BULLETINS

OF

AMERICAN

PALEONTOLOGY

★

VOL. XLV

★

NUMBER 204

LATE CENOZOIC PELECYPODS FROM NORTHERN VENEZUELA

BY

NORMAN E. WEISBORD

1964

PALEONTOLOGICAL RESEARCH INSTITUTION
ITHACA, NEW YORK
U. S. A.

PALEONTOLOGICAL RESEARCH INSTITUTION

1963-1964

BULLETINS OF AMERICAN PALEONTOLOGY

and

PALAEONTOGRAPHICA AMERICANA

Complete titles and price list of separate available numbers may be had on application. All volumes will be available except vol. I of Palaeontographica Americana.

For reprint, Vols. 1-6, 8-16, Bulletins of American Paleontology see Kraus Reprint Corp., 16 East 46th St., New York 17, N.Y., U.S.A.

Subscription may be entered at any time by volume or year, with average price of $16.00 per volume for Bulletins. Numbers of Palaeontographica Americana invoiced per issue. Purchases in U.S.A. for professional purposes are deductible from income tax.

For sale by

Paleontological Research Institution
109 Dearborn Place
Ithaca, New York
U.S.A.

BULLETINS

OF

AMERICAN PALEONTOLOGY

(Founded 1895)

Vol. 45

No. 204

LATE CENOZOIC PELECYPODS FROM NORTHERN VENEZUELA

By

Norman E. Weisbord
Department of Geology
The Florida State University

February 18, 1964

Paleontological Research Institution
Ithaca, New York, U.S.A.

Library of Congress Catalog Number: GS63-300

Printed in the United States of America

CONTENTS

LATE CENOZOIC PELECYPODS FROM NORTHERN VENEZUELA

Norman E. Weisbord
Department of Geology
The Florida State University

ABSTRACT

One hundred and seventy-two species of pelecypods are described, compared, and illustrated. Of this total, 29 forms are Recent, 22 are Recent and fossil, and 121 are fossil. One of the Recent shells—*Donax higuerotensis* Weisbord—and 63 of the 121 fossil shells are believed to be new. The Recent pelecypods were collected on the beach at Playa Grande in the Distrito Federal, and at Higuerote, in the State of Miranda. The fossils were collected from the Guaiguaza clay at La Salina de Guaiguaza in the State of Carabobo, and from the Cabo Blanco group, in the Distrito Federal. The fossiliferous units of the Cabo Blanco group are, from younger to older, the Abisinia formation, the Mare formation, and the Playa Grande formation. Combining the pelecypods with the gastropods described in a previous work (Weisbord, 1962), and utilizing the Lyellian principle of chronological classification together with stratigraphic control (Weisbord, 1957), the Abisinia formation is assigned a Pleistocene age, the Guaiguaza clay a late Pliocene age, and the Mare and Playa Grande formations an early Pliocene age. The observation is made that although the pelecypod species are less numerous than the gastropod species, a significantly greater percentage of the pelecypods have survived to Recent time. Concerning the problem of correlation, it is postulated that the Playa Grande and Mare formations of the Cabo Blanco group are directly contemporaneous with the Cumaná beds of eastern Venezuela and roughly equivalent to the Caloosahatchee deposits of Florida; that the Playa Grande formation may be the time counterpart of the Punta Gavilan formation in the State of Falcon, Venezuela; and that the Guaiguaza clay was laid down at some time during the interval of deposition of the Matura formation of Trinidad and the Moín formation of Costa Rica.

INTRODUCTION

This is the second of a series of monographs dealing with late Cenozoic and Recent invertebrates collected by the writer between 1955 and 1957 in northern Venezuela. The first monograph (Weisbord, 1962) was concerned with the Gastropoda; the present one deals with the Pelecypoda;[1] and a third, now in progress will be devoted to the Scaphopoda. The material described in these works was obtained from three locations in Venezuela: La Salina de Guaiguaza, approximately 6 kilometers west of Puerto Cabello, in the State of Carabobo; the Cabo Blanco area, about 17 kilometers northwest of Caracas, in the Distrito Federal; and Higuerote, some 88 kilometers east of Caracas, in the State of Miranda. The fossil shells were collected from La Salina de Guaiguaza and from the Cabo Blanco area, the Recent ones from the Cabo Blanco area

[1]The support given for this work by the National Science Foundation through its Research Grant NSF-8699, awarded 15 November 1959, is gratefully acknowledged.

(on the beach at the Playa Grande Yachting Club), and at Higuerote. In the 1962 paper, 288 species of gastropods were described, compared, and illustrated, and in the present one 172 species of pelecypods, both fossil and Recent, from one or the other of the localities mentioned above, are so treated. Most of the fossil pelecypods were obtained in the Cabo Blanco area, and each species from that area is given its stratigraphic position as determined from field observations by the writer and presented in his paper (Weisbord, 1957) titled "Notes on the Geology of the Cabo Blanco Area, Venezuela."

The systematic study of the pelecypods was started in July of 1960, and the manuscript submitted to the Paleontological Research Institution in May of 1962. The format of the present work is patterned after the gastropod paper, and again, as in that, the references to a species under synonymy rests on the authority of the one who has identified the species. For comparative studies of the Pelecypoda, the writer spent a total of ten weeks examining collections and consulting literature in the U. S. National Museum, Washington, D. C., the Academy of Natural Sciences of Philadelphia, the Museum of Comparative Zoology of Harvard College, and the Paleontological Research Institution in Ithaca, New York. Many of the references under the heading of Bibliography were consulted in the libraries of the above-mentioned museums. The bibliography in the present monograph contains a number of references given in my gastropod monograph, but most of the items are additional ones. For all of the titles listed thus far, the Bibliography of both monographs should be consulted.

The pelecypods described in this work are deposited with the Paleontological Research Institution, Ithaca, New York, United States.

ACKNOWLEDGMENTS

I wish to express again to my colleagues[2] in the Department of Geology at Florida State University my appreciation for their constant encouragement and support of my research efforts. I thank Katherine V. W. Palmer, editor of the Bulletins of American Paleontology, for coping with the problems involved in bringing this

[2]B. Frank Buie, chairman, George W. DeVore, H. Grant Goodell, Donn S. Gorsline, John Kenneth Osmond, William F. Tanner, Lyman D. Toulmin, and Stephen S. Winters.

monograph to publication, and for her help and advice during its preparation. For allowing me untrammeled access to the expertly curated collections and to the literature contained in the museums with which they are affiliated, and for their unstinted co-operation, I am indebted to William J. Clench of the Museum of Comparative Zoology; to G. Arthur Cooper, Harald A. Rehder, and Wendell P. Woodring of the U.S. National Museum; to R. Tucker Abbott and Horace G. Richards of the Academy of Natural Sciences of Philadelphia; and to Katherine V. W. Palmer, director of the Palaeontological Research Institution. I was fortunate in being able to examine the fine collection of Florida fossils in the Florida Geological Survey through the courtesy of its director, Robert O. Vernon. It is a pleasure to acknowledge the assistance given me by the staff of the Robert Manning Strozier Library at Florida State University in arranging for the acquisition or loan of certain rare publications essential to the pursuit of my studies. I thank J. Wyatt Durham of the University of California for lending me the types of *Pecten (Euvola) ziczac caboblancoensis* described in a thesis written under his direction by Daniel Druckerman. Frances de Rivero, professor of Paleontology at the Universidad Central de Venezuela, was good enough to discuss with me, prior to publication in the Léxico Estratigráfico de Venezuela, the nomenclature of the formations comprising the Cabo Blanco group. I am grateful to the late Prof. Royo y Gómez, also on the faculty of the Universidad Central de Venezuela, for the opportunity I had to accompany him on a field trip to the Cabo Blanco area on 19 February 1955. Many of the fossils described in this work were subsequently collected from localities pointed out by him on that occasion. The photographs of the pelecypods were taken and processed by Hal F. Riehle and Werner Vagt of Florida State University, and the drawings were made by Andrew R. Janson of the Florida Geological Survey and by Phyllis Garman of Florida State University.

LOCALITIES

The localities from which the pelecypods were obtained, and the formations in which they occur are listed below. The letter preceding the locality description is the same as that prefixing the

number given to each species in the explanation of plates. All of the localities, except La Salina de Guaiguaza in the State of Carabobo, are shown on the geologic map accompanying the writer's paper (Weisbord, 1957) on the geology of the Cabo Blanco area. On the 1957 map field stations are marked by the letter "W", and some of the localities listed below refer to these stations.

A. Beach, at Playa Grande Yachting Club, Distrito Federal. Recent.

B. Beach, southeast of Higuerote, State of Miranda. Recent.

C. Near south shore of La Salina de Guaiguaza, 5.6 kilometers west of Puerto Cabello, State of Carabobo. The fossils were collected from a drainage ditch about one meter in depth.

D. Eastern edge of Playa Grande village at W-30. Abisinia formation.

E. Approximately 115 meters south-southwest of the crossing of Quebrada Mare Abajo and coast road, and 90 meters southwest of W-12. Upper Mare formation.

F. Hillside above west bank of Quebrada Mare Abajo at W-14. Upper Mare formation.

G. Hillside above west bank of Quebrada Mare Abajo near W-14. Mare formation.

H. 15 meters south of axis of Punta Gorda anticline at W-25. Mare formation.

I. Hillside above west bank of Quebrada Mare Abajo at W-13. Lower Mare formation.

J. Small stream 100 meters west of Quebrada Mare Abajo and 125 meters west-southwest of the intersection of Quebrada Mare Abajo and the coast road. Lower Mare formation.

K. Bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road, and about 95 meters due south of the shoreline. Playa Grande formation (Catia member).

L. South side of Playa Grande road about 200 meters west of W-15. Playa Grande formation (Catia member).

M. South side of Playa Grande road 40 meters southwest of its intersection with the Playa Grande Yachting Club road. Playa Grande formation (Catia member).

N. Near W-21 and to the south of that station in stream flowing along the strike of the north flank of the Litoral anticline. Playa Grande formation (Catia member).

O. Dip slope 100 meters west of Costa fault and 130 meters south of shoreline at W-22. Playa Grande formation (Catia member).

P. North bank of Quebrada Las Pailas 35 meters south of Mare Abajo fault and 150 meters southwest of the intersection of the Mare Abajo fault and Maiquetía anticline. Playa Grande formation (Maiquetía member).

Q. Quebrada Las Pailas at, and in the vicinity of W-4. Playa Grande formation (Maiquetía member).

R. Quebrada Las Bruscas at W-26 approximately 125 meters upstream from junction with Quebrada Las Pailas. Playa Grande formation (Maiquetía member).

S. Near *Lithothamnium* reef at W-23, north flank of Punta Gorda anticline. Playa Grande formation (Maiquetía member).

T. Stream 250 meters south-southwest of the mouth of Quebrada Las Pailas and 255 meters east-northeast of wireless station. Upper Mare formation.

U. South side of coast road at east end of the village of Catia La Mar. Playa Grande formation (Catia member).

V. Scarp at W-18 about 200 meters south of the intersection of the Costa fault with the shoreline. Playa Grande formation (Catia member).

X. In Quebrada Las Pailas at W-3, south side of Mare Abajo fault near its intersection with the Bruscas fault. Playa Grande formation (Maiquetía member).

PELECYPODS FROM NORTHERN VENEZUELA

Following is a list of the pelecypods from northern Venezuela collected by the writer. Under the heading of "Formation" the abbreviations used are these:

Re=Recent

Sal=La Salina de Guaiguaza

Ab=Abisinia formation

Ma=Mare formation
PGm=Playa Grande formation (Maiquetía member)
PGc=Playa Grande formation (Catia member)

Species	*Formation*	*Geologic range of known species*
Nucula (Nucula) venezuelana Weisbord, n. sp.	PGm; Ma	
Nucula (Ennucula) mareana Weisbord, n. sp.	Ma	
Nuculana (Saccella) karlmartini Weisbord, n. sp.	PGm; Ma	
Nuculana (Saccella) axelolssoni Weisbord, n. sp.	PGm; Ma	
Nuculana (Saccella) marella Weisbord, n. sp.	Ma	
Nuculana (Saccella) species	PGc	
Nuculana (Jupiteria ?) species	PGc	
Adrana cf. tellinoides (Sowerby)	Ma	Recent
Arca (Arca) zebra Swainson	Re	Middle Miocene—Recent
Arca (Arca) zebra abisiniana Weisbord, n. subsp.	Ab	
Arca (Arca) imbricata Bruguière	Re; Ab; Sal	Lower Miocene—Recent
Barbatia (Barbatia) candida (Helbling)	Re; Ab	Lower Miocene—Recent
Barbatia (Acar) domingensis (Lamarck)	Re; Ab	Lower Miocene—Recent
Barbatia (Fugleria) tenera (C. B. Adams)	Re	Recent
Arcopsis adamsi "Shuttleworth" (E. A. Smith)	Re; Sal	Lower Miocene—Recent
Anadara (Larkinia) notabilis (Röding)	Re; PGm	Middle Miocene—Recent
Anadara (Larkinia) species	PGc	
Anadara (Lunarca) ovalis (Bruguière)	Re; Ma	Upper ? Miocene—Recent
Anadara (Lunarca ?) caboblanquensis Weisbord, n. sp.	PGm; Ma	
Anadara (Lunarca ?) mareana Weisbord, n. sp.	Ma	
Anadara (Cunearca) brasiliana (Lamarck)	Re	Upper Miocene—Recent
Anadara (Cunearca) chemnitzi (Philippi)	Re	Pleistocene—Recent
Anadara (Cunearca) cumanensis (Dall)	PGm; Ma	Mid. ? Miocene—Pliocene
Anadara (Cunearca) species indeterminate	PGc	Middle Miocene, Pliocene
Glycymeris (Glycymeris) undata (Linnaeus)	PGm; Ma	Miocene—Recent
Glycymeris (Tucetona) pectinata (Gmelin)	Ma	Middle Miocene—Recent
Glycymeris (Glycymerella) decussata (Linnaeus)	Re; Ma; PGm	Middle Miocene—Recent

Brachidontes (Ischadium) recurvus (Rafinesque)	Re	Upper Miocene—Recent
Modiolus americanus Leach	Re	Recent
Musculus lateralis (Say)	Ma	Pliocene—Recent
Crenella divaricata (d'Orbigny)	PGm; Ma	Upper Miocene—Recent
Lioberus ? marensis Weisbord, n. sp.	Ma	
Isognomon alatus (Gmelin)	Re	Pleistocene—Recent
Pinna aff. carnea Gmelin	Ma; Ab	Pliocene ?—Recent
Atrina (Servatrina) seminuda (Lamarck)	Re	Miocene ?, Recent
Atrina (Servatrina ?) aff. seminuda (Lamarck)	PGc	Miocene ?, Recent
Atrina (Servatrina) serrata ? (Sowerby)	PGc	Lower Pliocene—Recent
Plicatula gibbosa Lamarck	PGm; Ma	Pliocene—Recent
Plicatula venezuelana Weisbord, n. sp.	PGm	
Plicatula caribbeana Weisbord, n. sp.	Ma	
Pecten (Pecten) catianus Weisbord, n. sp.	PGc	
Pecten(Pecten) caribeus Weisbord, n. sp.	Ma	
Pecten (Pecten) maiquetiensis Weisbord, n. sp.	Ma	
Pecten (Pecten) species	PGc	
Pecten (Pecten ?) remulus Weisbord, n. sp.	PGm	
Pecten (Euvola) ziczac caboblancoensis Druckerman	PGc; PGm; Ma	Pliocene
Pecten (Amusium) papyraceus (Gabb)	PGc	Oligocene ?—Recent
Pecten (Amusium) marensis Weisbord, n. sp.	Ma	
Chlamys (Chlamys) ornata (Lamarck)	Re	Pleistocene—Recent
Chlamys (Chlamys) benedicti Verrill and Bush	PGc	Recent
Aequipecten muscosus (Wood)	PGc	Pliocene—Recent
Chlamys (Leptopecten) desultoria Weisbord, n. sp.	Ma	
Chlamys (Argopecten) gibbus antecessor Weisbord, n. subsp.	PGc; PGm; Ma	
Chlamys (Argopecten) imitata Weisbord, n. sp.	PGc	
Lyropecten (Nodipecten) nodosus ? (Linnaeus)	PGc	Lower Miocene ?—Recent
Lyropecten (Nodipecten) arnoldi Aguerrevere	PGc	Pliocene
Lyropecten (Nodipecten) species "a"	Ma	
Lyropecten (Nodipecten) species "b"	PGc	
Spondylus americanus Hermann	PGc; PGm	Pliocene—Recent
Lima (Limaria) pellucida C. B. Adams	Re	Recent
Anomia mareana Weisbord, n. sp.	Ma	
Anomia catiana Weisbord, n. sp.	PGc	

Pododesmus rudis (Broderip)	Ma	Pliocene—Recent
Ostrea (Ostrea) libella Weisbord, n. sp.	Sal	
Ostrea (Ostrea) pannucea Weisbord, n. sp.	PGm	
Ostrea (Ostrea) lixula Weisbord, n. sp.	PGc; Ma	
Ostrea (Ostrea) caraboboensis Weisbord, n. sp.	Sal	
Ostrea (Crassostrea) virginica Gmelin	Re	Oligocene—Recent
Ostrea (Crassostrea) species	Re	
Ostrea (Crassostrea) rhizophorae Guilding	Re	Pleistocene—Recent
Ostrea (Alectryonia) vespertina venezuelana Weisbord, n. subsp.	PGc; PGm; Ma	
Ostrea (Alectryonia ?) caboblanquensis Weisbord, n. sp.	PGc; PGm; Ma	
Ostrea (Agerostrea ?) antecursor Weisbord, n. sp.	PGm	
Eucrassatella (Hybolophus) antillarum (Reeve)	Ma	Pliocene—Recent
Crassinella aduncata Weisbord, n. sp.	Ma	
Crassinella triquetra Weisbord, n. sp.	Ma	
Cardita (Carditamera) gracilis Shuttleworth	Re; Ab; Ma	Recent
Venericardia (Glyptoactis) wendellwoodringi Weisbord, n. sp.	PGm; Ma	
Mytilopsis leucophaeatus ? Conrad	Re	Pleistocene—Recent
Diplodonta (Diplodonta) mareana Weisbord, n. sp.	Ma	
Diplodonta (Diplodonta) semiaspera Philippi	Re	Pliocene—Recent
Lucina (Cavilinga) trisulcata blanda (Dall and Simpson)	Ma	Recent
Lucina (Callucina ?) species	PGm	
Lucina (Bellucina) katherinepalmerae Weisbord, n. sp.	Ma	
Lucina (Parvilucina) ephraimi Weisbord, n. sp.	PGm; Ma	
Lucina (Parvilucina) multilineata Tuomey and Holmes	PGm	Upper Miocene—Recent
Lucina (Lucinisca) muricata (Spengler)	Sal	
Codakia (Lentillaria) orbicularis (Linnaeus)	Ab; PGm	Middle Miocene—Recent
Codakia (Jagonia) orbiculata (Montagu)	Re	Pliocene ?—Recent
Codakia (Jagonia) pectinata (C. B. Adams)	Re	Recent
Codakia (Jagonia) umbonicostata Weisbord, n. sp.	Ma	
Divaricella ? species	PGc	
Bornia tacaguana Weisbord, n. sp.	Ma	
Chama congregata Conrad	Re; Ab; Ma; PGm	Middle Miocene—Recent

Chama macerophylla Gmelin	Re; Ab; PGm	Middle Miocene—Recent
Chama florida Lamarck	Re	Pleistocene—Recent
Chama sinuosa bermudensis Heilprin	Sal; Ab	Recent
Pseudochama radians (Lamarck)	Re; Ab	Recent
Pseudochama ? species	Ab	
Echinochama species "a"	Ma	
Echinochama species "b"	Ma	
Trachycardium (Dallocardia) muricatum (Linnaeus)	Re; Sal; Ma; PGm	Pliocene—Recent
Trachycardium (Trachycardium) cf. isocardia (Linnaeus)	PGm; Ma	Pliocene—Recent
Trigoniocardia (Trigoniocardia) caboblanquensis Weisbord, n. sp.	PGm; Ma	
Trigoniocardia (Americardia) media (Linnaeus)	Re; PGm	Middle Miocene—Recent
Laevicardium ? species	Ma	
Papyridea aff. soleniformis (Bruguière)	Ma	Pliocene—Recent
Dosinia (Dosinidia) concentrica prosapia Weisbord, n. subsp.	Ma; PGm; PGc	
Anomalocardia brasiliana (Gmelin)	Sal	Upper Miocene—Recent
Anomalocardia venezuelana Weisbord, n. sp.	Sal	
Tivela (Tivela) mactroides (Born)	Re; Ab	Pleistocene—Recent
Tivela (Planitivela) venezuelana Weisbord, n. sp.	Ma	
Gouldia venezuelana Weisbord, n. sp.	PGm; Ma	
Gouldia ? diffidentia Weisbord, n. sp.	Ma	
Transennella caboblanquensis Weisbord, n. sp.	PGm; Ma	
Transennella venezuelana Weisbord, n. sp.	PGm	
Macrocallista maculata (Linnaeus)	Sal; Ma; PGm PGc	Lower Miocene—Recent
Pitar (Pitar) albida (Gmelin)	Sal	Pliocene—Recent
Pitar (Pitar) maiquetiensis Weisbord, n. sp.	Ma	
Pitar (Pitar ?) antillensis Weisbord, n. sp.	Ma	
Pitar (Nanopitar ?) marensis Weisbord, n. sp.	Ma	
Pitar (Pitarella ?) scutellaris Weisbord, n. sp.	Ma	
Pitar (Hysteroconcha) dione (Linnaeus)	Re; Ab; Ma	Pliocene—Recent
Periglypta aff. listeri (Gray)	Ma	Pleistocene—Recent
Antigona (Ventricolaria) aff. rigida Dillwyn	PGm	Pliocene—Recent
Antigona (Ventricolaria) rugatina (Heilprin)	Re	Pliocene—Recent
Chione (Chione) cancellata (Linnaeus)	Re; Sal; Ma; PGm	Miocene—Recent
Chione (Chione) pailasana Weisbord, n. sp.	PGm	

Chione (Chione ?) mamoensis Weisbord, n. sp.	PGm; Ab	
Chione (Chione ?) laciniosa Weisbord, n. sp.	Ma	
Chione (Timoclea) tacaguana Weisbord, n. sp.	PGm	
Chione (Chionopsis) subrostrata (Lamarck)	Re	Recent
Chione (Lirophora) riomaturensis Maury	Ma	Pliocene
Chione (Lirophora) cultellata Weisbord, n. sp.	Ma	
Petricola (Naranio) lapicida (Gmelin)	PGm	Pliocene—Recent
Petricola (Rupellaria) typica (Jonas)	Re; Ab	Pliocene—Recent
Pleiorytis venezuelensis Weisbord, n. sp.	Ma	
Tellina (Tellina ?) sp. indet.	PGm	
Tellina (Eurytellina) punicea Born	Ma; PGm	Pliocene ?, Recent
Tellina (Eurytellina) nitens C. B. Adams	Ma; PGm	Recent
Tellina (Eurytellina) alternata ? Say	PGm	Upper Miocene—Recent
Tellina (Merisca) cristallina Spengler	Ma	Mid. Miocene ?—Recent
Strigilla pisiformis (Linnaeus)	Re; Ab	Lower Miocene—Recent
Strigilla carnaria (Linnaeus)	Re; Ab; PGm	Pleistocene—Recent
Macoma (Psammacoma) hybrida Weisbord, n. sp.	Ma	
Semele purpurascens (Gmelin)	Re	Upper Miocene—Recent
Semele proficua (Pulteney)	Re; Ma	Pliocene—Recent
Semelina nuculoides (Conrad)	PGm	Upper Miocene—Recent
Donax denticulatus Linnaeus	Re	Pleistocene—Recent
Donax striatus Linnaeus	Re	Pliocene—Recent
Donax higuerotensis Weisbord, n. sp.	Re	Recent
Donax vagus Weisbord, n. sp.	Ma	
Donax marensis Weisbord, n. sp.	Ma	
Sanguinolaria (Psammotella) operculata (Gmelin)	Re	Recent
Tagelus plebeius (Solander)	Re	Upper Miocene—Recent
Solen (Solena) obliquus Spengler	Re	Miocene—Recent
Solen species	Ma	
Solecurtus cumingianus (Dunker)	Ma; PGm	Pliocene—Recent
Mactra (Mactrellona ?) iheringi (Dall)	Re	Recent
Mulinia cleryana (d'Orbigny)	Re	Recent
Labiosa (Raeta) aff. plicatella (Lamarck)	PGm	Upper Miocene—Recent
Ervilia nitens venezuelana Weisbord, n. subsp.	Ma; PGm	
Ervilia antilleana Weisbord, n. sp.	Ma; PGm	
Ervilia caribbeana Weisbord, n. sp.	PGm	
Ervilia mareana Weisbord, n. sp.	Ma	
Corbula (Juliacorbula) aequivalvis Philippi	Sal	Pliocene—Recent

Corbula (Caryocorbula) cf. lavalleana d'Orbigny	Sal; Ma	Pliocene—Recent
Corbula (Notocorbula) bruscasensis Weisbord, n. sp.	PGm	
Corbula (Notocorbula) puntagordensis Weisbord, n. sp.	Ma	
Martesia striata (Linnaeus)	Re	Pliocene—Recent
Periploma margaritacea (Lamarck)	Re; Ma	Recent
Cyathodonta cf. tristani Olsson	PGm; PGc	Middle—upper Miocene
Pholadomya cf. candida Sowerby	PGc	Pleistocene—Recent

RECENT PELECYPODS FROM PLAYA GRANDE AND HIGUEROTE

Dead shells of Recent bivalves were collected on the beach west of the breakwater at Playa Grande in the Distrito Federal (Fig. 2), and on the beach southeast of the town of Higuerote in the State of Miranda. The air-line distance between the beaches is 102 kilometers. At neither locality are the shells especially abundant. The beach southeast of Higuerote is sandy, and shelves gently seaward, whereas much of the shore at Playa Grande is floored with Quaternary beachrock. The beachrock extends seaward as well as landward, and the littoral marine mollusks are mostly gastropods. Conversely, the sandy bottom at Higuerote is more favorable for pelecypods and these outnumber the species of gastropods. At both localities the intertidal zone is narrow, and the difference in tide level is small. The surface salinity of the seawater is of the order of 36.5 parts per thousand during July-September, and the average monthly air temperature, as recorded by the U.S. Weather Bureau from shipboard observations, varies from 87.5°F. in February to 82.8°F. in September. According to Donn S. Gorsline[3] of the Oceanographic Institute at Florida State University, the air temperature compares closely with the surface temperature of the ocean in this general area. At a depth of 200 meters the temperature is about 59°F., and this is fairly constant. The main thermal variation in seawater is confined to the uppermost 50 to 60 meters.

Below is a list of the pelecypods collected at Playa Grande and Higuerote.

Species	*Playa Grande*	*Higuerote*
Arca (Arca) zebra Swainson	X	
Arca (Arca) imbricata Bruguière	X	

[3]Written communication dated 9 May 1958.

Barbatia (Barbatia) candida (Helbling)	X	
Barbatia (Acar) domingensis (Lamarck)	X	
Barbatia (Fugleria) tenera (C. B. Adams)	X	
Arcopsis adamsi "Shuttleworth" (E. A. Smith)	X	
Anadara (Larkinia) notabilis (Röding)	X	
Anadara (Lunarca) ovalis (Bruguière)	X	
Anadara (Cunearca) brasiliana (Lamarck)	X	X
Anadara (Cunearca) chemnitzi (Philippi)	X	
Glycymeris (Glycymerella) decussata (Linnaeus)	X	
Brachidontes (Ischadium) recurvus (Rafinesque)	X	
Modiolus americanus Leach	X	
Isognomom alatus (Gmelin)		X
Atrina (Servatrina) seminuda (Lamarck)		X
Chlamys (Chlamys) ornata (Lamarck)	X	
Lima (Limaria) pellucida C. B. Adams	X	
Ostrea (Crassostrea) virginica Gmelin		X
Ostrea (Crassostrea) species		X
Ostrea (Crassostrea) rhizophorae Guilding		X
Cardita (Carditamera) gracilis Shuttleworth	X	
Mytilopsis leucophaeatus ? Conrad		X
Diplodonta (Diplodonta) semiaspera Philippi	X	
Codakia (Jagonia) orbiculata (Montagu)	X	
Codakia (Jagonia) pectinata (C. B. Adams)	X	
Chama congregata Conrad	X	
Chama macerophylla Gmelin	X	X
Chama florida Lamarck	X	
Pseudochama radians (Lamarck)	X	
Trachycardium (Dallocardia) muricatum (Linnaeus)	X	X
Trigoniocardia (Americardia) media (Linnaeus)	X	
Tivela (Tivela) mactroides (Born)		X
Pitar (Hysteroconcha) dione (Linnaeus)		X
Antigona (Ventricolaria) rugatina (Heilprin)	X	
Chione (Chione) cancellata (Linnaeus)	X	X
Chione (Chionopsis) subrostrata (Lamarck)		X
Petricola (Rupellaria) typica (Jonas)	X	
Strigilla pisiformis (Linnaeus)		X
Strigilla carnaria (Linnaeus)	X	X
Semele purpurascens (Gmelin)	X	
Semele proficua (Pulteney)	X	
Donax denticulatus Linnaeus		X
Donax striatus Linnaeus		X
Donax higuerotensis Weisbord, n. sp.		X
Sanguinolaria (Psammotella) operculata (Gmelin)		X
Tagelus plebeius (Solander)		X
Solen (Solena) obliquus Spengler		X
Mactra (Mactrellona ?) iheringi (Dall)		X
Mulinia cleryana (d'Orbigny)		X
Martesia striata (Linnaeus)		X
Periploma margaritacea (Lamarck)	X	

PELECYPODS FROM LA SALINA DE GUAIGUAZA

For the little geologic information available on the area around the salt pond known as La Salina de Guaiguaza the reader is referred

to my 1962 paper. All of the fossils at La Salina were collected from gray and brown clays at a depth of about one meter below the surface, in a drainage ditch near the south end of the pond. The pelecypods obtained there are the following:

Species	*Geologic range or known species*	*Geologic range of nearest related species*
Arca (Arca) imbricata Bruguière	Low. Miocene—Recent	
Arcopsis adamsi "Shuttleworth" (E. A. Smith)	Low. Miocene—Recent	
Ostrea (Ostrea) libella Weisbord, n. sp.		Pleistocene—Recent
Ostrea (Ostrea) caraboboensis Weisbord, n. sp.		Lower Miocene
Lucina (Lucinisca) muricata (Spengler)	Pliocene—Recent	
Chama sinuosa bermudensis Heilprin	Recent	
Trachycardium (Dallocardia) muricatum (Linnaeus)	Pliocene—Recent	
Anomalocardia brasiliana (Gmelin)	Up. Miocene—Recent	
Anomalocardia venezuelana Weisbord, n. sp.		Up. Miocene—Recent
Macrocallista maculata (Linnaeus)	Low. Miocene—Recent	
Pitar (Pitar) albida (Gmelin)	Pliocene—Recent	
Chione (Chione) cancellata (Linnaeus)	Miocene—Recent	
Corbula (Juliacorbula) quivalvis Philippi	Mid-Miocene-Recent	
Corbula (Caryocorbula) cf. lavalleana d'Orbigny	Pliocene—Recent	

Fourteen species of pelecypods were collected, and 11 of them, or 78 per cent are living today. Of the gastropods obtained from the same clays (Weisbord, 1962), 9, or 36 per cent are living to-day, and it is anticipated that some of the new species of gastropods will eventually be found in the Recent fauna. Combining the gastropods and pelecypods, 51 per cent of the 39 species collected at La Salina are known to be still extant. Applying Lyell's principle for the subdivision of the Cenozoic era into epochs, but without putting too fine a point on it, the percentage of mollusks in the La Salina fauna which have survived to the present, suggests that the Guaiguaza clays are Pliocene—probably late Pliocene—in age.

THE CABO BLANCO GROUP

STRATIGRAPHY

The Cabo blanco group is a sedimentary complex forming the terrain between the Venezuelan Coast Range and the Caribbean Sea, and occupying a narrow east-west belt between La Guaira and Catia La Mar in the Distrito Federal. The stratigraphy of the Cabo Blanco group is summarized in the following table.

	Formation	*Thickness (meters)*	*Description*
	Sub-Recent and Quaternary	± 3	Bench-forming beachrock and reefs, and reworked clays, sands, and gravels.
	Abisinia formation	13 (max.)	Clays, silts, sands, and gravels. Locally with fossils.
		Disconformity	
	Mare formation	19 (max.)	Friable grits at base, soft siltstones above. Highly fossiliferous.
		Unconformity	
Playa Grande formation	Maiquetía member	± 34	Shales, siltstones, calcareous sandstones, and conglomerates. Bioherms of coralline algae. Other fossils moderately abundant.
	Catia member	156-233	Calcareous siltstones and sandstones, conglomerates, some shales and limestones, and occasional coquinas. Fossils, often as molds and casts.
		Unconformity	
	Las Pailas formation	375 +	Non-fossiliferous mudstones, siltstones, sandstones, and conglomerates (Fig. 1).

Noteworthy features of the section at Cabo Blanco are 1) the beds of subrecent to Recent beachrock, and 2) the fossil bioherms and biostromes of calcareous algae. The beachrock (Fig. 2) occurs along the shore and is especially well displayed from the mouth of Quebrada Las Pailas westward to the Playa Grande Yachting Club. The beachrock is essentially a beach conglomerate composed of such beach debris as rocks, shells, and reef-dwelling remains which

have been cemented by calcium carbonate. Inland from the shoreline, the Cabo Blanco beachrock forms the floor of some of the small streams near their debouchment, and seaward from the shoreline the beachrock may extend some scores of meters to form the sea bottom. The planed surface of the beachrock indicates marine abrasion, and the dip of the beachrock is at a low angle toward the sea. If memory serves me correctly, I recall having seen a bottlecap or some man-made contrivance cemented by calcareous carbonate into the beachrock, and this would mean that the processes of calcium carbonate precipitation and cementation are going on to-day. The problem of beachrock formation has aroused considerable interest in recent years, and a study of the occurrences along the shore at Cabo Blanco may prove to be informative.

Bioherms and biostromes of calcareous algae are present in some abundance in the Playa Grande formation, especially in the Maiquetía member. The largest bioherm observed in this member occurs at W-23 on the north flank of the Punta Gorda anticline (see geologic map in Weisbord, 1957) where it is 150 meters long and about 2 meters thick. The bioherm here (Figs. 6, 7) is composed of cemented spherular masses of an undetermined species of orange-colored alga which seems to belong to the family Corallinaceae and which I have referred to under the catch-all generic name of *Lithothamnium*. Some 400 meters southwest of the orange bioherm is a northeasterly striking ridge of a white algal limestone 90 meters or so in length, and there are several similar thin, southdipping algal limestones outropping in the upper course of Quebrada Las Pailas. A small exposure of algal limestone was observed east of the Playa Grande Yachting Club in the Catia member of the Playa Grande formation, and individual spherules of calcareous algae have been collected at several places in the Mare formation.

PELECYPODS OF THE ABISINIA FORMATION

The youngest formation of the Cabo Blanco group proper is the Abisinia. The following species of pelecypods were found in it (Fig. 3).

Species	*Geologic range of known species*	*Geologic range of nearest related species*
Arca (Arca) zebra abisiniana Weisbord, n. subsp.		Mid. Miocene—Recent
Arca (Arca) imbricata Bruguière	Low. Miocene—Recent	
Barbatia (Barbatia) candida Helbling	Low. Miocene—Recent	
Barbatia (Acar) domingensis (Lamarck)	Low. Miocene—Recent	
Pinna aff. carnea Gmelin	Pliocene ?—Recent	
Cardita (Carditamera) gracilis Shuttleworth	Recent	
Codakia (Lentillaria) orbicularis (Linnaeus)	Mid. Miocene—Recent	
Chama congregata Conrad	Mid. Miocene—Recent	
Chama macerophylla Gmelin	Mid. Miocene—Recent	
Chama sinuosa bermudensis Heilprin	Recent	
Pseudochama radians (Lamarck)	Recent	
Pseudochama ? species		Recent
Tivela (Tivela) mactroides (Born)	Pleistocene—Recent	
Pitar (Hysteroconcha) dione (Linnaeus)	Pliocene—Recent	
Chione (Chione ?) mamoensis Weisbord, n. sp.		Recent
Petricola (Rupellaria) typica (Jonas)	Pliocene—Recent	
Strigilla pisiformis (Linnaeus)	Low. Miocene—Recent	
Strigilla carnaria (Linnaeus)	Pleistocene—Recent	

Of the 18 species recorded, 15, or 83 per cent are living to-day. At least one of the remaining three species of pelecypods may eventually prove to be the same as a living form, and that would raise the number to 16, or 90 percent which have survived to Recent time. Taking the gastropods into account, 27, or 77 per cent of the 35 species collected from the Abisinia formation have survived to Recent time, and this figure might be as high as 88 per cent. Combining the totals, 79 to 89 percent of the 53 species thus far identified have continued their existence to the present, and these percentages indicate that the Abisinia formation is Pleistocene—possibly early Pleistocene—in age.

PELECYPODS OF THE MARE FORMATION

The Mare formation disconformably underlies the Abisinia for-

mation. The species of pelecypods collected from the Mare formation are listed below.

Species	*Geologic range of known species*	*Geologic range of nearest related species*
Nucula (Nucula) venezuelana Weisbord, n. sp.		Mid. Miocene
Nucula (Ennucula) mareana Weisbord, n. sp.		Miocene ?, Recent
Nuculana (Saccella) karlmartini Weisbord, n. sp.		Miocene—Recent
Nuculana (Saccella) axelolssoni Weisbord, n. sp.		Mid. Miocene, Recent
Nuculana (Saccella) marella Weisbord, n. sp.		Mid. Miocene, Recent
Adrana cf. tellinoides (Sowerby)	Recent	
Anadara (Lunarca) ovalis (Bruguière)	Up. ? Miocene—Recent	
Anadara (Lunarca ?) caboblanquensis Weisbord, n. sp.		Up. Miocene—Recent
Anadara (Lunarca ?) mareana Weisbord, n. sp.		Up. Miocene—Recent
Anadara (Cunearca) cumanensis Dall	Mid. ? Miocene—Pliocene	
Glycymeris (Glycymeris) undata (Linnaeus)	Miocene—Recent	
Glycymeris (Tucetona) pectinata (Gmelin)	Mid. Miocene—Recent	
Glycymeris (Glycymerella) decussata (Linnaeus)	Mid. Miocene—Recent	
Musculus lateralis (Say)	Pliocene—Recent	
Crenella divaricata (d'Orbigny)	Up. Miocene—Recent	
Lioberus ? marensis Weisbord, n. sp.		Recent
Pinna aff. carnea Gmelin	Pliocene ?—Recent	
Plicatula gibbosa Lamarck	Pliocene—Recent	
Plicatula caribbeana Weisbord, n. sp.		Miocene—Recent
Pecten (Pecten) caribeus Weisbord, n. sp.		Oligocene—Pliocene
Pecten (Pecten) maiquetiensis Weisbord, n. sp.		Mid. Miocene, Recent
Pecten (Euvola) ziczac caboblancoensis Druckerman	Pliocene	
Pecten (Amusium) marensis Weisbord, n. sp.		Oligocene ?—Recent
Chlamys (Leptopecten) desultoria Weisbord, n. sp.		Up. Miocene—Pliocene

Chlamys (Argopecten) gibbus antecessor Weisbord, n. subsp.		Miocene—Recent
Lyropecten (Nodipecten) species "a"		?
Anomia mareana Weisbord, n. sp.		Mid. Miocene—Recent
Pododesmus rudis (Broderip)	Pliocene—Recent	
Ostrea (Ostrea) lixula Weisbord, n. sp.		Low. Miocene, Mid. Pliocene
Ostrea (Alectryonia) vespertina venezuelana Weisbord, n. subsp.		Pliocene
Ostrea (Alectryonia ?) caboblanquensis Weisbord, n. sp.		Miocene—Recent
Eucrassatella (Hybolophus) antillarum Reeve	Pliocene—Recent	
Crassinella aduncata Weisbord, n. sp.		Up. Miocene
Crassinella triquetra Weisbord, n. sp.		Up. Miocene
Cardita (Carditamera) gracilis Shuttleworth	Recent	
Venericardia (Glyptoactis) wendellwoodringi Weisbord, n. sp.		Miocene, Recent
Diplodonta (Diplodonta) mareana Weisbord, n. sp.		Pliocene ?—Recent
Lucina (Cavilinga) trisulcata blanda (Dall and Simpson)	Recent	
Lucina (Bellucina) katherinepalmerae Weisbord, n. sp		Pleistocene—Recent
Lucina (Parvilucina) ephraimi Weisbord, n. sp.		Mid. Miocene—Recent
Codakia (Jagonia) umbonicostata Weisbord, n. sp.		Mid. Miocene
Bornia tacaguana Weisbord, n. sp.		Recent
Chama congregata Conrad	Mid. Miocene—Recent	
Echinochama species "a"		Pliocene—Pleistocene
Echinochama species "b"		Miocene—Recent
Trachycardium (Dallocardia) muricatum (Linnaeus)	Pliocene—Recent	
Trachycardium (Trachycardium) cf. isocardia (Linnaeus)	Pliocene—Recent	
Trigoniocardia (Trigoniocardia) caboblanquensis Weisbord, n. sp.		Low.-mid. Miocene, Pliocene, Pleistocene
Laevicardium ? species		Pliocene—Recent

Papyridea aff. soleniformis (Bruguière)	Pliocene—Recent	
Dosinia (Dosinidia) concentrica prosapia Weisbord, n. subsp.		Up. Miocene—Recent
Tivela (Planitivela) venezuelana Weisbord, n. sp.		Recent
Gouldia venezuelana Weisbord, n. sp.		Mid. Miocene
Gouldia diffidentia Weisbord, n. sp.		?
Transennella caboblanquensis Weisbord, n. sp.		Recent
Macrocallista maculata (Linnaeus)	Low. Miocene—Recent	
Pitar (Pitar) maiquetiensis Weisbord, n. sp.		Recent
Pitar (Pitar ?) antillensis Weisbord, n. sp.		Recent
Pitar (Nanopitar ?) marensis Weisbord, n. sp.		Recent
Pitar (Pitarella ?) scutellaris Weisbord, n. sp.		Pleistocene—Recent
Pitar (Hysteroconcha) dione (Linnaeus)	Pliocene—Recent	
Periglypta aff. listeri (Gray)	Pleistocene—Recent	
Chione (Chione) cancellata (Linnaeus)	Miocene—Recent	
Chione (Chione ?) laciniosa Weisbord, n. sp.		Mid. Miocene
Chione (Lirophora) riomaturensis Maury	Pliocene	
Chione (Lirophora) cultellata Weisbord, n. sp.		Up. Oligocene—Low. Miocene
Pleiorytis venezuelensis Weisbord, n. sp.		Mid.-up. Miocene, Recent
Tellina (Eurytellina) punicea Born	Pliocene ?, Recent	
Tellina (Eurytellina) nitens C. B. Adams	Recent	
Tellina (Merisca) cristallina Spengler	Mid. Miocene ?—Recent	
Macoma (Psammacoma) hybrida Weisbord, n. sp.		Pliocene—Recent
Semele proficua (Pulteney)	Pliocene—Recent	
Donax vagus Weisbord, n. sp.		Pliocene, Recent
Donax marensis Weisbord, n. sp.	Up. Miocene—Recent	
Solen species		Pliocene—Recent
Solecurtus cumingianus (Dunker)	Pliocene—Recent	
Ervilia nitens venezuelana Weisbord, n. subsp.		Recent

Ervilia antilleana Weisbord, n. sp.		Recent
Ervilia mareana Weisbord, n. sp.		Pliocene—Recent
Corbula (Caryocorbula) cf. lavalleana d'Orbigny	Pliocene—Recent	
Corbula (Notocorbula) puntagordensis Weisbord, n. sp.		Pliocene—Recent
Periploma margaritacea (Lamarck)	Recent	

The total number of pelecypods listed above is 82, and of this number 32, or 39 per cent are living to-day. Among the new species and subspecies described by this writer, at least four might be considered by some paleontologists to be identical with known Recent species, as in borderline cases of identity there is a judgment factor involved. If these are added to the list, the number of Recent species of pelecypods would come to 36, or 44 per cent. Adding two more species that might eventually be found as having survived to the present, the number of Recent pelecypods in the Mare formation would be 38, or 46 per cent. A comparable analysis of the 144 species of gastropods from the Mare formation (Weisbord, 1962) indicates that only 25, or 17 percent are living to-day; however 15 others are borderline and might be the same as Recent forms, and an additional 10 species may yet be found in the Recent fauna. This would bring the number of Recent gastropods in the Mare formation to 50, or 34 per cent. Combining the gastropods and pelecypods (226 species) collected from the Mare formation, the minimum number of species living to-day is 57, or 25 per cent, but because of the subjective bias inherent in identification, and the probability that a certain number of Mare species will be found in the Recent fauna, the number of surviving gastropods and pelecypods could be 88, or 34 per cent. Considering the geologic range of known species to which the new species are most closely related, it is seen that the overwhelming majority of the related species range from middle Miocene to Recent and that 46 per cent (105 out of 226 gastropods and pelecypods) of those are known from the Recent fauna. Based in part, then, on Lyell's percentage principle as well as on stratigraphy, and considering the similarity of the distinct species to geologically young forms, the mollusks in the Mare formation suggest

that the Mare formation is Pliocene—possibly lower Pliocene—in age.

PELECYPODS OF THE PLAYA GRANDE FORMATION

MAIQUETIA MEMBER

Unconformably below the Mare formation is the Playa Grande formation. The Playa Grande formation is made up of two members, the Maiquetía (Fig. 8) above, and the Catia (Fig. 4) below. The pelecypods from the Maiquetía member of the Playa Grande formation are the following:

Species	*Geologic range of known species*	*Geologic range of nearest related species*
Nucula (Nucula) venezuelana Weisbord, n. sp.		Middle Miocene
Nuculana (Saccella) karlmartini Weisbord, n. sp.		Miocene ?—Recent
Nuculana (Saccella) axelolssoni Weisbord, n. sp.		Middle Miocene—Recent
Anadara (Larkinia) notabilis (Röding)	Middle Miocene—Recent	
Anadara (Lunarca ?) caboblanquensis Weisbord, n. sp.		Upper Miocene—Recent
Anadara (Cunearca) cumanensis (Dall)	M. Miocene ?—Pliocene	
Glycymeris (Glycymeris) undata (Linnaeus)	Miocene—Recent	
Glycymeris (Glycymerella) decussata (Linnaeus)	Middle Miocene—Recent	
Crenella divaricata (d'Orbigny)	Upper Miocene—Recent	
Plicatula gibbosa Lamarck	Pliocene—Recent	
Plicatula venezuelana Weisbord, n. sp.		Recent
Pecten (Pecten ?) remulus Weisbord, n. sp.		Upper Miocene—Pliocene
Pecten (Euvola) ziczac caboblancoensis Druckerman	Pliocene	
Chlamys (Argopecten) gibbus antecessor Weisbord, n. subsp.		Miocene—Recent
Spondylus americanus Hermann	Pliocene—Recent	

Ostrea (Ostrea) pannucea Weisbord, n. sp.		Pleistocene—Recent
Ostrea (Alectryonia) vespertina venezuelana Weisbord, n. subsp.		Pliocene
Ostrea (Alectryonia ?) caboblanquensis Weisbord, n. sp.		Miocene—Recent
Ostrea (Agerostrea ?) antecursor Weisbord, n. sp.		Middle Miocene—Recent
Venericardia (Glyptoactis) wendellwoodringi Weisbord, n. sp.		Miocene—Recent
Lucina (Callucina ?) species		Recent
Lucina (Parvilucina) ephraimi Weisbord, n. sp.		Middle Miocene—Recent
Lucina (Parvilucina) multilineata Tuomey and Holmes	Upper Miocene—Recent	
Codakia (Lentillaria) orbicularis (Linnaeus)	Middle Miocene—Recent	
Chama congregata Conrad	Middle Miocene—Recent	
Chama macerophylla Gmelin	Middle Miocene—Recent	
Trachycardium (Dallocardia) muricatum (Linnaeus)	Pliocene—Recent	
Tracycardium (Trachycardium) cf. isocardia (Linnaeus)	Pliocene—Recent	
Trigoniocardia (Trigoniocardia) caboblanquensis Weisbord, n. sp.		Lower—middle Miocene, Pliocene, Pleistocene
Trigoniocardia (Americardia) media (Linnaeus)	Middle Miocene—Recent	
Dosinia (Dosinidia) concentrica prosapia Weisbord, n. subsp.		Upper Miocene—Recent
Gouldia venezuelana Weisbord, n. sp.		Middle Miocene
Transennella caboblanquensis Weisbord, n. sp.		Recent
Transennella venezuelana Weisbord, n. sp.		Upper Miocene—Pliocene
Macrocallista maculata (Linnaeus)	Lower Miocene—Recent	
Antigona (Ventricolaria) aff. rigida Dillwyn	Pliocene—Recent	
Chione (Chione) cancellata (Linnaeus)	Miocene—Recent	

Chione (Chione) pailasana Weisbord, n. sp.			Middle Miocene
Chione (Chione ?) mamoensis Weisbord, n. sp.			Recent
Chione (Timoclea) tacaguana Weisbord, n. sp.			Miocene—Recent
Petricola (Naranio) lapicida (Gmelin)	Pliocene—Recent		
Tellina (Tellina ?) sp. indet.			Recent
Tellina (Eurytellina) nitens C. B. Adams	Recent		
Tellina (Eurytellina) alternata ? Say	Upper Miocene—Recent		
Strigilla carnaria (Linnaeus)	Pleistocene—Recent		
Semelina nuculoides (Conrad)	Upper Miocene—Recent		
Solecurtus cumingianus (Dunker)	Pliocene—Recent		
Labiosa (Raeta) aff. plicatella (Lamarck)	Upper Miocene—Recent		
Ervilia nitens venezuelana Weisbord, n. subsp.			Recent
Ervilia antilleana Weisbord, n. sp.			Recent
Ervilia caribbeana Weisbord, n. sp.		Middle Miocene, Recent	
Corbula (Notocorbula) bruscasensis Weisbord, n. sp.		Upper Oligocene—lower Miocene	
Cyathodonta cf. tristani Olsson	Middle—upper Miocene		

Of the 53 species of pelecypods from the Maiquetía member listed above, 23, or 43 per cent are living to-day. Another six forms are separated from known Recent species by such slight differences that some paleontologists might consider them the same and thereby increase the ratio to 55 per cent. Speculating further, it may not be unreasonable to assume that two of the remaining species will be found eventually in the Recent fauna, and this would bring the total number of Recent pelecypods in the Maiquetía member to 31, or 58 per cent. A similar analysis of the 82 species of gastropods collected from the Maiquetía member indicates that 10 to 28 per cent of those mollusks occur in the Recent faunal assemblage. Combining the data to include both gastropods and pelecypods, the number of species livng to-day is 31, or 24 per cent, but could be as high as 54,

or 40 per cent. The great majority of analogous but distinct species of gastropods and pelecypods of the Maiquetía member range from Miocene to Recent, and of these analogues 66 per cent occur in the Recent. Equating the percentage bracket with geologic time, and taking into consideration its stratigraphic position, the Maiquetía member of the Playa Grande formation is believed to be Pliocene—probably lower Pliocene—in age. The unconformity between the Maiquetía member and the overlying Mare formation suggests a longer time interval than is actually evidenced by the faunal assemblages in each, and it must be concluded that the time span between the erosion of the Maiquetía member and the initial deposition of the Mare formation was geologically short.

CATIA MEMBER

Because of faults and Quaternary cover, the stratigraphic relationship of the Catia and Maiquetía members is not clearly established. Indirect evidence, however, suggests that the Catia member makes up the lower and preponderant part of the Playa Grande formation, the Maiquetía member the upper. The fossils collected from the Catia member are the following:

Species	*Geologic range of known species*	*Geologic range of nearest related species*
Nuculana (Saccella) species		?
Nuculana (Jupiteria ?) species		Middle Miocene
Anadara (Larkinia) species		Miocene—Recent
Atrina (Servatrina ?) aff. seminuda (Lamarck)	Miocene ?, Recent	
Atrina (Servatrina) serrata ?(Sowerby)	Lower Pliocene—Recent	
Pecten (Pecten) catianus Weisbord, n. sp.		Oligocene—middle Miocene
Pecten (Pecten) species		Oligocene—Pliocene, Recent
Pecten (Euvola) ziczac caboblancoensis Druckerman	Pliocene	
Pecten (Amusium) papyraceus (Gabb)	Oligocene ?—Recent	
Chlamys (Chlamys) benedicti Verrill and Bush	Recent	

Aequipecten muscosus (Wood)	Pliocene—Recent		
Chlamys (Argopecten) gibbus antecessor Weisbord, n. sp.			Miocene—Recent
Chlamys (Argopecten) imitata Weisbord n. sp.		Middle Miocene—Recent	
Lyropecten (Nodipecten) nodosus ? (Linnaeus)	Low. Miocene ?—Recent		
Lyropecten (Nodipecten) arnoldi Aguerrevere	Pliocene		
Lyropecten (Nodipecten) species "b"			Miocene—Pliocene
Spondylus americanus Hermann	Pliocene—Recent		
Anomia catiana Weisbord, n. sp.		Middle Eocene, Miocene —Recent	
Ostrea (Ostrea) lixula Weisbord, n. sp.		Lower Miocene, middle Pliocene	
Ostrea (Alectryonia) vespertina venezuelana Weisbord, n. subsp.			Pliocene
Ostrea (Alectryonia ?) caboblanquensis Weisbord, n. sp.			Miocene—Recent
Divaricella ? species			Miocene—Recent
Dosinia (Dosinidia) concentrica prosapia Weisbord, n. subsp.		Upper Miocene—Recent	
Macrocallista maculata (Linnaeus)	Lower Miocene—Recent		
Cyathodonta cf. tristani Olsson	Middle—upper Miocene		
Pholadomya cf. candida Sowerby	Pleistocene—Recent		

Of the 26 species of pelecypods from the Catia member, 8, or 31 per cent are also Recent. Two other species are so close to living forms that they might be considered the same by some paleontologists, and that would bring the total of Catia species surviving to the present to 10, or 40 per cent. Of the six gastropod species described from the Catia member, none was identified by the writer to occur in the Recent although two, or 33 per cent are in the borderline category. If the gastropods and pelecypods are considered jointly, the species in the Catia member that are living to-day range, depending on the judgment factor, from 25 to 37 per cent. In my work on the gastropods (Weisbord, 1962) I stated that the gastropods from the Catia member were too few in number to arrive at an age determination, though on the basis of relationship and strati-

graphic position they might be indicative of the later Miocene. Now, however, with the data of both the gastropods and pelecypods at hand, I am inclined to consider the Catia member of the Playa Grande formation as lower Pliocene in age.

GEOLOGIC AGE OF FORMATIONS

The succession of formations as determined in the field by the writer is given below. The geologic age assigned to these formations is based on the fossils thus far determined and on stratigraphy. In the chronological analysis of known species, the Lyellian percentage method of subdividing the Cenozoic era into epochs has been applied; in the analysis of new species, considerable weight has been given to the geologic range of the nearest analogues.

La Salina de Guaiguaza	*Cabo Blanco Group*	*Percentage of surviving species*	*Presumed geologic age*
	Coastal beachrock	Not determined	Subrecent-Recent
	Disconformity ?		
	Abisinia formation	79-89	Pleistocene
	Disconformity		
Guaiguaza Clay		50+	Upper Pliocene
	Mare formation	25-34	Lower Pliocene
	Unconformity		
	Playa Grande formation — Maiquetí member	24-40	Lower Pliocene
	Playa Grande formation — Catia member	25-37	Lower Pliocene
	Unconformity		
	Las Pailas formation	Unfossiliferous	Middle Tertiary
	Probable unconformity		

In the table, the percentages of the species still living apply only to the combined totals of the gastropods and pelecypods described thus far by the writer. The Abisinia formation is assigned a Pleistocene age by virtue of the high percentage of living forms as well as by its superior stratigraphic position. Stratigraphic control of the Guaiguaza clay is wanting, but with at least 50 per cent of the mollusks having survived to Recent time, a late Pliocene age is indicated. In the analysis of the pre-Pleistocene formations of the Cabo Blanco group, it is seen that the percentages of species which have survived to Recent time is roughly the same for both the Mare and Playa Grande formations even though the Mare formation lies

above, and is separated from the Playa Grande formation by an angular unconformity. Relating these percentages to Lyell's original division of the Tertiary, the age of these formations is postulated as lower Pliocene.

As the age determinations in this work have been based in good part on the Lyellian concept of Cenozoic classification, it might not be amiss to re-state, in Lyell's own words, the philosophic principle[4] behind his Tertiary timetable. Sir Charles Lyell was not only a perceptive observer of the geolgic scene but a logician as well. His personal charm enabled him to enlist the ideas of others, and, investing these ideas with his own leaven, he could present them in lucidly written prose that is a pleasure to read. From his own observations in Italy, France, and England, and with the contributions of such colleagues as Signor O. G. Costa, Prof. Viviani, Dr. Sasso, M. Desnoyers, and particularly the then dean of paleontology M. Deshayes, Lyell, in his preface to the "Principles" (p. xiii), succinctly introduced his concept of geochronology in the following sentence:

> On my return to Paris, in February, 1829, I communicated to M. Deshayes some of the new views to which my examination of Sicily had led me, and my intention to attempt a classification of the different Tertiary formations in chronological order, by reference to the comparative proportion of living species of shells found fossil in each.

After developing and discussing the implications of his thesis, Lyell (p. 59) summarized his now well-known concept as follows:

> In reference to the organic remains of the different groups which we have named, we may say that about a thirtieth part [3.3 per cent] of the Eocene shells are of recent species, about one-fifth [20 per cent] of the Miocene, more than a third [33 per cent], and often more than half [50 per cent], of the older Pliocene, and nine-tenths [90 per cent] of the newer Pliocene [Pleistocene].

In 1855, Beyrich[5] proposed the term Oligocene for deposits containing 10 to 15 per cent of Recent species of Mollusca.

No one, I think, knew better than Lyell that his classification was limned in broad strokes, but if anything, not only are Lyell's general conclusions standing the test of time, but even his specific ranges in certain provinces are proving surprisingly close to the

---

[4]Charles Lyell, *Principles of Geology,* volume 3. London, John Murray, xxxi + 398 pp., + Appendix I, pp. 1-52; Appendix II, pp. 53-83; Index, pp. 85-109 +93 figs., 4 pls., 1 geol. map, 1833.

[5]*Stellung der hessischen Tertiärbildungen.* Berl. Akad. Wissensch., Monatsber. for 1854, p. 664.

mark. Limitations of the Lyellian method have been discussed by Vaughan[6] among others, but such limitations, it seems to me, may lie in interpretation rather than in the principle itself. For example, the percentage of surviving species of Mollusca in the Mare and Playa Grande formations (lower Pliocene) is much the same as it is (32.5 per cent) for the roughly equivalent Caloosahatchee shell deposit at North St. Petersburg, Florida, whereas, according to Durham,[7] the gastropods and pelecypods in the lower Pliocene San Carlos formation of Baja California which have survived to the Recent is 46 per cent based on 37 species examined. As their standard, Lyell and Deshayes compared the fossils of the Italian Pliocene with the Recent mollusks of the Mediterranean; the Caloosahatchee Pliocene deposits of Florida have been compared with the Recent Western Atlantic mollusks by Heilprin, Dall, Olsson and Harbison, and others; the Cabo Blanco Pliocene fossils have been compared in my studies with the living mollusks in Western Atlantic, Caribbean, and Eastern Pacific waters; the Pliocene fossils of Baja California have been compared by Durham and predecessors with living ones in the Eastern Pacific; and the Pliocene of New Zealand has been established in part by the ratio of fossil species to the living species now inhabiting the surrounding sea. Because of such factors as geography, climate, ecology, the rate of organic change of species, the depositional and structural history, the abundance of species for statistical control, and the taxonomic discernment of the paleontologist, each geologic epoch within the Cenozoic era, and each biologic province within each epoch will have its own percentage standard. Nevertheless, Lyell's calendar is an important tool—perhaps the single most important tool—in dating the Cenozoic, and in this work I have been strongly influenced by it.

NOTES ON CORRELATION

At least 60 per cent (and probably a much larger proportion) of the mollusks collected from the Playa Grande and Mare forma-

---

[6]*Criteria and status of correlation and classification of Tertiary deposits.* Geol. Soc. Amer., Bull., vol. 35, pp. 677-742, 1924.

[7]*E. W. Scripps cruise to the Gulf of California. Pt. 2. Megascopic paleontology and marine stratigraphy.* Geol. Soc. Amer., Mem. 43, p. 6, 1950.

