. 23, pp. 304, 320, pl. 3, fig. 4. "Dredged near the head of the Gulf of California in 24 fathoms mud, off Point Fermin, by the U. S. Fish Commission, at Station 3034."

Not *Tellina recurva* Deshayes, 1855.

Tellina (*Moerella*) *recurvata* HERTLEIN AND

STRONG, 1949, Zoologica, New York, vol. 34, p. 71, pl. 1, figs. 2–4, 8.

TYPE LOCALITY: "San Luis Gonzaga Bay, Gulf of California."

RANGE: Point Fermin in the Gulf of California to Octavia Bay, Colombia.

MATERIAL EXAMINED: Four specimens from two stations:

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 3 valves.

Octavia Bay, March 7, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 1 specimen.

MEASUREMENTS: Length, about 11.9 mm.; height, 7.3 mm.; convexity (both valves together), approximately 2 mm.

HABITAT: Gray sand bottom.

REMARKS: The shell of this species is thin, and the posterior end is rather broadly obliquely truncated; a concavity extends along the dorsal margin just posterior to the beaks.

The present record of the occurrence of this species off Colombia is a slight extension south of the known range.

Tellina (*Moerella*) *tabogensis* Salisbury

Tellina (*Angulus*) *panamensis* DALL, 1900, Proc. U. S. Natl. Mus., vol. 23, p. 319, pl. 3, fig. 3. M. SMITH, 1944, Panamic marine shells, p. 65, fig. 837 (not fig. 832 = *T. panamanensis* Li). DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 88, pl. 23, figs. 13, 14.

Not *Tellina panamensis* Philippi, 1848.

Tellina tabogensis SALISBURY, 1934, Proc. Malacol. Soc. London, vol. 21, p. 86. New name for *Tellina* (*Angulus*) *panamensis* Dall, 1900, not *Tellina panamensis* Philippi, 1848.

Tellina (*Moerella*) *tabogensis* Salisbury, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 72.

TYPE LOCALITY: "Dredged in 30 fathoms in Panama Bay by the U. S. Fish Commission, at station 2799."

RANGE: San Felipe in the Gulf of California and south to Santa Elena, Ecuador.

MATERIAL EXAMINED: Eighteen valves from two stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 2 valves.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 16 valves.

MEASUREMENTS: Length, 12.4 mm.; height, 7.4 mm.; convexity (one valve), 1.5 mm.

HABITAT: Sandy bottom.

REMARKS: A number of single valves of this small ivory white shell, often with a flexuous posterior dorsal margin, are present in the collection. We can add nothing to our discussion of this species in an earlier paper [1949 (1940-1951)].

Durham recorded this species as occurring in the upper Pliocene and Pleistocene of the Gulf of California region.

SUBGENUS **EURYTELLINA** FISCHER

Tellina (Eurytellina) eburnea askoyana
Hertlein and Strong, new subspecies

Plate 3, figures 3, 13-15, 20, 21, 23

Tellina (Eurytellina) eburnea Hanley, HERTLEIN AND STRONG, 1949, *Zoologica*, New York, vol. 34, p. 73; 1950, *ibid.*, vol. 35, p. 252, pl. 2, fig. 7.

HOLOTYPE: C.A.S.¹ No. 9246, right valve, from 7 miles west of Champerico, Guatemala, latitude 14° 13' 00" N., longitude 92° 02' 00" W., December 15, 1937, dredged in 14 fathoms (25 meters), mud; length, 26.5 mm.; height, 17.5 mm.; convexity, 3.2 mm.

PARATYPES: A.M.N.H. No. 73432, Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, dredged in 14-33 meters (on label; 8-18 fathoms in list), gray, sandy mud bottom; length, 26.2 mm.; height, 17.4 mm.; convexity (both valves together), 6.5 mm. C.A.S. No. 9895, right valve, from La Libertad, El Salvador, latitude 13° 27' 20" N., longitude 89° 19' 20" W., December 16, 1937, dredged in 13 fathoms (24 meters), mud; length, 27.7 mm.; height, 18.1 mm.; convexity, 3.4 mm. C.A.S. No. 9896, left valve: length, 28.4 mm.; height, 17.6 mm.; convexity, 3.7 mm. C.A.S. No. 9897, left valve: length, 25.3 mm.; height, 16 mm.; convexity, 3.2 mm. C.A.S. No. 9898, right valve: length (incomplete), 22 mm.; height, 14.4 mm.; convexity, 2.5 mm. Last three specimens from 7 miles west of Champerico, Guatemala, latitude 14° 13' 00" N., longitude 92° 02' 00" W.,

¹ California Academy of Sciences, San Francisco, California.

December 15, 1937, dredged in 14 fathoms (25 meters), mud.

RANGE: Champerico, Guatemala, to Piñas Bay, Panama.

DESCRIPTION: Shell similar to that of *Tellina eburnea* Hanley in general characters but smaller, slightly longer in proportion to the height, also differing in that the pallial sinus extends almost to the anterior adductor impression rather than being separated by a space, in adult specimens, about 1.5 mm. in width.

REMARKS: The single specimen in the present collection appears to be identical with shells from Central America which the present authors cited in an earlier paper [1950 (1940-1951), p. 252, pl. 2, fig. 7] under the name *Tellina (Eurytellina) eburnea* Hanley [1844 (1844-1845), p. 61; 1846, p. 241, pl. 58, fig. 91], a species that was originally described from "Hab. Tumbez, Peru; in soft sandy mud, five fathoms."

These specimens, as mentioned above, differ from *T. eburnea* in various details and we therefore propose a new subspecific name, *askoyana*, to include them.

Tellina (Eurytellina) ecuadoriana
Pilsbry and Olsson

Tellina (Eurytellina) ecuadoriana PILSBRY AND OLSSON, 1941, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 93, p. 67, pl. 15, figs. 6-8.

TYPE LOCALITY: "Recent from S. Elena (fig. 8, Type, A.N.S.P. 175551)." [Ecuador.]

RANGE: Off Cape Pasado, Ecuador, to Santa Elena, Ecuador.

MATERIAL EXAMINED: Three valves from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 3 valves.

MEASUREMENTS: Length, 45.7 mm.; height, 25.4 mm.; convexity (both valves together), 9 mm.

HABITAT: Bottom of sand and shell fragments.

REMARKS: The shell of this species is similar in general features to that of *Tellina simulans* C. B. Adams. It differs from that species in that the apical angle is greater, the sculpture is finer, and the posterior area is smoother. It is rose-colored, with whitish concentric zones. The pallial sinus just barely

fails to touch the anterior adductor impression.

Tellina mantaensis Pilsbry and Olsson is another similar species but differs from *T. ecuadoriana* in that the posterior area bears strong concentric sculpture.

Pilsbry and Olsson recorded the occurrence of this species from Pliocene strata in Ecuador, and Olsson has recorded it from the Pliocene of Costa Rica.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is a slight extension north of the known range.

***Tellina (Eurytellina) inaequistriata* Donovan**

Tellina inaequistriata DONOVAN, 1802, The natural history of British shells, vol. 4, pl. 123 (2 figs.). HANLEY, 1846, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 238, pl. 57, fig. 58, pl. 58, fig. 80. SOWERBY, 1867, Conchologia iconica, vol. 17, *Tellina*, sp. 202, pl. 36, fig. 202a.

Tellina sanguinea WOOD, 1815, General conchology, p. 159, pl. 44, fig. 2, no locality cited.

Tellina (Eurytellina) leucogonia DALL, 1900, Proc. U. S. Natl. Mus., vol. 23, p. 317, pl. 4, fig. 5, "from the Gulf of California, Stearns collection."

Tellina (Eurytellina) inaequistriata Donovan, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 74, pl. 1, fig. 18.

TYPE LOCALITY: "Bay of Guayaquil; (Cuming)." Ecuador cited by Hanley (1846, p. 238) and Forbes and Hanley (1848, p. 314). Originally erroneously cited by Donovan, "It has been found by the late Dr. Pulteney we believe on the coast of Dorsetshire."

RANGE: Gulf of California to the Bay of Guayaquil, Ecuador. Caribbean (Dautzenberg).

MATERIAL EXAMINED: Eleven specimens from five stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 3 valves.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 1 valve.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 3 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to the entrance, 25-64 meters, 2 valves.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 2 valves.

MEASUREMENTS: Largest specimen: length, 35.8 mm.; height, 20.3 mm.; convexity (one valve), 4.3 mm.

HABITAT: Sandy bottom, occasionally gray mud.

REMARKS: Perfect specimens of this species are usually ornamented with fewer coarser striae on the posterior portion of the shell. The present series reveals gradation from typical forms to those on which such coarse striae are lacking. These specimens confirm our previous conclusion that the shell described as *Tellina leucogonia* by Dall was based upon a form of this species with nearly uniform concentric striae.

***Tellina (Eurytellina) panamanensis* Li**

Tellina panamanensis LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 262, pl. 5, fig. 32.

Tellina (Eurytellina) panamanensis Li, PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 436, pl. 41, figs. 4-6. HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 76.

Tellina panamensis [Li], M. SMITH, 1944, Panamic marine shells, fig. 832; not *Tellina (Angulus) panamensis* Dall, cited p. 65, fig. 837.

TYPE LOCALITY: "'Brought up by marine dredge from depths varying from 10 ft. to 40 ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay.'"

RANGE: Tenacatita Bay, Mexico, to Octavia Bay, Colombia.

MATERIAL EXAMINED: One valve from Octavia Bay, Colombia, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 25 meters.

MEASUREMENTS: Length, 28.8 mm.; height 18.4 mm.; convexity (one valve), 3.3 mm.

HABITAT: Black mud bottom.

REMARKS: The present record of the occurrence of this species at Octavia Bay, Colombia, is a slight extension south of the known range.

Olsson has recorded the occurrence of this species in the Pliocene of Costa Rica and Pleistocene of Panama.

SUBGENUS **MERISCA** DALL

***Tellina (Merisca) crystallina* Spengler**

Tellina crystallina CHEMNITZ, 1795, Neues Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 11, p. 210, pl. 199, figs. 1947, 1948. SPENGLER, 1798, Skr. Nat. Selsk., Copen-

hagen, vol. 4, no. 2, p. 113. WOOD, 1815, General conchology, p. 149; 1825, Index testaceologicus, p. 17, pl. 3, *Tellina*, fig. 10. HANLEY, 1846, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 270, pl. 57, fig. 43.

Tellina (Merisca) crystallina WOOD, DALL, 1900, Proc. U. S. Natl. Mus., vol. 23, pp. 293, 302, 311, pl. 2, fig. 10. M. SMITH, 1944, Panamic marine shells, p. 64, fig. 834.

Tellina schrammi RECLUZ, 1853, Jour. Conchyl., vol. 4, p. 152, pl. 6, figs. 7, 8, "habite la rade de la Pointe-à-Pitre (Guadeloupe): elle a été draguée sur un fond vaseux au fond de cette rade."

Tellina (Merisca) crystallina Spengler, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 82.

TYPE LOCALITY: "Fra Newport Long-Island" (Spengler). [? West Indies.]

RANGE: Scammon Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Guayaquil, Ecuador. Also Atlantic from Charleston, South Carolina, to Cartagena Bay, Colombia.

MATERIAL EXAMINED: Three valves from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Largest valve: length, 22 mm.; height, 16 mm.; convexity (one valve), 3.5 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species is roundly trigonal, posteriorly rostrate, and sculptured with raised, rather distant, concentric ribs.

This is one of the species that occur on both the Pacific and Atlantic coasts of the tropical Americas.

Tellina (Merisca) proclivis

Hertlein and Strong

Tellina declivis SOWERBY, 1868, Conchologia iconica, vol. 17, *Tellina*, sp. 261, pl. 44, fig. 261, "Hab.—?"

Not *Tellina declivis* Conrad, 1834.

Tellina (Merisca) proclivis HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 83, pl. 1, figs. 6, 7, 14.

TYPE LOCALITY: "Magdalena Bay, Lower California, Mexico."

RANGE: Cedros Island, Baja California, to the Gulf of California and south to Atacames, Ecuador.

MATERIAL EXAMINED: Four specimens of three samples from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 8-18 fathoms, 1 valve.

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, [sample 82], 24-28 meters, 1 valve. Also sample 83, March 7, 1941, dredged a little inside sample 82, 25 meters, 2 specimens.

MEASUREMENTS: Largest valve: length, 9.1 mm.; height, 7.4 mm.; convexity, 2.4 mm.

HABITAT: Gray sand and sandy mud, and mud bottom.

REMARKS: A few valves in the present collection are referable to this small, white, trigonal species. In an earlier paper [1949 (1940-1951)] the authors proposed the name *Tellina proclivis* for the species on this coast which had been cited under the name of *Tellina declivis* Sowerby. This was necessary because of an earlier usage of that combination of names by Conrad.

Lynge (1909, p. 193) cited a species from Siam under the name of *Tellina (Arcopagia?) declivis* Sowerby. We are uncertain as to the identification of the species represented by the Siamese record.

GENUS *TELLIDORA* MÖRCH, IN H. AND A. ADAMS

Tellidora burneti Broderip and Sowerby

Tellina burneti BRODERIP AND SOWERBY, 1829, Zool. Jour., vol. 4, p. 362, pl. 9, fig. 2. HANLEY, 1843, 1856, Catalogue of recent bivalve shells, pp. 72, 347, suppl. pl. 13, fig. 51; 1846, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 271, pl. 58, fig. 99. SOWERBY, 1867, Conchologia iconica, vol. 17, *Tellina*, sp. 199, pl. 35, figs. 199a, 199b. RÖMER, 1871, *Tellina*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 10, div. 4, p. 198, pl. 38, figs. 6-9.

Tellidora burneti Broderip and Sowerby, M. SMITH, 1944, Panamic marine shells, p. 65, fig. 843. HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 88.

TYPE LOCALITY: "Hab. ad Mazatlan, in Aestuario. . . Found in the estuary of Mazatlan, among the shoals of large Pinnac which are left dry at low water." [Mexico.]

RANGE: Soledad, Baja California, to Kino Bay in the Gulf of California and south to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: Eight valves from Bahia Santelmo, Isla del Rey, Pearl Islands,

Panama, February 14, 1941, Station 8, sample 4, 6–8 fathoms.

MEASUREMENTS: Largest (left) valve: length, 33.4 mm.; height, 32.4 mm.; convexity, 5 mm.

HABITAT: Sand bottom.

REMARKS: Eight valves in the present collection are typical of this species. The shell is white, triangular, with a serrated dorsal margin.

GENUS *MACOMA* LEACH

SUBGENUS *CYMATOICA* DALL

Macoma (Cymatoica) undulata Hanley

Tellina undulata HANLEY, 1844, Proc. Zool. Soc. London, p. 72; 1846, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 310, pl. 59, figs. 107, 107*. SOWERBY, 1867, Conchologia iconica, vol. 17, *Tellina*, sp. 119, pl. 23, figs. 119a, 119b.

Cymatoica occidentalis DALL, 1890, Proc. U. S. Natl. Mus., vol. 12, p. 272, pl. 10, fig. 11, dredged "in latitude 24° 18' N., longitude 110° 22' W., off the coast of Lower California, in 26½ fathoms, fine sandy mud."

Macoma (Cymatoica) undulata Hanley, M. SMITH, 1944, Panamic marine shells, p. 66, fig. 850F (as *Macoma undulata*). HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 89.

TYPE LOCALITY: "Hab. St. Elena, West Columbia; sandy mud, six fathoms." [Santa Elena, Ecuador.]

RANGE: Off the west coast of Baja California in latitude 24° 18' 00" N., longitude 110° 22' 00" W., to Punta Penasco in the Gulf of California and south to Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from South Passage, Pearl Islands, Panama, February 13, 1941, Station 7, 15 fathoms.

MEASUREMENTS: Length, 18 mm.; height, 9.1 mm.; convexity (both valves together), 4.6 mm.

HABITAT: Sandy bottom.

REMARKS: The single specimen in the present collection is sculptured with undulated concentric ribs typical of this form.

SUBGENUS *PSAMMACOMA* DALL

Macoma (Psammacoma) elongata Hanley

Tellina elongata HANLEY, 1844, Proc. Zool. Soc. London, p. 144; 1846, in Sowerby, Thesaurus

conchyliorum, vol. 1, p. 302, pl. 62, fig. 199. SOWERBY, 1867, Conchologia iconica, vol. 17, *Tellina*, sp. 137, pl. 25, fig. 137.

Macoma (Psammacoma) elongata Hanley, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 89.

TYPE LOCALITY: "Hab. Chiriqui, West Columbia; in sand at three fathoms." [Chiriqui, Panama.]

RANGE: Baja California, latitude 30° 36' N. (Dall), to northern Ecuador. Caribbean region (Dautzenberg).

MATERIAL EXAMINED: Two specimens from Octavia Bay, Colombia, March 6, 1941, Station 32, [sample 82], dredged across the mouth of the bay and back along same course, 24–28 meters.

MEASUREMENTS: Length, approximately 19.8 mm.; height, 10 mm.; convexity (both valves together), 5 mm.

HABITAT: Gray sand bottom.

REMARKS: The writers have discussed this species in an earlier paper [1949 (1940–1951)]. The present record of the occurrence of this species in Octavia Bay, Colombia, is a slight extension south of the known range.

Macoma (Psammacoma) panamensis spectri
Hertlein and Strong

Macoma (Psammacoma) panamensis spectri HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 91, pl. 1, figs. 9, 10, 16.

TYPE LOCALITY: "Dredged in Santa Inez Bay, Gulf of California, Station 143-D-3, Lat. 26° 57' N., Long. 111° 56' W., in 35 fathoms (64 meters), mud, crushed shell."

RANGE: Santa Inez Bay, Gulf of California, to Ardita Bay, Colombia.

MATERIAL EXAMINED: One valve from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters.

MEASUREMENTS: Length, 39.3 mm.; height, 20.5 mm.; convexity, 4.7 mm.

HABITAT: Gray sand bottom.

REMARKS: A single right valve in the present collection agrees in all particulars with specimens in the original lot of *Macoma panamensis spectri* except that it is considerably larger. Portions of the shell retain a pearly luster.

The present record of occurrence at Ardita

Bay, Colombia, is a slight extension south of the known range of this subspecies.

SUBGENUS **PSAMMOTRETA** DALL

Macoma (Psammotreta) pacis
Pilsbry and Lowe

Macoma pacis PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 95, pl. 10, figs. 1, 1a, 2, 3.

Macoma (Psammotreta) pacis Pilsbry and Lowe, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 92.

TYPE LOCALITY: "La Paz, Lower California." [Mexico.]

RANGE: Kino Bay and San Felipe in the Gulf of California, to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: One valve from Bahía Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: A left valve: length, 23 mm.; height, 13.5 mm.; convexity (one valve), 2.6 mm.

HABITAT: Sand bottom.

REMARKS: A single left valve in the present collection appears to be referable to this species. It is similar to small specimens of *Macoma pacis* from Kino Bay, Gulf of California, in the collection of the California Academy of Sciences, which were received from H. N. Lowe. This species is known to range south to the Santa Elena Peninsula, Ecuador, where it was collected by R. Hoffstetter. It also occurs in Pleistocene deposits at San Diego, California.

GENUS **STRIGILLA** TURTON

Strigilla costulifera Mörch

Tellina carnaria Linnaeus, HANLEY, 1846, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 260 (in part), pl. 56, fig. 38; west American record only.

Not *Tellina carnaria* Linnaeus, 1758; Caribbean region.

Tellina (Strigilla) fucata GOULD, 1851, Proc. Boston Soc. Nat. Hist., vol. 4, p. 91, no exact locality cited; 1853, Boston Jour. Nat. Hist., vol. 6, p. 399, pl. 16, fig. 4, "Inhabits Mazatlan."

Not *Tellina fucata* Hinds, 1844.

Strigilla costulifera MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 189. HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 95, pl. 1, fig. 15.

Tellina chroma SALISBURY, 1934, Proc. Malacol. Soc. London, vol. 21, p. 84. New name for *Tellina fucata* Gould, 1851, not *Tellina fucata* Hinds, 1844.

Strigilla fucata Gould, M. SMITH, 1944, Panamic marine shells, p. 65, figs. 848, 848A.

TYPE LOCALITY: "Sonsonate." [El Salvador.] For *Strigilla costulifera*.

RANGE: Magdalena Bay, Baja California, to the Gulf of California and south to Ecuador.

MATERIAL EXAMINED: One valve from Bahía Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 9, sample 5. One specimen from Playa Grande, San José Island, Pearl Islands, Panama, November 26, 1945, R. C. Murphy, collector.

MEASUREMENTS: A large left valve: length, 37.2 mm.; height, 32.2 mm.; convexity, 6.6 mm. Another specimen: length, 17 mm.; height, 15 mm.; convexity (both valves together), 7.5 mm.

HABITAT: Found on sand beach.

REMARKS: A left valve in the present collection is similar to other specimens of this species from the same region except that it is larger and pure white. The other specimen (both valves) is typical of the species.

FAMILY **SEMELIDAE**

GENUS **SEMELE** SCHUMACHER

Semele jovis Reeve

Amphidesma jovis REEVE, 1853, Conchologia iconica, vol. 8, *Amphidesma*, sp. 34, pl. 5, fig. 34.

Semele jovis A. ADAMS, 1854, Proc. Zool. Soc. London, for 1853, p. 94, "Hab.—? Mus. Cum-ling."

Tellina barbarae BOONE, 1928, Bull. Bingham Oceanogr. Coll., vol. 2, art. 5, p. 9, pl. 1, upper fig., "Pearl Islands, depth 12 fms."

Semele jovis Reeve, HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 244.

TYPE LOCALITY: "Hab.?" originally cited. Port Parker, Costa Rica, designated as type locality by Hertlein and Strong, 1949.

RANGE: Kino Bay, Gulf of California, to Las Perlas Islands, Panama.

MATERIAL EXAMINED: One valve from Bahía Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, 11 mm.; height, 9 mm.; convexity (one valve), 1.6 mm.

HABITAT: Sand bottom.

REMARKS: A small right valve and the apical portion of the left valve of this species are present in the collection. The specimen, although very small, agrees well with the young stage of *Semele jovis*.

FAMILY DONACIDAE

GENUS DONAX LINNAEUS

Donax asper Hanley

Donax asper HANLEY, 1845, Proc. Zool. Soc. London, pt. 13, p. 14. REEVE, 1854, Conchologia iconica, vol. 8, *Donax*, sp. 12, pl. 2, fig. 12. SOWERBY, 1866, Thesaurus conchyliorum, vol. 3, p. 307, pl. 280 (*Donax* pl. 1), fig. 24. HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 251.

Donax (Hecuba) asper Hanley, RÖMER, 1869, Donacidae, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 10, div. 3, p. 14, pl. 3, figs. 7-10.

Donax aspera Hanley, DALL, 1909, Proc. U. S. Natl. Mus., vol. 37, pp. 159, 273, pl. 28, fig. 7. M. SMITH, 1944, Panamic marine shells, p. 63, fig. 818.

TYPE LOCALITY: "Hab. Tumbez, Peru (Cuming)."

RANGE: Tangola-Tangola Bay, Mexico, to Tumbez, Peru.

MATERIAL EXAMINED: Three specimens from two stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 15, 1941, Station 9, sample 5, 1 specimen.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, 1 valve. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34-43 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length, 28 mm.; height, 21.8 mm.; convexity (both valves together), 14 mm.

HABITAT: Gray sand bottom. Also picked up on sandy beach.

REMARKS: The shell of this species has a high trigonal form. It also has been recorded as occurring in the Pleistocene of Ecuador.

GENUS IPHIGENIA SCHUMACHER

Iphigenia altior Sowerby

Capsa altior SOWERBY, 1833, Proc. Zool. Soc. London, for 1832, p. 196.

Iphigenia altior Sowerby, RÖMER, 1869, Donacidae, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 10, div. 3, p. 114, pl. 21, figs. 1-4. DALL, 1909, Proc. U. S. Natl. Mus., vol. 37, pp. 159, 274, pl. 25, fig. 8. M. SMITH, 1944, Panamic marine shells, p. 63, fig. 822 (as *Iphigenia altier*). HERTLEIN AND STRONG, 1949, Zoologica, New York, vol. 34, p. 257.

TYPE LOCALITY: "Hab. in Peruvia et America Centrali. Dredged among coarse gravel, in twelve fathoms water, in the Gulf of Nocoioyo. A smaller variety, which is also rather higher, was found at Tumbez, at a depth of five fathoms, in thin mud."

RANGE: Gulf of California (Dall), to Tumbez, Peru.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 15, 1941, Station 9, sample 5.

MEASUREMENTS: Length, 38.6 mm.; height, 26.5 mm.; convexity (one valve), 7.2 mm.

HABITAT: Picked up on sandy beach.

REMARKS: A single imperfect valve in the present collection is referred to this species.

FAMILY SANGUINOLARIIDAE

GENUS TAGELUS GRAY

SUBGENUS MESOPLEURA CONRAD

Tagelus (Mesopleura) peruvianus

Pilsbry and Olsson

Tagelus (Mesopleura) peruvianus PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 70, pl. 18, fig. 5. HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 224.

TYPE LOCALITY: "Punta Blanca Beds." Ecuador. Pliocene.

RANGE: Diggs Point, Gulf of California (L. O. Miles collector), to Negritos, Peru.

MATERIAL EXAMINED: Fifteen valves from three stations:

PANAMA

Bahia Santelmo, Isla de Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 9 valves.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 5 small valves.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24-28 meters, 1 valve.

MEASUREMENTS: Largest valve: length, 56.6 mm.; height, 21 mm.; convexity, 5.9 mm.

HABITAT: Gray sand, one valve on black mud bottom.

REMARKS: The shell of this species may be readily separated from that of *Tagelus dombeii* Lamarck in that the former is higher in proportion to the length and especially in that a flange or wing-like extension is present along the posterior dorsal margin.

SUPERFAMILY SOLENACEA

FAMILY SOLENIDAE

GENUS ENSIS SCHUMACHER

***Ensis tropicalis* Hertlein and Strong,
new species**

Plate 3, figures 34, 35

HOLOTYPE: A.M.N.H. No. 73421, left valve, from South Passage, Pearl Islands, Panama, February 13, 1941, Station 7, dredged in 15 fathoms, sandy bottom; length, 50 mm.; of dorsal ridge, 4.5 mm.; of ligament, 6.9 mm.; height of shell, 6.0 mm.; convexity, 1.6 mm.; chord of arcuation of dorsal margin, approximately 0.5 mm.

PARATYPES: A.M.N.H. No. 73422, left valve; length, 52.3 mm.; height, 6.6 mm.; convexity, 1.7 mm. A.M.N.H. No. 73422, right valve; length, 47 mm.; height, 6.6 mm.; convexity, 1.7 mm. A.M.N.H. No. 73422, left valve; length, 45.4 mm.; height, 5.8 mm.; convexity, 1.5 mm. A.M.N.H. No. 73422, right valve; length, 46.4 mm.; height, 6.1 mm.; convexity, 1.6 mm. C.A.S. No. 9900, left valve; length, 51.8 mm.; height, 6.5 mm.; convexity, 1.8 mm. C.A.S. No. 9901, right valve; length, 48.8 mm.; height, 6.3 mm.; convexity, 1.8 mm. C.A.S. No. 9902, left valve; length, 48.8 mm.; height, 6.3 mm.; convexity, 1.6 mm. C.A.S. No. 9903, right valve; length, 45.9 mm.; height, 6.5 mm.; convexity, 1.6 mm.

All paratypes are from the same locality as the holotype. About 30 single valves and fragments were dredged at the type locality. Four valves and a fragment were taken at Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, dredged in 6 to 8 fathoms, sand bottom.

DESCRIPTION: Shell small, slender, very slightly arcuate, sides nearly parallel, slightly attenuated towards the ends, the anterior end slightly upturned, beaks anteriorly situated, anterior and posterior ends bluntly

rounded; color olive-gray, polished; a diagonal line from the beaks to the posterior ventral margin separating a uniformly colored elongated triangular area below from the dorsal area above, the larger portion of it ornamented with brownish, convex markings, the area bordering the dorsal margins nearly uniform in color; hinge with delicate teeth, one in the right, two in the left, valve; dorsal ridge well developed and a little more than half as long as the ligament.

REMARKS: The shell of this species is characterized by the very slight arcuation of the valves, a feature that is constant in all the specimens in the collection. This character easily serves to separate the present species from *Ensis californicus* Dall (1899b, p. 110; Berry, 1953a, p. 395, fig. 2; 1953b, pl. 29, fig. 4) described "from 14 fathoms sand, off the island of San Pedro Martir, Gulf of California," from *Ensis minor* Dall (see Perry, 1940, p. 81, pl. 17, fig. 112) and *E. minor megistus* Pilsbry and McGinty (1943, p. 33, pl. 6, figs. 12, 13), from east American waters. The same character likewise serves to separate it from the species originally described as *Solen nitidus* Dunker in Clessin [1888 (1887-1889), p. 34, pl. 13, fig. 2], from "Vaterland: Mexico (coll. m.)," a species without indication as to whether it came from the east or west coast of that country.

SUPERFAMILY MACTRACEA

FAMILY MACTRIDAE

GENUS MACTRA LINNAEUS

SUBGENUS MICROMACTRA DALL

***Mactra (Micromactra) angusta* Reeve**

Mactra angusta REEVE, 1854, Conchologia iconica, vol. 8, *Mactra*, sp. 93, pl. 18, fig. 93. DESHAYES, 1855, Proc. Zool. Soc. London, for 1854, p. 67, "Hab. Panama. Coll. Cuming." WEINKAUFF, 1884, Mactracea, in Conchylien-Cabinet von Martini und Chemnitz, vol. 11, div. 2, p. 70, pl. 25, figs. 2, 2a.

Mactra (Micromactra) angusta Reeve, M. SMITH, 1944, Panamic marine shells, p. 66, fig. 863. HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 231, pl. 2, figs. 14, 18.

TYPE LOCALITY: "Hab. Panama; Cuming."

RANGE: Champerico, Guatemala, to Zorritos, Peru.

MATERIAL EXAMINED: Two valves from Bahia Santelmo, Isla del Rey, Pearl Islands,

Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Right valve: length, 27.2 mm.; height, 17.2 mm.; convexity, 4 mm. An imperfect left valve: length, 30 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species is rather thin, triangularly elongated, the margin is concave in front of the beaks, and the umbos are ornamented with wave-plaited sculpture. The pallial sinus extends anteriorly about three-sevenths of the length of the shell. The present writers have given a discussion of *Mactra angusta* in a previous paper [1950 (1940-1951)] and have pointed out how it differs from a similar species, *Mactra (Micromactra) fonsecana* Hertlein and Strong.

Mactra (Micromactra) fonsecana
Hertlein and Strong

Mactra (Micromactra) fonsecana HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 232, pl. 2, figs. 16, 19, 20.

TYPE LOCALITY: "From Potosi and Monypenny Point, Nicaragua, Gulf of Fonseca."

RANGE: Champerico, Guatemala, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Twenty-three valves from three stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, 15 fathoms, 1 valve.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 21 valves.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" N., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 valve.

MEASUREMENTS: Largest valve: length, 30 mm.; height, 18 mm.; convexity, 5.1 mm.

HABITAT: Sand and dead shell bottom.

REMARKS: The shells of this species in the present collection are small. They agree well with those of *Mactra fonsecana* except that the pallial sinus does not extend past a line vertical with the beaks.

The shell of this species bears a resemblance to that of *M. angusta* Reeve but differs in that the outline of the margin beneath the beaks is nearly straight rather than concave, the posterior end of the shell is

less broadly rounded, and in adult shells the pallial sinus is longer.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

GENUS **MACTRELLONA** MARKS

SUBGENUS **MACTRELLONA**, SENSU STRICTO

Macrellona MARKS, 1951, Bull. Amer. Paleont., vol. 33, p. 355.

TYPE: By original designation, *Mactra alata* Spengler. Recent, West Indies.

It has been pointed out recently by Marks that the type of *Macrellona* Gray is "*M. striatula*" [= *Mactra striatula* Linnaeus]. A study of the problem concerning the identification of the type species cited by Gray led Marks to conclude that *Macrellona* Gray should be placed in the synonymy of *Mactrinula* Gray. A strict interpretation of the International Rules of Zoological Nomenclature appears to substantiate this conclusion. Therefore, we have, at least for the present, accepted Mark's conclusions concerning *Macrellona*, and we apply the genus name *Macrellona* to the species that follows.

Macrellona (Macrellona) clisia Dall

Plate 1, figures 11, 13

Macrellona clisia DALL, 1915, Nautilus, vol. 29, p. 62; 1916, Proc. U. S. Natl. Mus., vol. 52, p. 415.

Mactra (Macrellona) clisia DALL, LAMY, 1934, Bull. Mus. Natl. Hist. Nat., Paris, ser. 2, vol. 6, p. 433. M. SMITH, 1944, Panamic marine shells, p. 66, fig. 860B.

Macrellona (Macrellona) clisia DALL, HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 233.

TYPE LOCALITY: "West coast of Mexico." Type from Manzanillo, Mexico, according to Dall, 1916.

RANGE: Gulf of California (H. Hemphill collection, California Academy of Sciences) to Salinas, Ecuador.

MATERIAL EXAMINED: One valve from Ardita Bay, Colombia, March 5, 1941, Station 31, sample 80.

MEASUREMENTS: Length, 81.8 mm.; height, 67.4 mm.; convexity, approximately 16.3 mm.

HABITAT: Picked up on beach.

REMARKS: The shell of this species is thin, white, arcuate, attenuated, and compressed anteriorly. Posteriorly it is truncated, and the umbonal angulation bears a thin, sharp, elevated keel. The presence of a slight gape of the posterior ventral margin serves to separate this species from *Mactrellona* (*Mactrellona*) *alata subalata* Mörch which is said to occur rarely in the region between Corinto, Nicaragua, and Santa Elena, Ecuador.

SUBGENUS **MACTRINULA** GRAY

Mactrellona (*Mactrinula*) **goniocyma**
Pilsbry and Lowe

Mactra (*Mactrinula*) *goniocyma* PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 90, pl. 15, figs. 5, 6. M. SMITH, 1944, Panamic marine shells, p. 66, fig. 856.

Mactrella (*Mactrinula*) *goniocyma* Pilsbry and Lowe, HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 234.

TYPE LOCALITY: "Nicaragua: San Juan del Sur."

RANGE: Acapulco Bay, Mexico, to Ardita Bay, Colombia.

MATERIAL EXAMINED: Three valves from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 2 valves.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 1 valve.

MEASUREMENTS: Largest valve: length, 22.3 mm.; height, 16 mm.; convexity, 4.3 mm.

HABITAT: Gray sand and sandy mud bottom.

REMARKS: The shell of this species is very thin and fragile, rather compressed, ovately triangular in outline, whitish. It is sculptured with oblique, concentric, V-shaped corrugations of the shell which are angulated along a line nearly vertically below the beaks. A thin, raised, radial lamina extends along the posterior umbonal angle to the posterior-basal angulation.

The present record of occurrence at Ardita Bay, Colombia, is an extension south of the known range of this species.

GENUS **ANATINA** SCHUMACHER

SUBGENUS **RAËTA** GRAY

Anatina (*Raëta*) **undulata** Gould

Lutraria undulata GOULD, 1851, Proc. Boston Soc. Nat. Hist., vol. 4, p. 89; 1853, Boston Jour. Nat. Hist., vol. 6, p. 391, pl. 15, fig. 7.

Labiosa undulata Gould, I. S. OLDROYD, 1924, Stanford Univ. Publ., Univ. Ser. Geol. Sci., vol. 1, p. 191, pl. 21, fig. 11.

Anatina (*Raëta*) *undulata* Gould, GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 407, pl. 23, figs. 5a-c. HERTLEIN AND STRONG, 1950, Zoologica, New York, vol. 35, p. 235.

Labiosa (*Raëta*) *undulata undulata* Gould, OLSON, 1932, Bull. Amer. Paleont., vol. 19, p. 131, pl. 14, fig. 11.

TYPE LOCALITY: "Inhabits La Paz, Lower California." [Mexico.]

RANGE: San Pedro, California (Dall). Ensenada, Baja California (Burch). Scammon Lagoon, Baja California, to Kino Bay in the Gulf of California and south to Piedra Redonda, Peru.

MATERIAL EXAMINED: Three valves from two stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 2 valves.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 15, 1941, Station 9, sample 5, on beach, 1 valve.

MEASUREMENTS: Right valve: length, 35.5 mm.; height, 27.2 mm.; convexity, 5 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species is elongately ovate, fragile, compressed posteriorly, and sculptured with concentric undulations of the shell.

SUPERFAMILY **MYACEA**

FAMILY **ALOIDIIDAE**

GENUS **ALOIDIS** MEGERLE VON MÜHLFELD

SUBGENUS **CARYOCORBULA** GARDNER

Aloidis (*Caryocorbula*) **nasuta** Sowerby

Corbula nasuta SOWERBY, 1833, Proc. Zool. Soc. London, p. 35. REEVE, 1843, Conchologia iconica, vol. 2, *Corbula*, sp. 1, pl. 1, fig. 1. M. SMITH, 1944, Panamic marine shells, p. 68, fig. 868.

Corbula pustulosa CARPENTER, 1855, Catalogue of . . . Mazatlan shells, p. 22, "Panama and St.

Blas, 33 fm. R. B. Hinds, Mus. Cuming.—Mazatlan: one small pair nestling in *Spondylus*, and 1 valve in *Chamae*, L'pool. Col."

Aloidis (Caryocorbula) nasuta Sowerby, HERTLEIN AND STRONG, 1950, *Zoologica*, New York, vol. 35, p. 240, pl. 2, fig. 9.

TYPE LOCALITY: "Hab. ad Xipixapi. Found in sandy mud at a depth of ten fathoms." [Jipijapa, Ecuador.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Zorritos, Peru.

MATERIAL EXAMINED: Four valves from three stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 2 specimens.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 25 meters, 1 valve.

ECUADOR

Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 valve.

MEASUREMENTS: One of the largest specimens: length, 10 mm.; height, 5.8 mm.; convexity (both valves together), 5.8 mm.

HABITAT: Sand, black mud, and live shell bottom.

REMARKS: The shell of this species is elongately oval, inequivalve, inflated, rostrate posteriorly; posterior umbonal angulation present; sculpture of rather fine, somewhat irregular concentric threads and on the early portion of the shell, fine radial striae composed of very fine pustules.

Aloidis (Caryocorbula) ovulata Sowerby

Corbula ovulata SOWERBY, 1833, *Proc. Zool. Soc. London*, p. 35. REEVE, 1843, *Conchologia iconica*, vol. 2, *Corbula*, sp. 7, pl. 1, fig. 7. HANLEY, 1843, 1856, *Catalogue of recent bivalve shells*, pp. 47, 344, suppl. pl. 10, fig. 52. M. SMITH, 1944, *Panamic marine shells*, p. 68, fig. 866.

Aloidis (Caryocorbula) ovulata Sowerby, HERTLEIN AND STRONG, 1950, *Zoologica*, New York, vol. 35, p. 241, pl. 2, fig. 11.

TYPE LOCALITY: "Hab. ad littora Americae Meridionalis. Found in sandy mud at various depths, from seven to seventeen fathoms, at

Xipixapi, and in the Bays of Montijo and Caraccas. Detached valves of a beautiful pink colour were picked up on the sands at Real Llejos and Mazatlan." Xipixapi [Jipijapa], Ecuador, designated as type locality by Hertlein and Strong, 1950.

RANGE: Ballandra Bay, Gulf of California, to Punta Picos, Peru.

MATERIAL EXAMINED: Three valves from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 valve.

Guayabo Chiquito, March 4, 1941, Station 30, 25-64 meters, 2 valves.

MEASUREMENTS: Largest valve: length, 24 mm.; height, 13.6 mm.; convexity, 5.8 mm.

HABITAT: Gray sandy mud and gray mud bottom.

REMARKS: Three valves of this elongately ovate, thick, nearly equivalve, rostrate species in the present collection agree in all details with valves of this species from various localities except in color. The present shells are pure white and show no trace of the beautiful pink coloration usually present on the interior margins and on the umbonal areas.

FAMILY GASTROCHAENIDAE

GENUS ROCELLARIA BLAINVILLE

Rocellaria ovata Sowerby

Gastrochaena ovata SOWERBY, 1834, *Proc. Zool. Soc. London*, p. 21. REEVE, 1860, *Elements of conchology*, vol. 2, p. 175, pl. 45, fig. 240. SOWERBY, 1878, *in* Reeve, *Conchologia iconica*, vol. 20, *Gastrochaena*, sp. 16, pl. 3, fig. 18, not fig. 16; 1884, *Thesaurus conchyliorum*, vol. 5, p. 128, pl. 470, fig. 9. CLESSIN, 1895, *Gastrochaenidae*, *in* *Systematisches Conchylien-Cabinet von Martini und Chemnitz*, vol. 11, div. 4a, p. 11, pl. 4, figs. 10-12. LAMY, 1925, *Jour. Conchyl.*, vol. 68, p. 304.

Rocellaria ovata Sowerby, TRYON, 1862, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 13, p. 481. HERTLEIN AND STRONG, 1950, *Zoologica*, New York, vol. 35, p. 246, pl. 2, fig. 2.

TYPE LOCALITY: "Hab. in Sinu Panamensi (Isle of Perico) et ad Insulam Platae. Found in *Spondyli* at the Isle of Perico, and in coral rocks, at a depth of seventeen fathoms, at the island of Plata." Island of Perico, Gulf of Panama, in *Spondyli*, designated as type locality by Hertlein and Strong, 1950.

RANGE: Scammon Lagoon, Baja Cali-

fornia, to the Gulf of California and south to the island of La Plata, Ecuador. Also in Atlantic from South Carolina to the West Indies.

MATERIAL EXAMINED: One specimen without locality.

MEASUREMENTS: Length, 18.3 mm.; height, 10.5 mm.; convexity (both valves together),

9.5 mm.

REMARKS: The shell of this species is small, ovate, widely gaping and is sculptured only with concentric striae which follow the shape of the margin.

This is one of the species that occur in the waters of both the Pacific and Atlantic oceans.

CLASS SCAPHOPODA

ORDER SOLENOCONCHA

The monograph of Pilsbry and Sharp (1897-1898) on this class as a whole and that of Henderson (1920) on the east American forms are indispensable sources of information on the Scaphopoda. We have drawn freely upon them during our work on this group. Emerson (1952) has recently published a paper dealing with the generic and subgeneric names in this class.

Scaphopods lie buried in the sand, with the posterior opening projecting up into the water.

FAMILY DENTALIIDAE

GENUS DENTALIUM LINNAEUS

SUBGENUS DENTALIUM, SENSU STRICTO

Dentalium (*Dentalium*) *oerstedii* Mörch

Dentalium oerstedii MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 177. PILSBRY AND SHARP, 1897, in Tryon and Pilsbry, Manual of conchology, vol. 17, p. 24, pl. 10, figs. 60-64. M. SMITH, 1944, Panamic marine shells, p. 46, fig. 604 (as *Dentalium oerstedii*).

TYPE LOCALITY: "Golf de Nicoya ad prof. 30 org. specimina 3." [Costa Rica.]

RANGE: Off Baja California in latitude 23° 06' 00" N., longitude 109° 36' 00" W., to Cueva Bay, Colombia, and the Galapagos Islands.

MATERIAL EXAMINED: Twenty specimens from Cueva Bay, Colombia, May 11, 1941, Station 93, sample 359, dredged east-southeast across bay, 5-20 fathoms. Also five specimens lacking information as to the locality from which they came.

MEASUREMENTS: Largest specimen: length, 44.4 mm.; diameter, 3.3 mm. The type specimen described by Mörch was 27 mm. in length and 3 mm. in diameter.

HABITAT: Gray sand and mud bottom.

DESCRIPTION: Shell slightly curved, taper-

ing, fairly thick, white; hexagonal at and near apex, with a narrow raised riblet at each angle, the intervals flat; a short distance from the apex each face is divided by a riblet which soon attains the size of the six primary ribs, and the tube becomes circular in section; later a tertiary riblet appears in each interval on the convex and lateral faces and farther on these appear in the intervals on the concave side; number of riblets at middle of shell about 12 (and some small threads), at the aperture 21 (occasionally 17) to 24; near aperture the riblets are low, wide, somewhat unequal; growth lines fine, occasionally there are low variciform rings. (Adapted from Pilsbry and Sharp.)

REMARKS: *Dentalium oerstedii numerosum* Dall intergrades with *D. oerstedii*, but typical forms of the former possess more numerous and finer longitudinal riblets which are flattened near the aperture. On some specimens of the subspecies, the six primary ribs retain their predominance for a greater distance from the apex than do those on typical *D. oerstedii*. *Dentalium phaneum* Dall described from the Hawaiian Islands is said to bear a resemblance to *D. o. numerosum*.

The present record of the occurrence of *Dentalium oerstedii* in Cueva Bay, Colombia, is a slight extension south along the mainland of the known range of this species. It also has been recorded as occurring in the Pleistocene of Magdalena Bay, Baja California.

SUBGENUS TESSERACME PILSBRY

Dentalium (*Tesseracme*) *tesseractum* Sowerby

Dentalium tesseractum SOWERBY, 1832, Proc. Zool. Soc. London, p. 29. PILSBRY AND SHARP, 1897, in Tryon and Pilsbry, Manual of conchology, vol. 17, p. 34, pl. 4, fig. 51.

Dentalium tetragonum SOWERBY, 1860, *Thesaurus conchyliorum*, vol. 3, p. 103, pl. 224 (*Dentalium* pl. 2), figs. 21, 22, "W. Columbia"; 1872, in Reeve, *Conchologia iconica*, vol. 18, *Dentalium*, sp. 20, pl. 4, figs. 20a, 20b.

Not *Dentalium tetragonum* Brocchi, 1814.

TYPE LOCALITY: "Hab. ad oras Americae Centralis. (Gulf of Nocoioyo and Puerto Portrero; also Xipixapi.)" Dredged in 10 to 16 fathoms water, on a sandy muddy bottom.

RANGE: Manzanillo, Mexico, to Jipijapa, Ecuador.

MATERIAL EXAMINED: Seven specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged in 14–33 meters, 6 specimens.

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, sample 83, dredged a little inside sample 82, 24–28 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length, 40 mm.; diameter at aperture, 2.7 mm.

HABITAT: Gray sandy mud and black mud bottom.

REMARKS: The strong, oblique growth lines and the absence of longitudinal sculpture on the anterior third of the shell are characteristic features of this species.

The Miocene specimens from a well in Galveston, Texas, cited by Harris (1895, p. 95), under the name of "*Dentalium tetragonum*" are probably referable to some other species. *Dentalium dissimile* Guppy which was described from the Miocene Bowden beds in Jamaica is similar to *D. tesseragonum*.

Dentalium tesseragonum also has been cited as occurring in the Pliocene of Ecuador.

SUBGENUS GRAPTACME PILSBRY AND SHARP

Dentalium (Graptacme) inversum Deshayes

Dentalium inversum DESHAYES, 1826, *Mem. Soc. Hist. Nat.*, Paris, vol. 2, p. 370, pl. 16, figs. 21, 22. REEVE, 1842, *Conchologia systematica*, vol. 2, p. 6, pl. 130, fig. 1. SOWERBY, 1860, *Thesaurus conchyliorum*, vol. 3, p. 99, pl. 225 (*Dentalium* pl. 3), fig. 42; 1872, in Reeve, *Conchologia iconica*, vol. 18, *Dentalium*, sp. 51, pl. 7, fig.

51. PILSBRY AND SHARP, 1897, in Tryon and Pilsbry, *Manual of conchology*, vol. 17, p. 95, pl. 21, figs. 47–49. M. SMITH, 1944, *Panamic marine shells*, p. 46, fig. 603.

TYPE LOCALITY: Gulf of California, here designated as type locality. No locality originally cited.

RANGE: "Bering Sea to Panama in increasingly deep water" (Dall). We have not seen specimens from north of the Gulf of California. According to Burch this species was collected by H. N. Lowe at Magdalena Bay, Baja California. Punta Penasco in the Gulf of California and south to Cape Santa Elena, Ecuador.

MATERIAL EXAMINED: Thirteen specimens from two stations:

PANAMA

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 5 specimens.

ECUADOR

3 miles west of light on Cape Santa Elena, April 10, 1941, Station 76, sample 274, 41 meters, 8 specimens.

MEASUREMENTS: Largest specimen: length, approximately 41.1 mm.; width of aperture, about 3.2 mm.

HABITAT: Gray mud and sand bottom.

DESCRIPTION: Shell small, gently curved, extremely slender, white, reddish towards the apex, very glossy; near the apex sculptured with fine, regular, longitudinal striae, but most of the shell is unsculptured; aperture circular; anal orifice minute, round, with a deep slit or a short notch in the middle or excentric on the concave side.

REMARKS: A slit on the concave side of this species is a characteristic feature. Fred Baker (1945, p. 11) noticed that the slit is always to the right when the shell is held with the tip away and the concave side up. Other than the character of the apex the shell is similar to that of *D. sectum*.

The occurrence of this species off Ecuador is an extension south of the known range. This species also has been recorded from the Pleistocene of Baja California.

CLASS GASTROPODA

ORDER OPISTHBRANCHIATA

FAMILY BULLIDAE

GENUS *BULLA* LINNAEUS*Bulla punctulata* A. ADAMS

Bulla punctata A. ADAMS, 1850, in Sowerby, Thesaurus conchyliorum, vol. 2, p. 577, pl. 123, fig. 77.

Not *Bulla punctata* Schroeter, 1804.

Bulla punctulata A. ADAMS, 1850, in Sowerby, Thesaurus conchyliorum, vol. 2, p. 604 (footnote states "printed in the text '*punctata*,' by error"). SOWERBY, 1868, in Reeve, Conchologia iconica, vol. 16, *Bulla*, sp. 8, pl. 3, figs. 8a, 8b. PILSBRY, 1895, in Tryon and Pilsbry, Manual of conchology, vol. 15, p. 341, pl. 36, figs. 29, 30, pl. 37, fig. 39. M. SMITH, 1944, Panamic marine shells, p. 44, fig. 586.

Bulla adamsi MENKE, 1850, Zeitschr. Malakozool., 7th yr., p. 162, Mazatlan, Mexico.

Not *Bulla adamsi* Brazier, 1885, Tahiti.

Bulla quoyii Gray MS, A. ADAMS, 1850, in Sowerby, Thesaurus conchyliorum, vol. 2, p. 576, pl. 123, fig. 71, "Gallipagos Islands; coral sand, 6-8 fathoms. Cuming. Mus. Cuming." SOWERBY, 1868, in Reeve, Conchologia iconica, vol. 16, *Bulla*, sp. 19, pl. 6, fig. 19 (as *Bulla quoyi*).

Not *Bulla quoyii* Gray, 1843, in Dieffenbach, Travels in New Zealand, vol. 2, p. 243, New Zealand.

Bullaria quoyana DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 300, "This is *Bulla quoyi* A. Adams, 1850, but not of Gray, 1843"; Catalina Island, California, to Acapulco, Mexico.

TYPE LOCALITY: "Panamá; sandy mud, 10 fathoms."

RANGE: Magdalena Bay, Baja California, to San Luis Gonzales Bay in the Gulf of California, and south to the Santa Elena Peninsula, Ecuador, and the Galapagos Islands; to Lobos Islands, Peru (Dall).

MATERIAL EXAMINED: One specimen from Molino Cove, Piñas Bay, Panama, February 25, 1941, Station 20, sample 36, on beach at head of cove.

MEASUREMENTS: Length, 18.6 mm.; maximum diameter, 12.1 mm.

HABITAT: Shell, inhabited by hermit crab, picked up on beach.

