

MARINE PLEISTOCENE MOLLUSKS FROM OAXACA, MEXICO

By ROBERT H. PALMER and LEO GEORGE HERTLEIN

During the course of geological work in southern Mexico in April and May, 1924, the senior author made a collection of fossils found on elevated beaches along the coast of Oaxaca. The field work and collecting are the results of the senior author's work, while the preparation of the manuscript is mostly the work of the junior author. Three papers dealing with this general area have been published.¹

The writers wish to acknowledge the kind assistance received from Mr. A. M. Strong of Los Angeles and Mrs. I. S. Oldroyd of Stanford University, in the identification of certain of the species. They wish especially to acknowledge the kindness of Dr. G. D. Hanna of the California Academy of Sciences for criticism of the manuscript, the line drawings, and photography of most of the specimens which have been illustrated in this paper.

The coast of Oaxaca is a series of alternating depressions and elevations. The occurrence of the Pleistocene has been summarized by Palmer in the paper dealing with the corals, as follows:

"Along the Oaxaca coast the Pleistocene occurs as a low cliff of loosely consolidated beach material. It extends along the coast in patches for some twenty-eight miles. In some places it is on the beach and in others it is inland about a mile and a half. Its elevation varies from low tide level to fifty feet or more. No reefs have been found in this exposure although there are abundant coral remains which include such reef-forming genera as *Porites* and *Pocillopora*."

The formation is made up mostly of a soft gray or buff sandstone, although locally it is hard and flinty. The name Colotepec formation is here proposed for this Pleistocene formation. The type locality is along the Pacific coast of Oaxaca, about 16 kilometers west of the mouth of the Rio Colotepec. The thickness of the formation is about 15 meters and the beds lie upon granite of Cretaceous age. No sedimentary beds of Tertiary age are known along the coast of Oaxaca.

¹ Palmer, R. H., Upper Pleistocene occurrence along the Oaxaca Coast of Mexico. *Science* (New Series), vol. 63, no. 1636, 1926, p. 476. — Palmer, R. H., Geology of Southern Oaxaca, Mexico. *Jour. Geol.*, vol. 36, no. 8, November-December, 1928, pp. 718-734, 8 figs. — Palmer, R. H., Fossil and Recent Corals and Coral Reefs of Western Mexico. *Three New Species*. *Proc. Amer. Phil. Soc.*, vol. 67, no. 1, 1928, pp. 21-31, 3 plates.

The excellent preservation of the fossils and lack of cross-bedding indicate quiet deposition of the Pleistocene beds in contrast to the present day wave-buffed strand. Some of the specimens still retain traces of the color markings.

Most of the collection was made from elevated beaches from five to sixteen meters above sea-level, at Loc. 1299 (C. A. S.), on the Oaxaca coast about 16 kilometers west of the mouth of the Rio Colotepec.

The original collection was divided into four parts. One each was given to Leland Stanford Junior University, University of California, California Academy of Sciences and the private collection of Palmer. Some of the species in the collection at Leland Stanford Junior University have been recorded by Grant and Gale.²

The type of the species described in this paper as well as the specimens illustrated but not representing new species, are in the type collection of the California Academy of Sciences.

The following faunal list contains the names of species collected by Palmer from the Pleistocene of Oaxaca, in the collections of the California Academy of Sciences as well as those of Stanford University.

FAUNAL LIST FROM THE UPPER PLEISTOCENE OF OAXACA, MEXICO

Anthozoa

Oculina sp.

Pocillopora palmata Palmer ("Pleistocene near Escondido Bay, Oaxaca, Mexico")

Porites panamensis Verrill.

Echinodermata

Encope micropora L. Agassiz.

Pelecypoda

Anomalocardia subimbricata Sowerby

Amphichaena kindermanni Philippi

Antigona multicostata Sowerby

Arca formosa Sowerby

Arca gordita Lowe

Arca gradata Broderip & Sowerby

Arca mutabilis Sowerby

Arca pacifica Sowerby

Arca reeviana d'Orbigny

Botula cf. *cinnamomea* Chemnitz

Cardium asperum Sowerby

Cardium consors Broderip & Sowerby

Cardium planicostatum Sowerby

Chama echinata Broderip

² Grant IV, U. S., and Gale, H. R., Mem. San Diego Soc. Nat. Hist., vol. 1, 1931.

Chama frondosa Broderip
Chione cf. *succincta* Valenciennes
Chione undatella Valenciennes
Codakia distinguenda Tryon
Divaricella eburnea Reeve
Donax punctatostriata Hanley
Dosinia ponderosa Gray
Glans affinis Sowerby
Glycymeris delessertii Reeve
Lima tetrica Gould
Modiolus capax Conrad
Mytilus edulis Linnaeus [? or *M. pedroanus* Conrad]
Macrocallista aurantiaca Sowerby
Macrocallista squalida Sowerby
Ostrea fisheri Dall
Ostrea iridescens Gray
Pecten circularis Sowerby
Pecten subnodosus Sowerby
Pinctada mazatlanica Hanley
Pitar concinna Sowerby
Pitar lupanaria Lesson
Pitar vulnerata Broderip
Pseudochama exogyra Conrad
Spondylus crassisquama Lamarck
Tellina cf. *rubescens* Hanley
Tivela byronensis Gray
Tivela hians Philippi
Venericardia cuvieri Broderip
Venericardia flammea Michelin
Venerupis foliata Deshayes

Gastropoda

Acanthina cingulata Lamarck
Acanthina muricata Broderip
Anachis cf. *costellata* Sowerby
Anachis rugosa Sowerby
Architectonica granulata Lamarck
Bullus aspersus A. Adams
Calyptraea mamillaris Broderip
Cantharus elegans Gray
Cantharus sanguinolentus Duclos
Cassis coarctata Gray
Conus brunneus Gray
Conus fergusonii Sowerby
Conus gladiator Broderip
Conus lucidus Mawe
Conus mahogani Reeve (cited by Grant & Gale, 1931)
Conus princeps lineolatus Valenciennes
Conus princeps regius Chemnitz