Fig. 1. Looking west to Cabo Blanco from Punta Gorda. The gray sediments dipping to the south are in the Las Pailas formation, and are unfossiliferous. The Cabo Blanco lighthouse is on the highest hill in the background.

Fig. 2. Looking west from Cabo Blanco lighthouse. The Recent shells were collected just beyond the breakwater, upper right. The village of Playa Grande is situated on the terrace (Abisina formation) to the left of the breakwater. Subrecent to Recent beachrock is exposed here and there along the shore.

Fig. 3. Fossiliferous gravels in the Abisinia formation (Pleistocene) at eastern edge of Playa Grande village. The gravels here are overlain by red sand and are underlain by sandy limestone of the Catia member of the Playa Grande formation, forming the floor of the bulldozed area in the foreground.

Fig. 4. Massive and bedded sandy limestone of the Catia member of the Playa Grande formation at west plunge of Litoral anticline, Playa Grande village.

Fig. 5. Wedge of highly fossiliferous Mare sandstone at W-25, south flank of Punta Gorda anticline. The wedge is seen at left center just above talus slope, and is overlain by non-fossiliferous cobble to boulder gravels of the Abisinia formation.

Fig. 6. *"Lithothamnium"* bioherm at W-25, north flank of Punta Gorda anticline, immediately overlain by poorly sorted conglomerates, both within the Maiquetía member of the Playa Grande formation.

Fig. 7. Close-up of "*Lithothamnium*" bioherm shown in fig. 6. The mollusks collected in the immediate area were found on and near the bioherm.

Fig. 8. South flank of Punta Gorda anticline showing steeply dipping beds in the Maiquetía member of the Playa Grande formation, on which are draped cobble to boulder gravels of the Abisinia formation.

tions of the Cabo Blanco group are identical with the fossils contained in Collection No. 18408 of the U. S. National Museum, from near Cumaná, Venezuela. The Cumaná fossils were collected by P. Henry and J. A. Tong in September 1931, from a point 2.5 kilometers N 80°E from the Cumaná Castle and S 30°W from the village of Caiguire Abajo, in yellowish brown marl about 30 feet thick, dipping steeply northward. Although the Cumaná locality is 310 kilometers (186 miles) east of the type locality of Playa Grande-Mare formations, there are so many of the same species in common that the deposits in question are believed to be directly contemporaneous. The strata in which the U.S. National Museum's fossils in Collection No. 18408 occur are included in the formation known as the Cumaná beds. There is an excellent discussion of this formation by Frances de Rivero in the *Stratigraphical Lexicon of Venezuela* (English edition), and in the Lexicon the Cumaná beds is assigned an age of upper Miocene or lower Pliocene. An advocate for the Pliocene is Wendell P. Woodring,[8] and his analysis is sustained first by the percentage of living species, secondly by the relatively large number of analogous but distinct species which have survived to Recent time, and thirdly by the relative scarcity of species that are common to the upper Miocene Springvale formation of Trinidad or to the middle Miocene of the Caribbean area.

Granting the equivalence of the Playa Grande-Mare formations and Cumaná beds, and their Pliocene age, there remains the question of correlating these formations with others within and around the Caribbean province. Among the more highly fossiliferous deposits that have been considered Pliocene in age are 1) the Caloosahatchee formation of Florida, 2) the Moín formation of Costa Rica, 3) the Matura formation of Trinidad, and 4) the Punta Gavilan formation of Venezuela.

1. *Caloosahatchee formation.* This is believed to be equivalent, at least in part, with the remarkable shell deposit at North St. Petersburg, Florida. The fossils from North St. Petersburg have been described by Olsson, Harbison, and Pilsbry[9] and reported by

[8]*Caribbean land and sea through the ages.* Geol. Soc. Amer., Bull., vol. 65, No. 8, p. 729.

[9]*Pliocene Mollusca of southern Florida with special reference to those from North Saint Petersburg.* Acad. Nat. Sci. Philadelphia, Mon. No. 8, 457 pp., 65 pls., 1953.

them to be Pliocene in age. Of the 512 species of marine gastropods (excluding the Pyramidellidae) and pelecypods described, 165, or 32 per cent are also Recent, and 128, or 25 per cent are new. A total of 316 species has been described from the Playa Grande-Mare formations, and of this number 208, or 66 per cent are new. The proportion of Recent species in the North St. Petersburg deposit is about the same as that in the Playa Grande-Mare formations, and there are 27 species that are common to both the Floridan and Venezuelan deposits. As the assemblages of genera in both areas are similar, and as well over half of the analogous but distinct species also occur in the Recent in their respective environments, the contemporaneity of the two during early Pliocene time is suggested.

2. *Moín formation.* In 1881, William M. Gabb[10] named 85 species of gastropods and 45 species of pelecypods from the then-designated Limon beds near Moín in Costa Rica. Of the total (130) in the two classes, 82, or 63 per cent were believed by Gabb to be the same as Recent species, 38 species were described as new, and 10 forms were thought to be identical with Miocene species of the Caribbean area. Some of Gabb's identifications have been revised over the years, though most paleontologists still accept Gabb's determination of the Limon beds (now known as the Moín formation) as Pliocene. Only 20, or 6 per cent of the 316 species occurring in the Playa Grande-Mare formations are common to the Moín formation, whereas 10, or 27 per cent of the 28 species identified in the Salina de Guaiguaza clays of Venezuela are common to the Moín formation of Costa Rica. As the proportion of Recent species (at least 50 per cent) in the Guaiguaza clay is also more nearly like that of the Moín Formation, it is inferred that these two deposits are more or less equivalent, and that their age is upper Pliocene.

3.*Matura formation.* According to Kugler,[11] the type locality

---

[10]*Descriptions of new species of fossils from the Pliocene clay beds between Limon and Moen Costa Rica, with notes on previously known species from there and elsewhere in the Caribbean area.* Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, pp. 349-380, pls. 45-47. Also see Hoffstetter, 1960, [in] *Lexique Stratigraphic International, vol. 5, Amérique Latine, No. 2a, Amérique Centrale,* pp. 265-266.

[11]*Lexique Stratigraphique International, vol. 5, Amérique Latine, No. 2, Antilles,* p. 75, 1958?

of the Matura formation is on the east coast of Trinidad north of the Oropuche River. Typically, the Matura formation is a dark, fine-grained, calcareous sandstone some 10 feet or so in thickness, containing well-preserved Mollusca. Approximately 78 species of gastropods and pelecypods from the Matura formation were identified by Guppy, and of this number 58, or 71 percent were determined as being identical with Recent species. A later study by Maury[12] of 52 species of gastropods and pelecypods revealed that only 17, or 33 per cent of the Matura mollusks were the same as Recent species. It is probable that further taxonomic studies of the Matura mollusks will reveal that Maury's percentage of living species should be increased, and, indeed, a number of students do attribute a late Pliocene age to the Matura formation. This would link it chronologically with the Moín formation of Costa Rica and the Guaiguaza clays of Venezuela. In the Playa Grande-Mare formations of the Cabo Blanco group, the proportion of living species is in the 24 to 40 per cent bracket, and only 11 (out of 316) species are common to the Matura formation.

4. *Punta Gavilan formation.* The most important work dealing with the molluscan fauna of this formation is a monograph by Rutsch[13] on the Gastropoda. In Rutsch's monograph a total of 58 species of gastropods are described, and of this total 19, or 33 per cent are endemic (but related to living forms), and 10, or 17 per cent are identical with, or hardly distinguishable from Recent species. Among the remainder (see Suter[14]), one or two forms are known from the Pliocene only; several definite forms occur that are not known from formations older than upper Miocene; a large number of species are found elsewhere in the lower and middle Miocene, although most of these extend to the upper Miocene; and two forms are reported from the Paleocene.

---

[12] *A further contribution to the paleontology of Trinidad.* Bull. Amer. Paleont., vol. 25, No. 42, 250 pp., 43 pls., 1925.

[13] *Die Gastropoden aus dem Neogen der Punta Gavilan in Nord Venezuela.* Schweiz. Palaeont. Gesell., Abhandl., vols. 54-55, 169 pp., 9 pls., 1934.

[14] *Geologic notes on the "Punta Gavilan" formation and on the eastern part of the State of Falcon.* Bol. Geol. y Min., vol. 1, Nos. 2-4 (English edition), pp. 269-279, 1937 [1938].

The type section of the Punta Gavilan formation is exposed in a bluff along the coast at Punta Gavilan, State of Falcon, Venezuela. Here, the lower two meters consist of knobby limestone with limonitic concretions and aggregations of well-preserved echinoids (described by Jeannet[15] in 1928), and an overlying three meters of yellowish sandy limestone containing an abundant molluscan fauna, the gastropods of which were described by Rutsch. The Punta Gavilan formation is bounded above by Quaternary and below by the middle Miocene, and, according to Renz[16] and others, its age is bracketed in the interval between late Miocene and early Pliocene time. Lithologically the Punta Gavilan beds at the type locality are similar to certain beds in the Playa Grande formation at Cabo Blanco, and a number of species of gastropods are common to both formations. For reasons mentioned earlier in the present report, this writer believes that the Playa Grande formation is lower Pliocene in age, though initial deposition may have started toward the end of the Miocene. The proportion (17 per cent) of Recent gastropods in the Punta Gavilan formation is in itself too low to be indicative of Pliocene, but if there is a parallelism between the Punta Gavilan and Cabo Blanco areas, as I venture to presume, the percentage of Recent mollusks in the Punta Gavilan formation will be increased by the pelecypods when they are determined. In the Playa Grande formation of the Cabo Blanco group the number of pelecypod species is less than the gastropods, but percentage-wise many more of the pelecypods have survived to Recent time than have the gastropods.

SYSTEMATIC DESCRIPTIONS

PELECYPODA

NUCULIDAE

Nucula (Nucula) venezuelana, new species Pl. 1, figs. 1-6

Shell minute, thin, moderately plump, obliquely subhexagonal, inequilateral. Beaks low, bluntly pointed, situated posterior to

---

[15] *Contribution a l'étude des Echinides tertiaires de la Trinité et du Vénézuéla.* Soc. Paléont. Suisse, Mém., vol. 48, pp. 1-48, 6 pls., 12 text figs.

[16] *Punta Gavilan formation.* [In] *Stratigraphical Lexicon of Venezuela.* Bol. Geol., Special Publ. No. 1, pp. 466-467, 1955.

center. Umbos large, somewhat inflated, the prodissoconch white and smooth. Posterior end subtruncate, ventral margin rounded (the curvature a little more pronounced near the middle), anterodorsal margin slightly convex, anterior end sharply rounded where it joins the ventral margin. There is neither a true lunule nor escutcheon, but the lunular area is large, more or less elliptical, a little depressed, and sculptured by raised wavy crenulate cords running at a right angle with the anterior margin of the disk. The area of the escutcheon is vaguely cordate and fairly smooth. Chondrophore small and rather shallow, its base relatively wide and gently rounded. Hinge continuous over the chondrophore, the posterior teeth numbering 4 to 5, the anterior 9 to 13, the average 4 and 10, respectively. The anterior teeth directly above the chondrophore are the smallest, the ones on either side of the beak becoming progressively larger and longer distally up to, but not including the farthest, the teeth wedge-shaped and sharp at the tip. Interior normally with a veneer of smooth nacre, but this film is often worn off revealing the numerous fine radial striae of the inner layer of shell through which the concentric ribs of the exterior may sometimes be seen. Ventral margin finely and evenly denticulate, the denticles numbering 52 on the holotype. The exterior of the valve is sculptured by low regular concentric ribs which are rendered crenulate by numerous fine equal radiating threads. The concentric ribs are smaller and closer on the umbos than from the middle down; anteriorly they extend to the lunular area which they cross as somewhat irregular cords; posteriorly they extend to the margin of the escutcheonal area but are obsolescent on the area itself. On specimens with a length of 2 mm. there are about 20-22 ribs from the base of the prodissoconch to the ventral margin.

Dimensions.—Holotype (G479a), left valve, length 2.7 mm.; height 2.1 mm.; thickness 0.75 mm. Paratype (G479b), left valve, length 2.1 mm.; height 2 mm.; thickness 0.6 mm. Paratype (G479c), right valve, length 1.8 mm.; height 1.6 mm., thickness 0.6 mm.

Type locality.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Nine specimens including six left valves and three right valves.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve. Upper Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas. One right valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Three specimens including two right valves and one left valve. Playa Grande formation (Maiquetía member) near W-4, Quebrada Las Pailas. One right ? valve, broken.

Comparisons.—The distinguishing character of *Nucula venezeulana,* n. sp. is its large white prodissoconch, and this serves to differentiate the Venezuelan fossil from the following related species:

N. crenulata A. Adams (1856, Zool. Soc. London, Proc., p. 52). Recent, Cape Hatteras to Barbados, 30-640 fathoms. This is also smaller and less tumid than *N. venezuelana,* n. sp.

N. culebrensis Smith (1885, Voyage H.M.S. Challenger, Zoology, vol. 13, p. 228, pl. 18, figs. 11, 11a). Recent, off Culebra Island, West Indies in 390 fathoms. The posterior end is rounded rather than subtruncate as on *N. venezuelana,* n. sp.

N. declivis Hinds (see Hertlein and Strong, 1940, Zoologica, vol. 25, pt. 4, No. 25, p. 380, pl. 1, figs. 1-3, 6-7). Recent, Mexico to Panama (Eastern Pacific), 4-30 fathoms. Subtrigonal in outline, and with less regular concentric ribs than *N. venezuelana.*

N. exigua Sowerby (see Hertlein and Strong, 1940, Zoologica, vol. 25, pt. 4, No. 25, p. 381, pl. 1, figs. 4-5). Recent, Baja California to Ecuador, 6-110 fathoms. Smoother than *N. venezuelana,* and the posterior truncation of *N. exigua* longer.

N. suprastriata (Arnold, 1903, p. 96, pl. 18, fig. 6). Pleistocene, California. Similar to *N. exigua* Sowerby, but the radial striae are not so prominent.

N. vieta Guppy (see Guppy, 1878, Sci. Assoc. Trinidad, Proc., p. 171, pl. 7, fig. 11). Pliocene at Matura, Trinidad. This is a subtrigonal shell, higher than long.

N. baccata Guppy (see Maury, 1925b, pp. 172-173, pl. 12, fig. 5). Pliocene at Matura, Trinidad. The concentric ribs are finer than those of *N. venezuelana,* n. sp.

N. cahuitensis Olsson (1922, pp. 343-344), pl. 18, figs. 21-24). Middle Miocene of Costa Rica. *N. venezuelana,* n. sp. is close to

N. cahuitensis especially in the general nature of the prodissoconch and the sculpture of the lunular area. However, the radial striae are more ubiquitous on *N. venezuelana,* and whereas *N. venezuelana* is rounded polyonal in outline *N. cahuitensis* is obliquely subtrigonal.

Nucula (Ennucula) mareana, new species Pl. 1, figs. 7-10

Shell small, elongate oval, moderately inflated, inequilateral. Umbo large and full, the beak fairly low, the prodissoconch small, smooth, and white. Anterior and posterior ends sharply rounded, the posterior a little more acute than the anterior. Dorsal margin anterior to beak gently convex, the posterior strongly convex at the middle and slightly concave as it approaches the curve of the ventral margin. Ventral margin well rounded. There is neither a true lunule nor true escutcheon, but the valves are somewhat flattened in both areas. Chondrophore oblique, narrowly spoon-shaped, the basal margin rounded. Hinge of adult with 5-6 posterior teeth and 13-14 anterior teeth, the anterior ones enlarging progressively away from the chondrophore, the posterior ones about as large near the chondrophore as they are distally. On the left valve the posterior tooth adjacent to the chondrophore tends to be bifid, whereas on the single right valve contained in my collection that tooth is single but a trifle broader than the others. The anterior and posterior teeth away from the chondrophore are triangularly cuspate, the concave sides facing the ends of the valves. Interior (including the margin) smooth, subnacreous. A broad radial band of reinforcing shell material extends from the beak toward the pallial line. Pallial line and adductor scars scarcely visible. Exterior dull and smooth but with concentric bands and lineations that show no relief whatsoever. Whether these concentric markings are raised or grooved on perfect specimens is not known.

Dimensions.—Holotype (G478a), left valve, length 4.4 mm.; height 3.3 mm., thickness 0.9 mm. Paratype (G478b), right valve, length 4 mm.; height 3.1 mm.; thickness 0.75 mm.

Type locality.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Five specimens including four left valves and one right valve.

Remarks.—Subgenerically the new Venezuelan species falls between *Ennucula* Iredale (1931, Australian Mus. Rec., vol. 18, no. 4, pp. 202, 231) and *Nucolopsis* Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, p. 14, pl. 1, figs. 2-3) but is closer to the former. On *Nucolopsis* (also spelled *Nuculopsis* by Woodring) the posterior teeth are not reduced in size toward the chondrophore, and in this respect the Venezuelan shell is like the type *N. (Nucolopsis) hilli* Woodring from the middle Miocene of Jamaica. In all other respects it fits the subgenus *Ennucula.*

Comparisons.—*Nucula mareana,* n. sp. is comparable to *N. tenuis* (Montagu) (1808, p. 56, pl. 29, fig. 1), *N. aegeënsis* Jeffreys (1879, Zool. Soc. London, Proc., p. 581), *N. cardara* Dall (see Schenck, 1939, p. 34, pl. 5, figs. 12, 14, 18, 21), and *N. uruguayensis* Smith (1880c, p. 320). *N. tenuis* is a circumboreal species which has been reported as far south as the Mediterranean in Europe, along the New England coast in the Western Atlantic, and to Baja California, Mexico, in the Eastern Pacific. As a fossil it has been reported by Dall from the "Miocene" of Alaska, according to Grant and Gale (1931, p. 111). *N. tenuis* is a variable shell but is always more gently rounded at the extremities than *N. mareana* and has a fairly well-defined escutcheon which is not present on the Venezuelan form. The southern Western Atlantic analogue of *N. tenuis* is *N. aegeënsis* which has been recorded from Cuba, Puerto Rico, and Trinidad in 5 to 464 fathoms. *N. aegeënsis* is differentiated from *N. mareana* in being much more rounded at the posterior end. *N. cardara,* a Recent Eastern Pacific shell ranging from Monterey, California, to Baja California, Mexico, in deep water (1090 fathoms, in mud, off San Diego, California), is considerably larger than *N. mareana,* and the posterior teeth are slightly smaller near the chondrophore than are those of the Venezuelan fossil. *N. uruguayensis* Smith, as figured in Voyage of H.M.S. Challenger, Zoology (vol. 13, p. 299, pl. 18, figs. 12-12b) is also much larger than *N. mareana,* and the valves instead of being smooth are somewhat deeply furrowed at stages of arrested growth. *N. uruguayensis* Smith was obtained off Montevideo, Uruguay, from mud at 13 fathoms. *N. uruguayensis* Marshall, also collected in Uruguay in the estuary of Río de La Plata on the Costa de Maldonado, is different than the *N. uruguayensis* of Smith, having weak radial sculpture and a crenulate

ventral margin. Marshall's *N. uruguayensis* has been re-named *N. marshalli* by Schenck (1939, Jour. Paleont., vol. 13, pp. 29-30).

NUCULANIDAE

Nuculana (Saccella) karlmartini, new species — Pl. 1, figs. 11-17; Pl. 2, figs. 1-4

1888. *Leda acuta* (Conrad) ?, Schepman [in] Martin, Bericht über eine Reise nach Nederlandisch West-Indien und darauf gegründete Studien, Leiden: II—Geologische Studien, Appendix. Not *Nuculana acuta* Conrad, Amer. Marine Conchology, p. 32, pl. 6, fig. 3, 1832.

Shell small, inflated, equivalve but inequilateral, a little elongate, the beaks slightly forward of the middle. Anterior end well rounded and a little produced, the posterior end prolonged to a moderately acute tip. Ventral margin rounded, the curvature generally a little more pronounced just anterior to the middle, the margin near the anterior end often forming a shallow embayment. Dorsal margin anterior to umbo evenly convex; posterior to the umbo, the margin is slightly concave to nearly straight from the chondrophore to above the farthest tooth, then concave again from there to the posterior tip. Young specimens are less elongate than adults. On the exterior there is a shallow anterior depression running from near the umbo to the base, the depression widening toward the ventral margin; posteriorly there is a narrow, moderately pronounced ridge diverging away from the rim of the escutcheon. Lunule long, narrow, lanceolate, defined by a slightly sunken, feebly impressed groove, the lunular edges of the valves a little raised. The concentric ribs at the summit of the valve end abruptly at the margin of the lunule, the lunule itself marked with faint longitudinal striae and short corrugations running at a right angle to the long axis of the shell. Escutcheon large, deeply sunken, elongate cordate, bordered by a keeled rim over which the concentric ribs of the valves are accented, the ribs continuing with slight obliqueness and somewhat diminished strength on the escutcheon itself. Hinge with a deep, rounded-triangular chondrophore. On specimens 10-12 mm. in length there are 17 to 22 teeth on the hinge anterior to the chondrophore, and 14 to 19 teeth posterior to the chondrophore. The teeth are small and crowded near the chondrophore, longer and

more widely separated away from it, the larger teeth angulately cuspate, the concave sides facing toward the extremities. Pallial line rather distant from the basal margin, the pallial sinus relatively large, subrectangular, and oblique, the apex broadly U-shaped, the connection with the pallial line acute, the re-entrant of the sinus reaching to about a line under the seventh tooth from the end. Anterior adductor scar larger and lower than the posterior. Interior not nacreous, generally smooth and porcelaneous but sometimes with the external ribs reflected through. External sculpture consisting of fairly regular concentric ribs parallel with the ventral margin, and extending to the extremities of the disk as well as on the umbo to near the tip of the beak. The ribs are close together on the umbos, farther apart and often recurved below and, on a specimen 10 mm. in length, there are 35 of them. The interspaces are generally smoothish, although on the anterior end of large specimens there may be faint microscopic radial striae locally.

Dimensions.—Holotype (I473a), a doublet, length 12.2 mm.; height 6.8 mm.; thickness 5 mm. Paratype (I473b), right valve, length 10.2 mm.; height 5.5 mm.; thickness 2.1 mm. Paratype (I473c), left valve, length 11.4 mm.; height 6.8 mm.; thickness 2 mm. Paratype (G473c), left valve, length 4.1 mm.; height 2.6 mm.; thickness 0.8 mm. Paratype (G473d), left valve, length 8.8 mm.; height 4.9 mm.; thickness 2.0 mm. Paratype (G473e), right valve, length 9.5 mm.; height 5.1 mm.; thickness 2.0 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Thirty-eight specimens including fourteen right valves, seventeen left valves, and seven doublets.

Other localities.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Seven specimens including three right valves, two left valves, and two doublets. Upper Mare formation, 115 meters south-southwest of the crossing of Quebrada Mare Abajo and coast road. Two specimens including one right valve and one left valve. Upper mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas. Three specimens including two left valves and one right valve. Playa Grande formation (Maiquetía member) at W-23, north flank of

Punta Gorda anticline. Two specimens including one right valve and one left valve. Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas about 125 meters upstream from junction with Quebrada Las Pailas. Three specimens including one right valve, one left valve, and one doublet.

Comparisons.—Although this is probably the same species as the one identified by Schepman as *Leda acuta* ?, I do not think it is the *Nuculana acuta* of Conrad as that is a smaller shell with more numerous concentric riblets than the Cabo Blanco species. It is true that *N. acuta* is as variable as it is widespread (Miocene to Recent, and from Maryland, U.S.A., to the West Indies as well as, according to Dall (1909, p. 250), from California to Chile in west America, but all of the many specimens of *N. acuta* I have examined at the Academy of Natural Sciences of Philadelphia are smaller and more closely ribbed than *N. karlmartini,* n. sp. Actually, the new species is just as close to the Pleistocene and Recent *N. elenensis* (Sowerby) (see Hertlein and Strong, Zoologica, vol. 25, pt. 4, No. 25, pp. 393-394, pl. 1, figs. 12, 14-19, 22) from the west coast of the Americas, the principal difference being that equivalent-sized forms of *N. elenensis* have fewer teeth on the hinge than *N. karlmartini,* n. sp. The middle Miocene *N. peltella* (Dall) (see Woodring, 1925, p. 16, pl. 1, figs. 4-5) from Bowden, Jamaica, has a more centrally located beak than *N. karlmartini* and is sculptured by more numerous concentric ribs.

Remarks.—*Nuculana* (*Saccella*) *karlmartini,* n. sp. is named in honor of Prof. [Johann] Karl [Ludvig] Martin, eminent Dutch geologist, who visited Venezuela in 1885 while on a scientific mission to the West Indian colonies of the Netherlands, and author of one of the early papers dealing with the geology of the Cabo Blanco area of Venezuela.

Nuculana (Saccella) axelolssoni, new species Pl. 2, figs. 5-10

Shell small, a little inflated, elongate-lenticular, equivalve but inequilateral, the beaks a little forward of the middle. Anterior end well rounded and a little produced, the posterior end tapering to a slightly blunted point. Ventral margin rounded except near the

anterior end where it may be shallowly sinuate. Dorsal margin anterior to umbo evenly convex; posterior to the umbo, the margin representing the edge of the valve is somewhat raised to about a point over the farthest tooth on the hinge, and a little concave therefrom to the posterior tip. On the exterior of the valve there is a slight radial depression near the anterior end, the depression widening toward the ventral margin; posteriorly there is also a radial depression bounded by the elevated rim of the escutcheon and by a feeble ridglet extending from the beak to the basal margin. Lunule long, narrow, lanceolate, defined by a feebly impressed groove; the concentric ribs of the valve terminate in strength at the lunular groove but continue weakly on the lunule itself which is, however, marked with short corrugations running at a right angle to the long axis of the shell. Escutcheon large, depressed, elongate cordate, bordered by a keeled rim over which the concentric ribs of the valve are accentuated, the ribs continuing with slight obliqueness and diminished strength on the escutcheon itself. Hinge with a fairly deep, small, more or less triangular chondrophore. On 2 specimens, each about 6 mm. in length, there are, including the crowded ones near the chondrophore, 17 teeth anterior to the chondrophore and 12 teeth posterior to the chondrophore. The teeth are longer and larger toward the ends of the hinge and are angulately cuspate, the concave sides facing toward the extremities. The pallial line and pallial sinus are not visible, nor are the adductor scars clear. Interior not nacreous, gently corrugated by the external ribs which are reflected through. External sculpture consisting of concentric ridges which are fine and close together on the umbos, farther apart, and subequally spaced below. The beak itself is smooth. On the disk proper the ridges tend to be recurved and rounded, but in the depressed areas fore and aft, the ridges are a little narrower and sharper. On the keel of the escutcheon there is often a short concentric riblet between the main ones, the former becoming obsolescent in the posterior radial depression. On specimens 6, 7, and 8 mm. long there are, respectively, 18, 22, and 23 concentric riblets. The interspaces are generally smoothish, although there may be a narrow zone adjacent to the depressions with a few very fine short radial threads.

Dimensions.—Holotype (G474a), left valve, length 6.3 mm.; height 3.5 mm.; thickness 0.8 mm. Paratype (G474b), right valve, length 4.5 mm.; height 2.4 mm.; thickness 0.8 mm. Paratype (G474c), immature left valve, length 2.4 mm.; height 1.3 mm.; thickness 0.3 mm.

Type locality.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Three specimens including two left valves and one right valve.

Other localities.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Eight specimens including five right valves and three left valves.

Comparisons.—This species is similar to *N. karlmartini,* n. sp. but is not so plump and has fewer concentric ridges. The closest Recent shell is the Eastern Pacific *N. impar* (Pilsbry and Lowe) (1932, pp. 106-107, pl. 17, figs. 3-6) from Mexico to Costa Rica, but on *N. impar* the ribs become closer together from the middle of the valve to the ventral margin whereas on the Venezuelan *N. axelolssoni,* n. sp. the ribs are more or less equally spaced from the middle down. The closest fossil species are *N. dodona* (Dall) (1898, pp. 589-590, pl. 32, fig. 6) and *N. trochilia* (Dall) (1898, p. 590, pl. 32, figs. 4, 12), both from the middle Miocene of Florida. *N. dodona* is characterized by "even, high, blunt-edged, slightly recurved lamellae, with deeply excavated, wider interspaces, which are striated by lines of growth," but on *N. axelolssoni* the ribs are less numerous and less elevated, and the interspaces are not spirally striate. On *N. trochilia* the keel of the escutcheon is much less strongly ribbed than on the new Venezuelan species.

Remarks.—The new species is named in honor of Axel A. Olsson in recognition of his contributions to American paleontology over a span of nearly half a century. Happily, his work continues with unabated vigor.

Nuculana (Saccella) marella, new species Pl. 2, figs. 11, 12

Shell small, thin, moderately inflated, inequilateral, the dorsal margin and forward end of the valve broken away, the posterior

end rostrate. Posterior dorsal margin convex to a little beyond the farthest tooth on the hinge, sinuate therefrom to the extremity. Ventral margin gently rounded forward from the posterior depression. Posterior depression caret-shaped, forming an angle of 37 degrees, and extending from the posterior side of the umbo to the basal margin. The ridge bordering the depression is smooth, relatively broad and high, prolonged somewhat at the base, the termination subacute. The rise of the disk at the forward side of the depression is gentle. Escutcheon narrowly cordate, relatively high and thin at the valve edge, sunken a little adjacent to the posterior ridge, defined from the ridge by a feebly impressed groove, and marked by microscopic, hardly discernible oblique striae. Hinge with about six teeth posterior to the beak, the teeth increasing in size toward the far end. Exterior of shell sculptured by low rounded prominent concentric ribs (estimated at 18 in all), the ribs smaller and closer together on the umbo than below, where, from about the middle down, they are about equal in size and spacing. The ribs are obsolescent in the posterior depression and seem absent or evanescent on the posterior ridge bordering the escutcheon. The interior is thinly enameled in part, smoothly corrugated by the impressions of the external ribs. The pallial line and pallial sinus are not visible.

Dimensions.—Holotype (F475a), broken right valve, length 1.3 mm.; width 0.9 mm.

Type locality.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One broken right valve, the holotype.

Remarks.—The seeming prolongation of the posterior ridge may perhaps be due to breakage of the ventral margin. In other respects the shell resembles *N. axelolssoni,* n. sp., and it might turn out that it is an immature specimen of that species. However, the posterior depression diverges much more than that of *N. axelolssoni* and the posterior ridge bordering the depression is completely smooth whereas on *N. axelolssoni,* n. sp. and *N. karlmartini,* n. sp. the ridge is sculptured by sharp concentric ridges. Until more specimens are available of this small shell it seems best to consider it distinct.

Nuculana (Saccella) species Pl. 2, fig. 13

Illustrated is the internal filling of a left valve. The shell is small, inflated, a little inequilateral, somewhat prolonged posteriorly. There is a fairly pronounced radial depression near the posterior end and the merest suggestion of an anterior one. The beak is relatively high, and there are at least 11 anterior and at least 10 posterior teeth on the hinge. The anterior dorsal margin is slightly convex, the posterior dorsal margin slightly concave, the ventral margin of the disk gently rounded.

Dimensions.—Figured specimen O476a (extremities broken away), length 4.5 mm.; height 2.9 mm.

Locality.—Playa Grande formation (Catia member) near W-22, on dip slope 100 meters west of Costa fault. One specimen.

Remarks.—The mold is not dissimilar to that of *N. karlmartini,* n. sp. but without more to go on the species must remain indeterminate.

Nuculana (Jupiteria ?) species Pl. 23, fig. 1

The internal filling is of a small plump subtriangular shell with a high umbo. The dorsal anterior margin is gently convex, the dorsal posterior margin slightly concave with a somewhat more inclined slope than the anterior. Basal margin evenly rounded. Posterior end of valve subtruncate. There are about 13 teeth on the hinge anterior to the beak, but the posterior ones are missing.

Dimensions.—Specimen O476b, left valve, length 4.5 mm.; height 3.2 mm.

Locality.—Playa Grande formation (Catia member) near W-22, on dip slope 100 meters west of Costa fault. One specimen.

Remarks.—This internal mold suggests a similarity to *N. bowdenensis bowdenensis* (Woodring) (1925, Carnegie Inst. Washington, Publ. No. 366, p. 19, pl. 1, figs. 11-12) from the middle Miocene of Jamaica, but until better Venezuelan specimens are available a definitive determination cannot be made.

Adrana cf. **tellinoides** (Sowerby) Pl. 2, figs. 14-15

1815. *Nucula tellinoides* Sowerby, The Genera of Recent and Fossil Shells, *Nucula,* vol. 1, pl. 82, fig. 2. Cumaná, Venezuela.

1828. *Arca tellinoides* (Sowerby), Wood, Index Testaceologicus, Supplement, p. 6, pl. 2, *Arca,* fig. 5b.
1866. *Leda tellinoides* (Sowerby), Thes. Conchyl., vol. 3, p. 108, pl. 227, fig. 36.
1939. *Nuculana tellinoides* (Sowerby), Rehder, Nautilus, vol. 53, No. 1, p. 17.

Shell thin, translucent, compressed, long elliptical, subequilateral. Anterior and posterior dorsal margins forming an angle of about 170 degrees, the anterior margin straight, the posterior gently concave. Beak small, glassy, smooth, subcentral, scarcely projecting. Escutcheon long and narrow, sunken below the bordering keel-like ridge, the valve margin a little elevated, thin, and strongly sloping. The ridge bordering the escutcheon is low, narrow, sharply rounded, marked with numerous sharp regularly disposed threads which are curved near the umbo but become more and more slanted toward the posterior; these threads are the continuations of the concentric threads on the disk but are more accentuated than they are on the valve proper; on the escutcheon itself the threads are present near the beak but become obsolescent distally. Lunule long and extremely narrow, also sunken in some measure below the anterior dorsal margin of the disk. Chondrophore large but shallow, broadly triangular, bisected by a vertical resilial groove a little aft of the middle. Teeth of hinge numerous, thin, erect, sharply pointed, smaller and closer near the chondrophore, a little more widely spaced and longer toward the extremities of the hinge. The total number of teeth is not known as the ends of the single specimen are broken away, but on this right valve there remain about 30 posterior teeth and 33 anterior teeth. Interior of valve glossy, the pallial line and pallial sinus not visible. Exterior of valve sculptured by sharp fine concentric threads extending from the umbo (the beak proper is completely smooth and hyaline) about halfway down the disk, the threads crowded on the umbo but widening progressively toward the ventral margin. There are approximately 25 of these concentric threads, all but the bottom 3 shallowly encircling the disk from the border of the lunule to the escutcheon. The three lowest threads extend from the lunule to about the middle of the disk and there become obsolescent. On the umbo there are three or four threads which splay off the concentric ones as straight rays roughly parallel with the posterior dorsal keel but extending only a short distance

across the disk. Below the bottommost concentric thread there are broad concentric bands parallel with threads, the bands probably representing former threads which have been worn down. The ventral margin of the valve is broken away as are the anterior and posterior ends. There is a barely perceptible radial furrow or depression diverging from the anterior side of the umbo toward the anterior ventral margin and possibly a similar posterior furrow radiating to the posterior ventral margin below the ridge bordering the escutcheon. The posterior dorsal area below the posterior ridge is smooth.

Dimensions.—Figured specimen T544a, right valve, (extremities and base missing), length 9.5 mm.; height 2.7 mm.

Locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One incomplete right valve.

Remarks.—Sowerby's 1866 English description of *A. tellinoides* was as follows:

> Elongated, lanceolated-elliptic, slightly flexuous, bending down a little in front, and inclining upwards a little behind; thin, glossy, snow-white, compressed; smooth behind, elsewhere striated; striae curved and slanting in the middle, almost concentric in front. Sides very nearly equal, gradually and nearly equally tapering to either extremity; anterior end rotundately peaked; posterior end angular above, rounded below. Dorsal slopes very slight; the front one plano-convex, the hinder one barely subretuse. Ventral margin subarcuated throughout, with an extremely slight anterior, and no posterior retusion. Dorsal areas inconspicuous; the hinder one impressed, its edges crenulated. Teeth very numerous on both sides.—Besides the longitudinal striae, a few symmetrical lines of growth may be discerned beneath the front dorsal edge, and a few still more indistinct ones (but no striae) on the opposite side. In mature examples similar lines are likewise manifest in the middle, near the lower margin.

The immature Cabo Blanco fossil is exceedingly close to the Recent *A. tellinoides* originally described from Cumaná, Venezuela, but whether it is the same or not cannot be determined without more material. The fossil closely resembles Sowerby's illustration, but comparison with an adult Recent specimen from Cumaná in the collection at the Academy of Natural Sciences of Philadelphia (No. 43333) shows the dorsal margin of the Cumaná shell to be gently convex overall whereas on the Cabo Blanco fossil the margins diverge at an angle of about 170 degrees. It is not unlikely, however,

that the configuration of the dorsal margin becomes more rounded with growth.

Comparisons.—Among other Recent species of *Adrana,* the Cabo Blanco fossil is closest perhaps to *A. notabilis* Rehder (1939, Nautilis, vol. 53, No. 1, pp. 16-17, pl. 6, figs. 4, 12) from the Paraguaná Peninsula, Venezuela, and is reminiscent of *A. scaphoides* Rehder (1939, Nautilus, vol. 53, No. 1, pp. 17-18, pl. 6, fig. 5) from near Cartagena, Colombia. Inasmuch as the ventral margin is broken away on *A.* cf. *tellinoides* (Sby.) a comparison by shape cannot be made but the angle of the hinge line is a little more acute on *notabilis* (165 degrees compared with 170 degrees on *A.* cf. *tellinoides*). The dorsal areas of *A. notabilis* are smooth whereas on *A.* cf. *tellinoides* not only is the keel of the escutcheon heavily threaded but there are short strong corrugations on the escutcheon itself near the beak, the corrugations running at right angles to the keel and becoming obsolescent away from the beak. Furthermore the concentric ribbing on the umbo is sharper on *A.* cf. *tellinoides* than on *A. notabilis.* The sculpture of *A. scaphoides* Rehder consists of "fine concentric grooves which cut slightly diagonally across the growth lines," and *A. scaphoides* lacks the keel-like ridge bordering the escutcheon. Among fossil species, the Cabo Blanco shell is somewhat similar to *A. montserratensis* (Maury) (1925, pp. 176-177, pl. 12, fig. 1) from the late Miocene Springvale deposits of Trinidad, but *A. montserratensis,* in addition to being differently sculptured, has a virtually horizontal hinge before and after the beak. *A. quitanensis* Olsson (1922, p. 346, pl. 18, fig. 29) from the middle Miocene of Costa Rica may be distinguished from *A.* cf. *tellinoides* (Sby.) by the anterior location of the beaks. Nine Recent species of *Adrana* have been described from tropical west American waters (see Hertlein and Strong, 1940, Zoologica, vol. 25, pt. 4, No. 25, pp. 406-412), but the Venezuelan shell appears to be distinct from all of them.

ARCIDAE

Arca (Arca) zebra (Swainson) Pl. 2, figs. 16-17

1831. *Byssoarca zebra* Swainson, Zoological Illustrations, No. 26, pl. 118 (*ex parte*). Not Reeve 1844.

1845. *Arca barbadensis* d'Orbigny, [in] La Sagra, Hist. Fís. Polít. Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 345.

1847. *Arca occidentalis* Philippi, Abbildungen und Beschreibungen Conchylien, vol. 3, p. 14, pl. 176, figs. 4a-c.
1853. *Arca barbadensis* d'Orbigny, [in] La Sagra, Hist. phys. polit. nat. l'Ile de Cuba, Mollusques, vol. 2, pp. 321-322.
1864. *Arca noae* Linnaeus, Krebs, The West Indian Marine Shells, p. 125. Not of Linnaeus.
1864. *Arca occidentalis* Philippi, Krebs, The West Indian Marine Shells, p. 125.
1864. *Arca noae* Linnaeus, Guppy, Sci. Assoc. Trindad, Trans., p. 36, Not of Linnaeus
1866. *Arca noae* Linnaeus, Guppy, Geol. Soc. London Quart. Jour., vol. 22, p. 293. Not of Linnaeus.
1867. *Arca noae* Linnaeus, Guppy, Sci. Assoc. Trinidad, Proc., p. 163. Not of Linnaeus.
1871. *Arca noae* Linnaeus, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 132. Not of Linnaeus.
1874. *Arca occidentalis* Philippi, Guppy, Geol. Mag., decade 2, vol. 1, p. 343.
1876. *Arca occidentalis* Philippi, Guppy, Geol. Soc. London Quart. Jour., vol. 32, p. 531.
1878. *Arca zebra* Swainson, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 262.
1878. *Arca occidentalis* Mörch, Catalogue of West-India Shells, p. 15.
1885. *Arca noae* Linnaeus, Smith, Voyage H. M. S. Challenger, Zoology, vol. 13, p. 258 (part).
1886. *Arca noae* Linnaeus, Dall, Mus. Comp. Zool., Bull., vol. 12, p. 243. Not of Linnaeus.
1889. *Arca Noae* Linnaeus, Dall, U. S. Nat . Mus., Proc., vol. 12, No. 773, p. 259. Not of Linnaeus.
1889. *Arca Noae* Linnaeus, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 119, 141. Not of Linnaeus.
1891. *Arca occidentalis* Philippi, Kobelt, Syst. Conchylien-Cabinet, *Arca,* p. 66, pl. 19, figs. 1-4.
1891. *Arca noae* Linnaeus, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46. Not of Linnaeus.
1898. *Arca occidentalis* Philippi, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 620.
1901. *Arca occidentalis* Philippi, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 459-460.
1903. *Arca noae* Linnaeus, Dall, U. S. Nat. Mus., Bull. 37, p. 40. Not of Linnaeus.
1907. *Arca zebra* (Swainson), Lamy, Jour. Conchyl., vol. 55, pp. 17-19.
1907. *Arca noae* Linnaeus, Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12, p. 186, pl. 35b, figs. 6, 6a. Not of Linnaeus.
1913. *Arca occidentalis* Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1916. *Arca occidentalis* Philippi, Sheldon, Palaeontographica Americana, vol. 1, No. 1, p. 8, pl. 1, figs. 8-11.
1917. *Arca occidentalis* Philippi, Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 327, pl. 29, fig. 3.
1920. *Arca occidentalis* Philippi, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 43.
1922. *Arca occidentalis* Philippi, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 189, 193, 199, 353-354, pl. 22, fig. 1.
1923. *Arca occidentalis* Philippi, Remington, Nautilus, vol. 35, No. 4, p. 121.
1923. *Arca occidentalis* Philippi, Clench, Nautilus, vol. 37, No. 2, p. 55.
1925. *Arca* (*Arca*) *occidentalis* Philippi, Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 29-30, pl. 2, figs. 8, 9.

1925. *Arca occidentalis* Philippi, Maury, Bull. Amer. Paleont., vol. 25, No. 42, pp. 186-187, pl. 1, figs. 1, 2.
1926. *Arca occidentalis* Philippi, Gardner, U. S. Geol. Sur., Prof. Paper 142-A, pp. 23-24.
1926. *Arca occidentalis* Philippi, Weisbord, Nautilus, vol. 39, No. 3, p. 82.
1927. *Arca* (*Arca*) *occidentalis* Philippi, F. Hodson, H. K. Hodson, and Harris, Bull. Amer. Paleont., vol. 13, No. 49, p. 2.
1929. *Arca* (*Arca*) *occidentalis* Philippi, Anderson, California Acad. Sci., Proc., ser. 4, vol. 18, No. 4, pp. 147-148.
1932. *Arca* (*Arca*) *occidentalis* Philippi, Mansfield, Florida State Geol. Sur., Bull. No. 3, p. 41, pl. 2, fig. 2.
1936. *Arca* (*Navicula*) *occidentalis* Philippi, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 39.
1936. *Arca* (*Navicula*) *occidentalis* Philippi, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 4, p. 160.
1936. *Arca occidentalis* Philippi, Richards, Nautilus, vol. 49, No. 4, p. 133.
1937. *Arca occidentalis* Philippi, Smith, East Coast Marine Shells, p. 27, pl. 3, fig. 7.
1938. *Arca occidentalis* Philippi, Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 2, p. 1290.
1939. *Arca occidentalis* Philippi, McLean, Nautilus, Vol. 49, No. 4, p. 116.
1939. *Navicula zebra* (Swainson), Bartsch and Rehder, Smithsonian Miscel. Collections, vol. 98, No. 10, p. 18.
1940. *Arca occidentalis* Philippi, Smith, World-wide Sea Shells, p. 90, fig. 1249.
1940. *Arca occidentalis* Philippi, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Arca occidentalis* Philippi, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1943. *Arca* (*Arca*) *zebra* (Swainson), Reinhart, Geol. Soc. Amer., Spec. Papers No. 47, p. 6.
1943. *Arca* (*Arca*) *occidentalis* Philippi, Hertlein and Strong, Zoologica, vol. 43, pt. 3, No. 19, p. 155.
1944. *Arca occidentalis* Philippi, Hackney, Nautilus, vol. 58, No. 2, p. 56.
1945. *Arca occidentalis* Philippi, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. Ser., vol. 14, p. 77.
1946. *Arca* (*Navicula*) *occidentalis* Philippi, Jaume, Soc. Malac. "Carlos de La Torre" Rev., vol. 4, No. 3, p. 98.
1949. *Arca* (*Navicula*) *occidentalis* Philippi, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 8.
1951. *Arca occidentalis* Philippi, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 13, pl. 1, fig. 7.
1952. *Arca occidentalis* Philippi, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180.
1953. *Arca occidentalis* Philippi, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 32.
1954. *Arca zebra* (Swainson), Abbott, American Seashells, p. 342, pl. 27n.
1955. *Arca zebra* (Swainson), Perry and Schwengel, Marine Shells of the Western Coast of Florida, 34, pl. 2, figs. 9a, b.
1958. *Arca* (*Arca*) *occidentalis* Philippi, Keen, Sea Shells of Tropical West America, p. 26.
1958. *Arca zebra* (Swainson), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Arca zebra* (Swainson), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 109.
1959. *Arca occidentalis* Philippi, Rodriguez, Bull. Marine Sci. Gulf and Caribbean, vol. 9, No. 3, p. 277.

1959. *Arca zebra* (Swainson), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.

1961. *Arca zebra* (Swainson), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 298.

1961. *Arca zebra* (Swainson), Warmke and Abbott, Caribbean Seashells, p. 157, pl. 30L.

The Recent Venezuelan shell is inequilateral, subrectangular, and somewhat eccentric. The anterior end is subtruncate, slightly to markedly narrower than the posterior, the posterior end angulately rounded at the curve with the ventral margin, the upper part of the posterior margin moderately concave and a little alate. The byssal gape is asymmetric, subcentral, shallowly to strongly embayed. Posterior rostration moderately broad, shallowly depressed. Cardinal area flat, moderately wide, marked with widely separated converging ligamental grooves of which the innermost pair or two may meet under the beak to form a somewhat inequilateral caret. Hinge straight, with numerous even teeth. Muscle scars high, the posterior large, broadly oval, and oriented parallel with the long axis of the valve, the anterior one smaller and subtriangular with a rounded basal margin. Ventral margin feebly crenulate. Exteriorly there is a radially depressed area diverging obliquely from the umbo and widening to the basal margin, the depression slight to pronounced. Within, the depression is reflected by a convexity of the interior. Sculpture consisting of radial riblets and interstitial threads, these often rendered crenulate by fine concentric growth grooves. The external ground color is straw with broad, zigzag, zebralike stripes of dark brown. The interior is mahogany, mottled with dull cream. The periostracum is a dull brown to straw-colored fibrous mat, the fibers distinctly radial.

Dimensions.—Figured specimen A369aa, right valve, length 50 mm.; height from umbo to ventral margin 20.3 mm.; thickness 12.2 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Four specimens including three right valves and one large fragment.

Remarks.—The Mediterranean analogue is *A. noae* Linnaeus (Syst. Nat., ed. 12, p. 1140). That species is more evenly rectangular, exhibits less of a torque effect, and the basal margin is more strongly

crenulate than that of *A. zebra.* The west American and Eastern Pacific analogue is the Pliocene to Recent *A. pacifica* (Sowerby) (see Reinhart, 1943, pp. 26-27, pl. 14, figs. 3, 4), but that is more expanded posteriorly than the east American and Western Atlantic *A. zebra.*

Range and distribution.—*Arca zebra* is a common Recent species which attaches itself to rocks with its byssus. It has been found from Cape Hatteras, North Carolina, to Brazil, at depths to 32 fathoms. In the Pleistocene it has been reported from Florida, the Yucatan Peninsula of Mexico, Cuba, the Panama Canal Zone, St. Eustatius, Curaçao, Blanquilla, and Aruba. Pliocene representatives are recorded from the Caloosahatchee marl of Florida and from Matura, Trinidad. In the upper Miocene it is found in Trinidad, and in the middle Miocene it occurs in Venezuela, Colombia, Jamaica, the Dominican Republic, Costa Rica, and Florida.

Arca (Arca) zebra abisiniana, new subspecies Pl. 2, figs. 18-19

This form is much the same as *A. zebra zebra* Swainson except that it is wanting in the broad radial depression extending from the umbo to the base. The exterior of the valve, instead of being depressed a little anterior to the middle as on the typical *A. zebra,* is evenly and rather highly inflated throughout, and the slight byssal gape is situated far forward rather than submedially. In all other respects the present shell seems the same as *A. zebra zebra,* and although it may turn out that the shell in question is merely an individual variant, it seems best to give it a subspecific designation until more specimens become available.

Dimensions.—Holotype (D368a), right valve broken away posteriorly, length 61 mm., height 34 mm.; thickness 20.5 mm.

Type locality.—Abisinia formation at W-30, eastern edge of Playa Grande village. One right valve, the holotype.

Arca (Arca) imbricata Bruguière Pl. 3, figs. 1-8

1792. *Arca imbricata* Bruguière, Encycl., Méth., vol. 1, p. 98, No. 3. Refers to Lister, pl. 367, fig. 207 from Jamaica.

1819. *Arca umbonata* Lamarck, An. sans Vert., vol. 6, p. 37. Refers to Lister, pl. 367, fig. 207 from Jamaica.

1835. *Arca umbonata* Lamarck, An. sans Vert., ed. 2, vol. 6, p. 432.

1842. *Arca americana* d'Orbigny, [in] La Sagra, Hist. phys. polit. nat. l'Ile de Cuba, vol. 2, Mollusques, pp. 317-318, pl. 27, figs. 1-2. Not of Gray.
1844. *Arca imbricata* Bruguière, Reeve, Conch. Icon., vol. 2, pl. 11, fig. 73.
1847. *Arca umbonata* Lamarck, Philippi, Abbildungen und Bescreibungen Conchylien, vol. 3, p. 13, pl. 17b, figs. 3a-c.
1864. *Arca umbonata* Lamarck, Krebs, The West Indian Marine Shells, p. 126.
1870. *Arca umbonata* Lamarck, Dunker, Novitates Conchologicae, p. 131, pl. 44, figs. 5-7.
1873. *Arca imbricata* Bruguière, Gabb, Amer. Philos. Soc., Trans., vol. 15, p. 254 (part).
1878. *Arca umbonata* Lamarck, Mörch, Catalogue of West-India Shells, p. 15.
1879. *Arca umbonata* Lamarck, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 261.
1881. *Arca imbricata* Bruguière, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 378.
1885. *Arca imbricata* Bruguière, Smith, Voyage H.M.S. Challenger, Zoology, vol. 13, p. 259.
1886. *Arca umbonata* Lamarck, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 243.
1887. *Arca imbricata* Bruguière, Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 118.
1889. *Arca imbricata* Bruguière, Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1890. *Arca imbricata* Bruguière, Smith, Linnaean Soc. London, Jour., Zoology, vol. 20, p. 499.
1891. *Arca umbonata* Lamarck, Kobelt, Syst. Conchylien-Cabinet, *Arca,* p. 63, pl. 18, figs. 3-6.
1891. *Arca imbricata* Bruguière, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1895. *Arca* imbricata Bruguière, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1895. *Arca imbricata* Bruguière, von Ihering, Jour. Conchyl., vol. 43, p. 212.
1898. *Arca umbonata* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 620, 659.
1900. *Arca umbonata* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pl. 38, figs. 4, 4a.
1901. *Arca umbonata* Lamarck, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 460.
1907. *Arca imbricata* Bruguière, Lamy, Jour. Conchyl., vol. 55, pp. 26-27.
1913. *Arca umbonata* Lamarck, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1913. *Arca imbricata* Bruguière, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1915. *Arca umbonata* Lamarck, Dall, U. S. Nat. Mus., Bull. 90, p. 118, pl. 17, figs. 6, 8.
1915. *Arca imbricata* Bruguière, Bartsch, U. S. Nat. Mus., Bull. 91, p. 230.
1916. *Arca umbonata* Lamarck, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 8-9, figs. 12-17.
1917. *Arca umbonata* Lamarck, Maury, Bull. Amer. Paleont., vol. 5, No. 29, pp. 327-328, pl. 30, fig. 11.
1919. *Arca umbonata* Lamarck, Vaughan, U. S. Nat. Mus., Bull. 103, p. 564.
1920. *Arca umbonata* Lamarck, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 43-44.
1920. *Arca umbonata* Lamarck, Maury, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 6.
1921. *Arca umbonata* Lamarck, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, No. 2, p. 403.

1922. *Arca umbonata* Lamarck, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, p. 354, pl. 22, fig. 2.
1924. *Arca umbonata* Lamarck, Emery, Nautilus, vol. 38, No. 2, p. 60.
1925. *Arca umbonata* Lamarck, Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 187, pl. 3, fig. 6; pl. 8, fig. 4.
1926. *Arca umbonata* Lamarck, Gardner, U. S. Geol. Sur., Prof. Paper 142-A, pp. 24-25.
1926. *Arca umbonata* Lamarck, Weisbord, Nautilus, vol. 39, No. 3, p. 82.
1933. *Arca imbricata* Bruguière, Trechmam, Geol. Mag., vol. 70, No. 823, p. 34.
1935. *Arca umbonata* Lamarck, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Arca (Navicula) umbonata* Lamarck, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 39.
1936. *Arca (Navicula) umbonata* Lamarck, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 4, p. 160.
1936. *Arca umbonata* Lamarck, McLean, Nautilus, vol. 49, No. 4, p. 116.
1937. *Arca (Navicula) umbonata* Lamarck, Smith, East Coast Marine Shells, pp. 27-28, pl. 3, fig. 1.
1938. *Arca umbonata* Lamarck, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1290.
1939. *Navicula umbonata* (Lamarck), Bartsch and Rehder, Smithsonian Miscel. Collections, vol. 98, No. 10, p. 18.
1940. *Arca umbonata* Lamarck, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Arca umbonata* Lamarck, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey" Mem., vol. 16, No. 1, p. 38.
1944. *Arca umbonata* Lamarck, Hackney, Nautilus, vol. 58, No. 2, p. 56.
1945. *Arca umbonata* Lamarck, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 277.
1946. *Arca umbonata* Lamarck, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98.
1949. *Arca umbonata* Lamarck, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 8.
1951. *Arca umbonata* Lamarck, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 14, pl. 2, fig. 1.
1952. *Arca umbonata* Lamarck, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180, pl. 6, figs.13-14.
1953. *Arca (Navicula) imbricata umbonata* Lamarck, Haas, Fieldiana - Zoology, vol. 34, No. 20, p. 203.
1953. *Arca (Arca) umbonata* Lamarck, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 32.
1954. *Arca umbonata* Lamarck, Abbott, American Seashells, p. 342, pl. 27j.
1955. *Arca umbonata* Lamarck, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 35, pl. 2, fig. 10.
1958. *Arca umbonata* Lamarck, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Arca umbonata* Lamarck, Moore, Nautilus, vol. 71, No. 4, pp. 126, 128.
1958. *Arca imbricata* Bruguière, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 109.
1958. *Arca umbonata* Lamarck, Moore, Inst. Marine Sci., vol. 5, p. 154.
1959. *Arca umbonata* Lamarck, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.
1961. *Arca imbricata* Bruguière, van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. 8, vol. 64, No. 2, p. 298.
1961. *Arca imbricata* Bruguière, Warmke and Abbott, Caribbean Seashells, p. 158, pl. 30e.

Shell somewhat distorted, narrowly to broadly rhomboidal, inflated, with a high sharp posterior ridge. Anterior end hardly rounded to subtruncate, the posterior angulately concave in greater or lesser degree. Byssal gape in front of middle, asymmetric, generally strongly embayed. Cardinal area broad, flattish, engraved with one or two sets of converging ligamental grooves below the beak, the grooves generally, but not always absent on the rest of the area. If there are two sets of grooves, the outer converges to a caret under the beak proper, whereas on the inner set the posterior groove is shorter and does not join the anterior one; if there is one set of grooves the posterior is invariably somewhat shorter than the anterior and does not join the anterior to form an apex to the caret. Beaks high, oblique, appressed on top, situated well forward. Hinge straight and narrow, widening slightly and gradually toward the extremities, the teeth numerous, equally spaced, and small. Exterior with a broad radial depression extending from the umbo to the byssal gape of the ventral margin. Surface closely sculptured by radial riblets which are crossed by concentric sublamellate ridges producing a reticulate pattern and rendering the riblets beadlike. On the posterior wing there are five or six widely separated low broad ribs which are made crenulate, nodulous, or scabrous by concentric growth laminae or striae. Posterior muscle scar large, broadly oval, and oriented in the long direction of the shell, the anterior scar a little smaller and roundly subtrigonal in outline. The Recent shells are purplish brown and cream-colored without, light purple within. The periostracum is shaggy, fibrous, and thick, standing out in long, radially striate tufts along the posterior ridge.

Dimensions.—Specimen A369a, right valve, length 50 mm.; height from umbo to ventral margin 24.5 mm.; thickness 16 mm. Specimen A369b, young left valve, length 26.7 mm.; height from umbo to ventral margin 16 mm.; thickness 9.9 mm. Specimen C369a, right valve, length 66.6 mm.; height from umbo to ventral margin 33.6 mm.; thickness 18 mm. Specimen A371a, left valve, length 37.8 mm.; height from umbo to ventral margin 32.3 mm.; thickness 19.8 mm. Specimen D371a, left valve, length 40 mm.; height from umbo to ventral margin 29 mm.; thickness 15.8 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club,

Distrito Federal. Forty specimens including twenty-two left valves, seventeen right valves, and one doublet. Abisinia formation at W-30, eastern edge of Playa Grande village. Two specimens including one left valve and one right. La Salina, west of Puerto Cabello, State of Carabobo. Five specimens including three left valves and two right valves.

Range and distribution.—The living *A. imbricata* Bruguière is a common species in the Western Atlantic, ranging from Cape Hatteras, North Carolina, to Brazil, in less than 50 fathoms. The species has also been recorded from Senegal, Malaya, and near Cape York, North Australia, in 25 fathoms. Of the last-named occurrence, Edgar A. Smith (1885) had this to say in his *Challenger* report: "There should be, one would think, and perhaps in reality there is, a difference between the West Indian and Australian shells which appear to belong to this species, but at present I am unable to discover it." In 1890, Smith reiterated this opinion, stating that "This species was also obtained by the 'Challenger' Expedition at Fernando Noronha; and other examples were dredged near Cape York, N. Australia. This seems a remarkable distribution; still, as far as I can discover, there appears to be no difference in the shells." Bartsch (1915, p. 230) listed *A. imbricata* as having been obtained by Col. Turton at Port Alfred, South Africa. Present-day authorities consider the Indo-Pacific form to be *A. ventricosa* Lamarck (1819, An. sans Vert., vol. 6, p. 38).

As a fossil *A. imbricata* has been reported from the following areas:

Pleistocene—Florida, Cuba, St. Kitts, St. Eustatius, Panama Canal Zone, Barbados, Venezuela; Pliocene—Florida, Trinidad, Costa Rica; middle Miocene—Florida, Dominican Republic, Costa Rica; lower Miocene—Florida, Puerto Rico.

Barbatia (Barbatia) candida (Helbling) Pl. 3, figs. 9-14; 15, 16

1779. *Arca candida* Helbling, Abh. Privatgesell. Bohm, vol. 4, p. 129, pl. 4, figs. 39, 40.
1791. *Arca candida* Gmelin, Syst. Nat., ed. 13, p. 3311. Refers to Syst. Conchylien-Cabinet, vol. 7, p. 195, pl. 55, fig. 542.
1791. *Arca jamaicensis* Gmelin, Syst. Nat., vol. 6, p. 3312.
1797. *Arca Helblingii* Bruguière, Encycl. Méth., p. 195.
1845. *Arca candida* Chemnitz, d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 344.