DESCRIPTION: Shell oval, thick, sometimes decidedly narrowed towards the apex; mottled, darker spots on a pinkish brown background often arranged in two poorly defined

darker concentric bands; vertex narrowly umbilicate, often with about eight to 12 rather closely spaced spiral striae.

REMARKS: Specimens of this species usually do not exceed 35 mm. in length. The smaller, thicker shell, less globose body whorl, more numerous spiral threads in the umbilical vertex, and the vague concentric banded coloration are features which serve to separate this species from *Bulla gouldiana* Pilsbry. However, there are specimens from the Gulf of California which have the shape and umbilical striae as in *B. gouldiana* but in which the shell is thick as in *B. punctulata*. It appears that the two species are closely related, a fact noted by Cooper (1895, p. 39) many years ago. We are uncertain what, if any, characters differentiate *B. punctulata* from *B. aspersa* A. Adams, 1850, which was described from Payta, Peru, in 6 to 8 fathoms. It seems quite likely that both are identical with *Bulla panamensis* Philippi (1849a, p. 141), described from Panama in 1849, but the type of which has not been illustrated.

The present species also has been recorded as occurring from Pliocene to Recent in southern California, in the Galapagos Islands (as *B. adamsi*), and in the Pleistocene from Baja California to Ecuador.

Records (Melvill and Standen, 1899, p. 155; Dautzenberg and Bouge, 1933, p. 54) of the occurrence of this species in the western Pacific can be referred to other species as has been indicated by Iredale (1937, p. 259) for the Australian species referred to *B. adamsi*.

ORDER PULMONATA

SUPERFAMILY AKTEOPHILA

FAMILY ELLOBIIDAE

Odhner (1925, pp. 8-14) and others have discussed the systematics of this family.

GENUS *MELAMPUS* MONTFORT*Melampus tabogensis* C. B. Adams

Auricula tabogensis C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 435, 542.

Melampus bridgesii CARPENTER, 1856, Proc. Zool. Soc. London, p. 161, "Hab. ad ora Sinus Panamensis; legit. T. Bridges. Sp. tria in Mus. Cuming."

Melampus tabogensis C. B. Adams, VON MAR-

TENS, 1900, *Biologia Centrali-Americana*, Mollusca, p. 560, pl. 43, fig. 8. HANNA AND HERTLEIN, 1938, *Allan Hancock Pacific Exped.*, vol. 2, no. 8, p. 133. MORRISON, 1946, *Smithsonian Misc. Coll.*, vol. 106, no. 6, p. 36.

TYPE LOCALITY: "Habitat.—Taboga and Panama; C.B.A. On and under stones and rocks at high water mark."

RANGE: San Lucas Island, Costa Rica (Morrison), to Panama Bay and the Galapagos Islands. Also Cocos Island.

MATERIAL EXAMINED: Five specimens from San José Island, Pearl Islands, Panama.

MEASUREMENTS: Largest specimen: length, 11.9 mm.; maximum diameter, 6.9 mm.

HABITAT: Not indicated for the present specimens. Often found under stones and rocks at about high-tide mark.

REMARKS: The shell of this species is dark reddish brown and usually has a polished appearance. There are three teeth on the columella; the anterior one is very thick and heavy.

Morrison placed *Melampus bridgesii* Carpenter in the synonymy of *M. tabogensis*. That species was originally described from Panama. Lacking any later information concerning it, we are inclined to follow Morrison's assignment of it to the synonymy of Adams' species.

GENUS **ELLOBIUM** BOLTEN

Ellobium stagnalis d'Orbigny

Auricula stagnalis D'ORBIGNY, 1835, *Mag. Zool.*, yr. 5, cl. 5, p. 23; 1837, *Voyage dans Amérique Méridionale*, vol. 5, p. 325, pl. 42, figs. 7, 8. SOWERBY, 1878, *Conchologia iconica*, vol. 20, *Auricula*, sp. 3, pl. 2, fig. 3. HANNA AND HERTLEIN, 1938, *Allan Hancock Pacific Exped.*, vol. 2, no. 8, p. 132.

Ellobium stagnalis d'Orbigny, M. SMITH, 1944, *Panamic marine shells*, p. 45, fig. 599. MORRISON, 1946, *Smithsonian Misc. Coll.*, vol. 106, no. 6, p. 37.

TYPE LOCALITY: "Habit. provincia Guayaquilensi (republica Colombiana)." [Ecuador.]

RANGE: El Salvador to Colombia. Also Cocos Island and Galapagos Islands.

MATERIAL EXAMINED: Four specimens from fresh water along lower reaches of Rio Marina, Isla San José, Pearl Islands, Panama, November 26, 1945, R. C. Murphy collector.

MEASUREMENTS: Juvenile forms, the largest: length, 15.2 mm.; maximum diameter, 8 mm.

HABITAT: Fresh water along lower reaches of Rio Marina. It often occurs in abundance in decaying wood near high-tide line.

REMARKS: The shell of this species is extremely variable in height of spire and in the ornamentation of the exterior surface.

The species described as *Auricula papillifera* Küster, 1844, was placed in the synonymy of *Ellobium stagnalis* by Morrison. This appears to be a reasonable conclusion in view of the great variation revealed in a series of specimens of d'Orbigny's species.

SUPERFAMILY **PETROPHILA**

FAMILY **SIPHONARIIDAE**

Hubendick (1946) has published the results of a modern study of this family.

GENUS **SIPHONARIA** SOWERBY

Siphonaria gigas Sowerby

Siphonaria gigas SOWERBY, 1825, A catalogue of . . . shells . . . in . . . collection . . . Tankerville, app., p. vi. REEVE, 1842, *Conchologia systematica*, vol. 2, p. 20, pl. 138, fig. 6. VALENCIENNES, 1846, *Voyage autour du monde sur . . . la Vénus*, Atlas de Zoologie, Mollusques, pls. 12, 13. REEVE, 1856, *Conchologia iconica*, vol. 9, *Siphonaria*, sp. 3, pl. 1, figs. 3a, 3b. BOONE, 1938, *Bull. Vanderbilt Mar. Mus.*, vol. 7, p. 299, pl. 115, 5 figs. M. SMITH, 1944, *Panamic marine shells*, p. 44, fig. 589. HUBENDICK, 1946, *K. Svenska Vetensk.-Akad. Handl.*, ser. 3, vol. 23, no. 5, p. 39, pl. 6, figs. 23-29, under section *Heterosiphonaria*.

TYPE LOCALITY: "From Panama."

RANGE: Acapulco, Mexico, to Peru. Also Cocos Island and Galapagos Islands. Concepcion, Chile (Hubendick).

MATERIAL EXAMINED: One specimen from Arditá Bay, Colombia, March 5, 1941, Station 31, sample 80.

MEASUREMENTS: Greater diameter, 43 mm.; lesser diameter, 35 mm.; convexity, 18.7 mm.

HABITAT: Specimen picked up on beach. This species clings to the rocks where it is exposed to the full force of the waves.

DESCRIPTION: Shell rather large, conical, high, about 10 to 20 angular, radiating ribs, interspaces with striae or riblets; exteriorly and interiorly brown or cream-colored grading into shiny black towards the margin. The shell of this species attains a length of at least 75 mm.

REMARKS: The shell of the subspecies

Siphonaria gigas characteristic Reeve [1842, p. 49; 1856 (1843-1878), vol. 9, *Siphonaria*, sp. 8, pl. 2, figs. 8a, 8b], differs from typical *S. gigas*, with which it intergrades, in the more numerous and often less elevated ribs of which those in the interspaces are strongly developed, often nearly equal in size to the major ribs. The total in some specimens numbers 75 or more. Reeve stated, "It is of a more irregular form, and the separate impressions of the muscle and the siphon are remarkably distinct."

ORDER CTENOBRANCHIATA

SUPERFAMILY TOXOGLOSSA

FAMILY TEREBRIDAE

GENUS **TEREBRA** (BRUGUIÈRE, 1789) LAMARCK

Terebra armillata Hinds

Terebra armillata HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 154; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 34; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 173, pl. 43, fig. 49. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, sp. 72, pl. 16, fig. 72b only. TRYON, 1885, Manual of conchology, vol. 7, p. 14, pl. 2, fig. 21 only.

TYPE LOCALITY: "Hab. abundant in various localities on the west coast of America between Panama and the Bay of Magdalena in Lower California, in from five to thirteen fathoms; also at the Galapagos, in ten fathoms: chiefly in sandy situations. It was also found imbedded in the fossiliferous cliffs which surround a portion of the Bay of Magdalena."

RANGE: Magdalena Bay, Baja California, to the Gulf of California and south to northern Peru. Galapagos Islands.

MATERIAL EXAMINED: Five specimens:

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 4 specimens. Also sample 307, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 31.4 mm.; maximum diameter, 8.8 mm.

HABITAT: Sand, mud, and shell bottom.

REMARKS: The shell of this species bears a general resemblance to that of *Terebra variegata*. It differs in the fewer and finer radial plicae of which there are about 11 to 13 on the penultimate whorl. There are about

six or seven low broad spiral cords on the penultimate whorl. The aperture is rather square. The shell is colored deep brown except for the radial plicae and row of subsutural nodes which are whitish; also a light spiral band usually occurs at the base of the last whorl.

Terebra cracilenta Li

Terebra cracilenta LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 274, pl. 8, fig. 67. M. SMITH, 1944, Panamic marine shells, p. 35, fig. 457.

Terebra tenuis LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 274, pl. 8, fig. 68, same locality as for *T. cracilenta*. PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 439, fig. 2.

Terebra (Strioterebrum) cracilenta Li, PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 439, figs. 1, 1a, 2 (*tenuis*). OLSSON, 1942, Bull. Amer. Paleont., vol. 27, p. 199, pl. 24, fig. 5.

TYPE LOCALITY: "'Brought up by marine dredge from depths varying from 10. ft. to 40. ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay.'"

RANGE: Panama Bay to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Five specimens from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged in 14-33 meters, 2 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, ±15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 38.5 mm.; maximum diameter, 8.0 mm.

HABITAT: Gray sand and mud bottom with live shells.

REMARKS: Pilsbry pointed out that the shell of this species may be easily recognized by the character of the early postembryonic whorls which are subangular above the suture. The corresponding whorls on the similar *T. aspera* Hinds are flat.

The penultimate whorl of *T. cracilenta* is sculptured with about 20 slightly curved axial ribs which are cut into beads by five or

six impressed spiral lines, the upper ones, deeper and wider, separating a beaded collar. The base of the whorl is sculptured only with spirals. A single wide plait occurs on the columella.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range. This species has been recorded as occurring in the Pliocene of Costa Rica and Ecuador.

Terebra cf. **Terebra cuenca** Pilsbry and Olsson

Terebra (Strioterebrum) cuenca PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 16, pl. 1, fig. 11.

TYPE LOCALITY: "Jama formation, Punta Venada." Ecuador, Pliocene.

RANGE: Known Recent only from the present questionable record from Ardita Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters.

MEASUREMENTS: Length (apex missing), 16 mm.; maximum diameter, 3.9 mm.

HABITAT: Gray sand bottom.

REMARKS: A single small shell in the present collection appears comparable to *Terebra cuenca* which was originally described from the Pliocene of Ecuador. The punctate feature of the groove bordering the sutural fasciole is not so pronounced on the present shell, but there are traces of such punctations. It appears best for the present to refer it with question to *T. cuenca*, at least until the characters of the numerous Recent west American species of this genus are better known.

***Terebra intertinctoria* Hinds**

Plate 1, figure 12; plate 3, figure 9

Terebra intertinctoria HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 155; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 173, pl. 44, fig. 81. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, pl. 16, fig. 12b. TRYON, 1885, Manual of conchology, vol. 7, p. 15, pl. 3, fig. 37.

Terebra marginata DESHAYES, 1857, Jour. Conchyl., vol. 6, p. 86, pl. 4, fig. 8, "Hab. l'embouchure de la Gambie." TOMLIN, 1944, Jour. Conchol., vol. 22, p. 106, "Gambia. Type B.M. = *T. intertinctoria* Hinds."

TYPE LOCALITY: "Hab. Gambia; among sandy mud." According to Tomlin (1944a),

"Said to be from Gambia but this is certainly an error: the single type in the B.M. is evidently a Panamic type."

RANGE: Panama to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Two specimens from two samples from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms; also sample 307, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, ± 15 fathoms.

MEASUREMENTS: Larger specimen: length (upper portion of spire lacking), 36 mm.; maximum diameter, 10.9 mm.

HABITAT: Sand, shell fragments, and mud and live shell bottom.

REMARKS: The specimens here referred to *Terebra intertinctoria* agree so closely with Hinds's description and illustration that we assign them to his species.

Hinds (1845) remarked on the species as follows: "The whorls are surmounted by a row of tubercles, with small brown spots in the intervals; beneath the area is polished, with some obsolete folds, which, descending to the suture, gradually develop, and terminate in a small tubercle; and, tracing them round the whorls till the lip ceases, they continue over the middle of the last whorl as a row of small tubercles."

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

***Terebra ligyrus* Pilsbry and Lowe**

Terebra (Strioterebrum) ligyrus PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 40, pl. 1, figs. 10, 11.

TYPE LOCALITY: "Guaymas, Mexico, in about 20 fathoms (Lowe)."

RANGE: Guaymas, Mexico, in the Gulf of California, to Ardita Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters.

MEASUREMENTS: Length, 27.5 mm.; maximum diameter, 6.2 mm.

HABITAT: Gray sand bottom.

REMARKS: Pilsbry and Lowe pointed out that the shell of this species is characterized by "the subcontinuous ribs which are only

weakly cut by a spiral groove below the fasciole, and not crossed by spiral cords." There are five or six low spiral cords in the interspaces below the fasciole on the penultimate whorl.

The present record of the occurrence of this species in Ardita Bay, Colombia, is an extension south of the known range.

Terebra lingualis Hinds

Terebra lingualis HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 153; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 33; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 167, pl. 43, fig. 50. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, sp. 15, pl. 4, fig. 13b, pl. 5, fig. 15. M. SMITH, 1944, Panamic marine shells, p. 35 (as *Terebra lingualis*), fig. 463.

Terebra insignis DESHAYES, 1857, Jour. Conchyl., vol. 6, p. 70, pl. 3, fig. 2, "Hab. Panama"; 1859, Proc. Zool. Soc. London, p. 308. REEVE, 1860, Proc. Zool. Soc. London, p. 450, "variety of *T. lingualis*, Hinds." TOMLIN, 1944, Jour. Conchol., vol. 22, p. 107, "Panama. Type B.M. = *lingualis* Hinds."

TYPE LOCALITY: "Hab. Gulf of Papagayo, Bay of Montejo, west coast of America; ten to seventeen fathoms, sandy mud."

RANGE: Mazatlan, Mexico, to northern Ecuador.

MATERIAL EXAMINED: Three specimens from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged in 14-33 meters, 1 specimen.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length, 58.6 mm.; maximum diameter, 11.0 mm.

HABITAT: Gray sandy mud and gray mud bottom.

REMARKS: The shell of this species is slender, brown spotted, and has an apical angle of approximately 8 degrees. The whorls of the posterior portion of the spire are sculptured with an incised line which occurs at about one-third of the distance from the posterior end of the whorl. Above and below

this line there are axial folds, but the anterior third of the whorl almost lacks sculpture. Usually the anterior whorls on adult shells lack axial folds, but occasionally folds are present on all the whorls. The shell is yellowish white, with brown spots in axial arrangement.

Terebra melia Pilsbry

Terebra gausapata laevifasciola MAURY, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 273, pl. 8, fig. 64, "Brought up by marine dredge from depths varying from 10. ft. to 40. ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay."

Not *Terebra gausapata laevifasciola* MAURY, 1917.

Terebra (Strioterebrum) melia PILSBRY, 1931, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, pp. 433, 437, figs. 3, 4.

Terebra melia Pilsbry, M. SMITH, 1944, Panamic marine shells, p. 36, fig. 458.

TYPE LOCALITY: "Taboga Island, beach in front of the town." [Panama.]

RANGE: Known only from Panama City, Taboga Island, and Piñas Bay, Panama.

MATERIAL EXAMINED: Ten specimens from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, dredged in 14-33 meters.

MEASUREMENTS: Largest specimen: length, 38 mm.; maximum diameter, 7.7 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: The shell of this species is usually sculptured with 12 to 15 (on penultimate whorl) axial ribs which are crossed by about five to seven flat cords, on the last whorl about 13 to 15 cords.

At the time of the original description of this species Pilsbry considered it to be a small, sharply sculptured member of the *Terebra varicosa* group.

The occurrence of this species at Piñas Bay, Panama, represents a slight extension south of the known range.

Terebra montijoensis Pilsbry and Lowe

Terebra (Strioterebrum) montijoensis PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 42, pl. 1, fig. 1.

Terebra montijoensis Pilsbry and Lowe, M. SMITH, 1944, Panamic marine shells, p. 36, fig. 465A.

TYPE LOCALITY: "Montijo Bay, R. P. (Lowe)." [Panama.]

RANGE: San Juan del Sur, Nicaragua, to Ardita Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters.

MEASUREMENTS: Length, 26.4 mm.; maximum diameter, 5.5 mm.

HABITAT: Gray sand bottom.

REMARKS: The present specimen agrees more closely with the original illustration of *Terebra montijoensis* than any other one with which we are familiar. The shell is slender, sculptured with about 16–17 radial costae. These costae are cut by spiral grooves which form broad cords between the subsutural fasciole and the suture of the succeeding whorl. There are eight to 10 grooves on the base of the whorl.

The present record of the occurrence of this species in Ardita Bay, Colombia, is an extension south of the known range.

Terebra robusta Hinds

Terebra robusta HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 149; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 152 (bis), pl. 42, fig. 35. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, sp. 10, pl. 3, fig. 10. TRYON, 1885, Manual of conchology, vol. 7, p. 11, pl. 2, figs. 16, 25. M. SMITH, 1944, Panamic marine shells, p. 36, fig. 471.

Terebra macrospira LI, 1930, Bull. Geol. Soc. China, vol. 9, no. 3, p. 273, pl. 8, fig. 66, "Brought up by marine dredge from depths varying from 10. ft. to 40. ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay." Equals *Terebra robusta* Hinds, Pilsbry, 1931, p. 434.

TYPE LOCALITY: "West coast of America, between 8° 57' and 21° 32' north latitude; namely at Panama, Gulf of Nicoya, Gulf of Papagayo, and San Blas: in from four to eighteen fathoms, sandy mud." Panama here selected as type locality.

RANGE: Guaymas in the Gulf of California to the Rio Esmeraldas, Ecuador. Galapagos Islands.

MATERIAL EXAMINED: Two specimens from two samples from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, one specimen. Also sample 307, latitude 00° 31' 00" S., longitude

80° 35' 00" W., April 14, 1941, 15 fathoms, one specimen.

MEASUREMENTS: Larger specimen: length, 86.1 mm.; maximum diameter, 16.4 mm.

HABITAT: Sand and dead shell fragments, also mud and live shell fragments.

REMARKS: The shell of this species is rather slender, the apical angle about 12 degrees, and is ornamented with chestnut-brown spots. The whorls, especially the upper portion of the spire, are divided into three areas by two incised spiral lines, but these are lacking on the later whorls. The upper area especially, and sometimes the middle one, is sculptured with coarse tuberculate folds, but the lower portion is usually smooth. Occasionally these folds persist to the lowermost whorls.

This species is very similar to *Terebra lingualis* Hinds, a species that is more slender in outline, with a correspondingly smaller apical angle.

Terebra specillata Hinds

Terebra specillata HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 155; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 163, pl. 45, fig. 116; not pl. 44, fig. 96, cited as *T. alveolata* Hinds on p. 190. TRYON, 1885, Manual of conchology, vol. 7, p. 24, pl. 7, fig. 18 (copy of Sowerby's fig. 116). TOMLIN, 1944, Min. Conchol. Club Southern California, no. 41, p. 14. M. SMITH, 1944, Panamic marine shells, p. 36, fig. 467.

TYPE LOCALITY: "Hab. San Blas; from seven fathoms, sandy mud." [Mexico.]

RANGE: Concepcion Bay, Gulf of California, to Piñas Bay, Panama.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14–33 meters.

MEASUREMENTS: Length, 39.7 mm.; maximum diameter, 8.5 mm.

HABITAT: Gray sandy mud bottom.

DESCRIPTION: The shell of this species is slender and very acuminate; the whorls are convexly flattened, and the posterior portion of each is set off by an impressed line resulting in a nodose collar. Axial plicae occur on the whorls from the apex to the base. On the early whorls there are five or six spiral ribs which are slightly grooved. On the penultimate whorl the axial costae are crossed by three spirals, the anterior one somewhat nodose, and below the latter is a nearly

smooth area bearing faint spirals. The columella is quite straight and nearly smooth.

REMARKS: Tomlin (1944a) stated concerning this species: "San Blas, Mexico. The B.M. has one example presented by Belcher and bearing a label in Hinds writing. It is probably [the] type though it is somewhat shorter than Hinds measurement."

Melville and Sykes (1898, p. 41) pointed out that Hinds's figure 116 on plate 45 represents *Terebra specillata*, whereas figure 96 on plate 44, attributed to that species in the text, is referable to *T. alveolata* Hinds as indicated by Hinds on page 190 of the "Thesaurus." They further stated that the species cited and illustrated as *T. specillata* by Reeve [1860 (1843-1878), vol. 12, *Terebra*, sp. 75, pl. 17, fig. 75] is referable to an East Indian species which they named *Terebra andamanica* (1898, p. 41, pl. 3, fig. 3).

The occurrence of *Terebra specillata* at Piñas Bay, Panama, is a slight extension south of the known range.

***Terebra specillata guayaquilensis* E. A. Smith**

Plate 3, figure 33

Myurella belcheri E. A. SMITH, 1873, Ann. Mag. Nat. Hist., ser. 4, vol. 11, p. 267.

Not *Terebra belcheri* Philippi, 1851.

Myurella guayaquilensis E. A. SMITH, 1880, Proc. Zool. Soc. London, p. 481. New name for *Myurella belcheri* E. A. Smith, 1873, not [*Terebra*] *Myurella belcheri* Philippi, 1851.

TYPE LOCALITY: "Guayaquil, Ecuador."

RANGE: Off Cape Pasado to Guayaquil, Ecuador.

MATERIAL EXAMINED: Two specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, [sample 35], 14-33 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Larger specimen: length, 58.2 mm.; maximum diameter, 11.4 mm.

HABITAT: Bottom of mud and live shells.

REMARKS: The type specimen of this species has never been illustrated. According to E. A. Smith, this form differs from *Terebra*

specillata in the greater coarseness of the longitudinal ribs which are cut by sulci, and the color is dilute red. He also believed that the whorls were shorter and the columella was less straight. Tryon considered Smith's species to be a synonym of *T. specillata*. The color of the present specimens is dark brown, although it may have been reddish originally.

The occurrence of this subspecies in Piñas Bay, Panama, is an extension north of the known range.

***Terebra* aff. *Terebra tumaca* Pilsbry and Olsson**

Terebra (Strioterebrum) tumaca PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 16, pl. 1, fig. 6.

TYPE LOCALITY: "Jama formation, Jama." Ecuador, Pliocene.

RANGE: Known with certainty only in the Pliocene of Ecuador. The present specimens, somewhat similar to this species, were taken at Piñas Bay, Panama, and Ardita Bay, Colombia.

MATERIAL EXAMINED: Two specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 1 specimen.

MEASUREMENTS: Larger one: length (incomplete), 29.8 mm.; maximum diameter, 7.3 mm.

HABITAT: Gray sand and gray sandy mud bottom.

REMARKS: Two specimens in the present collection appear to be allied to *Terebra tumaca* from the Pliocene of Ecuador. The present specimens are more slender and correspondingly more acutely pointed at the apex. The sculpture is similar to that of the Pliocene species but differs in that there are only two spiral rows of nodes below the sub-sutural fasciole rather than three. The fact that only two specimens are available together with their comparatively small size and imperfect preservation leads us merely to state the affinity of these shells.

***Terebra varicosa* Hinds**

Terebra varicosa HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 152; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 163, text fig.

Terebra larvaeformis HINDS, 1844, Proc. Zool. Soc. London, for 1843, p. 155, "Hab. St. Elena, Monte Christi, west coast of America; in from six to fifteen fathoms, sandy mud"; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 176, pl. 43, figs. 46, 47. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, sp. 41, pl. 10, figs. 41a, 41b. TRYON, 1885, Manual of conchology, vol. 7, p. 19, pl. 4, figs. 66, 67 (as synonym of *T. dislocata*). M. SMITH, 1944, Panamic marine shells, p. 36, fig. 462.

TYPE LOCALITY: "Hab. Gulf of Papagayo, west coast of Central America; in twenty-three fathoms, mud. Cab. Belcher." [Costa Rica.]

RANGE: Santa Maria Bay, Baja California, to Punta Penasco in the Gulf of California (by Lowe as *T. larvaeformis*), and south to Guayaquil, Ecuador.

MATERIAL EXAMINED: Ten specimens from five samples from four stations and two specimens from an unknown locality:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, [sample 4], 6-8 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, [sample 35], 14-33 meters, 4 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 3 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, ±10 fathoms, 1 specimen. Also sample 307, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length (tip of apex missing), 44.4 mm.; maximum diameter, 9.6 mm.

HABITAT: Sand, gray sandy mud, mud, and shell bottom.

REMARKS: The shell of this species is characterized by its elongately cylindrical outline, axially plicated ribs, about 15 to 16 on the last whorl, and the fact that the upper portion of the last whorl is cut by an incised line setting off a crenulated collar.

The interspaces between the ribs are minutely concentrically grooved. The color is brown to white or pinkish white.

There is considerable variation in the sculpture of the present shells, but in general they agree well with Hinds's description. His original figure in the text appears to represent a shell somewhat more robust and with fewer axial ribs than some of the present specimens.

Terebra larvaeformis Hinds is here placed in the synonymy of *T. varicosa* on the basis of the conclusions of Tomlin (1944a) who examined the specimens in the British Museum and stated concerning *T. larvaeformis*: "S. Elena and Monte Christi. Types in B.M. (three)—so marked by Smith. There is also an example from Guayaquil presented by Belcher, with label in Hinds writing." Concerning *T. varicosa* Tomlin stated: "Gulf of Papagayo. Two in the B.M. are probably types. It is identical with *larvaeformis* Hinds."

A specimen from Acapulco, Mexico, in the collections of the California Academy of Sciences, which agrees almost exactly with Reeve's figure [1860 (1843-1878), vol. 12, *Terebra*, pl. 10, fig. 41b] of *T. larvaeformis*, measures, length (tip of apex lacking), 47.2 mm.; maximum diameter, 10 mm.

We are uncertain what species is represented in Reeve's plate 23, figure 120, said to equal *T. varicosa*. According to Reeve, "The ribs of this species have a peculiar obliquely concentric character, and do not appear in the form of crenules on the sutural margin, which is depressly excavated."

***Terebra variegata* Gray**

Terebra variegata GRAY, 1834, Proc. Zool. Soc. London, p. 61. HINDS, 1843, Proc. Zool. Soc. London, p. 164; 1845, in Sowerby, Thesaurus conchyliorum, vol. 1, p. 173, pl. 43, fig. 53. REEVE, 1860, Conchologia iconica, vol. 12, *Terebra*, sp. 12, pl. 4, fig. 12. TRYON, 1885, Manual of conchology, vol. 7, p. 14, pl. 2, fig. 15.

Terebra (Myurella) variegata Gray, STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 517, pl. 1, fig. 1.

Terebra (Strioterebrum) variegata Gray, DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 98, pl. 33, figs. 10, 22.

TYPE LOCALITY: No locality cited originally. "Hab. Guaymas, Gulf of California;

ten to twelve fathoms, sandy mud: Cuming. (v.s. in m. Gray)" cited by Hinds, 1843.

RANGE: Sal-si-Puedes Island in the Gulf of California to the Santa Elena Peninsula, Ecuador, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms.

MEASUREMENTS: Length, 48.7 mm.; maximum diameter, 11.9 mm.

HABITAT: Sand and dead shell fragments bottom.

REMARKS: The present specimen agrees closely with Reeve's illustration [1860 (1843-1878), vol. 12, *Terebra*, pl. 4, fig. 12] of *Terebra variegata*. It is characterized by its rather broad form, crenulated and tuberculated subsutural collar, strong spiral riblets, four on the penultimate whorl, the posterior one separated from the succeeding one by an interspace wider than the rib and followed by three fine spirals, all crossing the axial riblets. The columella is strongly twisted. The shell is bluish gray, streaked and spotted with brown.

Tomlin (1944a, 1945) stated that *Terebra africana* Gray is a synonym of the present species.

FAMILY CONIDAE

GENUS CONUS LINNAEUS

The west American species of this genus have been studied by Hanna and Strong (1949).

Conus arcuatus Broderip and Sowerby

Conus arcuatus BRODERIP AND SOWERBY, 1829, Zool. Jour., vol. 4, p. 379. SOWERBY, 1833-1841, The conchological illustrations, *Conus*, p. 1, pl. 25, fig. 9. REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, sp. 15, pl. 15, fig. 77b. KIENER, 1847, Iconographie des coquilles vivantes, Enroulées, Cône, p. 157, pl. 72, fig. 5. SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 12, pl. 202 (*Conus* pl. 16), fig. 384. TRYON, 1884, Manual of conchology, vol. 6, p. 75, pl. 24, fig. 98. M. SMITH, 1944, Panamic marine shells, p. 36, fig. 475. HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 292, pl. 5, figs. 2-4.

Not *Conus arcuatus* Broderip and Sowerby, Gray, 1839 [= *Conus emarginatus* Reeve, 1844 = *Conus recurvus* Broderip].

Conus borneensis ADAMS AND REEVE, 1848, in Adams, The zoology of the voyage of H.M.S.

Samarang, Mollusca, p. 18, pl. 5, figs. 8a-d, "Hab. North-east coast of Borneo (in ten fathoms, sandy and stony bottom)"; locality erroneous.

TYPE LOCALITY: "Found in the Pacific Ocean, near Mazatlan." [Mexico.]

RANGE: Santa Inez Bay, Gulf of California, to Octavia Bay, Colombia.

MATERIAL EXAMINED: Three specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, [sample 35], 14-33 meters, 2 specimens.

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, [sample 82], dredged across mouth of bay and back along same course, 24-28 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length, 28.6 mm.; maximum diameter, 12.6 mm.

HABITAT: Gray sand and sandy mud bottom.

REMARKS: Three specimens in the present collection are typical of this species. It is characterized by the rather high spire, sharply angulated whorls at the periphery, and the strongly spirally grooved body whorl which is rather pointed anteriorly. It is ornamented with brownish streaks or spots on a white ground.

Conus (Leptoconus) arcuatus vacuanus Olson (1942, p. 201, pl. 19, figs. 11, 12) has been described as occurring in the Pliocene of Panama (holotype) and Costa Rica.

The present record of the occurrence of *Conus arcuatus* in Octavia Bay, Colombia, is a slight extension south of the known range of this species.

Conus gladiator Broderip

Conus gladiator BRODERIP, 1833, Proc. Zool. Soc. London, p. 55. SOWERBY, 1833-1841, The conchological illustrations, *Conus*, p. 2, pl. 33, fig. 34. REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, sp. 127, pl. 22, fig. 127. SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 6, pl. 189 (*Conus* pl. 3), figs. 59, 60. KIENER, 1846, Iconographie des coquilles vivantes, Enroulées, Cône, p. 25, pl. 15, fig. 4. TRYON, 1883, Manual of conchology, vol. 6, p. 28, pl. 8, fig. 38. HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 273, pl. 7, fig. 5.

Conus tribunis CROSSE, 1865, Jour. Conchyl.,

vol. 13, p. 312, pl. 10, fig. 2, "Hab. California. (Coll. Cuming)."

TYPE LOCALITY: "Hab. ad Panamam. Found in sandy mud in the clefts of rocks."

RANGE: San Lazaro Point, Baja California, to Guaymas in the Gulf of California and south to Santa Elena, Ecuador, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, December, 1942, C. M. Breder, Jr., collector.

MEASUREMENTS: Length, 37.2 mm.; maximum diameter, 23 mm.

HABITAT: Not indicated.

REMARKS: The coloration of the present specimen is light, but there are traces of concentric bands, and there are dark spots between the nodes on the shoulder.

The shell of this species differs from that of *Conus brunneus* in that the spire is lower, the sides are straighter, and the coronal nodes are less developed. It is generally smaller, and the coloration is lighter.

Conus gladiator bears considerable resemblance to *C. diadema*, but the coronal spines are less prominent and the body whorl is marked with darker brown.

The present species has been recorded as occurring in the Pleistocene of Ecuador.

Conus patricius Hinds

Conus patricius HINDS, 1843, Ann. Mag. Nat. Hist., new ser., vol. 11, p. 256. REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, sp. 63, pl. 13, fig. 63. HINDS, 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 1, p. 7, pl. 1, figs. 1, 2. KIENER, 1849-1850, Iconographie des coquilles vivantes, Enroulées, Cône, p. 353, pl. 88, fig. 4. SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 12, pl. 202 (*Conus* pl. 16), fig. 355. HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 300, pl. 6, fig. 12, pl. 9, figs. 6-9.

Conus pyriformis REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, sp. 70, pl. 13, fig. 70, "Bays of Caraccas and Montija, West Columbia (dredged from sandy mud at the depth of seven to ten fathoms); Cuming." KIENER, 1849-1850, Iconographie des coquilles vivantes, Enroulées, Cône, p. 275, pl. 44, fig. 4; not the locality "Habite la mer des Antilles." TRYON, 1883, Manual of conchology, vol. 6, p. 17, pl. 4, figs. 60, 61. M. SMITH, 1944, Panamic marine shells, p. 37, fig. 473.

TYPE LOCALITY: "Gulf of Nicoya, Central America; dredged from sandy mud in 7 fathoms." [Costa Rica.]

RANGE: Michoacan, Mexico, to Punta Carnero, Ecuador.

MATERIAL EXAMINED: Four specimens from four samples from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, picked up on beach near village, 1 specimen. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34-43 meters, 1 specimen.

Bahia Cuevita, May 11, 1941, Station 93, sample 359, dredged east-southeast across bay in 5-20 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 70.8 mm.; maximum diameter, 44.4 mm.

HABITAT: Gray sand, sandy mud and mud bottom.

REMARKS: There is little to add to the remarks of Hanna and Strong concerning this species. The pyriform shape and low spire are characteristic features of this species. The entire body whorl of young shells is frequently sculptured with raised concentric threads, but adult shells often are nearly smooth except for the presence of spiral threads on the lower portion of the last whorl. The color of the shell is creamy white.

Conus perplexus Sowerby

Conus perplexus SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 20, pl. 200 (*Conus* pl. 14), fig. 324. HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 289, pl. 8, figs. 1-3, not pl. 9, fig. 4 = ?*C. archon* Broderip, juv.

Conus puncticulatus Hwass, var. B, REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, pl. 20, fig. 116, "Salango and St. Elena, West Columbia (found in sandy mud at the depth of from five to nine fathoms); Cuming."

Not *Conus puncticulatus* Hwass in Bruguière, 1792.

Conus comptus Gould, DALL, 1910, Proc. U. S. Natl. Mus., vol. 38, p. 219. SORENSEN, 1943, Nautilus, vol. 57, pl. 1, fig. 5 (11 figs.).

Not *Conus comptus* Gould, 1853.

TYPE LOCALITY: "Gulf of California, West

Columbia, Cum." Gulf of California cited as type locality by Hanna and Strong and accepted by the present authors.

RANGE: Magdalena Bay, Baja California, to Kino Bay in the Gulf of California and south to Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from Octavia Bay, Colombia, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82 in 24–28 meters.

MEASUREMENTS: Length, 27.8 mm.; maximum diameter, 15.9 mm.

HABITAT: Black mud bottom.

REMARKS: The sculpture of the shell of this species is variable. Spiral grooves are present on the base of the single specimen in the present collection, but this shell is not pustulose as are some forms of it.

Conus princeps lineolatus Valenciennes

Conus lineolatus VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 336.

Conus princeps Linnaeus var., SOWERBY, 1833–1841, The conchological illustrations, *Conus*, p. 2, pl. 32, figs. 30a, 30b. REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, pl. 7, fig. 36b. SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 5, pl. 188 (*Conus* pl. 2), fig. 33. WEINKAUFF, 1875, in Conchylien-Cabinet von Martini u. Chemnitz, ed. 2, vol. 4, pt. 2, p. 302, pl. 54, fig. 13.

Conus regius Chemnitz, KIENER, 1846, Iconographie des coquilles vivantes, Enroulées, Cône, p. 15, pl. 11, fig. 4, "Habite l'océan Pacifique, les côtes du Mexique, la baie de Panama."

Conus princeps lineolatus Valenciennes, HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 278, pl. 7, fig. 8.

TYPE LOCALITY: "Habitat ad Acapulco." [Mexico.]

RANGE: Acapulco, Mexico, to Peru (Dall).

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, December 1942, C. M. Breder, Jr., collector.

MEASUREMENTS: Length, 44.5 mm.; maximum diameter, 24.5 mm.

REMARKS: Hanna and Strong pointed out that this form differs from typical *Conus princeps* Linnaeus only in that the shell is ornamented axially with fine brown hair lines on a pinkish ground rather than by stripes about a millimeter in width.

Conus tornatus Broderip

Conus tornatus BRODERIP, 1833–1841, in Sowerby, The conchological illustrations, *Conus*, p. 2, pl. 29, fig. 25; 1833, Proc. Zool. Soc. London, p. 53. REEVE, 1843, Conchologia iconica, vol. 1, *Conus*, sp. 68, pl. 13, fig. 68. SOWERBY, 1857, Thesaurus conchyliorum, vol. 3, p. 16, pl. 202 (*Conus* pl. 16), fig. 375, pl. 104 [204] (*Conus* pl. 18), fig. 425 (1858). M. SMITH, 1944, Panamic marine shells, p. 37, fig. 485D. HANNA AND STRONG, 1949, Proc. California Acad. Sci., ser. 4, vol. 26, p. 291, pl. 8, figs. 4–7.

TYPE LOCALITY: "Panama."

RANGE: Cedros Island, Baja California, to Santa Inez Bay in the Gulf of California and south to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: Nine specimens from five stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, dredged in 15 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged in 14–33 meters, 3 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 3 specimens.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24–28 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 36.4 mm.; maximum diameter, 14.8 mm.

HABITAT: Sand, gray sandy mud, mud, and sand and dead shell bottom.

REMARKS: The shell of this species is rather slender and is ornamented with spiral markings of brown dots. Some specimens are sculptured with spiral rows of pustules, whereas others are smooth.

The shell of this species differs from somewhat similar shells of *Conus perplexus* in that the spire is higher and the shell is much more slender.

Hanna and Strong have cited full synonymy of this species, which has been cited

under several other names in the literature including *Conus catenatus* Sowerby, 1878 (not *Conus catenatus* Sowerby, 1850), *Conus concatenatus* Sowerby, 1887 (not *Conus concatenatus* Kiener, 1849–1850), *Conus interruptus* Broderip and Sowerby of Tryon [1883 (1879–1913), vol. 6, pl. 20, fig. 4], and *Conus desmotus* Tomlin, 1937.

Conus virgatus Reeve

Conus zebra Lamarck, REEVE, 1843, *Conchologia iconica*, vol. 1, *Conus*, sp. 87, pl. 16, fig. 87.

Not *Conus zebra* Lamarck.

Conus lorenzianus Chemnitz, KIENER, 1846–1847, *Iconographie des coquilles vivantes*, Enroulées, Cône, p. 139, pl. 55, fig. 1.

Not *Conus lorenzianus* Chemnitz, 1795.

Conus virgatus REEVE, 1849, *Conchologia iconica*, suppl., p. 1; name proposed for pl. 16, fig. 87; *Conus zebra* from Salango, Central America. SORENSEN, 1943, *Nautilus*, vol. 57, p. 4, pl. 1, fig. 3. HANNA AND STRONG, 1949, *Proc. California Acad. Sci.*, ser. 4, vol. 26, p. 301, text figs. 3 (A–D), pl. 6, fig. 10, pl. 9, fig. 5.

Conus sanguinolentus REEVE, 1849, *Conchologia iconica*, suppl., pl. 8, fig. 274, no locality cited.

Not *Conus sanguinolentus* Quoy and Gaimard, 1834.

Conus cumingii REEVE, 1849, *Conchologia iconica*, suppl., pl. 8, figs. 277a, b, not pl. 3, fig. 282.

Conus signae BARTSCH, 1937, *Nautilus*, vol. 51, p. 3, pl. 2, fig. 8; figured specimen "from Guaymas," Mexico; also cited from Cedros Island and Panama.

TYPE LOCALITY: "Hab. Salango, Central America (dredged from sandy mud at the depth of twelve to sixteen fathoms); Cuming." [Salango, Ecuador.] For *Conus zebra* illustrated by Reeve.

RANGE: Cedros Island, Baja California, to Guaymas in the Gulf of California and south to the Santa Elena Peninsula, Ecuador.

MATERIAL EXAMINED: Seven specimens from five samples from four stations and one specimen lacking locality information:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 2 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample

80, picked up along beach, 1 specimen. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34–43 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENT: Largest specimen: length, 60.6 mm.; maximum diameter, 31.8 mm.

HABITAT: Gray sand, sandy mud, and mud and live shell bottom.

REMARKS: Hanna and Strong have discussed the problems connected with the identification of this species. Specimens vary in the height of the spire and in the width of the axial streaks in the color pattern. A specimen in the present collection from Guayabo Chiquito, Panama, has a total length of 55 mm., with the spire 15 mm. One of the chief features that differentiates this species from similar ones of the same size, such as *Conus recurvus* Broderip, is the presence of rather well-developed, raised, concentric spiral striae which are stronger on the lower half of the last whorl but are clearly discernible on the upper half of the whorl. These striae are much stronger than the very faint concentric ones on *C. recurvus* but not so coarse as those on *C. archon*.

FAMILY TURRIDAE

GENUS TURRICULA SCHUMACHER

Turricula maculosa Sowerby

Pleurotoma maculosa SOWERBY, 1833, *Proc. Zool. Soc. London*, p. 135. REEVE, 1842, *Conchologia systematica* vol. 2, p. 187, pl. 233, fig. 8; 1843, *Conchologia iconica*, vol. 1, *Pleurotoma*, sp. 45, pl. 6, fig. 45.

Surcula maculosa Sowerby, TRYON, 1884, *Manual of conchology*, vol. 6, p. 236, pl. 5, fig. 57.

Turricula maculosa Sowerby, GRANT AND GALE, 1931, *Mem. San Diego Soc. Nat. Hist.*, vol. 1, p. 488, pl. 25, figs. 11a, 11b.

TYPE LOCALITY: "Hab. ad Montem Christi Columbiae Occidentalis. One specimen only was dredged in sandy mud at a depth of sixteen fathoms." [Montechristi, Ecuador.]

RANGE: Kino Bay and San Felipe in the Gulf of California, to Guayaquil, Ecuador.

MATERIAL EXAMINED: One juvenile specimen from Octavia Bay, Colombia, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24–28 meters.

MEASUREMENTS: Length, 11.5 mm.; maximum diameter, 4 mm.

HABITAT: Black mud bottom.

REMARKS: The shell of this species is characterized by the presence of about 12 axial ribs and fine spiral striae which, however, on some specimens are obsolete. This species occurs rather abundantly at various localities along west Mexico and Central America.

Turricula maura Sowerby

Pleurotoma maura SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 134. REEVE, 1842, Conchologia systematica, vol. 2, p. 187, pl. 233, fig. 4; 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 47, pl. 6, fig. 47.

Drillia maura Sowerby, TRYON, 1884, Manual of conchology, vol. 6, p. 181, pl. 10, fig. 70 (copy of Reeve's figure).

Not *Pleurotoma maura* Valenciennes, KIENER, 1839-1840, Iconographie des coquilles vivantes, Canalifères, Pleurotome, p. 59, pl. 23, fig. 1.

TYPE LOCALITY: "Hab. ad Insulam Platam Columbiae Occidentalis." Dredged "from a depth of fourteen fathoms in coral sand." [Island of La Plata, Ecuador.]

RANGE: San Marcos Island, Gulf of California, to Guayaquil, Ecuador.

MATERIAL EXAMINED: Two specimens from two stations:

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 1 specimen.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24-28 meters, 1 specimen.

MEASUREMENTS: Specimen from Ardita Bay, Colombia: length, 37.3 mm.; maximum diameter, 9.6 mm.

HABITAT: Gray sand and black mud bottom.

DESCRIPTION: Shell slender, acuminate, whorls concave posteriorly; axial sculpture on adult shells consists of 12 (occasionally more) plica-like ribs on the shoulder which extend anteriorly, gradually decreasing in size to the base of the bottom whorl or even down onto the canal; axial sculpture crossed by spiral ribs which often form nodes at the intersection; anal fasciolar area with a spiral rib which meets the outer lip just above the posterior notch; color blackish brown.

REMARKS: *Turricula nigricans* Dall (1919a, p. 3, pl. 2, fig. 6), described from off Baja California in 21 fathoms, is a similar species, differing chiefly in the fewer (eight to 10 rather than 12), shorter, axial ribs and somewhat coarser and more widely spaced spiral threads which do not decussate the axial ribs to the degree that they do on *T. maura*.

Drillia chazaliei Dautzenberg (1900, p. 166, pl. 9, figs. 4, 4) from the Caribbean region and *Drillia pirabica* Maury (1924, p. 205, pl. 11, fig. 13) from the Miocene of Brazil have been compared with *Turricula maura*.

Melville pointed out a resemblance between *T. maura* and the species described as *Drillia anihamilla* (1923, p. 163, pl. 4, fig. 1) from an unknown locality.

Turricula panthea Dall

Turricula (Surcula) panthea DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 4, pl. 1, fig. 5.

TYPE LOCALITY: "Range.—Station 2795, in Panama Bay, in 33 fathoms, bottom temperature 64.1° F., U. S. Bureau of Fisheries."

RANGE: Panama Bay to Ardita Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters.

MEASUREMENTS: Length, 16.6 mm.; maximum diameter, 5 mm.

HABITAT: Gray sand bottom.

REMARKS: The state of preservation of the shell of the present specimen is such that we can add nothing to the original description by Dall.

The present record of the occurrence of this species in Ardita Bay, Colombia, is a slight extension south of the known range.

GENUS CYMATOSYRINX DALL

Cymatosyrinx roseola Hertlein and Strong,
new species

Plate 2, figure 27

Pleurotoma rosea SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 134, "Hab. ad Salango et ad Montem Christi. Found in sandy mud in from twelve to sixteen fathoms." REEVE, 1842, Conchologia systematica, vol. 2, p. 187, pl. 233, fig. 3; 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 43, pl. 6, fig. 43.

Not *Pleurotoma rosea* Quoy and Gaimard, 1833, Voyage . . . de l'Astrolabe, Zoologie, vol. 2, p. 524, pl. 35, figs. 10, 11, "Habite la Nouvelle-Zélande." *Pleurotoma zelandiae* Reeve, 1843, is said to be identical.

Drillia rosea Sowerby, TRYON, 1884, Manual of conchology, vol. 6, p. 190, pl. 10, fig. 62.

Elaeocyma rosea Sowerby, M. SMITH, 1944, Panamic marine shells, p. 38, fig. 502.

HOLOTYPE: C.A.S. No. 9893: length, 30.7 mm.; length of last whorl, 13.6 mm.; maximum diameter, 12.8 mm. From the Gulf of Tehuantepec, 15 miles south of La Puerta Light, Mexico, latitude 15° 40' 00" N., longitude 93° 49' 00" W., dredged in 28 fathoms; Templeton Crocker Expedition, July 12, 1932.

PARATYPES: C.A.S. No. 9894: length, 32.3 mm.; length of last whorl, 13.9 mm.; maximum diameter, 13.2 mm.; from the same locality as the holotype. A.M.N.H. No. 73438: length, 22.7 mm.; length of last whorl, 10.4 mm.; maximum diameter, 9.9 mm.; from off Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, dredged in 10 fathoms, bottom of sand and dead shell fragments. A.M.N.H. No. 73438: length, 32 mm.; length of last whorl, 13.5 mm.; maximum diameter, 12.6 mm.; from same station (81) as preceding specimen, sample 307, April 14, 1941, dredged in 15 fathoms, bottom of mud and live shells.

Additional specimens:

COLOMBIA

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen. Also latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

HABITAT: Gray sand and dead shell bottom; occasionally mud and live shell bottom.

RANGE: Punta Penasco in the Gulf of California to Salango, Ecuador.

DESCRIPTION: Shell fairly large, with a pointed spire, white tinged with pink; apex of nuclear whorls lacking, two and one-half smooth whorls remaining; post-nuclear

whorls nine, sutures closely appressed; axial sculpture of (on penultimate whorl) nine coarse, smooth plicae which are slightly protractive and which begin on the anal fasciolar band and fade out on the base of the last whorl; entire surface bearing faint lines of growth; anal fasciole moderately broad, gently concave, reflecting the undulations of the axial ribs; aperture rather narrow, with a deep, narrow, rounded anal sinus and a rounded subsutural callosity; outer lip thin at edge, thickened a short distance back, smooth within, a shallow notch near base; inner lip rounded, appressed; canal short, recurved, a moderate siphonal fasciole present.

A paratype is almost entirely rose-colored. Some specimens are pinkish brown.

REMARKS: The combination of names *Pleurotoma rosea* was proposed by Quoy and Gaimard for a species from New Zealand. According to Sherborn and Woodward (1901, p. 333), the work in which that species was described appeared in 1833. According to Sclater (1893, p. 436), the work containing Sowerby's description of a different species from Ecuador with the same name was issued in April, 1834. We have not discovered that any valid name has been applied to Sowerby's species. Unfortunately, it appears necessary to provide a new name for the west American species, *Pleurotoma rosea* Sowerby, and we propose *Cymatosyrinx roseola*, based upon holotype No. 9893, California Academy of Sciences Department of Paleontology type collection.

This species differs from *Clavatula quisqualis* Hinds [1844 (1844–1845), pt. 1, p. 19, pl. 6, fig. 5] described from the "Gulf of Papagayo, Central America. From eight to fourteen fathoms, mud," in possessing fewer, much more rounded, straighter ribs, and in the distinctly recurved canal. It differs from *Cymatosyrinx asaedai* Hertlein and Strong [1951 (1940–1951), vol. 36, p. 78, pl. 1, fig. 4], described from Arena Bank, Gulf of California, in 45 fathoms, in the fewer (nine rather than 13), more rounded axial ribs and in lacking spiral striae.

The fewer and more rugose axial ribs easily serve to separate this species from *Cymatosyrinx albicostata* Sowerby. Another somewhat similar species with a pinkish base

originally described as *Drillia roseobasis* by Pilsbry and Vanatta was later renamed *Pleurotoma testudinis* by the same authors. We have discussed the synonymy of that species in an earlier paper (1949, p. 103).

GENUS *CLATHRODRILLIA* DALL

Clathrodrillia pudica Hinds

Clavatula pudica HINDS, 1843, Proc. Zool. Soc. London, p. 41; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 1, p. 20, pl. 6, figs. 11, 12.

Pleurotoma pudica Hinds, REEVE, 1845, Conchologica iconica, vol. 1, *Pleurotoma*, sp. 199, pl. 23, fig. 199.

Drillia pudica Hinds, TRYON, 1884, Manual of conchology, vol. 6, p. 189, pl. 13, fig. 55.

Pleurotoma (Drillia) pudicum Hinds, KOBELT, 1887, Pleurotomidae, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 3, p. 184, pl. 36, fig. 6 (copy of Reeve's fig. 199).