Conus purpurascens Broderip
Conus regularis Sowerby
Crepidula aculeata Gmelin
Crepidula lessonii Broderip
Crucibulum imbricatum Sowerby
Crucibulum spinosum Sowerby
Cypraea arabicula Lamarck
Diodora inaequalis Sowerby
Diodora panamensis Sowerby³
Enaeta barnesii Gray
Erato scabriuscula Gray
Fasciolaria granosa Broderip
Harpa crenata Swainson
Hipponix barbatus Sowerby
Latirus concentricus Reeve
Malea ringens Swainson
Mazatlanian fulgurata Philippi
Melongena patula broderip & Sowerby
Mitra belcheri Hinds⁴
Mitra lens Wood
Morum tuberculosum Sowerby
Murex brassica Lamarck
Murex princeps Broderip
Murex radix Gmelin
Natica catenata Philippi
Natica intemerata Philippi
Oliva angulata Lamarck
Oliva kaleontina Duclos
Oliva spicata Bolten
Oliva testacea Lamarck
Olivella gracilis Broderip & Sowerby
Olivella porteri Dall
Patella mexicana Broderip & Sowerby
Polinices crickmayi Palmer & Hertlein, n. sp.
Pyrene fuscata Sowerby
Pyrene strombiformis major Sowerby
Strombina lanceolata Sowerby
Strombina pulcherrima Sowerby
Surcula olivacea Sowerby
Tegula mariana Dall

³ This specimen has been compared with a large series of *Diodora panamensis* Sowerby by Mr. A. M. Strong and it is his opinion that the specimen falls within the range of variation of Sowerby's species.

⁴ *Mitra belcheri* Hinds, Ann. and Mag. Nat. Hist., vol. 11, 1843, p. 255. "Gulfs of Nicoya and Papagayo, Central America, dredged from a muddy floor in 17 fathoms." — Hinds, Zool. Voy. Sulphur, vol. 2, Moll. pt. 2, October, 1844, p. 40, pl. 11, figs. 1 and 2. "Gulfs of Nicoya and Papagayo, Central America. Dredged from a muddy floor in seventeen fathoms." — Tryon, Manual Conch., vol. 4, 1882, p. 139, pl. 40, fig. 179. Hind's record cited. This interesting species was collected from the Pleistocene at Escondido Bay, Oaxaca, Mexico by Mr. Bacon, who presented it to the California Academy of Sciences.

Tegula cf. *rubroflammulata* Koch
Terebra *strigata* Sowerby
Thais *biserialis* Blainville
Thais *triangularis* Blainville
Trivia *pustulata* Lamarck
Trivia *radians* Gray
Colubraria *soverbii* Reeve
Turritella *tigrina* Kiener
Turritella *gonostoma* Valenciennes var. [with strong spiral
ridges]
Vasum *caestus* Broderip
Vitularia *salebrosa* King

Cirripedia

Balanus tintinnabulum peninsularis Pilsbry

This fauna is decidedly tropical in character and all the species are known Recent. The majority of the species in the faunal list are now found in the waters of the Pacific Ocean adjacent to Oaxaca. A few of the species have not been reported north of Panama in their Recent range.

This suggests an indication of the northward migration during the warm Upper Pleistocene, well known along the west coast of Lower California and Upper California. The similarity of certain species to those of the Recent and fossil Caribbean forms is an interesting feature of the fauna.

In previous papers by Palmer, this fauna was considered to be of Upper Pleistocene age, and with this conclusion the present writers are in agreement. It appears that the Colotepec Upper Pleistocene formation of Oaxaca should be correlated with the Upper Pleistocene of the Tres Marias Islands,⁵ the Gulf of California region, Magdalena Bay,⁶ San Quintin Bay,⁷ and the Upper San Pedro formation of San Pedro,⁸ California and San Diego, California. These may be considered not as the same but as approximately equivalent formations.

⁵ Hertlein, L. G., Pleistocene mollusks from the Tres Marias Islands, Cedros Island, and San Ignacio Lagoon, Mexico. *Bulletin South. Calif. Acad. Sci.*, vol. 33, pt. 2, May-August (issued August 31), 1934, pp. 59-73, 1 pl.

⁶ Jordan, E. K., The Pleistocene of Magdalena Bay, Lower California, Ms.; also Dall, W. H., *Nautilus*, vol. 32, no. 1, 1918, pp. 23-26. See also Dall, W. H. and Ochsner, W. H., Tertiary and Pleistocene Mollusca from the Galapagos Islands. *Proc. Calif. Acad. Sci.*, Ser. 4, vol. 17, no. 4, 1928, pp. 89-139, plates 2-7, 5 text figs.

⁷ Jordan, E. K., Molluscan Fauna of the Pleistocene of San Quintin Bay, Lower California. *Proc. Calif. Acad. Sci.*, Ser. 4, vol. 15, no. 7, pp. 241-255, 1 pl., 1 text fig.

⁸ Arnold, R., The Paleontology and Stratigraphy of the marine Pliocene and Pleistocene of San Pedro, California. *Mem. Calif. Acad. Sci.*, vol. 3, 1903. — Smith, J. P., Climatic Relations of the Tertiary and Quaternary faunas of the California region. *Proc. Calif. Acad. Sci.*, Ser. 4, vol. 9, no. 4, 1919, pp. 123-173, 1 pl.

NOTES AND DESCRIPTIONS OF SPECIES

ARCA GORDITA Lowe

Plate 19, figures 1 and 4

Arca gordita Lowe, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 6, March 21, 1935, p. 16, pl. 1, fig. 1. "Acapulco, 20 fathoms" (type). Also "Guaymas, 20 fathoms" and "off West Mexico."

Specimens of this species from the Pleistocene of Oaxaca, Mexico, measure 61 mm. in length.

Arca gordita Lowe is near to *Arca golfoyaquensis* Maury,⁹ but differs in the fewer ribs, 30 rather than 38, and in that the beaks are less anteriorly placed than in Maury's species. Other species of this group are *Arca golfoyaquensis* var. *medioamericana* Olsson,¹⁰ and *A. henekeni* Maury,¹¹ all from the Caribbean Miocene.

LIMA TETRICA Gould

Lima tetrica Gould, Proc. Boston Soc. Nat. Hist., vol. 4, 1851, p. 93. "Gulf of California, La Paz." — Boston Jour. Nat. Hist., vol. 6, 1857, p. 405, pl. 16, fig. 6. "Inhabits La Paz, Gulf of California." — Grant and Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 239. "Upper Pleistocene of Coast of Oaxaca, Mexico. (coll. R. H. Palmer)." — Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 138. "Cape San Lucas; Mazatlan; Acapulco."