1864. *Arca candida* Helbling, Krebs, The West Indian Marine Shells, p. 124.
1873. *Barbatia Bonaczyi* Gabb, Amer. Philos. Soc., Trans., vol. 15, pp. 254-255.
1878. *Arca candida* Chemnitz, Arango y Molina, Contribución al la Fauna Malacológica Cubana, p. 263.
1878. *Arca candida* Helbling, Mörch, Catalogue of West-India Shells, p. 15.
1889. *Arca candida* Chemnitz, Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1895. *Barbatia candida* Chemnitz, Gregory, Geol. Soc. London, Quart. Jour. vol. 51, p. 241.
1898. *Barbatia (Calloarca) candida* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 626.
1901. *Arca (Barbatia) candida* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 460.
1907. *Arca nivea* Chemnitz, Lamy, Jour. Conchyl., vol. 55, p. 59 (part).
1916. *Arca candida* Gmelin, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 16-17.
1920. *Arca* (*Calloarca*) *candida* Gmelin, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 44-45.
1921. *Arca bonaczyi* Gabb, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, pt. 2, p. 403, pl. 39, figs. 1, 2.
1921. ? *Barbatia cf. bonaczyi* Gabb, Hubbard, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, pp. 106-107, pl. 14, fig. 4.
1925. *Barbatia* (*Calloarca*) *candida* (Gmelin), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 194-195, pl. 8, fig. 6.
1925. *Arca candida* Gmelin, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Arca* (*Barbatia*) *candida* Gmelin, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Arca* (*Barbatia*) *candida* Gmelin, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, pt. 3, p. 160.
1937. *Arca candida* Guilding, Smith, East Coast Marine Shells, p. 28, pl. 4, fig. 3.
1938. *Arca candida* Helbling, Schwengel and Dranga, Nautilus, vol. 52, No. 1, p. 29.
1942. *Barbatia candida* (Helbling), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1945. *Arca candida* Gmelin, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Arca candida* Helbling, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Arca* (*Barbatia*) *candida* Gmelin, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Barbatia*) *candida* Gmelin, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 14-15, pl. 2, figs. 6, 8.
1953. *Arca* (*Cucullaearca*) *candida* Gmelin, Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Barbatia* (*Barbatia*) *candida* (Helbling), Abbott, American Seashells, p. 342, pl. 27r.
1958. *Barbatia candida* (Helbling), Moore, Nautilus, vol. 71, No. 4, pp. 126-128.
1958. *Barbatia candida* (Helbling), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Barbatia candida* (Helbling), Moore, Inst. Marine Sci., vol. 5, p. 154.
1958. *Barbatia* (*Barbatia*) *candida* (Helbling), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 110.
1959. *Barbatia* (*Barbatia*) *candida* (Helbling), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.

1961. *Arca* (*Barbatia*) cf. *candida* Helbling, van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 298.
1961. *Barbatia* (*Barbatia*) *candida* (Helbling), Warmke and Abbott, Caribbean Seashells, p. 158, pl. 30i.

Venezuelan shell of medium size, thin, subrhomboidal to subtrapezoidal, with a slight but broad subcentral radial depression on the lower fourth of the valve. Anterior end gently rounded, the posterior lateral margin oblique, truncate to subtruncate, a little concave immediately below the end of the hinge line, the curve with the ventral margin acute to subacute, the central margin gently sinuous. Byssal gape forward of the middle, hardly embayed. Beaks anterior, low, appressed. Cardinal area relatively narrow, scored with four or five irregular, obtusely angulate ligamental grooves. Posterior rostration moderately wide, a little sunken, generally well defined by the posterior rib. Hinge nearly straight, narrowest a little posterior to the beak, widening slightly and gradually toward the extremities. Inner margin fluted throughout, the flutings lying under the termini of the external ribs, larger and more widely spaced along the posterior and anterior lateral borders, smaller and more numerous on the ventral border. Surface sculptured by fairly numerous, strong, somewhat nodulous radial ribs, most of the ribs single but some of them double, those on the posterior dorsal area more widely separated than the others. Crossing the radials are growth ridges, the ridges low and obscure on the disk but much more pronounced on the anterior and posterior dorsal areas, especially the latter where they form strong elevated ropy crenations on the radial ribs. Color straw without, white within. Periostracum dark brown, shaggy, longest at posterior end.

Dimensions.—Specimen A338a, left valve, length 29 mm.; height 19.5 mm.; thickness 8 mm. Specimen A391al-2, paired valves, length 13.4 mm.; height 7.2 mm.; thickness of attached valves 5.6 mm. Specimen D381a, right valve, length 31 mm.; height (base broken away) 17.9 mm.; thickness 9.6 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Seven specimens including four left valves, one right valve, and two doublets. Abisinia formation at W-30, eastern edge of Playa Grande village. One poorly preserved right valve the identity of which is in doubt.

Remarks.—This species is distinguished from its congeners by the strongly crenate ribs on the posterior dorsal area.

Range and distribution.—Lower Miocene to Recent. Living from North Carolina, U.S.A., to Brazil, in shallow water. Pleistocene of Cuba, St. Eustatius, Barbados, and Venezuela. Pliocene of Trinidad. Middle Miocene of the Dominican Republic. Lower Miocene of Puerto Rico.

Barbatia (Acar) domingensis (Lamarck) Pl. 4, figs. 1-9

1819. *Arca domingensis* Lamarck, An. sans Vert., vol. 7, p. 40. Refers to Lister, pl. 233, fig. 67.
1864. *Arca squamosa* Lamarck, Krebs, The West Indian Marine Shells, p. 126. Not of Lamarck.
1867. *Arca squamosa* Lamarck, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 164. Not of Lamarck.
1874. *Arca squamosa* Lamarck, Guppy, Geol. Mag., decade 2, vol. 1, p. 443. Not of Lamarck.
1878. *Arca domingensis* Lamarck, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Arca domingensis* Lamarck, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 263.
1885. *Arca (Acar) domingensis* Lamarck, Smith, Voyage H.M.S. Challenger, Zoology, vol. 13, p. 265.
1886. *Arca reticulata* Chemnitz, Dall, Mus. Comp. Zool., Bull., vol. 12, p. 242. Not of Gmelin.
1889. *Arca reticulata* Gmelin, Dall, U. S. Nat. Mus., Bull. 37, p. 42. Not of Gmelin.
1889. *Arca reticulata* Gmelin, Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 259. Not of Gmelin.
1891. *Arca gradata* Broderip, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47. Not of Broderip.
1895. *Barbatia (Acar) domingensis* (Lamarck), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1898. *Barbatia (Acar) reticulata* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 629. Not of Gmelin.
1901. *Arca reticulata* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 460. Not of Gmelin.
1907. *Arca plicata* Chemnitz, Lamy, Jour. Conchyl., vol. 55, pp. 80 (part), 83.
1907. *Arca (Barbatia) domingensis* Lamarck, Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12, p. 186.
1913. *Arca reticulata* Gmelin, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496. Not of Gmelin.
1915. *Barbatia (Acar) reticulata* (Gmelin), Dall, U. S. Nat. Mus., Bull. 90, p. 120. Not of Gmelin.
1916. *Arca (Barbatia) reticulata* Gmelin, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 20-21, pl. 4, figs. 8-12. Not of Gmelin.
1917. *Barbatia (Acar) reticulata* (Gmelin), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 330, pl. 30, fig. 16. Not of Gmelin.
1920. *Barbatia (Acar) reticulata* (Gmelin), Maury, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 1, pp. 7-8. Not of Gmelin.

1920. *Barbatia* (*Acar*) *reticulata* (Gmelin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 45. Not of Gmelin.
1921. *Barbatia* (*Acar*) *reticulata* (Gmelin), Hubbard, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 106. Not of Gmelin.
1925. *Barbatia* (*Acar*) *reticulata* (Gmelin), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 195-196, pl. 8, figs. 18, 21. Not of Gmelin.
1925. *Barbatia* (*Acar*) *domingensis* (Lamarck), Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 37-38, pl. 3, figs. 17, 18.
1926. *Barbatia* (*Acar*) *reticulata* (Gmelin), Gardner, U. S. Geol. Sur., Prof. Paper 142-A, p. 27. Not of Gmelin.
1932. *Barbatia* (*Acar*) *domingensis* (Lamarck), Grant, Nautilus, vol. 45, No. 4, p. 128.
1933. *Araca domingensis* Lamarck, Trechmann, Geol. Mag., vol. 70, No. 823, p. 34.
1935. *Arca reticulata* Gmelin, Richards, Jour. Paleont., vol. 9, No. 3, p. 256. Not of Gmelin.
1936. *Arca* (*Acar*) *reticulata* Gmelin, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40. Not of Gmelin.
1936. *Arca* (*Acar*) *reticulata* Gmelin, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 160. Not of Gmelin.
1936. *Arca reticulata* Gmelin, McLean, Nautilus, vol. 49, No. 4, p. 116. Not of Gmelin.
1937. *Arca* (*Acar*) *reticulata* Gmelin, Smith, East Coast Marine Shells, p. 28, pl. 3, fig. 4. Not of Gmelin.
1937. *Barbatia* (*Acar*) *domingensis* (Lamarck), Mansfield, State of Florida Dept. Conserv., Geol. Bull., No. 15, p. 199, pl. 10, fig. 13.
1938. *Arca reticulata* Gmelin, Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 2, p. 1290. Not of Gmelin.
1942. *Barbatia reticulata* (Gmelin), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38. Not of Gmelin.
1944. *Arca reticulata* Gmelin, Hackney, Nautilus, vol. 58, No. 2, p. 56. Not of Gmelin.
1946. *Arca* (*Acar*) *reticulata* Gmelin, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98. Not of Gmelin.
1949. *Arca reticulata* Gmelin, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Acar*) *reticulata* Gmelin, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 15, pd. 2, fig. 5. Not of Gmelin.
1952. *Arca reticulata* Gmelin, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180. Not of Gmelin.
1954. *Barbatia* (*Acar*) *domingensis* (Lamarck), Abbott, American Seashells, p. 343, pl. 27u.
1955. *Barbatia* (*Acar*) *domingensis* (Lamarck), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 37, pl. 3, fig. 11.
1958. *Barbatia domingensis* (Lamarck), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Barbatia* (*Acar*) *domingensis* (Lamarck), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 111.
1958. *Barbatia domingensis* (Lamarck), Moore, Nautilus, vol. 71, No. 4, pp. 125, 128.
1959. *Barbatia domingensis* (Lamarck), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.
1961. *Barbatia* (*Acar*) *domingensis* (Lamarck), Warmke and Abbott, Caribbean Seashells, p. 158, pl. 30d.

Shell small and solid, swollen, boxlike, subrhomboidal, more or less distorted, with a subcentral radial depression from below the umbo to the ventral margin. Byssal gape a little behind the middle, slightly to moderately embayed. Posterior ridge well defined. Anterior end subtruncate to gently rounded, the posterior end oblique and slightly rounded, the curve with the ventral margin at the termination of the posterior ridge acutely rounded. Umbos broad, situated a little forward to considerably forward of center. Cardinal area narrow, bearing several irregular ligamental grooves rudely parallel with the hinge line. Hinge very gently arcuate, narrowest a little posterior to the beaks, widening gradually toward the ends. Muscle scars pronounced. Inner margin finely denticulate, the denticulations extending to the ends of the hinge. Sculpture consisting of numerous elevated radial cords separated by grooves of approximately the same width, crossed by larger more or less equally spaced concentric ridges, the radial cords nodulated at the intercepts. Between the concentric ridges, the interradial grooves appear as deep narrow rectangular pits. Color straw on exterior, whitish or dull brown within, the muscle scars snow-white.

Dimensions.—Specimen A385a, right valve, length 13.5 mm.; height 10.3 mm.; thickness 5.7 mm. Specimen A385b, left valve, length 20 mm.; height 12 mm.; thickness 5.8 mm. Specimen A385c, valves attached, length 12 mm.; height 9 mm.; thickness 7.4 mm. Specimen D 385a, right valve, length 12 mm.; height 6 mm.; thickness 3.4 mm. Specimen D 385b, left valve, length 12.9 mm.; height 7.5 mm.; thickness 4.1 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Eighty-one specimens including thirty-three left valves, thirty-three right valves, and fifteen doublets. Abisinia formation at W-30, eastern edge of Playa Grande village. Thirty specimens including twelve left valves, eighteen right valves, and a number of fragments.

Remarks.—*B. domingensis* (Lamarck) is the West Indian shell referred to by authors as *B. reticulata* (Gmelin) (1791, Syst. Nat., p. 3311). *B. reticulata,* however, is from the Indian Ocean. According to Woodring (1925c, p. 36), the illustration of *A. reticulata* by Chemnitz (1784, Syst, Conchylien-Cabinet, vol. 7, pp. 193-194, pl. 54, fig. 540) does not resemble the West Indian arcid that has been

identified as *reticulata*. The nearest west American analogue of *B. domingensis* is *B. rostae* Berry (see Keen, 1958, p. 28, fig. 41) but that is not as boxlike as *B. domingensis* and has a much more pronounced radial depression. The Pleistocene to Recent west American *B. gradata* Broderip and Sowerby (see Keen, 1958, p. 28, fig. 40) has also been synonymyzed with *D. domingensis* but is much more coarsely ribbed.

Range and distribution.—The Recent *B. domingensis* (Lamarck) ranges from North Carolina, U.S.A., to Brazil. It is usually found in shallow water under rocks but has been reported as deep as 287 fathoms by Dall (1889). In the Pleistocene, *B. domingensis* has been recorded from Florida, Cuba, Barbados, and the Panama Canal Zone; in the Pliocene from Florida and Trinidad; in the middle Miocene from Florida, Jamaica, and the Dominican Republic; and in the lower Miocene from Florida and Puerto Rico.

Barbatia (Fugleria) tenera (C. B. Adams) Pl. 4, figs. 10-13

1845. *Arca tenera* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 9.
1907. *Arca tenera* C. B. Adams, Lamy, Jour. Conchyl., vol. 55, p. 258.
1939. *Arca* (*Barbatia*) *balesi* Pilsbry and McLean, Notulae Naturae, No. 39, pp. 1-2, figs. 1a, b.
1950. *Arca tenera* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, p. 348, pl. 43, figs. 1-2.
1951. *Arca* (*Barbatia*) *tenera* C. B. Adams, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 15, pl. 2, fig. 2.
1954. *Barbatia* (*Fugleria*) *tenera* (C. B. Adams), Abbott, American Seashells, pp. 343-344, pl. 27k.
1955. *Barbatia tenera* (C. B. Adams), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 37, pl. 40, fig. 288.
1958. *Barbatia tenera* (C. B. Adams), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Barbatia* (*Fugleria*) *tenera* (C. B. Adams), Abbott, Acad. Nat. Sci. Philadlephia, Mon. No. 11, pp. 110-111.
1959. *Barbatia tenera* (C. B. Adams), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.
1961. *Barbatia* (*Fugleria*) *tenera* (C. B. Adams), Warmke and Abbott, Caribbean Seashells, p. 158, pl. 30g.

Shell of medium size, thin, subtranslucent, moderately inflated, trapezoidal in outline, with a faint submedial radial depression extending from below the umbo to the base. Hinge and base line subparallel, anterior end rounded, posterior end oblique, gently rounded to subtruncate, the curve with the posterior ventral margin acute, the ventral margin hardly embayed submedially. Beak an-

terior, appressed on top. Cardinal area somewhat concave, narrowly sublanceolate but broader under the beaks. Hinge narrow, gently arcuate, narrowest posterior to the beak, with about 26 small teeth of which there are 16 anteriorward from the narrowest point of the hinge and 10 posterior from that point. Edge of inner margin closely but feebly fluted, the interior of the valve rayed with low fine corrugations reflecting the external riblets. Surface uniformly sculptured by narrow, beaded, or crenulated radial riblets generally alternating in size on the lower half of the disk, the riblets a little larger and the crenulations coarser near the well-rounded posterior ridge. The periostracum is a thin fibrous mat, olive-brown in color, the fibers more closely spaced and longer on the posterior dorsal area adjacent to the posterior ridge. Shell color straw to light tan on the exterior, white within.

Dimensions.—Specimen A389al-2, length 19 mm.; height 13 mm.; thickness of doublet 9.5 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Three specimens including two left valves and one doublet.

Range and distribution.—The living *B. tenera* (C. B. Adams) ranges from Florida to northern South America. I have not seen it recorded as a fossil.

Arcopsis adamsi "Shuttleworth" (E. A. Smith) Pl. 4, figs. 14-17; Pl. 5, figs. 1-6

1845. *Arca caelata* Conrad, Fossils of the Medial Tertiary, p. 61, pl. 32, fig. 2. Not of Reeve, 1844, Conch. Icon., vol. 2, sp. 110.

1862. *Barbatia* (*Arca*) *caelata* (Conrad), Acad. Nat. Sci. Philadelphia, Proc., vol. 14, p. 580. Not of Reeve 1844.

1864. *Arca Adamsi* Shuttleworth, Krebs, The West Indian Marine Shells, p. 124.

1864. *Arca solida* Sowerby, Guppy, Sci. Assoc. Trinidad Proc., p. 36. Not of Sowerby, Zool. Soc. London Proc., p. 18.

1867. *Arca Adamsi* Shuttleworth, Guppy, Sci. Assoc. Trinidad, Proc., p. 164.

1878. *Arca Adamsii* Shuttleworth, Mörch, Catalogue of West-India Shells, p. 15.

1886. *Arca Adamsi* Shuttleworth, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 243.

1886. *Arca Adamsi* Shuttleworth var. *Conradiana* Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 243.

1889. *Arca Adamsi* Shuttleworth, Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 259.

1889. *Arca* (*Byssoarca*) *Adamsi* Shuttleworth, Dall, U. S. Nat. Mus., Bull. 37, p. 42.

1889. *Arca* (*Byssoarca*) *Adamsi* var. *Conradiana* Dall, U. S. Nat. Mus., Bull. 37, p. 42.
1890. *Arca* (*Acar*) *Adamsii* Shuttleworth MS ?, Smith, Linnean Soc. London, Jour., Zoology, vol. 20, p. 499, No. 52, pl. 30, figs. 6, 6a.
1891. *Arca Adamsi* Shuttleworth, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1895. *Barbatia (Acar) Adamsii* Shuttleworth, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1897. *Arca* (*Acar*) *Adamsi* Shuttleworth, von Ihering, Mus. Paulista, Rev., vol. 2, p. 80.
1898. *Barbatia* (*Fossularca*) *Adamsi* (Shuttleworth), Smith, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 629-630.
1901. *Arca adamsi* (Shuttleworth), Smith, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 461.
1902. *Arca* (*Fossularca*) *adamsi* Smith var. *conradiana* Dall, U. S. Nat. Mus., Proc., vol. 24, No. 1264, p. 508, pl. 31, fig. 1.
1907. *Arca Adamsi* Shuttleworth, Lamy, Jour. Conchyl., vol. 55, pp. 104-105.
1910. *Arca* (*Fossularca*) *Adamsi* Dall, Vaughan, Carnegie Inst. Washington, Publ. No. 133, p. 171.
1913. *Arca adamsi* Smith, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1914. *Arca Adamsi* Dall, Deussen, U. S. Geol. Sur., Water-Supply Paper 335, p. 77.
1915. *Barbatia* (*Fossularca*) *adamsi* (E. A. Smith), Dall, U. S. Nat. Mus., Bull. 90, p. 121.
1916. *Arca Adamsi* var. *Conradiana* Dall, Sheldon, Palaeontographica Americana, vol. 1, No. 1, p. 22, pl. 4, figs. 16-18; pl. 5, fig. 1.
1916. *Arca Adamsi* var. *Conradiana* Dall, Sheldon, Paleontographica Americana, vol. 1, No. 1, p. 22.
1919. *Arca* (*Barbatia*) *adamsi* Shuttleworth, Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, p. 18.
1920. *Arca* (*Fossularca*) *adamsi* Shuttleworth, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 45-46.
1920. *Arca* (*Fossularca*) *adamsi conradiana* Dall, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 46.
1925. *Barbatia* (*Fossularca*) *adamsi* (Shuttleworth), Smith, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 197-198, pl. 8, figs. 1, 8.
1925. *Fossularca* (*Fossularca*) *adamsi sawkinsi* Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 51-52, pl. 5, figs. 16-17.
1926. *Barbatia* (*Fossularca*) *adamsi* (Shuttleworth MS.), Gardner, U. S. Geol. Sur., Prof. Paper 142-A, p. 28, pl. 5, figs. 1-4.
1926. *Arca* (*Barbatia*) *adamsi* Shuttleworth, Weisbord, Nautilus, vol. 39, No. 3, p. 82.
1928. *Fossularca adamsi* (Dall), Woodring, Carnegie Inst. Washington, Publ. No. 385, p. 18. "The subspecific name *sawkinsi* apparently should be suppressed". See Woodring, 1925, above.
1932. *Arca* (*Fossularca*) *adamsi* (Shuttleworth MS.), Dall, Mansfield, Florida State Geol. Sur., Bull., No. 8, p. 45, pl. 7, figs. 1-3.
1935. *Arcopsis adamsi* (Smith), Reinhart, Mus. Roy. Hist. Nat. Belgique, Bull., vol. 11, No. 13, pp. 31-32.
1935. *Arca adamsi* Shuttleworth, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Arca* (*Acar*) *adamsi adamsi* "Shuttleworth", Smith, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 160.
1937. *Arca* (*Acar*) *adamsi* E. A. Smith, M. Smith, East Coast Marine Shells, p. 28, pl. 3, fig. 3.
1937. *Arcopsis adamsi* (Dall), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 15, pp. 16, 199-200.

1938. *Arca adamsi* Shuttleworth, Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 2, p. 1290.
1939. *Arca* (*Fossularca*) *adamsi* Dall, Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, p. 31.
1939. *Acar conradiana adamsi* (E. A. Smith), Bartsch and Rehder, Smithsonian Miscel. Collections, vol. 98, No. 10, p. 18.
1942. *Arcopsis adamsi* (E. A. Smith), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1946. *Arca adamsi* Smith, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1946. *Arca* (*Acar*) *adamsi* "Shuttleworth", E. A. Smith, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98.
1947. *Arca adamsi* Smith, Richards, Jour. Paleont., vol. 21, No. 1, p. 26.
1949. *Arca* (*Acar*) *adamsi adamsi* "Shuttleworth", E. A. Smith, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Acar*) *adamsi* Smith, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 16, pl. 2, fig. 4.
1953. *Fossularca* (*Fossularca*) *adamsi* (Dall), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 36.
1954. *Arcopsis adamsi* (E. A. Smith), Abbott, American Seashells, p. 344, fig. 26b.
1955. *Arcopsis adamsi conradiana* (Dall), Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 37-38, pl. 3, fig. 12.
1958. *Arcopsis adamsi* (E. A. Smith), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Arcopsis adamsi* (E. A. Smith), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 111.
1958. *Fossularca* (*Fossularca*) *adamsi* (Dall), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, p. 155.
1958. *Arcopsis adamsi* (E. A. Smith), Moore, Inst. Marine Sci., vol. 5, p. 154.
1959. *Arcopsis adamsi* (E. A. Smith), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.
1961. *Arcopsis adamsi* (Dall), Warmke and Abbott, Caribbean Seashells, p. 159, pl. 30f.

Shell small, inflated, boxlike, subrhomboidal in outline, with a slight submedial radial depression from well below the umbo to the base. Anterior end rounded, the hinge and base line parallel, the posterior end somewhat obliquely subtruncate, the ventral margin hardly embayed submedially. Posterior ridge high but rounded, the posterior dorsal area relatively broad. Beaks appressed, situated near the anterior third, the prodissoconch small and smooth. Cardinal area long and narrow, the ligamental scar a small triangular area directly below the beak. The hinge line proper is straight but the distal teeth of the hinge are arrayed in a gentle downward curve. Hinge teeth subequal, about 10 of them anterior to, and 18 posterior to the small edentulous gap underneath the ligamental caret. Muscle impressions enclosed within broad white slightly raised bands which

converge dorsally under the umbo. The rim of the inner margin is rendered finely crenulate by the termini of the external riblets, but the border itself is smooth. Surface sculptured by numerous subequal radial riblets connected by finer concentric threads, the intercepts nodular or beaded, the pattern decussate. Toward the base, interstitial secondary riblets may be present. The interradial grooves of the disk are about the same width as the riblets and appear as narrow rectangular pits, the corners made round by the nodules, the concentric threads in the interspaces separating the pits. The beads are larger and closer on the anterior than on the disk proper, and the posterior rostration is scabrous, with the ends of the nodules forming flutings or arches. The color of the Recent specimens is dull white on the surface, pale brown within except for the raised bands which are white.

Dimensions.—Specimen A386al-2, attached valves, length 11.6 mm.; height 7.8 mm.; thickness 6.7 mm. Specimen C386a, right valve, length 9.7 mm.; height 6.2 mm.; thickness 3 mm. Specimen C386b, left valve, length 10.1 mm.; height 6.8 mm.; thickness 3.5 mm. Specimen C396a, juvenile right valve, length 2.4 mm.; height 1.5 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One specimen, a doublet. La Salina de Guaiguaza, west of Puerto Cabello, State of Carabobo. Five specimens including three left valves and two right valves.

Remarks.—This species is readily recognized by the small ligamental caret on the cardinal area under beak, by the raised lateral bands converging to the umbo in the interior, and by the fluted external ribs. The Pleistocene to Recent *A. solida* (Sowerby) is the west American analogue of *A. adamsi,* and *A. afra* (Gmelin) (see Hertlein and Strong, 1943, p. 158) is said to be the Eastern Atlantic congener. Typically, *A. solida,* which ranges from Baja California to Peru, is thicker and more gibbous than *A. adamsi.*

Range and distribution.—Recent, from Cape Hatteras, North Carolina to Brazil, in shallow water to 116 fathoms. Pleistocene in South Carolina, Florida, Cuba, Panama Canal Zone, and Barbados. Pliocene in North Carolina, South Carolina, Florida and Trinidad. Upper Miocene in Virginia, North Carolina, South Carolina, Georgia,

Florida, and Texas (?). Middle Miocene of Jamaica and Trinidad. Lower Miocene of Florida.

Anadara (Larkinia) notabilis (Röding) Pl. 5, figs. 7-10

1798. *Arca notabilis* Röding, Mus. Boltenianum, p. 173 (refers to Chemnitz, Syst. Conchylien-Cabinet, vol. 7, pl. 55, fig. 459).
1843. *Arca Deshayesii* Hanley, An Illustrative and Descriptive Catalogue of Recent Bivalve Shells, p. 157 (footnote).
1844. *Arca Deshayesii* Hanley, Reeve, Conch. Icon., vol. 2, *Arca,* pl. 7, sp. 47.
1845. *Arca Deshayesii* Hanley, Philippi, Abbildungen und Beschreibungen Conchylien, vol. 1, *Arca,* p. 6, pl. 2, fig. 3.
1845. ? *Arca hemidermos* d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, vol. 5, pt. 2, Moluscos, p. 345.
1845. ? *Arca hemidermos* d'Orbigny, Philippi, Abbildungen und Beschreibungen Conchylien, vol. 1, *Arca,* pl. 2, fig. 5.
1853. *Arca notabilis* Bolton, Mörch, Catalogue Conchyliorum Comes de Yoldi, vol. 2, p. 41.
1864. *Arca auriculata* Lamarck, *A. notabilis* Bolten, *A. Deshayesii* Hanley, Krebs, The West Indian Marine Shells, pp. 124, 125.
1878. *Arca notabilis* Bolten, Mörch, Catalogue of West-India Shells, p. 16.
1878. *Arca auriculata* Lamarck, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 262.
1881. *Arca Deshayesii* Hanley, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 378.
1886. *Arca auriculata* Lamarck, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, pp. 241-242. Not of Lamarck.
1889. *Arca* aff. *Deshayesii* Hanley, Lorié, Samml. Geol. Reíchs-Mus. Leiden, ser. 2, vol. 1, pp. 116-118, 141, pl. 1, fig. 9.
1889. *Arca* (*Scapharca*) *auriculata* Lamarck, Dall, U. S. Nat. Mus., Bull. 37, p. 40. Not of Lamarck.
1891. *Arca Deshayesii* Hanley, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1896. *Arca Deshayesii* Hanley, Heilprin [in] Sapper, translation by Maury and Harris, Jour. Geol., vol. 4, No. 8, p. 945.
1897. *Arca (Anomalocardia) auriculata* Lamarck, von Ihering, Mus. Paulista, Rev., vol. 2, p. 82.
1898. *Scapharca* (*Scapharca*) *auriculata* (Lamarck), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 649 (part), 659. Not of Lamarck.
1898. *Scapharca* (*Scapharca*) *Deshayesii* (Hanley), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 659.
1900. *Arca Deshayesii* Hanley, Dautzenberg, Soc. Zool. France, Mém., vol. 13, p. 236.
1901. *Arca deshayesii* Hanley, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 461.
1907. *Arca deshayesi* Hanley, Lamy, Jour. Conchyl., vol. 55, pp. 218-221.
1913. *Arca deshayesi* Hanley, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1913. *Arca deshayesii* Hanley, Jenkins, Amer. Philos. Soc., Proc., vol. 52, No. 211, p. 457.
1916. *Arca auriculata* Lamarck, Sheldon, Palaeontographica Americana, vol. 1, No. 1, p. 50, pl. 11, figs. 15-18.
1916. *Arca auriculata* Lamarck, Sheldon, Palaeontographica Americana, vol. 1, No. 1, p. 50, pl. 11, fig. 19. Not of Lamarck.

1917. *Scapharca auriculata* (Lamarck), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 339, pl. 28, fig. 3. Not of Lamarck.
1922. *Arca deshayesii* Hanley, Remington, Nautilus, vol. 35, No. 4, p. 121.
1922. *Arca auriculata* Lamarck, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 189, 193, 362, pl. 22, fig. 3. Not of Lamarck.
1925. *Arca* (*Scapharca*) *auriculata* Lamarck, Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 201, pl. 4, fig. 2. Not of Lamarck.
1925. *Arca* (*Scapharca*) *deshayesi* Hanley, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 201-203, pl. 4, fig. 3.
1926. *Arca* (*Scapharca*) *auriculata* Lamarck, Weisbord, Nautilus, vol. 39, No. 3, p. 82. Not of Lamarck.
1929. *Arca* (*Scapharca*) *auriculata* Lamarck, Anderson, California Acad. Sci., Proc., ser. 4, vol. 18, No. 4, pp. 149-150. Not of Lamarck.
1933. *Scapharca* cf. *Deshayesi* Hanley var., Trechmann, Geol. Mag., vol. 70, No. 823, pp. 34-35, pl. 4, fig. 1.
1935. *Arca auriculata* Lamarck, Richards, Jour. Paleont., vol. 9, No. 3, p. 256. Not of Lamarck.
1936. *Arca auriculata* Lamarck, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 39. Not of Lamarck.
1936. *Arca auriculata* Lamarck Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 159. Not of Lamarck.
1936. *Arca auriculata* Lamarck, McLean, Nautilus, vol. 49, No. 4, p. 116. Not of Lamarck.
1936. *Arca auriculata* Lamarck, Richards, Nautilus, vol. 49, No. 4, pp. 133-134. Not of Lamarck.
1937. *Arca auriculata* Lamarck, Smith, East Coast Marine Shells, p. 26, pl. 3, figs. 8a, b. Not of Lamarck.
1938. *Arca auriculata* Lamarck, Perry, Schwengel, and Dranga, Nautilus, vol. 52, No. 1, p. 27. Not of Lamarck.
1938. *Arca auriculata* Lamarck, Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 2, p. 1290. Not of Lamarck.
1942. *Anadara auriculata* (Lamarck), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38. Not of Lamarck.
1945. *Arca auriculata* Lamarck, van Benthem Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Arca* (*Scapharca*) *auriculata* Lamarck, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98. Not of Lamarck.
1949. *Arca* (*Arca*) *auriculata* Lamarck, Lange de Morretes. Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Scapharca*) *auriculata* Lamarck, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 16, pl. 2, fig. 9. Not of Lamarck.
1953. *Arca* (*Arca*) *deshayesi* Hanley, Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Anadara* (*Larkinia*) *notabilis* (Röding), Abbot, American Seashells, p. 344, pl. 27p.
1955. *Anadara notabilis* (Röding), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 35, pl. 1, figs. 6a, b.
1958. *Anadara notabilis* (Röding), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Anadara* (*Larkinia*) *notabilis* (Röding), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, pp. 111-112.
1959. *Anadara notabilis* (Röding), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 1.
1961. *Arca* (*Anadara*) *notabilis* Roeding, van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 298.

1961. *Anadara (Larkinia) notabilis* Röding, Warmke and Abbott, Caribbean Seashells, p. 159, pl. 30h.

Shell inflated, oblong-rhomboidal, slightly tapering anteriorly, auriculate behind. Anterior end rounded, base gently curved, posterior margin concave above. Beaks high, well forward, separated by a moderately wide lanceolate cardinal area which is scored with several long irregular obtusely angled ligamental grooves. Hinge line fairly straight, the hinge itself bearing numerous comblike teeth of which there are 15 to 18 anterior and 35 to 39 posterior. The posterior teeth are smaller than the anterior at the point of divergence of the hinge and tend to over-ride the initial anterior one. The anterior teeth at the point of divergence of the hinge may be larger than the ones immediately forward but they are longest at the distal end; the posterior teeth, on the other hand, enlarge gradually and regularly toward the posterior end. The teeth do not reach the basal margin of the hinge which is thick and smooth. Inner margin broadly corrugated. Exterior sculptured by 27 or 28 straight radial ribs crossed by numerous, more or less equally spaced concentric threads which are sharp in the interspaces but form crenations on the crest of the ribs particularly on the lower half of the disk and on the ends. The interspaces on the disk are as wide as, or in places a trifle wider, than the ribs themselves. The color of the Recent shell is whitish, and such of the periostracum as remains is brown and silky.

Dimensions.—Recent specimen (A382a), right valve, length 30 mm.; height 22.3 mm.; thickness 9.5 mm. Fossil specimen (S382a), left valve, length 40 mm.; height 28.2 mm.; thickness 13.5 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Two right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve.

Remarks.—The east American *A. notabilis* (Röding) has often been called *A. auriculata* Lamarck, but as pointed out by Abbott (1954) *A. auriculata* is from the Red Sea. The ribs of *A. notabilis* are straight, those of *A. auriculata* slightly curved. The middle Miocene Jamaican form referred by Dall (1898, p. 649) to *A. auriculata* Lamarck is *A. prephina* (Woodring) (1925, pp. 44-45, pl. 4, fig. 8).

Range and distribution.—The living *A. notabilis* (Röding) ranges from northern Florida to Brazil, and is found near shore to 40 fathoms. As a fossil it occurs in the Pleistocene of Florida, Cuba, St. Kitts, St. Eustatius, the Panama Canal Zone, Curaçao, Colombia, Venezuela, Barbados and Brazil; in the Pliocene of the Yucatan Peninsula and Costa Rica; and in the middle Miocene of Costa Rica, Colombia, and the Dominican Republic.

Anadara (Larkinia) species Pl. 5, figs. 11, 12

The internal mold of fine-grained calcareous sandstone indicates that the shell is large, elongate-rhomboidal, inflated, alate behind, with the high beaks situated well forward. The anterior and ventral margins are gently rounded, the posterior end obliquely subtruncate, the posterior ridge moderately high and subrounded. Cardinal area fairly broad, lanceolate, a little concave. Hinge line straight, the hinge with 16 anterior teeth and an estimated 48 posterior ones. The distal anterior teeth are relatively long and crowded, whereas the posterior teeth increase regularly and progressively in size from the point of divergence. The inner margin is crenulate, and judging from the number of crenations it is estimated that there are 22-24 radial ribs on the exterior.

Dimensions.—Specimen M367a, length of doublet 67 mm.; height 42 mm.; thickness 38 mm.

Locality.—Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southeast of its intersection with the Playa Grande Yachting Club road. One specimen, an internal mold of the valves attached.

Remarks.—It is not possible to identify this species, but it seems to be of the same general form as the Miocene to Recent *A. notabilis* (Röding).

Anadara (Lunarca) ovalis (Bruguière) Pl. 5, figs. 13-16; Pl. 6, figs. 1-4

1789. *Arca ovalis* Bruguière, Encycl. Méth., vol. 1, pt. 1, p. 110.
1791. *Arca campechiensis* Gmelin, Syst. Nat., ed. 13, p. 3312.
1817. *Arca campechiensis* Gmelin, Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 238 (part).
1822. *Arca pexata* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st. ser., vol. 2, p. 268.

1824. *Arca pexata* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 4, p. 78.
1828. *Arca americana* (Gray), Wood, Index Testaceologicus Suppl., pl. 2, *Arca,* fig. 1.
1841. *Arca pexata* Say, Gould, A Report on the Invertebrata of Massachusetts, p. 95, fig. 60.
1844. *Arca americana* Wood, Reeve, Conch. Icon., vol. 2, *Arca,* sp. 21.
1844. *Arca pexata* Say, Reeve, Conch., vol. 2, *Arca,* sp. 22.
1845. *Arca pexata* Say, d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 344.
1845. *Arca pexata* Say, Philippi, Abbildungen und Beschreibungen Conchylien, vol. 1, p. 45, pl. 1, fig. 4.
1860. *Arca americana* Wood, Holmes, Post-Pleiocene Fossils of South Carolina, p. 19, pl. 4, figs. 2, 2a.
1860. *Arca Holmesii* Stimpson, Smithsonian Inst. Checklist, p. 2.
1862. *Arca* (*Argina*) *pexata* Say, Conrad, Acad. Nat. Sci. Philadelphia, Proc., vol. 14, p. 580.
1864. *Arca americana* Gray, Krebs, The West Indian Marine Shells, p. 124.
1867. *Arca pexata* Say, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 164.
1871. *Arca americana* Gray and *A. holmesii* Kurtz, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 132.
1874. *Arca americana* Wood, Tryon, Amer. Marine Conch., p. 179, pl. 37, fig. 470.
1878. *Arca americana* Gray, Mörch, Catalogue of West-India Shells, p. 16.
1880. *Arca campechiensis* Gmelin, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 262.
1884. *Arca pexata* Say, Tryon, Structural and Systematic Conchology, vol. 3, p. 255, pl. 126, figs. 46-47.
1889. *Arca pexata* Say, *A. Holmesii* Kurtz, and *A. Americana* Gray, Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1891. *Arca* (*Argina*) *pexata* Say, Kobelt, Syst. Conchylien-Cabinet, p. 33, pl. 11, figs. 5-6.
1892. *Arca americana* Gray and *A. pexata* Say, Singley, Geol. Survey Texas, Fourth An. Rept., p. 385.
1897. *Arca indica* von Ihering (*non* Gmelin), Jour. Conchyl., vol. 43, p. 214.
1898. *Scapharca* (*Argina*) *campechensis* (Dillwyn), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 650-652, 659.
1901. *Arca* (*Scapharca*) *campechensis* Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 461.
1903. *Arca campechiensis* Gmelin, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1907. *Arca* (*Argina*) *campechiensis* Gmelin, Lamy, Jour. Conchyl., vol. 55, pp. 292-293.
1912. *Arca* (*Argina*) *pariaensis* Maury, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 15, p. 47, pl. 8, figs. 7-9.
1913. *Arca campeachiensis* Dillwyn, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1913. *Arca* (*Scapharca*) *pexata* var. *holmesii* Stimpson, Jenkins, Amer. Philos. Soc., Proc., vol. 52, No. 211, p. 457.
1914. *Scapharca campechensis pexata* (Say), and *holmesii* (Kurtz), Henderson and Bartsch, U. S. Nat. Mus., Proc., vol. 47, No. 2055, p. 412.
1916. *Arca campechensis* Dillwyn, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 61-63, pl. 15, figs. 6-13.
1920. *Arca* (*Argina*) *campechensis* Gmelin, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 51-52.
1924. *Arca* (*Scapharca*) *campechiensis* Gmelin, Jacot, Nautilus, vol. 38, No. 2, p. 49.

1925. *Scapharca* (*Argina*) *campechensis* (Dillwyn), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 226-227, pl. 7, fig. 8.
1926. *Arca* (*Argina*) *campechiensis* Gmelin, Weisbord, Nautilus, vol. 39, No. 3, p. 82.
1927. *Arca pexata* Say, Wood, Nautilus, vol. 41, No. 1, p. 15.
1929. *Arca* (*Scapharca*) *campechiensis* Gmelin, Clench, Nautilus, vol. 43, No. 1, p. 35.
1934. *Arca* (*Argina*) *campechensis* Gmelin, Maury, Amer. Mus. Nat. Hist., Bull., vol. 67, art. 4, pp. 160-161, pl. 18, fig. 5.
1935. *Arca campechiensis* Gmelin, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Arca campechiensis* Gmelin, Richards, Nautilus, vol. 49, No. 4, p. 133.
1937. *Arca campechiensis* Gmelin, Smith, East Coast Marine Shells, p. 26, pl. 4, figs. 8a, b.
1937. *Arca campechiensis pexata* Say, Smith, East Coast Marine Shells, pp. 26-27, pl. 2, fig. 11.
1937. *Arca campechiensis americana* Wood, Smith, East Coast Marine Shells, p. 27, pl. 2, fig. 13.
1938. *Arca campechiensis* Gmelin, Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 3, p. 1290.
1940. *Arca campechiensis* Gmelin, Stenzel, Nautilus, vol. 54, No. 1, p. 20.
1942. *Arca campechiensis* Gmelin, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Rev., vol. 16, No. 1, p. 38.
1943. *Lunarca pexata* (Gray), Reinhart, Geol. Soc. Amer., Spec. Papers No. 47, p. 75.
1943. *Arca (Scapharca) campechiensis* Gmelin, and *A. campechiensis americana* Wood, Jacobson, Nautilus, vol. 56, No. 4, p. 141.
1944. *Arca campechiensis* Gmelin, Hackney, Nautilus, vol. 58, No. 2, p. 56.
1945. *Arca campechiensis* Gmelin, van Bentham-Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonian, Geol. ser., vol. 14, p. 77.
1946. *Arca campechiensis Gmelin,* Stewart, Nautilus, vol. 60, No. 1, p. 19.
1946. *Arca campechiensis* Gmelin, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98.
1949. *Arca campechiensis americana* "Gray", Wood, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Argina*) *campechiensis* Gmelin, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 17-18, pl. 3, fig. 1.
1952. *Arca campechiensis* Gmelin, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 179, pl. 6, figs. 1-2.
1953. *Arca* (*Argina*) *campechiensis pexata* Say and *A. campechiensis americana* Wood, Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Anadara* (*Lunarca*) *ovalis* (Bruguière), Abbott, American Seashells, p. 345, pl. 27t.
1961. *Anadara ovalis* (Bruguière), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 36.
1961. *Anadara* (*Lunarca*) *ovalis* (Bruguière), Warmke and Abbott, Caribbean Seashells, pp. 159-150, pl. 30m.

The Recent Venezuelan shell is moderately large, fairly solid, inflated, porcelaneous, longer than high, obliquely subrhomboidal or subrectangular or suboval. Anterior end rounded, base gently rounded to subtruncate, posterior end oblique and subtruncate, the posterior basal end well rounded and a little produced. Posterior ridge

high, somewhat rounded. Posterior dorsal area alate, more so on small shells than on large. Beaks far forward, nearly touching each other, snugged into the cardinal area. Anterior to the beak, the cardinal area is short and wide; posteriorly it is narrowly lanceolate, the ligamental tegument scored with several long and sometimes obtusely angulated resilial grooves. Hinge fairly straight medially, curved downward at the ends, the anterior curve shorter and more pronounced that the posterior. Separating the anterior teeth from the posterior there is a small deep irregular fossette, and the margin of the hinge above the anterior teeth is thinned and elevated into an auricular plate or strong septum. On an average there are 8 anterior teeth and 29 posterior ones, the anterior teeth coarse and irregular and not infrequently coalescing, the posterior small and crowded near the fossette which they override, gradually becoming larger and more widely separated distally. Muscle scars distinct, the pallial line parallel with, and well removed from the ventral margin. Margin corrugated by broad flat crenations, the rim of the basal margin thin. Surface sculptured by square, flat-topped radial ribs, averaging 34 in number, crossed by numerous concentric striae and lamellae, the lamellae becoming more pronounced basalward. The ribs of both valves may be feebly grooved along the middle, the grooving perhaps a little more distinct on the right valve. At the base, the ribs are a little wider than the square-cut interspaces. The color is flesh on the exterior, white within. The periostracum is black-brown and closely lamellar.

The Venezuelan fossil specimens are identical with the Recent ones. The radial ribs on young valves are tubular at the margin.

Dimensions.—Specimen A372b, length 32.5 mm.; height 25 mm.; thickness 10 mm. Left valve, Recent. Specimen A372a, length 35 mm.; height 27 mm.; thickness 12 mm. Right valve, Recent. Specimen T384b, length 33 mm.; height 20.5 mm.; thickness 10 mm. Left valve, fossil. Specimen T384a, length 39 mm.; height 27 mm.; thickness 11 mm. Right valve, fossil.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Forty-four specimens including twenty-eight right valves and sixteen left valves. Upper Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas.

Twenty-five specimens including fifteen right valves and ten left valves. Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Four specimens, two of each valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Forty-six specimens including twenty-one right valves and twenty-five left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Twenty-five specimens including fifteen right valves and ten left valves.

Remarks.—Bruguière's *A. ovalis* seems to have been named prior to Gmelin's well-known *campechiensis*. The species, though constant otherwise, is variable in shape, and this has given rise to such names as *A. ovalis* [*campechiensis campechiensis*] and *A. holmesi* for the rounded form, *A. americana* for the elongated porcelaneous form, and *A. pexata* for the somewhat elongated earthy form. My Recent Venezuelan shells are porcelaneous and approach *A. pexata* in shape. The largest of my fossil specimens is elongated like the variant *A. americana*. In Brazil (Jenkins, Haas) and elsewhere, roundish forms occur together with subrectangular ones, and to-day conchologists tend to agree with Dall (1898, p. 651) who, after study of a large series of Recent specimens, ranging from Jamaica to Cape Cod, was "obliged to recognize that no sharp line of discrimination can be drawn between the several varieties."

The [sub]generic name of *Lunarca* was proposed by Reinhart (1943, p. 75) as a substitute for *Argina* Gray, the latter having been preoccupied by a genus of Lepidoptera. *Argina* Gray is antedated by *Argina* Hübner *circa* 1822 by about 20 years.

Range and distribution.—The living *A. ovalis* and its several forms is a far-flung species ranging from Cape Cod, Massachusetts, to Brazil. As a sub-Recent or Pleistocene fossil it has been reported from southern New England, New Jersey, Georgia, South Carolina, Florida, Louisiana (in wells), Cuba, the Panama Canal Zone, Venezuela and Brazil (Estado Rio Grande do Norte). Guppy listed the species (as *A. pexata*) from the Pliocene at Cumaná, Venezuela, (see *Lunarca* aff. *ovalis* Bruguière in collection 18408 at the U.S. National Museum) and Matura, Trinidad, and from the middle Miocene of the Dominican Republic, the last being referable, however, to *A. tolepia* Dall (1898, pp. 649-650, pl. 33, figs. 1, 8). Maury

recorded the present shell as a questionable late Miocene species in well No. 29 Jennings, Louisiana, at 1960-1980 feet.

Anadara (Lunarca ?) caboblanquensis, new species Pl. 6, figs. 5-8

Shell small, moderately inflated, subquadrate, broadly alate behind, narrowed somewhat in front. Anterior and posterior ends gently rounded, the ventral margin obliquely subtruncate, the curve at the ventral posterior margin fairly acute. Beaks low, a little anterior, nearly touching, slightly sulcate on top, the sulcation broadening into a very feeble radial depression and continuing to the basal margin where it becomes obsolescent. Cardinal area extremely narrow, lanceolate, concave. Hinge line sharp and straight, the hinge itself obtusely angulate, forming a small, more or less edentulous embayment under the beak. Left valve with four or five anterior teeth and seven or eight posterior teeth, the distal anterior end of the hinge a little broader than the distal posterior end. Margins scalloped or fluted at the rim, corrugated within by flat-topped crenations, each crenation lying under the corresponding intercostal groove of the exterior. Surface sculptured by 26 low square-cut radial ribs which are feebly crenulate, and, at the base of the disk, about as wide as the interspaces. Faintly decussating the exterior are rather regularly spaced concentric threads which stand out more sharply in the intercostal spaces than on the ribs themselves.

Dimensions.—Holotype (Q394a), left valve, length 2.1 mm.; height 1.8 mm.; thickness 0.9 mm.; Paratype (T394a), left valve, length 1.8 mm.; height 1.5 mm.; thickness 0.5 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. 2 left valves, including the holotype.

Other localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One left valve, the paratype. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve, badly corroded.

Comparisons.—This new species is not only much smaller than the upper Miocene to Recent *A. ovalis* (Bruguière), but it has fewer radial ribs and fewer teeth than that, and its beak is not situated so far forward. Also the faint radial depression (at least on the left

valve) of *A. caboblanquensis,* n. sp. is wanting on *A. ovalis.* The subgeneric position of the new species is somewhat in doubt.

Anadara (Lunarca ?) mareana, new species Pl. 6, figs. 9-12

Shell small, moderately inflated, subquadrate, broadly alate behind, narrowed a little in front. Anterior end well rounded, the posterior gently so, the base slightly rounded to obliquely subtruncate, the curve at the basal posterior margin fairly acute. Beaks situated a little forward, the umbos with a slight radial depression which broadens toward, but becomes obsolescent at the base. Cardinal area narrow, lanceolate, slightly concave. Hinge line fairly sharp and straight, the hinge itself slightly arcuate, with the posterior end curved slightly downward and the anterior end nearly straight. The posterior dorsal margin of the valve is thin and sharp, and the hinge line abuts into it immediately above the third from last tooth. There are 15 or 16 uninterrupted teeth of which 7 are anterior, the distal teeth scored by minute transverse grooves or striae. Margin scalloped or fluted at the rim, corrugated within by flat-topped denticles, the denticles lying under the corresponding intercostal grooves of the exterior, the ends of both the denticles and the external ribs tubular. Posterior muscle scar larger and lower than the anterior, the pallial line connecting them well removed from the ventral margin. Surface sculptured by 30 radial ribs, the ribs of the left valve seeming to be more uniformly beaded or crenate than those of the right valve, and perhaps a trifle wider than the latter at the base. Crossing the surface are regularly spaced concentric threads which stand out more sharply in the interspaces than on the ribs themselves.

Dimensions.—Holotype (J393a), length 3.6 mm.; height 3 mm.; thickness 1.5 mm. Right valve. Paratype (J393b), length 3.7 mm.; height 3.4 mm.; thickness 1.3 mm. Left valve.

Type locality.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Two specimens including one right valve (holotype) and one left valve (paratype).

Other localities.—Mare formation at W-25, south flank of Punta Gorda anticline. One right valve.

Comparisons.—*A. mareana,* n. sp. is close to *A. caboblanquensis,* n. sp. but differs from *A. caboblanquensis* in having several more

radial ribs and a wider cardinal area. Also the hinge of *A. caboblanquensis* has an embayed area under the beak where it is more or less edentulous, whereas the teeth are continuous across the gently and evenly arcuate hinge of the present species. The well-known upper Miocene to Recent *A. ovalis* (Bruguière) is larger, is more generously ribbed and toothed, has the beak more forward, and lacks, in specimens of comparable size, the faint radial depression on the umbos.

Anadara (Cunearca) brasiliana (Lamarck) Pl. 6, figs. 13-16

1819. *Arca brasiliana* Lamarck, An. sans Vert., vol. 6, p. 44.
1822. *Arca incongrua* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 2, p. 268.
1824. *Arca incongrua* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 4, p. 78.
1844. *Arca incongrua* Say, Reeve, Conch. Icon., vol. 2, *Arca,* pl. 8, sp. 50.
1845. *Arca brasiliana* Lamarck, Philippi, Abbildungen und Beschreibungen Conchylien, *Arca,* vol. 1, p. 44, pl. 1, fig. 3.
1857. *Arca incongrua* Say, Tuomey and Holmes, Pleiocene Fossils of South Carolina, p. 45, pl. 16, figs. 5, 6.
1860. *Arca incongrua* Say, Holmes, Post-Pleiocene Fossils of South Carolina, p. 19, pl. 4, figs. 1, 1a.
1864. *Arca incongrua* Say, Guppy, Sci. Assoc. Trinidad, Trans., p. 41.
1864. *Arca brasiliana* Lamarck, Krebs, The West Indian Marine Shells, p. 124.
1867. *Arca incongrua* Say, Guppy, Sci. Assoc. Trinidad, Proc., p. 163 (part).
1871. *Arca incongrua* Say, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 133.
1878. *Arca brasiliana* Lamarck, Mörch, Catalogue of West-India Shells, p. 16.
1889. *Arca* (*Scapharca*) *incongrua* Say, Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1891. *Arca incongrua* Say, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1891. *Arca* (*Scapharca*) *incongrua* Say, Kobelt, Syst. Conchylien-Cabinet, *Arca,* p. 97, pl. 26, figs. 5-6.
1892. *Arca incongrua* Say, Singley, Geol. Survey Texas, Fourth An. Rept., p. 325.
1895. *Arca incongrua* Say, Harris, Bull. Amer. Paleont., vol. 1, No. 3, pp. 87-88.
1895. *Arca* (*Scapharca*) *brasiliana* Lamarck, von Ihering, Jour. Conchyl., vol. 43, p. 213.
1898. *Scapharca* (*Cunearca*) *incongrua* (Say), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 618, 635, 659.
1898. *Scapharca* (*Cunearca*) *braziliana* (Lamarck), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 635.
1903. *Arca incongrua* Say, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1904. *Arca brasiliana* Lamarck, Lamy, Jour. Conchyl., vol. 52, p. 162, pl. 5, fig. 3.
1907. *Arca* (*Cunearca*) *brasiliana* Lamarck, Lamy, Jour. Conchyl., vol. 55, pp. 263-268.
1913. *Arca* (*Scapharca*) *braziliana* Lamarck, Jenkins, Amer. Philos. Soc., Proc., vol. 52, No. 211, p. 457.

1916. *Arca incongrua* Say, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 59-60, pl. 14, figs. 4-7.
1916. *Arca brasiliana* Lamarck, Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 59-60, pl. 14, fig. 8.
1920. *Scapharca* (*Cunearca*) *incongrua* (Say), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 50-51.
1922. *Scapharca* (*Cunearca*) *brasiliana* (Lamarck), Maury, Palaeontographica Americana, vol. 1, No. 4, p. 36.
1937. *Arca incongrua* Say, Smith, East Coast Marine Shells, p. 27, pl. 3, fig. 2.
1938. *Arca incongrua* Say, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2 p. 1290.
1945. *Arca brasiliana* Lamarck, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Arca incongrua brasiliana* Lamarck, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Arca brasiliana* Lamarck, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1952. *Arca incongrua* Say, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180, pl. 6, figs. 5-6.
1954. *Anadara* (*Cunearca*) *brasiliana* (Lamarck), Abbott, American Seashells, p. 346, pl. 27y.
1961. *Anadara brasiliana* (Lamarck), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 36.
1961. *Anadara* (*Cunearca*) *brasiliana* (Lamarck), Warmke and Abbott, Caribbean Seashells, p. 160, pl. 30n.

The Recent Venezuelan shell is inflated, moderately large and thin, rhomboidal in outline, the right valve always appearing a little distorted. Anterior end rounded, the posterior end oblique, and truncate to subtruncate. The ventral margin of the right valve is gently rounded to subtruncate whereas that of the left valve often has a gentle subangular curve at or a little aft of the middle, this part of the inferior edge always thinner and extending a little beyond the margin of the right valve. Posterior ridge high, subangulate. Umbos elevated, regularly convex, the beaks facing each other at the center of the cardinal area. Cardinal area lozenge-shaped, bounded by a deep groove, sloping down from under the beak toward the hinge and a little concave, generally marked, beneath the thin ligamental tegument, by numerous horizontal lineations which may be crossed by closely spaced vertical ones. The hinge line proper is straight, the hinge itself slightly arcuate and somewhat wider distally than along the narrow middle. Below the beak, the lower edge of the hinge is bowed down slightly at about the middle. Teeth 34 to 38, generally, but not always, with a few more of them occurring posteriorly than anteriorly. Inner border with broad flat slightly raised corrugations, each corrugation lying below the interspace of

the external ribs. Pallial line distinct, the line a little embayed anterior to the middle. Externally, the right valve has a feeble radial depression extending from the anterior side of the umbo to the ventral margin anterior to the middle. This depression is not present on the right valve. Sculpture consisting of about 30 radial ribs of which there are 10 on the posterior dorsal area. Left valve with all ribs wider than the interspaces which are narrow on the central area of the disk. Crossing the ribs of the left valve are regularly spaced beads, elongated in the concentric direction below, the beading or crenation most prominent anteriorly and becoming obsolescent toward the posterior ridge. On the posterior rostration the crenation is relatively weak above, obsolescent below. On the right valve, the ribs are smooth and narrower than the interspaces between the radial depression and the posterior ridge, the ribs of the anterior and posterior ends, however, wider than the interspaces, the anterior ones strongly beaded or crenate, the posterior ones weakly crenate as the hinge is approached. On an occasional right valve there is one interstitial rib on the disk in the depressed area in front of the middle. Color creamy white on the surface, white within. Periostracum thin, light brown.

Dimensions.—Left valve (A373b), length 39 mm.; height 32 mm.; thickness 14 mm. Right valve (A373a), length 35 mm.; height 29 mm.; thickness 12.2 mm. Average specimen, length 26.5 mm.; height 23.5 mm.; thickness (both valves) 22 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Thirty-three specimens including twenty-five left valves and eight right. Recent, on beach east of Higuerote, State of Miranda. One specimen, a right valve.

Remarks.—The distinguishing characters of *A. brasiliana* are the thin valves, the even thinner ventral margin behind the middle of the left valve, the narrowness of the ribs on the disk of the right valve contrasted with the wider ones of the left valve, the basal overhang of the posterior ventral margin of the left valve, and the feeble radial depression in front of the middle of the right valve.

Dall (1889, p. p. 635) was the first to call attention to the closeness of *A. incongrua* (Say) to *A. brasiliana* (Lamarck), and present-day conchologists consider them the same. As pointed out

by Abbott (1954, p. 346), the Pleistocene to Recent *A. chemnitzi* (Philippi) (1851, vol. 8, p. 50), living from Texas, U.S.A., to Brazil, is similar to *A. brasiliana* but is smaller, and the beaks are slightly forward of the center of the cardinal area. *A. willardausteni* Maury (1917, p. 343, pl. 29, figs. 6-7) from the middle Miocene of the Dominican Republic has more ribs than *A. brasiliana,* and on the right valve there are two faint radial depressions, one in front of the middle and the other behind.

Range and distribution.—Recent—North Carolina, U.S.A., to Brazil. Pleistocene—In wells, Texas and Louisiana; South Carolina; Colombia; Venezuela; in bed of Rio Ceará-Mirim, 10 kilometers northwest of Extremoz, Rio Grande do Norte, Brazil. Upper Miocene —Galveston well (2433-2920 feet), Texas.

Anadara (Cunearca) chemnitzi (Philippi) Pl. 23, figs. 2-5

1784. *Arca rhombea* var. Chemnitz, Syst. Conchylien-Cabinet, vol. 7, p. 212, pl. 56, fig. 553b. Not of Born 1778, Index Rerum Naturalium Musei Caesarei Vindobonensis, p. 76.
1851. *Arca chemnitzi* Philippi, Zeitschr. f. Malakozool., vol. 8, p. 50.
1864. *Scapharca Chemnitzii* (Philippi), Krebs, The West Indian Marine Shells, p. 125.
1878. *Arca rhombea* Born, Mörch, Catalogue of West-India Shells, p. 16. Not of Born 1778.
1889. *Arca* (*Noetia*) *Orbignyi* (Kobelt), Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1891. *Arca d'Orbignyi* Kobelt, Syst. Conchylien-Cabinet, vol. 2, p. 57, pl. 16, figs. 7-8.
1895. *Arca* (*Anomalocardia*) *Chemnitzi* Philippi, von Ihering, Jour. Conchyl., vol. 43, p. 213.
1898. *Scapharca* (*Cunearca*) *Chemnitzi* (Philippi), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 636, 659.
1901. *Arca* (*Scapharca*) *chemnitzi* Philippi, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 461.
1907. *Arca Chemnitzi* Philippi, Lamy, Jour. Conchyl., vol. 55, pp. 272-274.
1912. *Scapharca* (*Cunearca*) *chemnitzi* (Philippi), Maury, Acad. Nat. Sci. Philadelphia, Jour., vol. 15, pp. 44-45.
1916. *Arca chemnitzi* Philippi, Sheldon, Palaeontographica Americana, p. 60, pl. 15, figs. 3-4.
1920. *Scapharca* (*Cunearca*) *chemnitzi* (Philippi), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 34.
1922. *Scapharca* (*Cunearca*) *chemnitzi* (Philippi), Maury, Palaeontographica Americana, vol. 1, No. 4, p. 34.
1925. *Scapharca* (*Cunearca*) *chemnitzi* (Philippi), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 220-221.
1935. *Arca chemnitzi* Philippi, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Arca chemnitzi* Philippi, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 39.
1937. *Arca chemnitzi* Philippi, Smith, East Coast Marine Shells, p. 27, pl. 3, figs. 6a, b.