TYPE LOCALITY: "Hab. Gulf of Papagayo, Central America. From eight to fourteen fathoms; mud." [Costa Rica.]

RANGE: Santa Inez Bay, Gulf of California, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Eighteen specimens from five stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged in 14–33 meters, 6 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25–64 meters, 1 young specimen, identification questionable.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 24–43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 8 specimens. Also 1 small bleached specimen, the identification questionable.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen.

MEASUREMENTS: Specimen from Piñas Bay, Panama: length, 16.6 mm.; maximum diameter, 5.3 mm.

HABITAT: Gray sandy mud, gray mud and shell fragments.

DESCRIPTION: Shell rather small, acuminate, shining, whorls depressed on upper portion; axial sculpture consisting of oblique ribs which begin at the base of the anal fasciole and are well developed to the base but become obsolete on the back of the last whorl where the anal fasciole occasionally becomes slightly nodulous, whorls crossed by very faint, well-spaced, spiral lines; canal with about six to eight slight spiral grooves, the end strongly notched; pale brown or whitish with a reddish chestnut spot on the back of the last whorl, occasionally almost wholly brownish.

REMARKS: The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

Clathrodrillia unimaculata Sowerby

Pleurotoma unimaculata SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 134. REEVE, 1842, Conchologia systematica, vol. 2, p. 187, pl. 233, fig. 9; 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 42, pl. 6, fig. 42.

Drillia unimaculata Sowerby, TRYON, 1884, Manual of conchology, vol. 6, p. 180, pl. 10, fig. 59 (copy of Reeve's illustration).

TYPE LOCALITY: "Hab. ad oras Americae Centralis et Occidentalis. Found in sandy mud, in from eight to sixteen fathoms, at Monte Christe, Guacomayo and Salango."

RANGE: Punta Penasco in the Gulf of California to Salango, Ecuador.

MATERIAL EXAMINED: Five specimens from two stations:

PANAMA

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 4 specimens.

MEASUREMENTS: Specimen from Ardita Bay, Colombia: length (apex lacking), 35 mm.; maximum diameter, 12.2 mm.

HABITAT: Gray sand and mud bottom.

DESCRIPTION: Shell acuminate pointed, smooth, shining, the upper portion of the whorls concave; axial sculpture consists of

elongated tubercles (about 15 to 16 on penultimate whorl) beginning on the shoulder and extending anteriorly, on the last whorl these extend nearly to the base but are obsolete or nearly so on the last fourth of the whorl, the whole crossed by fine spiral striae; yellowish white to purplish white, with a brown spot on the back of the last whorl, also often with two rows of chestnut-brown spots on the riblets, with the addition of a third row on the base of the last whorl, interior purplish white.

REMARKS: The shell of this species was originally described as white with a brown spot on the back of the last whorl. Some specimens, which appear to be referable to this species, reveal that there is considerable variation in coloration, especially in the development of concentric bands of chestnut-brown spots. Reeve's illustration shows one series of such spots on the spire. Reeve (1843) stated that *Pleurotoma unimaculata* "may probably be merely a white variety of the *Pl. gibbosa*, Kiener, *Murex gibbosus*, Chemnitz." That species is the type of *Clathrodrillia*. In view of the general similarity of the two species, we have placed *unimaculata* in *Clathrodrillia* rather than in *Imaclava* as indicated by Bartsch (1950, p. 89).

GENUS POLYSTIRA WOODRING

Polystira WOODRING, 1928, Publ. Carnegie Inst. Washington, no. 385, p. 145. "Type.—*Pleurotoma albida* Perry. Recent, West Indies and Florida." BARTSCH, 1934, Smithsonian Misc. Coll., vol. 91, no. 2, p. 8; "The type of *Polystira* Woodring must therefore be *Murex virgo* Wood = *Polystira albida* Woodring, not Perry."

Bartsch has discussed the type species of *Polystira*. He stated that *Pleurotoma albida* Perry, 1811, occurs in the Australian region, and the shell cited by Woodring under that name from the West Indies is referable to *Murex virgo* Wood.

Three west American species of this genus, *Polystira nobilis*, *P. oxytropis*, and *P. picta*, form a closely related group, quite distinct in the adult but difficult to separate in the younger stages. All three possess slender shells with long canals, the major sculpture consisting of a few distinct, smooth, spiral cords, the most prominent of which ends at a deep, narrow, anal sulcus at the shoulder some distance below the suture.

Polystira panamensis Olsson, 1942, has been described from the Pliocene of Panama. The genus *Polystira* is known to occur in the Caribbean region, at least from Miocene to Recent.

Polystira oxytropis Sowerby

Plate 3, figure 24

Pleurotoma oxytropis SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 135. REEVE, 1842, Conchologia systematica, vol. 2, *Pleurotoma*, p. 187, pl. 233, fig. 2; 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 17, pl. 3, fig. 17a.

[?] *Pleurotoma albicarinata* SOWERBY, 1870, Proc. Zool. Soc. London, p. 253, "Hab. Manzanilla."

TYPE LOCALITY: "Hab. ad Panamam et ad Portam Portreram. Found in sandy mud at from thirteen to twenty fathoms' depth."

RANGE: Guaymas, Gulf of California, to Gorgona Island, Colombia.

MATERIAL EXAMINED: Forty-two specimens from six samples from four stations and four specimens lacking information as to locality:

PANAMA

Piñas Bay, February 25, 1941, Station 19, sample 35, 14–33 meters, 15 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 6 specimens.

COLOMBIA

Ardita Bay, March 5–6, Station 31, sample 80 (680 in list), 5 specimens. Also sample 81, March 6, 1941, dredged in and out of center of bay, 34–43 meters, 14 specimens.

Octavia Bay, March 6, 1941, Station 32 [sample 82], dredged across mouth of bay and back along same course, 24–28 meters, 1 specimen. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 1 specimen.

MEASUREMENTS: One of largest specimens: length, 35 mm.; maximum diameter, 10 mm.

HABITAT: Gray sand and mud bottom. Also picked up on beach.

DESCRIPTION: "Pleur. testâ turrîto-sublatâ, brunnescente; anfractibus decem, spiraliter carinatis, carinâ medianâ albicante, conspicuâ, interstitiis decussatis; aperturâ oblongâ, canali rectâ, elongatâ, emarginaturâ laterali in carinam medianam decurrente; long. 1.8, lat. 0.5 poll" (original description).

REMARKS: This species is the earliest

named of a group of three closely related forms. It is the smallest of the group, usually not exceeding 30–35 mm. in altitude. The carina at the shoulder is much stronger than the other spiral cords. The color of the shell is grayish or brownish, and the spiral cords are usually white or at least much lighter. The raised lines of growth give the surface between the spiral cords a roughened appearance.

Sowerby described *Pleurotoma albicarinata* from "Manzanilla," presumably Mexico, in 1870. He stated, "This shell differs from *P. oxytropis* in being laterally much more compressed, in being much shorter above the keel, which is sharp and white, and in being altogether more closely sculptured." An examination of a large series of shells from various localities between the Gulf of California and Panama has led us to doubt that *P. albicarinata* is distinct from *P. oxytropis*. Reeve's illustrations of *P. oxytropis* do not show the white carina of the species mentioned in the original description, and it seems quite possible that his figure 17b may represent a young specimen of *Polystira nobilis* Hinds. *Polystira oxytropis* possesses a smaller and much more slender shell, with less broadly tabulated whorls than that of *P. nobilis*.

Compared to *P. picta* the shell of *P. oxytropis* is smaller, lacks the irregular patches of brown on the spiral ribs, and has stronger, raised lines of growth.

Pleurotoma trypanodes Melvill (1904, p. 57, pl. 5, fig. 2), from the Arabian Sea, was compared to *P. oxytropis* at the time of its original description, but in his later paper on the Turridae of that region Melvill compared it to *P. nivea* Philippi.

Watson pointed out that *P. oxytropis* and *P. leucotropis* Adams and Reeve, an Oriental form, are quite distinct species. The same author (1886, p. 285) however, cited "*Pleurotoma (Surcula) oxytropis*, Sowerby, var. *albicarinata*, Sowerby" as occurring at "Monte Video," Uruguay. The Uruguayan shell no doubt can be referred to some other species.

Nomura (1935b, p. 112) considered *Pleurotoma albicarinata* Sowerby, *P. nobilis* Hinds, *P. leucotropis* Adams and Reeve, and *P. gendinganensis* Martin to be specifically identical with one variable species, "*Turris (Turris) oxytropis*" Sowerby, which he cited

from the late Tertiary and Quaternary of Japan. Yabe and Hatai (1941, p. 75) also cited a species from the Pliocene of Japan under the name of *Turris oxytropis*. It appears probable that the Oriental shell represents a distinct species, as indicated by Watson.

Wolf, 1892, mentioned a species occurring in Ecuador said to be very similar to *P. oxytropis*. Olsson, 1942, cited *P. oxytropis* as occurring in the Pleistocene of Panama.

Polystira picta Beck in Reeve

Plate 3, figure 11

Pleurotoma picta BECK, 1843, in Reeve, *Conchologia iconica*, vol. 1, *Pleurotoma*, sp. 16, pl. 3, fig. 16. TRYON, 1884, *Manual of conchology*, vol. 6, p. 163, pl. 1, fig. 8 (copy of Mörch's fig. 6), pl. 2, fig. 19 (copy of Reeve's fig. 16).

Pleurotoma (Turris) rombergii MÖRCH, 1857, *Jour. Conchyl.*, vol. 6, p. 281, pl. 10, fig. 6, "Hab. près Realejo."

Turris picta Beck, M. SMITH, 1944, *Panamic marine shells*, p. 38, fig. 565.

TYPE LOCALITY: "Hab. Panama, St. Blas, Gulf of Nicoya, &c., Western coast of America. Hinds."

RANGE: Guaymas, Gulf of California, to Octavia Bay, Colombia.

MATERIAL EXAMINED: Twenty specimens from five samples from four stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, 6–8 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 5 specimens.

COLUMBIA

Ardita Bay, March 5–6, 1941, Station 31, sample 80 (680 in list), 3 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 3 specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 8 specimens.

MEASUREMENTS: Largest specimen from Isla del Rey, Pearl Islands: length, 61.2 mm.; maximum diameter, 17.3 mm.

HABITAT: Gray sand and black mud bottom.

REMARKS: The shell of this species is mostly white, and the spiral cords are flecked with irregular patches of brown. It is more slender in outline than that of *Polystira*

nobilis, often lighter in color and more maculated with brown. It differs from that of *P. oxytropis* in the irregular coloration, larger size in the adult stage, and, except for spiral sculpture, in that the shell is comparatively smooth, whereas Sowerby's species is roughened with strong, raised lines of growth.

The present record of the occurrence of this species in Octavia Bay, Colombia, is an extension south of the known range.

GENUS CARINODRILLIA DALL

Carinodrillia alcestis Dall

Clathrodrillia (*Carinodrillia*) *alcestis* DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 18, pl. 5, fig. 6.

Drillia zooki Brown and Pilsbry, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 275, pl. 8, fig. 70 (lower fig.). Equals *Clathrodrillia alcestis* Dall, according to Pilsbry, 1931, p. 434.

Not *Drillia zooki* Brown and Pilsbry, 1911.

Clathrodrillia alcestris Dall, M. SMITH, 1944, Panamic marine shells, p. 38, fig. 503.

TYPE LOCALITY: "Station 3037, off Guaymas in the Gulf of California in 20 fathoms green mud. U. S. Bureau of Fisheries." [Mexico.]

RANGE: Off Santa Margarita Island, Baja California, to Punta Penasco in the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Seven specimens from four samples from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19 (sample 35), 14–33 meters, 1 specimen.

COLUMBIA

Ardita Bay, March 6, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 2 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 3 specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 1 specimen.

MEASUREMENTS: Length, 36 mm.; maximum diameter, 12 mm.

HABITAT: Gray sand, sandy mud, and black mud bottom.

REMARKS: A few specimens, mostly small, in the present collection are referable to *Carinodrillia alcestis* Dall. One large specimen

from Ardita Bay, Colombia, length (apex missing), 36 mm., maximum diameter, 11.8 mm., appears referable to this species but differs from typical forms in that the axial ribs are rather broadly rounded and the spirals crossing the axial ribs do not form sharp nodules at the intersections. This large specimen bears a resemblance to *Pleurotoma duplicata* Sowerby as illustrated by Reeve [1843 (1843–1878), vol. 1, *Pleurotoma*, sp. 78, pl. 9, fig. 78]. However, there is considerable variation in a series of specimens of this species, and for the present, at least, we refer all these specimens to Dall's species.

The present record of the occurrence of this species at Octavia Bay, Colombia, is an extension south of the known range.

Carinodrillia haliplexa Dall

Clathrodrillia (*Carinodrillia*) *haliplexa* DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 19, pl. 5, fig. 5.

Clathrodrillia haliplexa Dall, M. SMITH, 1944, Panamic marine shells, p. 38, fig. 507.

TYPE LOCALITY: "Range.—Station 2824, near La Paz, Lower California, in 8 fathoms; U. S. Bureau of Fisheries steamer *Albatross*." [Mexico.]

RANGE: Off Cape Tosca, Magdalena Bay, Baja California, to Santa Inez Bay, Gulf of California, and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Thirteen specimens from five stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, dredged in 6–8 fathoms, 2 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, dredged, 14–33 meters, 5 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters, 2 specimens.

COLUMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 1 specimen.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24–28 meters, 2 specimens. Also 1 small specimen comparable to this species.

MEASUREMENTS: Specimen from Octavia

Bay, Colombia: length (tip of apex lacking), 35.2 mm.; maximum diameter, 9.5 mm.

HABITAT: Gray sand, sandy mud, and black mud bottom.

REMARKS: Shell similar to that of *Carinodrillia alcestis* but more slender and with a wider anal fasciole which is decidedly spirally striated; also the whorls are less constricted at that point.

The present record of the occurrence of this species at Octavia Bay, Colombia, is an extension south of the known range.

HINDSICLAVA HERTLEIN AND STRONG, NEW GENUS

TYPE: *Pleurotoma militaris* Hinds, 1843, in Reeve (1843-1878, vol. 1, *Pleurotoma*, sp. 55, pl. 7, fig. 55, Veragua, Panama).

Shell of medium size, rather slender, whorls usually angulated, canal moderately long; sculpture consisting of strong axial and spiral cords; anal notch about midway between suture and shoulder, a strong node of callus at the suture.

The shells of the species of this genus differ from those of *Carinodrillia* in the somewhat longer anterior canal, and coarser axial sculpture. They differ from those of *Knefastia* in the smaller size and in the presence of a strong node of callus at the sutural edge of the anal sinus. They differ from typical *Turricula* in possessing a well-developed node of callus at the sutural edge of the posterior sinus and in the generally coarse reticulate sculpture exteriorly.

In this group may be included the species described under the names *Clathrodrillia aenone* Dall, *Clathrodrillia andromeda* Dall, *Pleurotoma militaris* Hinds, and perhaps *Turris* (*Surcula*) *resina* Dall.

Hindsiclava militaris Hinds in Reeve

Pleurotoma militaris HINDS, 1843, in Reeve, *Conchologia iconica*, vol. 1, *Pleurotoma*, sp. 55, pl. 7, fig. 55.

Clavatula militaris HINDS, 1843, *Proc. Zool. Soc. London*, p. 38; 1844, *The zoology of the voyage of H.M.S. Sulphur*, Mollusca, pt. 1, p. 16, pl. 5, fig. 10.

Drillia militaris Hinds, TRYON, 1884, *Manual of conchology*, vol. 6, p. 181, pl. 10, fig. 74 (copy of Reeve's figure).

Pleurotoma (*Drillia*) *militaris* Reeve, WEINKAUFF, 1887, *Pleurotomidae*, in *Systematisches Conchylien-Cabinet von Martini und Chemnitz*, vol. 4, div. 3, p. 132, pl. 29, fig. 10.

[?] *Clathrodrillia aenone* DALL, 1919, *Proc. U. S. Natl. Mus.*, vol. 56, p. 15, "Agua Verde Bay, Lower California."

TYPE LOCALITY: "Hab. Veragua, Central America (found in mud at the depth of eighteen fathoms); Hinds." [Panama.]

RANGE: Off Margarita Island, Magdalena Bay, Baja California, to Santa Inez Bay in the Gulf of California and south to Octavia Bay, Colombia.

MATERIAL EXAMINED: Twenty-three specimens from four samples from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 5 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 10 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24-28 meters, 2 very young specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24-28 meters, 5 specimens and 1 very young specimen probably this species.

MEASUREMENTS: Largest specimen from Octavia Bay: length, 33.8 mm.; maximum diameter, 9.3 mm. A very large specimen in the collections of the California Academy of Sciences from the southern portion of the Gulf of California: length, 56.4 mm.; maximum diameter, 17 mm.

HABITAT: Gray sand, sandy mud, and black mud bottom.

DESCRIPTION: Shell rather slender, spire acuminate, whorls strongly shouldered; axial sculpture consists of nodulous ribs, about 18 to 20 on the last whorl; spiral sculpture consists of lirae which decussate the axial ribs forming nodules, about 18 to 20 spirals present between the shoulder and the end of the canal, these become progressively finer anteriorly, between these are one to three finer spiral threads; color, yellowish brown to olive brown, the interior whitish.

REMARKS: The species described by Dall (1919a, p. 16, pl. 2, fig. 2) under the name *Clathrodrillia andromeda* appears to possess a shell very similar to that of the present species but is less slender and the base of the last whorl is much more rounded.

The Caribbean species described as *Pleurotoma consors* Sowerby, 1850 (see Rutsch, 1934, p. 99, pl. 8, figs. 13-16) bears a similarity to *Hindsiclava militaris*.

The present record of the occurrence of *Hindsiclava militaris* in Octavia Bay, Colombia, is a slight extension south of the known range.

GENUS CRASSISPIRA SWAINSON

Crassispira erebus Pilsbry and Lowe

Crassispira erebus PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 49, pl. 2, fig. 10. M. SMITH, 1944, Panamic marine shells, p. 39, fig. 512, ?fig. 530.

TYPE LOCALITY: "Corinto, Nicaragua, in about 20 fathoms (Lowe)."

RANGE: Tangola-Tangola Bay, Mexico, to Guayabo Chiquito, Panama.

MATERIAL EXAMINED: Two specimens from Guayabo Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters.

MEASUREMENTS: Larger specimen: length, 21.3 mm.; maximum diameter, 7.9 mm.

HABITAT: Gray mud bottom.

DESCRIPTION: Spire straightly conic; sculptured with about 15 narrow, smooth axial ribs (on last whorl) crossed by fine spiral striae, the subsutural cord finely nodose; brownish black.

REMARKS: On the larger specimen about every fourth or fifth spiral thread on the base of the last whorl and on the canal is a little larger than the others.

The present record of the occurrence of this species at Guayabo Chiquito, Panama, is an extension south of the known range.

Crassispira nigerrima Sowerby

Pleurotoma nigerrima SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 137. REEVE, 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 102, pl. 12, fig. 102.

Pleurotoma cornuta SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 136, "Hab. ad Sinum Caraccas Columbiae Occidentalis. Found in sandy mud at a depth of ten fathoms."

Drillia nigerrima Sowerby, TRYON, 1884, Manual of conchology, vol. 6, p. 196, pl. 14, fig. 91.

TYPE LOCALITY: "Hab. ad Panamam. Dredged in sandy mud in six and ten fathoms."

RANGE: Guaymas, Mexico, in the Gulf of California (Pilsbry and Lowe), to Santa Elena, Ecuador.

MATERIAL EXAMINED: Two specimens from two stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, dredged in 6-8 fathoms, 1 specimen.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24-28 meters, 1 specimen.

MEASUREMENTS: Larger specimen: length (tip of apex missing), 11.5 mm.; maximum diameter, 4.6 mm.

HABITAT: Sand and black mud bottom.

DESCRIPTION: Shell rather small, spire acuminate; sculptured on upper portion of whorl with a spiral keel above and below which there are a few fine spiral striae; axial ribs (about 13 on last whorl) become obsolete on the base and are crossed by fine spiral threads which become stronger and sometimes more widely spaced on the base and canal; black.

REMARKS: The specimens in the present collection referred to *Crassispira nigerrima* are small and not perfectly preserved. The identification is not positive, but the shells appear to be referable to this species.

The name *Pleurotoma cornuta* Sowerby has page priority over *P. nigerrima*. It has not been figured but has generally been considered identical with *P. nigerrima*. Because the type specimen of *P. cornuta* has not been illustrated and there remains an element of doubt as to the identity of the two species, we retain the well-known specific name *nigerrima* for the present species.

Crassispira turricula Sowerby

Pleurotoma turricula SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 137. REEVE, 1842, Conchologia systematica, vol. 2, p. 187, pl. 233, fig. 6; 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 49, pl. 6, fig. 49; in *errata* it is stated, "Species 49. For *P. turricula*, Sowerby—read *P. sowerbyi*, Reeve; and for *P. turricula*, refer to species 162."

Not *Murex turricula* Montagu, 1803.

Pleurotoma corrugata SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 137, "Hab. ad

Sinum Montijae et ad Portam Portreram. Found in muddy sand at ten fathoms' depth."

Not *Pleurotoma corrugata* Kiener, 1839-1840.

Drillia sowerbyi Reeve, TRYON, 1884, Manual of conchology, vol. 6, p. 180, pl. 10, fig. 67.

TYPE LOCALITY: "Hab. ad Sanctam Eleenam Columbiae Occidentalis. From sandy mud at a depth of six fathoms." [Santa Elena, Ecuador.]

RANGE: Magdalena Bay, Baja California, to Santa Elena, Ecuador.

MATERIAL EXAMINED: Three specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 2 specimens.

ECUADOR

3 miles west of light on Cape Santa Elena, April 10, 1941, Station 76, sample 274, 41 meters, 1 specimen.

MEASUREMENTS: A specimen from Piñas Bay: length, 36.2 mm.; maximum diameter, 12 mm.

HABITAT: Gray sand and sandy mud bottom.

REMARKS: Typical specimens of this dark-colored species are sculptured with about 12 to 15 slightly oblique axial ribs which become finer and slightly retractive anteriorly. These are crossed by about 22 (on the last whorl) spiral lirae which decussate the axial ribs and continue down over the canal. The subsutural collar is granulose. A strong projection of callus is present at the upper end of the anal sinus. The interior of the outer lip is slightly liriate.

There appears to be considerable variation in a series of specimens of this species. Some specimens have much coarser ribs than others and some have decidedly more rounded whorls whereas on typical specimens the body whorl is angulately shouldered.

The present authors [1951 (1940-1951), p. 73] have given a discussion of the synonymy of this species.

A subspecies, *Crassispira turricula bal-lenaensis* Hertlein and Strong [1951 (1940-1951), p. 73, pl. 11, figs. 4, 11], described from off Port Culebra, Costa Rica, is similar but differs from typical *C. turricula* in that the whorls are more rounded, the axial

ribbing is finer, and the last whorl is shorter in proportion to the height of the shell.

GENUS ELAEOCYMA DALL

Elaeocyma cf. *Elaeocyma nautica* Pilsbry and Lowe

Clathrodrillia nautica PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 44, pl. 2, fig. 1.

TYPE LOCALITY: "Acapulco, in about 20 fathoms (Lowe)." [Mexico.]

RANGE: Santa Inez Bay, Gulf of California, to Guayabo Chiquito, Panama.

MATERIAL EXAMINED: One specimen from Guayabo Chiquito, Panama, March 4, 1941, station 30, sample 78, dredged from center of bay to entrance, 25-64 meters.

MEASUREMENTS: Length, 29 mm.; maximum diameter, 6.6 mm.

HABITAT: Gray mud bottom.

REMARKS: The single shell here compared with *Elaeocyma nautica* Pilsbry and Lowe differs from typical forms of that species in that the whorls are rounded rather than decidedly angulate at the shoulder and the short riblets extending from the angulation to the periphery are narrower and proportionately longer. Possibly the shell may be considered a juvenile form of *E. nautica*. Large specimens of *E. nautica* attain a height of at least 34 mm.

Elaeocyma nautica bears a strong resemblance to *Crassispira tomliniana* Melvill (1927, p. 154, pl. 12, fig. 2) which was described from "Gorgona Isles, off the coast of Columbia, S. America (Hornell)," but is a little more slender in outline. Furthermore, the spiral threads below the periphery on the last whorl are of even strength; whereas, on Melvill's species, it appears that some of the corresponding threads are considerably larger than others, although no mention is made of this feature in the original description.

The occurrence of this species at Guayabo Chiquito, Panama, is an extension south of the known range.

Elaeocyma pallida Sowerby

Pleurotoma pallida SOWERBY, 1834, Proc. Zool. Soc. London, for 1833, p. 137. REEVE, 1843, Conchologia iconica, vol. 1, *Pleurotoma*, sp. 134, pl. 16, fig. 134.

Drillia pallida Sowerby, TRYON, 1884, Manual of conchology, vol. 6, p. 196, pl. 14, fig. 8.

Crassipira pallida Sowerby, M. SMITH, 1944, Panamic marine shells, p. 40, fig. 523.

TYPE LOCALITY: "Hab. ad Portam Portreram Americae Centralis. Found in thirteen fathoms, on a sandy muddy floor." [Costa Rica.]

RANGE: Tenacatita Bay, Mexico, to Ardita Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters.

MEASUREMENTS: Length (apex missing), 16.6 mm.; maximum diameter, 6 mm.

HABITAT: Gray sand bottom.

DESCRIPTION: Shell with spire acuminate, whorls rather rounded; axial sculpture consisting of sharp ribs which are continuous from suture to suture but deflected at the periphery, about 17 to 18 on the last whorl; interspaces crossed by fine spiral grooves; sinus broad and deep; anterior canal short and a little recurved; white.

REMARKS: The specimen of this species in the present collection is small. A large specimen in the collections of the California Academy of Sciences, dredged by the Templeton Crocker Expedition, 1932, off Manzanillo, Mexico, in 52 fathoms, measures: length, 26.6 mm.; maximum diameter, 9.4 mm.

The species from Panama described by E. A. Smith (1888, p. 305) as *Pleurotoma (Drillia) cretata* was said to differ from *E. pallida* "in having the upper part of the whorls excavated, in the ribs being almost obsolete above and not ending nodulously, as in that species, and the spiral striae are finer."

Melville (1917, p. 159) mentioned that *Drillia tasconium* Melville and Standen, described from the Gulf of Oman, is comparable to *E. pallida* but a quite distinct species.

The present record of the occurrence of *Elaeocyma pallida* at Ardita Bay, Colombia, is an extension south of the known range of this species.

GENUS GLYPHOSTOMA GABB

Glyphostoma partefilosa Dall

Glyphostoma partefilosa DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 53, pl. 17, fig. 4.

TYPE LOCALITY: "Range.—Off Cape Te-

poca, Gulf of California, in 36 fathoms, sand."

RANGE: Cape Tepoca in the Gulf of California to Guayabo Chiquito, Panama.

MATERIAL EXAMINED: One specimen from Guayabo Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters.

MEASUREMENTS: Length, 11.3 mm.; maximum diameter, 4.6 mm.

HABITAT: Gray mud bottom.

REMARKS: The last whorl of the present specimen is sculptured with about 11 axial ribs and on the base and canal, spiral sculpture consists of about 14 threads. The sculpture, size, and color agree so well with those of *Glyphostoma partefilosa* Dall that we refer it to that species. It appears possible that it may be referable to the very similar species described as *Clavatula candida* Hinds [1843c, p. 42; Hinds, 1844 (1844-1845), pt. 1, p. 20, pl. 6, fig. 18; Reeve, 1845 (1843-1878), vol. 1, *Pleurotoma*, sp. 221, pl. 25, fig. 221] from "Hab. Magnetic Island, coast of Veragua." Grant and Gale (1931, p. 605) considered Dall's species to be a synonym of *Clavatula candida*. However, the shell described by Hinds appears to be slightly broader in proportion to the height, the axial ribs shown in the original illustration are more curved, and the color is lighter. In view of these differences, we have applied the name proposed by Dall to the present species.

The present record of the occurrence of this species at Guayabo Chiquito, Panama, is an extension south of the known range.

GENUS LIOGLYPHOSTOMA WOODRING

Lioglyphostoma armstrongi Hertlein and Strong, new species

Plate 3, figure 12

HOLOTYPE: A.M.N.H. No. 73442: length (tip of apex missing), 11.8 mm.; length of last whorl, 5.5 mm.; maximum diameter, 4.4 mm. From Guayabo, Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25-64 meters, gray mud bottom, one specimen.

DESCRIPTION: Shell small, slender, spire acute, pale brown, interior white; nuclear whorls missing; subsequent whorls seven and one-half, the portion of the first one with an anterior peripheral keel; subsequent whorls

with a broad fasciole marked with short, arcuate striae which are crossed by two or three faint spiral striae, these are followed by three or four spiral threads strongest where they cross the axial ribs but faint in the interspaces, on the last whorl these number 19 or 20 to the end of the canal, those below the periphery gradually decreasing in size; axial sculpture (on the last whorl and excluding the terminal varix) of 10 slightly protractively oblique ribs which extend from the fasciole to the periphery where they divide into two rows of nodes which decrease in size towards the canal where they fade out; terminal varix large, margin incurved, finely denticulated; anal fasciole with a nodular callus on the body whorl and corresponding to this a well-developed denticle on the outer lip; canal rather short, deep, recurved, the aperture rather narrow.

REMARKS: The shell of this new species is quite similar in general appearance to that of *Lioglyphostoma adana* Dall (1919a, p. 52, pl. 17, fig. 1) from "Head of Concepcion Bay, Lower California," but it differs in that the axial ribs split, forming two rows of nodules below the periphery. Furthermore, it lacks the strong thread on the middle of the fasciolar band shown in the original illustration of Dall's species.

The axial ornamentation of the new species appears to be somewhat similar to that of a Miocene species, *Glyphostoma golfoyaquensis* Maury (1917, p. 225, pl. 35, figs. 17, 17a), described from "Zone 1, Rio Cana, near Caimito," Santo Domingo, in the Caribbean. The axial ribs of that species are said to increase by intercalation. Furthermore, the axial ribs on the present species are fewer, only 10 as compared to 13 or 14 on the Caribbean species.

Lioglyphostoma cf. *Lioglyphostoma sirena*
Dall

Glyphostoma sirena DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 53, pl. 17, fig. 3.

TYPE LOCALITY: "Range.—Station 2813, in the Galapagos Islands, in 40 fathoms, coral sand, surface temperature 81° F. U. S. Bureau of Fisheries."

RANGE: Ardita Bay, Colombia, to the Galapagos Islands.

MATERIAL EXAMINED: Three specimens from three samples from two stations:

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 1 specimen. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length (tip of apex missing), 13.3 mm.; maximum diameter, 4.5 mm.

HABITAT: Gray sand and black mud bottom.

REMARKS: The specimens here compared with *Lioglyphostoma sirena* resemble that species but differ in the greater number of spiral threads on the last whorl (to the end of the canal), about 18 in comparison with about 14 to 15 on the original illustration of Dall's species. The axial ribs on the largest specimen are curved similar to those of *L. sirena*, but on the other two they are more nearly vertical and more nearly resemble those of *L. adana* Dall (1919a, p. 52, pl. 17, fig. 1) from "Head of Concepcion Bay, Lower California." The axial ribs are not strongly developed in the subsutural area, and on the two larger specimens a fine subsutural spiral threadlet is present, and in both these characters they resemble *L. adana*. The number of spiral threads, about 18, is perhaps one or two fewer than on *L. adana*; furthermore they are not nodulous where they cross the axial ribs.

The present shells appear to possess characters intermediate between those of *L. sirena* and those of *L. adana*. However, in general they appear more nearly referable to *L. sirena*, and, in view of the variation shown in the present specimens, it appears justifiable to refer them questionably to that species.

The present record of specimens probably identical with this species at Ardita Bay, Colombia, is an extension north of the known range.

GENUS *KURTZINA* BARTSCH

Kurtzina antiochroa Pilsbry and Lowe

"*Mangelia*" *antiochroa* PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 56,

pl. 3, fig. 8 (as *Mangelia antichroa*). M. SMITH, 1944, Panamic marine shells, p. 41, fig. 546.

TYPE LOCALITY: "Montijo Bay, R. P. (Lowe)." [Panama.]

RANGE: Mazatlan, Mexico, to Piñas Bay, Panama.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14–33 meters.

MEASUREMENTS: Length, 9.7 mm.; maximum diameter, 2.8 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: The present shell agrees well with the original description and figure of "*Mangelia*" *antiochroa*. It differs only in that the specimen is bleached white and the chocolate bands are lacking.

The occurrence of this species at Piñas Bay, Panama, is a slight extension south of the known range.

NOTOCYTHARELLA HERTLEIN AND STRONG,
NEW GENUS

TYPE: *Cytharella niobe* Dall (1919a, p. 77, pl. 23, figs. 4, 5; "Panama, in beach drift; James Zetek.")

DESCRIPTION: Shell small, elongate; nuclear whorls three, the first two smooth, the third one spirally striated with finer radial striae, forming a reticulate pattern; adult whorls with about five to eight or more rounded, nearly vertical or slightly curved ribs which extend from suture to suture on the spire and nearly to the canal on the last whorl; spiral sculpture of fine threads sometimes separated by finer, close-set threadlets; aperture narrow, anal sulcus rather large, rounded, the outer lip thickened, both outer and inner lips smooth, canal barely differentiated from the body whorl.

REMARKS: The type of *Cytharella* Monterosato is *Murex costatus* Donovan (see Grant and Gale, 1931, p. 589) which appears to differ from west American species referred to that genus. Grant and Gale placed it in the synonymy of *Bela* Leach. They pointed out that *Pleurotoma bertrandi* Payraudeau, considered by Dall to be the type of *Cytharella*, does not occur in the original list of species cited by Monterosato. Grant and Gale placed the species *Cytharella niobe* Dall under *Agathotoma* Cossmann, the type of which is *Mangelia angusta* Jan (see Cossmann, 1896–1903, no. 2, pl. 7, figs. 29, 30)

from the Miocene and Pliocene of Europe. The first two nuclear whorls of *Mangelia angusta*, as illustrated by Cossmann, are smooth, and the third whorl is ornamented with strong radial sculpture and weak spiral striae. On the type species of *Notocytharella* the first two nuclear whorls are smooth and the third whorl bears reticulate sculpture of which the concentric element is the stronger. The later whorls also are ornamented with finer radial costae.

West American species referable to *Notocytharella* include *Philbertia ephedra* Dall, *Cytharella hastula* Pilsbry and Lowe, *Cytharella hippolita* Dall, *Cytharella niobe* Dall, *Cytharella phaethusa* Dall, *Cytharella taemior-nata* Pilsbry and Lowe, and perhaps others.

Notocytharella niobe Dall

Cytharella niobe DALL, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 77, pl. 23, figs. 4, 5.

TYPE LOCALITY: "Range.—Panama, in beach drift; James Zetek."

RANGE: ?Cape San Lucas, Baja California. Panama to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms.

MEASUREMENTS: Length (apex missing), approximately 4.1 mm.; maximum diameter, approximately 1.8 mm.

HABITAT: Mud and live shell bottom.

REMARKS: A single small somewhat bleached specimen, the apex missing, appears referable to this species. The spiral sculpture consists of major and minor threads, of which there are three major ones on the body whorl.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

FAMILY CANCELLARIIDAE

An excellent paper by Marks (1949) deals with the supraspecific units of this family, and a review of the eastern Pacific species by Strong appeared in 1954.

GENUS CANCELLARIA LAMARCK

Cancellaria albida Hinds

Cancellaria albida HINDS, 1843, Proc. Zool. Soc. London, p. 47; 1844, Ann. Mag. Nat. Hist., vol. 13, p. 222; 1844, The zoology of the voyage

of H.M.S. Sulphur, Mollusca, pt. 2, p. 42, pl. 12, figs. 9, 10. SOWERBY, 1849, Thesaurus conchyliorum, vol. 2, p. 442, pl. 94, fig. 43. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 45, pl. 10, figs. 45a, 45b. TRYON, 1885, Manual of conchology, vol. 7, p. 69, pl. 2, fig. 23. KOBELT, 1887, *Cancellaria*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 4, p. 83, pl. 21, fig. 7. M. SMITH, 1944, Panamic marine shells, p. 43, fig. 567.

TYPE LOCALITY: "Hab. the west coast of America, between 2° 47' south, and 9° 55' north latitude; viz. Bay of Guayaquil, Panama, and Veragua, in from seven to twenty-three fathoms."

RANGE: Off Maldonado Point, Mexico, to the Bay of Guayaquil, Ecuador.

MATERIAL EXAMINED: One specimen from Guayabo Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters.

MEASUREMENTS: Length, 20.8 mm.; maximum diameter, 10.8 mm.

HABITAT: Gray mud bottom.

DESCRIPTION: Shell rather small and slender, whorls gently rounded, slantingly shouldered and somewhat puckered at the sutures; color uniformly white, with a few irregular brown lines.

REMARKS: The shell of this species differs from that of *Cancellaria ventricosa* Hinds, another white shell, in the more slender form and the rounded rather than tabulate whorls.

Cancellaria decussata Sowerby

Cancellaria decussata SOWERBY, 1832, Proc. Zool. Soc. London, p. 55; 1832-1833, The conchological illustrations, *Cancellaria*, p. 2, sp. 8, pl. 9, fig. 8; 1849, Thesaurus conchyliorum, vol. 2, p. 446, pl. 92, fig. 3. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 22, pl. 5, figs. 22a, 22b. TRYON, 1885, Manual of conchology, vol. 7, p. 70, pl. 2, fig. 27. KOBELT, 1887, *Cancellaria*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 4, p. 18, pl. 4, figs. 7, 8.

TYPE LOCALITY: "Hab. ad oras Americae Meridionalis et Centralis. (Panama and Puerto Portrero.) Found at various depths from ten to thirteen fathoms, with a sandy muddy bottom."

RANGE: Magdalena Bay, Baja California, to Arena Point in the Gulf of California and south to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Three specimens from off Cape Pasado, Ecuador, latitude

00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms.

MEASUREMENTS: Largest specimen: length, 27.3 mm.; maximum diameter, 17.3 mm.

HABITAT: Mud and live shell bottom.

DESCRIPTION: Shell somewhat globose, whorls evenly rounded, sculpture finely, evenly decussated over entire surface; reddish brown or fawn colored, sometimes with a light band on the periphery.

REMARKS: *Cancellaria* (*Cancellaria*) *cominella* Pilsbry and Olsson (1941, p. 23, pl. 3, fig. 7) from the Pliocene of Ecuador bears a resemblance to the present species, but the shell is imperforate and the features of the nuclear and post-nuclear whorls are said to differ.

The present record of the occurrence of *C. decussata* off Cape Pasado, Ecuador, is an extension south of the known range.

Cancellaria indentata Sowerby

Cancellaria indentata SOWERBY, 1832, Proc. Zool. Soc. London, p. 54; 1832-1833, The conchological illustrations, *Cancellaria*, p. 2, pl. 10, fig. 10, not pl. 9, fig. 9, which is *C. cremata*. KIENER, 1841, Iconographie des coquilles vivantes, Canalifères, pt. 2, *Cancellaria*, p. 29, pl. 9, fig. 2, not pl. 8, fig. 4. REEVE, 1842, Conchologia systematica, vol. 2, p. 182, pl. 230, fig. 10. SOWERBY, 1849, Thesaurus conchyliorum, vol. 2, p. 444, pl. 92, fig. 7 only. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 41, pl. 9, figs. 41a, 41b. TRYON, 1885, Manual of conchology, vol. 7, p. 70, pl. 3, fig. 30 (copy of Reeve's figure).

TYPE LOCALITY: "Hab. ad Panamam."

RANGE: Santa Inez Bay, Gulf of California, to Cape Pasado, Ecuador.

MATERIAL EXAMINED: Three specimens from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 27 mm.; maximum diameter, 16 mm.

HABITAT: Gray sand and dead shell bottom.

DESCRIPTION: Whorls with sloping, sharply angulated shoulder; sculpture consisting of sharply reticulated ribs, about 20 axials crossed by concentric ribs, with a strong spiral cord at the angulation where sharp points occur at the intersection of the axial and concentric ribs; color reddish brown.

REMARKS: This species takes its name from the strong indentation of the inner lip just above the posterior fold on the columella.

The species described as *Cancellaria affinis* by Reeve [1856 (1843–1878), vol. 10, *Cancellaria*, sp. 39, pl. 9, figs. 39a, 39b, "Hab.—?"], without information as to the locality from which it came, is very similar to *C. indentata*. The illustration suggests that it is a little more slender and the whorls are more sloping above the angulation. Sowerby illustrated it under the name of *Cancellaria indentata* [1849 (1842–1887), vol. 2, pl. 95, fig. 80].

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

***Cancellaria gemmulata* Sowerby**

Cancellaria gemmulata SOWERBY, 1832, Proc. Zool. Soc. London, p. 55; 1832–1833, The conchological illustrations, *Cancellaria*, p. 1, pl. 9, fig. 7; 1849, Thesaurus conchyliorum, vol. 2, p. 446, pl. 92, fig. 14. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 48, pl. 10, figs. 48a, 48b. TRYON, 1885, Manual of conchology, vol. 7, p. 69, pl. 2, fig. 24. KOBELT, 1887, *Cancellaria*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 4, p. 84, pl. 21, figs. 9, 10.

TYPE LOCALITY: "Hab. in Sinu Nocoia, Americae Centralis. . . dredged from a sandy muddy bottom." [Costa Rica.]

RANGE: Gulf of California to Panama Bay. Galapagos Islands (Tomlin).

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6–8 fathoms.

MEASUREMENTS: Length, 16.5 mm.; maximum diameter, 11.6 mm.

HABITAT: Sand bottom.

DESCRIPTION: Globosely ovate, rather thick, whorls broadly rounded; sculptured with strong, rounded axial ribs which are

crossed by narrower spiral cords; columella with three plaits, the posterior one the largest.

REMARKS: The present specimen is whitish brown, with a brown concentric band around the periphery and another one on the base of the last whorl. This specimen, as well as others in the collections of the California Academy of Sciences, is umbilicate.

***Cancellaria obesa acuminata* Sowerby**

Plate 2, figure 26

Cancellaria acuminata SOWERBY, 1832, Proc. Zool. Soc. London, p. 53; 1832–1833, The conchological illustrations, *Cancellaria*, p. 1, pl. 9, fig. 5; 1849, Thesaurus conchyliorum, vol. 2, p. 458, pl. 92, fig. 1. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 4, pl. 1, figs. 4a, 4b. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 275, fig. 1817. CROSSE, 1861, Jour. Conchyl., vol. 9, p. 237. TRYON, 1885, Manual of conchology, vol. 7, p. 69, pl. 2, fig. 19 (copy of Sowerby's fig. 1). KOBELT, 1887, *Cancellaria*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 4, p. 22, pl. 5, figs. 7, 8.

TYPE LOCALITY: "Hab. ad Guacamayo, Americae Centralis. Found in a sandy muddy bottom at a depth of about twelve fathoms."

RANGE: Guacomayo, Central America (exact locality uncertain), to off Cape Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from 3 miles west of the light on Cape Santa Elena, Ecuador, April 10, 1941, Station 76, sample 274, 41 meters.

MEASUREMENTS: Length, 39.3; maximum diameter, 22.5 mm.

HABITAT: Sand bottom.

REMARKS: The present specimen agrees well with the illustration of *Cancellaria acuminata* given by Sowerby in 1849. The original illustration, 1832, shows a banded shell, the shape somewhat similar to that of *C. decussata*. The strong rounded axial ribs extend over the entire surface of the body whorl and are crossed by finer spiral cords. The appearance is somewhat different from that of young specimens of *C. obesa* Sowerby of the same size. However, most authors, including Sowerby and Reeve, considered *C. acuminata* to be a high-spired form of *C. obesa*. Those authors would likely have had Sowerby's type specimen available for study,

and we are therefore inclined to follow them to the extent of assigning *acuminata* to the rank of a subspecies of *C. obesa*. The original figure may be slightly exaggerated in certain details, thus giving an impression of a different sort of shell. The form illustrated by Sowerby [1832 (1832-1841), pl. 9, fig. 2] as *C. ovata* appears to be a very low-spined form of *C. obesa*. *Cancellaria kugleri* Rutsch (1934, p. 90, pl. 8, figs. 3, 4) described from the upper Miocene of Venezuela was compared to *C. acuminata* by its author.

The present record of the occurrence of *C. obesa acuminata* from off Ecuador is an extension south of the known range.

Cancellaria urceolata Hinds

Cancellaria urceolata HINDS, 1843, Proc. Zool. Soc. London, p. 47; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 41, pl. 12, figs. 7, 8. SOWERBY, 1849, Thesaurus conchyliorum, vol. 2, p. 443, pl. 94, fig. 48. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 23, pl. 5, figs. 23a, 23b. TRYON, 1885, Manual of conchology, vol. 7, p. 69, pl. 2, fig. 20 (copy of Reeve's fig. 23b).

Cancellaria affinis C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 356, 532, "Panama." CARPENTER, 1863, Proc. Zool. Soc. London, p. 347.

Not *Cancellaria affinis* Reeve, 1856.

TYPE LOCALITY: "Hab. The west coast of America, between 12° 2' and 21° 32' north latitude; viz. Gulf of Papagayo, in from eight to fourteen fathoms; San Blas, in seven fathoms."

RANGE: Magdalena Bay, Baja California, to San Felipe in the Gulf of California and south to Cape Pasado, Ecuador.

MATERIAL EXAMINED: Four specimens from two stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms, 2 specimens.

MEASUREMENTS: Largest specimen: length (apex missing), 22.8 mm.; maximum diameter, 15 mm.

HABITAT: Gray sandy mud, and sand and dead shell fragments.

DESCRIPTION: Whorls with narrowly rounded shoulder, sides of body whorl flattened, axial ribs distinctly coarser than the concentric cords; two plaits on columella.

REMARKS: The specimens of this species in the present collection are small. The axial ribs are more closely spaced on juvenile specimens.

The type of *Cancellaria affinis* C. B. Adams has not been illustrated, but Carpenter who examined the original specimens stated, "Very closely allied to *C. urceolata*."

Apparently the species cited from the eastern Pacific under the name of *Cancellaria candida* Sowerby, a Polynesian species, is referable to *C. urceolata*.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range. It also has been recorded as occurring from Pliocene to Recent.

SUBGENUS *NARONA* H. AND A. ADAMS

Cancellaria (Narona) clavatula Sowerby

Cancellaria clavatula SOWERBY, 1832, Proc. Zool. Soc. London, p. 52; 1832-1833, The conchological illustrations, *Cancellaria*, p. 2, pl. 10, fig. 12. KIENER, 1841, Iconographie des coquilles vivantes, Canalifères, pt. 2, *Cancellaria*, p. 31, pl. 5, fig. 2. REEVE, 1842, Conchologia systematica, vol. 2, p. 182, pl. 230, fig. 12. SOWERBY, 1849, Thesaurus conchyliorum; vol. 2, p. 445, pl. 92, fig. 13, pl. 95, fig. 67. REEVE, 1856, Conchologia iconica, vol. 10, *Cancellaria*, sp. 52, pl. 11, figs. 52a, 52b, 52c. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 277, fig. 1850. TRYON, 1883, Structural and systematic conchology, vol. 2, p. 181, pl. 57, fig. 1 [on p. 406 as *Cancellaria (Narona) clavatula*]; 1885, Manual of conchology, vol. 7, p. 75, pl. 4, fig. 61. KOBELT, 1887, *Cancellaria*, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 4, div. 4, p. 52, pl. 15, figs. 6-9. GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 615, pl. 27, fig. 2. M. SMITH, 1944, Panamic marine shells, p. 43, fig. 575.

TYPE LOCALITY: "Hab. ad Panamam et Paytam. It was taken up from a sandy muddy bottom in seven fathoms water."

RANGE: Mazatlan, Mexico, to Paita, Peru.

MATERIAL EXAMINED: Four specimens from two stations:

PANAMA

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25-64 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 3 specimens.

MEASUREMENTS: Largest specimen: length, 14.7 mm.; maximum diameter, 6.5 mm.

HABITAT: Gray sand and mud bottom.

DESCRIPTION: Adult shells of this species are slender, brownish, blotched and banded with white and sculptured with strong, rounded axial ribs and finer spiral cords. The varices are coarse and irregularly placed.

REMARKS: The present specimens are small. The identification of these shells with *Cancellaria clavatula* is based on their resemblance to young specimens from Panama so labeled in the collections of the California Academy of Sciences which were collected by Newcomb. There is an element of doubt in the identification of the present specimens, but the shells appear referable to this species rather than to *C. exopleura* Dall (1908, p. 294). Concerning that species Dall stated, "This is nearest to *C. clavatula* Sowerby, from the same region, which is a smaller shell, with one less whorl, with fewer ribs (ten on the antepenultimate whorl), which are rounded and much more prominent; the whorls in *C. clavatula* also increase more rapidly and have a tabulate aspect."

SUPERFAMILY RHACHIGLOSSA

FAMILY OLIVIDAE

Notes on some of the tropical west American species of this family have been published by Johnson (1911, 1915), Vanatta (1915), and Hill (1954).

GENUS OLIVA MARTYN

Oliva polpasta Duclos

Plate 3, figure 10

Oliva polpasta DUCLOS, 1833, Mag. Zool., yr. 3, cl. 5, pl. 20, 1 fig.; 1844-1845, in Chenu, Illustrations conchyliologiques, *Oliva*, p. 26, pl. 17, figs. 1, 2. REEVE, 1850, Conchologia iconica, vol. 6, *Oliva*, sp. 29, pl. 14, figs. 29a-29c. MARRAT, 1870-1871, in Sowerby, Thesaurus conchyliorum, vol. 4, p. 6, pl. 331 (*Oliva* pl. 4), figs. 42, 43. M. SMITH, 1944, Panamic marine shells, p. 34, figs. 428, 433.

Strephona polpasta Duclos, GRAY, 1865, List of the Mollusca in the . . . British Museum, pt. 2, Olividae, p. 13.

[*Oliva araneosa*] var. *polpasta* Duclos, TRYON, 1883, Manual of conchology, vol. 5, p. 82, pl. 29, fig. 83 (copy of Marrat's fig. 43).

Oliva cf. *litterata* Lamarck, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 271, pl. 7, fig. 60; = *O. polpasta* Duclos, according to Pilsbry, 1931, p. 433.

Oliva callosa LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 271, pl. 7, fig. 61, dredged in Panama Bay from depths from 10 to 40 feet in mud at the mouth of the Rio Grande near La Boca, about 1 mile from the mainland; = *O. polpasta* Duclos according to Pilsbry, 1931, p. 433.

TYPE LOCALITY: "Habite Panama."

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Ecuador.

MATERIAL EXAMINED: Seven specimens from four stations:

PANAMA

■ Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

Four specimens with label blurred (A-7065 readable) occurred in bag with others from Station 1, sample 2, which is Pacheca Island, Pearl Islands, beach on north side of island, in crevices in rocks, February 10, 1941.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 1 specimen.

MEASUREMENTS: Largest specimen: length, 34.8 mm.; maximum diameter, 19.5 mm.

HABITAT: Gray sand bottom.

DESCRIPTION: Shell short, rather broad and ventricose, widest above middle, spire generally low; olive-green to light brown ground color marked with dark brown dots and dashes or longitudinal zigzag lines, and just anterior to the suture there is a row of yellowish white trigonal spots, columella and interior of aperture bluish white; parietal wall liriate.