Radula tetrica Gould, Lamy, Journ. de Conchyl., vol. 57, no. 3, 1909, p. 214. "Golfe de Californie."

Lima lima forme *tetrica* Gould, Lamy, Journ. de Conchyl., vol. 74, no. 2, 1930, p. 98. "Golfe de Californie" (p. 102); "Basse-Californie, L. Diguët, 1894" (p. 104).

⁹ Maury, C. J., Bull. Amer. Paleo., vol. 5, no. 29, 1917, p. 332 [168], pl. 54 [28], fig. 5. "Zones B, F, G, Rio Gurabo at Los Quemados; Zone H, Rio Cana at Caimito; Bluff 1, Cercado de Mao." Santo Domingo, Miocene.

¹⁰ Olsson, A. A., Bull. Amer. Paleo., vol. 9, no. 39, 1922, p. 360 [188], pl. 26 [23], figs. 4-6. "Hone Walk Creek"; Costa Rica. "Gatun Stage."

¹¹ [Arca] *Scapharca Henekeni* Maury, Bull. Amer. Paleo., vol. 5, no. 29, 1917, p. 331 [167], pl. 55 [29], fig. 2. "Bluff 2, Cercado de Mao; zone B, Rio Gurabo at Los Quemados." New name for *Arca consobrina* Sowerby, Quart. Jour. Geol. Soc. London, vol. 6, 1850, p. 52, pl. 10, fig. 12. "Santo Domingo, Miocene." (Not *Arca consobrina* d'Orbigny, Paleo. Franc. Terr. Crétacés, vol. 3, 1844, p. 209, pl. 311, figs. 4-7. "Elle est propre au terrain néocomien du bassin parisien. Je l'ai recueillie à Marolles (Aube).")

Arca Henekeni Maury, Olsson, Bull. Amer. Paleo., vol. 9, no. 39, 1922, p. 358 [186], pl. 24 [27], figs. 13, 14. "Gatun Stage: Water Cay," Costa Rica, Miocene.

Lima tetrica is narrower and more compressed than *Lima lima* Linnaeus¹² and the posterior and ventral margins are less broadly rounded.

The Recent range has been given by Dall as Lower California to Panama, Galapagos and Juan Fernandez Islands.

AMPHICHAENA Philippi

Amphichaena Philippi, Archiv für Naturgeschichte, 1847, p. 63. Sole species *Amphichaena kindermanni* Philippi. — Dall, Proc. Acad. Nat. Sci. Philadelphia, vol. 50, 1898, p. 58. Sole species *Amphichaena kindermanni* Philippi. "Mazatlan." — Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 5, 1900, p. 979. "Type *A. Kindermannii* Phil., loc. cit., pl. 3, fig. 7; Mazatlan."

AMPHICHAENA KINDERMANNI Philippi

Plate 18, figures A, B. C.; plate 19, figures 5, 6, 7, 8, 9, 10

Amphichaena kindermanni Philippi, Archiv. für Naturgeschichte, 1847, p. 63, Tab. 3, fig. 7. "Habitat litus Oceani Pacifici ad oppidum Mexicanum Mazatlan."

Psammobia kindermanni Philippi, Giebel, Naturgeschichte des Thierreichs, Bd. 5, 1864, p. 146. "mit drei Schloszzähnen in der einen Klappe unter Amphichaena."

Sanguinolaria kindermanni Philippi, Stearns, Proc. U. S. Nat. Mus., vol. 17, 1894, p. 156. "San Juanico." Lower California.

Amphichaena kindermannii Philippi, Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 5, 1900, pp. 979-980. "recent and in the Quaternary of the west American coast near Mazatlan, Mexico."

¹² *Ostrea lima* Linnaeus, Syst. Nat., Ed., 10, vol. 1, 1758, p. 699. "Habitat in O. meridional."

Radula, *Pecten testa ovali*, . . . [etc.], Chemnitz, Syst. Conch.-Cab., vol. 7, 1784, p. 349, pl. 68, fig. 651. "Tranquebar."

Lima lima Linnaeus, Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 767. "Pliocene of the Caloosahatchie marls, Florida, Dall; Pleistocene of the West Indies; recent on the American coast from Sarasota Bay, Florida, to Brazil, and widely distributed in foreign seas."

Lima squamosa Lamarck, Syst. Anim. s. Vert., 1801, p. 136 [no locality cited but reference given to Argenville, Chemnitz, etc.]. — Lamarck, Anim. s. Vert., vol. 6, 1819, p. 156. "Habite les mers d'Amerique etc." — Sowerby, Thes. Conch., vol. 1, 1843, *Lima*, p. 84, pl. 21, figs. 1, 18. "Red Sea, Mediterranean."

Philippi and Dall have well described the characters of this interesting shell. The general shape is that of *Tagelus divisus*, but the texture and solidity and internal marginal grooving resemble *Donax*. The smooth surface shows suppressed radial sculpture which on weathered specimens is much more pronounced. There are two cardinals on the right and three on the left valve. Several specimens are present in the collection from the Oaxaca Pleistocene.

Recent specimens of the species were collected by the junior author at Loc. 27223 (C. A. S.), Mazatlan, Sinaloa, Mexico; at Loc. 27217 (C. A. S.), Tenacatita Bay, Jalisco, Mexico; and a fine series of specimens was secured at Loc. 27230 (C. A. S.), Petatlan Bay, Guerrero, Mexico.

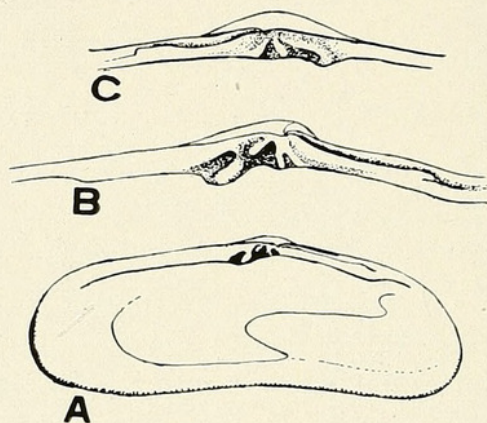


PLATE 18

Amphichaena kindermanni Philippi. Recent specimens from Petatlan Bay, Guerrero Mexico.

- A. View of the interior of right valve, plesiotype No. 6954 (C. A. S. Type Coll.); length of valve 32.4 mm.
- B. View showing details of hinge of valve shown in figure A.
- C. View of hinge of left valve, plesiotype No. 6955 (C. A. S. Type Coll.).