1940. *Arca chemnitzii* Philippi, Richards, Soc. Venezolana Cienc. Nat., Bol., vol. 6, No. 46, p. 306.
1942. *Arca chemnitzi* Philippi, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1943. *Arca chemnitzi* Philippi, Richards, Jour. Paleont., vol. 17, No. 1, p. 121.
1945. *Arca chemnitzi* Philippi, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1949. *Arca chemnitzi* Philippi, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 9.
1951. *Arca* (*Scapharca*) *chemnitzi* Philippi, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 17, pl. 2, fig. 7.
1952. *Arca chemnitzi* Philippi, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 179.
1954. *Anadara* (*Cunearca*) *chemnitzi* (Philippi), Abbott, American Seashells, p. 346.
1958. *Anadara chemnitzi* (Philippi), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.

Shell of medium size, inflated, slightly inequivalve, interior rhomboidal, exterior of disk triangular. Anterior end gently rounded, posterior end oblique and truncate, ventral margin gently rounded anteriorly, subtruncate posteriorly. Posterior ridge high, somewhat rounded. Beaks high, swollen, slightly forward of the center of the cardinal area. Cardinal area lozenge-shaped, bounded by a deep narrow groove, marked, beneath the thin ligamental tegument, by fine horizontal and vertical lineations. Hinge line straight, the hinge itself narrow throughout its length although a trifle wider near the ends where it is also curved a little downward. Total number of teeth 36 to 46 depending on the size of the shell, with generally a few more of them posteriorly than anteriorly, the "middle" of the hinge sometimes exhibited as a small, irregular edentulous depression. The larger teeth at the ends of the hinge are often scored by fine vertical grooves. Inner margin corrugated by broad flat denticles each denticle lying under the corresponding intercostal groove of the exterior, the external ribs reflected through to the interior of the valve. Surface sculptured by 28 radial ribs, those of the left valve beaded more or less uniformly on the whole of the exterior, the beading of the right valve tending to become obsolescent posteriorly from the middle of the disk to the last 3 or 4 ribs on the posterior rostration. On both valves near the base the ribs are a little wider than the flat interspaces. Color whitish. Periostracum dark brown, closely lamellar on the posterior rostration, spinose in the grooves of the anterior half, the soft spines pointing upward.

Dimensions.—Specimen A659a, right valve, length 20 mm.; height 18.6 mm.; thickness 8.4 mm. Specimen A659b, left valve, length 19 mm.; height 18.7 mm.; thickness 8 mm. Specimen A659c, right valve, length 22.9 mm.; height 22.5 mm.; thickness 10 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Four specimens including two left valves and two right.

Range and distribution.—The living *A. chemnitzi* (Philippi) ranges from Texas to Brazil. As a fossil it has been reported from the Pleistocene of Cuba and the Island of Margarita, Venezuela. Van Bentham Jutting listed the species from the Quaternary at Punta Gorda, Venezuela, but the fossiliferous sediments at this locality are probably pre-Pleistocene in age.

Anadara (Cunearca) cumanensis (Dall) Pl. 7, figs. 1-6

1867. *Arca incongrua* Say, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 163 (part). Reprinted by Harris, 1921, Bull. Amer. Paleont., vol. 8, No. 35, p. 190. Not of Say, 1822, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 2, p. 268.
1874. *Arca incongrua* Say, Guppy, Geol. Mag., decade 2, vol. 1, p. 443. Not of Say.
1898. *Scapharca* (*Cunearca*) *cumanensis* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 633-634.
1916. *Scapharca* (*Cunearca*) *cumanensis* Dall, Sheldon, Palaeontographica Americana, vol. 1, No. 1, p. 61.
1917. *Scapharca* (*Cunearca*) *cumanensis* Dall, Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 344.
1920. *Arca* (*Cunearca*) cf. *cumanensis* (Dall), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 1, pp. 11-12.
1925. *Scapharca* (*Cunearca*) *cumanensis* Dall, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 222-223.

The Cabo Blanco shell referred to *A. cumanensis* is of medium size, inflated, squarish rhomboidal, slightly inequivalve, the ventral margin of the left valve extending a little beyond the margin of the right valve. Anterior end rounded, the basal and posterior margins truncate, the latter oblique. Posterior ridge high, somewhat rounded. Beaks elevated, full, a little anterior to the center of the cardinal area. Cardinal area moderately broad, generally concave, lozenge-shaped, bounded by a deep narrow groove, marked by fine horizontal striae which are crossed by vertical lineations, occasionally engraved with wavy to lunate resilial grooves, the latter discon-

tinuous. Hinge line straight, the hinge itself curved downward somewhat at the ends. Teeth 25 to 37 in all, with a range of 12 to 15 anterior ones and 13 to 30 posterior ones. There are a few more posterior teeth than anterior ones, and on well-preserved specimens most of the teeth are scored by fine closely spaced transverse grooves. Inner margin of valves corrugated into broad flat denticles, each denticle lying under the corresponding intercostal groove of the exterior. Surface sculptured by 28 squarish radial ribs, the ribs of the left valve more or less uniformly beaded or crenate on the whole of the valve, the beading of the right valve obsolescent on the posterior half of the disk. At the base, the radial ribs of the left valve are a little wider than the interspaces, whereas on the right valve the ribs are about the same width or a trifle narrower than the interspaces. On the right valve also a feeble interstitial thread may be present in the intercostal areas but none has been observed on the left valve. Fine concentric striae and lamellae overrun the surface, the latter more pronounced toward the base. On young specimens the ends of the ribs may be tubular.

Dimensions.—Specimen R374a, right valve, length 28.5 mm.; height 27.5 mm.; thickness 12.4 mm. Specimen R374b, left valve, length 27.5 mm.; height 26 mm.; thickness 11.3 mm. Largest specimen (I377a), right valve, length 35.6 mm.; height 37.6 mm.; thickness 18 mm.

Localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two specimens, one of each valve. Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Six specimens including four left valves, one right valve, and one doublet. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Twelve specimens including eight left valves and four right valves. Lower Mare formation in small stream 100 meters west of Quebrada Mare Abajo. Eight specimens including six left valves and two right valves. Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. Two broken specimens. Playa Grande formation (Maiquetía member) at W-26 in Quebrada Las Bruscas approximately 125 meters upstream from junction with Quebrada Las Pailas. Six specimens including three left valves and three right

valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One worn specimen.

Remarks.—*A cumanensis* (Dall) is closely related to the Pleistocene to Recent *A. chemnitzi* (Philippi) but is distinguished from that by its broader hinge and fewer teeth. Both *A. chemnitzi* and *A. cumanensis* may be discriminated from the upper Miocene to Recent *A. brasiliana* (Lamarck) in being more tumid and in lacking the faint radial depression on the exterior.

Range and distribution.—*A cumanensis* (Dall) has been previously recorded from Cumaná, Venezuela (Pliocene ?), and from an island in Lago Henriquillo, Dominican Republic (middle Miocene ?).

Anadara (Cunearca) species indeterminate Pl. 7, figs. 7, 8

The cast, which is composed of a highly calcareous shelly sandstone, indicates that the shell is of medium size, inflated, and subrhomboidal, with an elevated and subrounded posterior ridge. The beaks are high and a little forward. The cardinal area is moderately broad, somewhat concave, and lanceolate. The hinge line is straight. A faint imprint on the anterior lower half of the left valve suggests that there is an interstitial riblet between the principal radial ribs.

Dimensions.—Specimen M370a, left valve, length 25.5 mm.; height 25 mm.; thickness 10.5 mm.

Locality.—Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southwest of its intersection with the Playa Grande Yachting Club road. One specimen, the cast of a left valve.

Remarks.—This form, which is included for the sake of completeness, might be *A. cumanensis* (Dall) or a species of similar ilk.

GLYCYMERIDAE

Glycymeris (Glycymeris) undata (Linnaeus) Pl. 7, figs. 9-12

1758. *Arca undata* Linnaeus, Syst. Nat., ed. 10, p. 695, No. 149.
1767. *Arca undata* Linnaeus, Syst. Nat., ed. 12, pt. 2, p. 1142, No. 179.
1784. *Arca undata* Linnaeus, Chemnitz, Syst. Chonchylien-Cabinet, vol. 7, p. 224, pl. 57, fig. 560.
1819. *Pectunculus undatus* (Linnaeus), Lamarck, An. sans Vert., vol. 6, p. 50.
1843. *Pectunculus lineatus* Reeve, Conch. Icon., vol. 1, pl. 5, sp. 25.

1846. *Pectunculus hirtus* Philippi, Zeitschr. f. Malakozool., vol. 3, p. 191.
1852. *Axinea undata* (Linnaeus), Mörch, Catalogue Conchyliorum Comes de Yoldi, pt. 1, p. 42.
1855. *Arca undata* Linnaeus, Hanley, Ipsa Linnaei Conchylia, p. 97.
1864. *Pectunculus undatus* (Linnaeus), Krebs, The West Indian Marine Shells, p. 127.
1878. *Pectunculus undatus* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 16.
1886. *Pectunculus undatus* (Linnaeus), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, pp. 238-239 (part).
1889. *Pectunculus undatus* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 42.
1889. *Pectunculus undatus* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 260.
1897. *Pectunculus undatus* (Linnaeus), von Ihering, Mus. Paulista, Rev., vol. 2, p. 89.
1900. *Pectunculus undatus* (Linnaeus), Verrill and Bush, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 12, p. 517.
1905. *Pectunculus undatus* (Linnaeus), Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12, art. 2, p. 186.
1911. *Pectunculus undatus* (Linnaeus), Lamy, Jour. Conchyl., vol. 59, p. 116.
1936. *Glycymeris lineata* (Reeve), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1938. *Glycymeris lineata* (Reeve), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1290.
1952. *Arca undata* Linnaeus, Dodge, Amer. Mus. Nat. Hist. Bull., vol. 100, art. 1, pp. 155-157.
1954. *Glycymeris undata* (Linnaeus), Abbott, American Seashells, p. 348, pl. 27g.
1959. *Glycymeris undata* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 1, 2.
1961. *Glycymeris undatus* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Glycymeris undata* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 161.

Shell small, solid, suborbicular, moderately inflated. Beaks fairly high, subcentral. Dorsal margin on either side of beak straight. Cardinal area narrow, subtriangular. Hinge evenly arcuate, provided with 15 to 17 minutely striate teeth, with one more tooth on what is taken to be the anterior series than on the posterior series. The inner teeth are bent a little whereas the outer ones are stubbier, shorter, and obliquely directed. Inner margin crenulate, the crenulations extending well above the ends of the hinge plate. The crenulations on the lateral margins are in the form of short, single, oblique denticles, but starting at about the middle of the valve and continuing around the base the denticles are very narrowly bifid, with the points directed downward. There are in all about 64 crenulations on

specimens some 10 millimeters or so in diameter. Muscle scars bordered by a ridgelet which converges toward the umbo but plays out beneath the base of the hinge plate. Surface sculptured by faintly beaded or crenate radial riblets which are crossed by numerous, exceedingly fine concentric striae. On the umbo the radial riblets are single and stand out rather sharply, and across the upper part of the valve there are about 22 of them. Below the umbonal area interstitial riblets appear, and both those and the primary radials flatten out and become bipartite at the base. The interspaces are minutely and regularly punctate, the punctations probably representing points of attachment of the periostracum.

Dimensions.—Specimen S484a, right ? valve, length 10.8 mm.; height 10.6 mm.; thickness 3.5 mm. Specimen I484a, right ? valve, length 9.7 mm.; height 9 mm.; thickness 3.2 mm. Specimen J482a, right ? valve, length 6.5 mm.; height 6.3 mm.; thickness 2 mm.

Localities.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One right ? valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right ? valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right ? valve.

Remarks.—The three Venezuelan fossil specimens are young and are similar to the immature shell of *G. americana* (DeFrance) illustrated by Gardner (1943, pp. 27-28, pl. 1, figs. 18, 19) from the Pliocene at Neils Eddy Landing on the Cape Fear River of North Carolina. Although the Recent *G. americana* has been reported as far south as Brazil. Nicol (1953, pp. 451-455) indicated that the southern limit of *G. americana s. s.*, either living or fossil, is Florida. The adult *G. americana* is said to be much flatter than the adult *G. undata,* but the young are much alike. Tentatively this fossil is referred to *G. undata* as that is known to extend to the tropics.

Range and distribution.—The living *G. undata* (Linnaeus) ranges from North Carolina to the West Indies at depths generally above 65 fathoms. As a fossil it occurs in the Pleistocene of Florida, St. Kitts, and St. Eustatius, and it has been reported as far back as the Miocene by Dall (1889, p. 42).

Glycymeris (Tucetona) pectinata (Gmelin) Pl. 7, figs. 13, 14; Pl. 8, figs. 1-4

1791. *Arca pectinata* Gmelin, Syst. Nat., vol. 6, p. 3313.
1819. *Pectunculus pectinatus* (Gmelin), Lamarck, An. sans Vert, ed. 2, vol. 6, p. 494.
1843. *Pectunculus pectinatus* (Gmelin), Reeve, Conch. Icon., vol. 1, pl. 6, sp. 28.
1853. *Pectunculus pectiniformis* d'Orbigny, [in] La Sagra, Hist. phys., polit. nat. l'Ile de Cuba, Mollusques, vol. 2, p. 313. Not of Lamarck 1819, East Indies.
1864. *Pectunculus pectinatus* (Gmelin), Krebs, The West Indian Marine Shells, p. 127.
1878. *Pectunculus pectinatus* (Gmelin), Mörch, Catalogue of West-India Shells, p. 16.
1885. *Pectunculus pectinatus* (Gmelin), Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, p. 250.
1886. *Pectunculus pectinatus* (Gmelin), Dall, Mus. Comp. Zool., Bull., vol. 12, p. 239.
1889. *Pectunculus pectinatus* (Gmelin), Dall, U. S. Nat. Mus., Bull. 37, p. 42.
1889. *Pectunculus pectinatus* Lamarck, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 68.
1890. *Pectunculus pectinatus* (Gmelin), Smith, Linnean Soc. London, Jour., vol. 20, p. 503.
1895. *Pectunculus pectinatus* (Gmelin), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1898. *Glycymeris pectinata* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 612-613.
1897. *Pectunculus pectinatus* (Gmlein), von Ihering, Mus. Paulista, Rev., vol. 2, p. 89.
1901. *Glycymeris pectinatus* (Gmelin), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 459.
1911. *Pectunculus pectinatus* (Gmelin), Lamy, Jour. Conchyl., vol. 59, pp. 98-100, pl. 2, fig. 5.
1920. *Glycymeris pectinata* (Gmelin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 53.
1922. *Glycymeris pectinata* (Gmelin), Johnson, Nautilus, vol. 36, No. 1, p. 11.
1924. *Glycymeris pectinata* (Gmelin), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., list following p. 28.
1926. *Glycymeris pectinata* (Gmelin), Gardner, U. S. Geol. Sur., Prof. Paper 142-A, p. 38, pl. 9, figs. 9-12.
1926. *Glycymeris pectinata* (Gmelin), Weisbord, Nautilus, vol. 39, No. 3, p. 82.
1932. *Glycymeris pectinata* (Gmelin), Mansfield, Florida State Geol. Sur., Bull. No. 8, pp. 38-39, pl. 3, figs. 1, 7.
1936. *Glycymeris pectinata* (Gmelin), McLean, Nautilus, vol. 49, No. 4, p. 116.
1936. *Glycymeris pectinata* (Gmelin), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Glycymeris pectinata* (Gmelin), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 162.
1937. *Glycymeris pectinatus* (Gmelin), Smith, East Coast Marine Shells, p. 29, pl. 2, fig. 8.
1938. *Glycymeris pectinata* (Gmelin), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1290.
1939. *Glycymeris pectinata* (Gmelin), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 12, 18, 22, 25.

1944. *Glycymeris pectinata* (Gmelin), Hackney, vol. 58, No. 2, p. 57.
1945. *Glycymeris pectinata* (Lamarck), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Glycymeris pectinata* (Gmelin), Jaume, Soc. Malac. "Carlos de La Torre" Rev., vol. 4, No. 3, p. 98.
1949. *Glycymeris pectinata* (Gmelin), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 10.
1951. *Glycymeris (Glycymeris) pectinatus* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 11, pl. 1, fig. 8.
1954. *Glycymeris pectinata* (Gmelin), Abbott, American Seashells, p. 348, pl. 27i.
1955. *Glycymeris pectinata* (Gmelin), Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 38-39, pl. 3, figs. 14a, b.
1956. *Glycymeris* (*Tucetona*) *pectinata* (Gmelin), Nicol, Nautilus, vol. 70, No. 2, pp. 51, 52.
1958. *Glycymeris* (*Tucetona*) *pectinata* (Gmelin), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 112.
1959. *Glycymeris pectinata* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 1, 2.
1961. *Glycymeris* (*Tucetona*) *pectinata* (Gmelin), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Glycymeris pectinata* (Gmelin), Warmke and Abbott, Caribbean Seashells, p. 161, pl. 31a.

The Venezuelan fossils referred to *G. pectinata* are of medium size, subequivalve, equilateral to inequilateral, a little inflated, subtrigonal to suborbicular in outline. Typically, the posterior margin is obliquely truncate to slightly concave above, the ventral margin well rounded, and the anterior end gently rounded to subtruncate. Some specimens, however, are equilateral and orbicular. Beaks moderately high and central. Cardinal area fairly narrow, triangular, grooved with two to five resilial carets which are more or less parallel with the sides of the area. Hinge line straight, lying atop and truncating the inner teeth of the hinge. Hinge plate subangularly arched. Hinge teeth 19 to 24 in number, with usually one more on the anterior series than on the posterior, the ones near the beak chevron-shaped to bent, the distal ones oblique, all of them transversely and minutely striate. Internal ventral margin crenulate, the crenulations paired and corresponding to the spaces between the external radial ribs. Muscle scars pronounced, the posterior one a little larger and slightly lower than the anterior, the inner border of the scars bounded by a sharp ridgelet, the ridgelets converging toward the umbo but becoming obsolescent under the hinge plate. Exterior sculptured by 22 to 27 fanlike radial ribs, the ribs squarish

or somewhat rounded or occasionally subtriangular, crossed by concentric striae and lamellae. At the basal margin the ribs may be wider than or about the same width as the intercoastal areas.

Dimensions.—Specimen G481a, left valve, length 24.6 mm.; height 24.5 mm.; thickness 6.1 mm. Specimen G481b, right ? valve, length 16 mm.; height 16 mm.; thickness 4.2 mm. Specimen G481c, left ? valve, length 7.2 mm.; height 7 mm.; thickness 3 mm. Specimen H481a, left ? valve, length 25 mm.; height 26 mm.; thickness 7.1 mm. Specimen H481b, left valve, length 27.5 mm.; height 30 mm.; thickness 10 mm.

Localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One specimen, a right valve. Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Eight specimens including four right valves and four left valves. Mare formation at W-25, south flank of Punta Gorda anticline. Three specimens including two left ? valves and one right valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two specimens including one right valve and one left.

Remarks.—On equilateral examples of this species, as on others of this genus, it is often difficult to distinguish posterior from anterior, and even with inequilateral specimens paleontologists differ in their vews of what constitutes the front and rear of a valve. In this work the posterior end of *G. pectinata* is the one which is usually truncate, which has the larger and lower muscle scar, and which often has a tooth or two less on the hinge.

Range and distribution.—The living *Glycymeris pectinata* (Gmelin) ranges from North Carolina, U.S.A., to Brazil, in 2 to 874 fathoms. In the Pleistocene it has been found in South Carolina, Louisiana (Knapp's no. 3 well at 670, 700-780 feet and New Orleans Gymnasium well at 1200 feet), Florida, St. Kitts, St. Eustatius, Venezuela (Paraguaná), and Barbados. In the Pliocene it has been reported from North Carolina, South Carolina, and Florida; in the upper Miocene from Virginia, North Carolina, South Carolina, and Florida; and from the middle Miocene of Florida.

Glycymeris pectinata is a variable species both in shape and character of the ribbing, and some authors have placed *G. arata*

(Conrad) (1841, Am. Jour. Sci., vol. 41, p. 346) in synonymy with it. However, Olsson and Harbison (1953, pp. 30-31, pl. 1, figs. 6, 6a) examined and illustrated the holotype of *G. arata* and believe it should be considered a distinct species on the basis of its heavier shell, trigonal outline, and widely spaced ribs. According to their information, the typical *G. arata* seems to be restricted to the Miocene.

Glycymeris (Glycymerella) decussata (Linnaeus) Pl. 8, figs. 5-10; Pl. 9, figs. 1, 2

1758. *Arca decussata* Linnaeus, Syst. Nat., ed. 10, p. 694, No. 147.
1767. *Arca decussata* Linnaeus, Syst. Nat., ed. 12, p. 1142, No. 177.
1784. *Arca decussata* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 7, p. 226, pl. 57, fig. 561.
1789. *Arca decussata* Linnaeus, Bruguière, Encycl. Méth., vol. 1, p. 112, pl. 310, fig. 5.
1819. *Pectunculus pennaceus* Lamarck, An. sans Vert., vol. 6, p. 51.
1843. *Pectunculus pennaceus* Lamarck, Reeve, Conch., Icon., *Pectunculus,* pl. 5, sp. 24.
1855. *Arca decussata* Linnaeus, Hanley, Ipsa Linnaei Conchylia, p. 96.
1864. *Pectunculus decussatus* (Linnaeus), Krebs, The West Indian Marine Shells, p. 126.
1864. *Pectunculus decussata* (Chemnitz), Guppy, Sci. Assoc. Trinidad, Trans., p. 36.
1867. *Pectunculus pennaceus* Lamarck, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 164.
1878. *Pectunculus decussatus* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 16.
1878. *Pectunculus decussatus* (Linnaeus), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 260.
1889. *Pectunculus pennaceus* Lamarck, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 120, 141.
1895. *Pectunculus* (*Axinea*) *pennaceus* Lamarck, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1898. *Glycymeris pennacea* (Lamarck), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 608-609.
1901. *Glycymeris pennaceus* (Lamarck), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 459.
1911. *Pectunculus decussatus* (Linnaeus), and *P. pennaceus* Lamarck, Lamy, Jour. Conchyl., vol. 59, p. 119, pl. 3, fig. 7.
1922. *Glycymeris decussatus* (Linnaeus), Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 352-353, pl. 19, figs. 6, 7.
1925. *Glycymeris (Glycymerella) pennacea* (Lamark), Woodring, Carnegie Inst. Washington, Publ. No. 366, p. 26.
1925. *Glycymeris decussata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 182-183, pl. 18, fig. 14.
1933. *Pectunculus* (*Glycimeris*) *pennaceus* Lamarck, Trechmann, Geol. Mag., vol. 70, No. 823, p. 35.
1936. *Glycymeris pennacea* (Lamarck), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Glycymeris pennacea* (Lamarck), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 160.

1937. *Glycymeris pennaceus* (Lamarck), Smith, East Coast Marine Shells, p. 29, pl. 8, figs. 7a, 7b.
1946. *Glycymeris pennacea* (Lamarck), Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 98.
1951. *Glycymeris (Glycymerella) pennaceus* (Lamarck), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 7, pt. 1, p. 12, pl. 1, fig. 5.
1952. *Arca decussata* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 153-155.
1953. *Glycymeris* (*Glycymerella*) *decussata* (Linnaeus), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 30, pl. 1, fig. 3.
1954. *Glycymeris decussata* (Linnaeus), Abbott, American Seashells, p. 348, pl. 27h.
1958. *Glycymeris* (*Glycymerella*) *decussata* (Linnaeus), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 112.
1959. *Glycymeris decussata* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 1, 2.
1961. *Glycymeris* (*Glycymeris*) *decussata* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Glycymeris decussata* (Linnaeus), Warmks and Abbott, Caribbean Seashells, p. 160, pl. 31b.

Shell fairly large, moderately inflated, broadly elliptical to suborbicular. Anterior and ventral margins rounded, the posterior end subangulate, the upper half obliquely truncate, the lower very gently rounded to subtruncate. Umbos low, the beaks sharp, nearly touching, opisthogyrate, located at about the posterior fourth of the cardinal area. Cardinal rudely lozenge-shaped, sunken, bounded on either side by a sulcus which widens hingeward, the posterior sulcus a little more pronounced than the anterior. On some specimens there is a hump on the cardinal area under the beak, and on well-preserved examples there are about three asymmetrically angulate ligamental grooves, the anterior ones the longer. Hinge line short and nearly straight, lying atop and truncating the proximal anterior teeth. The hinge itself is usually gently and subangularly arched, but on two large right valves the smooth thickened basal margin of the hinge is nearly straight. Depending more or less on the size of the shell there are 18 to 29 teeth in all, of which there are 2 to 5 more on the anterior side than on the posterior. The proximal four to seven teeth of the anterior series are nearly vertical, and due to their truncation by the hinge line are relatively short, the distal ones heavier and a little curved. The posterior teeth nearest the beak are larger than the anterior and are chevron-shaped, the angulation becoming less pronounced, but the thickness of the teeth

greater at the end of the hinge. All of the teeth are scored with fine closely spaced transverse grooves, the grooves a little sharper on the left face of each tooth as viewed with the umbos up. Inner margin of valve denticulate, the denticles small and pustular opposite the ends of the hinge, but bifid and progressively longer toward the middle of the base, the apex of the bifid denticles closed and pointing downward. Anterior muscle scar longer than the posterior, both of them bounded by a slightly raised ridgelet, the ridgelets converging toward the umbo but playing out beneath the base of the hinge plate. Surface sculptured by broad, gently rounded, hardly raised, evenly spaced radial ribs, which, with the spaces between them, are engraved by fine evenly spaced radial grooves of which there may be as many as nine from trough to trough at the basal margin. On the anterior and posterior ends of the valve the primary ribs as such disappear and are replaced by closely spaced radial cords or threads. The radials are impressed by exceedingly fine and numerous slanting striae which impart a delicate, minutely crenate, latticed pattern. In addition, the surface is crossed by fine concentric striae which show to better advantage in the intercostal troughs when those are corroded. On the exterior, the Recent shell has a whitish ground with subradial markings, and with splotches of chestnut on the umbo; the interior is white except under the hinge where it is clouded with chestnut.

Dimensions.—Recent specimen A480a, right valve, length 19.5 mm.; height 17 mm.; thickness 5.2 mm. Fossil specimen I480a, left valve, length 34 mm.; height 30 mm.; thickness 16 mm. Fossil specimen I490b, left valve, length 18 mm.; height 16.7 mm.; thickness 5.5 mm. Fossil specimen I480c, right valve, length 18 mm.; height 16.8 mm.; thickness 5.4 mm. Fossil specimen I483a, immature right valve, length 7 mm.; height 5.9 mm.; thickness 1.9 mm. Largest fossil specimen J480a, right valve, length 58.0 mm.; height 57.8 mm.; thickness 21 mm. Fossil specimen T480a, right valve, length 33.4 mm.; height 30 mm.; thickness 11.5 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One specimen, a right valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Four specimens including three right valves and one left

valve. Mare formation at W-25, south flank of Punta Gorda anticline. Seven specimens, all of them left valves. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Thirty-one specimens including sixteen right valves and fifteen left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Twenty-three specimens including thirteen left valves and ten right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Fifty-five specimens including thirty right valves and twenty-five left valves.

Remarks.—Lorié was the first to record this species from the Cabo Blanco area ("Muschelbank Cabo Blanco"), and so far as I can determine the fossils are indeed identical with the Recent *G. decussata.* The posterior position of the beak serves to differentiate *G. decussata* (Linnaeus) from the Pleistocene to Recent *G. undata* (Linnaeus) on which the beak is at about the middle of the ligamental area. The Recent *G. spectralis* Nicol (1952, pp. 266-257, figs. 1, 2) which ranges from North Carolina to Costa Rica has narrower and more prominent radial ribs than *G. decussata.* The middle Miocene *G. jamaicensis* Dall (1898, p. 608) (see Woodring, 1925, pp. 24-25, pl. 2, figs. 1-3) is similar to both *G. decussata* and *G. undata,* differing from *G. decussata* by its medial beak, and from *G. undata* by having "stronger radial ribs on the upper half of the shell" (Woodring).

Range and distribution.—The living *Glycymeris decussata* (Linnaeus) ranges from southeast Florida to northern South America. In the Pleistocene it occurs in Barbados, St. Kitts, and St. Eustatius. In the Pliocene it occurs at Matura, Trinidad, and near Cumaná, Venezuela. In the upper Miocene ? it is reported from La Belle, Florida, and in the middle Miocene from Costa Rica and Trinidad.

MYTILIDAE

Brachidontes (Ischadium) recurvus (Rafinesque) Pl. 8, figs. 11-14

1820. *Mytilus recurvus* Rafinesque, An. Gén. Sci. Phys. Bruxelles, vol. 5, p. 320.
1822. *Mytilus hamatus* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 2, p. 265.
1823. *Mytilus striatus* Barnes, Amer. Jour. Sci. and Arts., 1st. ser., vol. 6, p. 364.

1832. *Mytilus hamatus* Say, American Conchology, unpaginated text, pl. 50, figs. 1-2.
1837. *Mytilus carolinensis* Conrad, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 7, p. 244, pl. 20, fig. 6.
1843. *Mytilus hamatus* Say, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 46.
1857. *Mytilus hamatus* Say, Reeve, Conch. Icon., vol. 7, pl. 3, sp. 7.
1869. *Brachydontes hamatus* (Say), Perkins, Boston Soc. Nat. Hist., Proc., vol. 13, p. 156.
1871. *Mytilus carolinensis* Conrad, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 134.
1872. *Modiola hamatus* (Say), Verrill, Amer. Jour. Sci. and Arts, ser. 3, vol. 3, p. 211, pl. 7, fig. 3.
1874. *Mytilus carolinensis* Conrad, Tryon, American Marine Conchology, p. 187, fig. 513.
1875. *Modiola hamatus* (Say), Verrill, Amer. Jour. Sci. and Arts, ser. 3, vol. 10, p. 37.
1882. *Modiola hamatus* (Say), Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 5, pp. 577-578, fig. 10.
1889. *Mytilus hamatus* Say, Clessin, [in] Syst. Conchylien-Cabinet, 2d ed., p. 77, pl. 11, figs. 9-10.
1889. *Mytilus hamatus* Say, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 69.
1889. *Mytilus hamatus* Say, Dall, U. S. Nat. Mus., Bull. 37, p. 38.
1891. *Mytilus hamatus* Say, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1892. *Mytilus hamatus* Say, Singley, Geol. Survey Texas, Fourth An. Rept., p. 325.
1898. *Mytilus* (*Hormomya*) *hamatus* Say, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 789.
1901. *Mytilus* (*Hormomya*) *hamatus* Say, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 469.
1905. *Brachydontes* (*Ischadium*) *hamatus* (Say), Jukes-Browne, Malac. Soc. London, Proc., vol. 6, pp. 222-223.
1906. *Mytilus hamatus* Say, Clark, Maryland Geol. Sur., Pliocene and Pleistocene, p. 203, pl. 60, figs. 5-6.
1920. *Mytilus hamatus* Say, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 65-66.
1925. *Mytilus hamatus* Say, Clench, Nautilus, vol. 38, No. 3, p. 94.
1929. *Mytilus hamatus* Say, Clench, Nautilus, vol. 43, No. 1, p. 35.
1934. *Mytilus* (*Hormomya*) *recurvus* Rafinesque, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 27.
1936. *Brachydontes* (*Ischadium*) *hamatus* (Say), Lamy, Jour. Conchyl., ser. 4, vol. 34(80), pp. 196-198.
1937. *Mytilus recurvus* Rafinesque, Smith, East Coast Marine Shells, p. 37, pl. 10, figs. 8a, b.
1938. *Mytilus hamatus* Say, Wheeler, Nautilus, vol. 51, No. 3, p. 92.
1938. *Mytilus hamatus* Say, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1940. *Mytilus recurvus* Rafinesque, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1943. *Brachidontes* (*Ischadium*) *recurvus* (Rafinesque), Gardner, U. S. Geol. Sur., Prof. Paper 199-B, pp. 29-30, pl. 1, figs. 7-8.
1944. *Mytilus recurvus* Rafinesque, Hackney, Nautilus, vol. 58, No. 2, p. 57.
1951. *Brachydontes* (*Ischadium*) *recurvus* (Rafinesque), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 44-45, pl. 9, fig. 5.

1952. *Brachidontes recurvus* (Rafinesque), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180, pl. 6, figs. 17-18.
1954. *Brachidontes* (*Ischadium*) *recurvus* (Rafinesque), Abbott, American Seashells, p. 353, pl. 35n.
1955. *Ischadium recurvus* (Rafinesque), Soot-Ryen, Allan Hancock Expeditions. Univ. Southern California Press, vol. 20, No. 1, p. 36, text figs. 19-20.
1955. *Brachidontes recurvus* (Rafinesque), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 52, pl. 7, fig. 24.
1959. *Brachidontes recurvus* (Rafinesque), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 3.
1959. *Brachidontes recurvus* (Rafinesque), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2121, 2122, 2161, 2165, pl. 1, fig. 12.
1961. *Brachidontes recurvus* (Rafinesque), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 37.
1961. *Brachidontes recurvus* (Rafinesque), Warmke and Abbott, Caribbean Seashells, p. 162, pl. 31g.

The young Venezuelan shell referred to this species is small, broadly falcate, the ventral margin a little concave, the dorsal margin subangularly rounded. Byssal gape small, situated well in front of the middle. Dorsum asymmetrically humped, the hump starting at the umbo and extending arcuately to the sharp curve at the posterior basal end of the valve. Ventral slope steep, dorsal and posterior slopes gentle. Beaks low, terminal. Umbonal end with three to five fairly long irregular teeth plus several small ones at the curve with the anteroventral margin. Ligamental groove rather shallow but fairly wide, the lower edge of the groove sharp. Behind the ligament, the internal margin is finely crenulate, the crenulations continuing around the margin to the corner of the byssal gape. Interior slightly nacreous, the color white with large areas of violet-brown. Exterior sculptured by rather coarse but finely beaded radiating ribs and numerous microscopic concentric striae. Additionally, there are widely spaced concentric rifts representing hiatuses in growth. The color of the surface is predominantly light brown with areas of dark brown and, near the basal posterior margin, brownish black.

Dimensions.—Specimen A556a1-2, attached valves, length 9.7 mm.; max. width 6 mm.; thickness of doublet 5.1 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One young specimen, collected with valves attached.

Range and distribution.—Recent—Cape Cod, Massachusetts, to northern South America. In temperate regions *B. recurvus* is often

found associated with oysters in waters of low salinity; in southern waters it often inhabits mangrove flats. Pleistocene—Massachusetts, Maryland, Florida, Louisiana (in well samples). Pliocene — North Carolina, Florida. Upper Miocene—Virginia.

Modiolus americanus Leach Pl. 9, figs. 3-6

1775. *Mytilus americanus* Favart d'Herbigny, Dict. hist. nat. Test., vol. 3, p. 418.
1815. *Modiola americana* Leach, The Zoological Miscellany, vol. 2, p. 32, pl. 72, fig. 1.
1819. *Modiola tulipa* Lamarck, An. sans Vert., vol. 6, p. 111.
1857. *Modiola tulipa* Lamarck, Reeve, Conch. Icon., vol. 10, pl. 4, sp. 15.
1864. *Modiolus americana* d'Herbigny, *M. americana* ? Leach, and *M. tulipa* Lamarck, Krebs, The West Indian Marine Shells, p. 128.
1873. *Modiolus tulipa* (Linnaeus), Tryon, American Marine Conchology, p. 187.
1878. *Modiola americana* d'Herbigny, Mörch, Catalogue of West-India Shells, p. 16.
1884. *Modiola tulipa* (Linnaeus), Tryon, Structural and Systematic Conchology, vol. 3, p. 263, pl. 128, fig. 95.
1889. *Modiola tulipa* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 38.
1889. *Modiola tulipa* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 69.
1891. *Modiola tulipa* (Linnaeus), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1898. *Modiolus tulipus* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 793.
1901. *Modiolus tulipus* Lamarck, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 470.
1903. *Modiolus tulipus* (Linnaeus), Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1907. *Modiola tulipa* Lamarck, Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12, art. 2, p. 186, pl. 35B, fig. 5.
1920. *Modiolus tulipus* Lamarck, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 66.
1923. *Modiolus tulipa* (Linnaeus), Clench, Nautilus, vol. 37, No. 2, p. 55.
1934. *Modiolus tulipus* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 28.
1936. *Modiolus tulipa americana* Leach, Lamy, Jour. Conchyl., ser. 4, vol. 80, pp. 278-279.
1936. *Modiolus tulipus* (Linnaeus), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Modiolus tulipus* (Linnaeus), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 164.
1937. *Modiolus tulipus* (Linnaeus), Smith, East Coast Marine Shells, p. 38, pl. 11, figs. 7a, 7b.
1944. *Modiolus tulipa* Lamarck, Hackney, Nautilus, vol. 58, No. 2, 57.
1945. *Volsella tulipa* (Lamarck), and *V. americana* (Leach), Rehder, Nautilus, vol. 59, No. 2, pp. 67-68.
1951. *Modiolus* (*Modiolus*) *tulipa* Lamarck, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 39, pl. 8, fig. 4.
1952. *Modiolus tulipus* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180, pl. 6, fig. 15.

1953. *Modiolus* (*Modiolus*) *tulipa* (Linnaeus), Haas, Fieldiana-Zoology, vol. 34, No. 20, pp. 203, 204, 205.
1954. *Volsella americana* (Leach), Abbott, American Seashells, p. 351, pl. 35L.
1955. *Modiolus americanus* Leach, Soot-Ryen, Allan Hancock Expeditions. Univ. Southern California Press, vol. 20, No. 1, pp. 67-68, pl. 6, figs. 27-28, text fig. 56.
1955. *Modiolus americanus* Leach, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 53, pl. 7, fig. 36.
1958. *Modiolus americanus* Leach, Keen, Sea Shells of Tropical West America, pp. 54-55, fig. 100.
1958. *Modiolus americanus* Leach, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 114.
1959. *Volsella americana* (Leach), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 3.
1961. *Modiolus americanus* Leach, Warmke and Abbott, Caribbean Seashells, p. 162, pl. 31k.

Shell moderately large, thin, subtrapezoidal, somewhat elongated, the posterodorsal side alate, the dorsum proper well inflated along the middle. Anterior end attenuate, acutely rounded, with a rather broad somewhat reflected margin, the posterior end relatively wide and evenly rounded, the ventral margin embayed and gently gaping a little in front of the middle. Extending from the anterior side of the umbo to the base there is an angulate depression terminating at the back of the byssal gape. Beak oblique, situated a little distance back from the anterior tip of the valve, virtually touching the reflected anterodorsal margin. Interior iridescent, violet under the umbo, but with wide concentric bands of pale green toward the rear. Exterior marked with faint concentric laminae, the color a burnt red or brown on the sides, the dorsum a deep rose with a number of unequal radial stripes of deep violet and purple. Periostracum straw-colored, disposed as a scaly integument around the margins back of the byssal gape, the integument developing into relatively sparse but long hairs which are matted every which way, and frequently with fine grains of sand enmeshed in them.

Dimensions.—Figured specimen (A555al-2), length 41 mm.; max. width 21 mm.; thickness of doublet 18 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One doublet and one left valve.

Remarks.—Although the generic name *Volsella* of Scopoli (1777, Introductio ad Historiam Naturalem) has priority, The International Commission on Zoological Nomenclature ruled, in Opinion 325 issued 7 January 1955, to conserve the later but better-known name of

Modiolus Lamarck (1799, Soc. Hist. nat. Paris Mém., p. 87).

Modiolus tulipus Lamarck, often referred to as *M. tulipus* (Linnaeus), is the same as *M. americanus* Leach, the latter having been named in 1815, the former in 1819.

M. americanus is often difficult to distinguish, particularly in the young, from *M. modiolus* (Linnaeus), a northern species originally described from the Mediterranean, and identified in the Western Atlantic from the Arctic to northern Florida, in the Eastern Pacific from the Arctic to perhaps Monterey, California, and in the Western Pacific in Japan. Generally *M. modiolus* is separated from *M. americanus* by its heavier shell and thicker, black-brown periostracum.

Range and distribution.—In the Western Atlantic *Modiolus americanus* Leach lives in shallow water from North Carolina, U.S.A., to Brazil. In Brazil the species has been found on the beach at Ilha Grande, in the intestine of a sea cucumber, and in the stomach of a sea slug (Haas). Soot-Ryen (1955, p. 68) stated that he was unable to separate certain Eastern Pacific specimens from others collected at Clearwater, Florida, and suggested tentatively that the range of *M. americanus* off the west coast of the Americas may be from Baja California to Ecuador.

Musculus lateralis (Say) Pl. 9, figs. 7-8

1822. *Mytilus lateralis* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 264.
1842. *Modiola elliptica* H. C. Lea, Amer. Jour. Sci., vol. 43, No. 1, pt. 11, p. 106, pl. 1, fig. 2.
1870. *Modiolaria lateralis* (Say), Conrad, Amer. Jour. Conch., vol. 5, pt. 2, No. 7, p. 108.
1874. *Crenella lateralis* (Say), American Marine Conchology, p. 190, pl. 40, fig. 523.
1881. ? *Crenella* (*Modiolaria*) *translucida,* Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 377, pl. 47, fig. 81.
1886. *Modiolaria lateralis* (Say), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 236, pl. 6, figs. 7-8.
1889. *Modiolaria lateralis* (Say), Dall, U. S. Nat. Mus., Bull. 37, p. 40, pl. 6, figs. 7-8.
1889. *Modiolaria lateralis* (Say), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, 69.
1898. *Modiolaria lateralis* (Say), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 807.
1901. *Modiolaria lateralis* (Say), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 471.
1909. *Modiolaria lateralis* (Say), Vaughan, Florida Geol. Sur., Second An. Rept., p. 149.
1916. *Modiolaria lateralis* (Say), Thiele, Zool., Jahrb. Suppl. 11, p. 127.

1920. *Modiolaria lateralis* (Say), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 68.
1934. *Modiolaria lateralis* (Say), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 29.
1936. *Musculus lateralis* (Say), McLean, Nautilus, vol. 49, No. 4, p. 117.
1936. *Modiolaria lateralis* (Say), Lermond, Check List of Florida Marine Shells, Gulfport, p. 14.
1937. *Modiolaria lateralis* (Say), Lamy, Jour. Conchyl., ser. 4, vol. 35 (81), p. 21.
1937. *Modiolaria lateralis* (Say), Smith, East Coast Marine Shells, p. 39, pl. 11, fig. 8.
1944. *Modiolaria lateralis* (Say), Hackney, Nautilus, vol. 58, No. 2, p. 57.
1951. *Modiolaria lateralis* (Say), New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 45, pl. 9, fig. 7.
1954. *Musculus lateralis* (Say), Abbott, American Seashells, p. 355, fig. 75d.
1955. *Modiolaria lateralis* (Say), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 55, pl. 8, fig. 45.
1958. *Musculus lateralis* (Say), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Modiolaria lateralis* (Say), Moore, Nautilus, vol. 71, No. 4, pp. 127, 128.
1958. *Musculus lateralis* (Say), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 114.
1959. *Musculus lateralis* (Say), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 4.
1961. *Musculus lateralis* (Say), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 38.
1961. *Musculus lateralis* (Say), Warmke and Abbott, Caribbean Seashells, p. 163, pl. 31c.

Shell small, thin, subtranslucent, elongate-rhomboidal, somewhat narrowed anteriorly, broader and produced posteriorly, moderately inflated. Posterodorsal margin nearly horizontal, posterior end obtusely angular, ventral margin obliquely truncated, the anterior end and the anterodorsal margin rounded and evenly continuous. Disk with a low broad rounded posterior ridge, a fairly wide posterior end, and a hardly discernible medial depression along the base of which the margin is slightly embayed. Umbonal area full and high, the beak somewhat appressed on top, directed forward, situated near the anterior end. Externally the posterior third of the valve and the narrower anterior submargin are sculptured by radiating, faintly crenated riblets, the riblets wanting on the middle area where only the fine faint concentric growth wrinkles appear. Interior glossy, the scars not distinguishable, the radial riblets of the exterior reflected through. Inner edge crenate except at the posterodorsal margin and middle of the ventral margin. Extending in a narrow stripe or band from the umbo to the ventral margin, the shell substance of the interior is whitened.

Dimensions.—Specimen I514a, left valve, length 2.1 mm.; height 1.5 mm.

Locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One left valve.

Range and distribution.—The living *M. lateralis* ranges from Maine to northern South America in the Western Atlantic to depths of 30 fathoms. In the Pleistocene the species occurs in South Carolina and Florida, and in the Pliocene it has been reported from Florida. As pointed out by Dall, *M. translucida* (Gabb) from the Pliocene of Costa Rica is a similar species and may well be the same as *M. lateralis* (Say).

Crenella divaricata (d'Orbigny) Pl. 9, figs. 9-12

1842. *Nuculocardia divaricata* d'Orbigny, [In] La Sagra, Hist. phys., polit. nat. l'Ile de Cuba, Mollusques, vol. 2, p. 311, Atlas, pl. 27, figs. 56-59.
1862. *Nuculocardia divaricata* d'Orbigny, Chenu, Man. Conchyl., vol. 2, p. 154, fig. 754.
1886. *Crenella divaricata* (D'Orbigny), Dall. Mus. Comp. Zool., Bull., vol. 12, p. 235 (part).
1889. *Crenella divaricata* (Orbigny), Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1898. *Crenella divaricata* (Orbigny), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 803.
1901. *Crenella divaricata* (d'Orbigny), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 471.
1908. *Crenella divaricata* (Orbigny), Dall, Mus. Comp. Zool., Bull., vol. 43, No. 6, p. 410.
1920. *Crenella divaricata* (Orbigny), Dall, U. S. Nat. Mus., Bull. 112, p. 24.
1920. *Crenella divaricata* (d'Orbigny), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 69.
1925. *Crenella divaricata* (d'Orbigny), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 247, pl. 18, fig. 13.
1930. *Crenella divaricata* (d'Orbigny), Strong and Hanna, California Acad. Sci., Proc., ser. 4, vol. 19, Nos. 1, 3, pp. 4, 15.
1937. *Crenella divaricata* (Orbigny), Smith, East Coast Marine Shells, p. 39.
1937. *Crenella divaricata* (d'Orbigny), Lamy, Jour. Conchyl., ser. 4, vol. 35(81), pp. 60-61.
1938. *Crenella divaricata* (d'Orbigny), Vokes, Am. Mus. Novitates, No. 988, p. 3.
1939. *Crenella divaricata* (d'Orbigny), Cockerell, Nautilus, vol. 53, No. 1, p. 22.
1942-43. *Crenella divaricata* (d'Orbigny), Rutsch, Naturforschenden Gesell. Verhandl., vol. 54 (1943), p. 101.
1946. *Crenella divaricata* (d'Orbigny), Hertlein and Strong, Zoologica, vol. 31, pt. 2, p. 75, pl. 1, figs. 12, 13.
1951. *Crenella divaricata* (d'Orbigny), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 46, pl. 9, fig. 6.
1953. *Crenella divaricata* (d'Orbigny), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 63.
1953. *Crenella* (*Crenella*) *divaricata* (Orbigny), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.

1954. *Crenella divaricata* (Orbigny), Abbott, American Seashells, p. 350.
1955. *Crenella divaricata* (Orbigny), Soot-Ryen, Allan Hancock Pacific Expeditions. Univ. Southern California Press, vol. 20, No. 1, pp. 80-81, pl. 8, figs. 42, 44.
1958. *Crenella divaricata* (Orbigny), Keen, Sea Shells of Tropical West America, p. 50, fig. 88.
1958. *Crenella divaricata* (d'Orbigny), DuBar, Florida Geol. Survey, Geol., Bull. No. 40, p. 210.
1958. *Crenella divaricata* (d'Orbigny), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1961. *Crenella divaricata* (Orbigny), Warmke and Abbott, Caribbean Seashells, p. 161, text fig. 26.

Shell small, thin, inflated, obliquely subelliptical to suborbicular. Umbonal region high, the prodissoconch usually well preserved, acute, pure white, smooth, and sharply defined from the disk. Ligament narrow, sunken, tapering and descending posteriorly. In front of the ligament the hinge process is short, thick, and fairly broad, and is provided with three to four teeth of which there is one more on the left valve than on the right. Behind the ligament and partially over-riding it, the hinge, or margin of the valve, is a little thickened, narrowly lenticular, bearing about 11 short straight denticles of which the farther ones are the more pronounced. The entire inner margin of the valve is finely and regularly crenulate, the crenulations continuing without interruption from the hinge. Interior of valve coated wtih a calcareous wash which is often dissolved away revealing the external radii through the translucency. Under the wash the shell substance is faintly iridescent. Exterior sculptured by 70 to 80 delicate radial ribs which divaricate a little along a medial line from the beak toward the base. On each side of the disk there is a slightly more prominent curved rib, and from that the ribs on the anterior and posterior ends of the valve are sharply divaricate. Also traversing the surface are fine concentric threads which stand out more sharply in the intercostal areas and form a decussate pattern, especially on the umbos.

Dimensions.—Specimen R487a, right valve, length 3.1 mm.; width 2.7 mm.; thickness 0.75 mm. Specimen R487b, left valve, length 2.9 mm.; width 2.4 mm.; thickness 0.7 mm.

Localities.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, about 125 meters upstream from junction with Quebrada Las Pailas. Eleven specimens including eight

left valves and three right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Two specimens including one left valve and one right. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One left valve.

Remarks.—Specimens from West America are considered by a number of authorities to be the same as *C. divaricata* which was originally described by D'Orbigny from Cuba. Soot-Ryen would place the west American *C. inflata* Carpenter (1864, An. Mag. Nat. Hist., ser. 3, vol. 13, p. 313) and the Pliocene *C. ecuadoriana* Pilsbry and Olsson (1941, pp. 55-56, pl. 18, figs. 2, 3) from the Canoa formation of Ecuador in synonymy with *C. divaricata,* but compared with the Venezuelan fossils herein referred to *C. divaricata,* the Ecuadorian shell is more coarsely sculptured and has a broader ligament. The northern race of *C. divaricata* is the Pleistocene to Recent *C. decussata* (Montagu) (1808, p. 69), and *C. decussata* has been reported from the Eastern Atlantic, the Western Atlantic (from Greenland to North Carolina), and the Eastern Pacific (from Bering Sea to Baja California, Mexico). *C. decussata* is more coarsely ribbed than *C. divaricata,* but the toothed hingelike process behind the ligament is much less conspicuous than on *C. divaricata.* The middle Miocene form referred to as *C. divaricata* by Gabb (1873, p. 252) and Maury (1917, pp. 358-359, pl. 26, fig. 18) from the Dominican Republic is *C. diuturna* Pilsbry and Johnson (1917, p. 195; Pilsbry, 1921, p. 414, text fig. 37). East American fossils close to *C. divaricata* are *C. duplinensis* Dall (1898, p. 804, pl. 35, fig 6) from the upper Miocene of North Carolina, *C. duplinensis waltoniana* Mansfield (1932, p. 71, pl. 9, figs. 5-7) from the late Miocene in Walton County, Florida, and *C. armstrongi* Gardner (1936, pp. 13-14, pl. 1, figs. 5-6) from the middle Miocene in Folk's Creek, Florida. *C. duplinensis* differs from *C. divaricata* "by its feebler sculpture, somewhat smaller shell, and especially by its much weaker hinge, with less conspicuous and strong crenulations. The line of divarication of the sculpture is also more anterior and the beaks more recurved" (Dall). *C. duplinensis waltoniana* has a heavier shell than

both *C. duplinensis* and *C. divaricata*. *C. armstrongi* is sturdier and coarser than *C. divaricata*. Except perhaps for its slightly narrower ligament, the Venezuelan fossil seems identical to the living Western Atlantic *C. divaricata*.

Range and distribution.—In the Western Atlantic, *C. divaricata* ranges from North Carolina, U.S.A., to Rio de Janeiro, Brazil, occurring in shallow water to 100 fathoms. In the Eastern Pacific it is reported from Southern California to Peru in 2-250 fathoms. The fossil *C. divaricata* is reported in the Pleistocene of San Clemente Island, California; in the Pliocene of Florida, Costa Rica, and Trinidad; and in the upper Miocene of Trinidad.

Lioberus ? marensis, new species Pl. 9, figs. 13, 14

Shell small, moderately thick, modioliform, a little inflated, gently and obliquely humped from the umbo toward the base. Hinge smooth, the hinge plate robust, the anterior end of the plate recurved upward forming a thick septum or lamella rising above and rolled a little over the beak. The ligamental groove aft of the septum is wide and fairly shallow, and in the groove there is a narrow ridgelet which splays off from the back edge of the septum, the ridgelet lying near the lower margin of the ligamental groove and extending along it to near the middle, after which the ridgelet becomes obsolescent. Interior of valve vaguely iridescent, marked with a number of feeble narrow corrugations emerging from under the umbo. The posterior adductor impression is large, oval-oblong in outline, weakly striate. The anterior adductor scar is small, whitish, subtriangular. Exterior smooth but marked with faint concentric growth lines, the lines appearing as fine threads on the back side of the septum at the beak.

Dimensions.—Holotype (I511a), left valve, the margins and part of the hinge broken away, length 5 mm.; width across umbo 3 mm.; thickness 1.3 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One broken specimen, the holotype.

Remarks.—I have seen no other species with such a pronounced

shield development of the hinge plate, and it may eventuate that even the genus is new. The Recent *Lioberus castaneus* (Say) (Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 2, p. 266) which ranges from Florida to the West Indies is thinner than the Venezuelan shell and the anterior margin of the hinge plate is not produced upward as a shield. The Recent Eastern Pacific *L. salvadoricus* (Hertlein and Strong) (1946, p. 73, pl. 1, figs. 7, 11) which ranges from Sonora, Mexico, to Costa Rica in 2-16 fathoms, also lacks the umbonal shield of the Venezuelan fossil.

ISOGNOMONIDAE

Isognomon alatus (Gmelin) Pl. 10, figs. 1, 2

1791. *Ostrea alata* Gmelin, Syst. Nat., ed. 13, vol. 1, pt. 6, No. 129, p. 3339. Chemnitz, Syst. Conchylien-Cabinet, vol. 7, pl. 59, fig. 581.
1864. *Melina alata* (Gmelin), Krebs, The West Indian Marine Shells, p. 132.
1878. *Isognomum alatum* (Gmelin), Mörch, West-Indian Marine Shells, p. 16.
1878. *Isognomon alatum* (Gmelin), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 269.
1901. *Melina alata* (Gmelin), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 462.
1934. *Pedalion alata* (Gmelin), Johnson, Boston Soc. Nat. Hist. Proc., vol. 40, No. 1, p. 23.
1935. *Perna alata* (Gmelin), Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Isognoma alata* (Gmelin), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Isognoma alata* (Gmelin), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 162.
1936. *Pedalion alata* (Gmelin), McLean, Nautilus, vol. 49, No. 4, p. 117.
1937. *Pedalion alata* (Gmelin), Smith, East Coast Marine Shells, p. 31, pl. 5, fig. 4.
1938. *Perna alata* (Gmelin), Richards, Geol. Soc. Amer. Bull., vol. 49, pt. 2, p. 1291.
1940. *Pteria alata* (Gmelin), Smith, World-wide Sea Shells, p. 92, fig. 1267.
1942. *Perna alata* (Gmelin), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1951. *Isognomon alata* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 22, pl. 4, fig. 3.
1954. *Isognomon alata* (Gmelin), Abbott, American Seashells, p. 358, pl. 35b.
1958. *Isognomon alata* (Gmelin), Moore, Nautilus, vol. 71, No. 4, p. 128.
1958. *Isognomon alatus* (Gmelin), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 19.
1958. *Isognomon alatus* (Gmelin), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 115.
1959. *Isognomon alatus* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 4.
1961. *Isognomon alatus* (Gmelin), Warmke and Abbott, Caribbean Seashells, p. 165, pl. 32c.

The young Venezuelan shell referred to this species is flattish and suboval, with a low posterior wing forming an angle of about 121 degrees, and a well-rounded ventral margin. The byssal gape near the beak is rather pronounced, and the border of the gape on the left valve is thickened and lamellate. Hinge with 10 oblong sockets decreasing in size more or less progressively to the posterior end. Interior nacreous, with blotches of dull brown, dull purple and drab gray. Body cavity line about a third of the distance in from the basal margin. Exterior smoothish, but built up of appressed lamellae. The color of the exterior is brown to blackish brown, with several rays of dark brown diverging from the umbo.

Dimensions.—Specimen B560a, left valve, height 40 mm.; max. width 37.8 mm.; thickness 3 mm.

Locality.—Beach, southeast of Higuerote, State of Miranda. One specimen, a left valve.

Range and distribution.—The Recent *I. alatus* ranges from south Florida to northern South America and is said to be edible. In the Pleistocene it has been recorded from Florida and Cuba.

PINNIDAE

Pinna aff. **carnea** Gmelin Pl. 10, fig. 3

1791. *Pinna carnea* Gmelin, Syst. Nat., ed. 13, vol. 1, p. 3365. Refers to Knorr 1771, vol. 2, pl. 23, fig. 1.
1807. *Pinna degenera* Link, Beschreibung der Naturalien-Sammlung der Universität zu Rostock. Refers to Chemnitz 1785, vol. 8, pl. 87, fig. 769.
1819. *Pinna flabellum* Lamarck, An. sans Vert., vol. 6, p. 130.
1836. *Pinna carnea* Gmelin, Deshayes, An. sans Vert., ed. 2, vol. 7, p. 61.
1864. *Pinna degenera* Link, Krebs, The West Indian Marine Shells, p. 131 (part).
1889. *Pinna carnea* Gmelin, Dall, U. S. Nat. Mus., Bull. 37, p. 36.
1889. *Pinna carnea* Gmelin, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1898. *Pinna carnea* Gmelin, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 661 (part).
1934. *Pinna carnea* Gmelin, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, pt. 1, p. 22.
1936. *Pinna carnea* Gmelin, McLean, Nautilus, vol. 49, No. 4, p. 117.
1936. *Pinna carnea* Gmelin, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Pinna carnea* Gmelin, Clench, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 162.
1937. *Pinna carnea* Gmelin, Smith, East Coast Marine Shells, pp. 29-30, pl. 5, fig. 1.

1939. *Pinna carnea* Gmelin, Bartsch and Rehder, Smithsonian Misc. Collections, vol. 98, No. 10, p. 18.
1940. *Pinna carnea* Gmelin, Smith, World-wide Sea Shells, p. 93, fig. 1271.
1950. *Pinna carnea* Gmelin, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 223, 224, 225.
1954. *Pinna carnea* Gmelin, Abbott, American Seashells, p. 360, pl. 27w.
1958. *Pinna carnea* Gmelin, Turner and Rosewater, Johnsonia, vol. 3, No. 38, pp. 306-310, pl. 149; pl. 150, figs. 1-2; pls. 151, 157.
1958. *Pinna carnea* Gmelin, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 116.
1959. *Pinna carnea* Gmelin, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 5.
1961. *Pinna carnea* Gmelin, Warmke and Abbott, Caribbean Seashells, p. 166, pl. 34i.

Shell large, fairly thick, narrowly wedge-shaped, rather regularly enlarging, the dorsal margin nearly straight, the side of the front half of the valve angulate along the middle. The surface is worn away but the impressions on nacreous slivers indicate that the dorsal slope of the anterior half of the valves is sculptured by about four low radiating slightly wavy ribs; the number of ribs on the ventral slope cannot be discerned clearly though there seem to be about the same number as on the dorsal slope.

Dimensions.—Specimen G359a (broken away at the ends and base), length 145 mm.

Localities.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. One specimen, the valves attached, and with an internal filling of calcareous silt. Abisinia formation at W-30, eastern edge of Playa Grande village. One specimen representing a portion of the anterior end; the valves are attached and filled with fine-grained calcareous sandstone.

Remarks.— Although it is not possible to identify the Cabo Blanco fossils authoritatively, they show an affinity to the Recent Western Atlantic *P. carnea* Gmelin.

Range and distribution.—Pinna carena Gmelin ranges from Florida to northern South America. As a fossil it occurs in the Pleistocene of Florida, and if it can be assumed that east American species referred to *P. rudis* Linnaeus are in truth *P. carnea* Gmelin, then *P. carnea* probably occurs also in the Pliocene of Costa Rica (see Gabb, 1881, p. 378). The Mare formation of Venezuela referred to above is probably Pliocene in age and the Abisinia formation Pleistocene.

Comparisons.—There are two other medially angulate fossil Pinnas from the Caribbean region and they are *Pinna refurca* Woodring (1925, pp. 56-57, pl. 6, fig. 8) from the middle Miocene Bowden formation of Jamaica and *Pinna vaughani* Cooke (1919, pp. 127-128, pl. 9, figs. 4a, b) from the lower Miocene Anguilla formation of Anguilla Island. Neither those shells nor ours are complete enough to compare definitively, but the Cabo Blanco *P. carnea* seems to lack the conspicuous internal ridge of *P. refurca;* and concerning the Anguillan *P. vaughani,* Cooke stated that it is not unlike *P. carnea* Gmelin but lacks the rudimentary riblets on the lower part of the ventral area of that species.