REMARKS: Most of the specimens of this species in the present collection are small. There is considerable variation in the shell of this species; some specimens are much more

inflated than others. The specimens in the present collection agree well with the illustrations of this species given by Duclos except that the ground color is brownish olive or light brown rather than olive-green. Our shells agree exactly with Reeve's interpretation of this species.

A study of a series of specimens of *O. polpasta* suggests that there is gradation towards the forms *O. spicata venulata* Lamarck on one hand and *O. julieta* Duclos on the other. It may be easily separated from *O. peruviana* Lamarck by the coloration, lower spire, and more consistently lirated parietal wall.

Oliva davisae Durham (1950, p. 103, pl. 26, figs. 3, 5), described from the Pleistocene of Santa Inez Bay in the Gulf of California, appears to be a very similar form.

Oliva polpasta has been recorded as occurring in the Pliocene of Ecuador and in the Pleistocene of Panama.

GENUS OLIVELLA SWAINSON

Olivella semistriata Gray

Plate 3, figure 22

Oliva semistriata GRAY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, p. 130, pl. 36, fig. 10. REEVE, 1850, Conchologia iconica, vol. 6, *Oliva*, sp. 61, pl. 23, figs. 61a, 61b. MARRAT, 1871, in Sowerby, Thesaurus conchyliorum, vol. 4, p. 28, pl. 348 (*Oliva* pl. 21), figs. 350, 351.

Olivina semisulcata GRAY, 1858, Proc. Zool. Soc. London, p. 55, "Hab. West Columbia"; 1865, List of the Mollusca in the . . . British Museum, pt. 2, Olividae, p. 30.

Olivella semistriata Gray, TRYON, 1883, Manual of conchology, vol. 5, pl. 15, fig. 71 (copy of Marrat's fig. 351). HIDALGO, 1898, Mem. R. Acad. Cien. Fis. Nat. Madrid, vol. 19, p. 539.

TYPE LOCALITY: No locality cited originally. Salango, Ecuador (cited by Reeve), here designated as type locality.

RANGE: San José Island, Gulf of California, to Sechura Bay, Peru.

MATERIAL EXAMINED: Forty-eight specimens from Ardita Bay, Colombia, March 5, 1941, Station 31, sample 80, on beach.

MEASUREMENTS: One of largest specimens: length, 11.1 mm.; maximum diameter, 5 mm. A specimen in the collections of the California Academy of Sciences from Piedra Blanca Bay, Costa Rica, measures: length, 20 mm.; maximum diameter, 8.1 mm.

HABITAT: On wet sand in front of advancing tide.

DESCRIPTION: Shell elongate, posteriorly acuminate, on adult specimens the posterior half of last whorl is often closely, finely, longitudinally sulcated; columella arched, one oblique fold at base; columellar callus extending up on the penultimate whorl; body whorl grayish lead color often with a narrow, yellowish band below the suture and another on the middle of the whorl, spire gray, sutures brown, base and columella white, interior deep chestnut-brown.

REMARKS: The shells here identified as *Olivella semistriata* Gray are certainly identical with those illustrated under that name by Reeve and Marrat. Although Gray's original description stated, "last whorl closely concentrically striated on the hinder half," an inspection of his figure 10 reveals but the faintest traces of either concentric or radial striae. Reeve and Tryon repeated Gray's remark concerning concentric striae, but Marrat stated what is certainly true of the specimen illustrated by Reeve as well as the present specimens, "having the upper half of the last whorl strongly and closely sulcated." Unless authors subsequent to Gray have misidentified Gray's species, it appears that his remarks about concentric striae are a mistake for longitudinal striae or sulcations.

The shell of this species differs from that of *Olivella columellaris* Sowerby in the higher spire, less strongly developed columellar callus, and in the presence of fine axial sulcations on the posterior half of the last whorl.

The form described as *Oliva affinis* Marrat [1871, in Sowerby (1870-1871), vol. 4, p. 28, pl. 348 (*Oliva* pl. 21), fig. 352] is very similar to and probably identical with *O. semistriata*. The original illustration shows only a trace of the axial sulcations such as are present on Gray's species.

Olivella undatella Lamarck

Oliva undatella LAMARCK, 1810, Ann. Mus. Hist. Nat., Paris, vol. 16, p. 326. DUCLOS, 1835, Histoire naturelle . . . de coquilles, genre Olive, pl. 5, figs. 5, 6, vars. 7-10. REEVE, 1850, Conchologia iconica, vol. 6, *Oliva*, sp. 73, pl. 25, figs. 73a-73e. MARRAT, 1871, in Sowerby, Thesaurus conchyliorum, vol. 4, p. 21, pl. 343 (*Oliva* pl. 16), figs. 258-262 (fig. 262 as var. *O. "nidulina"*).

Oliva nedulina DUCLOS, 1835, Histoire natur-

elle . . . de coquilles, genre Olive, pl. 5, figs. 13, 14, no locality cited; 1844, *in* Chenu, Illustrations conchyliologiques, *Oliva*, p. 12, pl. 6, figs. 13, 14. TRYON, 1883, Manual of conchology, vol. 5, pl. 33, fig. 31 (copy of Duclos' fig. 14).

Anazola undatella Lamarck, GRAY, 1858, Proc. Zool. Soc. London, p. 51; 1865, List of the Mollusca in the . . . British Museum, pt. 2, Olividae, p. 23.

Olivella undatella Lamarck, TRYON, 1883, Manual of conchology, vol. 5, p. 70, pl. 16, fig. 18, pl. 17, figs. 35-37 (copies of Marrat's figs. 258, 260, 261), fig. 38 (*Olivella* "*nodulina*" Duclos). M. SMITH, 1944, Panamic marine shells, p. 35, fig. 455. D. S. AND E. W. GIFFORD, 1947, Nautilus, vol. 60, pp. 81-84. HILL, 1954, Nautilus, vol. 68, p. 69.

TYPE LOCALITY: "Habite l'Océan pacifique, sur les côtes d'Acapulco, d'où M. Bonplan l'a rapportée." [Mexico.]

RANGE: Magdalena Bay, Baja California, to San Felipe in the Gulf of California and south to Punta Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, [sample 3], 14-33 meters.

MEASUREMENTS: Length, (approximately) 15.8 mm.; maximum diameter, 7.3 mm.

HABITAT: Sandy mud bottom.

DESCRIPTION: Shell subcylindrically ovate, spire rather short and sharp, columella with several well-spaced plaits and about four rounded, well-spaced, sometimes divaricate plaits on the base; color variable, ash-gray

with blue-gray or brown or zigzag lines or with triangular markings or with broad bluish gray or blackish blue band or sometimes almost entirely white, base usually with a yellow band streaked with brown and often a similar narrow band with brownish red dots or streaks just anterior to the suture; columella often white, sometimes stained with purple or brown.

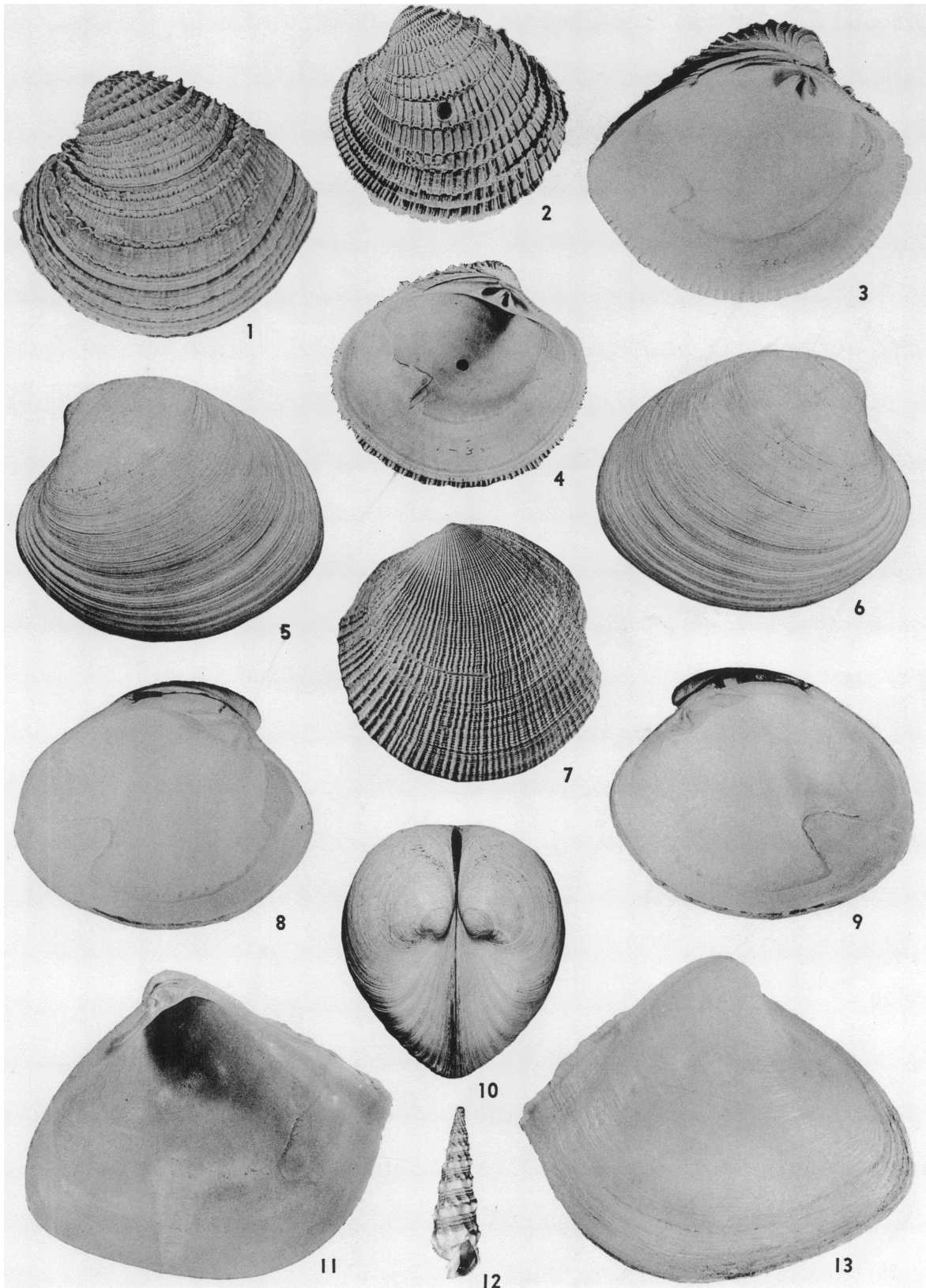
REMARKS: The shell of this species is characterized by its rather stout, subcylindrical shape, low spire, and strong, well-spaced columellar plaits. The color is variable, but usually the body whorl of the darker colored forms is ornamented with zigzag longitudinal lines or triangular markings and with two yellowish bands streaked with brown, one at the base and a narrower one just below the suture. The present specimen is white. D. S. and E. W. Gifford (1947, p. 82) recently mentioned that 20 per cent of the specimens of this species occurring at Santiago Bay, near Manzanillo, Mexico, are albino forms.

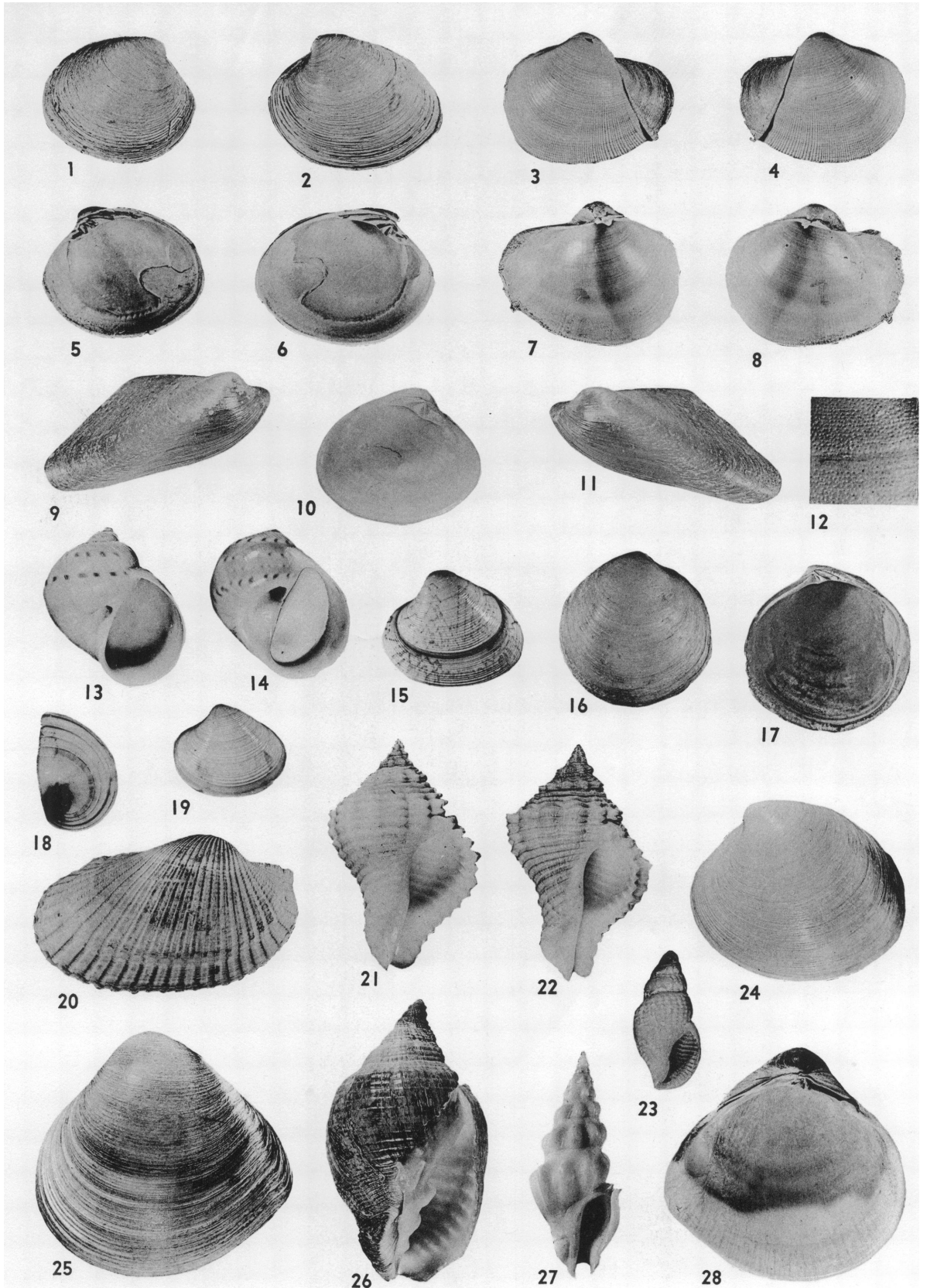
The form named *Oliva nedulina* by Duclos appears to be identical with this species. In view of the great variation in color shown in a series of specimens, the naming of shells of this species based only on variation in color would hardly seem useful.

Olivella dimidiata Pilsbry and Johnson, described from the Miocene of Santo Domingo, was compared by its authors with *O. undatella*.

PLATE 1

1. *Chione* (*Chionopsis*) *gnidia jamaniana* Pilsbry and Olsson. Exterior of left valve, $\times 1.04$; A.M.N.H. No. 73419; off Punta Pasado, Ecuador, 10 fathoms.
2. *Chione* (*Chionopsis*) *traftoni* Pilsbry and Olsson. Exterior of left valve, $\times 1.07$; A.M.N.H. No. 73417; Piñas Bay, Panama, 14-33 meters.
3. *Chione* (*Chionopsis*) *gnidia jamaniana* Pilsbry and Olsson. Interior of specimen shown in 1, $\times 1.09$.
4. *Chione* (*Chionopsis*) *traftoni* Pilsbry and Olsson. Interior of specimen shown in 2, $\times 1.16$.
- 5, 6. *Pitar* (*Pitarella*) *catharius* Dall. 5. Exterior of left valve, $\times 0.88$; A.M.N.H. No. 73430; Octavia Bay, Colombia, 24-28 meters. 6. Exterior of right valve of same specimen, $\times 0.88$.
7. *Lucina* (*Lucinisca*) *fenestrata* Hinds. Exterior of left valve, $\times 0.96$; C.A.S. No. 9889, Department of Paleontology type collection; Santa Inez Bay, Baja California, Mexico, 25 fathoms.
- 8-10. *Pitar* (*Pitarella*) *catharius* Dall. 8. Interior of left valve shown in 5, $\times 0.86$. 9. Interior of right valve shown in 6, $\times 0.89$. 10. Anterior end view of both valves together, $\times 0.89$.
11. *Mactrellona* (*Mactrellona*) *clisia* Dall. Interior of right valve, $\times 0.78$; A.M.N.H. No. 73425; Arditia Bay, Colombia, on beach.
12. *Terebra intertincta* Hinds. A.M.N.H. No. 73452, $\times 1.03$; off Cape Pasado, Ecuador, 15 fathoms.
13. *Mactrellona* (*Mactrellona*) *clisia* Dall. Exterior of specimen shown in 11, $\times 0.79$.





GENUS AGARONIA GRAY

Agaronia testacea Lamarck

Oliva testacea LAMARCK, 1810, Ann. Mus. Hist. Nat., Paris, vol. 16, p. 324. REEVE, 1850, Conchologia iconica, vol. 6, *Oliva*, sp. 36, pl. 18, fig. 36. MARRAT, 1871, in Sowerby, Thesaurus conchyliorum, vol. 4, p. 26, pl. 348 (*Oliva* pl. 21), figs. 334, 335. TRYON, 1883, Manual of conchology, vol. 5, pl. 34, fig. 65 (copy of Marrat's fig. 334). VON MARTENS, 1897, Arch. Naturgesch., 63d yr., vol. 1, p. 163, pl. 16, figs. 7, 12.

Oliva hiatula Gmelin, DUCLOS, 1835, Histoire naturelle de . . . coquilles, genre Olive, pl. 3, figs. 13, 14, not figs. 16, 17.

Not *Oliva hiatula* Gmelin, 1790.

Agaronia reevei MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 87 (based on Reeve's fig. 36).

TYPE LOCALITY: "Habite la mer du Sud, sur les côtes du Mexique, où M. Bonplan l'a recueillie."

RANGE: Punta Penasco in the Gulf of California to Peru.

PLATE 2

1, 2. *Pitar (Pitar) tomeanus* Dall. 1. Exterior of right valve, $\times 1.1$; A.M.N.H. No. 73428; Ardita Bay, Colombia, 34–43 meters. 2. Exterior of left valve, $\times 1.1$; A.M.N.H. No. 73475; same locality.

3, 4. *Cardium (Lophocardium) cumingii* Broderip. 3. Exterior of left valve, $\times 1.03$; A.M.N.H. No. 73416; Octavia Bay, Colombia, 24–28 meters. 4. Exterior of right valve of same specimen, $\times 1.03$.

5, 6. *Pitar (Pitar) tomeanus* Dall. 5. Interior of right valve shown in 1, $\times 1.2$. 6. Interior of left valve shown in 2, $\times 1.1$.

7, 8. *Cardium (Lophocardium) cumingii* Broderip. 7. Interior of left valve shown in 3, $\times 1.1$. 8. Interior of right valve shown in 4, $\times 1.09$.

9. *Modiolus eiseni* Strong and Hertlein. Exterior of right valve, $\times 1.0$; A.M.N.H. No. 73433; off Cape Pasado, Ecuador, 15 fathoms.

10. *Pitar (Pitar) fluctuatus* Sowerby. Interior of left valve, $\times 2.1$; A.M.N.H. No. 73429; Guayabo Chiquito, Panama, 25–64 meters.

11. *Modiolus eiseni* Strong and Hertlein. Exterior of left valve of specimen shown in 9, $\times 1.0$.

12. *Diplodonta semirugosa* Dall. Portion of exterior of right valve, $\times 20$; C.A.S. No. 9890, Department of Paleontology type collection; Port Parker, Costa Rica, 12 fathoms.

13. *Natica caneloensis* Hertlein and Strong, new species. Holotype, C.A.S. No. 9891, Department of Paleontology type collection; $\times 1.02$; Port Parker, Costa Rica, on beach.

14. *Natica grayi* Philippi. C.A.S. No. 9892, Department of Paleontology type collection, $\times 1.7$; off Cape San Lucas, Baja California, Mexico, 20–25 fathoms.

15. *Pitar (Pitar) fluctuatus* Sowerby. Exterior of specimen shown in 10, $\times 1.8$.

16, 17. *Diplodonta semirugosa* Dall. 16. Exterior of specimen shown in 12, $\times 1.8$. 17. Interior of same specimen, $\times 2.0$.

18. *Natica caneloensis* Hertlein and Strong, new species. Exterior of operculum of specimen shown in 13, $\times 1.1$.

19. *Pitar (Pitar) fluctuatus* Sowerby. Exterior of left valve, $\times 2.4$; A.M.N.H. No. 73427; Isla del Rey, Pearl Islands, Panama, 6–8 fathoms.

20. *Arca (Scapharca) concinna* Sowerby. Exterior of right valve, $\times 1.09$; A.M.N.H. No. 73415; Octavia Bay, Colombia, 24–28 meters.

21. *Hanetia pallida anomala* Reeve. A.M.N.H. No. 73441; $\times 1.1$; Isla del Rey, Pearl Islands, Panama, 6–8 fathoms.

22. *Hanetia pallida* Broderip and Sowerby. A.M.N.H. No. 73440; $\times 1.08$; Piñas Bay, Panama, 14–33 meters.

23. *Amphissa* sp. A.M.N.H. No. 73434, $\times 1.6$; off Cape Pasado, Ecuador, 15 fathoms.

24. *Pitar (Pitar) catharius* Dall. Exterior of left valve, $\times 1.05$; A.M.N.H. No. 73426; Octavia Bay, Colombia, 24–28 meters.

25. *Polymesoda isocardioides* Deshayes. Exterior of left valve, $\times 1.02$; A.M.N.H. No. 73431; Santelmo Bay, Isla del Rey, Pearl Islands, Panama, on beach.

26. *Cancellaria obesa acuminata* Sowerby. A.M.N.H. No. 73436; $\times 1.2$; off Cape Santa Elena, Ecuador, 41 meters.

27. *Cymatosyrinx roseola* Hertlein and Strong, new species. Holotype, C.A.S. No. 9893, Department of Paleontology type collection; $\times 1.2$; Gulf of Tehuantepec, Mexico, 28 fathoms.

28. *Polymesoda isocardioides* Deshayes. Interior of specimen shown in 25, $\times 0.94$.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, 14–33 meters.

MEASUREMENTS: Juvenile form: length, 13 mm.; maximum diameter, 5 mm. Adult specimens from the Gulf of California in the collections of the California Academy of Sciences measure: length, 55 mm.; diameter, 22.6 mm.

HABITAT: Gray sandy mud bottom.

DESCRIPTION: "O Cylindraceo-ventricosa, dorso testacea, extremitatibus fuscata; ore patulo, subviolaceo." (Original description.)

Shell rather large, thin, spire acutely tapering; aperture wide and flaring anteriorly, notched posteriorly; columella with twisted plaits; yellowish gray with brownish, flexuous, longitudinal lines, base brown, also brown towards apex, columella white, interior of aperture violet-brown.

REMARKS: There is variation in the outline and color of this species. Some authors have considered it to be identical with the west African *Agaronia hiatula* Gmelin. The two are undoubtedly very similar.

Von Martens (1897, pp. 160–167, pls. 15, 16) discussed the relationship of the west African and west American species. He recognized three subspecific forms of the west American species, which he cited as *Oliva (Agaronia) testacea*, *sensu stricto*, from Panama, *testacea* var. *griseoalba*, from Mexico, and *testacea* var. *philippii* from Cobija, Chile. In addition he cited two mutations which he stated might be only individual variations and not local races. These were cited as *Oliva (Agaronia) testacea* mut. *angularis*, and *testacea* mut. *candida*, a pure white form from Panama. *Oliva propatula* Conrad (1849, p. 156) was considered to be a synonym of *O. testacea* by Carpenter (1857, p. 265).

Agaronia murrha Berry (1953b, p. 417, text fig. 5, pl. 29, fig. 1) has been described recently from Corinto, Nicaragua. The shell of this form is said to differ from that of *A. testacea* in possessing a lower spire, longer aperture, constricted and relatively shallow sutural canal, and more ovate outline, and in other details.

Olsson, 1922, described *Oliva testacea* var. *costaricensis* from the Miocene of Costa Rica, and stated that it was wider, shorter, and had a lower spire than typical *testacea*.

The same author mentioned a form (1922, pp. 262–263) occurring in the Pleistocene and Recent of the east coast of Panama and of Costa Rica and said it differed from west coast specimens of *Agaronia testacea* in the more slender form and somewhat different coloration. Olsson has also described species of *Agaronia* which occur in the Oligocene and Miocene of Peru. *Agaronia testacea* has been recorded as occurring in the Pliocene of Costa Rica and Panama and in the Pleistocene of Maria Magdalena Island, Tres Marias group, and Oaxaca, Mexico.

According to D. S. and E. W. Gifford, this species, in the Gulf of California, was found living higher on the beach than any other olive shell.

FAMILY MITRIDAE

Some of the nomenclatorial problems connected with a study of this family have been mentioned by Woodring (1928, pp. 242–249) and Iredale (1929a, pp. 285–288). Dautzenberg (1935) published the results of a study of the East Indian species of Mitridae.

GENUS MITRA MARTYN

Von Martens and others have mentioned the fact that the west American mitras are especially characterized by the comparatively large number of black or brownish black species.

Hedley (1899b, p. 414) stated that the sea does not act as a barrier to many species of *Mitra* which occur on both continental and oceanic islands in the western Pacific. In connection with this observation it is interesting to note the occurrence (Hertlein, 1937, p. 308, pl. 1, fig. 23; Hertlein and Emerson, 1953, p. 352) of *Mitra papalis* Linnaeus at Clipperton Island, about 670 miles southwest of Acapulco, Mexico.

SUBGENUS TIARA SWAINSON

Mitra (Tiara) attenuata Swainson in Broderip

Plate 3, figure 18

Tiara attenuata SWAINSON, 1836, in Broderip, Proc. Zool. Soc. London, for 1835, p. 197.

Mitra attenuata Swainson (Broderip), REEVE, 1844, Conchologia iconica, vol. 2, *Mitra*, sp. 124, pl. 16, fig. 124. SOWERBY, 1874, Thesaurus conchyliorum, vol. 4, p. 11, pl. 363 (*Mitra* pl. 12), fig. 194. TRYON, 1882, Manual of conchology, vol. 4, pl. 40, fig. 184 (copy of Sowerby's fig. 194).

Not *Mitra attenuata* Reeve, 1844, *Conchologia iconica*, vol. 2, *Mitra*, pl. 6, fig. 45, "Hab.—?"; corrected in *errata*, "Species 45, for *Mitra attenuata* read *Mitra fulva*, var."

TYPE LOCALITY: "Hab. ad Insulam Cañam Americae Centralis. Found on a rocky bottom at the depth of twenty-eight fathoms." There is an Isle of Caño, Gulf of Nicoya, Costa Rica, and also an island of Caño west of the Gulf of Dulce, Costa Rica.

RANGE: Santa Margarita Island, Baja California, to Punta Penasco in the Gulf of California and south to Ecuador.

MATERIAL EXAMINED: Twelve specimens from four stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 2 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 very small specimen.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 24-64 meters, 6 specimens.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 24-28 meters, 3 specimens.

MEASUREMENTS: Largest specimen: length, 38 mm.; maximum diameter (imperfect), 10.6 mm. A very large specimen of this species in the collections of the California Academy of Sciences from Arena Bank in the Gulf of California measures: length, 52 mm.; maximum diameter, 15.5 mm.

HABITAT: Sand, gray sandy mud, and black mud bottom.

DESCRIPTION: Shell attenuately fusiform, spire high, body whorl tapering, whorls angulated posteriorly, sculptured with well-spaced, narrow, elevated spiral ridges, between which there are fine spiral and axial striae; columella with three plaits; color whitish, the spiral ridges sometimes brown, periostracum brown, aperture white.

REMARKS: The angulation on the shoulder of the last whorl is more pronounced on large adult shells of this species than on juvenile forms.

The shell of this species has a much higher spire and more angulated body whorl than that of *Mitra erythrogramma* Tomlin or *M.*

sulcata Swainson in Sowerby, 1825 (*M. funiculata* Reeve, 1844). Compared to *Mitra gigantea* Sowerby (*M. hindsii* Reeve, 1844), the present species has a stronger, sharper angulation on the shoulder of the body whorl, the ribs are narrower and a little more widely spaced, and the body whorl is more tapering anteriorly and has a smaller, siphonal fasciole.

FAMILY FASCIOLARIIDAE

GENUS FUSINUS RAFINESQUE

Fusinus panamensis Dall

Fusinus panamensis DALL, 1908, *Bull. Mus. Comp. Zool.*, vol. 43, p. 301.

TYPE LOCALITY: "U.S.S. 'Albatross', station 3391, Gulf of Panama, in 153 fathoms, mud, bottom temperature 55°.8 F."

RANGE: Gulf of Panama to off Cape Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from 3 miles west of light of Cape Santa Elena, Ecuador, April 10, 1941, Station 76, sample 274, 41 meters.

MEASUREMENTS: Length, 91.8 mm.; maximum diameter, 33 mm.

HABITAT: Sand bottom.

REMARKS: The shell of this species is sub-angulately shouldered on the last and penultimate whorls. From this shoulder the penultimate whorl slopes posteriorly to the suture. There are about 10 rather sharp tubercles along the angulation where it is crossed by low axial costae, but these tubercles become fainter towards the aperture.

The present record of the occurrence of this species off Cape Santa Elena, Ecuador, is an extension south of the known range.

This species also has been recorded as occurring in the Pliocene of Ecuador and the Galapagos Islands.

GENUS LATIRUS MONTFORT

Latirus hemphilli Hertlein and Strong

Latirus hemphilli HERTLEIN AND STRONG, 1951, *Zoologica*, New York, vol. 36, p. 79, pl. 2, fig. 4.

TYPE LOCALITY: "Port Parker, Costa Rica."

RANGE: Santa Margarita Island, Baja California, to Isla del Rey, Pearl Islands, Gulf of Panama.

MATERIAL EXAMINED: Three specimens from Bahia Santelmo, Panama, Isla del Rey,

Pearl Islands, February 14, 1941, Station 8, [no sample number given], 6–8 fathoms.

MEASUREMENTS: One of the largest specimens (canal imperfect): length, approximately 40.5 mm.; maximum diameter, 17 mm.

HABITAT: Sand bottom.

REMARKS: The specimens of this species in the present collection are almost covered with Bryozoa and other organisms, and the canals of the two larger ones are incomplete. These specimens possess rounded, somewhat uneven axial costae which are crossed by fine concentric riblets, and the whole is covered with a brown periostracum. In these and other characters the shells agree with *Latirus hemphilli* which was recently described from Port Parker, Costa Rica.

This species differs from *Latirus spadiceus* Reeve, originally described from an unknown locality, in the more slender form, less strongly rounded whorls, and in the longer canal. The whorls and axial ribs are more rounded and the spiral riblets are finer than those of *L. mediamericus* Hertlein and Strong (*Turbinella castanea* Reeve, 1847, not *Turbinella castanea* Gray, 1839).

The present record of the occurrence of *Latirus hemphilli* at the Pearl Islands in Panama Bay is an extension south of the known range.

GENUS LEUCOZONIA GRAY

Leucozonia cingulata Lamarck

Monoceros cingulatum LAMARCK, 1816, Tableau encyclopédique, Vers, pl. 396, figs. 4a, 4b; Liste, p. 2; 1822, Histoire naturelle des animaux sans vertèbres, vol. 7, p. 250. REEVE, 1842, Conchologia systematica, vol. 2, p. 224, pl. 261, fig. 4; 1846, Conchologia iconica, vol. 3, *Monoceros*, sp. 11, pl. 3, fig. 11. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 169, fig. 832.

Buccinum pseudodon BURROW, 1825, Elements of conchology, p. 172, pl. 26, fig. 2, "Habitat unknown"; 1844, *op. cit.*

Turbinella cingulata KIENER, 1841, Iconographie des coquilles vivantes, Canalifères, pt. 2, Turbinelle, p. 36, pl. 20, fig. 1 (2 figs.); reference to Tableau encyclopédique, pl. 396, figs. 4a, b); "Habite les côtes occidentales du Mexique, celles de la Californie."

Leucozonia cingulata Lamarck, TRYON, 1881, Manual of conchology, vol. 3, p. 96, pl. 70, fig. 180. VIGNON, 1931, Jour. Conchyl., vol. 75, p.

251, as *Latirus* (s.-g. *Leucozonia*) *cingulata* Lk., pl. 1, fig. 4. LAMY, 1931, Jour. Conchyl., vol. 75, p. 273. M. SMITH, 1940, World-wide sea shells, p. 62, fig. 848; 1944, Panamic marine shells, p. 32, fig. 411.

Monoceros angulatum ROGERS, 1913, The shell book, pl. 9, fig. 4; 1951, *op. cit.*, p. 482, as *Leucozonia cingulata* Lamarck.

Macron cingulatus Lamarck, HOFFSTETTER, 1952, Bol. Inst. Cien. Nat., Quito, yr. 1, p. 66.

TYPE LOCALITY: No locality cited originally. "Habite les côtes occidentales du Mexique" (Lamarck, 1822) accepted as type locality by the present authors.

RANGE: Mazatlan, Mexico, to Mancora, Peru. Supe Bay, Peru (Eyerdam).

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, December, 1942, C. M. Breder, Jr., collector.

MEASUREMENTS: Length, 41.8 mm.; maximum diameter, 31 mm. Large specimens attain a length of over 50 mm.

HABITAT: Not indicated. This species lives in shallow water, often between clefts of rocks.

DESCRIPTION: Shell rather broad; spire moderately elevated, whorls broadly rounded but concavely depressed on their upper portion, a sharp angular shoulder is usually present; sculptured with slightly raised, flattened, spiral ribs which are separated by wider interspaces bearing six or seven fine spiral threads of which a central one is often larger than the others; columella with two grooves anteriorly; canal slightly recurved, a fairly well-developed basal fasciole is present; outer lip crenated by the raised ribs, a long, narrow, sharp spine occurs near the base; exteriorly the raised ridges are deep chestnut-brown, the remainder white, aperture white except for brown spots near the edge corresponding to the ribs, periostracum yellowish brown.

REMARKS: *Leucozonia rudis* Reeve [1847 (1843–1878), vol. 4, *Turbinella*, sp. 51, pl. 10, fig. 51 "Hab.—?"] the only other Recent west American species of this genus, possesses a much higher spire, more rounded whorls, and in general appearance resembles the east American *L. cingulifera* Lamarck.

Leucozonia cingulata has been recorded as occurring in the Pleistocene of Ecuador.

FAMILY BUCCINIDAE

GENUS CANTHARUS BOLTEN

Cantharus sanguinolentus Duclos

Purpura sanguinolenta DUCLOS, 1833, Mag. Zool., yr. 3, cl. 5, pl. 22, fig. 1, and text.

Pollia haemastoma GRAY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, p. 112, no locality cited.

Buccinum haemastoma Gray, REEVE, 1846, Conchologia iconica, vol. 3, *Buccinum*, sp. 46, pl. 7, fig. 46. "Hab. Panama (under stones at low water); Cuming."

Buccinum janellii VALENCIENNES, 1846, Voyage autour du monde sur . . . la Vénus, Atlas de Zoologie, Mollusques, pl. 6, figs. 1, 1a-1c, no description or locality.

Not *Purpura janellii* Kiener, 1835-1836, Iconographie des coquilles vivantes, Purpurifères, Pourpre, pt. 1, p. 122, pl. 38, fig. 89 (2 figs.), "Habite l'Océan Pacifique, le rivage de Payta."

Pisania sanguinolenta Duclos, CARPENTER, 1857, Catalogue of . . . Mazatlan shells, p. 517.

Cantharus sanguinolentus Duclos, TRYON, 1881, Manual of conchology, vol. 3, p. 164, pl. 74, figs. 293 (copy of Duclos' fig. 1), 294 (copy of Reeve's fig. 46), 295 (copy of Valenciennes' fig. 1). M. SMITH, 1944, Panamic marine shells, p. 31, fig. 380.

TYPE LOCALITY: No locality cited originally. Panama Bay here designated as type locality.

RANGE: Point Abrejos, Baja California, to Guayaquil, Ecuador. Peru (Troschel). Also Cocos Island and Galapagos Islands.

MATERIAL EXAMINED: One specimen not localized and two specimens from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, northeast end of island, in 3 fathoms.

MEASUREMENTS: Length, 24 mm.; maximum diameter, 13 mm. Large specimens attain a length of 30 mm.

HABITAT: With masses of coral.

REMARKS: The shell of this species is characterized by the inner lip which bears small white warts on a blood-red ground, by the axial tubercles on the middle of the body whorl, and by the spiral ridges which here and there are red or reddish brown in color.

This species also has been recorded as occurring in the Pleistocene at Magdalena Bay, Baja California, of Oaxaca, Mexico, and the Galapagos Islands.

GENUS HANETIA JOUSSEAUME

Hanetia pallida Broderip and Sowerby

Plate 2, figure 22

Fusus pallidus BRODERIP AND SOWERBY, 1829, Zool. Jour., vol. 4, p. 378. GRAY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, p. 117, pl. 36, fig. 14.

Pyrula lignaria REEVE, 1847, Conchologia iconica, *Pyrula*, vol. 4, sp. 12, pl. 9, figs. 13a, 13b, "Hab.—?"; see Carpenter, 1855-1857, p. 502.

Fusus turbinelloides REEVE, 1848, Conchologia iconica, vol. 4, *Fusus*, sp. 56, pl. 15, fig. 56, "Hab. Africa?"

Not *Triton (Pusio) turbinelloides* Gray, 1834, in Griffith and Pidgeon, in Griffith, The animal kingdom . . . by . . . Cuvier, vol. 12, p. 600, pl. 25 (Mollusca), fig. 1.

Pyrula pallida Broderip, SOWERBY, 1880, Thesaurus conchyliorum, vol. 4, p. 100, pl. 422 (*Pyrula* pl. 5), figs., 37, ?38, "Hab.—?"

Melongena pallida Broderip and Sowerby, TRYON, 1881, Manual of conchology, vol. 3, p. 109, pl. 42, figs. 210, 211, 214, 215.

TYPE LOCALITY: "Hab. ad littora Oceani Pacifici. . . From Mazatlan." [Mexico.]

RANGE: San Ignacio Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Cape Pasado, Ecuador. Peru (Troschel).

MATERIAL EXAMINED: Twelve specimens from five stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 5 specimens.

Molino Cove, Piñas Bay, February 25, 1941, Station 20, sample 36, on beach at head of cove, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 1 specimen.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82 in 24-28 meters, 4 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, [sample 306], 10 fathoms, 3 specimens. Also latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, in 15 fathoms, 1 specimen.

MEASUREMENTS: Specimen from Piñas Bay, Panama: length, 35.9 mm.; maximum diameter, 24 mm. A very large specimen in the collections of the California Academy of Sciences dredged on Hannibal Bank, Panama, measures: length, 71.3 mm.; maximum diameter, 47 mm.

HABITAT: Gray sand and sandy mud, sand and shell fragments, mud and live shells, and black mud bottom.

DESCRIPTION: "F. testâ subfusiformi, sulcatâ, anfractibus medio carinato-tuberculatis; caudâ reflexâ; labio internè striato, margine crenulato; epidermide tenui; long. $1\frac{4}{10}$, lat. $\frac{8}{10}$, poll."

"A very pretty species, of a pale brownish colour, and with a white, internally striated aperture. A thin fuscous epidermis coats the outer surface; and the tubercles are sharp-edged" (Broderip and Sowerby).

REMARKS: The shell of this species is extremely variable in most characters, and the number of specific names adopted depends upon the number of specimens and lots before the student. We have large lots available for study, and we feel that the names can be reduced to one species, *pallida*, and a subspecies, *anomala*. This species was originally described from Mazatlan, Mexico, by Broderip and Sowerby, but it was not figured until 1839 when Gray published an illustration. This original figure shows blunt spines and is truly intermediate between the most and the least spinose of a large series. The most spinose form was described by Reeve under the specific name *turbinelloides*. The opposite extreme with rounded whorls and low spire was named *anomala* by Reeve. Both of these names were based on specimens of which the locality was unknown. All these are found in most large lots, and there is nearly every gradation between the two extremes. A very large siphonal fasciole is present on all the specimens. The spiral sculpture consists of spiral cords with about three fine riblets in the interspaces.

Variation exists not only in the sculpture but also in the thickness of the shell. There is a fairly heavy covering of dull-colored periostracum which upon removal leaves an uncolored or pale buff shell. We have observed a few Pleistocene fossils from Magda-

lena Bay which show faint reddish brown axial rows of spots.

Gray (1856, p. 41) who studied the soft parts of this species, cited it as "*Fusus pallidus* ('*F. turbinelloides* = *Pyrula lignaria*, Reeve')."

In the collections of the California Academy of Sciences there is a large specimen dredged on Hannibal Bank, Panama, which, if not actually identical with, certainly closely resembles, the shell illustrated by Olsson (1942, pp. 171, 219, pl. 23, fig. 1) under the name of *Hanetia* (*Fusinosteira*) *alternata* Nelson, from the Pliocene of Panama. Other large specimens in the Academy's collection are somewhat similar to *Hanetia cymioides* Pilsbry and Olsson (1941, p. 28, pl. 5, fig. 1) described from the "Jama formation, Puerto Jama," Ecuador, Pliocene. The fossil species, as suggested by its name, resembles the genus *Cymia* but the columella lacks plaits.

Pilsbry and Olsson (1941, p. 29) considered *Hanetia pallida* to be a generally northern tropical American form not occurring in the southern portion of the Panamic province. We have observed specimens dredged as far south as Hannibal Bank, Panama, and Pilsbry (1931, p. 433) in a rectification of Li's record of *Melongena* (*Pugilina*) *mengeana* Dall, cited *H. pallida* from Panama Bay. This species also occurs in the Pleistocene of Magdalena Bay, Baja California, and Panama.

Hanetia pallida anomala Reeve

Plate 2, figure 21

Pyrula anomala REEVE, 1847, *Conchologia iconica*, vol. 4, *Pyrula*, sp. 9, pl. 3, figs. 9, 12.

Melongena anomala Reeve, TRYON, 1881, *Manual of conchology*, vol. 3, p. 109, pl. 42, figs. 212, 213 (copies of Reeve's figs. 9, 12).

Solenosteira anomala Reeve, HANNA, 1926, *Proc. California Acad. Sci.*, ser. 4, vol. 14, p. 453, pl. 20, figs. 1, 2.

Cantharus anomalus Reeve, M. SMITH, 1944, *Panamic marine shells*, p. 31, fig. 396.

TYPE LOCALITY: Original locality unknown. Specimens typical of this species have been taken at Tenacatita Bay, Mexico.

RANGE: Magdalena Bay, Baja California, to Punta Penasco and San Felipe in the Gulf of California and south to Peru.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, 35.2 mm.; maximum width, 24.5 mm.

HABITAT: Sand bottom.

DESCRIPTION: "Shell solid, somewhat fusiform, whorls transversely grooved and striated, swollen in the middle, longitudinally plicated and noded; columella umbilicated; lip serrated; yellowish-white." (Original description.)

REMARKS: We have referred one specimen to this subspecies because it agrees almost exactly with Reeve's illustration (pl. 3, fig. 12) which according to him is a characteristic figure of this form. There appears to be all gradations between this form and the one shown in Reeve's plate 3, figure 9, as well as with typical *H. pallida*.

Compared to typical *H. pallida*, the present subspecies has more rounded whorls, a lower spire, and coarser spiral sculpture.

Probably records of *Buccinum modificata* Reeve [1846 (1843-1878), vol. 3, *Buccinum*, sp. 67, pl. 9, fig. 67. "Hab.—?"] from west American localities can be referred to somewhat elongate forms of *H. pallida anomala*.

This subspecies is known to occur from Pliocene to Recent.

Hanetia anomala burica Olsson (1942, p. 219, pl. 24, fig. 2), described from the Pliocene of Panama, is said to differ from typical *anomala* in that it possesses fewer axial ribs (about seven) and a more strongly ribbed shoulder.

Hanetia boggsi Pilsbry and Olsson (1941, p. 28, pl. 5, figs. 3, 4), described from the Pliocene of Ecuador, is said to resemble *Hanetia pallida anomala* but differs in that it possesses 15 to 17 axial ribs on the last whorl rather than 9 to 11. There are also related forms in the Miocene of the Caribbean region.

FAMILY NASSARIIDAE

GENUS NASSARIUS DUMÉRIL

The species of this genus, many of which have been described but not figured, offer considerable difficulty in their identification. Dall's (1917a) summary of west American

species, papers by Tomlin (1932a, 1932b) dealing with the type species described by A. Adams and Reeve, and Strong's (1945a) key to some of the west American species are all useful in a study of this group. In addition to these, Demond (1951, 1952) has recently published two papers containing the results of a study of the species of *Nassarius* occurring along the west coast of the United States and Baja California.

Nassarius pagodus Reeve

Buccinum decussatum KIENER, 1841, Iconographie des coquilles vivantes, Purpurifères, *Buccinum*, p. 109, pl. 30, fig. 3 (2 figs.), "Habite l'Océan Atlantique, sur les côtes d'Afrique"; locality erroneous.

Not *Buccinum decussatum* Linnaeus, 1758.

Triton pagodus REEVE, 1844, Conchologia iconica, vol. 2, *Triton*, sp. 97, pl. 20, fig. 97.

Nassa angulifera A. Adams, REEVE, 1853, Conchologia iconica, vol. 8, *Nassa*, sp. 34, pl. 6, fig. 34, "Hab. Galapagos Islands (at ten fathoms); Cuming."

Not *Nassa angulifera* A. Adams, 1851, according to Tomlin (1932a, p. 41) who stated concerning that species, "The locality, Galapagos Island, is incorrect, and the three types are the Mediterranean *miga* Brug."

Nassa canescens C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 283, 528, "Habitat.—Panama."

Hindsia pagodus Reeve, KOBELT, 1878, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 3, div. 2, p. 319, pl. 67, fig. 6.

Nassa pagoda Reeve, TRYON, 1882, Manual of conchology, vol. 4, p. 45, pl. 14, figs. 226 (copy of Reeve's fig. 97), 227 (copy of Kiener's fig. 3 of *decussata*), 228 (copy of Reeve's fig. 34 of *angulifera*).

Phos costatus Gabb, LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 269, pl. 7, figs. 55, 55a, dredged in Panama Bay.

Not *Phos costatus* Gabb, 1873; see Pilsbry, 1931, p. 433.

Nassarius pagodus Reeve, DEMOND, 1952, Pacific Sci., vol. 6, p. 310, pl. 1, fig. 7.

TYPE LOCALITY: "Hab. Bay of Montija, West Columbia; Cuming." [Panama.]

RANGE: Off Cape Tosco, Santa Margarita Island, Baja California, to Punta Penasco in the Gulf of California and south to the island of Puna, Ecuador.

MATERIAL EXAMINED: Forty-six specimens from seven samples from six stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, 6-8 fathoms, 2 very small specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 8 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to the entrance, 24-64 meters, 16 small specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 2 small specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24-28 meters, 8 specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24-25 meters, 8 young shells.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 2 specimens.

MEASUREMENTS: An adult specimen: length, 18.5 mm.; maximum diameter, 12 mm. A large specimen in the collections of the California Academy of Sciences, collected near Mazatlan, Mexico, by the Templeton Crocker Expedition, 1932, measures: length, 27.3 mm.; maximum diameter, 16.6 mm.

HABITAT: Sand, sandy mud, black mud, and live shell bottom.

REMARKS: This interesting species is characterized by its comparatively thin, rather broadly pyramidal shell, its strong decussate sculpture, and by the angulated character of the whorls at the shoulder of which on adults the ribs form rather sharp projections.

This species occurs fairly commonly along the west coast of Mexico in shallow water and sometimes on mud flats. It also has been recorded as occurring in the Pleistocene of Panama.

Nassarius versicolor C. B. Adams

Nassa versicolor C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 290, 529. REEVE, 1853, Conchologia iconica, vol. 8, *Nassa*, sp. 110, pl. 17, fig. 110. TRYON, 1882, Manual of conchology, vol. 4, p. 50, pl. 15, figs. 270 (copy of Reeve's fig. 110), 272 (copy of Reeve's fig. 112, *N. rufocincta*).

Nassa versicolor var. *striatula* C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 290, "Habitat.—Taboga."

Nassa rufocincta A. ADAMS, 1852, Proc. Zool. Soc. London, for 1851, p. 106, "Hab. Honduras (Dyson). Mus. Cuming." REEVE, 1853, Conchologia iconica, vol. 8, *Nassa*, sp. 112, pl. 17, fig. 112; according to Tomlin (1932a, p. 43), this is a synonym of *N. versicolor*.

Nassa albipunctata REEVE, 1853, Conchologia iconica, vol. 8, *Nassa*, sp. 144, pl. 21, fig. 144, "Hab.—?"; according to Tomlin (1932b, p. 95), this is a synonym of *N. versicolor*.

Nassarius versicolor C. B. Adams, DEMOND, 1952, Pacific Sci., vol. 6, p. 310, pl. 1, fig. 5.

TYPE LOCALITY: "Habitat.—Taboga." [Panama.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru. Also Galapagos Islands.

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms.

MEASUREMENTS: Length, 11.7 mm.; maximum diameter, 5.6 mm. A large specimen of this species in the collections of the California Academy of Sciences, collected at Magdalena Bay by Henry Hemphill, measures: length, 18 mm.; maximum diameter, 9.9 mm.

HABITAT: Bottom began to run to mud and live shells.

DESCRIPTION: Shell sculptured with nine or 10 rather narrow, prominent, rounded, axial ribs and by fine spiral striae or riblets. The color is usually pale yellowish brown or whitish, with brown spiral lines.

REMARKS: There is, as mentioned by Stearns, remarkable variation in the shell of this species, especially the spiral sculpture. The spiral striae on the typical form were described as almost obsolete on the middle of the last whorl. There is gradation from this to the form *striatula* C. B. Adams which was described as possessing 12 to 13 axial ribs and coarser spiral striae than *N. versicolor*. Probably Tryon was correct in considering the shells described as *Nassa crebristriata* Carpenter, *N. lecadrei* de Folin, and *N. proxima* C. B. Adams to be identical with *Nassarius versicolor*. Tomlin (1932b, p. 96), stated regarding *Nassa nucleolus* Reeve, "his

type is a small or young example of *N. versicolor* C. B. Adams." Furthermore he stated that Reeve's species is probably the same as *Buccinum nucleolus* Philippi (1846b, p. 52) described from "Patria: Mazatlan," Mexico.

Nassarius versicolor hooveri Arnold, 1903, described from the Pleistocene of San Pedro, California, is said to have a shorter spire and the body whorl more abruptly truncated anteriorly and to bear rounded, sinuous, axial ribs.

Nassarius ambiguus Montagu, which occurs in the Caribbean region, is a similar species. According to Dall (1915a), *N. gardnerae*, which he described from the Tampa Silex Miocene beds of Florida, belongs to the group of *N. versicolor*.

Watson (1882, pp. 369-370) has mentioned the differences between the shell of *N. versicolor* and that of the similar *N. capillaris* which was described from Fernando Noronha Island in the Atlantic Ocean.

Nassarius versicolor has been recorded from the Pleistocene of Magdalena Bay, Baja California, the Tres Marias Islands, and James Island, Galapagos group. It also has been recorded as excavated in archeologic ruins and middens near Flagstaff, Arizona.