CHAMA FRONDOSA Broderip

Chama frondosa Broderip, Proc. Zool. Soc. London, 1834, p. 148. "*Hab.* ad Insulam Platam Colombiae Occidentalis. It was dredged up from a rock of coral, to which it was adhering, at a depth of seventeen fathoms." — Broderip, Trans. Zool. Soc., London, vol. 1, 1835, p. 302, pl. 38, figs. 1, 2. — Chenu, Illustr. Conchyl., 1846, *Chama*, pl. 6, fig. 8. — Reeve, Conch. Icon., vol. 4, 1846, *Chama*, pl. 1, fig. 1a. [Broderip's locality cited]. — Lamy, Journ. de Conchyl., vol. 71, no. 4, 1928, p. 34. "Acapulco." "Panama." — E. K. Jordan and Hertlein, Proc. Calif. Acad. Sci., Ser. 4, vol. 15, no. 14, 1926, p. 427, pl. 34, fig. 1. Pliocene of Cedros Island and Turtle Bay, Lower California; Recent from San Diego, California to Peru. — Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 137. "Tres Marias; Cape San Lucas; La Paz; Manzanillo."

The specimens referred to *Chama frondosa* from the Pleistocene of Oaxaca, have in most cases lost the exterior ornamentation of lamellae and spines as well as the color. Recent shells of this species in the collection have frondose laminae, and each lamella is somewhat of the shape of a broad fan-shaped leaf, which is radiately plaited on the upper surface and of saffron color, tinged with purple.

Due to loss of lamellae and color it seems best to refer our specimens to *C. frondosa* Broderip. Perhaps they might equally well be included with the form listed as *Chama purpurascens* Conrad which was given as a synonym of *C. frondosa* by Tryon,¹³ or they might be listed under *Chama frondosa* var. *b.* Broderip,¹⁴ later named *Chama frondosa* var. *mexicana* Carpenter.

PITAR (HYSTEROCONCHA) LUPANARIA Lesson

Cytherea lupanaria Lesson, Centurie Zool., 1830, p. 196, pl. 64. — Lesson, Voyage autour du Monde . . . La Coquille, Zool., vol. 2, pt. 1, 1830, p. 430-432. "est tres-commune sur les grèves, entre Colan et Payta, sur la côte du Pérou."

Cytheraea lupinaria Lesson, Sowerby, Thes. Conch., vol. 2, 1851, p. 632, pl. 132, fig. 111. "Real Llejos, Central America. Cuming." — Reeve, Elem. Conch., vol. 2, 1860, p. 109, pl. 35, fig. 189 [no locality cited].

¹³ Tryon, G. W., Proc. Acad. Nat. Sci. Philadelphia, vol. 22, 1872, p. 117.

¹⁴ *Chama frondosa* var. *b.* Broderip, Proc. Zool. Soc. London, 1834, p. 149. "*Hab.* ad Mexico. (Gulf of Tehuantepec). Dredged up from sandy mud attached to Aviculae (Meleagrinae, Lam., Margaritae, Leach) at a depth of ten fathoms. — Broderip, Trans. Zool. Soc. London, vol. 1, 1835, p. 302, pl. 38, fig. 2 [according to Lamy]. — Chenu, Illustr. Conchyl., 1846, *Chama*, pl. 6, fig. 7. — Reeve, Conch. Icon., vol. 4, 1846, *Chama*, pl. 1, fig. 1b. [Broderip's locality cited].

Chama frondosa var. *mexicana* Carpenter, Mazatlan Catalog., [1855-]1857, pp. 87, 549. Mazatlan. — Lamy, Journ. de Conchyl., vol. 71, no. 4, 1928, p. 315. "Basse-Californie."

Chama parasitica De Rochebrune, Bull. Mus. Hist. Nat., vol. 1, 1895, p. 243. Basse-Californie [according to Lamy, 1928, pp. 315, 316].

Cytherea dione Linnaeus, Giebel, Naturgeschichte des Thierreichs, Bd. 5, 1864, p. 149, figs. 351, 352. "tropischen Westküste Südamerikas." [Not *Cytherea dione* Linnaeus.]

Dione lupanaria Lesson, Römer, Monographie Molluskengattung Venus, Linné, vol. 1, 1868, p. 130, pl. 34, fig. 2; pl. 35, fig. 1 (*exspinata*). "America centralis in Oceano pacifico (Salango, Tumbez, Payta (Peru), San Blas, Mazatlan, Realtejos)."

Cytherea (Dione) lupanaria Deshayes, Tryon, Struct. and Syst. Conch., vol. 3, 1884, p. 178, pl. 113, fig. 23. "Mazatlan." Recent.

Pitaria (Hysteroconcha) lupanaria Lesson, Dall, Proc. U. S. Nat. Mus., vol. 26, 1902, p. 388. "Ballenas Bay, Pacific coast of Lower California, the Gulf of California, and southward to Payta, Peru."

Amiantis (Hysteroconcha) lupanaria Lesson, Grant and Gale, Mem. San Diego Soc. Nat. Hist., vol. 1, 1931, p. 350. "Oaxaca, Mexico (R. H. Palmer, Coll.)." Also Recent, Dall's record.

Pitar lupanaria Lesson, Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 134. "Mazatlan; Guaymas; Acapulco; Corinto; San Juan del Sur."

This species is an analogue of the Antillean *P. dione* Linnaeus¹⁵ and has been regarded as a variety of that species by some authors. It is easily recognizable by the violet spots at the base of the spines. This species was figured by Delessert¹⁶ and the locality given was China, but Römer has pointed out that the species is definitely known only along the Pacific coast of North America.

According to Römer, *Dione exspinata*¹⁷ Reeve is considered as a synonym of *P. lupanaria* and Dall has regarded Reeve's species as only a mutation.

¹⁵ *Venus dione* Linnaeus, Syst. Naturae, Ed. 10., 1758, vol. 1, p. 684. "Habitat in O. Americae."

Cytherea dione Linnaeus, Sowerby, Thes. Conch., vol. 2, 1851, p. 631, pl. 132, fig. 110. "Venezuela and Trinidad."

Dione dione Linné, Römer, Monographie Molluskengattung Venus, Linné, 1868, p. 129, Taf. 34, fig. 1. "Mare Antillarum."