Atrina (Servatrina) seminuda (Lamarck) Pl. 10, fig. 4

1819. *Pinna semi-nuda* Lamarck, An. sans Vert., vol. 6, pt. 1, p. 131.
1835. *Pinna alta* Sowerby, Zool. Soc. London Proc., p. 84.
1843. *Pinna listeri* d'Orbigny, Voyage l'Amérique Méridionale, vol. 5, pt. 3, Mollusques, p. 641, pl. 85, fig. 1.
1843. *Pinna patagonia* d'Orbigny, Voyage l'Ameérique Méridionale, vol. 5, pt. 3, Mollusques, p. 641, pl. 85, fig. 2.
1858. *Pinna alta* Sowerby, Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 6, sp. 11.
1858. *Pinna subviridis* Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 17, sp. 32.
1858. *Pinna d'Orbignyi* Hanley, Zool. Soc. London, Proc., p. 228.
1858. *Pinna d'Orbignyi* 'Hanley', Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 26, sp. 49.
1858. *Pinna ramulosa* Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 28, sp. 52.
1871. *Pinna seminuda* Lamarck, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 133.
1881. *Pinna seminuda* Lamarck, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 345.
1889. *Pinna seminuda* Lamarck, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1889. *Pinna seminuda* Lamarck, Dall, U. S. Nat. Mus., Bull. 37, p. 36.
1898. *Atrina rigida* (Dillwyn), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 663, 664, 665 (part). Many of the synonyms listed under *rigida* are, according to Turner and Rosewater (1958, p. 315), referable to *seminuda.*
1920. *Atrina seminuda* (Lamarck), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 54 (part).
1923. *Pinna seminuda* Lamarck, Clench, Nautilus, vol. 37, No. 2, p. 55.
1929. *Pinna seminuda* Lamarck, Clench, Nautilus, vol. 43, No. 1, p. 35.
1932. *Pinna semi-nuda* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 4, p. 896.
1944. *Pinna listeri* d'Orbigny, Carcelles, Museo de La Plata, Rev., new ser., Zoology, vol. 3, p. 278, pl. 10, fig. 77.
1944. *Pinna patagonica* d'Orbigny, Carcelles, Museo de La Plata, Rev., new ser., Zoology, vol. 3, p. 278, pl. 10, fig. 78.
1958. *Atrina (Servatrina) seminuda* (Lamarck), Turner and Rosewater, Johnsonia, vol. 3, No. 38, pp. 315-320, pl. 150, figs. 5-6; pl. 159, figs. 5-8; pls. 160-169.

1959. *Atrina seminuda* (Lamarck), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2130, 2143, 2163, 2164, pl. 3, figs. 8a, 8b.
1961. *Atrina* (*servatrina*) *seminuda* (Lamarck), Warmke and Abbott, Caribbean Seashells, p. 166, pl. 34k.
1961. *Atrina seminuda* (Lamarck), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 38.

Venezuelan shell thin and translucent, wedge-shaped, the dorsal margin hardly concave, the posterior margin truncate and forming a near right angle with the dorsal margin, the curve of the posterior margin with that of the ventral margin angularly rounded. The nacreous wash in the interior extends about two-thirds the length of the shell, the margin of the wash visible through the exterior. The posterior adductor impression is oval in outline and lies within the nacreous wash. Surface somewhat glistening, tan in color with areas of pale purplish brown and an occasional streak of iridescent green. Surface sculptured by 16 radiating ribs on the dorsal posterior slope, every alternate rib much the larger, the ribs scaly to spinose, the spines occurring as arched lamellae open to the rear. The ventral slope lacks the radiating ribs except for incipient ones at the posterior but is instead subpustular in front to scabrous and then scaly behind, the passage from one end to the other transitional.

Dimensions.—Specimen B358a, length (anterior tip broken away) 78.5 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. One young specimen, the valves attached.

Remarks.—*Atrina* (*Servatrina*) *seminuda* Lamarck is a variable species and has been confused on the one hand with *Atrina* (*Atrina*) *rigida* (Solander) and with *Atrina* (*Servatrina*) *serrata* (Sowerby) on the other. In their excellent monograph on the Western Atlantic Pinnidae, Turner and Rosewater point out that *A. seminuda* is less inflated, has fewer ribs, and has a thicker shell than *A. serrata;* that the nacreous layer of *A. seminuda* extends only about one-half to two-thirds the length of the valve whereas that of *A. serrata* extends at least three-fourths the length of the valve; and that the posterior adductor scar of *A. seminuda* is usually smaller, proportionally, than that of *A. serrata.* In *A. rigida* the muscle scar protrudes well beyond the posterior margin of the nacreous area or

is continuous with the margin. In *A. seminuda* the muscle scar always lies well within the nacreous area. Also *A. rigida* has a heavier, darker colored shell than *A. seminuda,* and is usually more spinose than *A. seminuda,* particularly on the ventral slope.

Range and distribution.—In the Western Atlantic *A. seminuda* (Lamarck) ranges from North Carolina, U.S.A., to Argentina. I do not know of its occurrence in the Pleistocene, but since *A. rigida* is reported from deposits of that epoch I would expect *A. seminuda* to extend at least that far back. Gabb (1881, p. 345) reported *A. seminuda* from Sapote, Costa Rica, in a brown shale of purported Miocene age.

Atrina (Servatrina ?) aff. seminuda (Lamarck) Pl. 10, fig. 5

Internal mold large, wedge-shaped, the dorsal margin slightly concave, the ventral margin embayed anteriorly, fairly straight posteriorly. There are no impressions on the left valve but on the right valve there are impressions of coarse radiating ribs particularly on the posterior ventral slope.

Dimensions.—Specimen M360a, mold of paired valves broken off anteriorly and posteriorly, length 137 mm.; max. width 87 mm.; thickness of doublet 43 mm.

Locality.—Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southeast of its intersection with the Playa Grande Yachting Club road. One specimen, an internal mold of closed valves.

Remarks.—It is not possible to identify this species surely, but it seems to be close to *A. seminuda* (Lamarck).

Atrina (Servatrina) serrata ? (Sowerby) Pl. 10, figs. 6-9

1786. *Pinna serrata* Solander, A Catalogue of the Portland Museum, pp. 71, 165.
1825. *Pinna serrata* Sowerby, A Catalogue of the Shells contained in the Collection of the late Earl of Tankerville, London, p. 23, appendix, p. v.
1841. *Pinna serrata* Sowerby, Reeve, Conchologica Systematica, vol. 1, pl. 103.
1849. *Pinna squamosissima* Philippi, [in] Roemer, Texas, Bonn, p. 454.
1849. *Pinna squamosissima* Philippi, Zeitschr. f. Malakozool., yr. 5, p. 164.
1858. *Pinna squamosissima* Philippi, Hanley, Zool. Soc. London, Proc., p. 226.
1858. *Pinna seminuda* Lamarck, Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 2, sp. 2. Not of Lamarck 1819.
1859. *Pinna serrata* Sowerby, Reeve, Conch. Icon., vol. 11, *Pinna,* pl. 34, fig. 65.

1860. *Pinna muricata* 'Linnaeus', Holmes, Post-Pleiocene Fossils of South Carolina, p. 15, pl. 3, fig. 3. Not of Linnaeus 1758.
1864. *Pinna muricata* Linnaeus, Krebs, The West Indian Marine Shells, pp. 130-131 (part). Not of Linnaeus 1758.
1898. *Atrina serrata* (Sowerby), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 664-665.
1903. *Atrina serrata* Solander, (Sowerby), Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1906. *Pinna (Atrina) serrata* Sowerby, Böse, Inst. Geol. México, Bol. 22, p. 74, pl. 9, figs. 1-2.
1920. *Atrina serrata* (Sowerby), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 54-55 (part).
1934. *Atrina serrata* (Sowerby), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 22.
1937. *Atrina serrata* (Sowerby), Smith, East Coast Marine Shells, p. 30, pl. 5, fig. 3.
1940. *Atrina serrata* (Sowerby), Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1944. *Atrina serrata* (Sowerby), Hackney, Nautilus, vol. 58, No. 2, p. 57.
1952. *Atrina serrata* (Sowerby), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180, pl. 7, fig. 5.
1954. *Atrina serrata* (Sowerby), Abbott, American Seashells, p. 360, pl. 27v.
1955. *Atrina serrata* (Sowerby), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 40, pl. 3, fig. 16.
1958. *Atrina* (*Servatrina*) *serrata* (Sowerby), Turner and Rosewater, Johnsonia, vol. 3, No. 38, pp. 320-323, pls. 170-171.
1961. *Atrina* (*Servatrina*) *serrata* (Sowerby), Warmke and Abbott, Caribbean Seashells, p. 167.
1961. *Atrina serrata* (Sowerby), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 38.

The Venezuelan fossils, referred with diffidence to *A. serrata,* are young, thin-shelled, and moderately inflated anteriorly. The dorsal margin is straight and, as seen on the right valve of one specimen, saw-toothed. The surface is sculptured by low radiating riblets on each of which are somewhat elevated arched lamellae open toward the rear, the vaulted arches arranged in a regular concentric pattern.

Dimensions.—Incomplete specimen (L361), length 54.5 mm. Anterior end of broken specimen (L361b), length 40.5 mm.

Locality.—Playa Grande formation (Catia member) about 220 meters west of W-15, south side of Playa Grande road, in calcareous siltstone. Three specimens, all with valves attached.

Remarks.—The fragments are scarcely sufficient for definitive determination, but the resemblance to *A. serrata* is marked.

Range and distribution.—*Atrina* (*Servatrina*) *serrata* (Sowerby) is a shallow-water species ranging, in the Western Atlantic, from North Carolina, U.S.A., to northern South America. In the Pleisto-

cene it occurs in South Carolina, U.S.A. In the Pliocene it was reported by Dall (1898). And in the lower Pliocene it was recorded by Böse (1906) from Santa María Tatetla, in the State of Vera Cruz, Mexico.

PLICATULIDAE

Plicatula gibbosa Lamarck Pl. 10, figs. 10-13

1702. *Spondylus barbadensis* Petiver, Gazophyl. Decas III, pl. 24, fig. 12.
1781. *Ostrea spondyloidea* Meuschen, Mus. Gronovianum, No. 3, p. 276, No. 1189.
1801. *Plicatula gibbosa* Lamarck, Syst. An. sans Vert., p. 132.
1819. *Plicatula ramosa* Lamarck, Hist. Nat. An. sans Vert., vol. 6, p. 184.
1822. *Plicatula gibbosa* Lamarck, Sowerby, The Genera of Recent and Fossil Shells, vol. 1, No. 3, figs. 1-2.
1832. *Plicatula ramosa* Lamarck, Deshayes, Encyl. Méth., p. 801.
1836. *Plicatula ramosa* Lamarck, Deshayes, An. sans Vert., vol. 7, p. 176.
1845. *Plicatula barbadensis* d'Orbigny, Voyage dans l'Amérique Méridionale. Mollusques, p. 669.
1847. *Plicatula ramosa* Lamarck, Sowerby, Thes. Conchyl., vol. 1, p. 435, pl. 90, figs. 1-4.
1856. *Plicatula ramosa* Lamarck, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 288.
1864. *Plicatula ramosa* Lamarck, Krebs, The West Indian Marine Shells, p. 135.
1873. *Plicatula vexillata* Guppy, Sci. Assoc. Trinidad, Proc., vol. 2, p. 73; pp. 86-87, pl. 2, fig. 7.
1874. *Plicatula vexillata* Guppy, Geol. Mag., decade 2, vol. 1, p. 444, pl. 17, fig. 7.
1878. *Plicatula spondyloidea* (Meuschen), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 271.
1878. *Plicatula spondyloidea* (Meuschen), Mörch, Catalogue of West-India Shells, p. 16.
1884. *Plicatula ramosa* Lamarck, Tryon, Structural and Systematic Conchology, vol. 3, p. 284, pl. 131, fig. 69.
1885. *Plicatula ramosa* Lamarck, Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, pp. 286-287.
1886. *Plicatula spondyloidea* (Meuschen), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 227.
1889. *Plicatula ramosa* Lamarck, Dall, U. S. Nat. Mus., Bull. 37, p. 32.
1889. *Plicatula ramosa* Lamarck, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1891. *Plicatula ramosa* Lamarck, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1898. *Plicatula gibbosa* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 763.
1900. *Plicatula spondyloidea* (Meuschen), Dautzenberg, Soc. Zool. France, Mém., vol. 13, p. 222.
1901. *Plicatula gibbosa* Lamarck, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 467.
1903. *Plicatula gibbosa* Lamarck, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.

1910. *Plicatula spondyloidea* (Meuschen), Vaughan, Carnegie Inst. Washington, Publ. No. 133, p. 171.
1919. *Plicatula ramosa* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 24 (1918), p. 511.
1923. *Plicatula gibbosa* Lamarck, Clench, Nautilus, vol. 37, No. 2, p. 54.
1925. *Plicatula gibbosa* Lamarck, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 243-244, pl. 11, figs. 4-5.
1926. *Plicatula gibbosa* Lamarck, Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1927. *Plicatula gibbosa* Lamarck, van Bentham Jutting, Dierk. Natura Artis. Magistra Bidjr., vol. 25, p. 24.
1933. *Plicatula ramosa* Lamarck Trechmann, Geol. Mag., vol. 70, No. 823, p. 33.
1934. *Plicatula gibbosa* Lamarck, *P. ramosa* Lamarck, *P. spondyloidea* (Meuschen), and *P. imbricata* Reeve, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 23.
1936. *Plicatula gibbosa* Lamarck, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Plicatula gibbosa* Lamarck, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 163.
1937. *Plicatula gibbosa* Lamarck, Smith, East Coast Marine Shells, p. 32, pl. 6, figs. 5a, 5b.
1938. *Plicatula gibbosa* Lamarck, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 1, p. 1291.
1939. *Plicatula spondyloidea* (Meuschen), Lamy, Jour. Conchyl., vol. 83, No. 1, pp. 19-21.
1940. *Plicatula gibbosa* Lamarck, Smith, World-wide Sea Shells, p. 95, fig. 1287.
1942. *Plicatula gibbosa* Lamarck, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1944. *Plicatula gibbosa* Lamarck, Hackney, Nautilus, vol. 58, No. 2, p. 57.
1945. *Plicatula spondyloidea* (Meuschen), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Plicatula gibbosa* Lamarck, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 99.
1946. *Plicatula gibbosa* Lamarck, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Plicatula gibbosa* Lamarck, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 13.
1951. *Plicatula gibbosa* Lamarck, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 33, pl. 6, fig. 7.
1952. *Plicatula gibbosa* Lamarck, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181, pl. 8, figs. 8-9.
1954. *Plicatula gibbosa* Lamarck, Abbott, American Seashells, p. 361, pl. 35e.
1955. *Plicatula gibbosa* Lamarck, Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 45-46, pl. 5, fig. 24.
1956. *Plicatula gibbosa* Lamarck, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 308, 317, 371.
1958. *Plicatula gibbosa* Lamarck, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1959. *Plicatula gibbosa* Lamarck, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 5
1961. *Plicatula gibbosa* Lamarck, Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 38.
1961. *Plicatula gibbosa* Lamarck, Olsson, Panamic-Pacific Pelecypoda, p. 155.
1961. *Plicatula gibbosa* Lamarck, van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Plicatula gibbosa* Lamarck, Warmke and Abbott, Caribbean Seashells, p. 167, pl. 34g.

The Cabo Blanco fossils referred to this species are variable in shape, thickness, and character of the ribs. The shells are of medium size, generally thick, subtrigonal to asymmetrically fan-shaped in outline, the right (lower, attached) valve deeper than the left (upper) valve. The posterior dorsal margin is usually concave to some degree, and the outer basal margin of the larger and thicker shells is built up of coalescent incremental lamellae forming a short subtruncate slope. Inner surface of valves irregular. Muscle scar prominent, rather large, broadly kidney-shaped, raised a little, the outer lateral margin of the scar situated near the edge of the body cavity, the scar surface irregularly undulatory and sometimes finely rayed on one side like a fish scale. Left valve with two pairs of slightly divergent teeth under the beak, the outer pair large and strong, sometimes rendered bipartite by a medial groove, and marked with prominent irregular striae; the inner pair of teeth is much lower and thinner but with the same angle of divergence, the lower teeth also striate, and separated from the primary ones by fairly deep straight channels. Right valve with two deep sockets to receive the primary teeth of the opposite valve, the sockets finely fluted on the distal side in consonance with striae of the nestled teeth of the left valve; the sockets are bordered inward by a strong pair of complementary teeth, and between those is a deep medial socket. Inner lateral margins provided with about seven small crenulations or denticles which may be bifid. The ventral margin is serrated within by the ends of the external ribs, and in the troughs there are several small subpustular denticles. Body cavity defined by a strong impressed groove, the groove generally well removed from the margin. The pallial line lies outside of the groove and is relatively close to the margin. Exterior sculptured by high coarse trigonal radiating ribs crossed by concentric lamellae. The ribs may divaricate near the basal margin where the total number varies from about 10 to 15. In addition there are several short irregular riblets on the dorsal margins. The primary ribs extend to the flattened area of attachment on the umbo. The concentric lamellae are fine to coarse, the coarse ones forming vaulted arches which may project a little as stubby tubular spines on the crest of the ribs.

Dimensions.—Specimen S433a, right valve, height 31 mm.;

max. width 27 mm.; thickness (including ribs) 13 mm. Specimen T434a, left valve, height 19.5 mm.; max. width 17.3 mm.; thickness 6 mm.

Localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two left (upper) valves. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two specimens including one right valve and one left. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Two right (lower) valves.

Remarks.—The living *P. gibbosa,* and commonly the late Cenozoic fossil specimens as well, are marked by irregular radiating red-brown or purplish lines on the ribs and in the intercoastal areas. None of the Cabo Blanco fossils retains any vestige of color but otherwise certain specimens are identical with Recent examples of *P. gibbosa.*

Comparisons.—East American species resembling *P. gibbosa* Lamarck are the Miocene *P. densata* Conrad (1843, Acad. Nat. Sci. Philadelphia, Proc., vol. 1, p. 311), the middle Miocene *P. guppyi* Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, pp. 78-79, pl. 9, figs. 9-11) from Jamaica, and the middle Miocene *P. gibbosa* Lamarck var. Pilsbry (1921, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 413) from the Dominican Republic. West American species of *Plicatula* to which the variable Cabo Blanco fossils exhibit some affinity are the upper Pliocene to Recent *P. spondylopsis* Rochebrune (1895, Mus. Nat. Hist. nat. Paris, Bull., vol. 1, p. 242; see Hertlein and Strong, 1946, Zoologica, pt. 2, No. 5, pp. 63-64, pl. 1, figs. 1516), and the Pleistocene *P. inezana* Durham (1950, Geol Soc. Amer, Mem. 43, pt. 2, pp. 68-69, pl. 13, figs. 1, 3, 6). Specimens of *P. densata* Conrad at the Academy of Natural Sciences of Philadelphia, although otherwise extremely close to *P. gibbosa,* do not have as prominent a muscle impression as *P. gibbosa,* and the teeth of *P. densata* are more strongly fluted than on *P. gibbosa.* According to Woodring, "*P. guppyi* is smaller than *P. gibbosa,* and has more distinctly foliaceous ribs," and according to Pilsbry, *P. gibbosa* var. (identified as *P. cristata* Lamarck by Gabb, 1873, Amer. Philos. Soc., Trans., vol. 15, p. 257) appears to be identical with *P. gibbosa,* "except that in places *fine radial striation* or crinkling may be seen

under the lens. No color markings are preserved." On *P. spondylopsis* the lateral margin of the muscle impression is farther from the edge of the body cavity groove, and the ribs are less acute than on the Cabo Blanco shells. *P. inezana* is more spinose than *P. gibbosa* and the muscle scar is oval rather than kidney-shaped.

Range and distribution.—Recent, North Carolina to Brazil. Pleistocene—Louisiana, Florida, St. Eustatius, Cuba, Venezuela, Barbados. Pliocene—Yucatan Peninsula (México) and Trinidad.

Plicatula venezuelana, new species Pl. 11, figs. 1-4

Shell of medium size, thin, oval-suborbicular. Hinge strong, the left valve with a pair of large outer teeth, which are rudely fluted or striate, divergent, and shallowly but broadly sulcate, and a pair of much lower teeth within the confines of the primary ones. Margin irregularly scalloped, the inner side with small, unevenly spaced pustules or denticles. Muscle impression rather large, distinct, broadly oval, a little impressed, the far lateral margin of the impression fairly close to the edge of the body cavity. Exterior of left valve flattish, undulatory, and with a shagreened texture, sculptured by a few broad low irregular radial folds and a few small radial riblets, the whole crossed by concentric lamellae. The radial folds are more prominent near the margin, and the radial riblets are faint on the umbo but sharper toward the base. The concentric lamellae become progressively coarser toward the base and sides where they are overlapping.

Dimensions.—Holotype (S432a), left valve, height 16.7 mm.; max. width 20.3 mm.; thickness 2.6 mm. Paratype (R432a), immature right ? valve, height 1.8 mm.; max. width 1.9 mm.; thickness about 0.5 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve, the holotype.

Other localities.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, approximately 125 meters upstream from junction with Quebrada Las Pailas. One immature right ? valve, the paratype.

Comparisons.—The new Venezuelan species is reminiscent of

the Recent Eastern Pacific *P. anomioides* Keen (1958a, pp. 241-242, pl. 31, figs. 4, 7, 8) found between Guaymas and Mazatlan, Mexico, and of the Recent *P. penicillata* Carpenter (1856, Catalogue of the Collection of Mazatlan Shells in the British Museum Collected by Frederick Reigen, p. 155) ranging from southern Mexico to Panama in the Eastern Pacific and reported by Olsson and McGinty (1958, p. 20) from the Caribbean coast of Panama. Although the Venezuelan juvenile is similar to the adult *P. anomioides,* the adult *P. venezuelana* is a little more strongly ribbed and much more coarsely lamellose than *P. anomioides,* whereas it is less strongly ribbed than *P. penicillata* and is not spinose as is *P. penicillata.*

Plicatula caribbeana, new species Pl. 11, figs. 5-8

Shell small, triangular, the anterior dorsal margin gently embayed, the posterior dorsal margin undulatory, the ventral margin a little rounded. Valves compressed, the right valve slightly convex and deeper than the left, the left valve slightly concave and a trifle smaller than the right. Prodissoconch nearly flat, suborbicular, marked with faint and fine concentric lineations, the beak appressed and blunt. Hinge strong, the left valve with a pair of large asymmetrically divergent teeth; the anterior tooth is shorter and thicker than the posterior one and is not so strongly fluted; another pair of teeth lies within the confines of the primary ones and are much lower and finer than the primaries. On the right valve the posterior socket is elongate and is strongly striate or fluted in consonance with the tooth on the opposite valve; the anterior socket is shorter, and is smooth on the distal side but striate on the near side; the chondrophore between the central teeth of the right valve is triangular and deep, with the apex of the septum rounded. Muscle impression large, distinct, oval-oblong in outline, oriented parallel with the long axis of the valve. The far lateral margin of the muscle impression is well removed from the edge of the body cavity. Inner margin of left valve shelflike, provided with small, rather irregularly spaced pustules or denticles which fit into small shallow complementary indentations on the opposite valve. Exterior of right valve smoothed down except at the umbonal area which is made up of coalesced concentric lamellae. Exterior of left valve rough, irregu-

larly humped near the umbo, sculptured by thin concentric laminae and by two or three radial ribs on the lower posterior side of the disk, the larger of the ribs tubular at the end. There are also several short feeble radial rugae on the umbonal area below the prodissoconch.

Dimensions.—Holotype (H431a 1-2), paired valves. Height of right valve (A431a1) 8.2 mm.; max. width 7.7 mm.; thickness of doublet 2.6 mm. Height of left valve (A431a2) 7.6 mm.; max. width 7.2 mm.

Type locality.—Mare formation at W-25, south flank of Punta Gorda anticline. One specimen, found with valves attached.

Remarks.—The holotype of *Plicatula caribbeana,* n. sp. is probably not fully grown, but I have seen no other American species of even remotely similar stamp.

PECTINIDAE

Pecten (Pecten) catianus, new species Pl. 11, figs. 9-13

Shell of medium size, thin, a trifle wider than high, inequivalve, nearly equilateral. Right valve moderately convex, the left valve concave, the beak of the right valve flattish, the point extending slightly beyond the hinge line. Hinge line straightish, the ventral margin of the disk well rounded, the dorsal margins slightly concave, diverging at an angle of about 94 degrees. Auricles of right valve a little unequal, the posterior ear triangular, sharply truncate at the margin which is oriented vertically or parallel with the beak-to-base axis, the anterior ear subrectangular, its margin subtruncate, gently scalloped at the edge and also parallel with the beak-to-base axis, the base of the anterior ear with a moderately prominent notch at the byssal area. Both ears are marked on the lower part by four feeble low radial folds or riblets, but on the upper part radial markings are absent; the shallow fasciolar depression between the disk margin and lowest rib of the anterior ear is somewhat wider than the corresponding shallow groove of the posterior ear; the exterior of both ears on the right valve is traversed by numerous inconspicuous concentric lineations. Internally, the right anterior ear is weakly fluted distally, the flutings corresponding with the external riblets.

The auricles of the left valve are sunken below the exterior submargins, are sculptured by two, and possibly three radial riblets, and are traversed by sharp closely spaced concentric lamellae. Interior of right valve with a deep triangular chondrophore and a cardinal crura running along the inner margin of either ear, the posterior crura a little thicker at the distal end than the anterior. A feeble arcuate cardinal ridge is present on the posterior ear, the ridge merging with the ligamental groove a short distance in from the end. Along the ventral margin of the right valve there are 21 radial bicrenulate ribs, these internal ribs separated at the base by deep elongate triangular flutings, the flutings becoming narrow shallow interspaces upward, the ribs and interspaces dying out toward the body cavity. The exterior of the right valve is sculptured by 22 radial ribs, and is crossed by strong regularly spaced concentric ridgelets. The radial ribs are squarish but gently rounded at the crest, and are separated by somewhat narrower interspaces with evenly rounded bottoms. The radial rib at either margin of the disk is rendered bipartite by a faint longitudinal groove. The concentric ridgelets are strong and rounded, and pass over the top of the ribs where they are often eroded away but where normally they are nearly as pronounced as in the interspaces; on the submargins, however, the concentric cords disappear. The character of the inner surface of the left valve is not known. The exterior of the left valve is sculptured by 20 or 21 radial ribs with slightly narrower interspaces, and by closely packed concentric cords which cross both the ribs and intercostal areas in equal strength; the concentric cords are rounded but corrode into lamellae or foliations; on the shouldered submargins of the left valve the concentric cords or lamellae become obsolescent and appear as inconspicuous lineations.

Dimensions.—Holotype (K330a), both valves attached, height 36.2 mm.; width 36.9 mm. Paratype (K332a), right valve, height 23.3 mm.; width 33.6 mm.; thickness 7.6 mm.

Type locality.—Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. Three specimens including one doublet

(holotype), one right valve (paratype), and one fragment of a right valve.

Remarks.—The distinguishing character of this species, though not brought out well on the illustration, is the unusually coarse concentric cording. These cords are continuous over the disk and are as pronounced on the ribs as in the intercostal spaces on unweathered examples.

Comparisons.—The new species is allied to *Janira soror* Gabb (1873, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 257) (see Pilsbry, 1921, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 410, pl. 44, figs. 1-2) from the middle Miocene of the Dominican Republic; to *P. barretti* Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, pp. 62-63, pl. 7, figs. 6-7) from the middle Miocene of Jamaica; to *P. soror urumaconis* Harris (1927, Bull. Amer. Paleont., vol. 13, No. 49, pp. 22-23, pl. 13, fig. 1; pl. 14, figs. 3-4) from the Miocene of the State of Falcon, Venezuela; and to *P. ventonensis* Cooke (1919, Carnegie Inst. Washington, Publ. No. 261, pp. 130-131, pl. 12, figs. 1a, b) from Cuba, in what is stated to be the Oligocene. On the left valve, the radial ribs of *P. soror* are narrower and the interspaces much wider than on *P. catianus,* n. sp., and the concentric markings, though crossing both the ribs and interspaces as they do on the Cabo Blanco left valve, are lamellar rather than cordlike. On the right valve, the auricular riblets of *P. barretti* are smaller, stronger, and more numerous than on *P. catianus,* n. sp., and the concentric markings are lamellar instead of cordlike. *P. soror urumaconis* is a closely related form, but the ears of the left valve are bent decidedly inward, and the one or two radial riblets are nearer the hinge line than on the Cabo Blanco shell; also, the right valve of *P. soror urumaconis* is much more gibbous than that of *P. catianus.* On the Cuban *P. ventonensis,* the byssal notch of the right valve is shallower than on *P. catianus,* and the concentric markings on the disk are much finer.

Pecten (Pecten) caribeus, new species — Pl. 12, figs. 1, 2; Pl. 23, figs. 6-8

The following description pertains to the right (lower, convex) valve.

Shell large, fairly thin, nearly equilateral, inflated, somewhat wider than high, the disk fan-shaped. Hinge line straight, dorsal margins concave and diverging from the beak at an angle of about 108 degrees, ventral margin semicircular. Dorsal slopes short and steep, the margin of the disk subrounded below the ears, excavated opposite the ears which are slightly sunken. Auricles a little unequal, the anterior one subtruncate at the margin and notched at the base, the posterior ear sharply squared off at the nearly vertical margin. Both ears are radiately ribbed below, obsoletely ribbed above, the anterior ear with about five subequal ribs in all, of which the lowest one adjacent to the fasciolar groove is the strongest, the others, particularly the uppermost one or two, progressively weaker; posterior ear with about four radial ribs, the upper one nearly obsolescent, the upper third of the ear smoothish. Crossing the ears are numerous sinuous concentric growth striae. The inner surface of the anterior ear is shallowly fluted in consonance with the external ribbing, and the edge is gently scalloped. Beak small, triangular, appressed, the point even with the hinge line. Chondrophore small, triangular, deep, the sides a little thickened, and merging, in a sort of dog-leg, with the low rounded cardinal crura running along the inner margin of the ears, the anterior crura more pronounced than the posterior. There is no cardinal ridge under the ligamental groove of the anterior ear but there is a faint arcuate one on the posterior ear, the ridge curving down obliquely from the distal end of the ear to join the upper part of the cardinal crura. Ctenolium with four small teeth, these disappearing or covered in adults. Exterior sculptured by a total of 23 radial ribs of which the two at either margin of the disk are paired, the outer rib of each pair the smallest of the disk, the submargins of the valve smooth. The ribs are squarish but gently rounded at the summit, generally regular, although occasionally feebly grooved medially, and separated by squarish interspaces about half the width of the ribs. Crossing the interspaces, but smoothed off on the crest of the ribs, are regularly spaced fine concentric lamellae which become crowded at the base of the disk. Internal ribs about 20, the interspaces narrow and shallow except at the ventral margin where they become deeper flutings nearly as wide as the ribs themselves; near the base, the ribs are bicrenulate, and the internal ribs converge toward, and become obsoles-

cent at the middle of the valve. The body cavity is well removed from the ventral margin, and the large, rudely orbicular muscle impression lies a little in from the byssal area.

Dimensions.—Holotype (G344a), right valve, height 43.8 mm.; width 47.9 mm.; thickness 16.5 mm. Paratype (J344b), right valve, height 30.9 mm.; width 32.9 mm.; thickness 11.1 mm. Paratype (I344c), right valve, height 27.3.; width 29.2 mm.; thickness 9.6 mm.

Type locality.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One broken right valve, the holotype.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve, a paratype. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve, a paratype. Mare formation at W-25, south flank of Punta Gorda anticline. One large broken right valve.

Comparisons.—*P. caribeus,* n. sp. is not to be confused with the preceding *P. catianus,* n. sp.; the latter is a smaller shell than *P. caribeus,* the dorsal margins diverge considerably less, and the concentric markings are much stronger on the interspaces and ribs alike. Other allied species are *P. ventonensis* Cooke (1919, pp. 130-131, pl. 12, figs. 1a, b) from what is stated to be the Oligocene of Cuba; *P. aztecus* Böse (1906, pp. 72-73, pl. 7, figs. 3-4) from the Pliocene of Mexico; *P. soror urumaconis* Harris (1927, pp. 22-23, pl. 13, fig. 1; pl. 14, figs. 3-4) from the Miocene of the State of Falcon, Venezuela; and *P. soror codercola* Harris (1927, pp. 23-24, pl. 13, fig. 3; pl. 14, figs. 1, 5; pl. 15, fig. 7) from the Miocene and Pliocene of Falcon. *P. ventonensis* has two ribs less, and they are flattened on top whereas those of *P. caribeus* are gently rounded. On *P. aztecus* the interspaces are a little narrower and the ribs a little broader than on the right valve of the Cabo Blanco shell; also, according to Böse's description, the right posterior ear of *P. aztecus* is marked only by fine concentric striae whereas there are radial riblets on both ears of *P. caribeus.* Both *P. soror urumaconis* and *P. s. codercola* have one or two more radial riblets on the auricles than does *P. caribeus,* n. sp.; furthermore, *P. s. urumaconis* is less fan-shaped

and *P. s. codercola* more fan-shaped than *P. caribeus* from Cabo Blanco.

Pecten (Pecten) maiquetiensis, new species Pl. 12, figs. 3-6

The description of this species pertains to the left valve.

Left valve slightly concave, suborbicular, a little wider than high. Ventral margin well rounded, dorsal margins slightly concave, sharply shouldered, diverging at an angle of about 83 degrees on young specimens but up to about 107 degrees on adults. Auricles subequal, triangular, the anterior one concave in plan, the posterior nearly plane, squared off straight at the hinge line, and with subtruncate margins. Auricles sculptured by two to four radiating riblets which produce a finely scalloped or serrated effect at the lateral margins, particularly on the posterior ear, and both ears are traversed by numerous sharp sinuous concentric laminae. In the interior, the auricles are raised a little above the level of the disk, and often there is a small nodule or two near the base of the ears, particularly the anterior one. The internal ribs of the left valve are paired crenulations near the basal margin, the crenulations extending upward for but a short distance. The flutings between the ribs at the base proper are deeper than the sulcus dividing the ribs themselves. Muscle scar rather large, more or less orbicular. Chondrophore triangular, the ligamental groove adjacent to the hinge line extremely narrow and rather deep, the area immediately below the groove marked with numerous vermiform striae. Outer surface of disk sculptured by 18 to 20 strong squarish radial ribs separated by interspaces with gently rounded troughs, the interspaces a trifle narrower to a trifle wider than the ribs. The ribs and interspaces are crossed by numerous fine regular concentric laminae and lamellae, the laminae more or less erect on the upper half of the valve but flattening down into lamellae and becoming closer toward the base; the laminae and lamellae, though minutely ragged, run straight across the ribs and interspaces without sinuosity, and are sharper in the interspaces than over the ribs; on the submargins, which are relatively narrow, the concentric lineations are faint and crowded.

Dimensions.—Holotype (T329a), left valve, height 34.3 mm.; width 38.2 mm. Paratype (J329a), left valve, height 22.1 mm.;

width 22.4 mm. Largest specimen, height 46 mm.; width 52 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two left valves, including the holotype.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Three left valves, including the paratype. Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Two fragmentary left valves.

Comparisons.—The left valve of *P. maiquetiensis,* n. sp. resembles the left valve of *P. bowdenensis* Dall (see Woodring, 1925, p. 63, pl. 7, figs. 8-9) and *P. barretti* Woodring (1925, p. 62, pl. 7, figs. 6-7), both of which are from the middle Miocene Bowden formation of Jamaica. The principal difference between the Cabo Blanco shell and *P. bowdenensis* is that the intercostals of *P. bowdenensis* are usually slightly raised whereas those of *P. maiquetiensis* are not. On *P. barretti* the auricles have stronger radial riblets than *P. maiquetiensis.* On the left valve of *P. soror* (Gabb) (see Pilsbry, 1921, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 410, pl. 44, figs. 1-2) from the middle Miocene of the Dominican Republic there are 17 external ribs and those are rounder, and the interspaces wider, than on *P. maiquetiensis.* Also the left anterior ear on the type of *P. soror* does not bear the strong radial riblets of the Venezuelan species. Perhaps the nearest relative of *P. maiquetiensis* is *P. soror urumaconis* Harris (1927, Bull. Amer. Paleont., vol. 13, No. 49, p. 22, pl. 13, fig. 1; pl. 14, figs. 3-4) from the Miocene of the State of Falcon, Venezuela, but on the left valve of the Falcon shell both ears are more concave, and the external ribs of the disk more rounded than on the Cabo Blanco shell. The Recent Western Atlantic *P. chazaliei* Dautzenberg (see Grau, 1955, Nautilus, vol 68, No. 4, pp. 113-115), first collected by the yacht Chazalie in 1896 at Los Testigos Island, Venezuela, and which ranges from Florida to Brazil in 10 to 75 fathoms, is a smaller, more fragile shell than the fossil *P. maiquetiensis,* and on the left valve the interspaces of *P. chazaliei* are much wider. *P. chazaliei* was formerly known as *P. tereinus* Dall (1925, Nautilus, vol. 38, No. 4, p. 115).

Remarks.—It is not precluded that *P. maiquetiensis,* n. sp. is, in truth, the left valve of *P. caribeus,* n. sp. (represented by the right valve only), but as neither *P. maiquetiensis* nor *P. caribeus* were found with both valves attached, it seems advisable to consider them distinct for the present.

Pecten (Pecten) species Pl. 12, figs. 7, 8

The following description pertains to the left valve only.

Left valve large and moderately thick, flattish except for the raised and broad rounded shoulders at the lateral margins of the exterior. Dorsal slopes steep and broad, the dorsal margins diverging somewhat concavely at what seems to be a little over 90 degrees, the ventral margin of the valve shallowly rounded. Auricles deeply sunken and unusually long, the posterior one measuring 19 mm. vertically from the hinge line to the point of union with the margin, compared with 53 mm. for the beak-to-base height of the valve. Fine concentric laminae may be discerned on the ears, but because of adherent calcareous sandstone the character of the radial ribs, if present, cannot be determined. The external sculpture of the disk consists of radial ribs, estimated at 18 in number, and fine concentric laminae. The ribs are high, relatively narrow, and squarish with a gently rounded summit, and the anterior marginal rib is rendered bipartite by a strong longitudinal groove. The intercostal areas are a little wider than the ribs, and are flat-bottomed. The concentric laminae are regularly spaced to about the middle of the disk but crowded basalward, and though they cross both the interspaces and the ribs they are smoothed off on the ribs at the base; on the submargins the concentric markings are fine, closely spaced, and relatively inconspicuous. Within, the left valve is flattish, but the top of the hinge is bent somewhat toward the exterior. The area of the valve below the chondrophore is irregularly pitted in an arc extending from the posterior side of the chondrophore across the middle of the inner margin of the ear, and within the area encircled by the pits there are several small pustules. The internal ribs are flat and broad, with deep narrower flutings between them at the basal margin; the flutings, as well as the ribs themselves, become obsolescent before reaching the body cavity.

Dimensions.—Specimen 0330a, posterior half of left valve, height 53 mm. Specimen K330b, lower posterior quarter of left valve, height 35 mm.

Localities.—Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One specimen, the posterior half of a left valve. Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. One anterior fragment of a left valve.

Remarks.—Although it resembles both, this is neither the left valve of *P. catianus,* n. sp. nor of *P. maiquetiensis,* n. sp. It lacks the coarse concentric cords of *P. catianus,* and has higher, more rounded shoulders on the submargins than *P. maiquetiensis.* It is not possible, however, to determine unequivocally whether this is or is not the left valve of *P. caribeus,* n. sp., but as the right valve of *P. caribeus* has a thinner shell and comes from a lower formation, the conjecture is that the present form may be distinct from that. Furthermore, the specimens are too fragmentary to compare definitively with other known species.

Pecten (Pecten ?) remulus, new species Pl. 12, figs. 9, 10

The following description is based on one immature left valve.

Shell small, paper-thin, subtranslucent, subsquarish in outline, nearly equilateral, flat except for slightly elevated sides, the dorsal margins diverging at an angle of about 99 degrees, the ventral margin shallowly rounded. Hinge line long and straight. Beak small, rather full, about level with the hinge line, the umbo appressed. Auricles large, a little unequal, depressed slightly below the submargins but merging smoothly with them. Anterior ear a little larger than the posterior, slightly embayed at the base, the margin hardly convex; posterior ear triangular, the margin seemingly subtruncate. Both ears are gently concave and smooth except for fine inconspicuous concentric lineations. Lower half of disk sculptured by 19 nearly obsolete low broad radial ribs which are reflected as mirror counterparts in the interior; visible concentric markings are wanting, and the submagins are smooth. Within the valve, the ligamental groove is straight and exceedingly narrow. The chondro-

phore is shallow, and the base of the hinge plate below it is arcuate. The body cavity, as represented by a whitish calcareous veneer on the surface, is elongate oval.

Dimensions.—Holotype (S345a), left valve, height 8 mm., width 8.3 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline; one left valve, the holotype.

Comparisons.—The left valve of the new species resembles, in miniature, *Pecten (Pecten) refugioensis* Hertlein (1925, California Acad. Sci., Proc., ser. 4, vol. 14, No. 1, p. 7, pl. 5, fig. 9) from the upper Miocene or Pliocene at Rancho Refugio, north of San José del Cabo, Baja California, México. The principal difference is that the Mexican shell, other than its much larger size, has a semicircular basal margin.

Pecten (Euvola) ziczag caboblancoensis Druckerman, n. sp. Pl. 13, figs. 1-6

The following description is based on two type specimens (with both valves attached on each) sent to me by Daniel Druckerman through the courtesy of the Museum of Paleontology, University of California, and on a number of single valves, both right and left, contained in my own collection from Cabo Blanco. The types were collected by J. A. Tong, L. W. Henry, and J. Nomland, and donated to the Museum of Paleontology at the University of California in 1931. The original description of the subspecies was made by Druckerman in his thesis which deals with the Tertiary history of the true Pectens in the Caribbean and Eastern Pacific.

Shell fairly large, a little wider than high, inequivalve, nearly equilaterial, with an evenly rounded, nearly semicircular ventral margin, and concave dorsal margins which diverge on the adult holotype at an angle of about 116 degrees. Right valve thin, evenly inflated. Auricles of right valve a little unequal, both of them normally straight at the hingle line with perhaps a slight declivity toward the beak, the anterior ear separated from the disk by a fairly deep impressed groove; adjacent to this groove, and parallel with it, the right anterior ear is narrowly convex although the larger

part of the ear above the swelling is shallowly concave. The right anterior ear is gracefully notched above the ctenolium, and the lateral margin above the notch is a little arcuate; the right posterior ear is triangular, hardly concave in plan, and has a slightly arcuate to subtruncate margin. The outer surface of both ears is smooth and completely wanting in markings except for fine obsolete concentric lineations which are sinuous on the anterior ear and parallel with the margin on the posterior ear. Within, there is a strong rounded ridge or crura extending from the beak to a little below the byssal area along the base of the anterior ear, and it is inferred that a similar but slightly smaller ridge is present along the base of the posterior ear. The chondrophore is of medium size, triangular, and moderately deep. Ligamental groove narrow, the ligamental area on both valves bearing numerous fine vertical slightly wavy striae. The exterior of the right valve is sculptured by 19 to 23 low flat radial ribs with fine shallowly impressed grooves between them. From about the middle of the valve to the base, most of the ribs are divided by a fine groove along the middle, and occasionally there are two such grooves, close together and feebly impressed, along the middle on a lateral rib or two. The submargins are smooth as are the ribs, although with a lens the ribs are seen to be traversed by numerous microscopic concentric lineations. The interior of the right valve is shallowly fluted, the flutings becoming obsolescent upward toward the beak; between the flutings, the internal ribs are narrowly bipartite, with the pairing effect more pronounced at the basal margin.

Left valve moderately thin but solid, orbicular, nearly equilateral, slightly concave, the dorsal margins diverging at an angle of 111 to 117 degrees, the angle of divergence becoming greater, apparently, with size. Auricles subequal, sunken below the submargins of the disk, straight at the hinge line, the margins subtruncate, the anterior ear strongly concave, the posterior scarcely concave to nearly plane. The ears are marked with about four flat low tenuous ribs which render the margins somewhat serrate or scalloped, and are crossed by numerous sharp concentric laminae, the laminae sinuous where they cross the few subdued radial ribs on the outer surface of the ears. Exterior of disk sculptured by 30 to 33 wide low radial ribs alternating more or less regularly in size,

with the smaller ones a trifle lower than the larger, the ribs obsolescent or wanting on the sides or submargins of the valve. Crossing the disk are rather closely spaced regular raised concentric laminae which traverse both the ribs and interspaces with little or no deviation. Internally, the left valve has a moderately deep triangular chondrophore bordered on both sides by a thickening which curves outward and then upward to join the ligamental groove near the extremities. Ligamental groove sharp and narrow, but widening gradually toward the distal ends. Ears with a faint crura along the lower margin. The internal ribs of the disk tend to be paired at the ventral margin, and extend upward toward the beak, there becoming obsolescent.

Dimensions.—Holotype (Museum of Paleontology, University of California), height 73 mm.; width 80 mm.; thickness of convex valve 23 mm. Topotype (K324a), broken right valve, height 38 mm.; thickness 12 mm. Topotype (U324a), right valve somewhat compressed, height 67 mm.; width 60 mm.; thickness 25 mm. Hypotype (H327a), left valve, height 37.6 mm.; width 37.6 mm. Hypotype (I327a), young left valve, height 26.2 mm.; width 26.2 mm.

Type locality.—The precise locality in the Cabo Blanco area of Druckerman's holotype is not known, although judging from the type of granular limestone filling the valves, I would infer that it was found in the Catia member of the Playa Grande formation near the coast road north of the village of Playa Grande.

Other Cabo Blanco localities.—Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. Two fragmentary right valves (including topotype K324a), and one fragment of a left valve (K328a). Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One right valve. Playa Grande formation (Catia member), south side of Playa Grande road about 220 meters west of W-15. One juvenile left valve. Playa Grande formation (Catia member), south side of coast road at east end of Catia La Mar. One right valve, topotype U324a. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One right valve, the identification of which

is doubtful. Mare formation at W-25, south flank of Punta Gorda anticline. Two left valves, one of them the hypotype H327a. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two left valves, one of them (I327a), a hypotype.

Comporisans.—*P. z. caboblancoensis* Druckerman is related to the Pleistocene and Recent *P. ziczac* of Linnaeus (1758, Syst. Nat., ed. 10, p. 696) and may be an ancestor. It is readily discriminated from *P. ziczac s. s.*, however, in its lack of radial ribs on the auricles of the right valve, and in having more regular alternating larger and smaller ribs separated by fairly wide interspaces, on the left valve. The right valve of *P. z. caboblancoensis* is also similar to the right valve of *P. bowdenensis* Dall (1898, p. 713, pl. 29, fig. 1) from the middle Miocene of Jamaica and Colombia, but as shown in the illustrations of *P. bowdenensis* by Woodring (1925, pp. 63-64, pl. 7, figs. 8-9), the hinge of the Jamaican shell is more downwarped toward the beak than it is on *P. z. caboblancoensis,* and the swelling on the anterior ear is narrow and near the margin of the disk on *P. z. caboblancoensis* whereas it is broad and more centrally situated on the ear of *P. bowdenensis.* The ribbing on the left valves of these two forms is dissimilar.

Remarks.—I wish to express my appreciation to Daniel Druckerman for the loan of the holotype of *P. z. caboblancoensis,* as in my collection from Cabo Blanco I have no specimens with both valves attached.

Pecten (Amusium) papyraceus (Gabb) Pl. 13, figs. 7-9; Pl. 14, fig. 1

1873. *Pleuronectia papyracea* Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 257.
1881. *Pleuronectia papyracea* Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 347.
1889. *Pecten (Amusium) Mortoni* Say, Dall, U. S. Nat. Mus., Bull. 37, p. 34. Not *P. mortoni* Ravenel 1844.
1898. *Pecten (Amusium) papyraceus* (Gabb), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 757.
1903. *Amusium papycraceum* (Gabb), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1586.
1917. *Amusium papyraceum* (Gabb), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 354, pl. 26, fig. 22.
1920. *Amusium papyraceum* (Gabb), Maury, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 21.

1920. *Amusium papyraceum,* (Gabb), Hubbard, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 96.
1920. *Amusium papyraceum* (Gabb), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 61.
1921. *Amusium papyraceum* (Gabb), Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 413, pl. 43, figs. 8-9.
1925. *Amusium papyraceum* (Gabb), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 241-242.
1925. *Amusium* (*Amusium*) *papyraceum* (Gabb), Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 73-74, pl. 9, figs. 1-2.
1926. *Amusium papyraceum* (Gabb), Gardner, U. S. Geol. Sur., Prof. Paper 142-A, p. 50.
1934. *Pecten* (*Amusium*) *papyraceus* (Gabb), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 26.
1951. *Amusium papyraceum* (Gabb), Rehder and Abbott, Soc. Malac. " Carlos de La Torre" Rev., vol. 8, No. 2, pp. 55-56.
1954. *Pecten* (*Amusium*) *papyraceus* (Gabb), Abbott, American Seashells, p. 362.

Shell fairly large, thin, discoidal, suborbicular, subequilateral, and somewhat inequivalve, with the ventral margin of the left valve extending slightly beyond that of the right valve. Left valve compressed, the disk gently sinuous, the umbonal area flat, the middle area below the umbo hardly convex, the side areas a trifle depressed. The right valve is slightly convex overall except for the dorsolateral areas which are flattish, the anterior flattening of greater extent than the posterior. Beaks smooth, small, triangular, projecting a little above the hinge line. Dorsal margins slightly concave on left valve, decidedly concave on right, the divergence on an adult specimen measured near the beak, about 122 degrees on the right valve and about 128 on the left; the divergence on a young right valve 19 mm. in height is 116 degrees. Auricles subequal, the anterior ones a little the larger. Auricles of adult left valve sculptured by a few low radiating riblets crossed by subdued sinuous concentric growth lines, the margins of the ears scalloped, the hinge line straight. On immature shells, the auricles of the left valve may not be radially ribbed. The auricles of the right valve are different than their counterparts of the opposite valve: there are no radial riblets, the lateral margins are not scalloped, and the hinge line is distinctly concave; the margin of the right posterior ear is gently and evenly rounded, whereas that of the right anterior ear is gracefully incurved below; both ears of the right valve are smoothish but are traversed by very faint curved concentric growth lines. Chondrophore tri-

angular, moderately deep, narrowly ridged along the sides. Ligamental grooves narrow. Left valve with a single cardinal crura or ridge running along the inner margin of the auricles, each crura terminating distally in a small denticle. Internally the valves bear about 24 sets of fine radiating ribs, arranged for the most part in pairs, the ribs extending from the margins to about the middle of the disk where they become obsolescent. The surface of the valves is smooth and polished although there is often revealed faintly through the shell the radial pattern of the internal ribs; usually too, there are fine, concentric, subequally spaced, concentric lineations.

Dimensions.—Specimen L326a, paired valves. Left valve (margins frayed away), height 71 mm.; width 76 mm. Right valve of L326a, height 69 mm.; width 77 mm.; thickness of pair 14 mm. Specimen L326b, left valve, height 47 mm.; thickness 5 mm.

Cabo Blanco localities.—Playa Grande formation (Catia member), south side of Playa Grande road about 220 meters west of W-15. Six specimens including one doublet, two right valves, two left valves, and one fragment. Playa Grande formation (Catia member), in bluff 125 meters west of intersection of the Playa Grande Yachting Club road and coast road. Six specimens including one doublet, one broken right valve, and four fragments. Playa Grande formation (Catia member), south side of Playa Grande road at W-15, about 40 meters southeast of its intersection with the Playa Grande Yachting Club road. Four specimens including one young left valve, and three fragments.

Remarks.—A left valve from the Dominican Republic was illustrated by Maury in 1917; the flat, or right valve of Gabb's type from the Dominican Republic was illustrated by Pilsbry in 1921. Allowing for minor variations such as the slightly more concave hinge line and the somewhat stronger radial riblets on the ears of the left valve of the Venezuelan shell, the Cabo Blanco fossil compares closely with the type specimen of *P.* (*A*) *papyraceus.*

Range and distribution.—*Pecten* (*Amusium*) *papyraceus* (Gabb) is said to range from Oligocene to Recent. The Oligocene *P. papyraceus* is reported from the San Sebastian shale of Puerto Rico. In Trinidad the species occurs in the lower-middle Miocene Manzanilla formation. In the middle Miocene it is found in the

Dominican Republic and Jamaica. From the Pliocene ? near Cumaná, Venezuela, a form nearly identical with the Cabo Blanco *P. papyraceus* is contained in Collection No. 18408 at the U. S. National Museum. The living shell inhabits the Antilles up to a reported maximum depth of 60 fathoms.

Comparisons.—Late Cenozoic species of the subgenus *Amusium* in the eastern Americas which resemble *P.* (*A.*) *papyraceus* are the following:

Pecten mortoni Ravenel (1844, Acad. Nat. Sci. Philadelphia, Proc., vol. 2, p. 96). Late Miocene and Pliocene from Maryland to Florida, U. S. A. This is a circular, rather than suborbicular shell, with ears nearly level with the plane of the disk, and with several fewer internal ribs than *P. papyraceus*. *P. mortoni* has also been reported from the Miocene and Pliocene of Mexico by Böse (1906, Inst. Geol. Mexico, Bol. No. 22, p. 24, pl. 1, figs. 3, 6, 7, 9; p. 74, pl. 8, figs. 1-2; pl. 9, fig. 3); from the Miocene and Pliocene of Venezuela by F. Hodson, H. K. Hodson, and Harris (1927, Bull. Amer. Paleont., vol. 13, No. 39, p. 38); from the middle Miocene of Colombia by Anderson (1929, California Acad. Soc., Proc., ser. 4, vol. 18, No. 4, p. 155); and from the middle Miocene of the Panamá Canal Zone by Toula (1908, K.-K. Geol. Reichs. Jahrb., vol. 58, p. 714, pl. 26, figs. 8-9). Although the Caribbean fossils are closely akin to the *P. mortoni* of Ravenel, there is still some reservation among authors of their specific identity.

Pecten (*Amusium*) *precursor* Dall (1898, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 755). Middle Miocene (Chipola formation), of Florida. Closely related to *P. mortoni* Ravenel and differing from *P. papyraceus* in the greater convexity of the left valve and in the radial striae on the beak and submargins.

Amusium mauryi Hubbard (1920, N. Y. Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 96). Oligocene of Puerto Rico. This is a small shell, much more solid than *P. papyraceus* (which has also been reported from the Oligocene of Puerto Rico), and probably with no, or very obscure internal ribs.

Pecten (*Amusium*) *antiguensis* Brown (1913, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, pp. 613-614, pl. 18, figs. 1-3, 5). Lower

Miocene of Antigua. Exterior sculptured by fine concentric laminae and about 13 radial ribs running from the beaks, where they are pronounced. The exterior of *P. papyraceus* is smooth.

Pleuronectia lyoni Gabb (1881, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 347). Lower Miocene of Costa Rica and Anguilla, and middle Miocene of Panamá Canal Zone. The internal ribs are single and not arranged in pairs as they are in *P. papyraceus*.

Amusium bocasensis Olsson (1922, Bull. Amer. Paleont., vol. 9, No. 39, p. 378, pl. 17, figs. 3-4). Middle Miocene of Costa Rica. "Interior of shell with about thirty-four lirae, which are usually nearly evenly spaced and not in pairs". The Venezuelan examples of *P. papyraceus* have about 24 paired ribs within.

Pecten (*Amusium*) *sol* Brown and Pilsbry (1912, Acad. Nat. Sci. Philadelphia, Proc., vol. 64, p. 513, pl. 24,[17] figs. 1-2). Middle Miocene of the Panamá Canal Zone. The beaks on this species have strong radial sculpture; on *P. papyraceus* the beaks are smooth.

Pecten (*Amusium*) *luna* Brown and Pilsbry (1912, p. 514, pl. 23*, fig. 1). Middle Miocene of the Panamá Canal Zone, of Colombia (Weisbord, 1929, pp. 245-246, pl. 3, fig. 1), of Venezuela (F. Hodson, H. K. Hodson, and Harris, 1927, pp. 37-38), and of Costa Rica (Olsson, 1922, pp. 377-378, pl. 17, fig. 1). Olsson placed *P. mortoni* from the Miocene of Mexico in synonymy with *P. luna*. The right valve of *P. luna* is much like that of *P. papyraceus* from Cabo Blanco save in the character of the ears: on *P. luna* the ear margins are raggedly subtruncate, whereas on the Cabo Blanco *P. papyraceus* they are gently and evenly curved. Also the right valve of *P. luna* is more convex. For a supplemental description of *P. luna* from the Gatun Locks of the Panamá Canal see Pilsbry, 1931 (Acad. Sci. Philadelphia, Proc., vol. 83, pp. 434-435, pl. 4, fig. 1).

Pecten (*Amusium*) *toulae* Brown and Pilsbry (1911, Acad. Nat. Sci. Philadelphia, Proc., vol. 63, pp. 365-366, pl. 28, fig. 7). Middle Miocene, Panamá Canal Zone. "The surface is marked with narrow, sharply defined rays on a white ground, the rays less than half as wide as the intervals, subequal in the median part, much

---

[17]Plates 23 and 24 are numbered erroneously; pl. 23 should read pl. 24, and pl. 24 should read pl. 23.

narrower at the sides, where they gradually fade out, and about 17 in number". The interior of the valves is smooth.

Pecten (Amusium) aguaclarensis F. and H. Hodson (1927, Bull. Amer. Paleont., vol. 13, No. 49, pp. 36-37, pl. 18, fig. 1; pl. 21 figs. 1-2). Oligocene-Miocene in the States of Falcon and Lara, Venezuela. This species has 10-12 paired internal ribs compared with 22-24 on *P. papyraceus*.

Pecten (Amusium) zamorensis F. and H. Hodson (1927, pp. 38-39, pl. 22, figs. 1, 3, 4, 5, 6). Pliocene, District of Zamora, State of Falcon, Venezuela. The umbos are radially striate, and internally the disk "carries about 14 pairs of internal lirae". On *P. papyraceus* the umbos are smooth, and there are 22-24 pairs of internal ribs.

Amusium rex-maris Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, pp. 242-243, pl. 15, fig. 1). Upper Miocene (Springvale formation), Trinidad. Distinguished from *P. papyraceus* by the greater obliquity of the valves and fewer internal ribs.

Pecten (Amusium) marensis, new species Pl. 14, figs. 2, 3

The following description pertains to the left valve. Shell small, thin, subtranslucent, orbicular, a little higher than wide, subequilateral. Ventral margin nearly semicircular, the dorsal margins diverging at an angle of about 109 degrees. Auricles subequal, both ears depressed slightly below the plane of the disk, the anterior one more so than the posterior; lateral margin of anterior ear subtruncate, that of the posterior hardly curved, both ears marked with barely visible concentric lineations. Hinge line straight. Along the inner margin of the posterior ear there is a fairly sharp ridge or crura, but the inner margin of the anterior ear is poorly defined. Disk flattish, with a faint radial depression on either side, the posterior depression slightly more pronounced. Chondrophore triangular, relatively shallow. Internally there are about 20 subequal to unequal sets of feeble radiating lirae or ribs, arranged generally in pairs, extending from the margins to the upper part of the disk where they become obsolescent. The exterior of the valve is smooth but marked with faint concentric lineations, and through the shell there are revealed faintly the internal lirae.

Dimensions.—Holotype (G326a), left valve, height 19 mm.;

width 18.1 mm.; thickness 0.8 mm. Paratype (J326a), left valve, height 13 mm.; width 12.5 mm.; thickness 0.7 mm.

Type locality.—Lower Mare at W-14, on hillside above west bank of Quebrada Mare Abajo. One young left valve, the holotype.

Other localities.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One juvenile left valve, the paratype.

Comparisons.—Of the various species of *Amusium* mentioned in the immediately preceding pages the ones nearest *P. marensis,* n. sp. are *P. papyraceus* (Gabb), *P. mortoni* Ravenel, and *P. luna* Brown and Pilsbry. In the Cabo Blanco collection is a left valve of *P. papyraceus* from the Catia member of the Playa Grande formation which is just about the same size as *P. marensis,* n. sp. from the Mare formation, and though they appear much the same the following differences may be noted: *P. papyraceus* is a little wider than high, *P. marensis* a little higher than wide; the divergence of the dorsal margins is 115 degrees on the Catia *P. papyraceus,* 109 degrees on the Mare *P. marensis;* the Catia *P. papyraceus* has the thicker shell, a few more internal lirae than *P. marensis,* and the cardinal crurae are broader. *P. mortoni* is a circular shell, and unlike those of *P. marensis* which are somewhat sunken, the auricles are separated from the disk by a faintly impressed groove. In *P. luna,* according to Olsson (1922, p. 377), the internal ribs are in pairs and spaced at intervals nearly twice the width of the pairs of ribs themselves, whereas in *P. marensis* the subequally spaced rib-pairs and interspaces are about equal in width.