GENUS PHOS MONTFORT

The results of a study of the west American species of *Phos* have been published in a paper by Strong and Lowe (1936). One species from Panama Bay, *Phos clarki* M. Smith (1944b, p. 27, pl. 1, fig. 2), has been added since.

Phos articulatus Hinds

Phos articulatus HINDS, 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 38, pl. 10, figs. 7, 8. SOWERBY, 1859, Thesaurus conchyliorum, vol. 3, pt. 19, p. 91, pl. 222, fig. 32. TRYON, 1881, Manual of conchology, vol. 3, p. 218, pl. 83, figs. 516, 517. STRONG AND LOWE, 1936, Trans. San Diego Soc. Nat. Hist., vol. 8, p. 309, pl. 22, fig. 6.

Phos turritus A. ADAMS, 1851, Proc. Zool. Soc. London, for 1850, p. 154, "Hab. Panama, coral sand, 6 to 10 fathoms; H.C." SOWERBY, 1859, Thesaurus conchyliorum, vol. 3, pt. 19, p. 91, pl. 222, fig. 37.

TYPE LOCALITY: "Inhab. Panama."

RANGE: Santa Inez Bay, Gulf of California, to Cape Pasado, Ecuador.

MATERIAL EXAMINED: Four specimens from four samples from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Bahia de Cuevita, May 11, 1941, Station 93, dredged east-southeast across bay, 5-20 fathoms, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, [sample 306], 10 fathoms, 1 specimen. Also sample 307, April 14, 1941, latitude 00° 31' 00" S., longitude 80° 35' 00" W., 15 fathoms, 1 specimen.

MEASUREMENTS: One of larger specimens: length, 27 mm.; maximum diameter, 10.2 mm. A large specimen from Hannibal Bank, Panama, in the collections of the California Academy of Sciences measures: length, 53.3 mm.; maximum diameter, 18.6 mm.

HABITAT: Gray sandy mud, sand and shell fragments, and mud and live shells.

REMARKS: The diameter of the body whorl is greater in proportion to the height on some specimens of these species than on others.

The shell of this species is characterized by the subangulate shoulder, spirally striated nuclear whorls, and narrow brown bands or clouds of brownish coloration.

Phos cocosensis Dall, also with subangulate shoulder on the last whorl, is said to possess a few flattish threads between the suture and the shoulder which are more prominent than the others, and apparently the nuclear whorls are smooth. Specimens questionably referred to that species have been recorded from the Pliocene of Ecuador.

Phos chelonia Dall differs from other west American species of this genus in that it possesses white varices.

Phos veraguensis Hinds

Phos veraguensis HINDS, 1843, Ann. Mag. Nat. Hist., new ser., vol. 11, p. 257; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 37, pl. 10, figs. 13, 14. TRYON, 1881, Manual of conchology, vol. 3, p. 219, pl. 84, figs. 529, 530. STRONG AND LOWE, 1936, Trans. San Diego

Soc. Nat. Hist., vol. 8, p. 314, pl. 22, figs. 2, 8, 9. M. SMITH, 1944, Panamic marine shells, p. 31, fig. 388.

Phos biplicatus CARPENTER, 1856, Proc. Zool. Soc. London, p. 166, "Hab. in Sinu Panamensi; legit T. Bridges, Sp. un. in Mus. Cuming."

F[usinus]. porticus DALL, 1915, Nautilus, vol. 29, p. 56, "inhabitant of Panama."

Phos alternatus DALL, 1917, Proc. U.S. Natl. Mus., vol. 51, p. 578, "From the Gulf of California."

TYPE LOCALITY: "Pueblo Nueva, coast of Veragua; dredged in some numbers from 26 fathoms, mud." [Panama.]

RANGE: Punta Penasco in the Gulf of California to Octavia Bay, Colombia.

MATERIAL EXAMINED: Ten specimens from two stations:

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of bay, 34-43 meters, 5 specimens.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 25 meters, 1 specimen and 4 others which apparently came from this locality.

MEASUREMENTS: Largest specimen: length, 28 mm.; maximum diameter, 11.8 mm. A large specimen from Santa Inez Bay in the Gulf of California in the collections of the California Academy of Sciences measures: length (apex missing), 34 mm.; maximum diameter, 15 mm.

HABITAT: Gray sand and black mud bottom.

REMARKS: The rounded, nodose, reticulate sculpture and two basal folds on the columella are characteristic features of this species.

The general character of *Phos veraguensis* is similar to that of *P. elegans* Guppy, *P. elegans limonensis* Olsson, and *P. moorei* Guppy, all from the Miocene of the Caribbean region.

The present record of the occurrence of *Phos veraguensis* from Octavia Bay, Colombia, is an extension south of the known range.

FAMILY COLUMBELLIDAE

Papers by Pace (1902) and Strong (1945b) are very useful in the study of the members of the Columbelloidea.

The supraspecific groups in some instances are rather difficult to separate.

GENUS MITRELLA RISSO

Mitrella ocellata Gmelin

Voluta ocellata GMELIN, 1791, Systema naturae, ed. 13, pt. 6, p. 3455. Reference to Martini, 1780, Neues Conchylien-Cabinet, vol. 4, pl. 150, fig. 1409.

Columbella guttata SOWERBY, 1832, Proc. Zool. Soc. London, p. 118, "Hab. ad Panamam, sub lapidibus"; 1844, Thesaurus conchyliorum, vol. 1, p. 131, pl. 39 (*Columbella* pl. 4), fig. 124; cited as *C. punctata* in explanation to plate.

Columbella cribraria Lamarck, SOWERBY, 1844, Thesaurus conchyliorum, vol. 1, p. 129, pl. 38 (*Columbella* pl. 4), figs. 112, 113 (juv.), "Very common at Panama, under stones, H. Cuming." REEVE, 1858, Conchologia iconica, vol. 11, *Columbella*, sp. 62, pl. 13, figs. 62a, 62b. TRYON, 1883, Manual of conchology, vol. 5, p. 122, pl. 48, figs. 73-75.

Mitrella ocellata Gmelin, BAKER, HANNA, AND STRONG, 1938, Proc. California Acad. Sci., ser. 4, vol. 23, p. 248, pl. 24, fig. 3.

Mitrella ocellata guttata Sowerby, M. SMITH, 1944, Panamic marine shells, p. 27, fig. 337.

TYPE LOCALITY: No locality cited originally, but West Indies mentioned by Martini.

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Guayaquil, Ecuador. Also Socorro Island and Galapagos Islands. Caribbean.

MATERIAL EXAMINED: One specimen from San José Island, Pearl Islands, Panama, November 26, 1945, R. C. Murphy collector.

MEASUREMENTS: Length (apex imperfect), 9.8 mm.; maximum diameter, 4.1 mm. The shell of this species attains a length of about 19 to 20 mm.

HABITAT: No habitat cited on label, but this species occurs commonly under rocks between tides in shallow water.

DESCRIPTION: Shell oblong-pyramidal, apex usually truncated; exterior ornamented with white dots upon a chocolate-brown ground, sometimes with an obscure light band below the periphery; aperture white.

REMARKS: There appears to be no satisfactory method for separating the west coast shells from the east American *Mitrella ocellata* Gmelin described in 1791.

Sowerby considered the west American shell to be referable to *Columbella cribraria* Lamarck, and both east and west coast shells have been cited under that name by

various authors. Lamarck's species was originally described in 1822 from "les mers de Java."

Columbella guttata Sowerby was described in 1832 from Panama. Later, 1844, in his discussion of *C. cribraria*, G. B. Sowerby, Jr., stated, "It has long been well known, but we have described it by the name of *Col. guttata* in Zool. Proc. ii, p. 118."

A subspecies, "*Nitidella guttata baileyi*," was described by Bartsch and Rehder (1939, p. 6, pl. 2, fig. 6), from Albemarle Island, Galapagos group. It was said to be darker than the typical form from Panama.

Mitrella ocellata bowdenensis Woodring, 1928, was described from the Bowden Miocene of Jamaica.

Mitrella ocellata has been recorded as occurring in the Pleistocene of Magdalena Bay, Baja California, and the Galapagos Islands.

GENUS COSMIOCONCHA DALL

Cosmioconcha modesta Powys

Plate 3, figure 19

Buccinum modestum POWYS, 1835, Proc. Zool. Soc. London, p. 94. REEVE, 1846, Conchologia iconica, vol. 3, *Buccinum*, sp. 19, pl. 4, fig. 19.

Truncaria modesta Powis, TRYON, 1882, Manual of conchology, vol. 4, p. 10, pl. 5, fig. 57 (copy of Reeve's fig. 19).

Strombina laevistriata LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 268, pl. 6, fig. 51, dredged in Panama Bay off mouth of Rio Grande River 10-40 feet; described as Miocene, but it is a Recent shell according to Pilsbry (1931, p. 433).

Cosmioconcha modesta Powis, M. SMITH, 1944, Panamic marine shells, p. 28, fig. 352.

TYPE LOCALITY: "Hab. ad oras Americae Centralis. Dredged from muddy gravel in the Bay of Montija, at a depth varying from seven to seventeen fathoms." [Panama.]

RANGE: La Libertad, El Salvador, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Seventeen specimens from five samples from four stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34-43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24-28 meters, 6 specimens. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24-28 meters, 6 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., Station 81, sample 307, 15 fathoms, 3 specimens.

MEASUREMENTS: One of largest specimens: length (apex missing), 22.4 mm.; maximum diameter, 8.5 mm.

HABITAT: Bottom of gray sand, black mud, black mud and live shell.

DESCRIPTION: Shell elongate, fusiform, whorls gently rounded; grooved spirals on base, above these there are well-developed spiral grooves or striae on the body whorl, the penultimate whorl, and sometimes on the earlier whorls; on the body whorl a fine spiral groove occurs just anterior to the suture, and anterior to this is a spiral cord followed by a very strong spiral groove; a varix is present behind the outer lip which is lirate interiorly, sometimes several axial plicae are present; a single groove is usually present towards the base of the columella; a narrow white band often occurs at the periphery and a whitish area is present near the sutures.

REMARKS: The shell of the present species usually possesses one varix behind the outer lip but on some specimens there are several axial plicae. One specimen from El Salvador, in the collections of the California Academy of Sciences, bears 12 such plicae.

The shell of this species can be separated from other similar west American species of *Cosmioconcha* by the presence of comparatively strong spiral grooves usually on the penultimate whorl. The last whorl of this species is more slender than that of *Cosmioconcha palmeri* Dall (1913, p. 589; 1925, p. 2, pl. 21, fig. 8) described from the head of the Gulf of California, but is much more inflated than that of *C. parvula* Dall (1913, p. 590; 1925, p. 2, pl. 21, fig. 1) or *C. pergracilis* Dall (1913, p. 590; 1925, p. 2, pl. 21, fig. 9). Occasionally specimens bear characteristics intermediate between *C. modesta* and *C. palmeri*, but the former can usually be recognized by the more numerous spirals on the base.

Some of the shells of this species are reminiscent of those of the genus *Metula*. They differ in the more bucciniform shape, greater width of pillar at the base, and in the lack of a thick columellar callus. Furthermore, they usually lack the decidedly reticulate pattern of sculpture so well developed on *Metula*.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range. It has been recorded by Olsson as occurring in the Pleistocene of Panama.

GENUS AMPHISSA H. AND A. ADAMS

Amphissa sp.

Plate 2, figure 23

MATERIAL EXAMINED: One specimen from off Cape Pasado, Ecuador, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms.

MEASUREMENTS: Length, 13.8 mm.; maximum diameter, 6.5 mm.

HABITAT: Bottom of mud and live shells.

REMARKS: The single shell here discussed differs, so far as we are aware, from any described species. We are convinced that it is undescribed, but the imperfect preservation has led us to the opinion that this specimen would not be suitable for a type.

The interior of the outer lip bears about 16 lirae. The general reticulate sculpture is very similar to that of *Amphissa meridionalis* Pilsbry and Olsson (1941, p. 36, pl. 2, fig. 6) described from the Pliocene of Puna Island, Ecuador, but the whorls of the present form are more acutely rounded. The present shell resembles the similarly sculptured *Amphissa lyrta* Baker, Hanna, and Strong (1938b, p. 252; Strong, 1938, p. 215, pl. 15, fig. 1), which was described from Isla Partida in the Gulf of California, but apparently differs in the larger size and in the possession of more numerous axial ribs.

GENUS STROMBINA MÖRCH

Strombina gibberula Sowerby

Columbella gibberula SOWERBY, 1832, Proc. Zool. Soc. London, p. 115. DUCLOS, 1835, Histoire naturelle . . . de coquilles, genre Colombelle, pl. 12, figs. 5, 6. SOWERBY, 1844, Thesaurus conchyliorum, vol. 1, p. 136 (bis), pl. 39 (*Columbella* pl. 4), figs. 142, 143. DUCLOS, 1846, in Chenu, Illustrations conchyliologiques, Colombelle, pl. 12,

figs. 5, 6. REEVE, 1858, Conchologia iconica, vol. 11, *Columbella*, sp. 61, pl. 13, figs. 61a, 61b. TRYON, 1883, Manual of conchology, vol. 5, p. 184, pl. 60, fig. 90 (copy of Reeve's fig. 61b), pl. 63, fig. 71 (figs. of dentition from Troschel).

Strombina gibberula Sowerby, M. SMITH, 1944, Panamic marine shells, p. 28, fig. 354.

TYPE LOCALITY: "Hab. ad oras Americae Meridionalis et Centralis. Found in sandy mud at eleven fathoms depth, at the Bay of Caraccas and Puerto Portrero."

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, 6-8 fathoms.

MEASUREMENTS: Length, 7.3 mm. Large specimens in the collections of the California Academy of Sciences measure 13.5 mm. in length and 6.4-6.5 mm. in diameter.

HABITAT: Sand bottom.

DESCRIPTION: Shell small, outer lip greatly thickened; body whorl with hump of callus on back and side; the humps white, the remainder with reticulated chestnut-brown lines on yellowish white ground.

REMARKS: The shell of this species is similar to that of *Strombina dorsata* but is smaller and has more strongly incised lines on the canal.

We have observed specimens of this species taken on the beach and others dredged to a depth of 55 fathoms. It also has been recorded as occurring in the Pliocene of Ecuador, and the Pleistocene of Scammon Lagoon, and Magdalena Bay, Baja California, and Panama.

Strombina hirundo Gaskoin

Plate 3, figure 5

Columbella hirundo GASKOIN, 1852, Proc. Zool. Soc. London, for 1851, p. 12. REEVE, 1859, Conchologia iconica, vol. 11, *Columbella*, sp. 219, pl. 34, figs. 219a, 219b. TRYON, 1883, Manual of conchology, vol. 5, p. 147, pl. 52, fig. 94 (copy of Reeve's figure 219a).

TYPE LOCALITY: "Hab. Per the 'Samarang.' Cab. Gaskoin." Typical specimens of this species have been taken off Maldonado Point, Mexico, and other localities in tropical west American waters.

RANGE: Southeast of Santa Margarita Island, west coast of Baja California to Cape Pasado, Ecuador.

MATERIAL EXAMINED: Six specimens from four stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 2 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, 18 mm.; maximum diameter, 6.6 mm.

HABITAT: Gray sand, sandy mud, and mud and live shells.

DESCRIPTION: Shell small, slender, spire attenuated, smooth, shining, body whorl lacking a hump of callus; canal long, somewhat diverging at the end, spirally striated; outer lip thickened, a sinuation at the posterior end, below this a single denticle and sometimes a trace of a second; columella arched; exterior whitish, freckled with many orange-brown lines.

REMARKS: This beautiful little species is characterized by the slender, shiny shell, lack of a hump of callus on the body whorl, single strong denticle below the sinuation in the outer lip, and the long canal. In perfect specimens the canal diverges at the end, suggesting a swallow's tail, hence the specific name *hirundo*.

This species is exceptional in that it lacks the hump of callus on the last whorl, a feature that occurs on most species of *Strombina*.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

Strombina recurva Sowerby

Plate 3, figure 17

Columbella recurva SOWERBY, 1832, Proc. Zool. Soc. London, p. 115. DUCLOS, 1835, Histoire

naturelle . . . de coquilles, genre Colombelle, pl. 12, figs. 13, 14. REEVE, 1842, Conchologia systematica, vol. 2, p. 218, pl. 257, fig. 8. SOWERBY, 1843, Thesaurus conchyliorum, vol. 1, p. 139 (bis), pl. 40 (*Columbella* pl. 5), fig. 152. DUCLOS, 1846, in Chenu, Illustrations conchyliologiques, Colombelle, pl. 12, figs. 13, 14. REEVE, 1858, Conchologia iconica, vol. 11, *Columbella*, sp. 18, pl. 4, figs. 18a, 18b. TRYON, 1883, Manual of conchology, vol. 5, p. 187, pl. 60, fig. 3 (copy of Reeve's fig. 18a); under section *Strombina*.

TYPE LOCALITY: "Hab. ad oras Americae Meridionalis. (Isle of Plata.) Found among coral sand at a depth of seventeen fathoms." [Ecuador.]

RANGE: San Ignacio Lagoon, Baja California (E. K. Jordan). Acapulco, Mexico, to Lobitos, Peru.

MATERIAL EXAMINED: Twenty specimens from six samples from four stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 8 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters, 7 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course, 24–28 meters, 1 specimen. Also sample 83, March 7, 1941, dredged a little inside sample 82, 24–28 meters, 4 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, 10 fathoms; also sample 307, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, 15 fathoms, 2 shells with labels for samples 306 and 307 together.

MEASUREMENTS: Large specimen: length (apex incomplete), 32.5 mm.; maximum diameter, 13 mm.

HABITAT: Gray sand, sand and shell fragments, sandy mud and black mud bottom which began to run to live shells.

DESCRIPTION: Shell moderately broad, first six whorls axially ribbed, the remainder with a single row of tubercles at the shoulder which are crossed by a few fine spiral lines; canal spirally grooved, recurved; interior of outer lip with denticles; outer surface of shell often with a network of fine irregular grooves.

REMARKS: The shell of this species is similar to that of *Strombina lanceolata* but is less elongated. *Strombina gradata humboldti* Rutsch, 1934, described from the upper Miocene of Venezuela, was compared with *S. recurva*.

We have observed specimens of *Strombina recurva* which were dredged from off west Mexico to Costa Rica, in 5.5 to 30 fathoms. It has also been recorded as occurring in the Pliocene of Costa Rica, Panama, and Ecuador and in the Pleistocene of Panama and the Galapagos Islands.

GENUS *ANACHIS* H. AND A. ADAMS

Anachis rehderi Hertlein and Strong

Anachis rehderi HERTLEIN AND STRONG, 1951, Zoologica, New York, vol. 36, p. 83, pl. 2, fig. 14.

TYPE LOCALITY: "Off Port Parker, Costa Rica, Lat. 10° 55' 45" N., Long. 85° 49' 05" W., dredged in 12 fathoms (22 meters), shelly mud."

RANGE: Port Parker, Costa Rica, to Octavia Bay, Colombia.

MATERIAL EXAMINED: Three specimens from Octavia Bay, Colombia, March 7, 1941, (Station 32, sample 83), dredged a little inside sample 82, 24–28 meters.

MEASUREMENTS: Length, 7.5 mm.; maximum diameter, 3 mm.

HABITAT: Black mud bottom.

REMARKS: The shell of this species may be separated from that of similar forms, such as *Anachis gracilis* C. B. Adams, by the fact that the axial ribs are expanded anteriorly to the suture to form a cord-like row of raised nodules coronating the whorls. Spiral sculpture is lacking on the spire but is present on the base and canal.

The present record of the occurrence of this species in Octavia Bay, Colombia, is an extension south of the known range.

FAMILY MURICIDAE

A monograph of the species of *Murex* occurring in the western Atlantic has been published by Clench and Pérez Farfante (1945). Among earlier papers dealing with the classification of this family those of Jousseaume (1879, 1880), Baker (1895), Cossmann (1903), Dall (1923), and Grant and Gale (1931, pp. 704–731) are all very useful.

GENUS *MUREX* LINNAEUS

SUBGENUS *MUREX*, SENSU STRICTO

Murex (Murex) recurvirostris Broderip

Murex recurvirostris BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 174. SOWERBY, 1834–1841, The conchological illustrations, *Murex*, p. 1, pl. 59, fig. 9 (as *Murex recurvirostrum*). REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 75, pl. 19, fig. 75. SOWERBY, 1879, Thesaurus conchyliorum, vol. 4, p. 4, pl. 381 (*Murex* pl. 2), fig. 16. TRYON, 1880, Manual of conchology, vol. 2, p. 80, pl. 11, fig. 193. M. SMITH, 1944, Panamic marine shells, p. 24, fig. 286.

Murex nigrescens SOWERBY, 1841, Proc. Zool. Soc. London, for 1840, p. 138, "Hab. ad Xipixapi. H. Cuming legit"; 1839–1841, The conchological illustrations, *Murex*, p. 1, pl. 198, fig. 113. REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 92, pl. 23, fig. 92. TRYON, 1880, Manual of conchology, vol. 2, p. 81, pl. 12, fig. 124.

TYPE LOCALITY: "Hab. in Americâ Centrali. (Gulf of Nicoiyo.) Found in sandy mud at the depth of nine fathoms." [Costa Rica.]

RANGE: Mazatlan, Mexico, to Jipijapa, Ecuador.

MATERIAL EXAMINED: One specimen from Guayabo Chiquito, Panama, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance, 25–64 meters.

MEASUREMENTS: Small specimen: length, 25 mm.; maximum diameter, 12.1 mm. This species attains a height of 55 mm. or more.

HABITAT: Gray mud bottom.

DESCRIPTION: Shell with about seven to eight strongly convex whorls, spire rather low, anterior canal long and slender; three large, rounded varices present, the backs excavated or pitted, a spine may be present on the varices at the shoulder with two or three small spines anteriorly or they may be devoid of spines; there are usually three axial ridges between the varices, the whole crossed by spiral ridges; anterior canal usually bearing one, sometimes two small spines below the aperture; edge of outer lip finely crenated, the interior under the varix bears denticles corresponding to about every two of the crenellations on the edge; color brownish, often with a slaty or bluish black concentric band around the shoulder of the penultimate and body whorls and sometimes another band at the base of the body whorl, the spiral cords usually reddish brown.

REMARKS: This species was originally described from the Gulf of Nicoya, Costa Rica. The typical form as illustrated by Sowerby and Reeve is brownish with slaty-black concentric bands of color and the varices are not spinose. According to Tryon, it rarely exceeds 2 inches in length. Clench and Pérez Farfante (1945, p. 9) stated that a study of cotypes of *Murex recurvirostris* Broderip and *M. nigrescens* Sowerby reveals that the latter is an absolute synonym of Broderip's species.

Study of a series of specimens of this species indicates that there is variation in the height of the spire, in the spinosity of the varices, and in the degree of light or dark coloration. A study of the present collection together with specimens in the California Academy of Sciences seems to indicate that the forms in the Gulf of California region attain a greater size and are in general lighter in color with light reddish concentric lines. We consider this form to be a northern subspecies originally described under the name of *Murex ? recurvirostris* var. *lividus* Carpenter (1855-1857, p. 519) from Mazatlan, Mexico. Steinbeck and Ricketts (1941, p. 522, pl. 2, fig. 1; inner and outer figures only; central figure = *M. elenensis*) illustrated this subspecies from San Lucas Cove, Baja California, under the name of *Murex rectirostris*. There is complete integradation between the northern shells and typical *M. recurvirostris*, but the subspecies *lividus* appears to be characteristically developed in the Gulf of California region.

Murex rectirostris Sowerby (1841b, p. 138; 1841 [1832-1841], *Murex*, p. 1, pl. 197, fig. 111) was described without information as to the locality from which it came. Sowerby stated that it differed from *M. recurvirostris* in the more elongated spire and in the longer caudal canal. Reeve [1845 (1843-1878), vol. 3, *Murex*, sp. 91, pl. 22, fig. 91] illustrated the species and gave the locality as "Xipixapi, west Colombia" [Ecuador]. This illustration as well as that of Sowerby shows a well-developed spine on the shoulder of the varix. Some shells from tropical west American waters agree exactly with Reeve's figure of *M. rectirostris*. However, E. A. Smith (1906, p. 169) cited a variety of this species from south of Lower Burma, in 61 fathoms. He

stated "The locality given by Reeve, 'West Colombia', I regard as a mistake, for Mr. G. B. Sowerby informs me that he knows it for a certainty as a Hong Kong species." Yen (1942, p. 222, pl. 20, fig. 137) cited the type locality of *Murex rectirostris* as "(Hong Kong)" and illustrated specimens said to be "Cuming (types)." If it is assumed that Cuming's locality for this *Murex* is correct, the species can be excluded from the list of west American mollusks.

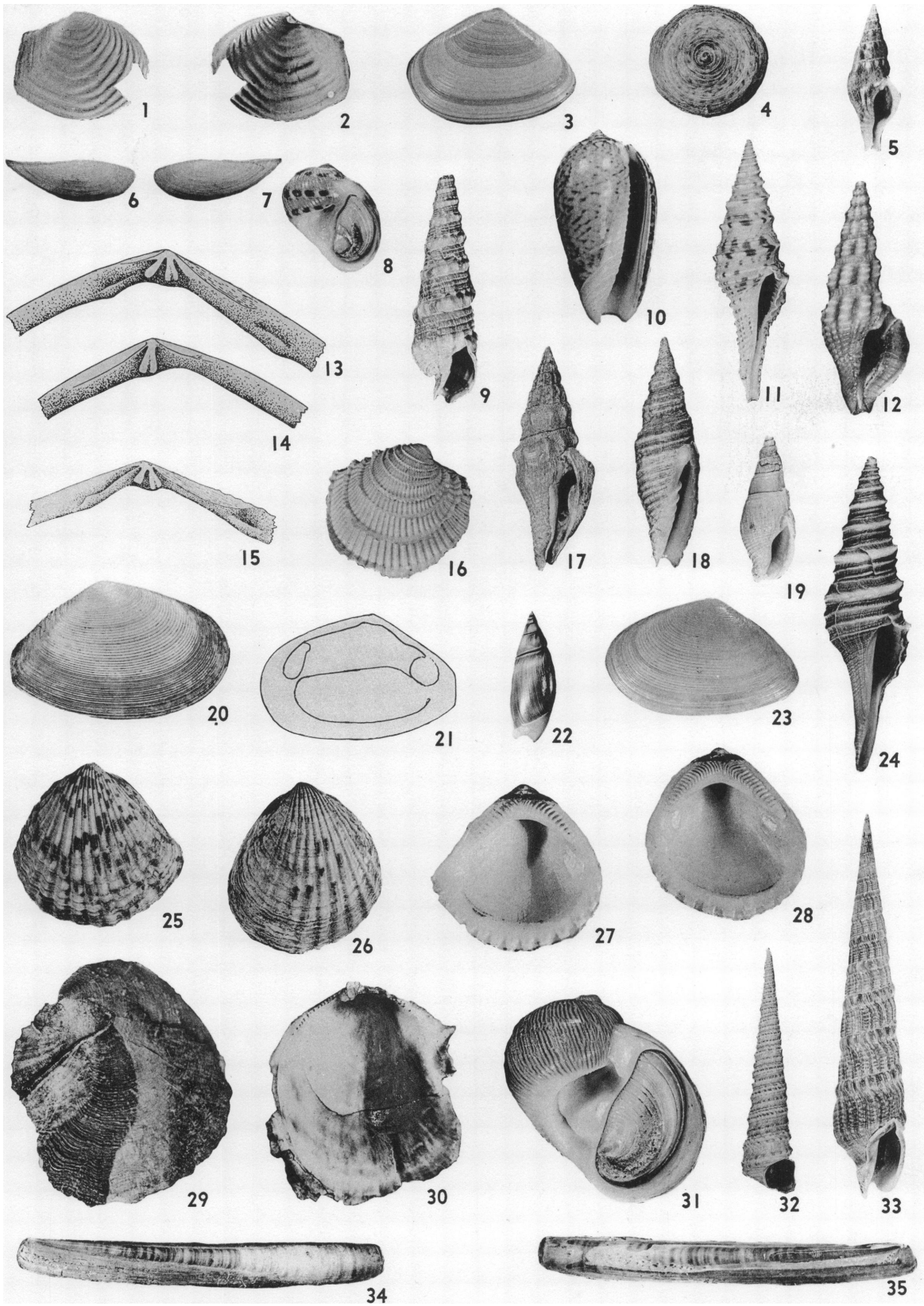
Murex funiculatus Sowerby was described without information as to the locality from which it came. Reeve's illustration [1845 (1843-1878), vol. 3, pl. 19, fig. 74] of it shows a shell similar to that of *M. recurvirostris* but lighter colored and with regularly spaced reddish brown lines on the concentric ridges.

Murex messorius Sowerby (1841b, p. 137; 1841 [1832-1841], *Murex*, p. 1, pl. 194, fig. 93; Reeve, 1845, vol. 3, *Murex*, sp. 90, pl. 22, fig. 90), also described without information as to the locality from which it came, has often been cited as occurring in the Caribbean region. Sowerby stated regarding it, "Distinguishable by the thickened varices, and the spine at the base of the caudal canal, shaped like a reaper's hook." If the shape of the spine on the canal just below the base of the body whorl is characteristic of this species, we have certainly not seen specimens similar to it from west American waters. A fossil form described as *Murex recurvirostris quirosensis* by F. Hodson, 1931, appears to be closer to some of the Caribbean species than it is to typical *M. recurvirostris*.

Murex recurvirostris ranges south to Ecuador. According to Clench and Pérez Farfante (1945, p. 9) it may possibly occur along the east coast of Central and South America. A subspecies, *Murex recurvirostris rubidus* F. C. Baker (see Clench and Pérez Farfante, 1945, p. 6, pl. 3, figs. 1-7), occurs along east and west Florida and the Bahama Islands and other somewhat similar forms, such as *Murex recurvirostris sallasi* Rehder and Abbott (1951, p. 58, pl. 9, figs. 7, 8), occur in the Caribbean region. *Murex recurvirostris* has been recorded as occurring in the Pliocene of Costa Rica and Pleistocene of Panama. Very similar species of this group occur in widely separated regions. Ladd (1934, p. 224, pl. 40, figs. 3-5) cited "*Murex* (*Murex*)

PLATE 3

- 1, 2. *Cyathodonta undulata* Conrad. 1. Exterior of right valve, $\times 1.1$; A.M.N.H. No. 73420; Isla del Rey, Pearl Islands, Panama, 6–8 fathoms. 2. Interior of same specimen, $\times 1.11$.
3. *Tellina (Eurytellina) eburnea askoyana* Hertlein and Strong, new subspecies. Exterior of left valve, $\times 1.08$; paratype, A.M.N.H. No. 73432; Piñas Bay, Panama, 14–33 meters.
4. *Calyptraea mamillaris conica* Broderip. Apical view of exterior, $\times 1.4$; A.M.N.H. No. 73435; Piñas Bay, Panama, 14–33 meters.
5. *Strombina hirundo* Gaskoin. A.M.N.H. No. 73449, $\times 1.36$; Octavia Bay, Colombia, 24–28 meters.
- 6, 7. *Adrana exoptata* Pilsbry and Lowe. 6. Exterior of right valve, $\times 1.1$; A.M.N.H. No. 73414; off Cape Pasado, Ecuador, 10 fathoms. 7. Exterior of left valve of same specimen, $\times 1.1$.
8. *Natica broderipiana* Recluz. A.M.N.H. No. 73444, $\times 1.02$; off Cape Pasado, Ecuador, 15 fathoms.
9. *Terebra interincta* Hinds. A.M.N.H. No. 73453, $\times 1.04$; latitude $00^{\circ} 32' 00''$ S., longitude $80^{\circ} 30' 00''$ W., Ecuador, 10 fathoms.
10. *Oliva polpasta* Duclos. A.M.N.H. No. 73446, $\times 0.96$; probably off Ecuador or Colombia.
11. *Polystira picta* Beck in Reeve. A.M.N.H. No. 73448, $\times 0.7$; Isla del Rey, Pearl Islands, Panama, 6–8 fathoms.
12. *Lioglyphostoma armstrongi* Hertlein and Strong, new species. Holotype, A.M.N.H. No. 73442, $\times 3.2$; Guayabo Chiquito, Panama, 25–64 meters.
- 13–15. *Tellina (Eurytellina) eburnea askoyana* Hertlein and Strong, new subspecies. 13. Hinge of right valve of specimen shown in 3, approximately $\times 2.9$. 14. Hinge of left valve of same specimen, approximately $\times 2.9$. 15. Holotype, C.A.S. No. 9246, Department of Paleontology type collection, hinge of right valve, approximately $\times 3.4$; west of Champerico, Guatemala, 14 fathoms (25 meters).
16. *Chione (Chionopsis) traftoni* Pilsbry and Olsson. Exterior of right valve, $\times 1.3$; A.M.N.H. No. 73417; Piñas Bay, Panama, 14–33 meters.
17. *Strombina recurva* Sowerby. A.M.N.H. No. 73450, $\times 1.3$; Octavia Bay, Colombia, 24–28 meters.
18. *Mitra attenuata* (Swainson) Broderip. A.M.N.H. No. 73443, $\times 1.1$; Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, 6–8 fathoms.
19. *Cosmiococoncha modesta* Powys. A.M.N.H. No. 73437, $\times 1.05$; Ardita Bay, Colombia, 34–43 meters. Tip of apex lacking.
- 20, 21. *Tellina (Eurytellina) eburnea askoyana* Hertlein and Strong, new subspecies. 20. Holotype, exterior of right valve shown in 15, $\times 1.3$. 21. Holotype, interior of same specimen, $\times 1.2$.
22. *Olivella semistriata* Gray. C.A.S. No. 9899, Department of Paleontology type collection, $\times 1.1$; Uvita Bay, Costa Rica, beach.
23. *Tellina (Eurytellina) eburnea askoyana* Hertlein and Strong, new subspecies. Exterior of left valve, $\times 1.13$; paratype, C.A.S. No. 9896, Department of Paleontology type collection; same locality as holotype (see 15 above).
24. *Polystira oxytropis* Sowerby. A.M.N.H. No. 73447, $\times 1.46$; Piñas Bay, Panama, 14–33 meters.
- 25–28. *Glycymeris tessellata strigilata* Sowerby. 25. Exterior of left valve, $\times 1.0$; A.M.N.H. No. 73424; Guayabo Chiquito, Panama, 24–64 meters. 26. Exterior of right valve, $\times 0.96$; A.M.N.H. No. 73424; same locality as for specimen shown in 25. 27. Interior of specimen shown in 25. 28. Interior of specimen shown in 26.
- 29, 30. *Ostrea conchaphila* Carpenter. Holotype, British Museum (Natural History) No. 214, catalogue of Mazatlan shells 728; Mazatlan, Mexico. 29. Exterior of upper valve, $\times 1.5$. 30. Interior of upper valve of another specimen, $\times 1.5$. Photographs obtained from the British Museum (Natural History) through the courtesy of Dr. U. S. Grant, IV, who has kindly permitted their use.
31. *Natica elenae* Recluz. A.M.N.H. No. 73445, $\times 1.08$, Ardita Bay, Colombia, 34–43 meters.
32. *Turritella mariana* Dall. A.M.N.H. No. 73454, $\times 0.70$. Ardita Bay, Colombia, 34–43 meters.
33. *Terebra specillata guayaquilensis* E. A. Smith. A.M.N.H. No. 73451, $\times 1.25$; off Cape Pasado, Ecuador, 15 fathoms.
- 34, 35. *Ensis tropicalis* Hertlein and Strong, new species. Holotype, A.M.N.H. No. 73421; South Passage, Pearl Islands, Panama, 15 fathoms. 34. Exterior of left valve, $\times 1.2$. 35. Interior of left valve, same specimen, $\times 1.2$.



aff. *recurvirostris* Broderip" as occurring in the Neogene of Fiji. We are not certain whether or not the fossil shell from the upper Miocene of Venezuela illustrated by Rutsch (1934, p. 64, pl. 4, fig. 1) under the name of *M. recurvirostris* represents the typical form or one of the closely related Caribbean species. Vredenburg (1925, p. 215) and Cox (1948, p. 44) have remarked on the similarity of *Murex recurvirostris* to *M. bantamensis* Martin, a species which occurs in the Pliocene and perhaps upper Miocene of Java and Borneo.

SUBGENUS **HEXAPLEX** PERRY

Hexaplex PERRY, 1811, Conchology, explanation to pl. 8. Species cited: *Hexaplex tenuis*, from "South Seas"; *anatomica*, from "East Indies"; *fusca*, no locality cited; *foliacea*, no locality cited; *punctuata*, locality unknown; *ovata*, from "South Seas."

TYPE (HERE DESIGNATED): *Hexaplex foliacea* Perry.

DESCRIPTION: Shell univalve, spiral, divided longitudinally by six folds, from whence its name is derived; these folds are membranaceous and tuberculous, and sometimes spreading out into branched horns; the mouth round; the beak long, and armed with several calcaria or spurs, in a similar manner to the genus *Triples*. (Original description.)

Jousseume (1880, p. 335) cited *Murex cichoreus* Gmelin as type of *Hexaplex* Perry. That species, however, is not included in the original list of species cited by Perry. For that reason we have designated *Hexaplex foliacea* Perry as type. The locality from which this species originally came is unknown, but it appears to be referable to *Murex cichoreus* Gmelin, an earlier name for *Murex endivia* Lamarck.

The supraspecific categories to which many Recent species of the Muricidae should be assigned are very uncertain. *Hexaplex* Perry, 1811, appears applicable to some of the species heretofore assigned to *Phyllonotus* Swainson. The type species of *Phyllonotus*, *Murex imperialis* Swainson (= *M. pomum* Gmelin), has but three varices. For that and other reasons we have, at least until the relationship of the subgenera are better known, referred some of the west American species to *Hexaplex*.

Murex (Hexaplex) erythrostomus Swainson

Murex erythrostomus SWAINSON, 1831, Zoological illustrations, ser. 2, vol. 2, no. 16, pl. 73 (Muricinae pl. 2), and text.

Murex bicolor VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 301, "Habitat cum praecedente ad Acapulco." KIENER, 1843, Iconographie des coquilles vivantes, Canalifères, pt. 3, *Murex*, p. 67, pl. 28, fig. 1 (2 figs.). REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 44, pl. 11, fig. 44. SOWERBY, 1879, Thesaurus conchyliorum, vol. 4, p. 35, pl. 396 (*Murex* pl. 17), fig. 163. TRYON, 1880, Manual of conchology, vol. 2, p. 101, pl. 23, fig. 204.

Not *Murex bicolor* Renier, 1804.

Not *Murex bicolor* Risso, 1826.

Not *Murex (Gracilimurex) bicolor* Thiele, 1929.

Murex hippocastanum PHILIPPI, 1845, Abbildungen und Beschreibungen . . . Conchylien, vol. 1, no. 8, *Murex*, p. 191 (1), p. 1, fig. 2, "Patria: Peru." TRYON, 1880, Manual of conchology, vol. 2, p. 101, pl. 22, fig. 203.

Not *Murex hippocastanum* Linnaeus, 1758.

Phyllonotus bicolor Valenciennes, BOONE, 1928, Bull. Bingham Oceanogr. Coll., vol. 2, p. 12, pl. 2, lower fig. STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 523, pl. 1, fig. 1. M. SMITH, 1944, Panamic marine shells, p. 24, fig. 285.

Phyllonotus erythrostomus Swainson, DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 111, pl. 35, fig. 7.

TYPE LOCALITY: No locality cited originally. Acapulco, Mexico, here designated as as type locality.

RANGE: Punta Penasco in the Gulf of California to Paita, Peru.

MATERIAL EXAMINED: One specimen from Isle of Bayoneta, Pearl Islands, Panama, May 24, 1941, Station 109, sample 428, 4½-5 fathoms.

MEASUREMENTS: Length, 100.5 mm.; maximum diameter, 71.4 mm.

HABITAT: Sand bottom.

DESCRIPTION: "Shell spinous: varices between the two lips four; armed with conic, generally pointed spines, the upper and lower of which are vaulted; colour reddish white, articulated with brown: false varices intermediate; aperture rosy: inner lip smooth" (original description).

REMARKS: This beautiful species has a pinkish white shell very lightly stained with

brown. It is sculptured with four to five varices bearing spines on their upper and lower portions but with compressed nodules in the central portion. Nodose, varix-like ridges occur between the varices. The inner lip is broadly expanded and lamella-like anteriorly. The entire aperture and interior of the shell are colored a beautiful bright rosy pink. It completely lacks the black patches of color present on the upper portion of the inner lip of *M. regius*.

Lowe recorded that he observed this species in Concepcion Bay in the Gulf of California feeding upon *Megapitaria squalida*. It also is known to occur in the Pleistocene at Magdalena Bay, Baja California, and in the Gulf of California region.

Teare (1953, p. 77) mentioned that a shell of this species containing the live animal was found on the beach at St. Petersburg, Florida.

***Murex (Hexaplex) princeps* Broderip**

Murex princeps BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 175. SOWERBY, 1834-1841, The conchological illustrations, *Murex*, p. 6, pl. 64, fig. 43. KIENER, 1843, Iconographie des coquilles vivantes, Canalifères, pt. 3, *Murex*, p. 56, pl. 29, fig. 1 (2 figs.). REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 23, pl. 6, fig. 23. Sowerby, 1879, Thesaurus conchyliorum, vol. 4, p. 33, pl. 398 (*Murex* pl. 19), figs. 175, ?176. TRYON, 1880, Manual of conchology, vol. 2, p. 106, pl. 28, fig. 250.

Murex nitidus BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 176, "Hab. in America Centrali. (Real Llejjos). . . found in the cleft of a rock." SOWERBY, 1834-1841, The conchological illustrations, *Murex*, p. 6, pl. 58, fig. 4, "Probably a variety of the last [*M. princeps*] in a young state." TRYON, 1880, Manual of conchology, vol. 2, pl. 26, fig. 233.

Not *Murex nitidus* Broderip, Reeve, 1845, Conchologia iconica, vol. 3, *Murex*, pl. 17, figs. 70a, 70b, which represents *M. radix* Gmelin.

Phyllonotus princeps Broderip, STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 523, pl. 3, fig. 2. M. SMITH, 1944, Panamic marine shells, p. 24, fig. 281. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 112, pl. 35, fig. 3.

TYPE LOCALITY: "Hab. in America Centrali. (Puerto Portrero.) Found in coral reefs." [Costa Rica.]

RANGE: Espiritu Santo Island in the Gulf of California to Peru and the Galapagos Islands.

MATERIAL EXAMINED: One specimen not localized.

MEASUREMENTS: Length, 91.4 mm.; maximum diameter, 75 mm. A large specimen in the collections of the California Academy of Sciences measures 138 mm. in length.

DESCRIPTION: Shell ovately elongate, spire rather high, whorls angulated on upper portion, often somewhat hexagonal in section, sculptured with six varices which bear erect, rather rude, frondose spines, those on the angulation strongest, and crossed by weak spiral ridges; canal moderately short; exterior white with rusty brown spiral bands and lines, interior white.

REMARKS: Compared to the other large common murices in tropical west American waters, the shell of *Murex princeps* is more elongated, the whorls are angulated on the upper portion, and the color of the aperture and interior is white except that a narrow curved brown line is often present on the inner lip of fresh shells.

Stearns (1894, p. 184) mentioned that southern shells of this species, as well as those of *M. radix*, are generally more stumpy and solid.

DISTRIBUTION: *Murex princeps* often occurs on rocks at lowest tide. It also has been recorded as occurring in the Pleistocene at Magdalena Bay, Baja California, the Gulf of California region, at Oaxaca, Mexico, and in the Pliocene and Pleistocene of the Galapagos Islands.

SUBGENUS **MURICANTHUS** SWAINSON

***Murex (Muricanthus) radix* Gmelin**

Murex nigritus MEUSCHEN, 1787, Museum Geversianum, p. 324, no locality cited.

Murex radix GMELIN, 1791, Systema naturae, ed. 13, vol. 1, pt. 6, p. 3527, "Habitat rarissimus." Reference to: "Argenv. Zoom. t. 11. f. k." KIENER, 1843, Iconographie des coquilles vivantes, Canalifères, pt. 3, *Murex*, p. 60, pl. 37, fig. 1, pl. 38, fig. 1. REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 69, pl. 17, fig. 69. CHENU, 1859, Manuel de conchyliologie, vol. 1, pp. 133, 134, figs. 570, 572. SOWERBY, 1879, Thesaurus conchyliorum, vol. 4, p. 33, pl. 397 (*Murex* pl. 18), fig. 170. TRYON, 1880, Manual of conchology, vol. 2, p. 105, pl. 27, figs. 244, 247, 248. ROGERS, 1913, The shell book, p. 33, pl. opp. p. 27, fig. 3; 1951, *op. cit.*

Murex ambiguus REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 51, pl. 13, fig. 51, "Hab.—?"

Murex nitidus Broderip, REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 70, pl. 17, figs. 70a, 70b, "Hab. Guacomayo, Central America (found on the coral reefs at low water); Cuming."

Not *Murex nitidus* Broderip, 1833, which is *M. princeps*.

Hexaplex (Muricanthus) radix Gmelin, WENZ, 1941, Handbuch der Paläozoologie, vol. 6, pt. 5, no. 7, p. 1088, fig. 3091.

Phyllonotus radix Lamarck, M. SMITH, 1944, Panamic marine shells, p. 24, fig. 290.

TYPE LOCALITY: No locality cited originally. Panama Bay here designated as type locality.

RANGE: Acapulco, Mexico, to Paita, Peru.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, March 2, 1941, Station 19, on beach in front of village.

MEASUREMENTS: Length, 104.5 mm.; maximum diameter (including spines), 92.6 mm. This species attains a length of 135 mm. or more.

HABITAT: On beach.

REMARKS: We have concurred with the great majority of authors in applying Gmelin's name *Murex radix* to this species. Dillwyn (1817, p. 686) pointed out that Gmelin's species was based on d'Argenville's figure ("Zoom.," pl. 11, fig. K). He placed the species with question in the synonymy of *Murex melanamathos* Gmelin, a name now applied to the west American shell usually cited under the name of *Murex oxyacantha* Broderip. Most authors, however, have considered *Murex radix* applicable to the large, black-spined *Murex* occurring in tropical west American waters. So far as we know, no modern author has found the name applicable to any East Indian species.

The name *Murex nigrinus* Meuschen appears to be an earlier name for the present species. If Meuschen's work be accepted as valid nomenclatorially, the present species will take the name *Murex nigrinus*. Winckworth (1926, p. 104), in a review of Meuschen's work, considered it not strictly binominal and therefore not acceptable nomenclatorially.

The subspecies *Murex (Muricanthus) radix nigrinus* Philippi [1845 (1842-1851), vol. 1, no. 8, p. 191 (1), pl. 1, fig. 1; Reeve, 1845 (1843-1878), vol. 3, *Murex*, sp. 47, pl. 12, fig. 47] originally described from "Patria: Oceanus pacificus Mejico alluens?," which occurs in

the Gulf of California region, differs from typical *M. radix* in the higher spire, the often posteriorly angulated body whorl, and in the fewer (six to 12) and strongly developed varices which bear less frondose spines, those on the shoulder often the largest.

Should Meuschen's (1787, p. 324) use of the name *Murex nigrinus* be considered as valid, the west American subspecies can take the name *melanoleucus* Mörch [1852, p. 96; new name for *Murex nigrinus* Philippi; Mörch, 1860, vol. 7, p. 100, as *Murex (Polyplex) melanoleucus*; Realejo] which was proposed for the species described by Philippi.

GENUS MURICOPSIS BUCQUOY AND DAUTZENBERG

Muricopsis zeteki Hertlein and Strong

Murex aculeatus WOOD, 1828, Supplement to the Index testaceologicus, pp. 15, 44, *Murex*, pl. 5, fig. 19, no locality cited.

Not *Murex aculeatus* Lamarck, 1822.

Murex dubius SOWERBY, 1834-1841, The conchological illustrations, *Murex*, p. 8, pl. 61, fig. 23, "Panama, Mr. Cuming." New name for *Murex aculeatus* Wood, 1828, not *Murex aculeatus* Lamarck, 1822. REEVE, 1845, Conchologia iconica, vol. 3, *Murex*, sp. 116, pl. 26, fig. 116. SOWERBY, 1879, Thesaurus conchyliorum, vol. 4, p. 43, pl. 403 (*Murex* pl. 24), fig. 250. TRYON, 1880, Manual of conchology, vol. 2, p. 109, pl. 29, fig. 266.

Not *Murex dubius* Dillwyn, 1817.

Tritonalia dubia Sowerby, M. SMITH, 1944, Panamic marine shells, p. 25, fig. 280 (as *Muricidea dubia*).

Muricopsis zeteki HERTLEIN AND STRONG, 1951, Zoologica, New York, vol. 36, p. 85, pl. 2, fig. 9.

TYPE LOCALITY: "Panama City, Panama."

RANGE: Manzanillo, Mexico (Dall), to La Plata Island, Ecuador.

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, northeast end of island in 3 fathoms.

MEASUREMENTS: Length, 16.9 mm.; maximum diameter (including spines), 9.9 mm.

HABITAT: With masses of corals.

REMARKS: A discussion of this small spiny muricid shell has been given recently by the present authors. It is quite similar to *Muricopsis squamulata* Carpenter, a generally more northern form, but differs from that species in the lower spire, in the more nodose or subplicate lower portion of the columella,

in the thicker inner portion of the outer lip, and in the darker color of the exterior of the shell.

The present record of the occurrence of this species at the island of La Plata, Ecuador, is an extension south of the known range.

GENUS *EUPLEURA* H. AND A. ADAMS

Eupleura muriciformis Broderip

Ranella muriciformis BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 179. REEVE, 1844, Conchologia iconica, vol. 2, *Ranella*, sp. 34, pl. 7, fig. 34. KOBELT, 1878, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 3, div. 2, p. 139, pl. 38a, fig. 1.

Ranella plicata REEVE, 1844, Conchologia iconica, vol. 2, *Ranella*, sp. 33, pl. 7, fig. 33, "Hab.—?"; 1844, Proc. Zool. Soc. London, p. 138. KOBELT, 1878, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 3, div. 2, p. 139, pl. 38a, fig. 2.

Ranella triquetra REEVE, 1844, Conchologia iconica, vol. 2, *Ranella*, sp. 41, pl. 7, fig. 41, "Hab. San Diego, California; Nuttall"; 1844, Proc. Zool. Soc. London, p. 139.

Eupleura muriciformis Broderip, TRYON, 1880, Manual of conchology, vol. 2, p. 158, pl. 39, figs. 502, 504, 505. GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 714. M. SMITH, 1944, Panamic Marine Shells, p. 25, fig. 307.

TYPE LOCALITY: "Hab. ad Columbiam Occidentalem. (Bay of Montija) . . . found in loose gravel at the depth of seven fathoms." [Panama.]

RANGE: Cedros Island, Baja California, to Punta Penasco in the Gulf of California and south to Lobitos, Peru.

MATERIAL EXAMINED: Three specimens from two samples from Cape Pasado, Ecuador, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, two specimens; also latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, in 15 fathoms, one specimen.

MEASUREMENTS: Largest specimen: length, 20.6 mm.; maximum diameter, 42.3 mm. Another specimen: length, 37.8 mm.; maximum diameter, 24 mm.

HABITAT: Bottom of sand and shell fragments, also mud and live shells.

DESCRIPTION: Shell somewhat flatly triangular, body whorl angulated on posterior portion, two varices present, usually spinose on each whorl, about three nodes on the

angulation between the varices, about five or six spiral cords on the last whorl, sometimes additional ones present on the canal which is fairly long; brownish or partly bluish brown.