¹⁶ *Cytherea semilamellosa* Gaudichaud, B. Delessert, Recueil Coq. décrites par Lamarck et non encore figurées, 1841, pl. 19, fig. 2. "rapportée des mers de China par M. Gaudichaud."

Cytherea Semi-Lamellosa Lesson, Chenu, Illustr. Conchyl., *Cytherea*, 1843, pl. 9, figs. 9, 9a, 9b, 9c [the date of this plate is 1843 according to Sherborn, see Proc. Malacol. Soc. London, vol. 9, pt. 4, 1911, pp. 264-267].

Dione semilamellosa Gaudichaud, Reeve, Conch. Icon., vol. 14, 1863, *Dione*, pl. 6, figs. 20a, 20b, 20c. "Central America."

¹⁷ *Dione exspinata* Reeve, Conch. Icon., vol. 14, 1863, *Dione*, pl. 6, fig. 24 for fig. 23 [see errata]. "Central America."

MUREX BRASSICA Lamarck

- Murex brassica* Lamarck, Hist. Nat. Anim. s. Vert., vol. 7, 1822, p. 167. "Habite . . ." — Sowerby, Conch. Illustrations, *Murex*, 1834, p. 6, pl. 67, fig. 56. "Mazatlan Pacific." — Gray, Zool. Beechey's Voyage, 1839, p. 108, pl. 33, fig. 1. "Pacific Ocean." — Kiener, Icon. Coq. viv. *Murex*, 1843, p. 68, pls. 26, fig. 1; 27, fig. 1. "Habite la mer Pacifique, les côtes de Mazatlan." — Menke, Zeitschr. für Malakozool., Jahrg. 7, no. 12, 1850, p. 187. "Mazatlan." — Tryon, Manual Conch., vol. 2, 1880, p. 100, pl. 22, fig. 200. "Mazatlan, Gulf of California." — Sowerby, Thes. Conch., vol. 4, 1879, *Murex*, p. 33, pl. 396, fig. 166. "Gulf of California."
- Murex (Polylex) brassica* Lamarck, Mörch, Malakozool, Blätter, Bd. 7, 1861, p. 100. "Realejo."
- Murex ducalis* Broderip, Zool. Journ., vol. 4, 1829, p. 377. "Hab. in Oceano Pacifico." "near Mazatlan." [Synonym of *M. brassica* according to Sowerby, Conch. Illustrations, 1834, p. 6.]
- Murex (Phyllonotus) brassica* Lamarck, Stearns, Proc. U. S. Nat. Mus., vol. 17, 1894, p. 185. "Magdalena Bay." "La Paz." "Mulege Bay."
- Phyllonotus brassica* Lamarck, Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 118. "Mazatlan; San Juan del Sur."

An excellent specimen of this handsome species is present in the Academy's collection from the Oaxaca Pleistocene.

VITULARIA Swainson

- Vitulina* Swainson, Treatise on Malacology, 1840, p. 64. "... and is represented by the *Murex Vitulinus* of authors."
- Vitularia* Swainson, Treatise on Malacology, 1840, p. 297. Sole species "*tuberculata* Sw. En. M. 419, f. 1 (*Murex vitulinus* Auct.)" fig. 65e. — Chenu, Manual Conchyl., vol. 1, 1859, p. 136. Example, *M. vitulinus* Lamarck, fig. 582 (p. 137). — Tryon, Struct. and Syst. Conch., vol. 2, 1883, p. 105. *M. miliaris* Gmelin listed, pl. 43, fig. 9. "W. Coast of Africa."

The type of this genus is *Murex vitulinus* Lamarck by monotypy. According to Kobelt¹⁸ and Tryon,¹⁹ *Murex vitulinus* Lamarck²⁰ is a synonym of *Murex miliaris* Gmelin.²¹

¹⁸ Kobelt, W., Illustrierte Conchylienbuch, Bd. 1, Lief. 1, 1876, p. 36.

¹⁹ Tryon, G. W., Manual Conch., vol. 2, 1880, p. 261.

²⁰ *Murex vitulinus* Lamarck, Anim. s. Vert., vol. 7, 1822, p. 173. "Habite . . . Mon cabinet." Reference given to Knorr, Vergn. 3, t. 29, f. 5. *Mala.* — *Murex purpura scabra* Chemnitz, Syst. Conch.-Cab., vol. 10, pl. 161, figs. 1532, 1533. — *Murex miliaris* Gmelin, p. 3536, no. 39, etc.

²¹ Gmelin, J. F., Linn. Systema Naturae, Ed. 13, 1790, p. 3536.

In *Vitularia miliaris* Gmelin the ribs are more prominent and rounded, the form is shorter and there is not as strong development of lamellae as in *V. salebrosa*. According to Tryon²² the *Murex vitulinus* Lamarck figured by Kiener²³ and the *M. purpura* of Reeve²⁴ can be referred to *Vitularia miliaris* Gmelin.

It is interesting to note that Swainson used both *Vitulina* and *Vitularia* in the original volume where the genus was proposed. Since the name *Vitularia* is so well established in the literature, that spelling is used in the present paper.

Iredale²⁵ has pointed out the resemblance of *Transtrafer longmani* Iredale, type of the genus *Transtrafer*, to *Vitularia vitulinus* Lamarck.

VITULARIA SALEBROSA King

Murex salebrosus King, Zool. Journ., vol. 5, 1831, p. 347. "Habitat? Mus. nost., Geo. Sowerby." — Sowerby, Conch. Illustrations, 1834, *Murex*, p. 8, pl. 65, fig. 48. "Southern Coast of S. America." — Kiener, Icon. Coq. Viv., *Murex*, 1841, p. 121, pl. 47, figs. 1, 1a. "Habite." — Reeve, Conch. Icon., vol. 3, 1845, *Murex*, pl. 24, figs. 98a, 98b. "Panama (found under stones); Cuming." — Menke, Zeitschr. für Malakozool., Jahrg. 7, no. 12, 1850, p. 187. Mazatlan. — C. B. Adams, Ann. Lyceum Nat. Hist. New York., vol. 5, 1852, p. 349. [Numerous localities from Lower California to South America.]

Murex vitulinus var., Gray, Zool. Beechey's Voyage, 1839, p. 108, pl. 33, figs. 4 and 6. [No locality cited.]