Chlamys (Chlamys) ornata (Lamarck) Pl. 14, figs. 4-7

1819. *Pecten ornatus* Lamarck, An. sans Vert., vol. 6, p. 176. Encycl. Méth., pl. 214, fig. 5, 1797.
1853. *Pecten ornatus* Lamarck, d'Orbigny, [in] La Sagra, Hist. Phys., polit. et nat. l'Ile de Cuba, vol. 2, Mollusques, pp. 353-354.
1853. *Pecten ornatus* Lamarck, Reeve, Conch. Icon., vol. 19, sp. 68.
1864. *Pecten ornatus* Lamarck, Krebs, The West Indian Marine Shells, p. 134.
1878. *Pecten ornatus* Lamarck, Mörch, Catalogue of West-India Shells, p. 16.
1878. *Pecten ornatus* Lamarck, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 270.
1886. *Pecten ornatus* Lamarck, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 218.
1889. *Pecten* (*Pecten*) *ornatus* Lamarck, Dall, U. S. Nat. Mus., Bull. 137, p. 34.

1889. *Pecten ornatus* Lamarck, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1891. *Pecten ornatus* Lamarck, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1897. *Chlamys ornata* (Lamarck), Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 2, pp. 59, 91.
1898. *Pecten* (*Chlamys*) *ornatus* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, 4, pp. 715-716, 743-744.
1901. *Pecten* (*Chlamys*) *ornatus* Lamarck, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pp. 465-466.
1920. *Pecten* (*Chlamys*) *ornatus* Lamarck, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 59.
1924. *Pecten ornatus* Lamarck, Emery, Nautilus, vol. 38, No. 2, p. 61.
1925. *Pecten ornatus* Lamarck, Dall, Nautilus, vol. 38, No. 4, p. 118.
1926. *Pecten ornatus* Lamarck, Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1933. *Pecten ornatus* Lamarck, Trechmann, Geol. Mag., vol. 70, No. 823, p. 33.
1934. *Pecten* (*Chlamys*) *ornatus* Lamarck, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 24.
1936. *Pecten* (*Chlamys*) *ornatus* Lamarck, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 163.
1937. *Pecten* (*Chlamys*) *ornatus* Lamarck, Smith, East Coast Marine Shells, p. 33, pl. 8, fig. 4.
1944. *Pecten ornatus* Lamarck, Patterson, Nautilus, vol. 58, No. 2, p. 38.
1946. *Pecten* (*Chlamys*) *ornatus* Lamarck, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 99.
1949. *Pecten* (*Chlamys*) *ornatus* Lamarck, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 14.
1951. *Chlamys* (*Chlamys*) *ornata* (Lamarck), McLean, N. Y. Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 29, pl. 5, fig. 6.
1954. *Chlamys ornatus* (Lamarck), Abbott, American Seashells, p. 363, pl. 34b.
1958. *Chlamys ornata* (Lamarck), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 116.
1959. *Chlamys ornata* (Lamarck), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 5.
1961. *Chlamys ornata* (Lamarck), Warmke and Abbott, Caribbean Seashells, p. 108, pl. 33a.

The Venezuelan Recent shell is thin, slightly inflated, somewhat oblique, a little higher than wide, inequilateral, nearly equivalve. Anterior and posterior auricles unequal, the posterior ones hardly developed, the left anterior triangular, with the lateral margin subtruncate and slightly oblique, the right anterior subrectangular, embayed somewhat at the byssal area. The auricles are sculptured by coarse diverse radial riblets and scabrous concentric lamellae, and below the right anterior ear there are about seven sharp pectinidial teeth. The inner surface of the right anterior ear is gently fluted, that of the slightly thicker left anterior ear smoothish, the latter finely scalloped by the projecting riblets along the lateral margin. Chondrophore small, triangular, moderately deep. Interior

of valves corrugated in consonance with the external ribs from base to beak, the basal margin crenulate. Exterior of disk sculptured by up to 20 high rounded radiating ribs. On the left valve three or five of the major ribs seem a little more prominent than the others, and between the ribs there are one or two secondary riblets; crossing the left valve are numerous fine concentric laminae which are smoothed away on the crest of the major ribs on the upper part of the disk but are sharp in the interspaces; also crossing the left valve are relatively widely spaced concentric scales which occur on the major and minor radial ribs on the lower half of the disk. On the right valve the radials are compounded of two, three, or four ribs of unequal size, and the scales and imbrications are stronger than on the left valve. Interior white, with the maculations of the exterior showing through on young or half-grown specimens. Exterior cream-yellow, with large maculations of maroon.

Dimensions.—Specimen A325a, right valve, height 16.5 mm.; width 14.4 mm.; thickness 2.1 mm. Specimen A325b, left valve, height 16.3 mm.; width 14.1 mm.; thickness 2.2 mm. Largest specimen, left valve, height 29.5 mm.; width 25.2 mm.; thickness 3.7 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Five specimens including three right valves and two left valves.

Range and distribution.—In the Western Atlantic, the living *C. ornata* is said to range from North Carolina, U.S.A., to Brazil, in depths to 116 fathoms. According to Dall (1898, p. 743), the species also occurs in the Pleistocene of the Florida Keys and in raised reefs of the Antilles. Trechmann (1933) found the species in the Coral Rock formation (Pliocene?-Pleistocene) at Canefield, Barbados, at an elevation of 1000 feet, as well as at lower levels elsewhere in Barbados.

Chlamys (Chlamys) benedicti Verrill and Bush Pl. 14, figs. 8-11

1897. *Chlamys Benedicti* Verrill and Bush, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 2, pp. 74-75.
1898. *Chlamys benedicti* Verrill and Bush, U. S. Nat. Mus., Proc., vol. 20, No. 1139, pp. 834-835, pl. 84, figs. 1-2
1898. *Chlamys Benedicti* Verrill and Bush, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 743, 744.

1934. *Pecten* (*Chlamys*) *benedicti* Verrill and Bush, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 24.
1954. *Chlamys benedicti* Verrill and Bush, Abbott, American Seashells, p. 364.
1959. *Chlamys benedicti* Verrill and Bush, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 5, 7.
1961. *Chlamys benedicti* Verrill and Bush, Warmke and Abbott, Caribbean Seashells, p. 168, pl. 33b.

Shell small, thin, compressed, subequivalve, subequilateral, a little higher than wide. Dorsal margins low, somewhat concave, diverging at an angle of about 85 degrees; ventral margin semicircular. Beaks hardly projecting beyond hinge line. Hinge line of right valve bowed slightly downward at the beak, straight on the left valve. Auricles unequal, the right anterior one the longest, subrectangular, and with a large byssal notch, below which, on the ctenolium, there are five to eight teeth; right posterior ear short, broadly triangular, the margin concave, the corner sharply right-angled; left anterior ear larger than the posterior, triangular, the margin slightly convex and fimbriate; left posterior ear small, the margin hardly concave, the corner also right-angled. Anterior auricle of right valve sculptured by six low radiating ribs progressively increasing in width from the fasciolar depression toward the hinge line; posterior auricle of right valve sculptured by six unequal radiating ribs, the broadest one at the top. Anterior auricle of left valve with eight to ten subequal radiating riblets, the posterior with five to seven small unequal riblets. The auricles are traversed by coarse, scaly to spinose concentric lamellae, the scales projecting well above the anterior hinge line of the right valve, the projections decreasing in size toward the beak; the scales also project over the posterior half of the hinge line but less so than on the forward half. On the left valve the concentric markings are spiny where they cross the auricular riblets, but in the interspaces they are in the form of regular threads, imparting a decussate pattern. The outer surface of the disk is sculptured by 23 single, moderately high, scaly to spinose radiating ribs, each with one minor scaly thread in the interspaces on the lower half of the disk. The primary ribs are squarish on the upper half of the disk on both valves; on the lower half of the left valve, however, they are subtriangular, and on the lower half of the left valve they are rounded at the summit. On both valves the relatively widely spaced scales or spines are more

pronounced on the lower half of the disk and at the margins, particularly on the anterior side of the right valve where the short spines are erect and sharp and the posterior side of the left valve where the markings on the ribs are in the form of low erect scales. On the interior, the right anterior ear is radially fluted, and the cardinal ridges below the ligamental groove are better defined on the right valve than on the left. The weak internal ribs, which correspond to the interspaces of the exterior, continue upward to the beak, and are bicrenulate at the basal margin.

Dimensions.—Specimen L337a, right valve, height 17 mm.; width 15 mm.; thickness 2.5 mm. Specimen L337b, left valve, height 13.9 mm.; width 12.2 mm.; thickness 2.1 mm. Specimen K338a, left valve, height 13 mm.; width 11.9 mm.; thickness 1.9 mm.

Localities.—Playa Grande formation (Catia member), south side of Playa Grande road, about 220 meters west of W-15. Five specimens including one right valve and four left valves. Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. One right valve (broken), and one left valve.

Remarks.—The type of *Chlamys benedicti* is an immature shell, and neither the original description nor illustrations of the type indicate the presence of interstitial riblets. However, adult Recent specimens of *Chlamys benedicti* in the Academy of Natural Sciences of Philadelphia all possess interstitial riblets, and except for being slightly narrower, the Venezuelan fossils are identical with the living species.

Comparisons.—Comparable but distinct species are the following:

C. hastata (Sowerby) (1843, Thes. Conchyl., vol. 1, p. 72, pl. 20, fig. 236). Late Miocene to Recent, west coast of the Americas. *C. hastata* is larger than *C. benedicti,* has several minor threads between the primary ribs, and the dorsal margins are more concave than in *C. benedicti.*

C. varius (Linnaeus) (Syst. Nat., ed. 10, p. 698, No. 168). Recent from northern Europe and the Mediterranean. This has 26 to 32 ribs compared with 23 for *C. benedicti.* Dautzenberg (1900,

Soc. Zool. France, Mém., vol. 13, p. 224) reported *C. varius* from the Gulf of Maracaibo and the Island of Tortuga, Venezuela.

Pecten (Chlamys) lowei Hertlein (1935, California Acad. Sci., Proc., ser. 4, vol. 21, No. 25, pp. 308-311, pl. 19, figs. 1, 2, 7, 8). Recent from the Gulf of California to Panamá in 30 to 55 fathoms. The apical angle is narrower than in *C. benedicti,* and the primary ribs are compound toward the base whereas in *C. benedicti* they are single.

C. muscosa (Wood) (Index Testaceologicus, Suppl., pl. 2, fig. 2), also known as *C. exasperata* (Sowerby) and *C. fuscopurpurea* (Conrad). Pliocene to Recent, Atlantic and Caribbean provinces. This is larger and more tumid than *C. benedicti* and has fewer ribs and larger auricles than the Cabo Blanco fossil.

C. vaginula Dall (1898, pp. 715-716). Middle Miocene of Jamaica and the Dominican Republic. As described and illustrated by Woodring (1925, p. 65, pl. 8, figs. 1-2), *C. vaginula* has broader and flatter ribs than *C. benedicti.*

Pecten (Chlamys) portoricoensis Hubbard (1920, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, pp. 87-88, pl. 11, figs. 2-3) from the Oligocene of Puerto Rico has 26 to 27 compound primary ribs compared with 23 simple primary ribs on the Venezuelan fossil here referred to *C. benedicti.*

Range and distribution.—Chlamys benedicti ranges from Florida to northern South America and has been recorded as far north as Martha's Vineyard, Massachusetts. The present report is the first record of it as a fossil.

Aequipecten muscosus (Wood) Pl. 15, figs. 1, 2

1828. *Pecten muscosus* Wood, Index Testaceologicus Supplement, pl. 2, fig. 2.
1847. *Pecten exasperatus* Sowerby, Thes. Conchyl., vol. 1, p. 54, pl. 18, figs. 183, 184, 186.
1847. *Pecten muscosus* Wood, Sowerby, Thes. Conchyl., vol. 2, p. 66, pl. 19, fig. 225.
1849. *Pecten fuscopurpureus* Conrad, Acad. Nat. Sci. Philadelphia, Jour., new ser., vol. 1, pp. 209, 280, pl. 39, fig. 10.
1852. *Pecten exasperatus* Sowerby, Reeve, Conch. Icon., vol. 8, pl. 2, sp. 7, 8a-b.
1853. *Pecten muscosus* Wood, Reeve, Conch. Icon., vol. 8, pl. 16, sp. 60.

1853. *Pecten triradiatus* Reeve, Conch. Icon., vol. 8, sp. 120. Not of Müller, Zool. Dan., vol. 2, p. 25, 1788.
1853. *Pecten cretatus* Reeve, Conch. Icon., vol. 8, pl. 29, sp. 129a-b.
1864. *Pecten exasperatus* Sowerby, Krebs, The West Indian Marine Shells, p. 134.
1867. *Pecten exasperatus* Sowerby, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 164 (part).
1878. *Pecten exasperatus* Sowerby, Mörch, Catalogue of West-India Shells, p. 16.
1878. *Pecten exasperatus* Sowerby, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 270.
1881. *Pecten exasperatus* Sowerby, Gabb, Acad. Nat. Sci. Philadelphia, Jour., 2d. ser., vol. 8, p. 379.
1886. *Pecten exasperatus* Sowerby, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 218.
1889. *Pecten exasperatus* Sowerby, Dall, U. S. Nat. Mus., Bull. 37, p. 34.
1889. *Pecten exasperatus* Sowerby, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1895. *Pecten exasperatus* Sowerby, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1897. *Chlamys exasperata* (Sowerby), Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 3, pp. 59, 91.
1898. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, pp. 742-743.
1901. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 466.
1913. *Pecten exasperatus* Sowerby, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1916. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Thiele, Zool. Jahrb., Suppl. 11, p. 125.
1920. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 59.
1923. *Pecten exasperatus* Sowerby, Clench, Nautilus, vol. 37, No. 2, p. 55.
1925. *Pecten muscosus* Wood, Dall, Nautilus, vol. 38, No. 4, p. 120.
1934. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 24.
1936. *Pecten exasperatus* Sowerby, Lermond, Check List of Florida Marine Shells, Gulfport, p. 16.
1937. *Pecten exasperatus* Sowerby, Smith, East Coast Marine Shells, p. 33, pl. 8, figs. 5a, 5b; pl. 9, figs. 4a, 4b.
1939. *Pecten* (*Chlamys*) *muscosus* Wood, Fulton, Nautilus, vol. 52, No. 3, p. 120.
1939. *Pecten exasperatus* Sowerby, Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, p. 27.
1942. *Pecten exasperatus* Sowerby, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 39.
1944. *Pecten exasperatus* Sowerby, Hackney, Nautilus, vol. 58, No. 2, p. 57.
1945. *Pecten exasperatus* Sowerby, van Bentham Jutting, Geol.-Mijnbouwk. Genootschap Nederland en Koloniën Verhandl., Geol. Ser., vol. 14, p. 77.
1949. *Pecten* (*Chlamys*) *exasperatus* Sowerby, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 14.
1951. *Chlamys* (*Chlamys*) *muscosa* (Wood), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 29, pl. 5, fig. 5.
1952. *Pecten muscosus* Wood, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 180.

1953. *Chlamys* (*Chlamys*) *fuscopurpureus* (Conrad), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 53, pl. 3, figs. 6, 6a.
1954. *Aequipecten* (*Aequipecten*) *muscosus* (Wood), Abbott, American Seashells, p. 367, pl. 34d, e.
1955. *Aequipecten muscosus* (Wood), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 48, pl. 5, fig. 27.
1958. *Chlamys* (*Chlamys*) *fuscopurpureus* (Conrad), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, p. 158.
1958. *Aequipecten muscosus* (Wood), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1959. *Pecten muscosus* Wood, Grau, Allan Hancock Pacific Exped., vol. 23, pp. 157, 158.
1959. *Aequipecten muscosus* (Wood), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 6, 7.
1961. *Pecten* (*Aequipecten*) *muscosus* Wood, van Regteren Altena, Konink. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Aequipecten* (*Aequipecten*) *muscosus* (Wood), Warmke and Abbott, Caribbean Seashells, p. 170, pl. 33e.

The following description pertains to the left valve.

Shell small, a little convex, nearly equilateral, the dorsal margins diverging at an angle of about 87 degrees, the ventral margin semicircular. Hinge line straight, the beak extending slightly above it. Anterior auricle slightly the larger, gently embayed at the base, and fimbriate at the margin, the posterior ear triangular and hardly convex at the margin. Anterior ear sculptured by seven coarse subequal radiating ribs crossed by scaly concentric threads which extend slightly above the hinge line as short sharp serrations; posterior ear also sculptured by seven subequal radiating ribs which are a little smaller than the anterior ones, but like those are coarsened by scaly concentric threads, the latter scarcely projecting beyond the hinge line as fine serrations. Both ears are convex outward at the corner leaving a small gap when the valves are in juxtaposition. Exterior of disk sculptured by 19 regular, prickly and scaly radiating ribs rounded at the summit, and separated by narrower, fairly deep interspaces. The ribs are traversed by regular, scaly lamellae which are much less pronounced in the interspaces; projecting from either slope of the ribs but not reaching the crest, are smaller scales alternating with the lamellae atop the ribs, the scales arrayed in a single file. The submargins or dorsal slopes are short and moderately steep, and bear two minor radiating ribs crossed by scales of the same order of magnitude as those on the disk proper. Internally, the ligamental grooves are exceedingly narrow, and be-

low them, on either side of the triangular chondrophore are slightly divergent narrow cardinal sulci. Both auricles are gently fluted distally, the anterior flutings longer than the posterior. On the inner margin at the base of the anterior ear there is a short bipartite cardinal crura. Internal ribs flat and broad, the interspaces shallow and narrow except at the base where they form deeper flutings which interlock with those of the opposite valve; the internal ribs continue upward toward the beak, and there are 18 of them.

Dimensions.—Specimen K339a, left valve, height 12.1 mm.; width 11.9 mm.; thickness 2 mm.

Locality.—Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. One young left valve.

Remarks.—The single Cabo Blanco fossil is identical with Recent shells of the same size from Cárdenas, Cuba, contained in the collection of the Academy of Natural Sciences of Philadelphia.

Range and distribution.—The living *A. muscosus* ranges from North Carolina, U.S.A., to Brazil. The fossil *A. muscosus* has been reported from the Pleistocene of South Carolina, Florida, Cuba, the Panamá Canal Zone, and the Island of St. Eustatius, and from the Pliocene of Florida and Costa Rica. Van Bentham Jutting (1945) also found the species at Punta Gorda, 2 kilometers east of Cabo Blanco, Venezuela.

Chlamys (Leptopecten) desultoria, new species Pl. 15, figs. 3-6

The following description pertains to the right valve.

Shell small, thin, subcompressed to slightly inflated, nearly equilateral, the dorsal margins low, diverging at an angle of 94 to 98 degrees, the ventral margin rounded. Beak about level with hinge line, the hinge line straight. Auricles unequal, the anterior one slightly longer, subrectangular, and with a prominent byssal notch, the posterior one triangular. Separating the anterior auricle from the disk is a prominent, wedge-shaped, fasciolar sulcus, widening rather rapidly away from the beak. Anterior ear sculptured by five or six small unequal riblets which are crossed by concentric lamellae, the lamellae crowded and low near the beak, more widely spaced and a

little higher toward the extermity; posterior ear marked by five or six fine radial riblets crossed by concentric threads which are more pronounced in the decussated interspaces. The radial riblets of both ears vary somewhat in size and spacing from specimen to specimen. Ctenolium bearing four or five teeth. Disk sculptured by 13 to 15 radial ribs separated by interspaces about equally as wide. In the interspaces near the base at the middle area of the valve there is a single feeble intercostal thread usually situated submedially in the interspaces but occasionally to the side. The ribs are moderately high and subsquarish, and some of them may be faintly divided. The concentric markings consist typically of rather widely spaced laminae which are generally much sharper in the interspaces; on unweathered specimens it may be seen that the laminae in ascending the sides of the ribs form small vaulted arches, although they straighten out on the summit of the ribs where they are usually smoothed off; on the paratype (J342a), the concentric laminae are worn away on both the ribs and interspaces on the lower half of the valve, thus modifying the appearance of the ribs. The submargins may or may not bear a faint radial groove, and the concentric lineations there are relatively inconspicuous, particularly on the anterior submargin. Within the valve, the ligamental groove is long, narrow, and shallow, and is finely scored by numerous short vermicular grooves. Chondrophore small, triangular. Both ears are shallowly and broadly fluted, the flutings longer on the anterior ear. Internal ribs strong, extending far upward in the valve, generally depressed or sulcate in greater or less degree along the middle, and separated by fairly deep interspaces.

Dimensions.—Holotype (G342a), right valve, height 10.3 mm.; width 10.3 mm.; thickness 1.1 mm. Paratype (J342a), right valve, height 9.6 mm.; width 9.8 mm.; thickness 2 mm. Paratype (G341a), right valve, height 11.4 mm.; width 12.3 mm.; thickness 1.9 mm.

Type locality.—Mare formation at G-14, on hillside above west bank of Quebrada Mare Abajo. Two right valves, the holotype and a paratype (G341a).

Other localities.—Lower Mare formation at G-13, on hillside above west bank of Quebrada Mare Abajo. Two right valves, one of them (J342a) a paratype. Lower Mare formation, in small stream

100 meters west of Quebrada Mare Abajo. One broken right valve.

Comparisons.—The nearest related species from the Atlantic-Caribbean side of the Americas are *Chlamys* (*Plagioctenium*) *irremotis* Olsson and Harbison (1953, p. 56, pl. 3, figs. 7, 7a) from the upper Miocene and Pliocene of Florida, and *Pecten* (*Aequipecten*) *effossus* Brown and Pilsbry (1911, pp. 364-365, pl. 28, figs. 4, 6) from the middle Miocene of the Isthmus of Panamá. Both of these species differ from *C. desultoria,* n. sp. in lacking the minor radial thread in the intercostal areas, and *C. effossa* not only has several more ribs than the Venezuelan shell, but on the type of *C. effosa* the ribs are sharply tripartite. Other somewhat similar species from the Caribbean area are *Pecten vaughani* Cooke (1919, p. 133, pl. 8, figs. 2-4) from the lower Miocene of Anguilla; *Pecten vaughani flabellum* Cooke (1919, p. 134, pl. 8, figs. 6a, 6b, 7) from the reported Oligocene of Cuba; *Pecten atlanticola* Anderson (1929, pp. 156-157, pl. 19, figs. 2-3) from the middle Miocene of Colombia; and *Pecten maturensis* Maury (1925, p. 241, pl. 14, figs. 3-4) from the Matura Pliocene of Trinidad. All of the above may be distinguished from *C. desultoria* in lacking radial threads on the right anterior ear. In west America, analogous forms are *Pecten woodringi* Spieker (1922, Johns Hopkins Univ., Studies in Geol., No. 3, p. 125, pl. 7, figs. 4-5) from the middle Miocene of Peru and Ecuador (see Marks, 1951, Bull. Amer. Paleont., vol. 33, No. 139, pp. 331-332, pl. 3, fig. 1); *Pecten* (*Chlamys*) *bellilamellatus* Arnold (1906, p. 41, pl. 41, figs. 6, 6a, 7, 7a) from the Pliocene of California; the Pleistocene and Recent *Pecten tumbezensis* d'Orbigny (1846, Voyage Amér. Mérid., vol. 5, p. 663); and the Recent *Pecten palmeri* Dall (1897, Nautilus, vol. 1, No. 8, p. 85) known only from the Gulf of California. On *C. woodringi* the radial threads on the right anterior ear are wanting or obsolete. *C. bellilamellata* is slightly more oblique than *C. desultoria,* and lacks the minor radial thread in the intercostal spaces. *C. tumbezensis* (see Grau, 1959, pp. 118-120, pl. 40), living from the Gulf of California to Peru in waters just below tide to 70 fathoms, is somewhat oblique whereas *C. desultoria* is nearly equilateral. On *C. palmeri* (see Grau. 1959, pp. 113-114, pl. 36), a species found on rocks and on sandy or muddy bottoms to 50 fathoms, the primary ribs are longitudinally threaded whereas on *C. desultoria* the primary ribs are simple.

Chlamys (Argopecten) gibbus antecessor, new subspecies, Pl. 15, figs. 7-12; Pl. 16, figs. 1-4

1925. *Pecten* (*Plagioctenium*) *gibbus* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 238-239, pl. 14, fig. 2; pl. 16, fig. 1. Not of Linnaeus ?

Cabo Blanco shell of moderate size and thickness, subequilateral, the valves a little unequal, varying in convexity from slight to full, occasionally gently humped medially. Beaks small, extending slightly beyond the hinge line. Ventral margin evenly rounded, the dorsal margins usually slightly concave, the posterior a little longer than the anterior and thus imparting a slight obliqueness to the valves, the divergence averaging about 95 degrees. Dorsal slopes short and steep, the submargins of the disk sharply defined. Hinge line of left valve sharp and straight, the hinge line of the right hardly bowed down toward the beak. Auricles of left valve rather high, a little unequal, the posterior one scarcely concave at the margin, the anterior one gently convex above, incurved below. A shallow radial furrow bisects the left anterior ear a little above the middle, and above the furrow the ear is smoothed and bears two widely spaced inconspicuous radial folds; below the furrow there are four or five closely spaced coarse radial riblets. The left posterior ear is also radiately ribbed but the riblets are finer than on the anterior ear. On the right, or lower valve the auricles are unequal, the posterior one triangular, more or less truncate at the margin, and scalloped along the edge, the anterior one subrectangular, convex at the margin, and subtruncate at the base. On the anterior ear of the right valve there are about five low unequal radial folds, and on the posterior ear there are about six subequal riblets on the lower two-thirds and two inconspicuous riblets on the upper third. Traversing the exterior of the auricles of both valves are concentric laminae which are sharper in the interspaces of the riblets than on the riblets themselves. Internally, the hinge plate is thickened by arcuate cardinal ridges, the ridges of the right valve more robust and more downswept than those of the left valve. On the left valve there is a fairly well-developed cardinal crura along the inner margin of the anterior ear, and below that there are two irregular nodulations representing the termini of the minor crurae. Chondrophore, or resilifer triangular and deep, the sides thickened

and merging with the cardinal ridges. There are three to five pectinidial teeth on the byssal area below the right anterior ear, and, when well preserved, the teeth are hooked. Both valves are sculptured by 19 to 21 external ribs, and there are usually two ribs less in the interior than on the exterior. The external ribs are high and regular, flattened or slightly rounded at the crest, and wider than or the same width as the interspaces but occasionally slightly narrower than the interspaces. There seems to be a tendency for the ribs of the right valve to be a trifle wider than those of the left. The exterior is crossed by regularly spaced concentric laminae which are sharp in the interspaces of the ribs but smoothed off on the crest of the ribs. On the short steep dorsal slopes the radial ribs are faint or wanting, and the concentric markings, though crowded, are less conspicuous than on the disk proper. The internal ribs are flat low and broad, the interspaces narrow and shallow except at the ventral margin proper where the interspaces are in the form of short deep triangular flutings, so designed that they interlock with the termini of the ribs of the opposite valve. The internal ribs are thickened slightly at the sides, and they extend to the body cavity toward which they become progressively fainter. The body cavity is situated well within the interior, and the muscle impression is large and rudely orbicular.

Dimensions.—Holotype (T344a), left valve, height 32 mm.; width 33.5 mm., thickness 10.2 mm. Paratype (G344b), left valve, height 22.3 mm.; width 22.3 mm.; thickness 6.3 mm. Paratype (G344c), right valve, height 18.7 mm.; width 18.7 mm.; thickness 6.8 mm. Paratype (1344a) right valve, height 17.5 mm.; width 17.8 mm.; thickness 4 mm. Paratype (1344b), left valve, height 18.9 mm.; width 18.3 mm.; thickness 5.1 mm. Paratype (J344a), left valve, height 12.5 mm.; width 11.8 mm.; thickness 2.2 mm. Paratype (J343a), left valve, height 21.4 mm.; width 21 mm.; thickness 5.8 mm. Paratype (L340a), left valve, height 12.2 mm.; width 11.8 thickness 2.1 mm. Paratype (L340b), right valve, height 17 mm.; width 17 mm.; thickness 3 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas; Two left valves, the larger (T344a), the holotype.

Other localities.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Six specimens including three left valves, two right valves, and one fragment. Mare formation at W-25, south flank of Punta Gorda anticline. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Four specimens including two left valves and two right valves. Lower Mare formation, in small stream west of Quebrada Mare Abajo. Seven specimens including five left valves and two right valves. Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, approximately 125 meters upstream from junction with Quebrada Las Pailas. One right valve. Playa Grande formation (Catia member), south side of Playa Grande road about 20 meters west of W-15. Four left valves. Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yaching Club road and coast road. One left valve.

Remarks.—The new subspecies so closely resembles the Miocene to Recent *C. gibbus gibbus* (Linneaus) that a near relationship is indicated. *C. gibbus antecessor*, n. subsp. is differentiated from *C. gibbus gibbus* in both its much steeper dorsal slopes and thicker, more arcuate cardinal ridges. On many examples of the Recent *C. gibbus gibbus* the disk and submargins merge with but little change in the convexity, whereas on *C. g. antecessor* the dorsal slopes steepen so abruptly that the disk proper is subcarinate at the shoulders. I have seen variants of *C. gibbus,* notably *C. gibbus versicolor* (Lermond) from New Smyrna Beach, Florida, with fairly steep dorsal slopes, but on that form the cardinal ridges are not so arcuate or so thick as on the Cabo Blanco fossil. *C. g. antecessor* seems to be the same as Maury's *C. gibbus* from the Matura Pliocene of Trinidad, but the latter is probably not the *C. gibbus* of Linnaeus.

Comparisons.—C. gibbus antecessor, n. subsp. exhibits affinity to the following American species:

Pecten irradians irradians Lamarck (1819, An. sans Vert., vol. 6, p. 173). Pleistocene and Recent, east America. Larger and thinner than *C. g. antecessor,* and with fewer (17 to 18) ribs.

Ostrea nucleus Born (1780, Testacea Musei Caesarei Vindo-

bonensis, p. 107, pl. 7, fig. 2) (see *Aequipecten gibbus nucleus* (Born), Abbott, 1954, American Seashells, p. 368, pl. 34h). Recent, southeast Florida to northern South America. This is a thin form with 21 to 23 ribs and has smaller ears than *C. g. antecessor.*

Pecten circularis Sowerby (1835, Zool. Soc. London, p. 110) (see Arnold 1906, pp. 125-126, pl. 42, figs. 3-6; pl. 44, figs. 6-7). Upper Pliocene to Recent, west America. The typical Recent form is larger, more convex, and more oblique than *C. g. antecessor.*

Pecten (Plagioctenium) eldridgei Arnold (1906, p. 87, pl. 25, figs. 3-6). Etchegoin formation (Pliocene), California *fide* Grant and Gale (1931, p. 214). The interspaces are only one-half as wide as the ribs.

Pecten (Chlamys) santarosanus Böse (1906, Inst. Geol. México, Bol. No. 22, pp. 23-24, pl. 1, figs. 1,4; p. 27, pl. 1, figs. 2,5; pl. 6, figs. 3-4). Pliocene, States of Veracruz and Oaxaca, México. The right anterior ear of the Mexican forms illustrated by Böse is elongate-triangular, whereas that of *C. g. antecessor* is subrectangular.

Pecten levicostatus Toula (1908, K.-K. Geol. Reichs. Jahr., vol. 58, p. 713, pl. 26, figs. 4-6). Middle Miocene of the Isthmus of Panamá and Costa Rica. The right anterior ear of this species is also subtriangular. It has ben suggested by Olsson (1922, pp. 371-373, pl. 16, figs. 5-7) that the Costa Rican *C. levicostata* may be the same as Böse's *C. santarosana* (p. 73, pl. 6, figs. 3-4) from Barranca de Santa María de Tatetla, State of Veracruz, Mexico.

Pecten circularis venezuelanus F. and H. Hodson (1927, pp. 25-26, pl. 14, fig. 6; pl. 15, figs. 2,4,5; pl. 17, fig. 1) from the Miocene and Pliocene of the State of Falcon, Venezuela, and *P. circularis cornellanus* F. and H. Hodson (1927, pp. 27-28, pl. 14, fig. 2; pl. 15, figs. 3, 10; pl. 16, fig. 3) from the Miocene of the State of Falcon, Venezuela. These have a somewhat smaller angle of divergence of the dorsal margins than the Cabo Blanco *C. g. antecessor.*

Chlamys (Plagioctenium) amelea Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, pp. 70-71, pl. 8, fig. 9). Middle Miocene of Jamaica. On some examples of this species a slight

groove lies on the extreme lower part of a few ribs. No such grooves have been noted on *C. g. antecessor*. Also the fasciolar radial cord on the right anterior ear next to the margin of the disk is more elevated and much coarser than on the new Venezuelan subspecies.

Chlamys (Plagioctenium) nicholsi Gardner (1926, U. S. Geol. Sur., Prof. Paper 142-A, p. 48, pl. 12, figs. 5-6). Shoal River formation (middle Miocene), Florida, U.S.A. This abundant and widespread form from northwest Florida has an average of 17 radial ribs contrasted with the 19 to 21 on the Venezuelan *C. g. antecessor*. Gardner was of the opinion that *C. nicholsi* may have been an ancestral type of the *C. gibbus* group. Recent Pectinidae of the group exemplified by *C. gibbus* under the subgenus *Argopecten* are listed by Grau (1960, Nautilus, vol. 74, No. 1, pp. 17-18).

Pecten (Plagioctenium) gibbus portusregii Grau (1952, Nautilus, vol. 66, No. 2, p. 69), new name for *P. gibbus carolinensis* Grau, not Conrad (1952, Nautilus, vol. 66, No. 1, pp. 17-19, pl. 1, figs. 2-5,7). Recent, two miles off Port Royal, South Carolina, in about 13 fathoms. This species has scales on the radial riblets of the right anterior ear, and five or six pectinidial teeth on the ctenolium. *C. gibbus antecessor*, n. subsp. lacks scales on the right anterior ear, and the ctenolium or byssal area below the right anterior ear bears three to five pectinidial teeth.

Pecten (Plagioctenium) evergladensis Mansfield (1931, U. S. Geol. Sur., Prof. Paper 170-D, pp. 47-48, pl. 17, figs. 1,2,4,5). Tamiami limestone (upper Miocene) of southern Florida. This has a more inequilateral shell than *C. gibbus antecessor*, n. subsp.

Chlamys (Argopecten) imitata, new species Pl. 16, figs. 5-10

Shell thin, fairly large, moderately inflated, subequivalve, inequilateral, the valves always oblique to a greater or lesser extent. Dorso-lateral margins low, hardly concave, diverging at an angle of 103 to 109 degrees, the posterior submargin longer than the anterior, the ventral margin well rounded, the rounding posterior to the middle eccentric, the eccentricity commensurate with the obliqueness of the valve. Byssal gape narrow, the ctenolium without dentition. Auricles of right valve unequal, the posterior one triangular, gracefully concave at the margin and slightly concave

in plan, the anterior ear subrectangular, slightly convex in plan, with a small but excavated byssal notch. Both ears of the right valve are rolled over at the summit of the hinge, and the hinge line itself is slightly bowed down toward the beak. Externally the anterior ear of the right valve has a flattish to somewhat bulging fasciolar area adjacent to the disk, and above this there are three or four feeble to obsolete low radial ridges which are generally a little more apparent near the beak than distally; crossing the right anterior ear are growth striae, the striae convex upward and pronounced on the fasciole, rather faint near the margin of the ear but stronger inward where they form raised threads over the radial riblets and on the summit of the hinge; on the lower half of the posterior ear there are four to six radial riblets, but the upper half is relatively smooth; on some right valves, including that of the type, the radial riblets are wholly obsolete, and the entire ear is smooth except for the numerous concentric lineations; the concentric striae of the right posterior ear may be fine or coarse, the latter occasionally forming raised threads at the summit of the hinge near the beak. On the left valve the ears are subequal, the anterior one a little more concave at the margin than the posterior; both ears are slightly concave in plan and are also rolled over at the summit of the hinge, although more narrowly so than on the right valve, and the hinge line is straight and sharp; there may be as many as six small radial riblets on each ear of the left valve but these are generally faint and are crossed by numerous fine concentric laminae none of which forms elevated threads on the hinge summit. Umbonal areas compressed, the sides of the disk near the beak moderately sharp, the beaks extending a little beyond the hinge line. Below the umbos, the disk and submargins are evenly convex. External sculpture consisting of radial ribs and concentric laminae. There are 21 to 26 ribs on the disk, the ribs on the right valve low and broad, and with narrow shallow interspaces, the ribs on the right valve relatively high and square above, obtusely triangular toward the base, separated by interspaces a little wider than the ribs themselves. On the submargins radial ribs are generally absent, but on one right valve in the collection the posterior submargin bears three low broad ones. The concentric laminae are sharp and regularly spaced on the upper half of the valve but

crowded basalward; they are sharp in the intercostal areas of the left valve but have been smoothed off the crest of the ribs of both valves. On the right valve the concentric markings are occasionally bunched as incremental lamellae which cross the ribs and interspaces in equal prominence. Internally, the ligamental grooves are long and narrow, and below them is a shallow cardinal depression on either side of the triangular chondrophore, the depressions scored by fine vertical vermicular grooves. At or below the base of the ears there is a small pustule or two. The internal ribs are paired, and extend far upward toward the beak; at the ventral margin proper the ribs are separated by flutings, and on the right valve of the holotype the termini of the internal ribs form small wedges projecting downward beyond the rim of the margin.

Dimensions.—Holotype, right valve (L331a1), height and width 36.9 mm.; left valve (L331a2), height and width 37.1 mm.; thickness of valves atached 19 mm. Paratype (L331b), young right valve, height 17 mm.; width 16.8 mm.; thickness 2.7 mm. Paratype (U331a), right valve, height and width 27.9 mm.; thickness 5.4 mm. Specimen K334a, right valve, height 43.2 mm. Specimen U335a, right valve, height 34.7 mm.; width 36.8 mm.; thickness 11 mm.

Type locality. — Playa Grande formation (Catia member), south side of Playa Grande road, about 220 meters west of W-15. Nine specimens including five doublets, four right valves, and fragments of left valves.

Other localities.—Playa Grande formation (Catia member), south side of coast road at east end of Catia La Mar. Four specimens including two left valves and two right valves.

Comparisons.—This species is allied to various forms of both the east American *C. irradians* group and the west American *C. circularis* group. The most closely related perhaps is *Pecten eccentricus* Gabb (1873, p. 256) (see Maury, 1917, p. 351, pl. 34, fig. 8; and Pilsbry, 1921, pp. 412-413, pl. 40, fig. 12) from the middle Miocene of the Dominican Republic, but among other minor differences, *C. eccentrica* has deeper interspaces, more prominent ribs, and smaller ears on the right valve. *C. demiurgus* of authors (Maury, 1925, pp. 237-238, pl. 14, fig. 5; pl. 16, fig. 6; Harris [in] Waring,

1926, p. 109, pl. 20, figs. 3-4; and Rutsch, 1943, pp. 112-113, pl. 3, fig. 5) from the middle and upper Miocene of Trinidad and the middle Miocene of Venezuela ? and Colombia is a much larger and more coarsely ribbed shell than *C. imitata,* n. sp., and on young specimens of *C. demiurgus* the right valve is more convex than the left. It may be noted that in Dall's illustration (1898, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 178, pl. 26, fig. 3) of his type *C. demiurgus,* the ears of the right valve are shown to be entirely wanting in radial riblets whereas in illustrations by the above-mentioned authors the ears of the right valve are prominently ribbed. The intensity of the relatively weak auricular ribs on *C. imitata,* n. sp. varies considerably, and on some specimens they are absent. *Pecten levicostatus* Toula (1908, p. 713, pl. 26, figs. 4-6) as described by Olsson (1922, pp. 371-372, pl. 16, figs. 5-7) from the Gatun (middle Miocene) formation of the Isthmus of Panamá and Costa Rica is usually a little wider than high whereas on *C. imitata* the height and breadth are nearly the same. On *Pecten circularis venezuelanus* F. and H. Hodson (1927, pp. 25-26, pl. 14, fig. 6; pl. 15, figs. 2,4,5; pl. 17, fig. 1) from the Miocene and Pliocene of northwestern Venezuela the cardinal depressions below the ligamental grooves are much more pronounced than on *C. imitata,* the internal ribs of *C. c. venezuelana* do not continue far within as in *C. imitata,* and the external ribs of the right valve are much higher and flatter than on the Cabo Blanco form. The Pleistocene and Recent *C. irradians concentrica* (Say) (1822, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 259) from the Atlantic coastal plain area of the southern United States is more gibbous than *C. imitata,* and not so oblique.

In western America the Pliocene to Recent *C. circularis* (Sowerby) and congeners (see Keen, 1958, p. 72, fig. 132) are much more inflated than the Venezuelan *C. imitata,* n. sp. On the Pliocene *C. mendenhalli* (Arnold) (1906, pp. 84-85, pl. 25, figs. 2, 2a, 2b) (see Hertlein, 1925, California Acad. Sci., Proc., ser. 4, vol. 14, No. 1, p. 16, pl. 1, fig. 5; and Hanna, 1926, *ibid,* No. 18, p. 473, pl. 25, figs. 4-5) the intercostal areas on the left valve are narrower than on *C. imitata* but otherwise the Venezuelan and Californian shells are much alike. On *C. cristobalensis* (Hertlein) (1925, pp. 19-20, pl. 3, figs. 1, 2, 5) from the Pliocene of California the ribs of the

right valve are higher and squarer than on *C. imitata,* and it is a much larger shell. Grant and Gale, (1931, p. 210) report *C. cristobalensis* as a living shell from the coast of Peru. The Pliocene *C. subdola* (Hertlein) (1925, pp. 20-21, pl. 5, figs. 2, 4, 7) from California is yet another species allied to *C. imitata,* but the margin of the left posterior ear is subtruncate whereas on *C. imitata* it is gracefully sinuate.

Lyropecten (Nodipecten) nodosus ? (Linnaeus) Pl. 17, fig. 1

1758. *Ostrea nodosa* Linnaeus, Syst. Nat., ed. 10, p. 697, No. 164.
1767. *Ostrea nodosa* Linnaeus, Syst. Nat., ed. 12, p. 1145, No. 194.
1784. *Pecten corallinus* Chemnitz, Syst. Conchylien-Cabinet, vol. 7, p. 306, pl. 64, figs. 609-611.
1819. *Pecten nodosus* (Linnaeus), Lamarck, An. sans. Vert., vol. 6, p. 170.
1845. *Pecten nodosus* (Linnaeus), d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, pt. 2, vol. 5, p. 363.
1864. *Pecten nodosus* (Linnaeus), Krebs, The West Indian Marine Shells, p. 134.
1871. *Pecten nodosus* Lamarck, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 132.
1873. *Pecten magnificus* Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 256. Not of Sowerby, 1835, Zool. Soc. London, Proc., p. 109.
1878. *Pecten nodosus* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 16.
1878. *Pecten nodosus* (Linnaeus), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 270.
1884. *Pecten* (*Lyropecten*) *nodosus* (Linnaeus), Tryon, Structural and Systematic Conchology, vol. 3, p. 290, pl. 133, fig. 17.
1887. *Pecten nodosus* (Linnaeus), Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 100.
1887. *Pecten pernodosus* Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 131, pl. 16b, figs. 69, 69a.
1889. *Pecten* (*Pecten*) *nodosus* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 34.
1889. *Pecten nodosus* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1897. *Lyropecten nodosus* (Linnaeus), Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 2, pp. 64, 91.
1898. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 695, 717, 728-729.
1900. *Lyropecten nodosus* (Linnaeus), Verrill and Bush, Connecticut Acad. Arts and Sci. Trans., vol. 10, art. 12, p. 516.
1901. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1901, pt. 1, p. 465.
1916. *Pecten (Nodipecten) nodosus* (Linnaeus), Thiele, Zool. Jahr., Suppl. 11, p. 125.
1917. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 5, No. 29, pp. 350-351.

1920. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 59.
1920. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Hubbard, N. Y. Acad. Sci. Scientific survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, pp. 86-87, pl. 10, fig. 5.
1921. *Pecten nodosus* (Linnaeus), Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, pp. 409-410.
1921. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Woodring, [in] Geol. Survey Dominican Republic, Mem., vol. 1, pp. 125, 144.
1925. *Pecten nodosus* (Linnaeus), Clench, Nautilus, vol. 38, No. 3, p. 94.
1931. *Pecten* (*Lyropecten*) *nodosus* (Linnaeus), Grant and Gale, San Diego Soc. Nat. Hist., Mem., vol. 1, pp. 179-180.
1934. *Pecten* (*Nodipecten*) *nodosus nodosus* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 24.
1936. *Pecten nodosus* (Linnaeus), Mansfield, Jour. Paleont., vol. 10, No. 3, p. 183.
1937. *Pecten* (*Lyropecten*) *nodosus* (Linnaeus), Smith, East Coast Marine Shells, pp. 34-35, pl. 8, fig. 3; pl. 9, fig. 6; pl. 28, fig. 5.
1939. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 19, 26, 54.
1944. *Pecten nodosus* (Linnaeus), Hackney, Nautilus, vol. 58, No. 2, p. 57.
1945. *Pecten nodosus* (Linnaeus), van Bentham Jutting, Geol.-Mijnbouwk. Genootschap Nederland en Kolonien, Verh., Geol. ser., vol. 14, p. 77.
1946. *Pecten* (*Lyropecten*) *nodosus* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 99.
1949. *Pecten nodosus* (Linnaeus), Platt, Natl. Geogr. Mag., vol. 96, p. 43, fig. 7.
1949. *Pecten* (*Lyropecten*) *nodosus* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 14.
1951. *Lyropecten* (*Nodipecten*) *nodosus* (Linnaeus), Rogers, The Shell Book, pp. 415, 502.
1951. *Chlamys* (*Lyropecten*) *nodosa* (Linnaeus), McLean, N. Y. Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 30, pl. 6, fig. 1.
1952. *Pecten nodosus* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181, pl. 8, fig. 10.
1952. *Ostrea nodosa* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 171-172.
1953. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Lyropecten* (*Nodipecten*) *nodosus* (Linnaeus), Abbott, American Seashells, p. 366, pl. 33b.
1955. *Lyropecten nodosus* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 49, pl. 6, fig. 30.
1959. *Lyropecten nodosus* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 6.
1961. *Pecten* (*Nodipecten*) *nodosus* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Lyropecten* (*Nodipecten*) *nodosus* (Linnaeus), Warmke and Abbott, Caribbean Seashells, pp. 169-170, pl. 4b; 33g.

Shell large, suborbicular, sculptured by nine strong rounded nodose ribs which are separated by deep rounded interspaces nearly as wide as the ribs themselves; ribs and interspaces alike marked by strong radial riblets of which there are as many as nine on the

largest ribs and as many as six in the widest interspaces, the latter riblets a little smaller than those on the principal ribs. The nodules occur in a few concentric rows of unequal spacing, and are much larger on the lower part of the shell; on the right ? valve of the Cabo Blanco specimen there is one node on each rib per row. The entire surface is covered with numerous equal concentric laminae, and there are concentric growth ridgelets near the base. Auricles unequal, the anterior one larger, both sculptured by radial riblets which are crossed by strong concentric lamellae. Interior fluted, the flutings converging to the beak, toward which they diminish gradually in depth and strength. At the base of the valve the internal ribs between the flutings are thickened slightly on the sides, and there is the suggestion that at the base the internal ribs are multicrenulate.

Dimensions.—Figured specimen (N322a) right ? valve, height 103 mm.

Localities.—Playa Grande formation (Catia member) near W-21, in stream flowing along the strike of the north flank of the Litoral anticline. One valve (right ?) filled with fine calcareous fossiliferous standstone, found loose in bed of stream. Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One clean fragment.

Remarks.—The imperfect Cabo Blanco fossil so closely resembles *L. nodosus* that it may well be the same. Often, the nodes on the left valve of *L. nodosus* occur on every other primary rib whereas the nodes on the right valve, though not so large, are present on each primary rib. Recent Eastern Atlantic analogues of *L. nodosus* are *L. corallinoides* (d'Orbigny) and *L. noduliferus* (Sowerby) (see Dodge, 1952, p. 172). The east American *L. fragosus* (Conrad) and the west American *L. subnodosus* (Sowerby) were thought by Dall (1898, pp. 728-729) to be mere variants of *L. nodosus nodosus,* but some authors consider the seven-ribbed *L. fragosus* to be a subspecies of *L. nodosus,* and *L. subnodosus* to be a distinct species.

Range and distribution.—Lyropecten (Nodipecten) nodosus (Linnaeus) ranges from lower Miocene to Recent. The living shell is found in the Western Atlantic from North Carolina, U.S.A., to

Brazil. As a Pleistocene fossil, *L. nodosus* is recorded from St. Kitts and St. Eustasias, doubtfully from the Dominican Republic (Pilsbry 1921, pp. 409-410), and from Paraguaná, Tortuga, and Cubagua in Venezuela. In the Pliocene it is said to occur in Florida and Costa Rica. Maury (1917, pp. 350-351) collected several imperfect specimens of the species from the middle Miocene of the Dominican Republic, and Hubbard (1920, pp. 86-87) classified as *L. nodosus* a few poorly preserved specimens from the Quebradillas limestone (lower ? Miocene) of Puerto Rico.

Lyropecten (Nodipecten) arnoldi Aguerrevere — Pl. 18, fig. 1; Pl. 19, fig. 1

1886. *"Pecten gigas"* Karsten, Géologie de l'ancienne Colombie bolivarienne, Vénézuela, Nouvelle-Grénade et Ecuador, p. 9.
1925. *Pecten (Lyropecten) arnoldi* Aguerrevere, Southern California Acad. Sci., Bull., vol. 24, pt. 2, pp. 51-53, pl. 5.
1956. *Pecten arnoldi* Aguerrevere, Rivero, Bol. de Geología, Publ. Especial, No. 1, p. 120.
1957. *Pecten arnoldi* Aguerrevere, Weisbord, Bull. Amer. Paleont., vol. 38, No. 165, p. 16.

The Cabo Blanco shell is large, slightly broader than high, subequilateral, subequivalve, the right valve moderately convex, the left compressed. Both valves have a fairly thick shell substance, and fit snugly at the evenly rounded basal margin, with the ribs of one valve nestled into the flutings of the other. Anterior auricle of right valve somewhat larger than the posterior, the anterior auricle obliquely truncate at the superior lateral margin, incurved below, sculptured by four subequal radiating riblets on the upper two-thirds of the ear; there are no radiating riblets on the lower third or so of the anterior auricle of the right valve, but the whole auricle is traversed by numerous raised sinuous laminae. Anterior auricle of left valve with about six radiating riblets which are finer and weaker than those of the right valve, the entire ear also crossed by numerous sharp laminae. Posterior auricles squarish, the auricle of the right valve sculptured by five or six radiating riblets which are much feebler than those on the anterior ear of the right valve, and by numerous raised wavy laminae which are stronger than those on the anterior ear. The posterior auricle of the left valve is completely wanting in radiating riblets but is transversed by

closely spaced, raised, wavy laminae sharper than the laminae of the anterior ear. Byssal gape narrow and relatively small, the byssal area flattened and marked with concentric laminae only. Pectinidial teeth below the anterior auricle are absent, but on one adult specimen with the ear broken at the junction of the disk there are a number of denticulations normally covered by the inner margin of the auricle. Chondrophore large, deep, wedge-shaped, internal, bounded along the posterior side by a thick ridge with a sulcus down the middle paralleling the edge of the chondrophore. On the hinge plate behind this ridge there is a triangular or ovate depression with the long axis paralleling the ligamental groove above it but extending only about half the length of the ligamental groove. The anterior side of the chondrophore is bordered by a single narrow ridge, on the forward side of which is a roughly rectangular depressed area bearing heavy irregular vertical rugae. Ligamental groove long and narrow, extending along the full length of the hinge line. Body cavity well removed from the margins, the border of the cavity scored with numerous short vertical grooves. Muscle scar large, suborbicular, the posterior margin coinciding with the margin of the body cavity. Inner surface of ventral margin marked by generally nine short broad raised ribs separated by wide triangular flutings, the raised ribs corresponding to the intercostal areas of the exterior, the flutings corresponding to the external costae. The internal ribs are thickened along the margins rendering them bicarinate. The exterior of the shell is sculptured by nine or ten broad, gently rounded ribs which are themselves compounded of four subsidiary riblets of about equal size. At the base, the interspaces are slightly narrower than the primary ribs, and in the interspaces there are usually one prominent riblet in the middle and a minor one on either side; the intercostal riblets are much more prominent than the subsidiary ones on the main ribs. The sides of the disk are sculptured by several secondary radiating riblets, and crossing the whole of the exterior are numerous equally spaced concentric laminae. Both valves are somewhat nodose in the early stages of growth, the nodes occurring on every rib in about the same prominence. Several of the right valves are colored light violet around the body cavity.

Dimensions.—Specimen M320a, height 137 mm., width 148 mm.; length of hinge line 97 mm.; thickness (right valve) 35 mm. Largest specimen, height 205 mm.; width 220 mm.; thickness (valves attached) 90 mm.

Type locality.—"The type specimen of *Pecten arnoldi* was found 1 and ¾ miles east of the castle of Cumaná, State of Sucre, Venezuela, S.A." (Aguerrevere).

Cabo Blanco localities.—Playa Grande formation (Catia member) in bluff 125 meters west of intersection of the Playa Grande Yachting Club road and coast road. Eleven specimens including three doublets and eight large fragments. Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southeast of its intersection with Playa Grande Yachting Club road. Six right valves. Playa Grande formation (Catia member) near W-21 and in stream flowing along the strike of the north flank of the Litoral anticline. Two fragments.

Remarks.—This species is probably the same as the one listed by Karsten (1886) as *"Pecten gigas"* from Cabo Blanco near La Guaira. The name seems to have been coined by Karsten to indicate its size, but as there is no formal description it is a *nomen nudum* with no official status. However, Aguerrevere's excellent description leaves little doubt that the large Cabo Blanco *Pecten* is identical with *L. arnoldi* from Cumaná.

Comparisons.—The Miocene-Pliocene *Pecten* (aff. *Nodipecten*) *colinensis* F. and H. Hodson (1927, p. 33, pl. 18, figs. 3, 6; pl. 19, fig. 4) from the District of Colina, State of Falcon, Venezuela, is similar to *L. arnoldi* but has one or two more primary ribs than *L. arnoldi,* and the subsidary riblets on the primary ribs are stronger. *Pecten* (*Lyropecten*) *pittieri* Dall (1925, U.S. Nat. Mus. Proc., vol. 66, No. 2554, art. 17, p. 23, pl. 17, fig. 6) from the later Tertiary of Moín Hill, near Limon, Costa Rica, is much smaller than *L. arnoldi,* and the intercostal riblets are all of about the same size. The lower Miocene to Recent *L. nodosus* (Linnaeus) (1758, Syst. Nat., ed. 10, p. 697) in the eastern Americas is characterized by strong radiating riblets on both auricles of both valves. The lower Pliocene to Recent *L. subnodosus* (Sowerby) (see Thes. Conchyl., vol. 1, p. 65, pl. 15, figs. 97, 112) from the western Americas differs from *L.*

arnoldi in having more numerous secondary riblets of about equal size in the intercostal areas.

Range and distribution.—Lyropecten arnoldi is now known from two Venezuelan localities: Cabo Blanco in the Distrito Federal, and near Cumaná on the State of Sucre, about 310 kilometers east of Cabo Blanco. Aguerrevere suggested a Miocene age for the Cumaná deposit in which *L. arnoldi* was found. Tentatively I would consider the Catia member of the Playa Grande formation in the Cabo Blanco area to be Pliocene in age.

Lyropecten (Nodipecten) species "a" Pl. 17, figs. 2, 3

Illustrated are fragments of a species which is much the same as *L. arnoldi* Aguerrevere except in the character of the larger internal ribs on the basal margin. Those ribs are quadripartite on the present shell but bipartite on *L. arnoldi.* Whether this is an individual variation or a specific difference cannot be determined with the material at hand.

Dimensions.—Specimen 1323a, height of fragment 66 mm. Specimen J323a, width of fragment 80 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One fragment. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One fragment.

Lyropecten (Nodipecten) species "b" Pl. 17, figs. 4, 5

Shell attaining a large size, sculptured exteriorly by broad, flattish, flexuous and slightly curved radiating costae with steep sides. The costae are themselves made up of three to five strong, coarse radiating riblets more or less equal in size, the lateral riblets grooved along the middle, the inner ones single, all of them rendered nodulous where they are crossed by concentric growth ridges. In the intercostal areas there are one to three radial riblets, the middle one of these about the same size as the riblets on the principal costae and also nodulous, the ones on either side of that minor. On the middle of the disk, and presumedly above as well, there are widely spaced rows of large rounded nodes, with one such node per row on each costa. Crossing the whole of the disk are numerous concentric

laminae, the laminae curved downward on all radial ribs and upward in all of the interspaces. At the basal margin of the valve the laminae are crowded and more or less coalescent. The interior of the shell is fluted from the margins to the body cavity, the flutings corresponding with the external costae and more deeply impressed at the margin. The flutings are bordered by raised flat ribs corresponding to the intercostal areas of the exterior. Near the base of the shell these ribs are thickened on each side rendering them bidenticulate.

Dimensions.—Specimen 0321a (fragment), width 59 mm.; height 52 mm.

Locality.—Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One fragment.

Remarks.—Superficially the present shell resembles *L. colinensis* (F. and H. Hodson) (1927, p. 33, pl. 18, figs. 3, 6; pl. 19, fig. 4) from Miocene-Pliocene strata at various localities in the State of Falcon, Venezuela, but on Hodson's species the large nodes occur on every third costa whereas on the Cabo Blanco form they appear on each costa.

SPONDYLIDAE

Spondylus americanus Hermann — Pl. 17, figs. 6-8; Pl. 20, figs. 1, 2; Pl. 21, figs. 1, 2

1781. *Spondylus americanus* Hermann, Der Naturforscher, vol. 16, p. 51.
1784. *Ostrea echinata* Martyn, The Universal Conchologist, vol. 2, fig. 154.
1787. ? *Spondylus fimbriatus* Meuschen, Museum Geversianum, p. 434.
1798. *Spondylus dominicensis* Röding, Museum Botenianum, ed. 1, p. 193.
1798. *Spondylus aurantiacus* Röding, Museum Boltenianum, ed. 1, p. 195.
1819. *Spondylus arachnoides* Lamarck, An. sans Vert., vol. 6, p. 188.
1819. *Spondylus americanus* Lamarck, An. sans Vert., vol. 6, pp. 188-189. Not of Schreiber 1793.
1819. ? *Spondylus longitudinalis* Lamarck, An. sans Vert., vol. 6, p. 191.
1819. *Spondylus crassisquama* Lamarck, An. sans Vert., vol. 6, p. 191.
1832. *Spondylus americanus* Lamarck, Deshayes, Encycl. Méth., vol. 3, p. 978, pl. 195, figs. 1-2.
1845. ? *Spondylus striato-spinosus Chenu,* Illustrations Conchyliogiques, vol. 2, p. 7.
1848. *Spondylus spathuliferus* Sowerby, Thes. Conchyl., p. 421, pl. 89, fig. 61.
1853. *Spondylus folia-brassica* d'Orbigny, [in] La Sagra, Hist. phys., polit. nat. l'Ile de Cuba, Mollusques, vol. 2, p. 358.
1853. *Spondylus echinatus* (Martyn), d'Orbigny, [in] La Sagra, Hist. phys., polit. nat l'Ile de Cuba, Mollusques, vol. 2, p. 359.
1856. *Spondylus americanus* Lamarck, Reeve, Conch. Icon., vol. 9, pl. 4, sp. 17.