REMARKS: There is considerable variation in a series of specimens of this species. Pilsbry and Lowe (1932) considered *Eupleura triquetra* to be "the larger, slimmer form from Gulf of Cabo, La Paz; Guaymas." They considered *E. muriciformis* to be a generally more southern form. However, they cited the latter as occurring as far north as Mazatlan, and Lowe (1935) cited it as occurring at Punta Penasco in the northern portion of the Gulf of California.

We have not found that the specimens from the Gulf of California region differ constantly from *E. muriciformis*. However, it is possible that additional collections might show that differences do exist between the northern and southern forms. Specimens apparently referable to the form described as *Ranella plicata* Reeve appear to us to merit taxonomic recognition as much as does *E. triquetra*. It seems to us that gradation occurs between these three extreme forms, and we have accordingly placed them under one species, *E. muriciformis*.

In addition to the forms mentioned, two varieties of *Eupleura muriciformis* have been described from west Mexico. These are var. *unispinosa* Dall (1890b, p. 146; 1891, p. 174, pl. 6, fig. 5) from "Mazatlan" and var. *limata* Dall (1890b, p. 146; 1891, p. 175) from "the head of the Gulf of California, near the estuary of the Colorado River . . . and in the Post-Pliocene of the vicinity."

FAMILY THAIDIDAE

Clench (1947) has published a useful paper dealing with the members of *Purpura* and *Thais* that occur in the western Atlantic.

GENUS *ACANTHINA* FISCHER DE WALDHEIM

Acanthina brevidentata Wood

Buccinum brevidentatum WOOD, 1828, Supplement to the Index testaceologicus, pp. 12, 43 (as *Monoceros brevidentatum*), pl. 4, fig. 10; 1856, Index testaceologicus, ed. Hanley, suppl., p. 213, pl. 4, *Buccinum*, fig. 10, "W. Columbia."

Monoceros brevidentatum WOOD, SOWERBY, 1835, The conchological illustrations, *Monoceros*, p. 1, pl. 79, fig. 4 (2 figs.). REEVE, 1846, Conchologia

iconica, vol. 3, *Monoceros*, sp. 4, pl. 1, figs. 4a, 4b. TRYON, 1880, Manual of conchology, vol. 2, p. 194, pl. 60, fig. 294 (copy of Reeve's fig. 4b).

Purpura cornigera BLAINVILLE, 1832, Nouv. Ann. Mus. Hist. Nat., Paris, vol. 1, p. 123, pl. 9, fig. 10, "de la mer Pacifique, sur les côtes de Masatlan, d'où elle a été rapportée par M. Paul-Émile Botta." KIENER, 1835-1836, Iconographie des coquilles vivantes, Purpurifères, pt. 1, Pourpre, p. 123, pl. 39, fig. 92 (2 figs.).

Purpura ocellata KIENER, 1835-1836, Iconographie des coquilles vivantes, Purpurifères, pt. 1, Pourpre, p. 124, pl. 37, fig. 86 (2 figs.), "Habite la mer Pacifique, les côtes du Chili."

Monoceros maculatum GRAY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, Mollusca, p. 125, "Inhab. Pacific Ocean."

TYPE LOCALITY: Locality unknown originally. Reeve cited "Hab. Xipixapi and Monte Christi, West Columbia (in crevices of rocks at low water); Cuming." Jipijapa, Ecuador, in crevices of rocks at low water, here selected as type locality.

RANGE: Mazatlan, Mexico, to Paita, Peru, Chile.

MATERIAL EXAMINED: Five specimens from Ardita Bay, Colombia, March 5, 1941, Station 31, sample 80, near village.

MEASUREMENTS: Largest specimen: length, 24 mm.; diameter, 16.3 mm.

HABITAT: Taken on beach. This species occurs commonly on rocks between tides.

DESCRIPTION: "Shell ovate, thick, spire short, somewhat acuminate, transversely impressly striated, encircled with three obsolete noded ribs; ashy black, encircled with white spots, aperture white" (Reeve).

The white spots usually occur on the nodules, and the inner margin of the outer lip is usually chocolate or black. The columella sometimes bears a couple of faint ridges.

REMARKS: On the basis of a study of the radula, Cooke (1918, p. 7; 1919, p. 93) considered this species to be referable to the genus *Thais*. We leave it in the genus *Acanthina* for the present, to which genus it has been assigned by many authors.

This species is known to occur in the Pleistocene of Ecuador.

GENUS *PURPURA* BRUGUIÈRE

Clench (1947) has recently discussed the status of *Purpura* Bruguière, 1789. The

International Commission on Zoological Nomenclature has not yet ruled upon the validity of this generic name. *Patellipurpura* Dall, 1909, or *Plicopurpura* Cossmann, 1903, could be applied with certainty to some west American species if the Commission rules that *Purpura* Bruguière is invalid.

There is an earlier *Purpura* of Meuschen (1787, p. 308) which, if accepted as valid, as it was by Sherborn, would invalidate Bruguière's use of that name. Winckworth (1926, pp. 103-104), in a review of Meuschen's genera, considered Meuschen's work not to be strictly binominal and therefore not nomenclatorially acceptable. *Purpura* also was used in a generic sense by Martyn, 1784; P. Browne, 1789; Bolten, 1798; and Lamarck, 1799.

Purpura patula pansa Gould

Purpura pansa GOULD, 1853, Boston Jour. Nat. Hist., vol. 6, p. 406.

Purpura patula Lamarck, STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 522, pl. 34, fig. 2.

Purpura patula pansa Gould, CLENCH, 1947, Johnsonia, vol. 2, no. 23, p. 68, pl. 33, figs. 1, 2.

Purpura patula Linnaeus, west American locality records only.

TYPE LOCALITY: "West coast of America." Mazatlan, Mexico, selected as type locality by Clench.

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Ecuador. Also Revillagigedo Islands, Tres Marias Islands, Cocos Island, and Galapagos Islands.

MATERIAL EXAMINED: One specimen from Ardita Bay, Columbia, March 5, 1941, Station 31, sample 80.

MEASUREMENTS: Length, 65 mm.; maximum diameter, 44.4 mm. A large specimen from Clarion Island in the collections of the California Academy of Sciences measures: length, 103.4 mm.; maximum diameter, 71.5 mm.

HABITAT: Taken on beach.

DESCRIPTION: Shell rather large, ovate in outline, spire rather low, body whorl exceedingly large; sculptured usually with six to seven spiral rows of sharp nodes and between these rows several additional smaller spiral ridges varying in size; aperture broad, inner lip broad and smooth, often giving a beveled

appearance, usually salmon-brown, with the inner margin of the parietal area white, margin of outer lip crenulated, usually dark; anterior canal very short; interior often bluish white, exterior often rusty gray.

REMARKS: Clench pointed out that "*Purpura patula* Linné is very easily separated from the Eastern Pacific subspecies, *pansa* Gould, by the uniform salmon-brown coloration on *patula* and the lengthened white area on the parietal margin of *pansa*." This difference between the Atlantic and Pacific shells appears to be rather constant. This subspecies occurs rather abundantly along tropical west American shores between tides on rocks in exposed situations. The natives of west Mexico and Central America long ago used this snail as a source of purple dye for cloth, as mentioned by von Martens (1899), Nuttall (1909), and later by Clench. Pilsbry and Lowe (1932, p. 119) mentioned the fact that when this snail is disturbed it gives off a few drops of milky liquid which, when placed on white cloth, turns metallic green and later to permanent royal purple. Clench mentioned that the Atlantic *Purpura patula* has been observed feeding on a chiton. The west American subspecies also occurs in the Pleistocene at Magdalena Bay, Baja California, and the Galapagos Islands.

GENUS THAIS BOLTEN

SUBGENUS VASULA MÖRCH

Vasula MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 99. Species cited: "*Purpura (Vasula) melones* Ducl. Ann. sc. nat. 1832. vol. 26. p. 105. pl. 1. f. 2." in the synonymy of which were included "*P. melo* Sow. Gen. n. 24. f. 5, Desh. X. p. 106.—*P. crassa* Blainv. Ann. du Mus. I. p. 241. n. 83. pl. 12. f. 4.—Puntarenas specimina plura viva."

TYPE (HERE DESIGNATED): *Purpura (Vasula) melones* Duclos.

REMARKS: The shell of this subgenus is subglobose, thick, smooth, and completely lacks nodose ornamentation such as exists on *Mancinella* Lamarck.

The two west American species referred to the subgenus *Mancinella* may be easily separated by the fact that the posterior spiral row of nodes on the body whorl of *Thais speciosa* Valenciennes (*Purpura centiquadra* Duclos and *Purpura triserialis* Blainville) is

larger than the following anterior row, whereas on *T. triangularis* Blainville these corresponding rows of nodes are of equal size.

Thais (*Vasula*) melones Duclos

Purpura melones DUCLOS, 1832, Ann. Sci. Nat., Paris, vol. 26, p. 105, pl. 1, fig. 2, "Patrie ignorée." KIENER, 1835-1836, Iconographie des coquilles vivantes, Purpurifères, pt. 1, Pourpre, p. 125, pl. 39, figs. 93, 93a, "Habite la mer du Sud, les côtes du Pérou." REEVE, 1846, Conchologia iconica, vol. 3, *Purpura*, sp. 19, pl. 4, fig. 19, "Hab. Monte Christi, West Columbia (under stones at lower water); Cuming." TRYON, 1880, Manual of conchology, vol. 2, p. 164, pl. 47, fig. 56 (copy of Reeve's fig. 19).

[*urpura*]. *crassa* BLAINVILLE, 1832, Nouv. Ann. Mus. Hist. Nat., Paris, vol. 1, p. 241, pl. 12, fig. 4, "elle a été acquise d'un marchand anglais; mais nous ignorons dans quelle mere elle habite."

Purpura melo DUCLOS, REEVE, 1842, Conchologia systematica, vol. 2, p. 221, pl. 259, fig. 5.

Purpura (Vasula) melones DUCLOS, MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 99.

Thais melones DUCLOS, COOKE, 1919, Proc. Malacol. Soc. London, vol. 13, p. 96, fig. 6 (radula).

Thais crassa Blainville, M. SMITH, 1944, Panamic marine shells, p. 25, fig. 304.

TYPE LOCALITY: "Patrie ignorée." Monte-christi, Ecuador, under stones at low water, cited by Reeve, is here selected as the type locality.

RANGE: Port Guatulco, Mexico, to Callao, Peru. Cocos Island and Galapagos Islands.

MATERIAL EXAMINED: One specimen not localized, and five specimens from two stations:

COLOMBIA

Ardita Bay, March 5, 1941, Station 31, sample 80, 1 specimen.

ECUADOR

La Plata Island, December, 1942, C. M. Breder, Jr., collector, 4 specimens.

MEASUREMENTS: Largest specimen: length, 39.8 mm.; maximum diameter, 31.4 mm. A large specimen from Port Guatulco, Mexico, in the collections of the California Academy of Sciences measures: length, 58.8 mm.; maximum diameter, 45 mm.

HABITAT: Picked up on beach.

DESCRIPTION: Shell subglobose, very thick. spire low, sculptured with spiral striae; chest-

nut black blotched with white on the periphery and lower portion of the body whorl, aperture yellowish, columella yellowish tinged with purple or pink, edge of the interior of the outer lip often with a black border.

REMARKS: This species may be easily recognized by its thick, subglobose shell which is sculptured only with spiral striae. Mörch (1859–1861, vol. 7, p. 99) described the soft parts of this species.

We have cited this species under the specific name proposed for it by Duclos. According to Sherborn, that name was published in May, 1832. Dall cited it under the name *Thais crassa* Blainville and gave the date of publication as March, 1832. However, according to Sherborn, the name *Purpura crassa* Blainville was published "post May," 1832.

This species also has been recorded as occurring in the Quaternary of Ecuador as well as in the Pleistocene of Peru and of the Galapagos Islands.

SUPERFAMILY PTENOGLOSSA

FAMILY EPITONIIDAE

Dall (1917b), Baker, Hanna, and Strong (1930), Strong (1945c), and Durham (1937) have published papers dealing with west American species of Epitoniidae which are very useful to students of this group.

GENUS EPITONIUM BOLTEN

SUBGENUS NITIDISCALA DE BOURY

Notes on several species of *Nitidiscala* from western North America have been published by Strong (1930).

Epitonium (Nitidiscala) wurtsbaughi Strong and Hertlein

Epitonium (Nitidiscala) wurtsbaughi STRONG AND HERTLEIN, 1939, Allan Hancock Foundation Publ., vol. 2, no 12, p. 193, pl. 18, fig. 14.

TYPE LOCALITY: "Dredged in from 3 to 9 fms. in Bahia Honda, Panama."

RANGE: Corinto, Nicaragua, to Ardit Bay, Colombia.

MATERIAL EXAMINED: One specimen from Ardit Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay, 34–43 meters.

MEASUREMENTS: Length (spire incom-

plete), 7.5 mm.; maximum diameter, 5 mm.

HABITAT: Gray sand bottom.

DESCRIPTION: Shell small, broad; axial sculpture of seven thin, high varices which ascend the spire in a continuous line; over the body of the shell the varices are narrowly sharply reflected and at the shoulder expand into nearly vertical spines.

REMARKS: The present record of the occurrence of this species in Ardit Bay, Colombia, is an extension south of the known range.

SUPERFAMILY TAENIOGLOSSA

FAMILY CYPRAEIDAE

Two papers by Ingram (1947, 1951) are indispensable for students of west American Cypraeidae.

GENUS CYPRAEA LINNAEUS

Cypraea arabicula Lamarck

Cypraea arabicula LAMARCK, 1810, Ann. Mus. Hist. Nat., Paris, vol. 16, p. 100. KIENER, 1845, Iconographie des coquilles vivantes, Enroulées, *Cypraea*, p. 115, pl. 28, fig. 3 (2 figs.). REEVE, 1845, Conchologia iconica, vol. 3, *Cypraea*, sp. 60, pl. 13, figs. 60a, 60b. SOWERBY, 1870, Thesaurus conchyliorum, vol. 4, p. 16, pl. 298 (*Cypraea* pl. 7), figs. 38, 39. ROBERTS, 1885, in Tryon, Manual of conchology, vol. 7, p. 175, pl. 9, figs. 35, 36 (copies of Reeve's figs. 60a, 60b). INGRAM, 1947, Bull. Amer. Paleont., vol. 31, p. 65; 1951, Bull. Amer. Paleont., vol. 33, p. 143, pl. 23, figs. 7, 8.

[*Zonaria (Pseudozonaria)*] *arabicula* Lamarck, SCHILDER AND SCHILDER, 1938, Proc. Malacol. Soc. London, vol. 23, p. 145,

Zonaria arabicula Lamarck, M. SMITH, 1944, Panamic marine shells, p. 21, figs. 251, 255.

TYPE LOCALITY: "Habite les côtes occidentales de l'Amérique, à Acapulco, où M. Bonplan l'a recueillie." [Mexico.]

RANGE: San Hipolito Point, Baja California, to Concepcion Bay, Gulf of California, and south to Paita, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from the Gulf of Panama, not localized.

MEASUREMENTS: Length, 25.5 mm.; maximum diameter, 16.5 mm., convexity, 12.5 mm. The largest specimen in the collections of the California Academy of Sciences from Chamela Bay, Mexico, measures: length, 35 mm.; maximum diameter, 22.8 mm.; convexity, 15.9 mm.

HABITAT: Not indicated for present specimen. This species occurs under rocks between tides.

DESCRIPTION: Shell rather highly rounded, extremities angularly produced; dorsal area with bluish green ground upon which are close, fine, irregular, reticulate, brown markings, sometimes with gray, transverse bands; margins purplish brown with black spots; base flattish, yellowish white; teeth fine, deeply cut, somewhat radial; well-developed fossula present.

REMARKS: The flattish base, more angular margins, finer, more numerous teeth, and larger black spots on the margins are features which serve to separate easily this species from *Cypraea robertsi*. Ingram has discussed both these species.

Cypraea arabicula also has been recorded as occurring in the Pleistocene at Magdalena Bay, Baja California, at Oaxaca, Mexico, questionably at Maria Magdalena Island, Tres Marias Islands, and in Ecuador.

Cypraea cervinetta Kiener

Cypraea cervinetta KIENER, 1843-1845, Iconographie des coquilles vivantes, Enroulées, *Cypraea*, p. 74, pl. 6, figs. 1, 2 (2 figs. each). REEVE, 1845, Conchologia iconica, vol. 3, *Cypraea*, index, sp. 6, pl. 2, fig. 6a. ROBERTS, 1885, in Tryon, Manual of conchology, vol. 7, p. 164, pl. 1, fig. 3 (copy of Kiener's fig. 2), pl. 2, figs. 13, 14 (copy of Kiener's fig. 1). INGRAM, 1947, Bull. Amer. Paleont., vol. 31, p. 67; 1948, Proc. California Acad. Sci., ser. 4, vol. 26, p. 138; 1951, Bull. Amer. Paleont., vol. 33, p. 145, pl. 22, figs. 3, 4.

Cypraea cervus var. *cervinetta* Kiener, SOWERBY, 1870, Thesaurus conchyliorum, vol. 4, pl. 213 (*Cypraea* pl. 22), fig. 181.

Macrocypraea cervinetta Kiener, SCHILDER, 1930, Proc. Malacol. Soc. London, vol. 19, p. 55.

[*Trona* (*Trona*)] *cervinetta* Kiener, SCHILDER AND SCHILDER, 1939, Proc. Malacol. Soc. London, vol. 23, p. 179. M. SMITH, 1944, Panamic marine shells, p. 21, fig. 254 (as *Trona cervinetta*).

TYPE LOCALITY: "Habite l'océan des Antilles et les côtes du Sénégal." The original localities are erroneous. The Bay of Panama is here selected as type locality.

RANGE: Margarita Island, west coast of Baja California, to Guaymas in the Gulf of California and south to Paita, Peru. Also Galapagos Islands.

MATERIAL EXAMINED: Four specimens from two stations:

PANAMA

Gulf of Panama, not localized, 1 specimen.

ECUADOR

La Plata Island, April 13, 1941, Station 80, sample 302, northeast end of island in 3 fathoms, 3 juvenile specimens.

MEASUREMENTS: Largest specimen: length, 51.4 mm.; maximum diameter, 28 mm.; convexity, 22.1 mm. A large specimen in the collections of the California Academy of Sciences, collected by Ted Dranga at Vique Point, Panama, measures: length, 89.5 mm.; maximum diameter, 48 mm.; convexity, 37 mm.

HABITAT: Brought up with masses of corals. This species sometimes may be taken under rocks at extreme low tide.

DESCRIPTION: Shell large, elongate, sub-cylindric, rather thin; dark brown with numerous rounded white spots, often with four more or less obscure, transverse bluish bands more pronounced on young shells; base light brown, about 30 dark brown teeth on outer lip of a large specimen; fossula present.

REMARKS: The shell of this species is generally smaller, more cylindrical in form, and generally of a deeper hue than that of the very similar east American *Cypraea zebra* Linnaeus (= *C. exanthema* Linnaeus).

Cypraea cervinetta is definitely known to occur in the Pleistocene deposits of Ecuador. Probably the records of *C. exanthema* cited as occurring in the Pleistocene of Ecuador and Peru are referable also to Kiener's species. Dall and Ochsner recorded the occurrence of "*Cypraea* aff. *cervinetta*" in Pliocene beds in the Galapagos Islands.

FAMILY CYMATIIDAE

A paper by Dall (1904) containing a review of the "Frog-shells and tritons" is indispensable for a study of this family and the Bursidae. Powell (1933, pp. 154-164) more recently has presented considerable information on the Cymatiidae of New Zealand, and Iredale (1929b, pp. 172-178; 1936, pp. 306-308) has discussed members of this family occurring in Australia. Grant and Gale (1931, pp. 731-737) and Wrigley (1932, pp. 136-139) have discussed some of the Cenozoic species of this family.

Members of this family are, in many cases, widespread geographically. As Powell (1933,

p. 156) pointed out: "All tritons evidently pass through a very efficient free-swimming larval stage which is characterized by an apical shell allied to the type known as *Sinusigera*. . . The *Sinusigera* apex is always associated with species of wide distribution, and Iredale (1911) has noted its presence in species of the families of Mitridae, Buccinidae, Nassariidae, Thaisidae, Pyrenidae, Coralliophilidae, Turridae, and Terebridae."

GENUS **CYMATIUM** BOLTEN

Cymatium vestitum Hinds

Triton vestitus HINDS, 1844, Proc. Zool. Soc. London, p. 21; 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 1, p. 11, pl. 4, figs. 1, 2. REEVE, 1844, Conchologia iconica, vol. 2, *Triton*, sp. 101, pl. 20, fig. 101. HINDS, 1844, Ann. Mag. Nat. Hist., new ser., vol. 14, p. 436. TRYON, 1880, Manual of conchology, vol. 3, p. 12, pl. 7, figs. 38, 39.

Cymatium vestitum Hinds, M. SMITH, 1944, Panamic marine shells, p. 22, fig. 264. HERTLEIN AND EMERSON, 1953, Trans. San Diego Soc. Nat. Hist., vol. 11, pp. 351, 362, pl. 27, fig. 12.

Cymatium (Lampusia) vestitum Hinds, M. SMITH, 1948, Triton, helmet and harp shells, p. 3, pl. 5, fig. 6.

TYPE LOCALITY: "Hab. Realejo, gulf of Nicoya, and bay of Honda, west coast of America."

RANGE: Santa Cruz Island in the Gulf of California and south to the Chinchas Islands, Peru. Clipperton Island. Galapagos Islands.

MATERIAL EXAMINED: One specimen from Molino Cove, Piñas Bay, Panama, February 25, 1941, Station 20, sample 36, at head of cove. One specimen not localized.

MEASUREMENTS: Larger specimen: length (spire and canal incomplete), 48.6 mm.; maximum diameter, 29.6 mm. A large specimen from Santa Cruz Island in the Gulf of California in the collections of the California Academy of Sciences measures: length (spire incomplete), 60 mm.; maximum diameter, 31 mm. A specimen collected by the senior author at Darwin Bay, Tower Island, Galapagos Islands, measures 64 mm. in length.

HABITAT: Shells inhabited by crabs.

REMARKS: The shell of this species is quite similar to that of *Cymatium pileare* Linnaeus, a species originally described from "M. Mediterraneo" but which is now generally believed to be an Indo-Pacific species. Tryon

believed that intermediate forms exist between *C. pileare* and *C. vestitum*, but pointed out that the west American form "has normally, a shorter spire and more inflated body-whorl, is smoother, darker in color, the lip and columella between the plications dark chocolate." Mr. Ted Dranga has informed us that, on the basis of shell characters, specimens referred to *C. pileare* occurring in Florida cannot be separated from those occurring in the Hawaiian Islands.

Cymatium vestitum insulare Pilsbry (1921, p. 320) has been described from the Hawaiian Islands. It was described as "a race in which the tooth intervals are carnelian red or rufous, the form more slender, and the few intervariceal ribs are very weak."

FAMILY **BURSIDAE**

References to some of the general literature dealing with this group will be found in the present paper under the family Cymatiidae. Morrison (1949) has recently published additional information on this family.

GENUS **BURSA** BOLTEN

The members of this family differ from those of the Cymatiidae in that they possess a distinct posterior canal. On many of the shells in this family the varices are 180 degrees apart and form two continuous flanges.

SUBGENUS **COLUBRELLINA** FISCHER

The shells of the species of this subgenus are characterized by the position of the posterior siphonal canal which is not appressed to the spire, its parietal wall separate.

Bursa (Colubrellina) caelata Broderip

Ranella caelata BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 179. REEVE, 1842, Conchologia systematica, vol. 2, p. 196, pl. 241, fig. 8. REEVE, 1844, Conchologia iconica, vol. 2, *Ranella*, sp. 10, pl. 3, fig. 10. TRYON, 1880, Manual of conchology, vol. 3, p. 41, pl. 22, fig. 34.

Bursa caelata Broderip, M. SMITH, 1944, Panamic marine shells, p. 23, fig. 271.

Bursa (Colubrellina) caelata Broderip, M. SMITH, 1948, Triton, helmet and harp shells, p. 28, pl. 9, fig. 13.

Bursa (Colubrellina) caelata louisiana M. SMITH, 1948, Triton, helmet and harp shells, p. 28, pl. 9, fig. 4, "Hab. Perlas Archipelago, Gulf of Panama."

TYPE LOCALITY: "Hab. ad Panamam. Found under stones."

RANGE: Baja California (Morrison), Socorro Island, Revillagigedo Islands, Mexico, to Peru.

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, April 13, 1941, Station 80, sample 302, from 3 fathoms on northeast end of island.

MEASUREMENTS: Length (incomplete), 45.3 mm.; maximum diameter, 29 mm.

HABITAT: With masses of coral.

DESCRIPTION: Shell ovate, somewhat compressed, fairly thick, spire moderately high; sculptured with spiral rows of blackish brown nodes and granules on a chestnut brown ground, the nodes strongest on the periphery, other rows above and below finer and granulose; canal short; columella bearing white granulose wrinkles, outer lip crenellated, the grooves whitish, a sinus present on posterior portion of aperture; interior whitish.

REMARKS: Gray (1856, p. 44) has described the soft parts of this species.

The shell of this species differs from *Bursa nana* Broderip and Sowerby and *B. n. albofasciata* Sowerby, two other west American forms of this genus, in that it has a higher spire, and the shell is sculptured with much coarser nodules on the periphery and varices; there are deep cavities under the varices between the concentric rows of nodes, and the lips are usually brown rather than white. Another characteristic feature of this species mentioned by Broderip is that the apex of the spire is usually eroded.

Bursa pustulosa Reeve which occurs on the coast of Guinea, West Africa, is a similar species, as mentioned by Mörch. E. A. Smith (1890, p. 268) considered it to be only varietally distinct from *B. caelata*. Tomlin and Shackelford (1914-1915, p. 248) considered the two species to be distinct as did Cooke (1916, p. 8, footnote) who stated that *B. pustulosa* from West Africa "must surely be regarded as distinct from *caelata*, Brod."

The shell of *Bursa caelata* also is similar to that of *B. affinis* Broderip which was originally described from the island of Annaa in the western Pacific. The west American species has a more rugose appearance and differs in the generally fewer, less uniform nodes, the peripheral row of which is usually proportionally larger.

Morrison (1949, p. 12), in a recent review

of the species of *Bursa* occurring in Florida, considered *Bursa (Colubrellina) corrugata* G. Perry (*Biplex corrugata*, 1811, pl. 5 and expl., "Native place unknown") to be the correct name of the species discussed here. In the synonymy of Perry's species he placed *Ranella caelata*, *Bursa (Colubrellina) caelata louisiana* M. Smith, *Ranella albofasciata* Sowerby, ?1835, and *Ranella ponderosa* and *pustulosa* Reeve, 1844. This synonymy may be verified in a large collection of specimens but in our series of specimens *Bursa caelata* appears distinct from the west American forms *Bursa nana* Broderip, 1829, and *B. n. albofasciata* Sowerby, ?1835. The locality from which the original specimen of *Biplex corrugata* Perry came is unknown. For that and other reasons, we have applied the name *Bursa caelata* Broderip to the present species.

Bursa (Lampadopsis) calcipicta Dall (1908, p. 320) was described from "U.S.S. 'Albatross', station 3368, near Cocos Island, Gulf of Panama, in 66 fathoms, rocky bottom, temperature 58°.4 F."; the type has not been illustrated. It is said to bear a resemblance to *B. caelata* but to differ in details of sculpture and in the color.

Bursa granularis Bolten has been recorded as occurring at Clipperton Island in the eastern Pacific.

Bursa (Colubrellina) nana albofasciata
Sowerby

Ranella albofasciata SOWERBY, (?1835)-1841, The conchological illustrations, *Ranella*, p. 7, pl. 89, fig. 14; 1841, Proc. Zool. Soc. London, p. 52, "Hab. ad insulam Panama, Philippinarum. Found in coarse sand at 10 fathoms."

Ranella albifasciata Sowerby, REEVE, 1844, Conchologia iconica, vol. 2, *Ranella*, sp. 27, pl. 6, fig. 27, "Hab. Panama (found in coarse sand at the depth of ten fathoms); Cuming." TRYON, 1880, Manual of conchology, vol. 3, p. 38, pl. 19, fig. 9 (copy of Reeve's fig. 27).

TYPE LOCALITY: "Panama, of the Philippines." Panama, in coarse sand in 10 fathoms, here selected as type locality.

RANGE: Mazatlan, Mexico, to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Nine specimens from four samples from three stations:

PANAMA

Piñas Bay February 24, 1941, Station 19, in 8-18 fathoms, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34–43 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 5 specimens. Also at latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, in 15 fathoms, 2 specimens.

MEASUREMENTS: Largest specimen: length, 46.4 mm.; maximum diameter, 28 mm.

HABITAT: Gray sand and sandy mud, sand and shell fragments, and mud and live shell bottom.

REMARKS: The shell of this subspecies differs from that of typical *Bursa nana* Broderip and Sowerby in that it is sculptured with nearly uniform spiral rows of granules in addition to the stronger row on the shoulder. The shell of typical *Bursa nana* Broderip and Sowerby [1829, p. 376, no locality cited; Sowerby, 1835 (1832–1841), *Ranella*, p. 7, pl. 85, fig. 6, "Panama"; Reeve, 1844 (1843–1878), vol. 2, *Ranella*, sp. 29, pl. 6, figs. 29a, 29b] is nearly smooth except for a spiral row of tubercles on the shoulder, or with occasional fine spiral granulations. The color is purple or reddish brown, with a white band below the periphery; the inner and outer lips are usually white.

There is considerable variation shown in the sculpture of a series of specimens of *Bursa nana* and *B. n. albofasciata*. Some are sculptured with only slight granulation on part of the body whorl and in this feature are intermediate between the two forms, the extremes of which are quite distinct. Typical specimens of this subspecies in the collections of the California Academy of Sciences are on the whole smaller than those of *B. nana*. It often occurs on a muddy bottom.

The present record of the occurrence of *B. nana albofasciata* off Cape Pasado, Ecuador, is an extension south of the known range.

Bursa nana has been recorded from the Pliocene of Ecuador by Pilsbry and Olsson (1941, p. 39, pl. 5, fig. 6). A subspecies *B. nana jamanensis* was also cited by them (1941, p. 8) but without description or illustration. Olsson (1942, pp. 170, 172) later cited this

subspecies as occurring in the Pliocene of Panama and Costa Rica.

Bursa (Marsupina) albofasciata bous-singaulti Rutsch (1934, p. 58, fig. 7, pl. 3, figs. 3, 4) has been described from the upper Miocene at "Punta Gavilan," Venezuela.

GENUS *DISTORSIO* BOLTEN

A catalogue of the supraspecific units and of the species of this genus has been published recently by Emerson and Puffer (1953).

Distorsio decussatus Valenciennes

Tritonium decussatum VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 306.

Distorsio decussatus Valenciennes, PILSBRY AND OLSSON, 1941, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 40, pl. 5, fig. 9. M. SMITH, 1944, Panamic marine shells, p. 23, fig. 265; 1948, Triton, helmet and harp shells, p. 22, pl. 8, fig. 13.

[*Distorsio decussatum* [*Tritonium*] Valenciennes, EMERSON AND PUFFER, 1953, Proc. Biol. Soc. Washington, vol. 66, p. 99.

TYPE LOCALITY: "Habitat cum praecedente ad Acapulco." [Mexico.]

RANGE: Arena Bank, Gulf of California, to Manta, Ecuador.

MATERIAL EXAMINED: Five specimens from four stations:

PANAMA

Guayabo Chiquito, March 4, 1941, Station 30, [sample 78], in 25–64 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34–43 meters, 2 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, across mouth of bay and back along same course in 24–28 meters, 1 specimen.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 1 specimen.

MEASUREMENTS: Length, 33.6 mm.; maximum diameter, 19 mm. A large specimen in the collections of the California Academy of Sciences from Santa Inez Bay in the Gulf of California, measures: length, 56.4 mm.; maximum diameter, 34.6 mm.

HABITAT: Gray sand, gray mud, and sand and dead shell bottom.

REMARKS: The distorted shape of the shell, reticulate sculpture, broad flaring callus on the body whorl, and the presence of two plaits on the inner lip near the posterior end of the aperture are characteristic features of this species.

Tritonium decussatum Valenciennes was described one year earlier than *Triton constrictus* Broderip [1833, p. 5; Reeve, 1844 (1843-1878), vol. 2, *Triton*, sp. 41, pl. 12, fig. 41; Pilsbry and Olsson, 1941, p. 40, pl. 5, fig. 12 (as *Distorsio constrictus*); "Hab. ad Montem Christi et Xipixapi. Mr. Cuming dredged it up from sandy mud from seven to ten fathoms below the surface"]. It has generally been believed that only one species of *Distorsio* occurs in west American waters. Recently Pilsbry and Olsson have stated that two distinct species occur in this region. *Distorsio decussatus* was said to be characterized by a comparatively slender, thin shell with a long anterior canal and with two plates on the inner lip near the posterior end of the aperture, one emerging at the angle and one a little lower. *Distorsio constrictus* was said to possess a shorter, thicker shell with a shorter canal and with one plait on the upper portion of the inner lip; above the plait there are two or three wart-like tubercles. We have observed specimens representing these two forms from the Gulf of California to Panama. They appear to occur together throughout most of their range. Typical specimens occur which are quite distinct and can readily be assigned to two species, but with these are some specimens, especially smaller ones, which do not appear readily separable into two species. *Distorsio decussatus* has been recorded as occurring in the Pliocene of Ecuador and "Lobitos Tablazo," Peru, Pleistocene of Panama, Costa Rica, and Ecuador.

Distorsio constricta floridana Olsson and McGinty (1951, p. 27, pl. 1, figs. 5, 6, 9) described from off Palm Beach, Florida, in 30 to 40 fathoms, was assigned a new subspecific name, *mcgintyi*, by Emerson and Puffer (1953, p. 101) owing to the earlier combination of names, *Personella floridana* Gardner, 1947, which they placed in the genus *Distorsio*.

Pilsbry (1922, pp. 356-360) discussed the relationships of *Distorsio constrictus* *similli-*

mus Sowerby which occurs in the Miocene of the Caribbean region. Emerson and Puffer (1953, pp. 98, 99, 100) concluded that this Miocene form is questionably a paleo-subspecies of *D. decussatus* Valenciennes. They further concluded that *D. gatunensis* Toula, from the Miocene of Panama, and the form originally described as *Tritonium ringens* Philippi from the Tertiary of Chile are both paleo-subspecies of *D. decussatus*.

Distorsio ridens Reeve, which has been cited by some writers from west American waters, was originally described from the Philippine Islands. E. A. Smith (1895, p. 263) considered it to be a Philippine form and placed it as a variety of "*Distortrix cancellina* (Roissy)." The same author (1895, p. 264) commented on the fact that Tryon considered *Triton decipiens* Reeve and *T. ridens* to be identical with "*Triton constrictus* of Reeve" and stated regarding the latter, "I consider that its great solidity, the much more distorted spire, coarser sculpture, and heavy labrum are sufficient to separate it specifically." Faustino (1928, p. 232) placed Reeve's species in the synonymy of "*Distortrix cancellinus* Roissy." Emerson and Puffer (1953, p. 103), in a recent paper, consider *Triton ridens* Reeve to be a variant of *Distorsio reticulata* Bolten. The record of *Distortrix ridens* Reeve cited by Nicklès (1950, p. 86, fig. 133) as occurring along the west coast of Africa was referred by Puffer (1953, p. 112) to *Distorsio clathrata* Lamarck.

FAMILY COLUBRARIIDAE

GENUS COLUBRARIA SCHUMACHER

Colubraria aphrogenia Pilsbry and Lowe

Colubraria aphrogenia PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Philadelphia, vol. 84, p. 62, pl. 4, fig. 10. M. SMITH, 1944, Panamic marine shells, p. 23, fig. 310.

TYPE LOCALITY: "Taboga Island, R. P. (Lowe)." [Panama.]

RANGE: Corinto, Nicaragua, to Piñas Bay, Panama.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, in 8 to 10 fathoms.

MEASUREMENTS: Length, 11.4 mm.; maximum diameter, 4.2 mm.

HABITAT: Gray sandy mud bottom.

DESCRIPTION: Shell small, slender, rather

thin, about two varices on each whorl; whorls broadly rounded, sculptured with axial and spiral riblets, the whole bearing microscopic spiral striae; aperture narrow, merging into a short anterior canal, columella smooth, inner lip thin, somewhat expanded, standing free, outer lip with a small varix, the edge slightly crenulated; siphonal fasciole small; light brown, with white spots on the varices. (Adapted from Pilsbry and Lowe.)

REMARKS: The present specimen appears to be referable to the species described by Pilsbry and Lowe as *Colubraria aphrogenia*. *Colubraria panamensis* M. Smith (1947, p. 55, pl. 2, fig. 6), "Type locality: Panama Bay (Clark)," appears to be a very similar form. No comparison with *C. aphrogenia* was mentioned at the time of description. *Colubraria perla* M. Smith (1947, p. 55, pl. 2, fig. 2), "Type locality: Pearl Islands, Republic of Panama (Clark)," was said to differ from *C. panamensis* in that the inner wall of the aperture is more bent. The spiral and the axial sculpture on *C. perla* were said to be of almost equal strength throughout.

The present record of the occurrence of *Colubraria aphrogenia* in Piñas Bay, Panama, is a slight extension south of the known range.

FAMILY CASSIDIDAE

GENUS MORUM BOLTEN

Morum tuberculosum Sowerby in Reeve

Oniscia tuberculosa SOWERBY, 1824, The genera of recent and fossil shells, vol. 2, no. 24, p. 2, "South Seas"; *nomen nudum*. REEVE, 1842, Conchologia systematica, vol. 2, p. 211, pl. 253, figs. 2-4, no locality cited; 1849, Conchologia iconica, vol. 5, *Oniscia*, sp. 5, pl. 1, figs. 5a, "Gallapagos Island (in clefts of rocks at low water); Cuming," 5b, "Gulf of California." TRYON, 1885, Manual of conchology, vol. 7, p. 281, pl. 4, figs. 68, 69 (copies of Reeve's figs.).

Morum xanthostoma A. ADAMS, 1854, Proc. Zool. Soc. London, for 1853, p. 174, "Hab. Galapagos Archipelago. Mus. Cuming." Reference to Reeve's var. *a* in Conchologia systematica, but the variety "*a*" cited is so indicated in the Conchologia iconica.

Morum tuberculosum Sowerby, MELVILL, 1919, Proc. Malacol. Soc. London, vol. 13, p. 70. SCHENCK, 1926, Univ. California Publ. Bull. Dept. Geol. Sci., vol. 16, p. 87, pl. 15, fig. 9. WRIGLEY, 1934, Proc. Malacol. Soc. London, vol.

21, p. 113, pl. 15, fig. 7. M. SMITH, 1948, Triton, helmet and harp shells, p. 43, pl. 15, fig. 4.

TYPE LOCALITY: "South Seas" cited by Sowerby, but his name is without description or figure. Reeve cited Galapagos Islands and Gulf of California. Gulf of California here selected as type locality.

RANGE: ?Cedros Island, Baja California. Magdalena Bay, Baja California, to Ceralbo Island in the Gulf of California and south to Mancora, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach on northern side of island.

MEASUREMENTS: Length, 17.2 mm.; maximum diameter, 9.9 mm. A large specimen from Albemarle Island, Galapagos Islands, in the collections of the California Academy of Sciences measures 34.5 mm. in length.

HABITAT: Shell found on beach. This species is sometimes taken under rocks at extreme low tide.

DESCRIPTION: Shell cylindrical, oblong, thick, spire slightly elevated or depressed, the apex projecting as a sharp point; sculptured with about five concentric rows of blunt tubercles and fine concentric ridges; columella finely granulated, outer lip somewhat contracted in the middle, dentate within; chestnut or chocolate, dotted or reticulated with white, interior white or bright saffron.

REMARKS: *Oniscia xanthostoma* A. Adams was based on a specimen from the Galapagos Islands with a saffron-colored interior. Most authors have considered this to be merely a color variety of *Morum tuberculosum*.

Clench and Abbott (1943, p. 5, footnote) considered *Oniscia lamarckii* Deshayes [1844 (1835-1845), vol. 10, p. 12; ref. to various authors including Chemnitz, 1795 (1780-1795), vol. 11, pl. 195A, figs. 1872, 1873; Reeve, 1842 (1841-1842), vol. 2, pl. 254, fig. 4; Kiener, 1835 (1834-1879), p. 9, pl. 2, fig. 5] originally cited from "les mers de l'Inde" to be referable to *Morum tuberculosum* Sowerby. This is not the species described as *Oniscia lamarckii* by Lesson, 1840.

This species probably ranges north to Cedros Island, Baja California, a locality from which Lowe (1913, p. 29) cited "*Oniscia* sp." It also has been recorded as occurring on

the "Lobitos Tablazo," Peru, in Pleistocene deposits at Magdalena Bay, Baja California, Oaxaca, Mexico, and the Galapagos Islands.

FAMILY CERITHIIDAE

GENUS CLAVA MARTYN

Clava gemmata Hinds

Cerithium gemmatum HINDS, 1844, The zoology of the voyage of H.M.S. Sulphur, Mollusca, pt. 2, p. 27, pl. 11, figs. 5, 6. SOWERBY, 1855, Thesaurus conchyliorum, vol. 2, p. 853, pl. 177, fig. 41. TRYON, 1887, Manual of conchology, vol. 9, p. 146, pl. 28, fig. 44, under subgenus *Vertagus*.

Vertagus gemmatus Hinds, REEVE, 1866, Conchologia iconica, vol. 15, *Vertagus*, sp. 5, pl. 1, fig. 5.

Clava californica DALL, 1919, Proc. U. S. Natl. Mus. vol. 56, p. 346, "Type-locality.—South end Tiburon Island, Gulf of California; Dr. Paul Bartsch."

Clava gemmata Hinds, BAKER, HANNA, AND STRONG, 1938, Proc. California Acad. Sci., ser. 4, vol. 23, p. 226, pl. 17, fig. 5. M. SMITH, 1944, Panamic marine shells, p. 19, fig. 207. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 120, pl. 33, figs. 6, 9.

Clava (Ochetoclava) gemmata Hinds, HOFFSTETTER, 1952, Bol. Inst. Cien. Nat., Quito, yr. 1, p. 55, fig. 15.

TYPE LOCALITY: "Inhab. Panama. In situations where the floor is sandy mud, in from two or three to seven fathoms or upwards."

RANGE: Magdalena Bay, Baja California, to Santa Catalina Island in the Gulf of California and south to Ecuador.

MATERIAL EXAMINED: One specimen from Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8.

MEASUREMENTS: Length, 34.5 mm.; maximum diameter, 11.8 mm. Specimens of this species attain a length of 50 mm.

HABITAT: Not specified.

DESCRIPTION: Shell tapering, pointed at apex, body whorl flattened in front; sculptured with spiral rows of tubercles which are separated by spiral grooves, the rows just below the suture the strongest; aperture usually forming a narrow sinus posteriorly; columella with an oblique median plication; color yellowish white and somewhat spotted with chestnut brown.

REMARKS: *Cerithium articulatum* Adams and Reeve (1850, p. 43, pl. 10, fig. 14) originally described from "Coast of Borneo, China

Sea" and *Vertagus tenuisculptus* Sowerby in Reeve [1866 (1843–1878), vol. 15, *Vertagus*, sp. 22, pl. 5, figs. 22a, 22b] described from "Australia" were considered by Tryon to be identical with *Clava gemmata*. However, more recently Schepman (1909, p. 164) cited *Clava articulata* from the East Indies, and Dautzenberg and Bouge (1933, p. 316) recorded it as occurring at various islands in Polynesia. We have not noticed recent records of *C. tenuisculpta* in Australia, but Schepman (1909, p. 165) cited it from the East Indies and stated, "Probably only a variety of the preceding species¹; the only specimen is young and consequently the identification rather uncertain; in accordance with the figure of Reeve, the spire is more acuminate than in *C. articulata*." Consideration of the records of occurrence has led us to omit these species from the synonymy of the west American species, at least until their relationship to *C. gemmata* is better known.

Ochetoclava Woodring (1928, p. 334) was proposed as a subgenus of *Clava*, with *Cerithium gemmatum* Hinds as type.

Clava gemmata is known to occur from Pliocene to Recent.

GENUS CERITHIUM BRUGUIÈRE

Cerithium adustum Kiener

Cerithium adustum KIENER, 1841–1842, Iconographie des coquilles vivantes, Canalifères, pt. 1, Cérîte, p. 37, pl. 13, fig. 2. SOWERBY, 1855, Thesaurus conchyliorum, vol. 2, p. 865, pl. 178, fig. 48. REEVE, 1856, Conchologia iconica, vol. 15, *Cerithium*, sp. 12, pl. 2, fig. 12. TRYON, 1887, Manual of conchology, vol. 9, p. 126, pl. 21, fig. 52 only. M. SMITH, 1944, Panamic marine shells, p. 18, fig. 205 (fig. on right only).

TYPE LOCALITY: "Habite l'océan Indien, la mer Rouge." These original localities are erroneous.

RANGE: Isla Raza, Gulf of California, to Santa Elena, Ecuador, Cocos Island, and the Galapagos Islands.

MATERIAL EXAMINED: Five specimens from two stations:

PANAMA

Pacheca Island, Pearl Islands, February 10, 1941, Station 1, sample 2, beach on northern side of island, 3 specimens.

¹ *Clava articulata* Adams and Reeve.

ECUADOR

La Plata Island, December, 1942, 2 specimens.

MEASUREMENTS: Largest specimen: length, 43.4 mm.; maximum diameter, 22 mm.

HABITAT: Specimens picked up on beach.

DESCRIPTION: Shell ventricose, blackish gray, spirally striated, nearly smooth or with fine subobsolete nodes which are stronger on the spire; columella with a large node of callus posteriorly.

REMARKS: In the caption to Kiener's plate 13 this species is erroneously cited as figure 3 instead of figure 2.

Cerithium adustum, a generally southern form, is nearly smooth in comparison to the knobby, more northern *C. maculosum* Kiener [1841-1842 (1834-1879), *Cérite*, p. 36, pl. 13, fig. 3; Baker, Hanna, and Strong, 1938a, p. 225, pl. 17, fig. 2; not *C. maculosum* Mighels, 1845]. The present species is known to occur in the Pleistocene of Ecuador.

GENUS CERITHIDEA SWAINSON

Cerithidea montagnei d'Orbigny

Cerithium montagnei D'ORBIGNY, 1841, *Voyage dans l'Amérique Méridionale*, vol. 5, p. 443, pl. 63, figs. 3, 4. KIENER, 1841-1842, *Iconographie des coquilles vivantes*, Canalifères, pt. 1, *Cérite*, p. 98, pl. 30, fig. 1 (2 figs.).

Cerithium reevianum C. B. ADAMS, 1852, *Ann. Lyc. Nat. Hist. New York*, vol. 5, pp. 380, 534, "Habitat.—Panama."

Cerithidea montagnei d'Orbigny, BAKER, HANNA, AND STRONG, 1938, *Proc. California Acad. Sci.*, ser. 4, vol. 23, p. 227, pl. 18, figs. 1, 2.

Cerithidea (Cerithideopsis) montagnei d'Orbigny, ZILCH, 1954, *Com. Inst. Trop. Inves. Cien., El Salvador*, yr. 3, nos. 2, 3, p. 81, pl. 3, fig. 9, El Salvador.

TYPE LOCALITY: "Rencontrée dans les eaux saumâtres de la rivière de Guayaquil, avec le *Cérite* précédent [*C. varicosum* Sowerby]." [Ecuador.]

RANGE: San Ignacio Lagoon, Baja California, to the Gulf of California and south to the Guayaquil River, Ecuador.

MATERIAL EXAMINED: Three specimens from San José Island, Pearl Islands, Panama, November 26, 1945, R. C. Murphy, collector.

MEASUREMENTS: Largest specimen: length, 37.8 mm.; maximum diameter, 18 mm.

HABITAT: Specimens picked up on beach.

DESCRIPTION: About a dozen rounded

whorls which are rather closely longitudinally ribbed, the plicae varying in number but often numbering 25 to 40 on last whorl of large specimens; last whorl carinated at base and spirally striated below; aperture large, round, expanded; color brown, banded with blackish brown or white.

REMARKS: This beautiful species may be readily recognized by the polished chestnut-brown shell crossed by whitish bands, numerous longitudinal ribs, and lack of varices. Occasionally a specimen may have a small varix on the penultimate whorl.

The form described as *Cerithium pulchrum* by C. B. Adams (1852, pp. 380, 534, "Panama . . . Half buried in muddy sand under bushes at high water mark") is a varicose subspecies of *C. montagnei*. Some of the characteristic features of it cited by Adams were ". . . with about forty slender acute ribs on each whorl, which terminate abruptly on the periphery of the last whorl; with very stout varices 240° distant; with a narrow acute spiral keel, above the middle of the whorls, traversing the ribs and varices: with a few raised spiral lines and many minute spiral striae, which do not traverse the ribs." Carpenter (1863, p. 350), who studied the type specimen, stated, "A distinct and truly beautiful species, seldom obtained by collectors."

These remarks of Adams and of Carpenter agree well with specimens labeled *Cerithidea pulchra* in the collections of the California Academy of Sciences. One lot of five specimens from Panama in the Henry Hemphill collection were originally received from R. E. C. Stearns, and another lot of three specimens from the same locality, in the Academy's collection, came from the R. E. C. Stearns collection of duplicates.

Bequaert (1942, p. 25) considered *C. pulchra* to be identical with *Cerithidea varicosa* Sowerby, *C. valida* C. B. Adams, *C. fortiuscula* Bayle, and others.

The specimens of *C. pulchra* from Panama in the collections of the California Academy of Sciences agree so well with the descriptions of Adams and Carpenter that we consider that name, applicable to these varicose forms of *C. montagnei*, to be of subspecific value. Zilch (1954, p. 83) concluded from a study of specimens from El Salvador that *C. pulchra* is a valid species and stated that no intergradation occurs between it and the species

that he cited under the name of *C. hegewischii* (= *C. valida* C. B. Adams).

***Cerithidea valida* C. B. Adams**

[?] *Cerithium varicosum* VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 282, "Habitat cum praecedente," i.e., "Habitat ad portum Cumanensem."

Cerithium varicosum SOWERBY, 1834, The genera of recent and fossil shells, vol. 2, *Cerithium*, pl. 260, fig. 5, and explanation to pl., no locality cited. SOWERBY, 1855, Thesaurus conchyliorum, vol. 2, p. 887, pl. 186, figs. 280-282, "Real Llejos, Central America, at the roots of mangroves."

Not *Cerithium varicosum* DeFrance, 1817.

Cerithium validum C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 381, 534, "Panama."

Cerithidea solida Gould, CARPENTER, 1857, Rept. Brit. Assoc. Adv. Sci., for 1856, p. 230; no description; "*solida*, Gld. = *valida* C. B. Ad. = *variosa*, Sow. 68. Panama."

Cerithidea varicosa Sowerby, REEVE, 1866, Conchologia iconica, vol. 15, *Cerithium*, sp. 19, pl. 3, fig. 19a only. TRYON, 1887, Manual of conchology, vol. 9, p. 161, pl. 33, fig. 58 (copy of Reeve's fig. 19a).

Cerithium fortiusculum BAYLE, 1880, Jour. Conchyl., vol. 28, p. 250, "Amérique centrale." New name for *Cerithium varicosum* Sowerby, 1855, not *C. varicosum* DeFrance, 1817.