Vitularia salebrosa King, Mörch, Malakozool. Blätter, Bd. 7, 1861, p. 99. "Realejo." — Carpenter, Mazatlan Catalog. [1855-] 1857, p. 485. South America; Panama; Mazatlan. — Kobelt, Illustrierte Conchylienbuch, Bd. 1, Lief. 1, 1876, p. 36, Taf. 5, fig. 1. "Provinz von Panama." — Tryon, Manual Conch., vol. 2, 1880, p. 133, pl. 35, figs. 394, 396 and 398. — Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 120. "Mazatlan." "San Juan del Sur and Montijo Bay."

An excellent specimen showing the frilled ornamentation of this species is present in the collection at Stanford University.

²² Tryon, G. W., Manual Conch., vol. 2, 1880, p. 133, pl. 35, figs. 393 and 397. "W. coast of Africa."

²³ Kiener, L. C., Icon. Coq. Viv., *Murex*, 1843, p. 123, pl. 47, fig. 2 [no locality cited].

²⁴ Reeve, L., Conch. Icon., vol. 3, 1845, *Murex*, pl. 25, fig. 102. "West coast of Africa."

²⁵ *Transtrafer longmani* Iredale, new genus and new species, Mem. Queensland Mus., vol. 9, pt. 3, 1929, p. 290. "coral blocks at Michaelmas Bay," Queensland.

POLINICES CRICKMAYI Palmer & Hertlein, New Species

Plate 19, figures 12 and 14

Shell ovate globose, medium thickness, spire very short, whorls flatly convex, smooth or with fine oblique striations; aperture long and ovate; columella nearly straight and with callus at upper part; narrowly arcuately umbilicate. Altitude 18.8 mm.; greatest diameter of body whorl 14.2 mm.

Holotype, No. 5615 (C. A. S. Type Collection) from Loc. 1299 (C. A. S.) Coast of Oaxaca, Mexico; R. H. Palmer, collector; Pleistocene. Also Paratype, No. 5616 (C. A. S. Type Collection from Galapagos Islands?; W. H. Ochsner, collector; Recent).

This species is close to *Polinices gallapagosa* Recluz²⁶ but is distinguished by the longer aperture and lower spire. Furthermore, the figures of *P. gallapagosa* given by Reeve and Sowerby show an angular carina or angulation on the body whorl bordering the umbilicus while on *P. crickmayi* this area is rounded. The callus on *P. crickmayi* is relatively somewhat larger than on the species described by Recluz.

Polinices otis Broderip and Sowerby²⁷ has a broader shell and larger umbilical area as well as a smaller funicle on the callus in comparison to *P. crickmayi*.

Paratype No. 5616 is a Recent shell from the Galapagos Islands?; it was identified as *Polinices fusca* Carpenter at the United States National Museum by Mrs. I. S. Oldroyd.

Polinices fusca was listed by Carpenter²⁸ but was first figured and described by Sowerby and attributed to Carpenter. The illustrations of *P. fusca* given by Sowerby and Tryon apparently represent a species identical with *P. otis* Broderip and

²⁶ *Natica gallapagosa* Recluz, Proc. Zool. Soc. London, 1843, p. 213. "Gallapagos Islands; found in coral sand at Albemarle Island." "H. Cuming." — Sowerby, Thes. Conch., vol. 5, 1883, *Natica*, p. 89, pl. 460, fig. 95. "Albemarle Island, Gallapagos." — Reeve, Conch. Icon., vol. 9, 1856, *Natica*, pl. 19, figs. 86a, 86b. "Albemarle Island, Gallapagos group (in coral sand); Cuming." — Tryon, Manual Conch., vol. 8, 1886, pp. 43, 44, pl. 17, fig. 71.

²⁷ *Natica otis* Broderip and Sowerby, Zool. Jour., vol. 4, 1829, p. 372. "Hab. ad littora Oceani Pacifici." "From Mazatlan." — Gray, Zool. Beechey's Voyage, 1839, p. 136, pl. 34, fig. 13; pl. 37, fig. 3 [no locality cited]. — Tryon, Manual Conch., vol. 8, 1886, pp. 43, 44, pl. 17, fig. 4. "Gallapagos Is. to Cape St. Lucas, L. Cal."

Mamma (Naticina) otis Broderip and Sowerby, Mörch, Malakozoologische Blätter, Bd. 7, 1861, p. 71. Central America.

Polynices (Lunatia) otis Broderip, Stearns, Proc. U. S. Nat. Mus., vol. 16, 1893, p. 402 [in part]. Indefatigable Island, Galapagos Group; on the mainland as far south as Payta, Peru. Recent.

Polinices otis Broderip and Sowerby, Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 126. "Acapulco; Salina Cruz; Corinto; Puntarenas."

²⁸ *Polinices fusca* Carpenter, Rept. Brit. Assoc. Adv. Sci. for 1863 [issued 1864], pp. 523, 624. Galapagos; Gulf district; Acapulco; Panama. Reprint of the same in Smithsonian Misc. Coll. no. 252, 1872, pp. 9, 110.

Natica fusca Carpenter, Sowerby, Thes. Conch., vol. 5, 1883, *Natica*, p. 89, pl. 461, fig. 104. "Mazatlan." — Tryon, Manual Conch., vol. 8, 1886, p. 44, pl. 12, fig. 2.

Sowerby. According to Weinkauff²⁹ there is a *Natica fusca* Blainville.

The new species is named for Dr. Colin H. Crickmay, in recognition of his contributions to the geology and paleontology of Western North America.

POLINICES INTEMERATA Philippi

Plate 19, figure 3

Natica intemerata Philippi, Proc. Zool. Soc. London, 1851, p. 233. "Hab. in sinu Californiae; legit Rever. Steel."
—— Tryon, Manual Conch., vol. 8, 1886, p. 46, pl. 18, fig. 83; pl. 19, fig. 93. "Mazatlan."

Natica alabaster Reeve, Conch. Icon., vol. 9, *Natica*, 1856, pl. 9, figs. 33a, 33b. "Mazatlan."

Polinices uber Valenciennes, var. *intemerata* Philippi, Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 334. "Gulf of Panama, in 182 fathoms, mud, temperature 54°.1 F."
"Also at Mazatlan, Mexico, and living in Panama Bay, in 51 fathoms."