1856. *Spondylus ictericus* Reeve, Conch. Icon., vol. 9, pl. 11, sp. 40.
1856. *Spondylus longitudinalis* Lamarck, Reeve, Conch. Icon., vol. 9, pl. 13, sp. 46.
1864. *Spondylus americanus* Lamarck, Krebs, The West Indian Marine Shells, p. 135.
1878. *Spondylus fimbriatus* Meuschen, *S. spathuliferus* Lamarck, *S. americanus* Lamarck, and *S. croceus* Reeve, Mörch, Catalogue of West-India Shells, p. 16.
1878. *Spondylus croceus* Humphrey, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 271.
1881. *Spondylus americanus* Lamarck, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 379.
1884. *Spondylus americanus* Lamarck, Tryon, Structural and Systematic Conchology, vol. 3, p. 285, pl. 131, fig. 72.
1889. *Spondylus croceus* Chemnitz, and *S. spathuliferus* Sowerby, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 70.
1889. *Spondylus Americanus* Lamarck, Lorie, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 114-115, 141.
1889. *Spondylus spathuliferus* Sowerby, Dall, U. S. Nat. Mus., Bull. 37, p. 32.
1891. *Spondylus longitudinalis* Lamarck, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 46.
1895. *Spondylus ictericus* Reeve, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 291.
1898. *Spondylus echinata* (Martyn), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 759-761.
1901. *Spondylus echinatus* (Martyn), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 467.
1905. *Spondylus americanus* Lamarck, Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12 (1907), p. 186, pl. 35B, figs. 1, 1a.
1912. *Spondylus americanus* Hermann, Hedley and Pilsbry, Nautilus, vol. 26, No. 4, pp. 45-46.
1920. *Spondylus echinatus* (Martyn), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 62-63.
1924. *Spondylus echinatus* (Martyn), Emery, Nautilus, vol. 38, No. 2, p. 62.
1933. *Spondylus ictericus* Reeve, Trechmann, Geol. Mag., vol. 70, No. 823, p. 33.
1935. *Spondylus americanus* Lamarck, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Spondylus echinatus* (Martyn), McLean, Nautilus, vol. 49, No. 4, p. 117.
1936. *Spondylus echinatus* (Martin), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1936. *Spondylus echinatus* (Martyn), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 162.
1937. *Spondylus dominicensis* Röding, and *S. ictericus* Reeve, Fulton, Nautilus, vol. 51, No. 2, p. 38.
1937. *Spondylus americanus* Hermann, Smith, East Coast Marine Shells, p. 32, pl. 6, figs. 1a, 1b; pl. 54, figs. 1, 4.
1938. *Spondylus americanus* Hermann, Palmer, Palaeontographica Americana, vol. 2, No. 8, pp. 147, 150.
1938. *Spondylus americanus* Hermann, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1940. *Spondylus echinatus echinatus* (Martyn), and *S. echinatus americanus* Lamarck, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 23.
1940. *Spondylus americanus* Lamarck, Smith, World-wide Sea Shells, p. 94, figs. 1278a, b.

1940. *Spondylus americanus* Hermann, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Spondylus echinatus* (Martyn), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38.
1945. *Spondylus americanus* Hermann, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 4, p. 77.
1946. *Spondylus ictericus* Reeve, Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 99.
1949. *Spondylus echinatus* Martyn, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 15.
1951. *Spondylus americanus* Hermann, Rogers, The Shell Book, pp. 405, 502.
1951. *Spondylus americanus* Hermann, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 32-33, pl. 7, fig. 1.
1952. *Spondylus americanus* Lamarck, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181.
1953. *Spondylus echinatus* (Martyn), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Spondylus americanus* Hermann, Abbott, American Seashells, pp. 369-370, pl. 36b.
1955. *Spondylus ictericus* Reeve, Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 44-45, pl. 5, fig. 23.
1955. *Spondylus americanus* Hermann, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 45, frontispiece.
1958. *Spondylus americanus* Hermann, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1958. *Spondylus americanus* Hermann, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 117.
1959. *Spondylus americanus* Hermann, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 7.
1961. *Spondylus americanus* Hermann, Warmke and Abbott, Caribbean Seashells, p. 170-171, pl. 4e; 34a, b.

The Venezuelan fossils referred to this species are large, robust, suborbicular, and inflated. The posterior side is rounded a little more acutely than the anterior near the middle and is embayed more prominently below the posterior auricle. Interior with crenulate margins, a large, fairly deep adductor impression, a simple pallial line not far from the margin, and a well-defined body cavity. Exterior diversely sculptured by spinose radial ridges and foliaceous concentric lamellae. Our largest left valve, which is worn, has about six primary radials with short strong spines, and, on the disk, about half a dozen subequal secondary radial ribs. On the largest right ? valve, the spines are long and strong on the primary ridges, are convex on the upper surface, and are longitudinally fluted with a single groove on the under side. The exterior of other fragments is raspy and scabrous, and the spines flattened, the rasps produced by numerous small acutely vaulted lamellae. The umbo of the lower,

or right valve is extended high above the upper valve and is strongly lamellate or foliaceous. The cardinal area above the hinge proper on the lower valve is high triangular, but the specimen is too imperfect to reveal the nature of the longitudinal cartilage groove.

Dimensions.—Specimen (S354a), left valve, height 123 mm.; max. width 111 mm.; thickness approximately 45 mm. Specimen (0355a), right ? valve, height (umbo missing) 130 mm.; max. width 108 mm. Specimen 0441a (umbonal area and beak), right valve, height 42 mm. Specimen 0356a (part of the umbonal area), height 36.5 mm.

Localities.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve. Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. Two right valves, one fragment of umbonal area, three fragments of base.

Remarks.—Many present-day conchologists are of the opinion that there is but one living species of *Spondylus* in the Western Atlantic, and that is the one known currently as *S. americanus* Hermann. The Eastern Pacific analogue is *S. princeps* Broderip (1833, Zool. Soc. London Proc., p. 4; see Keen, 1958, p. 76, pl. 2). These two Recent species, on opposite sides of the American continent, are much alike, although Abbott (1954, pp. 169, 170) stated that the Pacific form (as *S. pictorum* Schreiber) is usually more brilliantly colored than the Atlantic species, and that the spines are 1-1/2 inches or less in length as compared with those of *S. americanus* which are 2 inches or less in length. Although worn and encrusted, the Cabo Blanco fossils are believed to be the same as the Recent American shell, but whether it should be referred to the Western Atlantic *S. americanus* or to the Eastern Pacific *S. princeps* is a moot question. The Western Atlantic name has priority, and I tentatively identify the Cabo Blanco fossils with that species.

Range and distribution.—*S. americanus* Hermann is known from the Pliocene to Recent in east America, and *S. princeps* Broderip from the lower Pliocene to Recent in west America. The living *S. americanus* ranges from Florida to Brazil, *S. princeps* from the Gulf of California to Ecuador. In the Pleistocene *S. americanus* is recorded from Florida, Cuba, St. Eustatius ?, Colombia, Barbados, and

Curaçao, and in the Pliocene from Costa Rica. There are several Caribbean Miocene species that are similar or related to the extremely variable *S. americanus* and among those are *Spondylus* species Woodring (1925, pp. 77-78, pl. 9, fig. 8) from Bowden, Jamaica, and the middle Miocene *S. colombiensis* Weisbord (1929, pp. 246-247, pl. 2, figs. 10-11) from near Tuberá, Colombia.

LIMIDAE

Lima (Limaria) pellucida C. B. Adams Pl. 18, figs. 2, 3

1846. *Lima pellucida* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 103.
1864. *Lima inflata* Lamarck (*L. pellucida* Adams), Krebs, The West Indian Marine Shells, p. 133.
1878. *Lima pellucida* Adams, Mörch, Catalogue of West-India Shells, p. 16.
1885. *Lima* (*Mantellum*) *hians* (Gmelin), Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, p. 290 (part). Not of Gmelin.
1886. *Lima inflata* Lamarck, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 224.
1889. *Lima inflata* Lamarck, Dall, U. S. Nat. Mus., Bull. 37, p. 36.
1901. *Lima inflata* Lamarck, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 468.
1920. *Lima inflata* Lamarck, Maury, Bull. Amer. Paleont., vol. 8, No. 34.
1931. *Lima inflata* Lamarck (*L. pellucida* C. B. Adams), Johnson, Nautilus, vol. 44, No. 4, p. 126.
1934. *Lima* (*Limaria*) *inflata* Lamarck (*L. pellucida* C. B. Adams), Johnson, Boston Soc. Nat. Hist., vol. 40, No. 1, p. 26.
1936. *Lima* (*Limaria*) *hians* (Gmelin), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 163. Not of Gmelin.
1937. *Lima hians* (Gmelin), Smith, East Coast Marine Shells, p. 36, pl. 10, figs. 3a, 3b. Not of Gmelin.
1940. *Lima inflata* Chemnitz, Smith, World-Wide Sea Shells, p. 97, fig. 1314.
1946. *Lima* (*Limaria*) *hians* (Gmelin), Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol. 4, No. 3, p. 99. Not of Gmelin.
1950. *Lima pellucida* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, p. 324, pl. 43, figs. 8-9.
1951. *Lima* (*Mantellum*) *inflata* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 35-36, pl. 7, fig. 5.
1954. *Lima pellucida* C. B. Adams, Abbott, American Seashells, p. 370.
1955. *Lima* (*Limaria*) *inflata* (Gmelin), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 50, pl. 6, fig. 31. Not of Gmelin.
1958. *Lima pellucida* C. B. Adams, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1958. *Lima* (*Mantellum*) *pellucida* C. B. Adams, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 117.
1958. *Lima inflata* Lamarck (*pellucida* C. B. Adams), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 8.
1961. *Lima* (*Limaria*) *pellucida* C. B. Adams, Warmke and Abbott, Caribbean Seashells, p. 171, pl. 34e.

The worn and encrusted shell referred to *Lima pellucida* is represented by a right valve which is thin, subtranslucent, a little

inflated, elongate, obliquely subelliptical. Anterior side straight, with a long narrow hardly embayed gape, the ventral margin rather acutely rounded, the posterior side subangularly rounded with the greatest curvature a little above the middle, and with a short fairly pronounced gape below the posterior auricle. Interior of valve polished, slightly corrugated by the sculpture of the exterior which is reflected through. Pallial line simple, a short distance in from the margins, the distinct edge of the body cavity farther removed. Beak small, smooth, pointed, appressed, projecting slightly, if at all, beyond the hinge line. Hinge line strongly inclined. Chondrophore relatively large, rounded-triangular, shallow. Just below the posterior auricle there is a short deep groove or sulcus. Exterior of valve sculptured by low delicate finely crenate radial riblets with finer threads between them, and widely spaced concentric lineations. The color is white within and without.

Dimensions.—Specimen A559a, right valve, height from beak to ventral margin 21 mm.; width 13.5 mm.; thickness 4 mm.

Locality.—Beach at Playa Grande Yachting Club, Distrito Federal. One right valve.

Remarks.—The Western Atlantic *L. pellucida* of C. B. Adams has been referred to by authors as *L. inflata* Lamarck (1819, An. san Vert., vol. 6, p. 156) and *L. hians* (Gmelin) (1791, Syst. Nat., p. 3333). According to Abbott (1958) *L. pellucida* is the same as *L. inflata* Lamarck 1819 but is not *L. hians* Gmelin 1791, which is from the Mediterranean. However, there is some question about the validity of Lamarck's 1819 *Lima inflata* as that name was first used by him in January (?) 1807 (Mus. Nat. Hist. nat. Paris An., vol. 8, p. 463) in his "Mémoires sur les fossiles des environs de Paris." In May 1807, Link (Beschreibung der Naturalien-Sammlung der Universität zu Rostock, vol. 1, pt. 3, p. 157) described *Limaria inflata* founded on Chemnitz 1784 (Neues systematisches Conchylien-Cabinet, vol. 7, pl. 68, fig. 649a) from "the coast of Guinea and the strands of the West Indian sugar islands." That species was chosen as the type of the subgenus *Limaria* by Winckworth (1930, Malac. Soc. London, Proc., vol. 19, pt. 3, p. 116) and may well be the same as that named *L. pellucida* by C. B. Adams in 1846. However, Abbott (1958) stated that "If Mediterranean specimens prove to

be the same as our West Indian ones [*L. pellucida*], the name *tuberculata* Olivi, 1792 or *imbricata* Risso, 1826 will have to be used." The Venezuelan shell is identical to Clench and Turner's illustration of the lectotype of *L. pellucida* from Jamaica, as well as, among others, to *L. hians* (Gmelin), Smith (1937) and *Lima* (*Mantellum*) *inflata* (Gmelin), McLean (1951) from Puerto Rico. Authoritative discussions of the subgenus *Mantellum* Röding *versus Limaria* Link are given by Winckworth (1930) and by Hertlein and Strong (1946, Zoologica, vol. 31, pt. 2, No. 55, p. 66).

Range and distribution.—Lima pellucida C. B. Adams has been found in the Western Atlantic from Florida to northern South America at depths to 128 fathoms. The Eastern Pacific analogue appears to be *L. hemphilli* Hertlein and Strong (1946, pp. 66-67, pl. 1, figs. 3-4) from Monterey, California, to Acapulco, Mexico, in 10-50 fathoms. *L. hemphilli* also occurs as far back as the upper Miocene in California. The curvature of the posterior side is more pronounced on *L. hemphilli* than on *L. pellucida.*

ANOMIIDAE

Anomia mareana, new species — Pl. 17, figs. 9, 10; Pl. 18, figs. 4-9

Left valve thin and subtransparent to thin and subtranslucent, irregularly suborbicular to broadly oval in outline. In configuration the left valve is undulatingly flattish to convex, and on some adults the dorsal and ventral margins are so bent over that the lateral profile of the valve is U-shaped. On many specimens there is a broad shallow radial depression before the posterior margin which itself may be upturned. Prodissoconch orbicular, the beak small, pointed, slightly raised, and distinct. Interior of shell slightly nacreous, with a subcentral oblongish patch of calcified white extending from below the ligament to about the middle of the valve where the patch widens. On the patch there are three rather prominent muscle scars, each of the scars offset from the other. The uppermost, or upper byssal scar, is the largest of the three, and is roughly circular in outline, lying in the top center of the patch; the lowest scar, or adductor impression, lies in the lower posterior area of the patch and is broadly ovate, the narrow end of the scar pointing upward;

the smallest scar, representing the lower byssal muscle, is subtrigonal to ovate, with the narrow end generally pointing down, and it lies below and a little to the right of the upper byssal scar. The calcified ligamental area is narrowly triangular, with a wide gently arched base, and the fourth muscle impression of the valve at the anterior end of the area is broadly semilunar, the upper edge of the impression lying under or near the anterior basal margin of the ligamental process. The dorsal margins of the valve overhang the ligament a little and are thickened by incremental lamellae. The exterior of all young specimens and most intermediate ones is sculptured by fine concentric lamellae and low vermicular radial ribs and rugae, but on large valves the radial ribs become obsolescent.

Dimensions.—Holotype (T362b), left valve, height 24.8 mm.; max. width 23.9 mm., thickness 7 mm. Paratype (T362a), left valve, height 36 mm.; max. width 40.2 mm.; thickness 15 mm. Paratype (G362b), left valve, height 25.2 mm.; max. width 26.5 mm.; thickness 1.7 mm. Paratype (J444a), left valve, height 6.3 mm.; max. width 7.7 mm.; thickness 1 mm. Largest specimen, a left valve, height 42 mm.; max. width 46.5 mm.; thickness 8.4 mm. Most highly bent specimen, a left valve, height 19.3 mm.; max. width 28 mm.; thickness 8 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Three left valves.

Other localities.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Six left valves. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Eleven left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Eight left valves.

Comparisons.—Some adult specimens of *A. mareana,* n. sp., on which the radial ribs are obsolescent, closely resemble certain variants of the middle Miocene to Recent *A. simplex* d'Orbigny (1842, p. 367, Atlas, pl. 38, figs. 31-34), but normally *A. mareana* is sculptured by both wavy radial ribs (which are inherent and not due to the influence of *situs*) and concentric lamellae, whereas typically *A. simplex* is a smoothish form marked only by concentric lamellae. Other species to which *A. mareana* exhibits affinity are the following:

A. peruviana d'Orbigny (1846, Voyage Amérique Méridonale, vol. 5, pt. 3, Mollusques, P. 673). Recent adult specimens of this west American Pliocene to Recent form which I have seen in the Academy of Natural Sciences of Philadelphia are all marked with fairly strong vermicular radiating rugae whereas adults of the Venezuelan fossil *A. mareana* and of *A. simplex* d'Orbigny are smoothish.

A. subcostata Conrad (see Hanna, 1926, California Acad. Sci., Proc., ser. 4, vol. 14, No. 18, pp. 460-461, pl. 23, figs. 3-5) from the Pliocene Carrizo formation of California varies in its radial sculpture from strongly plicate to none at all.

A. venezuelana Harris ([in] F. Hodson, H. K. Hodson, and Harris, 1927, pp. 43-44, pl. 23, figs. 2-3) from the Miocene and Pliocene of the State of Falcon, Venezuela. The adult of *A. venezuelana* is larger than *A. mareana,* n. sp., is more attentuate posteriorly, and has coarser and more prominent radial rugae.

A. indecisa Woodring (1925, p. 84, pl. 10, figs. 6-9) from the middle Miocene of Jamaica and the Dominican Republic. *A. indecisa* is a small smooth shell which may bear very fine obscure radial threads near the ventral margin. Also the lower byssal and adductor scars lie in a nearly horizontal plane whereas the lower byssal scar of *A. mareana* lies to the right of and higher than the adductor.

A. glypta Gardner (1926, U. S. Geol. Sur., Prof. Paper 142-A, pp. 53-54, pl. 12, figs. 6-7) from the middle Miocene Chipola formation of Florida. The upper byssal scar and lower adductor scar are about the same size, with the former lying almost directly above the adductor. On the Venezuelan *A. mareana,* the upper byssal scar is larger and rounder than the adductor, and lies above and to the right of the adductor.

A. suwaneensis Gardner (1926, pp. 54-55, pl. 13, fig. 5) from the middle Miocene Chipola formation of Florida. The ligamental scar is broadly conical or horshoe-shaped whereas the ligament of *A. mareana* is narrowly and widely triangular.

Anomia catiana, new species — Pl. 19, figs. 2-6; Pl. 23, fig. 9

The upper, or left valve of this species is moderately thin, sub-

trigonal, oval, or suborbicular in outline, compressed to convex, some specimens with the umbo so full and bent over that they are gryphaeaform. Prodissoconch orbicular, the beak small and pointed on young shells, appressed on old. Interior with a large, slightly oblique, more or less medial oblongish patch, the anterior edge of the patch fairly straight, the posterior edge arcuate. The muscle impressions on the patch are not visible. Dorsal margin of valve thickened by incremental lamellae, the lateral and ventral margins thin. Ligamental area broadly subconical, not on an elevated process, distinguished by vertical scratches on the inner surface of the valve under the overhang of the dorsal margin. On several examples a strong semilunar muscle impression may be seen touching the anterior end of the ligamental area. The exterior of the valve is shagreened by numerous erratically disposed short shallow grooves, superposed on the feeble concentric undulations or fine, concentric, appressed lamellae. An occasional specimen is marked with faint zigzag or vermicular rugae, and one specimen (K362d), undoubtedly belonging to this species, is sculptured by numerous microscopic crenated radial filaments of about equal size covering the whole of the disk from the umbo down; the umbo itself is smoothish. The character of the right, or attached valve is not known as no examples were found.

Dimensions.—Holotype (K362a), left valve, height 33 mm.; max. width 32 mm.; thickness 10 mm. Paratype (K362b), left valve, height 32.8 mm.; max. width 38.3 mm.; thickness 7.2 mm. Paratype (K362c), left valve, 31 mm.; max. width 30.2 mm.; thickness 5.5 mm. Paratype (K362d), left valve, height 26.6 mm.; max. width 25 mm.; thickness 4.5 mm.

Type locality.—Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road, about 95 meters due south of the shoreline. Eleven left valves.

Other localities.— Playa Grande formation (Catia member), about 220 meters west of W-15, on south side of Playa Grande road. One left valve.

Comparisons.—*Anomia catiana,* n. sp. is reminiscent of the middle Eocene *A. lisbonensis* Aldrich (see Harris, 1919, Bull. Am.

Paleont., vol. 6, No. 31, pp. 17-18, pl. 11, figs. 6-10) from Texas, Louisiana, and Alabama. *A. lisbonensis* is variable in shape, with some of the left valves having a pustular surface and others a finely lineate one. The radial lineations of *A. lisbonensis* are in the nature of somewhat irregular hachures, whereas those of *A. catiana* are uninterrupted, regular, faint even under a lens, and equal in size. The surface of the majority of the left valves of *A. catiana,* n. sp. is faintly roughened by a maze of short linear grooves, whereas the faint roughening of *A. lisbonesis* is pustular in aspect. The rare lineate variant of *A. catiana* is reminiscent of the Miocene to Recent *A. aculeata* Gmelin (1791, Syst. Nat., vol. 6, p. 3346), but the lineations are stronger on *A. aculeata.* On the single lineate specimen of *A. catiana,* the fine radial lineations cover the disk but are wanting on the prodissoconch.

Pododesmus rudis (Broderip) Pl. 19, figs. 7, 8; Pl. 23, fig. 10

1834. *Placunanomia rudis* Broderip, Zool. Soc. London, Proc. for 1834, p. 2.
1837. *Pododesmus decipiens* Philippi, [in] Wiegmann, Archiv Naturgeschichte, vol. 1, p. 386, pl. 9, figs. 1a-d.
1849. *Placunanomia rudis* Broderip, Gray, Zool. Soc. London, Proc. for 1849, p. 120.
1849. *Placunanomia abnormalis* Gray, Zool. Soc. London, Proc. for 1849, p. 121.
1859. *Placunanomia echinata* Broderip, Reeve, Conch. Icon., vol. 11, *Placunanomia,* pl. 1, sp. 1.
1859. *Placunanomia rudis* Broderip, Reeve, Conch. Icon., vol. 11, *Placunanomia,* pl. 1, sp. 2.
1859. *Placunanomia harfordi* Reeve, Conch. Icon., vol. 11, *Placunanomia,* pl. 2, sp. 8a, 8b.
1859. *Placunanomia abnormalis* Gray, Reeve, Conch. Icon., vol. 11, *Placunanomia,* pl. 3, sp. 14a, 14b.
1864. *Placunanomia rudis* Broderip, Krebs, The West Indian Marine Shells, p. 137.
1878. *Placunanomia echinata* Broderip and *P. rudis* Broderip, Mörch, Catalogue of West-India Shells, p. 16.
1884. *Pododesmus rudis* (Broderip), Tryon, Structural and Systematic Conchology, vol. 3, p. 294, pl. 131, fig. 77.
1886. *Pododesmus rudis* (Broderip), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 932 (1887).
1889. *Placunanomia rudis* Broderip, Dall, U. S. Nat. Mus., Bull. 37, p. 32.
1898. *Pododesmus rudis* (Broderip), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 779.
1901. *Pododesmus rudis* (Broderip), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 469.
1920. *Pododesmus rudis* (Broderip), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 64-65.

1926. *Pododesmus rudis* ? (Broderip), (Gray), Gardner, U. S. Geol. Sur., Prof. Paper 142-A, p. 55, pl. 13, fig. 12.
1934. *Pododesmus decipiens* Philippi, and *P. rudis* (Broderip), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 27.
1937. *Pododesmus decipiens* Philippi, Smith, East Coast Marine Shells, p. 37, pl. 10, fig. 13.
1949. *Pododesmus rudis* (Broderip), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 16.
1951. *Pododesmus rudis* (Broderip), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 38, pl. 8, fig. 1.
1954. *Pododesmus rudis* (Broderip), Abbott, American Seashells, pp. 372-373, pl. 38b.
1955. *Pododesmus rudis* (Broderip), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 51, pl. 6, fig. 33.
1961. *Pododesmus rudis* (Broderip), Warmke and Abbott, Caribbean Seashells, pl. 34j.

Left, or upper valve moderately solid, broadly oval to suborbicular, a little convex. Interior subnacreous, with a large oblongish patch of white enamel extending from the ligamental area to a little below the middle of the valve, the posterior margin of the patch ragged but straight, the anterior margin irregularly convex outward. The patch bears two prominent muscle impressions, the large ovate impression of the byssal muscle lying a little above the middle and near the anterior margin of the patch, the smaller adductor muscle impression lying in the lower left area of the patch. The larger impression exhibits faint rays divaricating from the long axis, the smaller marked with long faint striae running obliquely across the central area. The ligamental area is impressed into the enamel, and is semiconical in outline with the outer ends projecting downward as prongs, the horizontal basal edge of the ligamental area lying above but connected with the prongs. The dorsal margins of the left valve are built up by scabrous incremental lamellae; the lateral and ventral margins are irregularly scalloped along the edge and are faintly crenulate within. On the exterior, the beak is small, pointed, and smooth, and lies a short distance from the dorsal margin. The area of the prodissoconch below the beak is sculptured by fine, rather widely spaced crenated vermicular radial threads, these developing on the rest of the disk into irregular, fairly crowded, coarse radial rugae, here and there twisted, between which there are a few minor threads. The rugae are crossed by arched or vaulted scales which are relatively sparse on most of the disk but are much more numerous and stronger toward the foliaceous ventral margin.

What I take to be the attached, or right valve of this species is represented in the collection by a single young broken specimen. This valve is thin, hardly convex, subtransparent, more or less orbicular in outline, and with an undulating surface. The area of the byssal foramen is roundish and but partially open. The exterior of the valve is sculptured by sharp wavy crenated radiating riblets between which are a few minor radiating threadlets. From about the middle of the valve down the primary riblets bear widely spaced short vaulted lamellae or scales open toward the base. The riblets on the posterior side of the right ? valve are a little closer and more strongly crenate than the ones on the anterior side, but on the single specimen the anterior riblets seem more prone to develop the vaulted scales.

Dimensions.—Specimen G362a, adult left valve, height 38.2 mm.; width 44.8 mm.; thickness 4.7 mm. Specimen G362c, immature right ? valve, height 10.8 mm.; thickness 2.2 mm.

Localities.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One large left valve and one small right ? valve.

Remarks.—The Venezuelan fossil is believed to be the same as the Recent east American *P. rudis* (Broderip) which is a variable species with respect to shape and scaliness. It is also like the Pliocene to Recent west American *P. macroschisma* (Deshayes) (1839, Soc. Zool. Cuvierienne, Rev., p. 359; also, see Grant and Gale, 1931, San Diego Soc. Nat. Hist., Mem., vol. 1, pp. 241-242, pl. 12, figs 3, 4a, 4b) except for the position of the byssal muscle impression which lies more or less centrally within the enamel patch on *P. macroschisma* but near the anterior margin of the patch on the Venezuelan shell.

Range and distribution.—The Recent *P. rudis* (Broderip) is reported as ranging from Florida to the mouth of La Plata River, South America, in less than 50 fathoms. Gardner reported *P. rudis* from the Pliocene Waccamaw formation of North Carolina and from the middle Miocene Chipola formation of Florida. The identification of the latter, however, is doubtful as the single valve "does not retain enough of its diagnostic characters to make the determination convincing." Gardner's illustration is of a Recent left valve from the Antilles.

OSTREIDAE

Ostrea (Ostrea) libella, new species — Pl. 20, figs. 3, 4; Pl. 21, figs. 3-6

Shell small, rudely oval, subtriangular, or subfalcate, the valves subequal, compressed, irregularly undulate. Left, or attached valve with a small, slightly elevated opisthogyral beak, the beak of the right valve appressed. Cartilage process generally short, oblique, and shallow; on one left valve, however, the cartilage channel is narrow and sinuous, and is bordered on each side by a thickened ridge. The inner margins are normally pitted on the left valve and denticulate on the right, though the denticulations are usually slitted at the summit, the slits sometimes breaching the rim of the valve to form an *Isognomon*-like hinge pattern. The pits and denticles are present on the dorso-lateral margins, but they may continue around the ventral margin as well. The kidney-shaped muscle scar is situated posterior to the middle but its orientation depends on the shape of the valve; on most examples it lies normal to the long axis of the valve but sometimes it is parallel with it or transverse to it. The exterior is sculptured by rather coarse irregular concentric lamellae becoming incremental at the base and margins, and on a number of specimens there are gentle radial folds or plicae on the basal half of the valve.

Dimensions.—Holotype (C351e), left valve, height 11.5 mm.; width 10 mm.; thickness 2.2 mm. Paratype (C351d), right valve, height 13.7 mm.; width 15 mm.; thickness 2 mm. Paratype (C351a), left valve, height 11.4 mm.; width 10 mm.; thickness 2.9 mm.; Specimen C351f, left valve, height 9 mm.; width 6.5 mm.; thickness 3.2 mm. Largest specimen, right valve, height 23 mm.; width 20 mm.; thickness 4.8 mm.

Type locality.—La Salina, west of Puerto Cabello, State of Carabobo. Twenty specimens including at least three left valves and nine right valves, the remainder indeterminate.

Comparisons.—This species belongs in the category of such Ostreidae as the Recent Western Atlantic *O. spreta* d'Orbigny (1842, p. 365, pl. 28, fig. 30) and *O. permollis* Sowerby (1841, [in] Reeve, Conch Icon., vol. 28, pl. 10, fig. 18a). *O. spreta,* however, has a more

centrally located muscle scar, and *O. permollis,* which lives commensally in sponges, has a fuller and larger beak, much finer and closer concentric lamellae on the disk, and is wanting in the radial folds which are present on many, although not all specimens of *O. libella,* n. sp. The Recent Western Atlantic *O. cristata* Born (see Dall, 1925, U.S. Nat. Mus., Proc., vol. 66, No. 2554, art. 17, p. 23, pl. 28, figs. 7-8) and *O. equestris* Say (see Dall, 1925, p. 23, pl. 28, Figs. 1, 3) are sometimes placed in synonymy with *O. spreta* d'Orbigny, but as shown by Dall, *O. cristata* is a large shell with strong angular folds, and *O. equestris* has a deep, teardrop-shaped lower (left) valve with a relatively long, acutely tapering cartilage channel.

The La Salina fossil specimens here named *O. libella,* n. sp., are close to certain Recent forms labelled *O. cristata* Born in the Academy of Natural Sciences of Philadelphia. The La Salina fossils are also similar to the Recent *O. cristata* Born from Lake Worth, Florida, as illustrated by McLean in Notulae Naturae (page 6, pl. 4, figures 4-7, 1941). However, neither the Venezuelan fossils nor the Recent examples just referred to have the strong angular folds purportedly present on the *O. cristata* of Born. Lamy (1929, Jour. Conchyl., vol. 73, pp. 103-105) stated that of the species referred to *O. cristata* Born by various authors only the Puerto Rican form described by Dall and Simpson (1901, U.S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 464) was the true *O. cristata.* On the other hand, it is stated by Warmke and Abbott (1961, Caribbean Seashells, p. 172) that the Puerto Rican *O. cristata* of Dall and Simpson is *O. equestris* Say. In view of these considerations it seems advisable to give a new name to the La Salina fossil pending clarification of the *O. cristata-equestris-spreta* nomenclatural problem.

Ostrea cristata Born is reported living from the Gulf of Mexico and Florida as far south as Uruguay. In the Pleistocene *O. cristata* has been reported from Florida, and from the Paraguaná Peninsula, and the Island of Tortuga, Venezuela.

Ostrea (Ostrea) pannucea, new species Pl. 22, figs. 1, 2

The description of this species pertains to the right (upper) valve.

Shell small, irregularly flexuous and bent but more or less compressed, varying in outline from suborbicular to ovate to subtrigonal. Beak appressed, facing the posterior, the apex of the holotype so formed as to indicate that the prodissoconch is orbicular and that its axis is at nearly a right angle with the long axis of the grown valve. The exterior is ridged into smooth irregular corrugations, and is marked by concentric lamellae which are obsolete on the middle of the valve but stronger and incremental at the margins. On the paratype and other specimens, the thin outer layer of shell is worn away revealing faint vermicular radial threads on and below the umbonal area. In the interior, the cartilage area is broad and fairly long, directed opisthogyrally, its resilial depression moderately deep. The lateral margins are denticulate for longer or shorter distances from the apex toward the base, and there is the suggestion that the anterior series of denticles start at the top of the beak, the posterior ones at the base of the beak. The muscle scar is semicircular to elongate-lenticular, depending on the shape of the valve.

Dimensions.—Holotype (Q349a), right valve, length 13.5 mm.; width 9 mm. Paratype (Q349b), right valve, length 15 mm.; width 12.8 mm. The paratype is the largest of four specimens.

Type locality.—Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. Four right valves.

Comparisons.—In many respects this species is similar to the preceding *O. libella,* n. sp., from La Salina, differing, however, in lacking the radial folds or plicae which are present on the basal half of some of the specimens of *O. libella.* The right valve of *O. libella* is also more coarsely foliated by concentric lamellae, and the cartilage process of that valve is shorter and broader than on the present *O. pannucea,* n. sp. There is considerable resemblance, on their respective right valves, between the nepionic area of *O. pannucea* and *O. democraciana chiriguarana* F. Hodson (1927, Bull. Amer. Paleont., vol. 13, No. 49, p. 20, pl. 10, fig. 5; pl. 11, figs. 1-3) from the Miocene and Pliocene of the State of Falcon, Venezuela, but the right valve of *O. d. chiriguarana* is larger and much less undulate than that of *O. pannucea.*

Ostrea (Ostrea) lixula, new species Pl. 22, figs. 3-8

The following description pertains to the right (upper) valve.

Shell of medium size, rather thin, generally subtrigonally ovate, rarely suboval, suborbicular, or subfalcate, flat to medially depressed, the outer surface undulatory to plane. Exterior nonplicate, sculptured by wide, foliaceous appressed concentric lamellae often bearing faint irregular radial riblets and a few narrow obsolete folds. On the interior, the cartilage area is low, short, and broad, directed a little toward the posterior, the resilial depression proper wide and shallow, bordered on either side by a low, rather sharp ridge. The body cavity is not excavated and slopes up to the edge of the cartilage deck, the edge of the deck sinuous and bowed down in the middle. Beak pointed to blunt or truncate. The dorsolateral margins are denticulate, pustulate, or ridged, the nodulations occasionally continuing around the entire ventral margin, although where this occurs they are fainter and more widely separated than above. The muscle scar is large and pyriform, the narrow end of the scar extending high up the valve near the posterior margin.

Dimensions.—Holotype (0350a), right valve, length 55.4 mm.; width 37 mm. Paratype (0350b), right valve, length 33.5 mm.; width 25.8 mm. Paratype (J347a), right valve, length 32 mm.; width 24.8 mm. Largest specimen, right valve, length 63.2 mm.; width 43.4 mm.

Type locality.—Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. Eleven right valves.

Other localities.—Playa Grande formation (Catia member), in the vicinity of W-21. Three right valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve.

Comparisons.—There are a number of similar species from east and west America. The closest perhaps is *O. freudenbergeri* Hertlein and Jordan (1927, California Acad. Sci., Proc., ser. 4, vol. 16, No. 19, p. 622, pl. 17, fig. 9; pl. 18, fig. 4) (see also Loel and Corey, 1932, California Univ. Publ., Dept. Geol. Sci., vol. 22, No. 3, pp. 190-191, pl. 14, figs. 1a, 1b; pl. 15, figs. 1a, 1b) from the lower Miocene of

Baja California, México, and of the State of California, U.S.A. *O. freudenbergeri,* however, is a larger shell, and the muscle scar of the right valve is semicircular rather than pyriform as on the new Venezuelan species. *O. erici* Hertlein from the middle Pliocene of Baja California is also akin to *O. lixula,* n. sp., but as shown on the hypotype of the species by Durham (1950, Geol. Soc. Amer., Mem. 43, p. 59, pl. 4, fig. 2), the upper valve is more circular than that of *O. lixula,* and the radial riblets seem to be wanting.

Remarks.—Ostrea lixula, n. sp., is the dominant shell making up the *Ostrea* bed or coquina exposed across the Litoral anticline (see Weisbord, 1957, Geologic Sketch Map and Cross Section F-F′). This bed is six feet thick and is composed nearly entirely of valves of the new species. The oyster shells are firmly cemented at the outcrop trace except at the north end where some specimens have been loosened out naturally from the hard matrix. However, all of the loose shells collected represent the right valve of *O. lixula,* and the species has been described from that.

Ostrea (Ostrea) caraboboensis, new species — Pl. 22, figs. 9, 10; Pl. 23, figs. 11, 12

This species is described from the left (attached) valve.

Shell small, deep, oval and slightly arcuate, attached on the posterior side which is flattened irregularly. Apex relatively high, built up incrementally, the beak directed opisthogyrally. External sculpture variable, consisting, however, of both irregular concentric lamellae and radial plicae. On the holotype the lamellae, which have a shagreen texture and are somewhat foliaceous, cover nearly exclusively the whole of the valve although there are angular plicae at the basal margin. On the paratype thin sharp radial plicae extend from the umbo to the base and are traversed by closely spaced, coarse concentric lamellae which are arched over the plicae and here and there toward the margins project as spiny scales. Within, the lateral margins are rectangularly pitted, the pits on the paratype continuing feebly around the basal margin. The cartilage area is low, short, and broad, and is crossed by densely packed concentric growth laminae. The body cavity is excavated under the hinge so that the cartilage process is decklike. The muscle scar is large,

posterior, obovate, the basal margin of the scar reaching halfway down the valve, the inner margin of the scar extending to the mid-line of the valve.

Dimensions.—Holotype (C437a), left valve, height 21 mm.; width 12.3 mm.; thickness 9.5 mm. Paratype (C437b), left valve, height 17.2 mm.; width 11.5 mm.; thickness 8 mm.

Type locality.—La Salina, west of Puerto Cabello, State of Carabobo. Two left valves.

Comparisons.—The new species is reminiscent of *O. miguelensis* Hertlein (1928, Jour. Paleont., vol. 2, no. 2, p. 146, pl. 23, figs. 3-6) from the lower Miocene Vaqueros formation of San Miguel Island, California, but differs from that in being radially plicate to a greater or lesser extent.

Ostrea (Crassostrea) virginica Gmelin Pl. 22, figs. 11, 12

1692. *Ostrea virginiana* Lister, Historiae Conchyl., pl. 200, fig. 5.
1785. *Ostrea rostrata maxima* Chemnitz, Syst. Conchylien-Cabinet, vol. 8, pp. 38-39, pl. 73, fig. 677.
1785. *Ostrea crassa* Chemnitz, Syst. Conchylien-Cabinet, vol. 8, pp. 40-41, pl. 74, fig. 678.
1786. *Ostrea elongata* Solander, A Catalogue of the Portland Museum, p. 55. Not Born, 1780, Testacea Musei Caesarei Vindobonensis, p. 86.
1791. *Ostrea virginica* Gmelin, Syst. Nat., ed. 13, vol. 1, pt. 6, p. 3336.
1819. *Ostrea brasiliana* Lamarck, An. sans vert., vol. 6, p. 205.
1819. *Ostrea canadensis* and *Ostrea borealis* Lamarck, An. sans Vert., vol. 6, p. 207.
1822. *Ostrea semicylindrica* Say, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 2, p. 228.
1822. *Ostrea virginiana* Sowerby, The Genera of Recent and Fossil Shells, fig. 2.
1836. *Ostrea borealis* Lamarck, Deshayes, An. sans Vert., ed. 2, vol. 7, p. 220.
1856. *Ostrea triangularis* Holmes, Elliott Soc., Proc., vol. 1, p. 29.
1860. *Ostrea virginiana procyon* Holmes, Post-Pleiocene Fossils of South Carolina, p. 10, pl. 2, fig. 9a.
1867. *Ostrea virginica* Gmelin, Guppy, Sci. Assoc. Trinidad, Proc., p. 164.
1871. *Ostrea virginiana* Lister, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 131.
1871. *Ostrea floridensis* Sowerby, [in] Reeve, Conch. Icon., vol. 18, pl. 29, sp. 76a, b.
1873. *Ostrea virginica* Gmelin, Gabb, Amer. Philos. Soc., Trans., vol. 15, p. 257.
1876. *Ostrea virginica* Gmelin, Guppy, Geol. Soc. London, Quart. Jour., vol. 32, p. 532.
1881. *Ostrea virginica* Gmelin, Gabb. Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 380.
1884. *Ostrea virginica* Gmelin, Tryon, Structural and Systematic Conchology, vol. 3, p. 297, pl. 133, fig. 34.

1886. *Ostrea virginica* Gmelin, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 924.
1889. *Ostrea virginica* Gmelin, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 71.
1889. *Ostrea virginica* Gmelin, Dall, U. S. Nat. Mus., Bull. 37, p. 32.
1894. *Ostrea virginica* Gmelin, Whitfield, U. S. Geol. Sur., Mon. 24, pp. 27-28, pl. 2, figs. 1-7.
1898. *Ostrea virginica* Gmelin, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 687-688.
1901. *Ostrea virginica* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1901, pt. 1, p. 463 (part).
1903. *Ostrea virginica* Gmelin, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1906. *Ostrea virginica* Gmelin, Clark, Maryland Geol. Sur., Pliocene and Pleistocene, pp. 204-205, pls. 61-63.
1906. *Ostrea virginica* Gmelin, Böse, Inst. Geol. México, Bol., No. 22, pp. 66, 69, 75.
1910. *Ostrea virginica* Gmelin, Guppy, Agric. Soc. Trinidad and Tobago, Soc. Paper No. 440, p. 7.
1913. *Ostrea virginica* Gmelin, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 6, pp. 96-97.
1914. *Ostrea virginica* Gmelin, Henderson and Bartsch, U. S. Nat. Mus., Proc., vol. 47, No. 2055, p. 412.
1917. *Ostrea virginica* Gmelin, Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 348.
1918. *Ostrea virginica* Gmelin, Mansfield, Florida State Geol. Sur., Eleventh An. Rept., p. 115.
1920. *Ostrea virginica* Gmelin, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 56-57.
1920. *Ostrea virginica* Gmelin, Hubbard, N. Y. Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 100.
1923. *Ostrea virginica* Gmelin, Clench, Nautilus, vol. 37, No. 2, pp. 53-54.
1924. *Ostrea virginica* Gmelin, Jacot, Nautilus, vol. 38, No. 2, p. 49.
1924. *Ostrea borealis* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 30, p. 94.
1925. *Ostrea virginica* Gmelin, Maury, Bull. Amer. Paleont., vol. 10, No. 25, pp. 232-233.
1925. *Ostrea virginica* Gmelin, Dall, Nautilus, vol. 38, No. 4, p. 121.
1927. *Ostrea virginica* Gmelin, F. Hodson, H. K. Hodson, and Harris, Bull. Amer. Paleont., vol. 13, No. 49, pp. 21-22.
1927 *Ostrea virginica* Gmelin, A. Wood and H. E. Wood, Nautilus, vol. 41, No. 1, pp. 12, 14-15.
1929. *Ostrea virginica* Gmelin, Clench, Nautilus, vol. 43, No. 1, p. 35.
1929. *Ostrea virginica* Gmelin, Lamy, Jour. Conchyl., vol. 73, pp. 14, 40, 97, 264, 265, 267-272, 273, 274.
1934. *Ostrea virginica* Gmelin, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 23.
1936. *Ostrea virginica* Gmelin, Richards, Nautilus, vol. 49, No. 4, p. 132.
1938. *Ostrea virginica* Gmelin, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1939. *Ostrea virginica* Gmelin, Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 16, 18, 19, 21, 30, 31.
1939. *Ostrea virginica* Gmelin, McLean, Nautilus, vol. 52, No. 3, p. 107.
1940. *Ostrea virginica* Gmelin, Stubbs, Jour. Paleont., vol. 14, No. 5, p. 511.
1940. *Ostrea virginica* Gmelin, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1941. *Ostrea* (*Crassostrea*) *virginica* Gmelin, McLean, Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 67, pl. 8, figs. 1-4.

1942. *Ostrea virginica* Gmelin, Richards, Acad. Nat. Sci. Philadelphia, Proc., vol. 94, pp. 187-188, pl. 9, fig. 4.
1943. *Ostrea virginica* Gmelin, Jacobson, Nautilus, vol. 6, No. 4, p. 141.
1944. *Ostrea virginica* Gmelin, Hackney, Nautilus, vol. 58, No. 2, p. 57.
1945. *Ostrea virginica* Gmelin, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Ostrea virginica* Gmelin, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1947. *Ostrea virginica* Gmelin, Richards, Jour. Paleont., vol. 2, No. 1, pp. 25, 27.
1947. *Crassostrea virginica* (Gmelin), Stenzel, Jour. Paleont., vol. 21, No. 2, p. 172.
1947. *Ostrea virginica* Gmelin, Alexander, Nautilus, vol. 60, No. 3, p. 75.
1949. *Ostrea* (*Crassostrea*) *virginica* Gmelin, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 16.
1950. *Crassostrea virginica* (Gmelin), Gunter, Amer. Midland Naturalist, vol. 50, No. 2, pp. 438, 440, 446.
1951. *Crassostrea virginica* (Gmelin), Gunter, Bull. Marine Sci. Gulf and Caribbean, vol. 1, No. 1, pp. 43, 44, 45.
1951. *Ostrea* (*Crassostrea*) *virginica* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 24-25, pl. 4, fig. 5.
1951. *Ostrea virginica* Gmelin, Rogers, The Shell Book, pp. 423-424.
1952. *Ostrea virginica* Gmelin, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181, pl. 8, fig. 11.
1953. *Ostrea* (*Crassostrea*) *virginica* Gmelin, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 49, pl. 5, figs. 2, 2a.
1954. *Crassostrea virginica* (Gmelin), Abbott, American Seashells, p. 375, pl. 28a.
1955. *Crassostrea virginica* (Gmelin), Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 43-44, pl. 4, fig. 19.
1958. *Crassostrea virginica* (Gmelin), DuBar, Florida Geol. Sur., Geol. Bull. No. 40,
1959. *Crassostrea virginica* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 9.
1961. *Crassostrea virginica* (Gmelin), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 39.
1961. *Crassostrea virginica* (Gmelin), Jacobson and Emerson, Shells of the New York City Area, p. 76, 1 fig.

The left valve referred to *O. virginica* Gmelin is elongated, undulatingly convex, and irregularly gnarled and roughened on the exterior from the object to which it was attached. The beak is relatively long and straight but bent back and twisted slightly toward the anterior at the tip. The cartilage area is broad and shallow, and along the sides of the area there is a thickened ridge. The margins are unevenly scalloped. The muscle scar lies posterior to the middle and extends to the lower third of the valve. The color is dirty white tinged with purple in the interior.

Dimensions.—Specimen B352b, left valve, length 47.4 mm., width 23.5 mm., thickness 13.4 mm.

Locality.—On beach southeast of Higuerote, State of Miranda. One left valve. The occurrence of the shell at this particular locality is fortuitous, as the beach faces the open sea. However, the species is found in some abundance not too far distant in a brackish water environment, and as the oyster is eaten locally, it is presumed that the valve I collected was dropped on the beach by a bather.

Range and distribution.—*O. virginica* Gmelin is an extremely variable species which may date back to the Oligocene. In the Western Atlantic, the living shell has been recorded from Canada to Brazil. In the Pleistocene, *O. virginica* is known in North America from Prince Edward Island (Canada) to Florida and the southern Coastal Plain of the United States, in Central America from the Panamá Canal Zone, and in South America from the Goajira Peninsula and the Island of Tortuga (Venezuela). In the Pliocene it is known from the eastern and southern coastal plain area of the United States, and from México, Costa Rica, Venezuela, and Trinidad. In the Miocene it occurs as far north as New Jersey, extending through Maryland and the Carolinas to Florida; farther south the species has been reported in the Miocene of Hispaniola, Venezuela, and Trinidad. The Oligocene occurrence was determined by Hubbard (1920) who described it from the upper Lares limestone in Puerto Rico. Concerning it Hubbard wrote: "The specimens show the usual great variation, but comparison with recent specimens of *O. virginica* shows no constant differences."

Ostrea (Crassostrea) species Pl. 24, figs. 1, 2

The single specimen is a thin left valve, elongate-elliptical in outline, with a broad roughened and slightly concave attachment area, and a steep narrow posterior submargin. Beak appressed, the cartilage area broad, shallow, and obliquely directed toward the posterior. Muscle scar large and suboval, occupying an area a little below the middle of the valve. Inner margins smooth. Color light tan within and without.

Dimensions.—Specimen B352a, left valve, length 54.5 mm.; width 25.2 mm.; thickness 11 mm.

Locality.—On beach, southeast of Higuerote, State of Miranda. One left valve. Like the single specimen of *O. virginica* Gmelin dis-

cussed above, this shell is believed not to have been washed up by the waves at this particular locality but to have been brought in from some more distant area.

Remarks.—The shell is too worn for definitive comparison and identification.

Ostrea (Crassostrea) rhizophorae Guilding Pl. 24, figs. 3, 4

1785. *Ostrea arborea* Chemnitz, Syst. Conchylien-Cabinet, vol. 8, pp. 46-47, pl. 74, fig. 681.
1828. *Ostrea rhizophorae* Guilding, Zool. Jour., vol. 3, No. 12, p. 542.
1836. *Ostrea Braziliana* Lamarck, Deshayes, An. sans Vert., ed. 2, vol. 7, p. 223.
1864. *Ostrea rhizophora* Chemnitz, Krebs, The West Indian Marine Shells, p. 136.
1871. *Ostrea rhizophorae* Guilding, Reeve, Conch. Icon., vol. 18, pl. 9, sp. 17a, 17b.
1878. *Ostrea parasitica* Gmelin, Mörch, Catalogue of West-India Shells, p. 16. Not of Gmelin.
1878. *Ostrea parasitica* Gmelin, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 273. Not of Gmelin
1882. *Ostrea parasitica* Gmelin, Stahl, Imprenta Boletín Mercantil, p. 242. Not of Gmelin.
1889. *Ostrea rhizophorae* Guilding, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 114, 141.
1893. *Ostrea adsociata* Philippi, Mus. Nat. Chile, Anal., p. 14, pl. 2, fig. 1.
1898. *Ostrea rhizophorae* Guilding, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 687.
1901. *Ostrea virginica* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 463. Not of Gmelin.
1907. *Ostrea parasitica (non* Gmelin), von Ihering, Mus. Nac. Buenos Aires, Anal., vol. 14, pp. 359, 374, 426, 450.
1935. *Ostrea parasitica* Gmelin, Richards, Jour. Paleont., vol. 9, No. 3, p. 256. Not of Gmelin.
1929. *Ostrea rhizophorae* Guilding, Lamy, Jour. Conchyl., vol. 73, pp. 95-99, 100, 108, 135, 137, 139, 271.
1941. *Ostrea rhizophorae* Guilding, McLean, Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 67, pp. 5, 9, pl. 1, figs. 5-7.
1942. *Ostrea parasitica* Gmelin, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 38. Not of Gmelin.
1949. *Ostrea arborea* Chemnitz, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art 1, p. 16.
1949. *Ostrea rhizophorae* Guilding, Mattox, Ecol. Monogr., vol. 19, pp. 339-356.
1950. *Crassostrea rhizophorae* (Guilding), Gunter, American Midland Naturalist, vol. 43, No. 2, p. 446.
1951. *Crassostrea rhizophorae* (Guilding), Gunter, Bull. Marine Sci. Gulf and Caribbean, vol. 1, No. 1, pp. 44-45.
1951. *Ostrea (Crassostrea) rhizophorae* Guilding, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 25, pl. 4, fig. 6.

1954. *Crassostrea rhizophorae* (Guilding), Abbott, American Seashells, pp. 374, 375.
1958. *Ostrea rhizophorae* Guilding, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1959. *Crassostrea rhizophorae* (Guilding), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 9.
1961. *Crassostrea rhizophorae* (Guilding), Warmke and Abbott, Caribbean Seashells, p. 173, pl. 35b.

The left, or lower valve, is fairly large, thin, irregularly suboval, eccentrically convex, with smooth margins within. Beak low, slanted toward the posterior, the cartilage channel moderately short, shallow, and broad, the base of the hinge plate or deck truncate. Body cavity rudely orbicular, occupying the dorsal half of the valve. Muscle scar situated posterior to the middle, oval, light brown, oriented more or less parallel with the long axis of the valve. Interior mostly white, the margins and body cavity tinged a faded lavender-purple. Exterior of valve built up of broad foliaceous lamellae bearing a number of short low radial folds or plicae. Projecting from the posterior dorsal margin aft of the beak are two broad flat scales forming a broad "M". The exterior is off-white and dull tan, with a slaty tint at the incremental anterior margin.

Dimensions.—Figured specimen (B353a), length 76.4 mm.; width 58.7 mm.; thickness 26.5 mm.

Locality.—On beach, southeast of Higuerote, State of Miranda; one left valve, washed up, or possibly thrown on the beach by some one.

Remarks.—Although the solitary valve was found on a sandy, unvegetated beach, it was originally attached to what was probably a mangrove root as the bark is still present on the large attachment area at the umbo.

Range and distribution.—O. rhizopohorae is an edible oyster living in the Caribbean and Western Atlantic south to Brazil. In Puerto Rico, the shell is found mainly in lagoons attached to the aerial roots of mangrove in waters having a temperature of 25°C. to 31°C., a pH reading of 7.4 to 8.2, and a salinity of 37 to 44 parts per mille (Mattox, 1949). The species has been recorded in the Pleistocene of Curaçao and Cuba. The Caribbean *O. rhizophorae* has been referred to by authors as *O. parasitica* Gmelin, but that name is valid only for the Indian Ocean species.

Ostrea (Alectryonia) vespertina venezuelana, new subspecies
Pl. 24, figs. 5-11

1957. *Ostrea* cf. *haitensis* Sowerby, Weisbord, Bull. Amer. Paleont., vol. 38, No. 165, p. 17. Not of Sowerby.

Shell of medium size, coarse, moderately thick, varying in outline from triangularly ovate to subtriangular to subfalcate. Valves unequal, the lower (left) moderately convex, the upper (right) a little smaller and flattish to occasionally moderately concave. Both valves are radially plicate, the left more strongly so than the right, and the plications or folds, which are prominent on the two valves, are crossed by coarse lamellae, which, from the middle of the disk to the base, often form vaulted arches on the summit of the plicae, and become incremental toward the margins. The radial folds are high and sharply triangular, and there are usually five or six of them though there may be as few as four and as many as eight primary ones. On the left valve there are three to five smaller corrugations on the anterior submargin; the posterior submargin of the left valve may bear several obsolete wrinkles below the beak, but generally the posterior submargin of the left valve is sculptured solely by concentric lamellae. On some left valves there is a low broad fold virgating off the major plica next to the posteriormost one, but the rest of the primary folds diverge from below the umbonal area, where the valve is attached, to the base. On the right valve the primary folds diverge from below the beak. In profile the ventral margin is strongly saw-toothed, the plicae of one valve fitting tightly into the valleys of the opposite. On the interior of the left valve the cartilage channel is fairly broad and shallow and directed toward the posterior, and is bordered on each side by, typically, a fairly wide and low swelling. The body cavity is excavated slightly below the deck of the cartilage area, but on some specimens there is no overhang whatsoever at the edge of the deck. The dorso-lateral margins of the left valve are shallowly grooved, and in the grooves there is a series of shallow slot-like pits extending from near the beak to the ventral margin proper. The cartilage area of the right valve is lower and not so well defined as that of the right, and along the dorso-lateral margins there is a series of denticles which engage with the pits of the left valve. The muscle scar

is large, posterior to the middle, and subtriangularly kidney-shaped, the base of the scar bluntly produced and pointing toward the ventral margin.

Dimensions.—Holotype (N346b), valves attached, height 48 mm.; width 39 mm.; thickness (including the plications) 17 mm. Paratype (N346a), right valve, height 44 mm.; width 31 mm.; thickness (including the plications) 9 mm. Paratype (N346c), right valve, height 60 mm.; width 48 mm.; thickness (including the plications) 21 mm. Paratype (N346d), left valve, height 63 mm., width 57 mm.; thickness (including the plications) 20 mm. Paratype (N346e), left valve, height 39 mm.; width 31 mm.; thickness (including the plications) 11 mm. Largest specimen, a doublet, height 74 mm., width 56 mm.; thickness (including the plications) 35 mm. Smallest paired specimen (Q348a 1-2), left valve, height 23 mm.; width 13 mm.; right valve, height 21.5 mm.; width 12 mm.; thickness of doublet 6.7 mm. This is the most arcuate example of the species in the collection.

Type locality.—Playa Grande formation (Catia member) at W-21. Sixty-eight specimens including 38 right valves, 23 left valves, and 1 doublet.

Other localities.—Playa Grande formation (Catia member), south side of Playa Grande road, 40 meters southeast of its intersection with the Playa Grande Yachting Club road. Twelve specimens including six left valves, five right valves, and one doublet. Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One right valve. Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. One doublet. Lower Mare formation at W-13 on hillside above west bank of Quebrada Mare Abajo. One left valve and one right valve.

Comparisons.—This is the shell referred to by me (Weisbord, 1957, Bull. Amer. Paleont., vol. 38, No. 165, p. 17) to *Ostrea* cf. *haitensis* Sowerby, but although it meets Sowerby's generalized description of the original *O. haitensis* from the Dominican Republic, it is not, as can be seen by comparison with the illustrations of the Dominican form by Maury (1917, pl. 31), the same species. *O.*

haitensis Sowerby (1849, Geol. Soc. London Quart. Jour., vol. 6, p. 56) is a larger and more broadly oval shell than *O. vespertina venezuelana,* n. subsp., and has more numerous folds which, instead of being straightish and sharply angular, are somewhat vermicular. The Cabo Blanco subspecies does, however, closely resemble certain variants of *O. vespertina* Conrad (1854, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 2 p. 300), particularly the *O. vespertina* illustrated by Arnold (1909, U. S. Geol. Survey Bull. 396, pp. 76-79, pl. 24, figs. 4-5) from the Etchegoin formation (Pliocene) of California and the hypotype of *O. vespertina* figured by Hanna (1926, California Acad. Sci. Proc., ser. 4, vol. 14, no. 18, pp. 468-469, pl. 26, figs. 1-3) from the Pliocene of Coyote Mountain, California. *O. vespertina vespertina,* and the synonymous *veatchii* Gabb (1866, Geol. Survey California, Palaeontology, vol. 2, p. 34, pl. 11, fig. 59), ranges chronologically from the upper Miocene to the Pleistocene, and geographically from California to Baja California, Méxio. Some authors have placed *O. vespertina* and *O. veatchii* in synonymy with *O. haitensis* Sowerby, but, as pointed out by Arnold (1909, p. 78), after examination of the material in the U. S. National Museum, "*O. vespertina* is smaller, relatively much narrower, and usually more falcate in outline and carries plaits more regular in size and generally fewer in number than *O. haitensis.*" In the eastern United States and Caribbean area *O. haitensis* is reported from the Oligocene of Puerto Rico, the Miocene of Cuba and Peru, the middle Miocene of the Dominican Republic, Haiti, Colombia, and Venezuela, the upper Miocene of Florida, Venezuela, and Trinidad, and the Pliocene in the Paraguaná Peninsula, Venezuela.

The following are east American and Caribbean fossil species to which the new Venezuelan subspecies exhibits affinity:

O. sculpturata Conrad (1840, Fossils of the Medial Teriary of the United States, p. 50, pl. 25, fig. 3). Later Miocene from Virginia to Florida; Pliocene from North Carolina to Florida. This has a more elongate and more lenticular muscle scar than *O. v. venezuelana.*

O. sculpturata osculum Pilsbry and Brown (1917, Acad. Nat. Sci. Philadelphia Proc., vol. 69, p. 40, pl. 6, figs. 2, 2a). Middle Miocene, Colombia. Typically, this has two deep angular plications

on each valve whereas the fewest plications on *O. v. venezuelana* are four.

O. gatunensis Brown and Pilsbry (1911, Acad. Nat. Sci. Philadelphia, Proc., vol. 63, p. 366, pl. 29, figs. 1-2). Middle Miocene of the Isthmus of Panamá. This is a larger and more oval form than *O. v. venezuelana,* and the plications are lower and more vermiform.

O. meridionalis Heilprin (1887, Wagner Free Inst. Sci., Trans., vol. 1, p. 100, pl. 14, figs. 35, 35a). Pliocene of Florida. This is more orbicular than the Venezuelan *O. v. venezuelana,* the plications are not so pronounced, and the pits and denticles on the dorso-lateral margins seem to be wanting.

O. tamiamiensis monroensis Mansfield (1931, U. S. Geol. Sur., Prof. Paper 170-D, pp. 46-47, pl. 14, fig. 2; pl. 15, figs. 1-4). Upper Miocene of Florida. This also lacks the pits and denticles on the dorso-lateral margins, and the muscle scar is rudely oval rather than kidney-shaped as on *O. v. venezuelana.*

Remarks.—Ostrea vespertina venezuelana, n. subsp. is abundant at station W-21 where it occurs in a weathered, soft, fine-grained sandstone about two feet thick. This bed is underlain by a tan sandstone with irregular knobby masses of hard sandstone, and is overlain by about 15 feet of dull, soft, gray to tan siltsone containing knobby masses and branch- or trunk-like cylinders of hard sandstone which are interpreted to be casts of fossil mangrove. The *O. v. venezuelana* bed lies 150 feet stratigraphically higher than the *Ostrea* bed [*O. lixula,* n. sp.] whose trace around the plunge of the Litoral anticline is shown on the geologic map in my paper (Weisbord, 1957) dealing with the geology of the Cabo Blanco area.

Ostrea (Alectryonia ?) caboblanquensis, new species Pl. 25, figs. 1-6

The folowing description pertains to the right valve.

Shell moderately large and sturdy, a little convex, rudely suborbicular or subtrigonally ovate. The upper part of the disk is generally irregularly undulatory and gnarly, but rarely a large area of the disk may be relatively smooth and scored with faint irregular radial grooves. The base and sides of the valves are sculptured by radial plicae arising well below the umbo and becoming progres-

sively more prominent toward the margins. The plicae or folds (of which there are about 20 on the largest specimen) are fairly high, and angular to subrounded. Crossing them are coarse concentric lamellae. In the interior, the cartilage area is short, broad, and fairly straight; the resilial depression is subcentral and exceedingly shallow, and extends a little lower than the sides of the cartilage area. The body cavity is not excavated under the deck edge of the cartilage area but is flush with it. The muscle scar is large for the size of the shell, broadly ovate, subovate or oval in outline, clearly defined, lying generally normal to the long axis of the valve, the forward end reaching the center of the valve. The dorso-lateral margins are closely corrugated, shagreened, or pitted by small ridglets, pustules or indentations, these continuing over the beak. Immature right valves are thin, undulatory and gnarled over most of the disk, but at the margins the undulations tend to develop into plicae. On the more circular specimens the posterior dorsal margin forms an obtuse angle with the side of the beak.