Potamides meta LI, 1930, Bull. Geol. Soc. China, vol. 9, p. 267, pl. 6, fig. 50, "Brought up by marine dredge from depths varying from 10. ft. to 40. ft. in the mud at the mouth of the Rio Grande near La Boca about one mile from the mainland in Panama Bay." Horizon: Probably Recent." Pilsbry (1931, p. 433) stated, "A characteristic though worn example of *Cerithidea valida* (C. B. Ad.)."

Cerithidea aguayoi CLENCH, 1934, Proc. Boston Soc. Nat. Hist., vol. 40, p. 110, not the locality "Texas and Cuba." New name for *Cerithium varicosum* Sowerby, 1834, not *C. varicosum* DeFrance, 1817.

Cerithidea fortiuscula Bayle, BAKER, HANNA, AND STRONG, 1938, Proc. California Acad. Sci., ser. 4, vol. 23, p. 228, pl. 18, fig. 3.

TYPE LOCALITY: "Panama," for *Cerithium validum*.

RANGE: Las Animas Bay in the Gulf of California to Guayaquil, Ecuador. Peru (Troschel).

MATERIAL EXAMINED: One specimen from Ardita Bay, Colombia, March 5, 1941, Station 31, sample 80, on beach.

MEASUREMENTS: Length, 29 mm.; maximum diameter, 13 mm.

HABITAT: Specimen picked up on beach.

DESCRIPTION: Shell moderately long, spire acute, about 20 longitudinal ribs on the last whorl (on type) which terminate abruptly at the periphery; about six spiral ridges with intermediate spiral striae; strong varices present; outer lip thickened on adult shells; color reddish brown or grayish black, a pale spiral band or line along the middle of the whorls, sometimes varices white, also the spiral ridges and the last whorl, interior white or brown.

REMARKS: In the present paper we have applied the specific name *valida* C. B. Adams to the present species, because that name appears to be certainly applicable to it. Bequaert (1942, p. 25) applied the name *Cerithium hegewischii* variety *pulchra* C. B. Adams to this form. In the present paper, under the discussion of *C. montagnei*, we have given our reasons for considering *C. pulchra* to be a subspecies of *C. montagnei*. Bequaert considered the northern slender forms described by Carpenter as *mazatlanica* to be identical with, and *albonodosa* to be a variety of, the species originally described as *Cerithium (Potamides) hegewischii* Philippi (1848, p. 19), "Patria: Respublica Mejico; legit Hegewisch." However, Philippi did not indicate whether it came from the east or west coast of that country. Until the type specimen of *C. hegewischii*, as well as the types of the various forms described by Adams and Carpenter, has been illustrated, we believe it best to use the specific name *valida* for the present species.

FAMILY VERMETIDAE

GENUS VERMICULARIA LAMARCK

***Vermicularia pellucida eburnea* Reeve**

Vermetus eburneus REEVE, 1842, Conchologia systematica, vol. 2, p. 46, pl. 152, fig. 2; 1843, Proc. Zool. Soc. London, for 1842, p. 197. CARPENTER, 1856, Catalogue of . . . Mazatlan shells, p. 304. REEVE, 1860, Elements of conchology, vol. 2, p. 9, pl. 22, fig. 130.

Vermiculus eburneus Reeve, MÖRCH, 1860, Jour. Conchyl., vol. 8, p. 30.

[*Vermetus (Vermicularia) pellucidus* Broderip and Sowerby] var. *eburneus* Reeve, TRYON, 1886, Manual of conchology, vol. 8, p. 188, pl. 56, fig. 6.

Vermicularia eburnea Reeve, GRANT AND GALE,

1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 776. M. SMITH, 1944, Panamic marine shells, p. 13, fig. 141. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 121, pl. 33, fig. 15.

TYPE LOCALITY: "Brought by Mr. Cuming from South America."

RANGE: San Pedro, California, to Panama (Dall).

MATERIAL EXAMINED: One specimen not localized.

MEASUREMENTS: Length, approximately 65.4 mm.; maximum diameter, approximately 12 mm.

HABITAT: Not indicated.

DESCRIPTION: "Verm. testâ eburneâ, subobesâ, laxè volutâ, longitudinaliter costatâ, costis distantibus, subobsoletis. Long. $3\frac{1}{8}$; diam. $\frac{7}{8}$ poll." (Reeve, 1843).

REMARKS: *Vermicularia pellucida* Broderip and Sowerby (1829, p. 369) was originally described without information as to the locality from which it came, but it generally has been considered by later workers to be a west American shell. About the only apparent difference between that species and the subspecies *eburnea* is the larger turritelloid form and stronger sculpture of *V. pellucida*. It is by no means certain, however, that these are constant characters that may be relied upon to separate the two.

According to Carpenter (1864) the species cited from Panama by C. B. Adams under the name *Vermetus glomeratus?* Lamarck is identical with *Vermetus eburneus* Reeve.

Vermicularia pellucida eburnea also has been recorded as occurring in Pliocene and Pleistocene deposits of western North America, and *V. pellucida* has been recorded as occurring in the Pleistocene of Ecuador.

FAMILY TURRITELLIDAE

GENUS TURRITELLA LAMARCK

Turritella leucostoma Valenciennes

Turritella leucostoma VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 276. KIENER, 1843-1844, Iconographie des coquilles vivantes, Turbinacées, Turritelle, p. 9, pl. 6, fig. 2 (2 figs.). C. W. MERRIAM, 1941, Univ. California Publ. Bull. Dept. Geol. Sci., vol. 26, p. 56, pl. 39, fig. 11 (cited as *Turritella* cf. *leucostoma* on explanation to pl. 39).

Turritella tigrina KIENER, 1843-1844, Iconog-

raphie des coquilles vivantes, Turbinacées, Turritelle, p. 29, pl. 4, fig. 2 (2 figs.), "Habite." REEVE, 1849, Conchologia iconica, vol. 5, *Turritella*, sp. 8, pl. 3, fig. 8, "Gulf of California." TRYON, 1886, Manual of conchology, vol. 8, p. 199, pl. 62, fig. 65 (copy of Kiener's fig. 2, lower fig.).

Turritella cumingii REEVE, 1849, Conchologia iconica, vol. 5, *Turritella*, sp. 13, pl. 4, fig. 13, "Panama (in mud at depths from eleven to sixteen fathoms); Cuming. Conchagua; Belcher." TRYON, 1886, Manual of conchology, vol. 8, pl. 62, fig. 66 (reproduction of Reeve's fig. 13).

TYPE LOCALITY: "Habitat in Oceano Pacifico, ad portum Acapulco Mexicanorum."

RANGE: Cedros Island, Baja California, to Punta Penasco in the Gulf of California and south to Gorgona Island, Colombia.

MATERIAL EXAMINED: Fifteen specimens from four stations:

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 7 specimens.

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, 5 specimens.

LOCALITY DOUBTFUL

One specimen from either Station 32, sample 83, or Station 19.

No station cited, 2 specimens.

MEASUREMENTS: Largest specimen: length (apex incomplete), 103 mm.; maximum diameter, 22 mm. The shell of this species attains a length of at least 120 mm.

HABITAT: Gray sand, and black mud bottom.

REMARKS: The conically shaped, basally subcarinate whorls and brownish speckled coloration are characteristic of this species.

The earliest name for this species appears to be *Turritella leucostoma* Valenciennes. Later names for the same species are *T. tigrina* Kiener and *T. cumingii* Reeve. There is variation in the shape and ornamentation of the whorls, but the characteristic features of this species are usually well defined and quite different from those of any other west American *Turritella*. Sometimes some of the secondary riblets are nearly as strong as the primary spirals, and on some specimens the top of each whorl is about as wide as the base of the whorl posterior to it.

Turritella pasada Pilsbry and Olsson (1941, p. 42, pl. 11, figs. 3, 4; Durham, 1950, p. 123,

pl. 28, fig. 21) described from the Pliocene of Puerto Jama, Ecuador, is a very similar form. It is said to differ from *T. tigrina* [= *T. leucostoma*] in possessing more uniform and finer spiral sculpture and in the less attenuated character of the apical portion of the shell.

Turritella leucostoma also is known to occur in the Pleistocene at Magdalena Bay, San Ignacio Lagoon, and Scammon Lagoon, Baja California, Oaxaca, Mexico, Panama, and in the Pliocene of Costa Rica and Panama. It also has been recorded as occurring in archeologic ruins and middens of southwestern United States.

Turritella mariana Dall

Plate 3, figure 32

Turritella mariana DALL, 1908, Bull. Mus. Comp. Zool., vol. 43, p. 327, pl. 11, fig. 14. STRONG, HANNA, AND HERTLEIN, 1933, Proc. California Acad. Sci., ser. 4, vol. 21, p. 123, pl. 6, figs. 1-4. C. W. MERRIAM, 1941, Univ. California Publ. Bull. Dept. Geol. Sci., vol. 26, pp. 47, 56, pl. 32, fig. 3. M. SMITH, 1944, Panamic marine shells, p. 17, fig. 198.

TYPE LOCALITY: "U. S. S. 'Albatross,' station 3427, near the Tres Marias Islands, in 80 fathoms, rocky bottom, temperature 51.2° F. U.S.N. 123,036." [Off Mexico.]

RANGE: Cedros Island, Baja California, to Santa Inez Bay in the Gulf of California and south to Octavia Bay, Colombia, in 12-80 fathoms.

MATERIAL EXAMINED: Seventy-seven specimens from four samples from three stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, in 6-8 fathoms, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, [Station 31, sample 81], dredged in and out of bay in 34-43 meters, 41 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course in 24-28 meters, 19 specimens. Also March 7, 1941, Station 32, sample 83, dredged a little inside sample 82 in 25 meters, 16 specimens.

MEASUREMENTS: One of largest specimens: length, 61.6 mm.; maximum diameter, 12.5

mm. The species is known to attain a length of 110 mm.

HABITAT: Gray sand, one sample from black mud bottom.

DESCRIPTION: Shell slender, tapering, acute; whorls excavated in the middle between two beaded, spiral ridges or keels which are situated at about the anterior and posterior thirds of the whorl, respectively, also excavated or beveled above the upper keel and below the lower one; a spiral thread, sometimes fairly coarse, occurs between the posterior ridge and suture; between the two major ridges or keels there are usually two strong and two weaker, finely nodose spiral threads, and in addition the whorls are covered by minute spiral striae; base of last whorl is sharply carinate, but in the earlier whorls each succeeding whorl is laid even with the edge of the base of the earlier one; growth line with a symmetrical, deep, anti-spiral sinus which reaches its maximum about midway between the two major ridges, a spiral sinus reaches its maximum at the periphery, and on the base the line is broadly curved; color yellowish white and pinkish brown in fresh specimens.

REMARKS: As pointed out by Merriam, it is quite possible that the earlier name, *Turritella radula* Kiener [1843-1844 (1834-1879), *Turritella*, p. 13, pl. 2, fig. 1; Reeve, 1849 (1843-1878), vol. 5, *Turritella*, sp. 30, pl. 7, fig. 30] may take precedence over that of *T. mariana* Dall. The name *Turritella radula* Kiener was proposed for a shell 80 mm. in length which was described without information as to the locality from which it came. Later, Reeve cited it, "Hab. Isle of Muerte, Bay of Guayaquil (found at the depth of eleven fathoms in sandy mud); Cuming." This locality is here designated as the type locality of *T. radula*. Tomlin cited it from Panama, Colombia, and the Galapagos Islands, and Pilsbry and Lowe, and Strong, Hanna, and Hertlein cited it from Acapulco, Mexico. The description and illustrations given by Kiener agree almost exactly with those given of *T. mariana* Dall, the type of which was a young shell 25 mm. in length.

In an earlier paper the present authors (Strong, Hanna, and Hertlein, 1933) separated specimens under the name of *T.*

mariana, basing this distinction on the slightly greater apical angle and more strongly developed posterior spiral ridge. The variability of these characters shown by a series of specimens identified as *T. mariana* is such that it appears possible that this form is a subspecies of, or may be referable to the earlier name of, *T. radula* Kiener as surmised by Merriam. We apply the name *mariana* to the present specimens, because we have not a series for comparison from Ecuador, where typical *T. radula* is supposed to occur.

Turritella imperialis Hanna (1926, p. 457, pl. 21, figs. 1-3), a very similar species described from the Pliocene of Coyote Mountain, Imperial County, California, has been recorded as attaining a length of 155 mm.

The record of *T. mariana* from Catalina Island, California, cited by Dall (1921, p. 151) was probably based on a variant of *T. cooperi* (see Merriam, 1941, p. 56).

The present record of the occurrence of *Turritella mariana* in Octavia Bay, Colombia, is a slight extension south of the known range on the mainland.

Turritella nodulosa King and Broderip

Turritella nodulosa KING AND BRODERIP, 1832, Zool. Jour., vol. 5, p. 347. REEVE, 1849, Conchologia iconica, vol. 5, *Turritella*, sp. 11, pl. 4, figs. 11a, 11b. TRYON, 1886, Manual of conchology, vol. 8, p. 202, pl. 63, figs. 78, 79. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 123, pl. 28, figs. 1, 2.

Turritella papillosa KIENER, 1843-1844, Iconographie des coquilles vivantes, Turbinacées, Turritelle, p. 31, pl. 14, fig. 3, "Habite." TRYON, 1886, Manual of conchology, vol. 8, pl. 63, fig. 80 (copy of Kiener's fig.).

TYPE LOCALITY: "Habitat?" originally cited. Reeve cited "Hab. Gulf of Dulce, Central America (found in sandy mud at the depth of six to ten fathoms); Cuming." This is here designated as the type locality for this species.

RANGE: Magdalena Bay, Baja California, to Santa Inez Bay in the Gulf of California and south to the Santa Elena Peninsula, Ecuador, in 2 to 93 fathoms.

MATERIAL EXAMINED: One specimen from Playa Grande, San José Island, Pearl Islands, Panama, November 26, 1941, R. C. Murphy, collector.

MEASUREMENTS: Imperfect specimen: length, 29.5 mm.; maximum diameter, 7.8 mm. A very large specimen in the collections of the California Academy of Sciences from Port Parker, Costa Rica, measures: length (spire incomplete), 69.6 mm.; diameter of last whorl, 15 mm.

HABITAT: Not indicated for the present specimen. This species often occurs on a muddy or sandy bottom.

DESCRIPTION: Shell with about 15 whorls on large specimens; early whorls carinate, accompanied by fine secondaries, later whorls usually subangulate and nodulous along the upper third, on adult whorls there are about four nodulous spirals, the second from the posterior suture often the strongest, the nodes coincide with rounded longitudinal plications of the whorls; in addition, the whorls are covered with fine, sharp, lamina-like striae separated by deeply incised interspaces; a shallow spiral groove occurs a little anterior to the middle in adult whorls; base with fine spirals, four or five of which are slightly stronger than the others; growth line with a slightly asymmetrical antispinal sinus which reaches its maximum at or slightly below the middle of the whorl, and a small spiral sinus; color gray or buff with somewhat irregular longitudinal flammules.

REMARKS: Gardner (1948, p. 197) stated that the ornamentation of *Turritella nodulosa* is similar to that of the subgenus *Toruloidella* Sacco (type, *Turbo varicosus* Brocchi) except that the axial sculpture is stronger on the west American species.

This species also is known to occur in the Pleistocene at Magdalena Bay, Baja California, and at Maria Magdalena Island, Tres Marias Islands, and at Santa Inez Bay in the Gulf of California.

FAMILY LITTORINIDAE

GENUS LITTORINA FÉRUSSAC

Littorina araucana d'Orbigny

Littorina araucana D'ORBIGNY, 1840, Voyage dans l'Amérique Méridionale, vol. 5, p. 393, pl. 53, figs. 8-10. TRYON, 1887, Manual of conchology, vol. 9, pp. 250, 467, pl. 45, figs. 95, 96. M. SMITH, 1944, Panamic marine shells, p. 16, fig. 190A.

[?] *Littorina paytensis* PHILIPPI, 1847, Abhandlungen und Beschreibungen . . . Conchylien, vol. 2, no. 6, p. 166 (24), pl. 3, fig. 25, "Patria: Payta in

Peruvia; communicavit cl. Petit." TRYON, 1887, Manual of conchology, vol. 9, p. 250, pl. 45, figs. 90, 91.

TYPE LOCALITY: "Elle habite sur les rochers des environs de Valparaiso, au Chile, où l'avons recueillie au niveau des plus hautes marées de syzygies. Elle y est des plus commune; elle habite encore toute la côte jusqu'à Arica, au Pérou."

RANGE: Nicaragua to the Island of Chiloe, Chile (Dall).

MATERIAL EXAMINED: Six specimens from Salinas, Ecuador, 1942.

MEASUREMENTS: Largest specimen: length, 11.8 mm.; maximum diameter, 7.8 mm.

HABITAT: Not indicated for present specimens. This species occurs on rocks at approximately the high-tide mark.

REMARKS: The specimens in the present collection referred to *Littorina araucana* are rather small, mostly pitted and lacking color. They appear referable to this species because of the rather widely spaced, finely incised spiral lines and faint traces of an angulation at the base of the whorl on some of the specimens. These imperfectly preserved specimens might possibly be referable to *Littorina conspersa* Philippi, but the shell of that species is usually sculptured with a greater number of more closely spaced grooves separated by more strongly projecting ridges. Dall cited *L. araucana* as occurring from Nicaragua to Chiloe Island, Chile, but we have not seen specimens from north of Ecuador.

We have included *Littorina paytensis* Philippi questionably in the synonymy of *L. araucana* following Tryon and Dall, but we have not seen specimens.

A number of species of *Littorina* have been recorded from the Panamic region, and it seems desirable at this time to call attention to two of these records. Morrison (1946, pp. 9, 10) recorded the occurrence of *Littorina debilis* Philippi and "? *Littorina glabrata* Philippi" at San José Island, Pearl Islands, in the Bay of Panama. *Littorina debilis* Philippi [1846a, p. 140, "Hab. Unknown"; 1847 (1842-1851), vol. 3, no. 1, p. 47 (11), pl. 6, fig. 7] was originally described from an unknown locality and *Littorina glabrata* Philippi [1846a, p. 140; 1848 (1842-1851), vol. 3, no. 3, p. 62 (56), pl. 7, fig. 5] was described: "Hab. ad Payta Peru (on rocks, half tide);

Cuming. Ad Caput Natale (Wahlberg)." Cox (1930, p. 135, pl. 13, fig. 11), however, cited *L. glabrata* as occurring in a raised reef deposit of post-Pliocene age southeast of Mombasa Island, east Africa. He stated that the original record of the occurrence of this species at Peru was based on a Cuming label and was not reliable and that most authorities have accepted it as an Indian Ocean species. We have not seen specimens of the species.

FAMILY PLANAXIDAE

GENUS PLANAXIS LAMARCK

Planaxis planicostatus Sowerby

Planaxis planicostatus SOWERBY, 1825, A catalogue of . . . shells . . . in . . . collection . . . Tankerville, app., p. xiii. REEVE, 1846, Initialementa conchologica, p. 62, pl. 3, fig. 17; 1860, Elements of conchology, vol. 1, p. 62, pl. 3, fig. 17. SOWERBY, 1878, in Reeve, Conchologia iconica, vol. 20, *Planaxis*, sp. 26, pl. 4, figs. 26a, 26b; 1884, Thesaurus conchyliorum, vol. 5, p. 172, pl. 483 (*Planaxis* pl. 1), fig. 12. TRYON, 1887, Manual of conchology, vol. 9, p. 277, pl. 52, fig. 30. M. SMITH, 1944, Panamic marine shells, p. 17, fig. 195.

Buccinum planaxis WOOD, 1828, Supplement to the Index testaceologicus, pp. 12, 49 (as *Planaxis planaxis*), pl. 4, fig. 15, habitat unknown.

Planaxis canaliculatum DUVAL, 1840, Rev. Zool., Soc. Cuvierienne, vol. 3, p. 107, "Hab. Iles Gallapagos."

Planaxis circinatus LESSON, 1842, Rev. Zool., Soc. Cuvierienne, vol. 5, p. 187, "Acapulco."

Planaxis (Proplanaxis) planicostatus Sowerby, Thiele, 1929, Handbuch der systematischen Weichtierkunde, Jena, pt. 1, p. 203, figs. 196, 197.

TYPE LOCALITY. "Obs. from the Gallipagos Islands."

RANGE: Mazatlan, Mexico, to the Santa Elena Peninsula, Ecuador. Also Cocos Island and Galapagos Islands.

MATERIAL EXAMINED: Thirty-three specimens from two stations:

PANAMA

San José Island, Pearl Islands, November 26, 1945, R. C. Murphy collector, 2 specimens.

ECUADOR

La Plata Island, December, 1942, C. M. Breder, Jr., collector, 31 specimens.

MEASUREMENTS: Largest specimen: length, 28 mm.; maximum diameter, 15.9 mm.

HABITAT: Not indicated.

DESCRIPTION: Shell with about seven whorls, spire acute, thick, dark chocolate color, covered with a fine blackish brown periostracum; sculptured with flat spiral ribs separated by narrower grooves, about 10 on the last whorl; columella white, flattened, finely grooved; posterior callus thick; outer lip thin, crenulated, interior white and bearing about seven spiral ridges.

REMARKS: The shell of this species is larger and much more strongly spirally grooved in comparison to that of *Planaxis obsoletus* Menke (1850, p. 170) described from "Mazatlan," Mexico.

Planaxis nigrifella Forbes (1852, p. 273, pl. 11, fig. 6) described from "Straits of Juan del Fuaco" but cited by Sowerby [*in* Reeve, 1878 (1843-1878), vol. 20, *Planaxis*, sp. 8, pl. 2, fig. 8] from "Mazatlan" is believed to be a synonym of Menke's species.

FAMILY ARCHITECTONICIDAE

GENUS ARCHITECTONICA BOLTEN

Architectonica nobilis Bolten

A[rchitectonica]. nobilis BOLTEN, 1798, Museum Boltenianum, p. 78, "Die geperlte Perspektiv-Schnecke Gmel. T. perspectivus. sp. 3. sehr selten. Chemn. 5. t. 172. f. 1695. 1696. 1 St." MÖRCH, 1859, Malakozool. Blätter, vol. 6, p. 122, "Chemn. V. t. 172. f. 1695. 96 (typus)." GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 785. RUTSCH, 1934 Abhandl. Schweizerischen Palaeont. Gesell., vol. 54, p. 42, pl. 1, figs. 5-7; not all the synonymy. GARDNER, 1948, Prof. Paper U. S. Geol. Surv., no. 199B, p. 199, pl. 24, figs. 9, 13. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 124, pl. 34, figs. 5, 7.

Solarium granulatum LAMARCK, 1822, Histoire naturelle des animaux sans vertèbres, vol. 7, p. 3, "Habite . . ." KIENER, 1838-1839, Iconographie des coquilles vivantes, Turbinacées, *Solarium*, p. 4, pl. 2, fig. 2 (2 figs.), "Habite la mer des Indes." HANLEY, 1863, *in* Sowerby, Thesaurus conchyliorum, vol. 3, p. 231, pl. 250 (*Solarium* pl. 1), figs. 1, 2; under section *Architectonica*. REEVE, 1864, Conchologia iconica, vol. 15, *Solarium*, sp. 7, pl. 2, fig. 7, "Hab. Mexico." TRYON, 1887, Manual of conchology, vol. 9, p. 11, pl. 5, figs. 53, 54.

Solarium verrucosum PHILIPPI, 1848, Zeitschr. f. Malakozool., yr. 5, no. 11, p. 172, "Patria—" Reference to "Chemn. V. p. 126. t. 172. f. 1695. 96 bene!" REEVE, 1864, Conchologia iconica, vol. 15, *Solarium*, sp. 8, pl. 2, fig. 8, "Hab. West Indies."

Solarium nobile Bolten, HANLEY, 1863, *in*

Sowerby, Thesaurus conchyliorum, vol. 3, p. 230, pl. 253 (*Solarium* pl. 4), fig. 35; under section *Architectonica*.

Solarium nobilis (Roeding) BAYER, 1940, Zool. Meded., vol. 22, p. 229.

Architectonica granulata Lamarck, M. SMITH, 1944, Panamic marine shells, p. 15, fig. 166.

TPYE LOCALITY: No locality cited originally. Chemnitz's figures 1695 and 1696 were based on specimens in the Spengler Cabinet. Possibly these were from the Danish West Indies.

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Negritos, Peru. Cape Hatteras, North Carolina, to Colombia in the Atlantic.

MATERIAL EXAMINED: Five specimens from three stations:

PANAMA

Piñas Bay, February 24, 1941, Station 19, sample 35, in 14-33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 2 specimens.

MEASUREMENTS: Largest specimen: diameter, 39.8 mm.; height, 20 mm. Large specimens attain a diameter of approximately 50 mm.

HABITAT: Gray sand, sandy mud, and sand and dead shell fragments.

DESCRIPTION: Shell of low, broad, conoid form; whorls with four major spiral grooves and traces of others, all crossed by impressed lines of growth giving rise to granules especially on the early whorls; periphery angulate at base; base with spirals, an especially strong spiral just below the periphery and a very strong one near the umbilicus which is open and the margin crenulated with about 16 nodules; color purplish brown with dark brown spots, a spiral row especially pronounced just below the suture.

REMARKS: Bolten, 1798, divided Chemnitz's species *Trochus perspectivus* into two species, *Architectonica perspectiva* (pl. 172, figs. 1691-1694) and *A. nobilis* (pl. 172, figs.

1695, 1696), but cited no localities. Conchologists generally have come to recognize the former as oriental and the latter as American.

The west American shell has more often been listed under the name *Solarium granulatum* Lamarck, ranging from Magdalena Bay, Baja California, to Peru. At the time of the original description of this species Lamarck cited no locality. He gave a description and cited references to "Lister, Conch. T. 634. f. 22" and to "Encyclop. pl. 446. f. 5. a. b." Valenciennes (1832b, p. 269) cited it: "Habitat ad Acapulco, Mexicanorum." Kiener [1838-1839 (1834-1878), *Solarium*, p. 4, pl. 2, fig. 2] later referred to Lamarck's species as an Asiatic shell as did Hinds [1845 (1844-1845), pt. 3, p. 50], and Mörch (1859, p. 123) cited the habitat as "India?" Specimens from tropical west American waters in the collections of the California Academy of Sciences, approximately the same size as figures 5a and 5b in the "Encyclopédique méthodique," resemble the figures closely in all important details. The resemblance is so close that we are inclined to consider the figures as representing west American shells. Dautzenberg (1900, p. 202) stated that *Architectonica nobilis* Bolten unquestionably is the species which Lamarck later named *Solarium granulatum*, and Bayer (1940, p. 229), in a review of the Recent species, likewise considered the two to be identical. In a recent work dealing with gastropods of the East Indies, Adam and Leloup (1938-1939) did not cite *Architectonica granulata* Lamarck as occurring in their collection.

If one assumes that Lamarck's species originally came from American waters, it is uncertain as to whether it came from the east or west coast. We have compared a series of west American shells with about 25 specimens from the Caribbean coast of Colombia and cannot with certainty find any characters whereby the shells can be separated. Carpenter studied specimens from the east and west coasts and decided that they were identical. Accordingly we have used the earlier name *A. nobilis* for the present specimens. Woodring (1928, p. 355) mentioned that *A. nobilis* and *A. granulata* represent the same species and that but slight differences separate the Recent shells of this species from fossil subspecies in the Caribbean region. Oinomikado [1939, p. 620 (106), pl. 29 (15),

fig. 11] cited a species under the name of *A. granulata* from the Miocene of Colombia. Recently Pulley (1952, p. 172, pl. 1, figs. 12, 13) applied the same name to the species occurring in marine waters off Texas.

The species described by Hinds [1845 (1844-1845), pt. 3, p. 50, pl. 14, figs. 7, 8; Reeve, 1864 (1843-1878), vol. 15, *Solarium*, sp. 18, pl. 3, figs. 18a, 18b] as *Solarium quadriceps* was based on a single specimen, apparently not fully grown, from "Bay of Panama; (in five fathoms, among mud)." He compared the shell to *S. granulatum* Lamarck but attributed that species to Asia, whereas it is generally considered to be an American shell. Hinds' figure of *quadriceps* has an umbilicus wider than in any east or west American shells we have seen, approaching in this respect the well-known Asiatic and Indo-Pacific *A. perspectiva* Linnaeus. Hanley [1863, expl. to pl. 250 (*Solarium* pl. 1), figs. 3, 4] cited it from "Zanzibar; Bay of Panama." Lamy (1909, p. 267) considered it to be a variety of *granulata* and later (1934, p. 432) he cited it from Colombia, apparently considering it to be a valid species, as did Bayer (1940, pp. 249-251). Grant and Gale (1931, p. 785) placed it in the synonymy of *A. nobilis*. At this time it is not possible to suggest a thoroughly satisfactory solution to the problem, but taking all of the available evidence into consideration, we conclude that Hinds was probably mistaken in his locality, Panama, for *quadriceps* as he was in ascribing *granulata* to Asia.

Hinds [1845 (1844-1845), pt. 3, p. 50, pl. 14, figs. 5, 6; Hanley, 1863, p. 235, pl. 252 (*Solarium* pl. 3), figs. 23, 24, as *Solarium placentula*; Reeve, 1864 (1843-1878), vol. 15, *Solarium*, sp. 13, pl. 3, fig. 13, as *Solarium placentula*] described and figured *Solarium placentale* from "Bay of Magdalena, California; in seven fathoms, sand." This appears to be a somewhat worn and young shell belonging to the common west coast *Architectonica* which may be referred to *A. nobilis*. Bayer (1940, pp. 248-249) cited the species with synonymy, but gave no discussion of it.

Solarium granosum Valenciennes (1832b, p. 269) was described with "Habitat ad Acapulco Mexicanorum." There seems to be no way whereby any reliable information can be obtained as to the identity of this species. Kiener, who had available some of the shells

described by Valenciennes, did not include this species in his work on *Solarium*. It has been omitted or considered as a doubtful species by most of the earlier writers such as Reeve, Carpenter, and others. Hanley (1863, p. 244) remarked on the characters of this species, but no one, so far as we can ascertain, has felt sufficiently certain of the identity to illustrate it. From the locality it would seem that the species should be either *Architectonica nobilis* or *Torinia radiata* Menke. Valenciennes compared the shell to *Solarium millegranum* Lamarck, a fossil from Italy. Sacco (1892, p. 59, pl. 2, figs. 18–25) has described and figured many variations of that species from the upper Miocene and Pliocene of Italy. All are widely umbilicate, with conical, slightly dome-shaped spire, and are sharply keeled shells. If Valenciennes' shell really resembles that Italian fossil, *millegranum* Lamarck, it should then be included under the genus *Heliacus* as now understood.

Solarium bicanaliculatum Valenciennes (1832b, p. 270; Hanley, 1863, p. 237), said to come from Acapulco, Mexico, likewise has not been recognized by later authors.

Mörch (1859, p. 122) proposed the name *Architectonica valenciennesii* for a shell from "Realejo," Nicaragua, in the synonymy of which he placed *Solarium granulatum* Lamarck cited by Valenciennes (not *S. granulatum* Lamarck). He believed his species to differ from both *A. nobilis* Bolten and *A. granulata* Lamarck. Bayer (1940, p. 249) placed Mörch's species with question in the synonymy of *Solarium quadriceps* Hinds.

The present species, *A. nobilis*, also has been recorded as occurring in the lower Miocene of Ecuador (Marks, 1951, p. 362), in the Pliocene of Costa Rica, Panama, and Ecuador, and in the Pleistocene of the Gulf of California region, Tres Marias Islands, and Oaxaca, Mexico, Panama, and Galapagos Islands, as well as from Miocene to Recent in the Caribbean region.

FAMILY CREPIDULIDAE

GENUS CREPIDULA LAMARCK

Crepidula aculeata Gmelin

Patella fornicata aculeata, CHEMNITZ, 1788, Neues Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 10, p. 334, pl. 168, figs. 1624, 1625, "Westindischen Zuckerinseln."

Patella aculeata GMELIN, 1791, Systema naturae, ed. 13, pt. 6, p. 3693. References to "Chemn. Conch. 10. p. 334. t. 168, f. 1624. 1625; Da Costa Conchol. t. 6. f. 1; Elem. of. Conch. t. 2. f. 2; Favann. Conch. 1. t. 4. f. 3; Walch. Naturf. 10. t. 1. f. 5; β) Favann. Conch. 1. t. 4. f. 2?"

Crepidula aculeata Gmelin, REEVE, 1859, Conchologia iconica, vol. 11, *Crepidula*, sp. 22, pl. 4, figs. 22a–d. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 67, pl. 452 (Calyptraedae pl. 8), figs. 124, 125. TRYON, 1886, Manual of conchology, vol. 8, p. 129, pl. 39, figs. 61–65. M. SMITH, 1944, Panamic marine shells, p. 14, fig. 149b, as *Crepidula aculeata aculeata*.

TYPE LOCALITY: "Habitat paulo rarior ad insulas Americae mediae obversas" (Gmelin).

RANGE: Cayucos, California, to the Gulf of California and south to Valparaiso, Chile. Cosmopolitan.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 15, 1941, Station 9, sample 5.

MEASUREMENTS: Length, 15 mm.; width, 11.6 mm.; convexity, 5.4 mm. Very large specimens attain a length of 35–40 mm.

HABITAT: Specimen picked up on beach.

DESCRIPTION: Shell ovate, moderately convex, apex laterally spirally incurved; radial ribs crinkly and densely scaly or spinose; often with brown or purple and white rays; interior often spotted with chocolate brown; septum white, slightly notched at the sides and in the center.

REMARKS: The shell of this species varies in the development of the radial and spinose sculpture. As pointed out by Tryon and others, because of this names have been proposed for forms which now are regarded as identical with Gmelin's species. Included among these are *Crepidula echinus* Broderip, *C. hystrix* Broderip, *C. californica* Nuttall MS, and *C. costata* Menke. Pilsbry and Lowe (1932, p. 125) cited *echinus* Broderip as a subspecies of *aculeata* and termed it "A well marked form with a multitude of very delicate spines." From the specimens available to us we have not been able to segregate a subspecies of which the sculpture is consistently characterized by those features.

We have observed specimens of this species taken from Cape San Lucas, Baja California, to Bahia Honda, Panama, on the

beach and in 1.5 to 40 fathoms. It is a cosmopolitan species and occurs in the Atlantic as well as in the Indo-Pacific region in tropical and warm temperate waters. It has been recorded as occurring from Pliocene to Recent in southern California and in the Caribbean region, also in the Pleistocene of west Mexico, Galapagos Islands, Ecuador, and Peru, and in the Pliocene and Pleistocene of Japan.

***Crepidula arenata* Broderip**

Calyptreaa arenata BRODERIP, 1834, Proc. Zool. Soc. London, p. 40; 1835, Trans. Zool. Soc. London, vol. 1, p. 205, pl. 29, fig. 8 (2 figs.).

Crepidula arenata Broderip, REEVE, 1859, Conchologia iconica, vol. 11, *Crepidula*, sp. 13, pl. 3, fig. 13. TRYON, 1886, Manual of conchology, vol. 8, pp. 124, 431, pl. 36, figs. 4, 5 (reproduction of Broderip's original figures). A. G. SMITH, 1946, Minutes Conchol. Club Southern California, no. 60, p. 7.

Crepidula arenosa Broderip, PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 125.

TYPE LOCALITY: "Hab. ad Sanctam Eleenam. From sandy mud, on shells, at a depth ranging from six to eight fathoms." [Ecuador.]

RANGE: Scammon Lagoon, Baja California, to Kino Bay in the Gulf of California, and south to Antofogasta, Chile.

MATERIAL EXAMINED: Three specimens from Ardita Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34 to 43 meters.

MEASUREMENTS: Length, 12.2 mm.; width, 7 mm.; convexity, approximately 5.5 mm. A large specimen in the collections of the California Academy of Sciences from Arena Bank, Gulf of California, measures: length, 52 mm.; width, 36 mm.; convexity, 12 mm.

HABITAT: Gray sand bottom. We have observed specimens of this species collected from Cedros Island, Baja California, Mexico, to Central America, on beaches and dredged in 4 to 55 fathoms.

DESCRIPTION: Shell obliquely ovate, smooth, beak slightly turned to right; whitish, dotted, and, especially near margin, streaked with brownish red, interior white streaked with brown near margin, shell sometimes mostly brown exteriorly and interiorly; internal septum white, sometimes opalescent, margin sloping gently obliquely to the left, a

slight indentation to the right of the center; a pronounced muscle impression at end of septum on right side (shell held with septum upward).

REMARKS: The specimens in the present collection which are referred to *Crepidula arenata* are small and misshapen and not at all typical of that species. They might perhaps equally well be referable to *C. onyx* Sowerby, but their general appearance and lighter coloration have led us to identify them with Broderip's species.

Crepidula arenata is very similar to the east American *C. fornicata* Linnaeus. On the whole, the west American shells may be ornamented with a more dotted pattern, but this condition is variable. Tryon stated that *C. arenata* "appears to be absolutely identical" with the east coast species.

The shell of *Crepidula arenata* differs from that of *C. onyx* in that it is usually lighter colored and the septum has only a faint sinuation, whereas that of *C. onyx* bears two well-defined indentations, one in the center and one on the right side next to the wall.

Crepidula excavata Broderip was described from "Real Llejos" near Corinto, Nicaragua. The original illustrations show a fairly high, somewhat twisted, and laterally compressed, moderately thin shell with a well-developed twisted beak. The septum is rather deeply sunken below the margin which suggested the specific name *excavata*. Exteriorly the color is brownish with dark spots on the earlier portion of the shell, and the remainder is longitudinally striped with darker brown. The shape of the septum and other features are similar to those of high, thin, compressed forms of *C. arenata*. Extreme forms appear quite distinct, but the variation in a series of specimens of *C. arenata* is such that we are inclined to consider *C. excavata* as representing a high form of *C. arenata* and not entitled to more than subspecific rank, if distinct at all. It should be noted, however, that *C. excavata* has line priority, and, if identical with *C. arenata*, it would be the valid name according to the present rules of nomenclature. Specimens from southern California which have been cited as *C. excavata* are in some cases referable to *C. norrisiarum* Williamson. Berry (1950, pp. 35-40) has recently reviewed some of the west American

species of *Crepidula*. According to him, the species from southern California usually cited under the names of *Crepidula arenata*, *excavata*, *naticarum*, and in some cases *adunca*, are referable to a distinct species which he described (1950, p. 35) as *C. coei* from "vicinity of Sunset Beach, Orange County, California."

Crepidula arenata has been recorded as occurring in the Pleistocene of the Galapagos Islands and Ecuador and is known to occur in the Pleistocene of Magdalena Bay, Baja California, Mexico.

SUBGENUS IANACUS MÖRCH

Crepidula (Ianacus) lessonii Broderip

Calyptraea lessonii BRODERIP, 1834, Proc. Zool. Soc. London, p. 39; 1835, Trans. Zool. Soc. London, vol. 1, p. 204, pl. 29, fig. 5 (2 figs.).

Crepidula lessonii Broderip, REEVE, 1859, Conchologia iconica, vol. 11, *Crepidula*, sp. 16, pl. 3, figs. 16a, 16b. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 69, pl. 453 (Calyptraedae pl. 9), figs. 144–146. TRYON, 1886, Manual of conchology, vol. 8, pp. 126 (in part), 432, pl. 36, figs. 18, 19. A. G. SMITH, 1946, Minutes Conchol. Club Southern California, no. 60, p. 4.

TYPE LOCALITY: "Hab. in sinu Guayaquil. (Island of Muerte.) . . . Found under stones at low water." [Ecuador.]

RANGE: Oaxaca, Mexico, to Paita, Peru.

MATERIAL EXAMINED: Santelmo Bay, Pearl Islands, Panama, February 15, 1941, Station 9, sample 5, one specimen.

MEASUREMENTS: Length, approximately 22.5 mm.; width, 15.3 mm.; convexity, 6.9 mm.

HABITAT: Empty shell on sandy beach.

DESCRIPTION: Shell obliquely ovate, rather flat, constructed of frilled concentric laminae; white streaked with brownish red radial lines, with similar lines occurring on the inner margin, occasionally brownish interiorly and the entire shell sometimes almost pure white; septum slightly notched at the side.

REMARKS: The single imperfectly preserved specimen in the present collection is white except for the brown beak and a faint brown concentric blotch towards the ventral margin of the interior. There is variation in the coloration of a series of shells, and we consider the present specimen to be a worn form of *C. lessonii*.

Sowerby stated that "The typical reddish-

streaked shell cannot be distinguished otherwise than by colour from the white variety named *C. fimbriata* Reeve." Pilsbry and Lowe cited Reeve's species from the coasts of Nicaragua and Panama. However, *Crepidula fimbriata* Reeve [1859 (1843–1878), vol. 11, *Crepidula*, sp. 11, pl. 2, figs. 11a, 11b] was originally described from "Vancouver's Straits," and A. G. Smith (1946, pp. 2, 3, 6) recently gave reasons for considering it to be a form of *Crepidula perforans* Valenciennes (1846, pl. 24, figs. 9, 9a, 9b).

Crepidula lessonii has been recorded as occurring in the Pleistocene of Oaxaca, Mexico. It also has been cited as occurring in the Pleistocene at Long Beach, California, but we have not seen the specimens on which that record was based.

Crepidula (Ianacus) nivea C. B. Adams

Crepidula unguiformis Lamarck var., BRODERIP, 1835, Trans. Zool. Soc. London, vol. 1, p. 204, pl. 29, fig. 4 (2 figs.), "Hab. ad Insulam Chilöen et ad Panamam. It was dredged from sandy mud, at a depth ranging from four to ten fathoms."

Not *Patella unguiformis* Lamarck, 1822, Histoire naturelle des animaux sans vertèbres, vol. 6, pt. 2, p. 25, "Habite les mers de Barbarie, selon Gmelin." Reference to "Gualtieri, Test., t. 69, fig. H." See also Mermod, 1950, p. 723, fig. 29.

Crepidula nivea C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 458, 544. A. G. SMITH, 1946, Minutes Conchol. Club Southern California, no. 60, p. 2.

TYPE LOCALITY: "Habitat.—Panama. . . . Under stones, near low water mark."

RANGE: ?San Pedro, California. Punta Penasco in the Gulf of California and south to off Cape Pasado, Ecuador.

MATERIAL EXAMINED: Five small specimens from three stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, in 6–8 fathoms, 2 specimens.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, in 24–28 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: length, approximately 19.3 mm.; width, 11 mm.; convexity, approximately 2.9 mm.

HABITAT: Sand, black mud, and bottom of sand and dead shell fragments. We have observed specimens of this species in the collections of the California Academy of Sciences which were taken from the Gulf of California to Panama on shore and at depths of from 4 to 16 fathoms.

DESCRIPTION: "Shell ovate-elliptic: rather thick: within snow white: without dingy white, sometimes with a faint tinge of brown: very irregularly concentrically more or less wrinkled, with very distinct striae of growth: apex turned more or less to the right, moderately prominent, marginal: septum longitudinally subangular, with a deep sinus at the left and a shallow one at the right: margin thick, exhibiting striae of growth. It closely resembles *C. unguiformis*, but constantly differs in characters and station. Length 1.4 inch; breadth 1 inch; height .4 inch" (C. B. Adams).

REMARKS: Specimens of this species often bear a thin, light brown periostracum. The shell varies in shape and in thickness. Southern tropical specimens generally possess a sharper notch where the margin of the septum joins the left side of the shell. Specimens from San Pedro, California, which have been referred to this species are, as mentioned by A. G. Smith (1946, p. 3), very similar to *Crepidula plana* Say, an east American species.

The periostracum of *C. nivea* is much thinner than that of *C. nummaria* Gould. White flat shells similar to *C. nummaria* but without a periostracum appear to be referable to *C. perforans* Valenciennes (1846, pl. 24, figs. 9, 9a, 9b) which appears to be the earliest of several names applied to the same sort of shell that varies depending on the *situs*. Many of the species described by Valenciennes came from tropical or subtropical west American waters. It may be open to question whether or not the name *C. perforans* should be applied to similar elongate shells occurring in cool northern waters or whether perhaps those should be cited under the name of *C. explanata* Gould (1853, p. 377, pl. 14, fig. 7, "Inhabits Monterey. Lieut. Green. Lower California. Maj. Rich.").

Carpenter (1855-1857, p. 281) at one time considered *Crepidula nivea* to belong to a species assuming different forms including *Crepidula lessonii*, *C. squama* Broderip, and *C. striolata* Menke. Later (1863, p. 361; 1864, p. 551) he stated that "The type-specimens are small, poor and rough, of the var. *striolata*, passing into *Lessonii*."

Crepidula striolata Menke [1851 (1850-1851), p. 35] was proposed for a shell from Mazatlan, Mexico. It was described as an ovate-elliptic, plano-convex, solid shell, densely longitudinally striated, dirty white, and ornamented on the vertex with obsolete fuscous radial color markings. Menke compared his species to *C. lessonii*. The type specimen has not been illustrated. For the present, at least, we consider *C. nivea* to represent a distinct species.

The present record of the occurrence of this species off Cape Pasado, Ecuador, is an extension south of the known range.

FAMILY CALYPTRAEIDAE

GENUS CALYPTRAEA LAMARCK

Calyptraea mamillaris Broderip

Calyptraea mamillaris BRODERIP, 1834, Proc. Zool. Soc. London, p. 38; 1835, Trans. Zool. Soc. London, vol. 1, p. 201, pl. 28, fig. 5 (2 figs.). M. SMITH, 1944, Panamic marine shells, p. 14, figs. 149, 149A.

Trochita mamillaris Broderip, REEVE, 1859, Conchologia iconica, vol. 11, *Trochita*, sp. 12, pl. 3, figs. 12a, 12b. SOWERBY, 1883, Thesaurus conchologia, vol. 5, p. 65, pl. 450 (Calyptraedae pl. 6), figs. 69-71. TRYON, 1886, Manual of conchology, vol. 8, p. 120, pl. 34, figs. 64, 65 (copy of Reeve's figs. 12a, 12b).

Trochita solida REEVE, 1859, Conchologia iconica, vol. 11, *Trochita*, sp. 10, pl. 2, figs. 10a, 10b, "Hab. Conchagua, Central America."

TYPE LOCALITY: "Hab. ad Insulam Muerte. . . Found on dead shells, in sandy mud, at a depth of eleven fathoms." [Ecuador.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: Seven specimens from four stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, in 6-8 fathoms, 2 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, in 14–33 meters, 1 specimen.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34–43 meters, 3 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: maximum diameter, 13 mm.; convexity, 5.2 mm. Another specimen measures: maximum diameter, approximately 12.5 mm.; convexity, 6.6 mm. Large specimens of this species attain a diameter of 38 mm.

HABITAT: Sand, gray sandy mud, sand and shell-fragment bottom. We have observed specimens of this species dredged in from 4 to 40 fathoms, from Santa Inez Bay in the Gulf of California to the Gulf of Chiriqui, Panama.

DESCRIPTION: Shell conical, smooth, white or yellowish, stained with purple or brown, the apex brown; interior brown or purple; sometimes white or spotted.

REMARKS: In the present collection the specimens of this species are small. Typical forms of *Calyptraea mamillaris* are illustrated by Broderip and Reeve. The color is variable, but often the shell is stained purplish brown exteriorly, especially on the apical region, and the interior is brownish. Some specimens are white or nearly so, others are spotted, but often the apex exteriorly or some portions of the interior of the shell are brownish. In view of the great variation in color, Tryon may have been correct in considering several of the tropical west American forms as representing one species.

Apparently *Trochita solida* Reeve described from "Conchagua, Central America," can be referred to typical *Calyptraea mamillaris*. Mermod (1950, p. 721) mentioned the similarity between *C. extintorium* Lamarck and *C. mamillaris*.

Calyptraea mamillaris has been recorded as occurring in the Pliocene and Pleistocene of southern California and in the Pleistocene of Panama. It also has been cited as occurring in the Pliocene of Patagonia, but it seems

likely that that record may be referable to some other species.

Calyptraea mamillaris conica Broderip

Plate 3, figure 4

Calyptraea conica BRODERIP, 1834, Proc. Zool. Soc. London, p. 38; 1835, Trans. Zool. Soc. London, vol. 1, p. 202, pl. 27, fig. 7.

[?] *Calyptraea* (*Syphopatella*) *aspersa* C. B. ADAMS, 1852, Ann. Lyc. Nat. Hist. New York, vol. 5, pp. 443, 543, "Habitat.—Panama. Under stones at low water mark."

Trochita conica Broderip, REEVE, 1859, Conchologia iconica, vol. 11, *Trochita*, sp. 13, pl. 3, figs. 13a, 13b. SOWERBY, 1883, Thesaurus conchylorum, vol. 5, p. 62, pl. 449 (*Calyptrae* pl. 5), figs. 61, 62. TRYON, 1886, Manual of conchology, vol. 8, p. 120, pl. 34, figs. 62, 63 (copy of Reeve's figs. 13a, 13b).

TYPE LOCALITY: "Hab. ad Xipixapi et ad Salango. Found attached to shells in deep water." [Ecuador.]

RANGE: Magdalena Bay, Baja California, to Punta Penasco in the Gulf of California and south to Manta, Ecuador. [?] Chile (Hupé).

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, in 14–33 meters, one specimen.

MEASUREMENTS: Maximum diameter, 13.8 mm.; convexity, 6 mm.

HABITAT: Gray sandy mud bottom.

REMARKS: Under the name of *Calyptraea mamillaris conica* we have segregated a specimen which agrees with the illustrations of *conica* given by Broderip and Reeve. The shell differs from *C. mamillaris* only in coloration. Shells typical of *conica* are whitish or pinkish brown and spotted or streaked with brown exteriorly and interiorly. The apical area is colored similar to the remainder of the shell rather than being dark purplish brown.

The coloration of this subspecies varies, and there appears to be no clearly defined character whereby certain specimens, especially juvenile ones, may be separated from *C. mamillaris*. Probably *C. aspersa* C. B. Adams described from Panama as illustrated by Reeve [1859 (1843–1878), vol. 11, *Trochita*, pl. 1, figs. 4, 4a] can be referred to the present subspecies.

We have observed specimens of this sub-

species from Santa Inez Bay in the Gulf of California to Panama, taken on the beach and at depths of from 3 to 25 fathoms. It also has been recorded as occurring in the Pleistocene of Panama.

GENUS **CRUCIBULUM** SCHUMACHER

Crucibulum imbricatum Sowerby

Calyptraea imbricata SOWERBY, 1824, The genera of recent and fossil shells, vol. 2, pl. 138, fig. 5. BRODERIP, 1834, Proc. Zool. Soc. London, p. 36, "Hab. ad Panamam. Found on stones, in sandy mud, at a depth of from six to ten fathoms"; 1835, Trans. Zool. Soc. London, vol. 1, p. 198, pl. 27, fig. 7 (2 figs.).

Calyptraea extincorium? SOWERBY, 1824, The genera of recent and fossil shells, vol. 2, pl. 137, fig. 3; see Rehder, 1943b, p. 45.

Not *Calyptraea extincorium* Lamarck, 1822.

Patella scutellata WOOD, 1828, Supplement to the Index testaceologicus, pp. 26, 32 (as *Calyptraea scutellata*), pl. 8, *Patella*, fig. 4, locality unknown.

Calyptraea (Calypeopsis) rugosa LESSON, 1830, Voyage autour du monde . . . sur . . . la Coquille, Zoologie, vol. 2, pt. 1, p. 397, "sur les sables de Payta, sur la côte du Pérou." REEVE, 1842, Conchologia systematica, vol. 2, p. 32, pl. 144, fig. 1.

Not *Calyptraea rugosa* Borson, 1825.