This species is represented in the collection by several specimens whose characters agree with the illustrations of *Polinices intemerata* Philippi. This is a fairly globose form with a thick callus on the inner lip which becomes very thick at the top of the aperture. The umbilicus is moderately small and crescentic in shape.

NATICA CATENATA Philippi

Plate 19, figures 2 and 11

Natica catenata Philippi, Proc. Zool. Soc. London, 1851, p. 233. "Hab. —— ?." —— Reeve, Conch. Icon., vol. 9, 1856, *Natica*, pl. 21, fig. 92a. "Sicily." —— Tryon, Manual Conch., vol. 8, 1886, p. 22, pl. 4, figs. 71, 72, 73. "Panama to Cape St. Lucas, L. Cal."

Natica catenatus Philippi, Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 126. "Tres Marias; Mazatlan; Acapulco; San Juan del Sur."

The type locality of *Natica catenata* was not given at the time of the original description but Carpenter³⁰ and Tryon as well as others have recognized it as a west coast species. Reeve and Sowerby illustrated specimens which they indicated came from Sicily but Tryon pointed out that they had confused *N.*

²⁹ Weinkauff, H. C., Conchylien des Mittelmeeres, Bd. 2, 1868, p. 251.

³⁰ Carpenter, P. P., Rept. Brit. Assoc. Adv. Sci. for 1863 [issued 1864], pp. 538, 624, 669.

catenata with a related Mediterranean species, *Natica marochiensis* Gmelin.³¹

The specimens from the Pleistocene of Oaxaca fit the description and agree with the figures of Philippi's species given by other authors. The specimens are identical with specimens of a Recent species from the west coast of North America referred to *Natica catenata* Philippi in the collections of the California Academy of Sciences.

The original reference to *Natica grayi* Philippi³² has not been available to us but that species was considered by Tryon to be a synonym of *N. catenata*. Our specimens resemble the figure of *Natica depressa* Gray³³ and it is quite likely that Tryon was correct in placing this species in the synonymy of *Natica catenata* Philippi.

Natica unifasciata Lamarck³⁴ has a slightly higher spire, proportionately smaller umbilicus and globose whorls. In the Recent shells *N. unifasciata* is ornamented by a single narrow yellowish white band on the upper part of the whorls, while the rest of the whorl is yellowish brown, chocolate or olivaceous and whitish towards the base.

According to the description, *Natica (Cochlis) scethra* Dall,³⁵ appears to differ from *N. catenata* only in color.

PLATE 19

Fig. 1. *Arca gordita* Lowe; true length of specimen 55 mm.; height 37.5 mm.; plesiotype, left valve, No. 5624 (C. A. S. Type Coll.): Pleistocene.

Fig. 2. *Natica catenata* Philippi; greatest diameter of body whorl 11.5 mm.; plesiotype, No. 5618 (C. A. S. Type Coll.): Pleistocene.

³¹ *Nerita marochiensis* Chemnitz, Neues Syst. Conchylien-Cabinet, Bd. 5, 1781, p. 270, pl. 188, figs. 1905-1910. "Ufern des Africanischen Meeres, und insonderheit an den Stranden des Marockanischen Reiches gefunden"; also "Antillen." — Gmelin, Syst. Nat., Ed. 13, 1790, p. 3673. — Bosc. Hist. Nat. des Coquilles, vol. 3, 1801, p. 290, "Se trouve sur la côte d'Afrique et aux Antilles."

Natica marochiensis Gmelin, Reeve, Conch. Icon., vol. 9, 1856, *Natica*, pl. 13, fig. 52. "North Africa and West Indies." — Sowerby, Thes. Conch., vol. 5, 1881, *Natica*, p. 82, pl. 48, fig. 62. — Tryon, Manual Conch., vol. 8, 1886, p. 22, pl. 5, fig. 74.

³² R. A. Philippi, in Martini und Chemnitz, Conchylien-Cabinet, Bd. 2, Abt. 1, 1852, pl. 11, fig. 13.

³³ Zool. Beechey's Voyage, 1839, p. 136, pl. 36, fig. 2. "Inhab." [no locality cited]. (Not *Natica depressa* J. Sowerby, Mineral Conch., vol. 1, 1812, p. 21, Tab. 5, lower figures. "Woodbridge, Suffolk." (*Ampullaria depressa*? Lamarck, Ann. du Mus., vol. 5, 1804, p. 32; vol. 8, pl. 61, fig. 3).)

³⁴ *Natica unifasciata* Lamarck, Hist. Nat. Anim. s. Vert., vol. 6, 1822, p. 201. "Habite . . ." — Delessert, Recueil de Coq. décrites par Lamarck et non encore figurées, 1841, pl. 32, figs. 13a, 13b. "Habite . . . ?" — Reeve, Conch. Icon., vol. 9, 1856, *Natica*, pl. 12, figs. 49a, 49b. "Bay of Panama (on mud banks at low water); Cuming." — Dall, Proc. U. S. Nat. Mus., vol. 37, 1909, p. 235. "Gulf of California, Panama and (fide Tschudi) Peru." — Pilsbry and Lowe, Proc. Acad. Nat. Sci. Philadelphia, vol. 84, 1932, p. 126. "Puntarenas; La Union; Montijo Bay; Corinto; San Juan del Sur."

³⁵ *Natica (Cochlis) scethra* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, October 1908, p. 333, pl. 11, fig. 5. "U. S. S. 'Albatross', station 3391, Gulf of Panama, in 153 fathoms, mud, bottom temperature 55° .8 F."

Fig. 3. *Polinices intemerata* Philippi; true height of figured specimen 24.8 mm.; plesiotype, No. 5617 (C. A. S. Type Coll.): Pleistocene.

Fig. 4. *Arca gordita* Lowe; same specimen as figure 1, interior view of shell.

Fig. 5. *Amphichaena kindermanni* Philippi; true length of figured specimen 37.2 mm.; plesiotype, right valve, No. 5636 (C. A. S. Type Coll.): Pleistocene.

Fig. 6. *Amphichaena kindermanni* Philippi; true length of figured specimen 35.8 mm.; plesiotype, left valve, No. 5637 (C. A. S. Type Coll.): Pleistocene.

Fig. 7. *Amphichaena kindermanni* Philippi; true length of figured specimen 38.3 mm.; plesiotype, left valve, No. 5638 (C. A. S. Type Coll.): Pleistocene.