Crucibulum imbricatum Sowerby, CARPENTER, 1857, Catalogue of . . . Mazatlan shells, p. 287. REEVE, 1858, Conchologia iconica, vol. 11, *Crucibulum*, sp. 9, pl. 3, figs. 8c, 8d, 9c, 9d. STEINBECK AND RICKETTS, 1941, Sea of Cortez, p. 528, pl. 35, fig. 6. M. SMITH, 1944, Panamic marine shells, p. 14, fig. 153. DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 126, pl. 30, figs. 12, 13.

Crucibulum scutellatum Gray in Wood, REEVE, 1858, Conchologia iconica, vol. 11, *Crucibulum*, sp. 2, pl. 1, figs. 1a-1c (erroneously referred to *C. tenue*), pl. 2, figs. 1d-1g, "Hab. Payta, Peru; Lesson. Punta, St. Elena, West Columbia; Cuming." SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 59, pl. 447 (*Calyptraedae* pl. 3), figs. 1-6; not all the synonymy. TRYON, 1886, Manual of conchology, vol. 8, p. 117, pl. 31, figs. 13-19.

TYPE LOCALITY: No locality cited originally. Panama, on stones, in sandy mud, at a depth of from 6 to 10 fathoms, cited by Broderip and accepted as type locality by the present authors.

RANGE: Cedros Island, Baja California, to Kino Bay and San Felipe in the Gulf of California and south to Callao, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: Thirty specimens from eight samples from seven stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, in 15 fathoms, 1 specimen.

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, in 6-8 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, in 14-33 meters, 5 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25-64 meters, 4 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 3 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course in 24-28 meters, 4 specimens. Also March 7, 1941, Station 32, sample 83, dredged a little inside sample 82 in 24-28 meters, 9 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, in 15 fathoms, 3 specimens.

MEASUREMENTS: Largest specimen: maximum diameter, 27.7 mm.; lesser diameter, 11.4 mm.; convexity, approximately 8.7 mm. Large specimens of this species attain a maximum diameter of 55 mm.

HABITAT: Gray sand, sandy mud, gray mud, black mud, and live shell bottom. We have observed specimens of this species taken from Cedros Island, Baja California, to Ecuador, in 1.5 to 45 fathoms.

DESCRIPTION: Shell solid, chestnut-brown or pale, with brown rays, polished and often darker colored within, rudely radiately ribbed, coarsely latticed by concentric ribs, or smoother and closely radiately striated (Tryon). The internal lamella is attached at its apex and along most of one side.

REMARKS: The shell of this species is variable as to outline and sculpture. Usually it is characterized by the coarse imbricated sculpture and the dark brown color.

This species also occurs in the Pliocene of southern California, the Gulf of California region, Ecuador, and the Pleistocene of west Mexico, Panama, Ecuador, and Peru. It has

been reported as questionably occurring in the Miocene of southern California.

Crucibulum serratum Broderip

Calyptraea serrata BRODERIP, 1834, Proc. Zool. Soc. London, p. 37; 1835, Trans. Zool. Soc. London, vol. 1, p. 200, pl. 28, fig. 1 (2 figs.).

Crucibulum serratum Broderip, REEVE, 1859, Conchologia iconica, vol. 11, *Crucibulum*, sp. 21, pl. 7, figs. 21a, 21b. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 60, pl. 448 (*Calyptraedae* pl. 4), figs. 25, 26. TRYON, 1886, Manual of conchology, vol. 8, p. 117, pl. 31, fig. 23.

TYPE LOCALITY: "Hab. ad Real Llejos et Muerte. Found on dead shells, in a muddy bottom, at the depth of from six to eleven fathoms." Realejo, near Corinto, Nicaragua, on dead shells on a muddy bottom, here selected as type locality.

RANGE: Corinto, Nicaragua, to the island of Muerte, Ecuador.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, in 6-8 fathoms.

MEASUREMENTS: Maximum diameter, 8.4 mm.; convexity, 4.5 mm. The largest specimen of this species in the collections of the California Academy of Sciences measures 19 mm. in maximum diameter, but probably it attains a greater size.

HABITAT: Sand bottom. We have observed specimens from Costa Rica which were dredged in from 6.5 to 12 fathoms.

REMARKS: The typical form of this species is fairly thin shelled, often depressed, white with a chestnut ray and with well-developed radial ribs, and the apex is sharp and posterior. However, shells in a series vary from thin to somewhat thick, from white to brown, and with from rather sharp to very thick radial ribs. These characters, together with the flattened internal septum, are so distinct from those of other species of the genus that we consider this form to be a separate species.

Gray, 1867, proposed the genus *Neleta* with *Calyptraea serrata* as type.

Crucibulum spinosum Sowerby

Calyptraea spinosa SOWERBY, 1824, The genera of recent and fossil shells, vol. 2, pl. 137, fig. 7, pl. 138, fig. 4, no locality cited.

Calyptraea (Calypeopsis) tubifera LESSON, 1830, Voyage autour du monde . . . sur . . . la Co-

quille, Zoologie, vol. 2, pt. 1, p. 399, "entre Payta et Colan, sur la côte du Pérou."

Calyptraea tubifera Lesson, VALENCIENNES, 1846, Voyage autour du monde sur . . . la Vénus, Atlas de Zoologie, Mollusques, pl. 14, fig. 2 (3 figs.).

Crucibulum spinosum Sowerby, CARPENTER, 1857, Catalogue of . . . Mazatlan shells, p. 290. REEVE, 1859, Conchologia iconica, vol. 11, *Crucibulum*, sp. 10, pl. 4, figs. 10a-k, "Hab. seas of Central America." GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 793. DURHAM, 1950, Mem. Geol. Soc. Amer. no. 43, pt. 2, p. 126, pl. 30, figs. 24, 25.

Crucibulum tubifer Sowerby, CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 325, figs. 2333, 2334.

[*Crucibulum scutellatum* Gray] var. *tubiferum* Lesson, TRYON, 1886, Manual of conchology, vol. 8, p. 118, pl. 32, figs. 32, 33, 38, pl. 33, figs. 39-43, "West Coast of America, Chile to California."

TYPE LOCALITY: No locality cited originally. Typical specimens occur at Guaymas, Mexico, in the Gulf of California.

RANGE: Trinidad, California, to Punta Penasco in the Gulf of California and south to Tomé, Chile. Galapagos Islands.

MATERIAL EXAMINED: Seven specimens from four samples from three stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands, February 14, 1941, Station 8, sample 4, in 6-8 fathoms, 1 specimen. Also February 14, 1941, Station 9, sample 5, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, in 14-33 meters, 5 specimens.

COLOMBIA

Octavia Bay, March 7, 1941, Station 32, sample 83, dredged a little inside sample 82 in 24-28 meters, 1 specimen.

MEASUREMENTS: Largest specimen: maximum diameter, 19.6 mm.; convexity, 7.4 mm.

The largest specimen of this species in the collections of the California Academy of Sciences, collected by Mr. and Mrs. H. R. Turver 3 to 4 miles southeast of Guaymas, Mexico, on the San Ramon mud flats, measures 54 mm. in maximum diameter.

HABITAT: Sand, gray sandy mud, black mud, sand beach. We have observed specimens of this species collected from west Mexico to Panama on beaches and at depths of from 1 to 30 fathoms.

DESCRIPTION: Shell orbicular, variable, vertex nearly central and obliquely twisted; sculptured with radial ribs as well as wrinkled striae and usually bearing numerous tubular spines, occasionally without major ribs or spines; yellowish white with curved purple rays or brown, the interior brownish to white; internal lamella large, somewhat compressed anteriorly, attached at apex and along most of one side, white, sometimes brown in the center.

REMARKS: The fine ribbing and tubular spines are characteristic of this species. It occurs in the Pliocene and Pleistocene of California and west Mexico, and it also has been reported as occurring in the Pliocene of southern California and the Gulf of California, and the Pleistocene of southern California, west Mexico, Panama, Ecuador, and the Galapagos Islands. *Crucibulum hispidum* Broderip, considered by many authors to be identical with *C. spinosum*, has been reported from the Pliocene of Costa Rica by Olsson and of Ecuador by Pilsbry and Olsson.

Crucibulum trigonale Adams and Reeve

Calyptraea trigonalis ADAMS AND REEVE, 1850, in Adams, The zoology of the voyage of H.M.S. Samarang, Mollusca, p. 70, pl. 9, figs. 7a, 7b.

Crucibulum trigonale Adams and Reeve, REEVE, 1858, Conchologia iconica, vol. 11, *Crucibulum*, sp. 3, pl. 1, figs. 3a, 3b. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, pl. 448 (*Crucibulum* pl. 4), figs. 21, 22. TRYON, 1886, Manual of conchology, vol. 8, p. 118, pl. 32, fig. 25 (copy of Reeve's fig. 3b). M. SMITH, 1944, Panamic marine shells, p. 14, fig. 150.

Crucibulum trigonale Reeve, CHENU, 1859, Manuel de Conchyliologie, vol. 1, p. 325, figs. 2332, 2335.

TYPE LOCALITY: "Hab. China Sea" cited originally, but the species is believed to have come from western Central or South America.

RANGE: Arena Bank, Gulf of California, to Panama Bay and the Galapagos Islands. ?Chile.

MATERIAL EXAMINED: One specimen from Bahia Santelmo, Isla del Rey, Pearl Islands, Panama, February 14, 1941, Station 8, sample 4, in from 6 to 8 fathoms.

MEASUREMENTS: Greater diameter, 10.3 mm.; lesser diameter, 7.4 mm.; convexity, 3.8 mm. The largest specimen of this species in the collections of the California Academy

of Sciences, slightly broken around the margin, measures about 21 mm. in maximum diameter.

HABITAT: Sand bottom.

DESCRIPTION: Shell triangularly ovate, highly convex, brownish, plicately wrinkled, juvenile shells resembling in sculpture that of *Hipponix*, in older shells some portions nearly smooth; interior lamina openly cup shaped.

REMARKS: We have applied the name *Crucibulum trigonale* Adams and Reeve to the present shell, because it agrees with the original illustrations of that species. This appears to be one of several species erroneously reported from "China Sea" by Adams and Reeve.

It is quite possible that this form should bear the older name of the species described as *Calyptraea quiriquinae* Lesson, 1830, or *Calyptraea tenuis* Broderip, 1834 ["Hab. ad Peruviae oras. (Samanco Bay.)"]; Reeve, 1858 (1843-1878), vol. 11, *Crucibulum*, pl. 1, figs. 2a, 2b, erroneously referred to *C. scutellatum* in the text]. Lesson's type apparently has not been illustrated, and the illustrations of *C. tenuis*, which may be identical, are all more rounded in outline than the present shell. Inspection of a series of specimens from the localities mentioned by Lesson when describing *C. quiriquinae*, namely, "commune au Chili, sur les côtes de l'île de Quiriquine et du port de Talcahuano," should conclusively determine whether or not those shells are identical with *C. trigonale*.

FAMILY NATICIDAE

GENUS NATICA SCOPOLI

Natica broderipiana Recluz

Plate 3, figure 8

Natica broderipiana RECLUZ, 1844, Proc. Zool. Soc. London, for 1843, p. 205. REEVE, 1855, Conchologia iconica, vol. 9, *Natica*, sp. 66, pl. 15, figs. 66a-66c. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 80, pl. 460 (*Natica* pl. 7), fig. 91.

Natica iostoma MENKE, 1847, Zeitschr. f. Malakozool., yr. 4, p. 178, "Bei Mazatlan, im Staate Cinaloa."

Natica broderipiana Recluz var. *iostoma* Menke, PHILIPPI, 1852 *Natica* und *Amaura*, in Conchylien-Cabinet von Martini und Chemnitz, vol. 2, div. 1, p. 17, fig. 5 (original specimen illustrated). TRYON, 1886, Manual of conchology, vol. 8, p. 21, pl. 4, fig. 67 (copy of Philippi's fig. 5).

Natica taslei RECLUZ, 1853, Jour. Conchyl., vol. 4, p. 53, pl. 2, figs. 11, 12, "Habite les environs de Mazatlan (Mexique)." TRYON, 1886, Manual of conchology, vol. 8, pl. 4, fig. 66 (copy of Recluz' fig. 12).

[*Natica ala-papilionis*] var. *broderipiana* Recluz, TRYON, 1886, Manual of conchology, vol. 8, p. 21, pl. 4, fig. 65.

Natica (Stigmaulax) broderipiana Reeve, M. SMITH, 1944, Panamic marine shells, p. 12, fig. 126.

TYPE LOCALITY: "Hab. 'Xipixapi, West Colombia; sandy mud, sixteen fathoms.' H. Cuming." [Jipijapa, Ecuador.]

RANGE: Cedros Island, Baja California, to Santa Inez Bay, Gulf of California, and south to Lobitos, Peru.

MATERIAL EXAMINED: Fourteen specimens from eight samples from six stations:

PANAMA

South Passage, Pearl Islands, February 13, 1941, Station 7, in 15 fathoms, 1 specimen.

Piñas Bay, February 24, 1941, Station 19, sample 35, 14–33 meters, 2 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25–64 meters, 3 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, in 34–43 meters, 3 specimens.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course in 24–28 meters, 1 specimen. Also March 7, 1941, Station 32, sample 83, dredged a little inside sample 82, in 24–28 meters, 2 specimens.

ECUADOR

Off Cape Pasado, latitude 00° 32' 00" S., longitude 80° 31' 00" W., April 14, 1941, Station 81, sample 306, in 10 fathoms, 1 specimen. Also latitude 00° 31' 00" S., longitude 80° 35' 00" W., April 14, 1941, Station 81, sample 307, in 15 fathoms, 1 specimen.

MEASUREMENTS: Largest specimen: height, 21.9 mm.; maximum diameter, 19.5 mm. A specimen in the collections of the California Academy of Sciences from Port Culebra, Costa Rica, measures: height, 27.3 mm.; maximum diameter, 24.5 mm.

HABITAT: Sand, sandy mud, mud, and live shell bottom.

DESCRIPTION: Shell globose, whorls convex, spire moderately elevated, aperture lunar-

ovate, umbilicus open but with a depressed spiral funicle; whorls are sculptured with longitudinally impressed grooves, the area between these near the suture and base form plicated ribs, these often end abruptly and are bounded by a smooth area near the base; color is orange or yellowish brown, with three white concentric bands articulated with dark chestnut spots, interior is often tinged with violet; exterior of operculum has one coarse, curved medial rib and four or five small outer ribs.

REMARKS: This handsome species may be easily recognized by the striking coloration and sculpture of the shell.

Rehder (1943a, p. 196) suggested the possibility that this species might be referable to his genus *Glypheapithema*, the type of which is *Natica idiopoma* Pilsbry and Lowe.

Natica broderipiana also has been reported as occurring as a fossil in the Pliocene of Costa Rica, Panama, and Ecuador, and in the Pleistocene of Panama, Magdalena Bay, Baja California, and the Tres Marias Islands, Mexico.

Natica elenae Recluz

Plate 3, figure 31

Natica elenae RECLUZ, 1844, Proc. Zool. Soc. London, for 1843, p. 205. REEVE, 1855, Conchologia iconica, vol. 9, *Natica*, sp. 94, pl. 21, figs. 94a, 94b. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 79, pl. 462 (*Natica* pl. 9), fig. 150. TRYON, 1886, Manual of conchology, vol. 8, p. 28, pl. 8, fig. 55. M. SMITH, 1944, Panamic marine shells, p. 12, fig. 128.

Natica excavata CARPENTER, 1856, Proc. Zool. Soc. London, p. 165, "Hab. in Sinu Panamensi; legit T. Bridges. 2 sp. in Mus. Cuming.—S.W. Mexico, P.P.C."

Stigmaulax excavata Carpenter, ABBOTT, 1954, American seashells, pl. 5, fig. m.

TYPE LOCALITY: "Hab. 'St. Elena, West Colombia; found in sandy mud at six fathoms.' H. Cuming." [Santa Elena, Ecuador.]

RANGE: Magdalena Bay, Baja California, to Santa Elena, Ecuador.

MATERIAL EXAMINED: One specimen from Ardit Bay, Colombia, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34 to 43 meters.

MEASUREMENTS: Height, 32.4 mm.; maximum diameter, 32.3 mm.

HABITAT: Gray sand bottom. We have

observed specimens of this species dredged from a depth of 30 fathoms off Manzanillo, Mexico.

DESCRIPTION: Shell similar to that of *Natica broderipiana* in general features, but the longitudinal grooves are more numerous and, on the middle of the last whorl, are represented only by fine incised lines. Also the funicle is slightly larger and is less excavated for shells of the same relative size. The shell is colored by close, sometimes branching, reddish chestnut longitudinal lines which in many shells are interrupted at well-defined intervals, forming one or more vague concentric bands. The operculum is similar to that of *N. broderipiana*, but the coarse medial ridge is grooved near the end and the smaller outer spirals are coarser and more irregular.

REMARKS: *Natica sulculosa* Philippi [1852 (1849–1853), vol. 2, div. 1, p. 76, pl. 11, fig. 15, "Aufenthalt: die Westküste von Mexico oder Südamerika"], described from the west coast of Mexico or South America, is probably identical with *N. elenae*.

Natica haneti Recluz, described from "Bahia," presumably Brazil, was considered by Tryon to be identical with *N. elenae*.

Natica elenae has been reported to occur in the Pliocene and Pleistocene of Ecuador and the Pleistocene of Oaxaca, Mexico.

Natica grayi Philippi

Plate 2, figure 14

Natica depressa GRAY, 1839, in Beechey, The zoology of Capt. Beechey's voyage, p. 136, pl. 36, fig. 2, no locality cited.

Not *Natica depressa* J. Sowerby, 1812, Mineral conchology, vol. 1, p. 21, pl. 5, lower figs., "from Woodbridge, Suffolk."

Not *Natica glaucinoides* Desh. var. *B. depressa* Grateloupe, 1840–1847, Conchyliologie fossile . . . du Bassin de l'Adour, vol. 1, Atlas, *Natica*, pl. 5, figs. 11, 12.

Natica grayi PHILIPPI, 1852, *Natica* und *Amaura*, in Conchylien-Cabinet von Martini und Chemnitz, vol. 2, div. 1, p. 74, pl. 11, fig. 13 (2 figs.), "meine Exemplare sollen von Mazatlan sein."

Natica catenata PHILIPPI, 1853, *Natica* und *Amaura*, in Conchylien-Cabinet von Martini und Chemnitz, vol. 2, div. 1, p. 130, pl. 18, fig. 11, locality unknown; 1853, Proc. Zool. Soc. London, for 1851, p. 233, "Hab.—?" TRYON, 1886, Manual of conchology, vol. 8, p. 22, pl. 4, figs. 72, 73. R. H. PALMER AND HERTLEIN, 1936, Bull. South-

ern California Acad. Sci., vol. 35, p. 78, pl. 19, figs. 2, 11.

TYPE LOCALITY: Mazatlan, Mexico, for *Natica grayi* Philippi.

RANGE: Magdalena Bay, Baja California (Orcutt); Gulf of California (H. Hemphill collection) to Manta, Ecuador.

MATERIAL EXAMINED: One specimen from Piñas Bay, Panama, February 24, 1941, Station 19, sample 35, in 14 to 33 meters.

MEASUREMENTS: Specimen small and imperfect, height, 8.8 mm.; maximum diameter, 7.6 mm.

HABITAT: Gray sandy mud bottom.

DESCRIPTION: Shell shiny, in general appearance similar to that of *Natica broderipiana*, but the axial plications on the somewhat obliquely depressed body whorl occur only between the suture and shoulder; the umbilical area is smaller, the callus on the upper portion of the columella is thinner; color light brown, with four whitish concentric bands which bear dark chestnut spots (sometimes faint); operculum white, nearly flat, with a single narrow groove near the outer edge.

REMARKS: There has been some confusion regarding the identification of this species. Reeve published three illustrations of shells said to come from Sicily. Tryon stated that Reeve's figure 92a represents *Natica catenata*. However, that figure reproduced by Tryon (his fig. 71) represents a shell with more inflated whorls and a higher spire than is shown in his figures 72 and 73 which are reproductions of the illustrations of *Natica catenata* and *Natica grayi* given by Philippi. According to Oostingh (1925, p. 344), plates 7–12 of Philippi's monograph in the "Conchylien-Cabinet" appeared in 1850, plates 13–18 in 1851, pages 27–120 in 1852, and pages 121–164 in 1853. *Natica catenata* also was described by Philippi on page 233 of the Proceedings of the Zoological Society of London for 1851. According to Sclater, pages 225–240 of that publication were published July 26, 1853. It appears then that *Natica grayi* is the earlier name for the present species.

Some specimens in the collections of the California Academy of Sciences from various localities along the west coast of Mexico and Central America agree well with Reeve's figure 92a. Although the coloration is some-

what similar, they are quite distinct from *N. grayi* both in the general outline of the whorls and in the operculum. The general outline of the whorls is somewhat similar to that of *N. chemnitzii*, but it differs from that species in the thinner shell, different coloration, and differently sculptured operculum. The color is ashy brown with two concentric rows of chestnut spots, one at the shoulder and one at about the middle of the whorl; sometimes there are two more similar but fainter concentric bands near the base of the whorl. The callus on the parietal wall is thin; below this is a shallow rounded notch, and posterior to this a somewhat flattened funicle which enters the umbilical opening. The operculum has four ribs and five grooves, the second from the outer edge the widest. The three inner ribs are low and flat and are separated from one another by smooth, narrow grooves. The outer rib is elevated and separated into two parts by a deep, smooth groove. The operculum differs from that of *Natica idiopoma* Pilsbry and Lowe in that it possesses four rather than three ribs, and in that the grooves are smooth rather than transversely ribbed.

Because the species appears to be undescribed, we herein describe it as new, as follows:

Natica caneloensis Hertlein and Strong,
new species

Plate 2, figures 13, 18

HOLOTYPE: C.A.S. No. 9891 (in the type collection of the Department of Paleontology); collected on the expedition into the eastern Pacific by the New York Zoological Society conducted by William Beebe on Templeton Crocker's Yacht "Zaca" at Port Parker, Costa Rica.

MEASUREMENTS OF TYPE: Height, 26.8 mm.; maximum diameter, 23.7 mm.

OCCURRENCE: Known to occur from Mazatlan, Mexico, to Manta, Ecuador.

DESCRIPTION: (See Remarks above, under *Natica grayi* Philippi).

GENUS POLINICES MONTFORT

Polinices helicoides Gray

Natica patula SOWERBY, 1824, Zool. Jour., vol. 1, p. 60, pl. 5, fig. 4 (2 figs.), locality unknown; another specimen seen in Ferussac's collection was

brought from South America by Humboldt. WOOD, 1828, Supplement to the Index testaceologicus, pp. 25 (as *Nerita patula*), 45, pl. 8, fig. 2; 1856, in Hanley, *op. cit.*, p. 231, suppl. pl. 8, fig. 2, "Acapulco." BARNES, 1824, Ann. Lyc. Nat. Hist. New York, vol. 1, p. 136, "Inhabits the coast of Peru."

Not *Natica patula* J. Sowerby, 1822.

[*Natica*]. *helicoides* Gray,¹ 1825, Zool. Jour., vol. 1, p. 511, footnote. Gray referred to *Natica patula* Sowerby cited by Barnes (1824, p. 136) and stated, "As there is another *N. patula* must be called by Mr. Barnes's MS. name of *N. helicoides*." CARPENTER, 1864, Rept. Brit. Assoc. Adv. Sci., for 1863, p. 522, footnote.

Natica glauca de Humboldt, LESSON, 1830, Voyage autour du monde . . . sur . . . la Coquille, Zoologie, vol. 2, pt. 1, p. 369, pl. 11, fig. 1, "n'est pas rare sur les grèves sablonneuses de Colan, non loin de Payta, sur la côte du Pérou"; figured specimens from "Côtes du Pérou." SOULÉYET, 1852, Voyage autour du monde . . . sur . . . la Bonite, Zoologique, vol. 2, p. 575, Atlas, Mollusques, p. 7, pl. 35, figs. 1-3. REEVE, 1855, Conchologia iconica, vol. 9, *Natica*, sp. 5, pl. 2, figs. 5a, 5b. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 214, fig. 1167. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 76, pl. 454 (*Natica* pl. 1), fig. 5. TRYON, 1886, Manual of conchology, vol. 8, p. 34, pl. 11, figs. 97, 98.

Natica bonplandi VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 264, pl. 57, figs. 3a, 3b, "Habitat ad Acapulco Mexicanorum."

Polinices glauca Humboldt, M. SMITH, 1944, Panamic marine shells, p. 12, figs. 125, 130.

TYPE LOCALITY: "Inhabits the coast of Peru," for *Natica helicoides*. Locality of *Natica patula* Sowerby unknown.

RANGE: Magdalena Bay, Baja California, to the Gulf of California and south to Callao, Peru.

MATERIAL EXAMINED: one specimen from Bahia Cuevita, Colombia, May 11, 1941, Station 93, sample 359, dredged east-southeast across bay in 5 to 20 fathoms.

MEASUREMENTS: Height, approximately 12 mm.; maximum diameter, 24.9 mm. A specimen in the collections of the California Academy of Sciences from Banderas Bay,

¹ Dr. J. L. Baily, Jr., kindly called our attention to Gray's rather obscure citation of this combination of names.

Mexico, measures: height, approximately 23 mm.; maximum diameter, 47.8 mm.

HABITAT: Gray sand and mud bottom.

DESCRIPTION: Shell very much depressed, rugosely striate, concavely excavated beneath, the umbilicus partly overhung by a thin, tongue-like callus; whitish, or yellowish, broadly chestnut banded above, callus and interior chestnut color (Tryon).

REMARKS: The only addition to the above description that seems necessary is that on some specimens there are faint concentric striae on the walls of the umbilical area.

Neverita nereidis Maury, described from the Miocene of Santo Domingo, and *Natica euryomphala* Philippi, from the Tertiary of Chile, are somewhat similar species.

Polinices glauca has been recorded by Olsson as occurring in the Pliocene of Rio La Vaca, Costa Rica, and by Rivera from the Pleistocene of Ecuador.

Polinices uber Valenciennes

Natica uber VALENCIENNES, 1832, in Humboldt and Bonpland, Voyage aux régions équinoxiales du Nouveau Continent, pt. 2, Recueil d'observations de zoologie et d'anatomie comparée, vol. 2, p. 266. D'ORBIGNY, 1840, Voyage dans l'Amérique Méridionale, Mollusca, vol. 5, p. 401, pl. 55, figs. 12-14.

Natica virginea RECLUZ, 1850, Jour. Conchyl., vol. 1, p. 388, pl. 12, fig. 6, "Hab. Realejos." TRYON, 1886, Manual of conchology, vol. 8, p. 48, pl. 17, fig. 66.

Polinices (Polinices) uber Valenciennes, GRANT AND GALE, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 799, fig. 12; not all the synonymy.

Polinices uber uber Valenciennes, M. SMITH, 1944, Panamic marine shells, p. 12, fig. 123.

TYPE LOCALITY: "Habitat ad portam Cumanensem." [Venezuela.] Probably from Acapulco, Mexico, or possibly from northern South America.

RANGE: Mission Bay, San Diego, California (Carpenter, 1857, p. 351; Baily, recorded by Burch, 1946, p. 30). Scammon Lagoon, Baja California, to Punta Penasco in the Gulf of California and south to Paita, Peru. Callao, Peru (d'Orbigny). Galapagos Islands.

MATERIAL EXAMINED: Nine specimens from five stations:

PANAMA

Bahia Santelmo, Isla del Rey, Pearl Islands,

February 14, 1941, Station 8, sample 4, in 6-8 fathoms, 2 specimens.

Piñas Bay, February 24, 1941, Station 19, sample 35, in 14-33 meters, 2 specimens.

Guayabo Chiquito, March 4, 1941, Station 30, sample 78, dredged from center of bay to entrance in 25-64 meters, 3 specimens.

COLOMBIA

Ardita Bay, March 6, 1941, Station 31, sample 81, dredged in and out of center of bay in 34-43 meters, 1 specimen.

Octavia Bay, March 6, 1941, Station 32, sample 82, dredged across mouth of bay and back along same course in 24-28 meters, 1 specimen.

MEASUREMENTS: One of largest specimens: height, 18.6 mm.; maximum diameter, 15.5 mm. A specimen from Guayabo Chiquito, Panama, measures: height, 22.6 mm.; maximum diameter, 17.3 mm. This specimen apparently represents the form described as *Natica cora* by d'Orbigny. An unusually large specimen in the collections of the California Academy of Sciences which was collected by Henry Hemphill at San Ignacio Lagoon, Baja California, measures: height, 51 mm.; maximum diameter, 42 mm.

HABITAT: Gray sand, gray sandy mud, and gray mud bottom. We have observed specimens of *Polinices uber* from off Cedros Island, Baja California, to Panama, on beaches and dredged in from 2.5 to 50 fathoms.

DESCRIPTION: "Testa ovali ventricosa, crassa, laevi, nitida, alba; spira prominens; umbilico aperto, nudo. . . L'individu a un pouce de diamètre" (original description).

Shell variable but typically roundly ovate, moderately thick, smooth except for lines of growth and faint concentric striae, white, periostracum thin and yellowish, spire moderately elevated; columella nearly straight, with thick reflected callus on upper portion which covers the upper portion of the umbilicus; the lower portion of the columella is usually covered by only slightly reflected callus which often forms an angle with the strongly reflected upper portion; umbilicus usually open, narrowly rounded, slightly curved, funicle usually lacking or only slightly developed.

REMARKS: The type locality of this species was originally given as "ad portam Cumanensem" which is in Venezuela. All later authors,

however, have considered it to be a west American shell, and it seems likely that it may have been collected at Acapulco, Mexico, from which locality Valenciennes described many species of mollusks collected by the Humboldt-Bonpland expedition. Possibly it may have been collected at some locality along the west coast of northern South America.

We have accepted d'Orbigny's illustrations as representing the typical form of *Polinices uber*. A large series of specimens shows that there is much variation in the shell characters, especially in height of spire, widely open or nearly closed umbilicus, and thickness of shell. Carpenter and Tryon considered many other named forms to be identical with this species, including *Natica ovum* Menke and *N. rapulum* Reeve. Carpenter included in the synonymy *N. intemerata* Philippi, but Tryon regarded it as a separate species, as do the present authors.

Several west American species of *Polinices* with white or nearly white shells form a closely related group. A study of the specimens available has led us, at least for the present, to recognize several distinct forms. These are as follows: *Polinices uber*, shell with spire of moderate height, umbilical opening only slightly closed, with slightly reflected callus on the lower portion of the columella not forming a funicle or only slightly so; *P. cora* d'Orbigny might be applicable to similar shells with the spire lower and the form more elongate, although such forms appear to be merely variants of *P. uber*; *P. limi* Pilsbry, shell similar but a more globose form; *P. intemerata* Philippi, spire low, umbilicus crescentic and deep, a well-defined funicle with low rounded ridge entering the umbilicus; *P. rapulum* Reeve, shell similar to the last but with a high spire; *P. unimaculata* Reeve, shell with well-developed funicular ridge which, with the entire umbilical area, is colored purplish brown; *P. lactea* Guilding, which occurs in the Caribbean region, is closely related to this group. *Natica uberina* d'Orbigny, described from the Caribbean region was considered by Tryon to be identical with Guilding's species.

We have not seen any shells that could be identified definitely as *P. panamensis* Recluz or the sinistral *P. glabella* Reeve which was

cited from western Mexico by Pilsbry and Lowe.

Polinices uber has been recorded as occurring in the Pleistocene of Magdalena Bay, Baja California, Maria Madre Island, Panama, and the Galapagos Islands. Olsson, 1932, cited "*Polinices (Polinices) cf. uber Valenciennes*" as occurring in the Miocene of Peru.

SUPERFAMILY RHIPIDOGLOSSA

FAMILY TROCHIDAE

GENUS TEGULA LESSON

Tegula mariana Dall

Omphalius turbinatus PEASE, 1869, Amer. Jour. Conchol., vol. 5, p. 84, pl. 8, fig. 15, "Hab.—La Paz, in sinu Californico."

Not *Chlorostoma turbinatum* A. Adams, 1853.

Chlorostoma coronulatum C. B. Adams, PILSBRY, 1889, Manual of conchology, vol. 11, p. 177, pl. 24, figs. 80–83.

Not *Trochus coronulatus* C. B. Adams, 1852, which is *Trochus rubroflammulatus* Koch, 1843, according to Pilsbry and Lowe, 1932, p. 86.

Chlorostoma coronulatum var. *turbinatum* Pease, PILSBRY, 1889, in Tryon and Pilsbry, Manual of conchology, vol. 11, p. 178, pl. 24, fig. 90.

Omphalius marianus DALL, 1919, Proc. U. S. Natl. Mus. vol. 56, p. 359. New name for "*O. coronatus* Pilsbry, 1889 [*Chlorostoma coronulatum* of Pilsbry], not of C. B. Adams, 1852, and *O. turbinatus* Pease, 1869, not of A. Adams, 1851 . . . Santa Barbara, California, to Panama and Paita, Peru."

Tegula (Omphalius) mariana Dall, PILSBRY AND LOWE, 1932, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 84, pl. 10, figs. 9, 9a, 9b, 10, "I designate the type specimen of *O. turbinatus* Pease as type of *O. marianus* Dall. This is No. 40820 ANSP. . . . The type locality is La Paz."

Tegula mariana Dall, DURHAM, 1950, Mem. Geol. Soc. Amer., no. 43, pt. 2, p. 131, pl. 29, figs. 14–16.

TYPE LOCALITY: "Hab.—La Paz, in sinu Californico." [Mexico.]

RANGE: Punta Penasco in the Gulf of California and south to Paita, Peru.

MATERIAL EXAMINED: One specimen from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach on northern side of island.

MEASUREMENTS: Height, 8.9 mm.; maximum diameter, 10.5 mm. A large specimen in the collections of the California Academy of Sciences, collected by H. N. Lowe at Punta

Penasco, Sonora, Mexico, measures: height, 13 mm.; maximum diameter, 15 mm.

HABITAT: In crevices in rocks.

DESCRIPTION: Shell variable but generally somewhat bi-angulate, with two nodulous keels, one about midway between the suture and the periphery and another at the periphery and sometimes another keel between these two; fine spiral sculpture is present in addition to the keels, and the base shows traces of about five spiral lirae; umbilicus open; columellar callus green; color of whorls purplish gray, sometimes striped above with rows of light and brown dots.

REMARKS: The bi-angulate character of the last whorl and the fine spiral sculpture between the two keels are characteristic features of this species. The interior of the inner lip usually lacks spiral sculpture, whereas such sculpture is usually present on the somewhat similar young specimens of *Tegula rubroflammulata* Koch.

The subspecies *T. mariana mariamadrae* Pilsbry and Lowe (1932, p. 85, pl. 10, figs. 13, 14, 14a) is characterized by the development of strong sculpture, the radial and concentric ribbing giving rise to a nodose character, especially below the suture and on the basal spirals. The type locality of this subspecies is Maria Madre Island, Tres Marias group, Mexico.

Tegula semigranosa A. Adams, which has close crenulated lirae and an obtuse carina on the middle of the upper surface of each whorl, has been reported by Tomlin (1927-1929, p. 187) as occurring at the Galapagos Islands, although it has generally been considered to be a Caribbean species.

Tegula impressa Jonas, described from the west coast of South America, was recorded by Gregg (1946, p. 38) as occurring at Point Vicente, California. The specimen on which that record was based appears to be a juvenile form of *Tegula ligulata* Menke.

Dall cited *Tegula mariana* as ranging north to Santa Barbara, California, but we have not seen specimens from that region. This species has been recorded as occurring in the Pleistocene of Oaxaca, Mexico, and from upper Pliocene to Recent in the Gulf of California region.

***Tegula pellisserpentis* Wood**

Trochus pellis serpentis WOOD, 1828, Supple-

ment to the Index testaceologicus, pp. 16, 56, pl. 5, fig. 4; 1856, in Hanley, *op. cit.*, p. 219, suppl. pl. 5, fig. 4. PHILIPPI, 1851, Trochoideen, in Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 2, div. 3, p. 105, pl. 17, fig. 4. FISCHER, 1877, in Kiener, Iconographie des coquilles vivantes, Turbinacées, Troque, p. 164, pl. 55, fig. 3 (2 figs.).

Trochus elegans LESSON, 1832, Illustrations de zoologie, pl. 51, "Hab. Ignota; probabiliter in mare Panamae isthmum alluente."

Trochus strigilatus ANTON, 1839, Verzeichniss der Conchylien, p. 56, no locality cited. PHILIPPI, 1844, Abbildungen und Beschreibungen . . . Conchylien, vol. 1, no. 3, *Trochus*, p. 68 (8), pl. 2, fig. 9.

Tegula pellis serpentis Wood, GRAY, 1856, Proc. Zool. Soc. London, p. 44, description of animal. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 361, fig. 2680. M. SMITH, 1940, Worldwide sea shells, p. 12, fig. 164; 1944, Panamic marine shells, p. 4, figs. 27, 41.

Trochocochlea (Tegula) pellis serpentis Wood, MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 173.

Chlorostoma pellisserpentis Wood, PILSBRY, 1889, in Tryon and Pilsbry, Manual of conchology, vol. 11, p. 168, pl. 20, figs. 1, 2. ROGERS, 1913, The shell book, p. 216, pl. 49, opposite p. 218, fig. 2; 1951, *op. cit.*, pp. 483, 495 (by Rehder), as *Tegula pellisserpentis*.

TYPE LOCALITY: "Panama."

RANGE: Gulf of California (Pilsbry). Gulf of Fonseca to Gorgona Island, Colombia.

MATERIAL EXAMINED: One specimen from San José Island, Pearl Islands, Panama, November 26, 1945, tide pools.

MEASUREMENTS: Height, 48 mm.; maximum diameter, 40 mm.

HABITAT: In tide pools.

DESCRIPTION: Shell highly conical, imperforate, thick; about eight whorls, sculptured with weak granose spiral ribs which are separated by narrow incised lines; outer lip beveled to an edge; one strong tubercle on the columella and a smaller one at the base; color yellowish brown or pinkish, crossed obliquely by narrow, black, axial stripes or patches; often stained greenish.

REMARKS: This species (*Tegula elegans* Lesson = *Trochus pellis serpentis* Wood) is the type of the genus *Tegula* Lesson.

FAMILY NERITIDAE

An interesting paper by Russell (1941) deals with the members of this family that occur in the western Atlantic.

***Nerita funiculata* Menke**

Nerita bernhardi RECLUZ, 1850, Jour. Conchyl., vol. 1, p. 285, name only, "Panama." REEVE, 1855, Conchologia iconica, vol. 9, *Nerita*, sp. 57, pl. 12, figs. 57a, 57b, "Hab. Peru." CARPENTER, 1856, Catalogue of . . . Mazatlan shells, p. 257.

Nerita funiculata MENKE, 1850, Zeitschr. f. Malakozool., yr. 7, p. 169.

Nerita (Theliostyla) bernhardi Recluz, MÖRCH, 1860, Malakozool. Blätter, vol. 7, p. 171.

[*Nerita fulgurans* Gmelin] var. *bernhardi* Recluz, TRYON, 1888, Manual of conchology, vol. 10, p. 24, pl. 4, figs. 66, 67, 69.

TYPE LOCALITY: "Von Mazatlan." [Mexico.] For *Nerita funiculata*.

RANGE: San Roque Island, Baja California, to Punta Penasco in the Gulf of California and south to Peru. Cocos Island.

MATERIAL EXAMINED: Four specimens from San José Island, Pearl Islands, Panama, November 26, 1941.

MEASUREMENTS: Largest specimen: height, 12 mm.; maximum diameter, 13.2 mm. A large specimen from Panama in the collections of the California Academy of Sciences measures: height, 18 mm.; maximum diameter, 19.5 mm.

HABITAT: Not indicated for present specimens. We have observed specimens occurring on rocky beaches and dredged to a depth of from 10 to 18 fathoms.

DESCRIPTION: Shell rather globose, spire low; sculptured with rather closely set, often somewhat unequal, rounded spiral ribs which are separated by incised grooves, the whole crossed by scabrous lines of growth; color black or maculated with yellowish gray or orange; aperture white; outer lip denticulate, larger teeth above and below; columellar area flat, granular, margin often with two, sometimes more, small teeth and a large quadrate denticle above; exterior of operculum bluish gray, finely papillose.

REMARKS: The specimens of this species in the present collection are small.

The name *Nerita bernhardi* was originally cited by Recluz in 1850 without a description or illustration. So far as we have ascertained, *bernhardi* was first described and illustrated by Reeve in 1855. It appears then that the first valid name for this species is *Nerita funiculata* Menke, dated November 11, 1850. According to Sherborn, publication of this name appeared in 1851.

Pilsbry considered *Nerita bernhardi* to be only a variety of *N. fulgurans* Gmelin, a Caribbean species. The west American shell is generally smaller and has a lower spire.

Nerita funiculata occurs in the Pliocene of the Gulf of California region and in the Pleistocene of Baja California, the Tres Marias Islands, Mexico, and Ecuador.

***Nerita scabricosta ornata* Sowerby**

Nerita ornata SOWERBY, 1825, The genera of recent and fossil shells, vol. 1, pt. 15, *Nerita*, pl. 88, fig. 4, and explanation to pl., no locality cited. WOOD, 1828, Supplement to the Index testaceologicus, pp. 25, 45, pl. 8, *Nerita*, fig. 4, apparently from "S. America." REEVE, 1842, Conchologia systematica, vol. 2, p. 139, pl. 202, fig. 4; 1855, Conchologia iconica, vol. 9, *Nerita*, sp. 3, pl. 1, figs. 3a, 3b, "Hab. Panama and Gallapagos Islands (on the rocks at low water); Cuming." CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 333, fig. 2419. SOWERBY, 1883, Thesaurus conchyliorum, vol. 5, p. 114, pl. 463 (*Nerita* pl. 1), fig. 13. TRYON, 1888, Manual of conchology, vol. 10, p. 30, pl. 6, fig. 5 (copy of Reeve's fig. 3b). M. SMITH, 1944, Panamic marine shells, p. 6, fig. 57.

TYPE LOCALITY: No locality cited originally. Galapagos Islands here designated as type locality.

RANGE: Gulf of Fonseca to La Plata Island, Ecuador, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from La Plata Island, Ecuador, December, 1942, C. M. Breder, Jr., collector. One specimen not localized.

MEASUREMENTS: Larger specimen: maximum diameter, 25 mm. A large specimen collected by the Templeton Crocker expedition of the California Academy of Sciences, 1932, at Conway Bay, Indefatigable Island, Galapagos Islands, measures: height, 50 mm.; maximum diameter, 45 mm.

HABITAT: Not indicated.

REMARKS: The shell of this subspecies differs from that of typical *Nerita scabricosta* Lamarck in that it is generally more globose, and especially in that it has very strong, equal, rounded ribs.

The Galapagos Islands have been designated as the type locality for this subspecies because it attains a large size and is typically developed in that archipelago. It is a generally more southern form than typical *N. scabricosta*.

There has been divergence of opinion concerning the interpretation of *Nerita scabricosta* Lamarck [1822 (1815–1822), vol. 6, pt. 2, p. 194, no locality cited], as mentioned by Adam and Leloup [1938 (1938–1939), fasc. 19, pp. 44–45] who placed it in the synonymy of *N. costata* Chemnitz. Deshayes [1838 (1835–1845), vol. 8, p. 608] considered Lamarck's description to fit *N. costata* Chemnitz (= *grossa* Born, not Linnaeus) but was in doubt concerning this possibility. The figure published by Delessert to represent Lamarck's species was said by Adam and Leloup undoubtedly to represent *N. costata*. Recluz (1850a, p. 287) gave a description of a specimen in the museum of natural history at Paris which he considered to be the type of *Nerita scabricosta*. He cited the island of Timor as the locality for the species. This specimen was illustrated by Petit de la Saussaye (1850) who pointed out that it represented a west American species that he believed to be identical with *N. ornata* Sowerby. Mermod (1953, pp. 167–169, fig. 177) gave an excellent discussion of this problem and published a figure of the specimen that was illustrated by Delessert which he stated was referable to *N. costata* Chemnitz (*N. costata* Gmelin). He stated that the type specimen of *N. scabricosta* is not in the Lamarck collection in the museum of natural history in Geneva. He mentioned, however, that examples of that species do occur in the collections of Delessert and Recluz accompanying the variety *deshayesii* Recluz [1841, p. 104; Reeve, 1855 (1843–1878), vol. 9, *Nerita*, sp. 7, pl. 2, figs. 7a, 7b, "Panama"], a form that was originally described by Recluz as "Hab. les côtes de la Californie, et la var. b. de Realejo et Samblas [San Blas]."

Many authors, including von Martens, Tryon, Dall, and Pilsbry, considered *N. scabricosta* Lamarck to represent a tropical west American species, and we are inclined to accept this view, at least until definite evidence to the contrary is adduced.

Keen (1942) mentioned that a specimen of *Nerita scabricosta* remained alive in moist sand five months after removal from its normal habitat.

The present record of the occurrence of *Nerita scabricosta ornata* at La Plata Island,

Ecuador, is a slight extension south along the mainland of the known range of this subspecies.

GENUS *NERITINA* LAMARCK

Neritina latissima Broderip

Neritina latissima BRODERIP, 1833, Proc. Zool. Soc. London, for 1832, p. 200. SOWERBY, 1835–1841, The conchological illustrations, *Nerita*, p. 3, pl. 86, fig. 3, pl. 91, fig. 16. REEVE, 1842, Conchologia systematica, vol. 2, p. 137, pl. 200, fig. 16 (var.). SOWERBY, 1849, Thesaurus conchyliorum, vol. 2, p. 519, pl. 114, figs. 172, 173. REEVE, 1855, Conchologia iconica, vol. 9, *Neritina*, sp. 13, pl. 3, figs. 13a, 13b. CHENU, 1859, Manuel de conchyliologie, vol. 1, p. 336, fig. 2465. VON MARTENS, 1879, *Neritina*, in Conchylien-Cabinet von Martini und Chemnitz, vol. 2, div. 10, p. 72, pl. 1, figs. 6, 7. MILLER, 1879, Malakozool. Blätter, new ser., vol. 1, p. 172. TRYON, 1888, Manual of conchology, vol. 10, p. 76, pl. 22, figs. 87, 88. VON MARTENS, 1899, Biologia Centrali-Americana, Mollusca, p. 469. M. SMITH, 1940, Worldwide sea shells, p. 20, fig. 268. MORRISON, 1946, Smithsonian Misc. Coll., vol. 106, p. 4.

TYPE LOCALITY: "Hab. ad Real Llejos, in fluvio, rupibus adhaerens." [Near Corinto, Nicaragua.]

RANGE: Corinto, Nicaragua, to Rio San Francisco, Ecuador.

MATERIAL EXAMINED: Nineteen specimens from two stations:

PANAMA

East coast of San José Island, Pearl Islands, November 26, 1945, tide pools, R. C. Murphy, collector, 5 specimens.

COLOMBIA

Limon Bay, Cupica Bay, May 7, 1941, Station 102, sample 403, from stream coming from bay's greater waterfall, 14 specimens.

MEASUREMENTS: Largest specimen: height, 24.2 mm.; greater diameter, 21.8 mm.; lesser diameter, 11.2 mm. The shell of this species has been reported to attain a diameter of 37 mm.

HABITAT: In stream coming from waterfall and in tide pools. Von Martens mentioned that Pittier reported this species as occurring along the coast of Costa Rica, in fresh water 20 meters above the sea.

DESCRIPTION: Shell subglobose, rather flattened on apertural side, thin, smooth, but

somewhat plicately wrinkled or striolate, last whorl often slightly concave next to the spire which it sometimes envelops; brownish black or olive speckled with light triangular or suboval black-margined spots; aperture expanded, often with broadly rounded ear-like processes above and below, bluish or yellowish gray; columellar area broad, flattened, yellowish gray, margin minutely denticulate in the middle; exterior of operculum bluish black.

REMARKS: Two species have been described which now are considered to be but forms of *Neritina latissima*, as follows:

Neritina globosa Broderip, 1832-1833, p. 201; Sowerby, 1835 (1832-1841), *Neritina*, p. 3, pl. 90, fig. 12. Type locality: "Hab. ad Chiriqui Colombiae Occidentalis in fluvio." See also von Martens, 1899, p. 469.

Neritina intermedia Sowerby, 1832-1833, p. 201; 1835 (1832-1841), *Neritina*, p. 3, pl. 87, fig. 7 (2 figs.). Type locality: "Hab. in America Centrali. Found abundantly on stones in a mountain stream in the Isle of Lions, Bay of Montejo. . . . A smaller variety occurs in a rivulet at San Lucas in the Gulf of Nicoya." See also von Martens, 1899, p. 469.

Neritina globosa has line priority over *N. intermedia*. Sowerby [1849 ([1842] 1847-1887)] stated that he could not separate the two and that both are similar to *N. latissima* except that the shell expansions are just beginning their development. Morrison (1946) recorded the occurrence of all three forms on San José Island, Pearl Islands, Panama.

The subspecies *Neritina latissima pilsbryi* Tryon [1888 (1879-1913), vol. 10, p. 76, pl. 22, fig. 91] also is very similar to typical *latissima*. It is "A color variety characterized by a purplish or pink very fine reticulation upon a white ground, upon which are numerous subtriangular white spots with dark margins."

Neritina fontaineana d'Orbigny, described from Guayaquil, Ecuador, apparently lacks wing-like expansions and is different in color from *N. latissima*. Tryon considered it to be a subspecies of *N. latissima*.

The thinner, more broadly expanded outer lip which is often extended above and below into ear-like projections, the more plicate or striolate character exteriorly, broadly flattened columellar area, and generally concave character of the last whorl next to the spire are features that serve to separate *N. latissima* and its forms from *N. cassiculum* Sowerby.

Neritina (Clypeolum) pterota Woodring, from the upper Miocene Bowden Beds of Jamaica, is similar to *N. latissima*.

SUPERFAMILY ZYGOBRANCHIA

FAMILY FISSURELLIDAE

GENUS FISSURELLA BRUGUIÈRE

SUBGENUS CREMIDES H. AND A. ADAMS

Fissurella (Cremides) virescens nigropunctata Sowerby

Fissurella nigropunctata SOWERBY, 1835, Proc. Zool. Soc. London. for 1834, p. 125, "Hab. ad Insulas Gallapagos"; var. from "Hab. ad Insulam Lobos sub lapidibus littoralibus." REEVE, 1849, *Conchologia iconica*, vol. 6, *Fissurella*, sp. 8, pl. 4, fig. 8. SOWERBY, 1862, *Thesaurus conchyliorum*, vol. 3, p. 188, pl. 237 (*Fissurella* pl. 2), fig. 33.

[*F. virescens*] var. *nigropunctata* Sowerby, PILSBRY, 1890, in Tryon and Pilsbry, *Manual of conchology*, vol. 12, p. 159, pl. 31, figs. 11-13.

TYPE LOCALITY: "Hab. ad Insulas Gallapagos."

RANGE: Mazatlan, Mexico, to Paita, Peru, and the Galapagos Islands.

MATERIAL EXAMINED: One specimen from Pacheca Island, Pearl Islands, Panama, February 10, 1941, Station 1, sample 2, beach on northern side of island.

MEASUREMENTS: Greater diameter, 19.7 mm.; lesser diameter, 12.3 mm.; convexity, 5.8 mm.

HABITAT: In crevices in rocks.

REMARKS: The single specimen in the present collection referred to this subspecies is small. The ribs alternate in size. The exterior is dark, with a faint tinge of red near the apex. Most of the interior is green, the callus a deeper green, similar to that of *Fissurella virescens* with which it intergrades.

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