Fig. 8. *Amphichaena kindermanni* Philippi; true length of figured specimen 43.5 mm.; plesiotype, right valve, No. 5639 (C. A. S. Type Coll.): Pleistocene.

Fig. 9. *Amphichaena kindermanni* Philippi; true length of figured specimen 32.4 mm.; plesiotype, left valve, No. 6955 (C. A. S. Type Coll.); from Loc. 27230 (C. A. S.), Petatlan Bay, about nine kilometers south of Zihuatanejo, Guerrero, Mexico: Recent.

Fig. 10. *Amphichaena kindermanni* Philippi; true length of figured specimen 32.4 mm.; plesiotype, right valve, No. 6954 (C. A. S. Type Coll.); from the same locality as specimen shown in figure 9.

Fig. 11. *Natica catenata* Philippi; true height of figured specimen 14.5 mm.; plesiotype, No. 5619 (C. A. S. Type Coll.): Pleistocene.

Fig. 12. *Polinices crickmayi* Palmer & Hertlein, new species; true height of figured specimen 18.8 mm.; holotype, No. 5615 (C. A. S. Type Coll.): Pleistocene.

Fig. 13. *Mazatlanian fulgurata* Philippi; true length of figured specimen 10.8 mm.; plesiotype No. 6956 (C. A. S. Type Coll.); from Loc. 27223 (C. A. S.), Mazatlan, Sinaloa, Mexico: Recent. This species also occurs fossil in the Pleistocene of Oaxaca.

Fig. 14. *Polinices crickmayi* Palmer & Hertlein, new species; true height of figured specimen 27 mm.; paratype, No. 5616 (C. A. S. Type Coll.), from Galapagos Islands?; W. H. Ochsner, collector: Recent.

All the specimens illustrated on this plate except figures 9, 10, 13 and 14 are from Loc. 1299 (C. A. S.), Pacific Coast of Oaxaca, Mexico, about 16 kilometers west of the mouth of the Rio Colotepec, from elevated beaches from five to sixteen meters above sea level; R. H. Palmer, collector: Pleistocene.

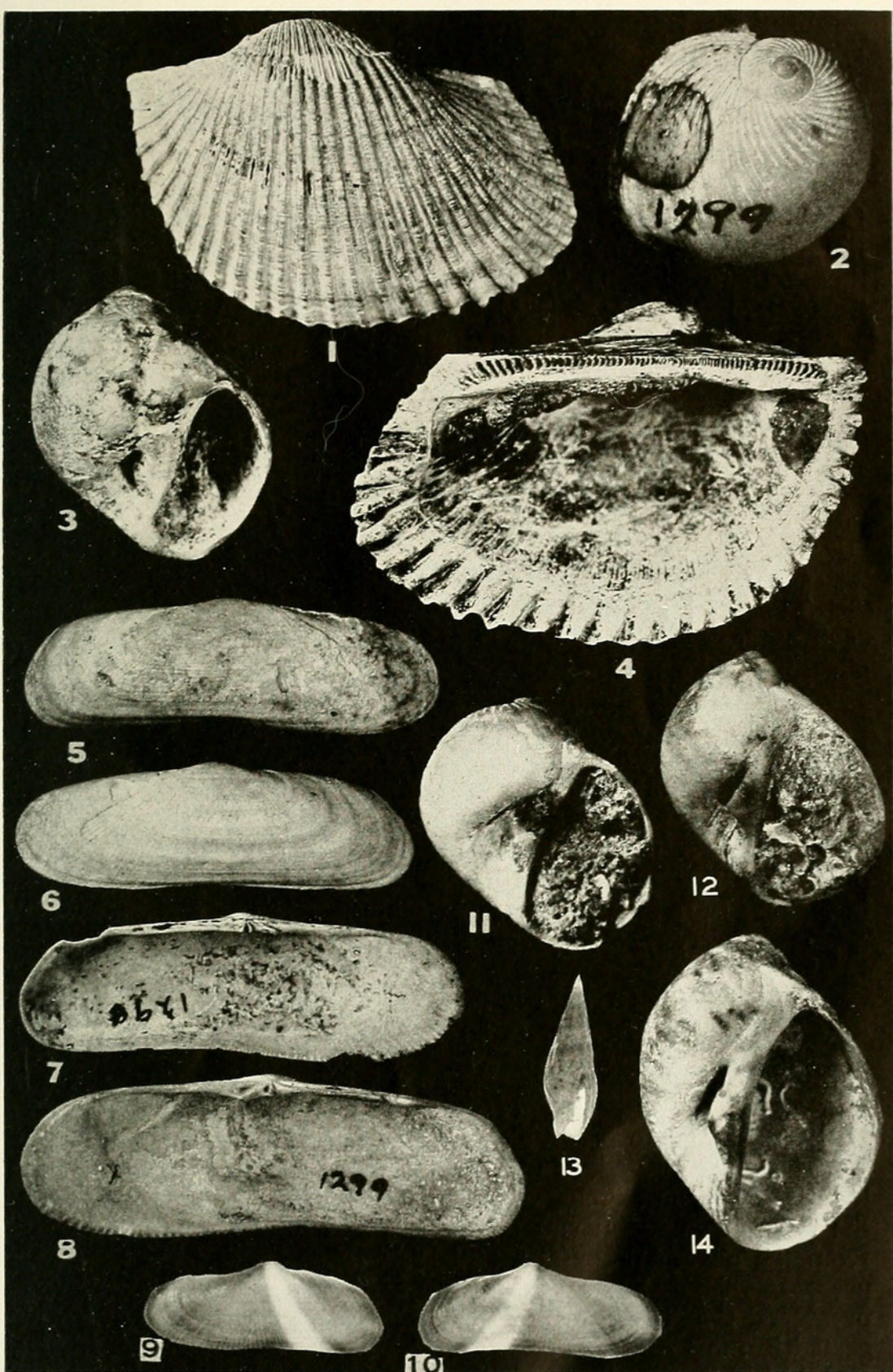


PLATE 19



1930. "Marine Pleistocene mollusks from Oaxaco, Mexico." *Bulletin of the Southern California Academy of Sciences* 35, 65–81.

View This Item Online: <https://www.biodiversitylibrary.org/item/106539>

Permalink: <https://www.biodiversitylibrary.org/partpdf/42147>

Holding Institution

New York Botanical Garden, LuEsther T. Mertz Library

Sponsored by

The LuEsther T Mertz Library, the New York Botanical Garden

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.