Dimensions.—Holotype (S346a), right valve, height (beak to base) 61.5 mm.; width 59.7 mm.; thickness 14 mm. Paratype (O346a), right valve, height 51 mm.; width 43 mm.; thickness 12.7 mm. Largest specimen, right valve, height 96 mm.; width 78 mm.; thickness 27 mm. Paratype (M430a), juvenile right valve, height 9 mm.; width 10 mm.; thickness 2 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Three right valves.

Other localities.—Playa Grande formation (Catia member) at W-22, on dip slope 100 meters west of Costa fault. One right valve. Playa Grande formation (Catia member), south side of the coast road at east end of Catia La Mar. One right valve. Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southeast of its intersection with the Playa Grande Yachting Club road. One juvenile right valve. Mare formation at W-25, south flank of Punta Gorda anticline. Three right valves, two of them immature. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve, a juvenile.

Comparisons.—It is sometimes difficult to differentiate certain individual variants of this species from the preceding *O. vespertina venezuelana* n. subsp., but on right valves of the same size, the muscle scar of *O. caboblanquensis* is always the larger and the more cleanly outlined. As with other fossil oysters from Cabo Blanco, the nearest related species are those from west America, among them such forms as the Miocene to Recent *O. fisheri* Dall (1914, Nautilus, vol. 28, p. 1) (see Durham, 1950, Geol. Soc. Amer., Mem. 43, p. 59, pl. 6, figs. 1, 4; and Keen, 1958, p. 66, fig. 121) and the lower and middle Miocene *O. vespertina loeli* Hertlein (1928, Jour. Paleont., vol. 2, p. 144, pl. 22, figs. 2-3) (see Loel and Corey, 1934, Univ. California Publ., Dept. Geol. Sci., vol. 22, No. 3, pp. 193-194, pl. 16, figs. 1a, 1b, 2; pl. 17, figs. 1a, 1b, 2a, 2b, 3). In east America and the Caribbean area a related species is *O. haitensis* Sowerby (1849, p. 53), that ranging from Oligocene to Pliocene. On all of the above-mentioned forms, however, the radial plicae extend from the umbonal area to the base whereas on *O. caboblanquensis* they arise relatively near the margins.

Remarks.—The juvenile right valve (M430a) tentatively referred to this species, is small, thin, moderately inflated, slightly oblique, a little wider than high, and broadly oval in outline, with rounded margins except immediately below the posterior side of the beak where the edge of the valve takes a right-angled turn. The beak is relatively full and nearly erect. The exterior is gently corrugated or gnarled by a few folds, and is sculptured by faint but fairly regular concentric ridges on the umbo and at the margins. In the interior, the cartilage area is hardly developed, and directed posteriorly. The dorsolateral margins at the apex are denticulate, with eight or nine denticles on the forward side and four larger ones on the posterior side; below the lowest posterior denticle, at the abrupt turn of the margin, there is a fairly pronounced depression. The muscle scar is faint, large, and orbicular, and is situated high up the posterior side. The marginal plicae characteristic of the adult are not present.

Ostrea (Agerostrea ?) antecursor, new species Pl. 25, figs. 7, 8

The following description pertains to the right (upper) valve.

Shell compressed, of medium size, sturdy throughout but with the anterior margin thickened more than the posterior, the holotype gently arcuate, the paratype distinctly falcate or sickle-shaped. Beak and umbo appressed. Outer surface sculptured by six or so angular to subrounded radial folds, most of them arising near the umbo, one or two of them originating near the margin, all of them attaining their maximum amplitude at the margins. Concentric markings consisting of lamellae, these smooth, appressed and faint on much of the surface but higher and incremental near and at the margins. Internally, the flattened cartilage area is short, broad, and directed posteriorly, the resilial channel proper broad and hardly depressed. Lateral margins denticulate, the denticles on the holotype extending from the beak to near the base; on the paratype, the denticles extend about halfway down the posterior margin but only a fourth of the way down on the anterior margin. The muscle scar is fairly large, slightly impressed, pyriform, cleanly and evenly outlined, situated near the posterior margin but reaching to about the center of the valve, the posterior margin of the scar long and straight, the narrow end pointing upward.

Dimensions.—Holotype (R348a), right valve, length 44.4 mm.; width 25 mm. Paratype (R348b), right valve, length 40 mm.; width 24 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas about 125 meters upstream from its junction with Quebrada Las Pailas. Two right valves.

Comparisons.—This oyster is allied to and may be a predecessor of the widesperad *O. megodon* Hanley. It is also akin to a number of other forms which themselves appear to be related to *O. megodon,* and these are listed below:

O. megodon Hanley (1846, Zool. Soc. London Proc. for 1845, pt. 13, p. 106) (see Keen, 1958, p. 66, fig. 123). Middle Miocene of the Dominican Republic, Costa Rica, Colombia, and Venezuela; Pliocene of Venezuela, Ecuador, Baja California (México), and California; Pleistocene of Baja California; and Recent from Baja California to Sechura Bay, Peru. The plicae of *O. megodon* arise near the margin, whereas on the Venezuelan shell they arise at the umbo.

O. locklini Gardner (1945, Nautilus, vol. 59, No. 2, pp. 39-40, pl. 4, figs. 3-4; pl. 5, figs. 1-2). Upper Miocene, from dredging off Snell Island, St. Petersburg, Florida. The Venezuelan shell is so close to the Floridan oyster that I would call it the same were it not for the absence of the radial folds on the middle of the right valve of *O. locklini.* It is stated by Gardner that on some individuals the marginal folds do originate on the umbonal area, but these occur on the left or lower valve.

O. messor Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, pp. 233-234, pl. 10, figs. 3-4). Upper Miocene, Trinidad. Maury gave this name to *megodon*-like oysters from the Antilles, differentiating *O. messor* from *O. megodon* by the smaller shell and fewer plications of the former. The Cabo Blanco *O. antecursor,* n. sp. may be distinguished from *O. messor* by having plicae which extend toward the beak whereas much of the surface of *O. messor* is not corrugated.

O. messor caimitica Maury (1925, pp. 234-235, pl. 11, fig. 6; pl. 12, fig. 6). Miocene, Trinidad. This is like *O. messor s. s.* but with fewer, weaker, and more rounded plications.

O. messor colombiensis Weisbord (1929, Bull. Amer. Paleont., vol. 14, No. 54, pp. 244-245, pl. 2, figs. 8-9). Middle Miocene, Colombia. Only the left valve of *O. m. colombiensis* is available for comparison with the right valve of the Venezuelan *O. antecursor.*

The right valve of *O. antecursor* is characterized by having a thicker anterior margin than the posterior. This enables the right valve to be differentiated from the right valve of falcate specimens of *O. vespertina venezuelana,* n. subsp. on which both margins are about the same in thickness.

CRASSATELLIDAE

Eucrassatella (Hybolophus) antillarum (Reeve) Pl. 25, figs. 9, 10

1841. *Crassatella rostrata* Delessert (*non* Lamarck), Recueil de coquilles décrites par Lamarck, pl. 4, figs. 2-3.

1842. *Crassatella Antillarum* Reeve, Zool. Soc. London, Proc., pt. 10, p. 44.

1843. *Crassatella Antillarum* Reeve, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 37.

1843. *Crassatella Antillarum* Reeve, Conch., Icon., vol. 1, *Crassatella,* pl. 2, sp. 8.
1847. *Crassatella Antillarum* Reeve, Nyst, Acad. Roy. Belgique, Bull., vol. 14, pt. 2, p. 120.
1862. *Crassatella Antillarum* Reeve, Chenu, Manuel de Conchyliologie et de Paléontologie Conchyliologique, vol. 2, p. 131, fig. 623.
1864. *Crassatella antillarum* Reeve, Krebs, The West Indian Marine Shells, p. 122.
1872. *Crassatella antillarum* Reeve, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 130, 249.
1872. *Crassatella Adelinae* Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, pp. 130, 249, pl. 6, fig. 1.
1881. *Crassatella antillarum* Reeve, Kobelt, Syst. Conchylien-Cabinet, vol. 10, pt. 1A, pp. 7-8, pl. 3, figs. 1-2.
1884. *Crassatella antillarum* Reeve, Tryon, Structural and Systematic Conchology, vol. 3, p. 224, pl. 123, fig. 64.
1886. *Crassatella antillarum* Reeve, Dall, Mus. Comp. Zool., vol. 12, No. 6, p. 257.
1890. *Crassatella antillarum* Reeve, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 3, p. 492.
1903. *Crassatellites antillarum* (Reeve), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1475.
1900. *Crassatella antillarum* Reeve, Dautzenberg, Soc. Zool. France, Mém., vol. 13, p. 243.
1913. *Crassatella Antillarum* Reeve, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 2, p. 104.
1916. *Crassatella Antillarum* Reeve, Lamy, Jour. Conchyl., vol. 62, pp. 202, 216-217, 222, figs. on p. 202.
1930. *Eucrassatella* (*Hybolophus*) *antillara,* Stewart, Acad. Nat. Sci. Philadelphia, Spec. Publ., No. 3, p. 139.
1931. *Crassatellites antillarum* (Reeve), Grant and Gale, San Diego Soc. Nat. Hist., Mem., vol. 1, p. 271, pl. 13, figs. 7a, 7b.
1943. *Eucrassatella antillarum* (Reeve), Rutsch, Naturforschenden Gesell. Basel, Verhandl., vol. 4, p. 116.
1951. *Eucrassatella* (*Hybolophus*) *antillarum* (Reeve), Rogers, The Shell Book, pp. 369, 501.
1961. *Eucrassatella* (*Hybolophus*) *antillarum* (Reeve), Olsson, Panamic-Pacific Pelecypoda, p. 180.

The following description pertains to the right valve.

Shell of medium size and sturdiness, subtriangular, inequitateral, slightly convex, somewhat attentuate posteriorly. Anterodorsal margin hardly concave, anterior margin sharply rounded, ventral margin shallowly rounded and gracefully embayed posteriorly, posterior margin rather short and obliquely truncate, posterodorsal margin concave. Umbo flattened at apex. The apical region, representing the nepionic shell or prodissoconch, is smooth in a tiny area at the point of the beak, but immediately below the beak there are a number of fine, regular, concentric ridgelets followed by half a dozen or so distant concentric waves with finer striae

between them; the remainder of the valve is relatively smooth although marked with obsolete concentric lineations. Posterior dorsal area bounded by a subangular radial ridge or keel, in front of which there is a broad shallow radial depression or sulcus narrowing toward, but not reaching the beak; about halfway between the ridge and the border of the escutcheon is a second radial ridge diverging from the side of the beak, and between the two ridges is a narrow sulcus extending from the apex to the posterior truncation. The escutcheon is large, sublanceolate, somewhat sunken, defined from the posterior rostration by a fine incision. The lunule is elongate, narrow, shallow, and ill-defined. Within, the anterior dorsolateral tooth bordering the anterior cardinal tooth is narrow, moderately long and deeply grooved. The cardinal process is composed of a large, subtriangular, posterior socket and a deep, narrow, oblique, anterior socket, the sockets lying on either side of the medial cardinal tooth. Adherent to the posterior side of the middle cardinal tooth is a thick lamina which separates from the tooth at its lower end forming a low thin wall near the tooth within the main socket. Both sides of the medial cardinal tooth, and the inner side of the anterior cardinal tooth are scored by sharp grooves. The base of the hinge plate is gently sinuous, and the valve is excavated below the edge of the plate. Muscle scars impressed, the anterior one reniform, the posterior subcircularly pyriform. Pallial line subparallel with the ventral margin, joining the adductor scars at the base, the line generally making a dog-leg bend just before joining the posterior scar. The inner margins of the valve are smooth, and on all specimens there is a rather pronounced pit above the superior end of the anterior adductor impression.

Dimensions.—Specimen I488a, right valve, length 41 mm.; height 28.7 mm.; thickness at umbo 6.7 mm. Specimen H488b, right valve, length 34 mm.; height 23 mm.; thickness at umbo 6.1 mm.

Localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two right valves. Mare formation at W-25, south flank of Punta Gorda anticline. Two right valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One hinge fragment of a large right valve.

Remarks.—On Recent specimens of *E. antillarum* from the type locality of Margarita Island, Venezuela, the ventral margin is embayed considerably more on adolescents than on adults, and it is with the smaller Recent examples that the right valves of the Cabo Blanco fossils are identical. Also, on most of the Recent specimens of *E. antillarum* in the collection at the Academy of Natural Sciences of Philadelphia, the escutcheon of the right valve is larger than that on the left. The habitat of Tryon's *E. adelinae* was unknown when that species was described in 1872, but it was subsequently determined to be also from Margarita Island in Venezuela. In comparing the types of *E. adelinae* and *E. antillarum* from the type locality of Margarita in the Academy's collection I was unable to discern any significant difference, and I believe them to be the same. The west American analogue of *E. antillarum* is the Pleistocene to Recent *E. digueti* (Lamy) (1917, Jour. Conchyl., vol. 62, No. 4, p. 217).

Range and distribution.—*Eucrassatella antillarum* ranges from Pliocene to Recent. The Recent shell is known from the island of Margarita, Venezuela, but will doubtless be found elsewhere along the northern coast of South America. As a fossil, *E. antillarum* was reported by Grant and Gale from the Pliocene or Pleistocene near Santa Rosalía on the eastern side of Baja California, México. The fossil *E. antillarum* also occurs in strata of probable Pliocene age near Cumaná, State of Sucre, Venezuela (Collection No. 18409, U. S. National Museum).

Crassinella aduncata, new species Pl. 25, figs. 11-14

Shell small, moderately thin, somewhat inflated, subequivalve, inequilateral, subtrigonal to veneridiform in outline, the beak small, opisthogyrate, sharp, and slightly hooked. Anterior dorsal margin convex, posterior dorsal margin truncate to hardly concave, ventral margin well rounded. Escutcheon of right valve smooth, fairly long, subtriangular, slightly sunken, bounded by the subangulate rim of the disk, the inner edge of the escutcheon sharp and straight. Lunule a linear ill-defined, shallow groove. Exterior sculptured by 13 to 18 regular concentric ribs, the ribs low and smooth, rounded

over most of the disk but sometimes a little sharper at the beak and anterior submargin, and generally closer together toward the base than at the umbos. Rarely, some of the ribs are engraved by a microscopic concentric groove, but the interspaces generally are smooth. Interior of valves smooth at the margins. Hinge of right valve with two simple cardinal teeth, the anterior one larger and higher than the posterior. The narrow lateral tooth or groove of the right valve extends along the anterior dorsal margin to about opposite the middle of the anterior adductor scar, the edge of the escutcheon of the opposite valve fitting into that. On the left valve the narrow lateral tooth or groove lies along the edge of of the escutcheon, and the escutcheon itself seems a trifle narrower and less developed than on the right valve. Anterior muscle scar oval, the posterior orbicular. Pallial line simple, entire, well removed from the margin, joining the muscle scars on their inner side near the base.

Dimensions.—Holotype (1485a), right valve, height 2.3 mm.; width 2.7 mm.; approx. thickness 0.8 mm. Paratype (1485b), left valve, height 1.9 mm.; width 2.1 mm.; approx. thickness 0.6 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two right valves and two left valves.

Other localities.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve and one left valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two right valves and one left valve.

Comparisons.—The most notable character of the new species is its venerid outline. The nearest relative with respect to shape and internal morphology is *C. nansemondensis* Gardner (1943, U. S. Geol. Sur., Prof. Paper 199-A, p. 64, pl. 13, figs. 18, 28) from the upper Miocene in the State of Virginia, U.S.A., that species differing from *C. aduncata,* n. sp. in being more robust and in having a narrower, more linear escutcheon. Other species which are similar in external sculpture are the Recent *C. mactracea* (Linsley) (1845, Amer. Jour. Sci. and Arts., vol. 48, No. 2, art. 6, p. 275, text figs. at bottom of page); the Recent West Indian *C. martinicensis*

(d'Orbigny) (1842, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, pp. 288-289, pl. 27, figs. 21-23); *C. dupliniana* Dall (1903, pp. 1478-1479, pl. 50, figs. 5-6) from the upper Miocene and Pliocene from Maryland to Florida; *C. xena* Woodring (1925, p. 98, pl. 12, figs. 5-6) from the middle Miocene Bowden formation of Jamaica; and *C. cahuitensis* Palmer (1923, Bull. Amer. Paleont., vol. 10, No. 40, p. 12, pl. 2, fig. 2) from the Uscari shale (lower Miocene) encountered in the Cahuita well, 22 miles southeast of Limon, Costa Rica, between 3818 and 3861 feet. *C. mactracea, C. martinicensis,* and *C. dupliniana* are higher and more trigonal than the new species; *C. xena* is fuller than *C. aduncata* and is rounded-triangular in shape; *C. cahuitensis* is more compressed than *C. aduncata,* and its posterodorsal margin is more concave.

Crassinella triquetra, new species Pl. 26, figs. 1, 2

This species is described from a single, well-preserved left valve.

Shell small, moderately sturdy, somewhat inflated, inequilateral, subangularly trigonal in outline, the left valve with a radial posterior depression starting narrowly below the umbo and shallowly broadening to the base. Anterodorsal margin with a pronounced bend at the umbo, ventral margin well rounded except posteriorly where it is embayed slightly to conform with the radial depression, posterodorsal margin subtruncate. Beak opisthogyrate, somewhat hooked. Escutcheon of left valve fairly long, semiovate, a little sunken, bounded by the low subangulate edge of the disk. Lunule long, semielliptical, hardly depressed. Exterior sculptured by about 18 smooth low regular concentric ribs, the ribs rather broad and gently rounded over most of the disk but narrower, sharper, and fainter at the umbo. Interior of valve smooth at the margins. Hinge of left valve with a strong elevated cardinal tooth and a deep triangular socket adjacent to it. The posterior lateral tooth is a narrow, moderately deep groove extending from near the beak along the inner edge of the escutcheon to the curve of the ventral margin. At the beak, the posterior lateral tooth and the escutcheon edge are fused into the posterior cardinal tooth. The anterior lateral tooth is represented by a faint narrow shallow sulcus along the anterior margin of the valve. Anterior muscle scar reniform, the posterior one not clear but seem-

ingly roughly oval. Pallial line simple, entire, well removed from the ventral margin, joining the muscle scars on their inner side at the base.

Dimensions.—Holotype (1486a), left valve, height 3 mm.; width 2.9 mm.; approx. thickness 0.9 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One left valve, the holotype.

Remarks.—The distinguishing characters of *C. triquetra,* n. sp. are the shallow but distinct radial depression in front of the posterior submargin, and the subangulate curve of the anterodorsal margin. The shell occurs together with the preceding-described *C. aduncata,* n. sp., but differs from that in its more trigonal outline as well as in the characters mentioned above.

CARDITIDAE

Cardita (Carditamera) gracilis Shuttleworth Pl. 26, figs. 3-17

1856. *Cardita gracilis* Shuttleworth, Jour. Conchyl., vol. 5, p. 173.
1864. *Trapezium* (*Cypricardia*) *gracilis* (Shuttleworth), Krebs, The West Indian Marine Shells, p. 123.
1888. ? *Cardita* (?) *sp.* Schepman, [in] Martin, Bericht über eine Reise nach Nederlandisch West-Indien und darauf gegründete Studien, Leiden. Pt. 2. Geologische Studien, appendix.
1888. *Cardita gracilis* Shuttleworth, Clessin, Syst. Conchylien-Cabinet, vol. 10, pt. 1, p. 45, pl. 10, figs. 4-5.
1889. *Cardita gracilis* Shuttleworth, Dall, U. S. Nat. Mus., Bull. 37, p. 46.
1902. *Cardita gracilis* Shuttleworth, Dall, Acad. Nat. Sci. Philadelphia, Proc., vol. 54, p. 702.
1920. *Cardita* (*Carditamera*) *gracilis* Shuttleworth, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 79.
1934. *Cardita gracilis* Shuttleworth, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 38.
1936. *Cardita gracilis* Shuttleworth, Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1937. ? *Cardita gracilis* Shuttleworth, Smith, East Coast Marine Shells, p. 44, pl. 11, fig. 9.
1946. *Cardita gracilis* Shuttleworth, Hertlein and Strong, Zoologica, vol. 31, pt. 3, No. 8, p. 108.
1951. *Cardita gracilis* Shuttleworth, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 54, pl. 10, fig. 7.
1954. *Cardita* (*Carditamera*) *gracilis* Shuttleworth, Abbott, American Seashells, p. 378.
1958. *Cardita gracilis* Shuttleworth, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1961. *Cardita gracilis* Shuttleworth, Warmke and Abbott, Caribbean Seashells, p. 174, pl. 35d.

This species occurs both living and fossil in the Cabo Blanco area. The rather thin shell is elongate-trapezoidal, moderately compressed, inequilateral, equivalve, broadly and roundly rostrate behind, slightly depressed medially, narrowish at the anterior end, subalate at the posterodorsal end. Anterior margin acutely rounded. ventral margin straight to a little embayed, posterior margin rounded below, obliquely subtruncate above. Radial ribs averaging 17 in number, crossed by concentric lamellae of varying degree of coarseness and scaliness. The anterior three or four radial ribs are strongly and regularly corded concentrically; the next three ribs are flattish, low, and relatively smooth, often rendered bipartite by a faint sulcus, with the posterior margin of these ribs a little higher than the anterior; as the posterior rostration or swelling is approached, the ribs become progressively more and more asymmetrically angulate, and are coarsely imbricated by the now incremental lamellae. The posterior rostration is sculptured by four large, elevated, imbricated and scaly radial ribs which are nodulous where weathered, the rostration starting at the thirteenth rib from the anterior end. The imbrications and scales are rather thick, the latter forming high vaulted projecting arches over the ribs. On the posterior alation there is always a single low scaly minor rib followed by one or two scaly ribs of intermediate size to the posterior hinge margin. At the umbos, the radial ribs are faintly beaded. On well-preserved Recent specimens the external surface is also marked by numerous delicate microscopic radial filaments decussated by minute spines. Interior radially corrugated by the ribs except at the anterior end. Lunule deep, small, broadly cordate. Escutcheon long and narrow, the ligament external. Adductor scars broadly reniform, the anterior one definitely impressed, the posterior one not impressed. Pallial line faint, entire, and straight except at the rear where it curves up to join the base of the posterior adductor scar. The right anterior cardinal tooth fits into the broadly triangular socket of the left valve, and the posterior cardinal tooth of the left valve is sturdier than the anterior tooth of the socket. Anterior half of the exterior of the Recent shell is cream-colored with rows of light brown maculations, whereas the posterior half is drab gray. Interior of valves subnacreous and mostly white except at the posterior end which is a deep shiny purplish chocolate; the posterior lateral tooth is also stained a dark brown.

Dimensions.—Specimen A540a1-2, a doublet, height 11.8 mm.; length 26 mm.; thickness (valves attached) 10 mm. Specimen A540b, a doublet, height 9.1 mm.; length 19.5 mm.; thickness (valves attached) 6.7 mm. Largest specimen, a doublet, height 15.5 mm.; length 34.8 mm.; thickness (valves attached) 14.1 mm. Specimen D540a, right valve, height 11 mm.; length 23 mm.; thickness 5.8 mm. Specimen D540b, left valve, height 7.2 mm.; length 14.4 mm.; thickness 3.1 mm. Specimen J540a, right valve, height 8.2 mm.; length 17.4 mm.; thickness 3.2 mm. Specimen J540b, left valve, height 9.1 mm.; length 18.1 mm.; thickness 4.1 mm. Specimen 1541a, infantile left valve, height 1.4 mm.; length 2.4 mm., approx. thickness 0.5 mm. (The identification of this specimen is somewhat in doubt.)

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Seventy-nine specimens including 24 right valves, 22 left valves, and 33 doublets. Abisinia formation at W-30, eastern edge of Playa Grande village. Nine specimens including four right valves and five left valves. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One infantile left valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve and one left valve.

Range and distribution.—The Recent *C. gracilis* ranges from southwest Florida to northern South America. Its occurrence in the Abisinia formation (Pleistocene ?) and Mare formation (Pliocene ?) is the first record as a fossil, although this might be the species from Cabo Blanco referred to by Martin (1888) as *Cardita* (?) *sp.*

Remarks.—The nearest east American relative of *C. gracilis* is the Miocene *C. protracta-aculeata-recta* tribe of Conrad (see Glenn, 1904, Maryland Geol. Sur., Miocene, pp. 343-344, pl. 91, figs. 4-6) from the State of Maryland, U. S. A. These integrading forms differ but slightly from *C. gracilis* in being a little more robust and in having a less truncate posterodorsal margin. Other east American counterparts are the Pliocene to Recent *C. floridana* Conrad (see Dall, 1903, p. 1415, pl. 56, fig. 11) which is more inflated than *C. gracilis* and has a crenulate inner margin, and *C. arata* (Conrad) (1832, Fossil Shells of the Tertiary Formations of North America, vol. 1, p. 20, pl. 5, fig. 2), occurring in the

Miocene and Pliocene from New Jersey to Florida, which also has a strongly crenulate inner margin. West American analogues are the upper Pliocene to Recent *C. affinis* Sowerby (1833, Zool. Soc. London, Proc., p. 195) and the Pleistocene to Recent *C. radiata* Sowerby (1833, *Ibid,* p. 195). As illustrated by Keen (1958), *C. affinis* is a coarser shell than *C. gracilis,* and *C. radiata* is not narrowed in front as is *C. gracilis.*

Venericardia (Glyptoactis) wendellwoodringi, new species
Pl. 26, figs. 18, 19; Pl. 27, figs. 1-10

1889. *Cardita ajar* Bruguière, Lorie, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 121, 141. Not of Bruguière.

This species occurs in two variants, one of which is thick-shelled highly inflated, subrhomboidal, and with high umbos, the other slightly thinner, moderately inflated, suboval, and with relatively low umbos. In other respects the forms are alike and seem to represent the same species.

Shell of medium size and equivalve, the beak full, sharp, prosogyrate, and a little forward of the middle. Anterior margin well rounded, ventral margin shallowly convex, posterior margin hardly curved to subtruncate. Radial ribs averaging 25 in number, the ribs elevated, squarish and nodulated, the interspaces about as wide as the ribs, and "U"-shaped to "V"-shaped in cross section. The nodules are most pronounced on the anterior and posterior submargins of the valves, occurring there as rounded to transverse beads. In general the nodules are somewhat fainter and more uniform on the disk of the left valve than of the right, but on the right valve several of the ribs posterior to the middle bear fainter nodules than the ribs anterior to the middle. On both valves the umbos are more closely beaded than the disk proper. On well-preserved specimens, the interspaces and sides of the ribs are seen with a lens to be lined by crowded microscopic concentric striae. The termini of the ribs at the ventral margin are serrated and fluted, and the inner margins of the valve are strongly crenulate. The crenulations are short, flat, and broad, and coincide with the interspaces of the external ribs; at the ventral margin proper the crenulations are usually shallowly bifid, and at their base are prolonged

into a short sloping ridge which unites with the end of the trough of the interspace. Anterior adductor scar elongate-lenticular, the posterior broadly pyriform. Pallial line simple, entire, joining the adductor scars at the base. Lunule small, depressed, broadly cordate, bounded by a narrow groove. Escutcheon area scythe-shaped and moderately deep. Right median cardinal tooth an expansive, flange-like process, upcurved a little at the edge and with a steep forward wall, the upper surface strongly scored with transverse grooves, the small but deep funnel-like socket, in front of the tooth lying directly below the beak; forward of the right socket, on the margin of the right valve, there is a smaller and shallower pit. The left median cardinal tooth is also strongly scored, and the socket in front of it is obliquely triangular; the left anterior cardinal tooth is upright, and the blunted tip is bent a little toward the beak.

Juvenile specimens of this species are relatively compressed and lucinid in outline, with an extended, well-rounded anterior margin, a shallowly rounded ventral margin and a nearly truncate posterior margin. The closely and regularly beaded ribs are low and broad, and are separated by much narrower interspaces. These infant shells resemble certain species of the subgenus *Pleuromeris* Conrad.

This fine shell is named in honor of Wendell P. Woodring for his classical works on the paleontology and stratigraphy of the Caribbean area.

Dimensions.—Holotype (T493a), adult right valve, height 24.2 mm.; width 23.9 mm.; thickness 11.2 mm. Paratype (T493b), young left valve, height 11.7 mm.; width 12.1 mm.; thickness 4.1 mm. Paratype (1493b), adult left valve, height 18.2 mm.; width 20.2 mm.; thickness 7 mm. Paratype (1493a), young valve, height 11.1 mm.; width 12 mm.; thickness 4.3 mm. Specimen T494a, juvenile left valve, height 3 mm.; width 3 mm.; thickness 1.2 mm. Specimen T494a, juvenile right valve, height 4.7 mm., width 4.8 mm. Specimen 5494a, juvenile left valve, height 6.5 mm.; width 6.6 mm.; thickness 2.1 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Eighty-eight

specimens including forty-one right valves and forty-seven left valves.

Other localities.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. Five specimens including four left valves and one right valve. Mare formation at W-25, south flank of Punta Gorda anticline. Five specimens including four left valves and one right valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One hundred twenty-eight specimens including 74 left valves and 54 right valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One juvenile right valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Sixteen specimens including ten left valves and six right valves.

Remarks.—This is one of the more abundant species in the Mare formation of the Cabo Blanco area. The subgeneric classification under *Glyptoactis* is from Stewart (1930, Acad. Nat. Sci. Philadelphia, Spec. Publ. 3, pp. 151-152). Typically, shells of this subgenus have tripartite or terraced ribs, but as suggested by Verastegui (1953, Palaeontographica Americana, vol. 3, No. 25, 434-435), certain late Teriary species of *Glyptoactis* may show a want of this character. The Cabo Blanco shell referred to as *Cardita ajar* Bruguière by Lorié is probably *V. wendellwoodringi,* n. sp. and not of Bruguière as *C. ajar* is an Eastern Atlantic species from West Africa.

Comparisons.—*Venericardia wendellwoodringi,* n. sp. is of the same genre as *V. hadra* Dall (1903, pp. 1429-1430, pl. 53, figs. 11, 13) and *V. himerta* Dall (1900, pl. 40, fig. 16; 1903, p. 1430, pl. 53, fig. 12) from the middle Miocene of Florida, but both of those have fewer ribs than the Cabo Blanco shell. *V. serricosta* (Heilprin) (1887, Wagner Free Inst. Sci., Trans., vol. 1, pp. 117-118, pl. 16, fig. 64) from the lower Miocene of Florida also has fewer ribs (about 16), and is more elongate than the new species. Juveniles of *V. wendellwoodringi* closely resemble the young of *V. granulata* Say (1824, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 4, p. 142, pl. 12, fig. 1) from the Miocene of Maryland (see Glenn, 1904, Maryland Geol. Sur., Miocene, pp. 344-345, pl. 91, fig. 10),

but is discriminated from *V. granulata* by the truncate posterior margin. *"Venericardia" waynensis* Mansfield (1940, Jour. Paleont., vol. 14, No. 3, pp. 189-190, pl. 25, figs. 9, 10, 18) from the lower Miocene Chickasawhay marl of Alabama and Mississippi differs from *V. wendellwoodringi* in having "a radial thread developed in the adult at the base of each rib." *V. vicksburgiana* Dall (1903, p. 1428, pl. 56, fig. 6) from the Oligocene of Florida is a good deal like *V. wendellwoodringi* in the character of the ribs but is a more orbicular shell. Compared with Caribbean species, the juvenile *C. wendellwoodringi* resembles *V. acaris* Dall (see Woodring, 1925, p. 102, pl. 12, figs. 10-12) from the middle Miocene of Jamaica, but the Venezuelan shell has 25 ribs compared with 18 on the Jamaican shell. Among adult forms, the nearest relative of *V. wendellwoodringi* is the middle Miocene *V. dominica* Weisbord (1929, Bull. Amer. Paleont., vol. 14, No. 54, pp. 249-250, pl. 2, fig. 12; pl. 13, figs. 10-11) from Colombia and the Dominican Republic, the latter, however, having 18 to 21 ribs, as compared with 24 to 27 on *V. wendellwoodringi.*

DREISSENSIIDAE

Mytilopsis leucophaeatus ? Conrad — Pl. 27, figs. 11, 12

1831. *Mytilus leucophaeatus* Conrad, Acad. Nat. Sci. Philadelphia, Jour., 1st ser. vol., 6, pp. 263-264, pl. 11, fig. 13.
1857. *Mytilopsis leucophaeatus* (Conrad), Acad. Nat. Sci. Philadelphia, Proc. for 1857, p. 167.
1858. *Mytilus americana* (Récluz MS), Reeve, Conch. Icon., vol. 10, *Mytilus,* pl. 10, sp. 43.
1858. *Dreissena americana* (Récluz MS), Fischer, Jour. Conchyl., vol. 7, ser. 2, p. 131.
1858. *Dreissena riisei* (Dunker MS), Fischer, Jour. Conchyl., vol. 7, ser. 2, p. 133.
1864. *Dreisenia Rissei* ? Krebs, The West Indian Marine Shells, p. 130.
1874. *Dreissena leucophaeata* (Conrad), Tryon, American Marine Conchology, p. 190, pl. 40, fig. 424.
1884. *Dreissensia* (*Mytilopsis*) *leucophaeata* (Conrad), Tryon, Structural and Systematic Conchology, vol. 3, p. 266.
1889. *Dreissensia* (*Mytilopsis*) *leucophaeata* (Conrad), Dall, U. S. Nat. Mus., Bull. 37, p. 40.
1889. *Dreissensia leucophaeata* (Conrad), Simpson, Davenport Acad. Nat. Sci., Proc., vol. , p. 69.
1898. *Congeria leucophaeata* (Conrad), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 808-809 (part).
1920. *Congeria leucopheata* (Conrad), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 70.

1929. *Congeria leucophaeata* (Conrad), Bailey, Nautilus, vol. 43, No. 1, p. 34.
1934. *Congeria leucopheata* (Conrad), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 29.
1935. *Dreissensia* (*Mytilopsis*) *leucophaeata* (Conrad), Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Congeria leucopheata* (Conrad), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.
1937. *Congeria leucophaeata* (Conrad), Rehder, Nautilus, vol. 50, No. 4, p. 143.
1937. *Mytilopsis leucophaeta* (Conrad), Smith, East Coast Marine Shells, pp. 39-40, pl. 11, fig. 3a, 3b.
1941. *Mytilopsis leucophaeata* (Conrad), Andrews, Nautilus, vol. 54, No. 1, p. 25.
1942. *Mytilopsis leucophaeata* (Conrad), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 39.
1949. *Dreissensia leucophaeata* (Conrad), Hertlein and Hanna, Southern California Acad. Sci., Bull., vol. 48, pt. 1, p. 18.
1954. *Congeria* (*Mytilopsis*) *leucophaeata* (Conrad), Abbott, American Seashells, p. 382.
1958. *Mytilopsis leucopheata* (Conrad), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.

Venezuelan shell of medium size, thin, mytiliform, flattened and subalate dorsally, the dorsum proper inflated, the ventral slope steep. Dorsal outline subangulate a little forward of the middle, the anterodorsal margin slightly sinuous, the posterodorsal margin subtruncate to hardly concave, the posterior end angularly rounded, the ventral margin nearly straight except below the beak where it is rather sharply incurved. Beak terminal, subacute, somewhat hooked. Anterior adductor impression seated on the apical septum, the septum of medium size, its hind margin thickened and evenly arcuate. Attached to the dorsal underside of the septum, and extending a short distance under the anterior dorsal margin, there is a cuneate lamina which bears the scar of the anterior retractor muscle. Internal margins are smooth, the part around the front of the septum is reflected and liplike. A shallow and rather narrow ligamental groove extends along the anterodorsal margin of the valve from the beak to the wing. Exterior marked with a few broad concentric undulations reflected in the interior and numerous concentric laminae, and, on the inflated area of the back, there are several exceedingly vague radial riblets which seem to lie on the dorsal half, the radii extending from the umbo to a little below the middle of the valve. Of the three specimens, one is bleached a more or less uniform cream color within and without.

The other two are rudely and concentrically banded in gray-black to brown and white in the interior, the exterior of one being slate-blue on the dorsum and dull white with a little slate-blue and brown elsewhere, the other concentrically banded in dull brown and white.

Dimensions.—Figured specimen (B557a), right valve, length 32 mm.; max. width 14.5 mm.; thickness 6.6 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. Three right valves.

Range and distribution.—The Recent *M. leucophaeatus* is said to range from the lower reaches of the Hudson River in New York State to the West Indies, Central America, and northern South America. It lives in brackish, fresh, or marine water, the marine shells seeming to attain a larger size. As a fossil, *M. leucopheatus* has been reported from the Pleistocene of Louisiana (in well samples), Florida, and Cuba.

Remarks.—Conrad described this species as follows:

> Shell incurved, white, with a very rugose epidermis; anterior side much depressed; hinge margin excavated, with the teeth obsolete; on the posterior side, under the beaks, is a pointed laminar tooth directed inward.
>
> Cab. Academy, No. 1453.
>
> Inhabits the southern coast of the U. S.
>
> Found attached by its byssus, to the *Ostrea virginica*. Mr. William Riley presented me with several specimens, and informs me that he observed great numbers of them between the shells of two attached oysters.

I was unable to locate the type at the Academy of Natural Sciences of Philadelphia, but in the Recent collection at the Academy there are forms labelled *M. leucophaeatus* from Jacmal and Aux Cayes, Haiti, with which the Venezuelan shell is identical. However, both the Haitian and Venezuelan shells are more pointed anteriorly than Conrad's illustration of the original species.

Following are other Neogene to Recent American species of *Mytilopsis*:

Mytilopsis adamsi Morrison, 1946, Smithsonian Misc. Collections, vo.l 106, No. 6, pp. 46-47, pl. 1, figs. 4, 7. Recent, San José Island, 60 miles south of Panamá, Panamá. The dorsal margin is evenly rounded whereas that of the Venezuelan *M. leucophaeatus* is subangulate. Also the beak of the Venezuelan shell is a little more hooked.

Mytilopsis cira Pilsbry and Olsson, 1935, Acad. Nat. Sci. Philadelphia, Proc., vol. 87, p. 19, pl. 5, fig. 2. La Cira formation (upper Oligocene-Lower Miocene), Colombia. This has a sharp umbonal ridge.

Mytilus cochleatus Kickx, 1835, Acad. Roy. Sci. Bruxelles, Bull., vol. 2, p. 235. Recent; reported from the Atlantic side of the Panamá Canal Zone. This may be *Mytilopsis leucophaeatus* or a variant, as the true *M. cochleatus* is European.

Dreissena cuminginiana (Dunker ms.) (see Fischer, 1858, Jour. Conchyl., sér. 2, vol. 7, p. 131). Recent, Mississippi River. This may be the same as *Mytilopsis tenebrosus* (Reeve) (1858, Conch. Icon., vol. 10, *Mytilus*, pl. 10, sp. 46).

Dreissensia dalli Joukowsky, 1906, Soc. Phys. et Hist. Nat. Genève, Mém., vol. 35, pt. 2, p. 171, pl. 6, figs. 1-5. South of Macaracas, Panamá. Miocene or Pliocene. This is smaller, relatively broader, and more triangular in outline than the Venezuelan *M. leucophaeatus?*

Dreissena domingensis Récluz, 1852, Jour. Conchyl., sér. 1, vol. 3, p. 255, pl. 10, fig. 8. Recent, Haiti; middle Miocene, Dominian Republic *fide* Maury (1917, p. 359, pl. 39, fig. 5). Maury's fossil is much more alate, and the dorsal margin higher and more arcuate than the Venezuelan Recent shell referred to *M. leucophaeatus*. Maury's *M. domingensis* is probably not the same as Récluz' *M. domingensis* as the latter is characterized by a strong embayment under the beak and a shallowly concave ventral margin.

Praxis ecuadoriana Clessin, 1879, Malakozool. Blätter, n. F., vol. 1, pp. 180-181, pl. 15, figs. 8a, b. Recent, Cayapas River, Esmeraldas Province, Ecuador.

Dreissena gundlachi Dunker, 1858, Novitates Conchologicae, Abtheilung 2, Mollusca Marina. Recent, Cuba. This is a relatively small, triangular species with a rounded keel running the length of the shell above the ventral margin.

Mytilopsis jamaicensis Woodring, 1925, Carnegie Inst. Washington, Publ. No. 366, pp. 86-87, pl. 10, figs. 13-14. Middle Miocene, Jamaica. Closely resembles *M. leucophaeatus* Conrad and *M. cochleatus* (Kickx).

Congeria lamellata Dall, 1898, Wagner Free Inst. Sci., Trans.,

vol. 3, pt. 4, pp. 809-810, pl. 35, figs. 13-15. Pliocene, Florida. This has a wider and deeper ligamental groove than *M. leucophaeatus.*

Praxis milleri Clessin, 1879, Malakozool. Blätter, n. F., vol. 1, p. 179, pl. 15, figs. 7a, b. Recent, Rio Verde, Esmeraldas Province, Ecuador. The dorsal margin is more evenly rounded than on *M. leucophaeatus.*

Dreissena mörchiana (Dunker), [in] Fischer, 1858, Jour. Conchyl., sér. 2, vol. 7, pp. 132-133. Reeve's illustration (1858, Conch. Icon., vol. 10, Pl. 10, sp. 51) indicates that this species is closely related to *M. leucophaeatus.*

Dreissena pfeifferi (Dunker), [in] Fischer, 1958, Jour. Conchyl., sér. 2, vol. 7, p. 132. Recent, Cuba.

Dreissena rossmässleri (Dunker) (see Fischer, 1858, Jour. Conchyl., sér. 2, vol. 7, p. 132). Recent, Florida to Brazil. "It is distinguishable from the common *leucophaeata* by its more triangular anteriorly flattened, heavier shell" (Dall, 1898, p. 809).

Dreissena sallei Récluz, 1849. Rev. et Mag. Zool., sér. 2, vol. 1, p. 69; 1852, Jour. Conchyl., sér. 1, vol. 3, p. 255, pl. 10, fig. 9. Recent, Rio Dulce, Guatemala: The dorsal margin is well and evenly rounded, and the beak is more hooked than that of *M. leucophaeatus.* See Tryon, 1884, Structural and Systematic Conchology, p. 266, pl. 129, fig. 22.

Mytilus sallei Reeve, 1858, Conch. Icon., vol. 10, pl. sp. 44. Not of Récluz. Recent, West Indies. According to Dall (1898, p. 809) Reeve's *M. sallei* is Dunker's *M. rossmässleri.*

Dressseina (Mytiloides) scripta Conrad, 1874, Acad. Nat. Sci. Philadelphia, Proc., vol. 26, pp. 29, 83, pl. 1, figs. 12, 16. Pliocene, Pebas clay, Brazil. The dorsal margin of the adult forms an angle of about 110 degrees.

Mytilopsis singewaldi Pilsbry, 1944, Acad. Nat. Sci. Philadelphia, Proc., vol. 96, p. 147, pl. 11, figs. 35-36. Upper Oligocene-lower Miocene, Pachitea River, Peru.

Septifer trautwineana Tryon, 1866, Amer. Jour. Conch., vol. 2, pt. 4, No. 5, p. 302, pl. 20, fig. 8. Recent, San Juan River, Colombia. This is more angulate than *M. leucophaeatus* on the dorsal margin, and it has a furrow separating the dorsum proper from the wing.

Mytilopsis zeteki Hertlein and Hanna, 1949, Southern Cali-

fornia Acad. Sci., Bull., vol. 48, pt. 1, pp. 15-16, figs. 1-4. Recent, Miraflores Locks, Panamá Canal Zone. The myophore under the septum is larger than on *M. leucophaeatus,* and the dorsal margin is more evenly rounded. Olsson and McGinty (1958, p. 20) reported *M. zeteki* from Colon on the Atlantic side of Panamá

DIPLODONTIDAE

Diplodonta (Diplodonta) mareana, new species Pl. 27, figs. 13, 14

Shell small, thin, translucent, suborbicular, a little wider than high, subequilateral, the disk slightly inflated, the submargins rather strongly sloping, the anterior submargin broader than the posterior. Anterodorsal margin hardly convex, anterior end well rounded and somewhat produced at the curve with the ventral margin, the ventral margin hardly rounded in front of the middle but well rounded at the posterior, the posterodorsal margin truncate, fairly long, and gently inclined from the horizontal. Umbo triangular, the beak subcentral. The upper half of the single specimen is vitreous, the lower half scored by fine sharp concentric grooves. Reflected through the shell, but visible through a lens and in certain light, are ephemeral radii. The surface is also covered by numerous microscopic punctations which are eroded off much of the umbonal area but still present on the lower part of the disk, the punctations showing through to the interior. Anterior cardinal of left valve cuneate, sharply bifid, protrusive, the posterior cardinal small and platy, the socket between the cardinals triangular and deep. The laterals of the left valve are feeble and close to the cardinals. The left posterior adductor scar cannot be seen; the left anterior adductor scar is also difficult to see, but if I make it out correctly it appears to be large and ovate. The pallial line is obscure but is probably entire throughout, joining the anterior scar at the base. The inner margin of the valve is smooth.

Dimensions.—Holotype (J428a), left valve, height 3.7 mm.; width 3.8 mm.; approx. thickness 0.9 mm.

Type locality.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo; One left valve, the holotype.

Comparisons.—The distinctive characters of *D. mareana,* n. sp.

are the relatively compressed disk and what seems to be an unusually large anterior muscle scar. Analogous species, most of them more obese than the immature Cabo Blanco shell, are the following:

D. punctata (Say) (1822, Acad. Nat. Sci. Philadelphia, Jour., new ser., vol. 2, p. 308). See Dall (1900, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1187) for synonymy. Pliocene? to Recent. The living shell is reported from North Carolina, U.S.A., to Brazil. Dall placed *D. venezuelensis* Dunker in synonymy with *D. punctata,* but other authors, among them C. W. Johnson (1934, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 41), considered them as separate species. *D. venezuelensis* is more globose than *D. punctata,* and both of these are more inflated than *D. mareana,* n. sp.

D. punctulata (H. C. Lea) (1843, Amer. Philos. Soc. Trans., new ser., vol. 9, p. 240, pl. 34, fig. 18). Upper Miocene at Petersburg, Virginia, U.S.A. This, like *D. mareana,* n. sp., is a diaphanous shell with a minutely punctulate surface; however, it is more convex than *D. mareana,* and there is no mention, in the original description, of the presence of the ephemeral radii that can be perceived on the Cabo Blanco shell.

D. gabbi Dall (see Woodring, 1925, Carnegie Inst. Washington, Publ. No. 366, p. 131, pl. 18, figs. 1-3). Lower-middle Miocene of the Dominican Republic, middle Miocene of Jamaica, Recent in the West Indies. The posterodorsal margin slopes down from the beak at a greater angle from the horizontal than on *D. mareana.*

D. semiaspera Philippi (see McLean, 1951, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 67, pl. 13, fig. 9). Recent, North Carolina, U.S.A., to Brazil. This is more tumid and more distinctly pustulose than *D. mareana.*

D. subquadrata Carpenter (see Hertlein and Strong, 1947, Zoologica, vol. 31, pt. 4, No. 10, pp. 130-131, pl. 1, fig. 11). Upper Pliocene to Recent, west America. The living shell ranges from Baja California to the Galapagos Islands, and is found in the intertidal zone to depths of 75 fathoms. Typically, *D. subquadrata* is more angular in outline than *D. mareana,* n. sp. *D. subquadrata* Carpenter was reported from the Miocene of the Dominican Republic by Gabb (1873, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 252) but that shell is now known as *D. gabbi* Dall.

Diplodonta (Phlyctiderma) semiaspera Philippi Pl. 23, fig. 13

1836. *Diplodonta semiaspera* Philippi, Arch. f. Naturg., vol. 2, pt. 1, p. 225, pl. 7, figs. 2a-2d.
1845. *Lucina granulosa* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, pp. 9-10.
1846. *Lucina semireticulata* d'Orbigny, Voyage dans L'Amérique Méridionale, vol. 5, pt. 3, Mollusques, p. 584, pl. 84, figs. 7-9.
1852. *Lucina granulosa* C. B. Adams, Contrib. to Conch., No. 12, p. 245.
1864. *Diplodonto* [*sic*] *semiaspera* ? Philippi, Krebs, The West Indian Marine Shells, p. 122.
1872. ? *Mysia semireticulata* (d'Orbigny), Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 95.
1878. *Diplodonta semiaspera* Philippi, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Diplodonta semiaspera* Philippi, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 257.
1889. *Diplodonta semiaspera* Philippi, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 66.
1889. *Diplodonta semiaspera* Philippi, Dall, U. S. Nat. Mus., Bull. 37, p. 52.
1900. *Diplodonta* (*Phlyctiderma*) *semiaspera* Philippi, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1188.
1901. *Diplodonta* (*Phlyctiderma*) *semiaspera* Philippi, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1237, p. 794.
1920. *Diplodonta semiaspera* Philippi, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 92.
1934. *Taras* (*Phlyctiderma*) *semiaspera* (Philippi), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 40.
1935. *Diplodonta semiaspera* Philippi, Richards, Jour. Paleont., vol. 9, No. 2, p. 256.
1936. *Taras* (*Phlyctiderma*) *semiaspera* (Philippi), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 3, p. 164.
1936. *Taras semiaspera* (Philippi), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1942. *Diplodonta semiaspera* Philippi, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 16, No. 1, p. 39.
1949. *Taras* (*Phlyctiderma*) *semiaspera* (Philippi), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 31.
1950. *Lucina granulosa* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, p. 289, pl. 46, figs. 3-4.
1951. *Taras* (*Phlyctiderma*) *semiaspera* (Philippi), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 67, pl. 13, fig. 6.
1954. *Diplodonta (Phlyctiderma) semiaspera* Philippi, Abbott, American Seashells, p. 383.
1955. *Taras* (*Phlyctiderma*) *semiaspera* (Philippi), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 63, pl. 40, fig. 290.
1956. *Diplodonta semiaspera* Philippi, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 308, 315, 370, pl. 3, figs. 3a, 3b.
1958. *Diplodonta semiaspera* Philippi, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1958. *Diplodonta (Phlyctiderma) semiaspera* Philippi, Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, pp. 118-119, pl. 4g, 4h.
1959. *Diplodonta semiaspera* Philippi, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 10.
1959. *Diplodonta semiaspera* Philippi, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, p. 2161.

1961. *Diplodonta* cf. *semiaspera* Philippi, van Regteren Altena, Koninkl. Nederl. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 299.
1961. *Diplodonta* (*Phlyctiderma*) *semiaspera* Philippi, Warmke and Abbott, Caribbean Seashells, p. 175, pl. 35L.

The Recent Venezuelan shell is suborbicular, thin, and well inflated. The sculpture consists of fine, irregular, concentric lineations and numerous concentric rows of small punctations. The adductor scars are large and relatively long, the anterior one lenticular, the posterior more or less elliptical. The shell is whitish, with the interior a pale lemon yellow below. The surface is encrusted here and there by calcareous algae and bryozoa.

Dimensions.—Specimen A66a, left valve, height 10 mm.; width 11 mm., thickness 5 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One left valve.

Range and distribution.—The living shell is found at moderate depths from North Carolina, U.S.A., to Brazil. As a fossil, *D. semiaspera* Philippi has been reported from the Pleistocene of Cuba and St. Kitts, and from the Pliocene of Florida.

LUCINIDAE

Lucina (Cavilinga) trisulcata blanda (Dall and Simpson)

Pl. 28, figs. 1-4

1901. *Phacoides* (*Cavilucina*) *trisulcatus* Conrad var. *blandus* Dall, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 493-494, pl. 58, fig. 13.
1920. *Phacoides* (*Cavilucina*) *trisulcatus blandus* Dall, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 86.
1937. *Linga* (*Cavilinga*) *blanda* Dall, Chavan, Jour. Conchyl., vol. 81, p. 201.
1951. *Phacoides* (*Linga*) *trisulcatus blandus* Dall and Simpson, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 64, pl. 12, fig. 9.
1959. *Phacoides trisulcatus blandus* Dall and Simpson, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 11.
1961. *Lucina* (*Cavilinga*) *blanda* Dall and Simpson, Warmke and Abbott, Caribbean Seashells, p. 176, pl. 36d.

Shell small, obliquely suborbicular, inflated, with a rather pronounced but shallow radial depression posteriorly, and with a narrow shallow anterior groove extending from well below the beak to the union of the anterodorsal and ventral margins. Anterior end

somewhat produced and rounded, the posterior end subtruncate, the ventral margin rounded. Umbo full and rather large, the beak high, a little behind the median line, pointed forward. Lunule deeply concave, broadly cordate, sharply defined, the inner edge of the lunule also deeply concave. Ligamental groove narrowly elliptical. Surface below prodissoconch sculptured by regular flattened concentric ribs separated by linear interspaces, the prodissoconch itself marked by evenly spaced fine concentric riblets. The disk proper is characterized by one or more resting stages, and here and there on the ribs and in the interspaces there seem to be extremely vague radial striae under the lens and in certain light. On the prodissoconch there are roughly 30 concentric riblets, and below the prodissoconch about 38 concentric ribs. All of the concentric markings are much more feebly displayed in the posterior depression. Hinge of left valve with two rather closely spaced and slightly divergent cardinal teeth, and both the anterior and posterior lateral teeth are bifid, the anterior lateral with a faint sulcus on the upper ridge. Anterior muscle scar elongate, slightly arcuate and lozenge-shaped, the posterior scar somewhat more distinct and rudely ovate. Pallial line simple but raggedy, uniting with the anterior adductor scar at about the middle of the outer border, and joining the posterior one at the base. The inner margin is finely and regularly denticulate from in front of the lunule to the rear of the ligamental area.

Dimensions.—Specimen I528a, left valve, height 7.2 mm.; width 7.4 mm., thickness 2.3 mm. Specimen J427a, left valve, height 9.3 mm., width 9.2 mm.; thickness 2.6 mm.

Localities.—Lower Mare formation near W-13, on hillside above west bank of Quebrada Mare Abajo. One left valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One left valve.

Remarks.—The Venezuelan fossil here referred to *L. trisulcata blanda* is slightly broader than the typical Recent shell from Puerto Rico but is indistinguishable from suborbicular variants of that species. Other forms to which the Venezuelan fossil exhibits affinity are the following:

L. trisulcata trisulcata (Conrad) (see Gardner, 1926, U. S. Geol. Sur., Prof. Paper 142-C, pp. 108-109, pl. 18, figs. 11-13 and

Olsson and Harbison, 1953, Acad. Nat. Sci. Philadelphia, Mon. No. 8, pp. 85-86, pl. 7, figs. 4, 4a, 4b). Miocene to Recent. The inner edge of the lunule is not so depressed as on the Venezuelan shell.

L. trisulcata multistriata Conrad (see Mansfield, 1932, Florida State Geol. Sur., Bull. No. 8, pp. 96-97, pl. 20, figs. 15-16 and Gardner, 1943, U. S. Geol. Sur., Prof. Paper 199-A, pp. 76-77, pl. 13, Figs. 25-26). Upper Miocene of Virginia, the Carolinas, and Florida. The lunule is more deeply sunken, the posterior depression more pronounced, and the anterior lateral of the left valve stouter than on the Venezuelan fossil.

L. parawhitfieldi (Gardner) (1926, U. S. Geol. Sur., Prof. Paper 142-C, pp. 109-110, pl. 18, figs. 14-15) is less inflated than *L. t. blanda,* but otherwise there is a marked similarity between the two. *L. parawhitfieldi* occurs in the middle Miocene of Florida.

L. crenulata Conrad (1845, Fossils of the Medial Tertiary of the United States, p. 39, pl. 20, fig. 2). Middle to late Miocene from New Jersey to Florida, U.S.A. The concentric ribs are finer than on *L. t. blanda,* and there are distinct closely spaced radial threads.

L. occurrens (Dall) (see Woodring, 1925, Carnegie Inst. Washington, Publ. No. 366, pp. 122-123, pl. 16, figs. 7-8). Middle Miocene, Bowden, Jamaica. The Venezuelan shell is less inequilateral, and the concentric ribs are stronger.

L. prolongata Carpenter (see Olsson, 1961, Panamic-Pacific Pelecypoda, p. 210, pl. 31, figs. 8, 8a, 10-10b). Recent, Mazatlan, Mexico to Ecuador. This is more strongly inequilateral than *L. t. blanda.*

Range and distribution.—The Recent *Lucina (Cavilinga) trisulcata blanda* (Dall and Simpson) has been reported only from Puerto Rico. The present notice constitutes a new record of its occurrence as a fossil in northern South America.

Lucina (Callucina ?) species Pl. 28, figs. 5, 6

The single broken specimen is small and slightly inflated, with a fairly low, smooth umbo and a moderately shallow cordate lunule. The sculpture consists, below the umbo, of fine closely spaced concentric laminae, but there are no radial markings. The right anterior

cardinal is small and rudimentary, the right posterior stout, the socket between them triangular and deep. Right anterior lateral heavy, corrugated by a sulcus on the face, the posterior lateral as well as the margins and base of the valve broken away. Ligamental groove opisthodetic, fairly deep, sublinear.

Dimensions.—Specimen R525a, fragment of right valve, height 1.7 mm.; width 1.5 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, approximately 125 meters upstream from junction with Quebrada Las Pailas: One broken right valve.

Remarks.—Except for its smaller size, this is reminiscent of the Recent *L. bermudensis* (Dall) (1901, U. S. Nat. Mus., Proc., vol. 23, No. 1237, p. 825, pl. 39, fig. 5), but there is too little to go on for a definitive comparison.

Lucina (Bellucina) katherinepalmerae, new species Pl. 28, figs. 7, 8

Shell small, obliquely suboval, a little inflated, but with a flattish posterior submargin. Anterodorsal margin somewhat concave, anterior end gently rounded, ventral margin produced and well rounded, posterior margin truncate, posterodorsal margin hardly convex. Umbo moderately full, the beak subcentral, low, directed forward. Lunule cordate, moderately concave. Primary radial costae about 13, the three or so on the anterior submargin indistinct, the ones on the disk proper low and broad, most of them doubled near the base by a faint groove. The posterior submargin is fairly wide and devoid of radial markings, but there is a bipartite costa bordering on the posterior margin. In the shallow intercostal areas of the disk there are one or two minor radial riblets. Rather prominent concentric lirae cross the entire surface, those on the umbo lamellar and imparting a cancellate effect, the others coarse and cordlike. On the posteriormost costa and on the one bordering the posterior submargin, the lirae rise into scalelike or subspinose prominences. Right valve with two unequal cardinal teeth, the central one much the stouter and with a triangular socket on either side, the anterior socket the deeper. Lateral teeth well developed, the anterior one

higher and longer than the posterior. Inner margin obscurely undulatory, marked with fine, closely spaced crenulations. Anterior muscle scar of right valve elongate and lozenge-shaped, the posterior scar seemingly reniform, lying immediately below the posterior lateral. Pallial line simple, entire, joining the outer edge of the anterior adductor scar at the base, and joining the posterior scar a little in from the center of the base.

Dimensions.—Holotype (H526a), right valve, height 5 mm.; width 4.4 mm.; thickness 1.9 mm.

Type locality.—Mare formation at W-25, south flank of Punta Gorda anticline. One right valve, the holotype.

Remarks.—This rare shell is named in honor of Dr. Katherine Van Winkle Palmer, Director of the Paleontological Research Institution.

Comparisons.—The nearest living relative is *L. nux* Verrill and Bush (1900, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 12, pp. 518-519, pl. 58, figs. 12-13) from the Bermudas. That species, however, is more regularly oval than *L. katherinepalmerae,* differs in details of sculpture, and is not flattened posteriorly. The Pleistocene and Recent *L. amiantus* Dall (1901, U. S. Nat. Mus., Proc., vol. 23, No. 1237, pp. 826-827, pl. 39, fig. 10) from east America, and the Pleistocene and Recent *L. cancellaris* Philippi (see Durham, 1950, Geol. Soc. Amer., Mem. 43, p. 75, pl. 18, figs. 8, 13) from west America are both wider than high, whereas *L. katherinepalmerae* is higher than wide. The Pliocene *L. waccamawensis* Dall (1903, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1386, pl. 52, fig. 2) from North and South Carolina, U.S.A., and the upper Miocene *L. tuomeyi* Dall (1903, pp. 1385-1386, pl. 52, fig. 1) from the Carolinas and Florida are more broadly costate than *L. katherinepalmeri,* and *L. waccamawensis* has nine or ten radial ribs, *L. tuomeyi* seven to nine. *L. nereidideditus* Maury (1910, Bull. Amer. Paleont., vol. 4, No. 21, p. 154, pl. 9, fig. 5) from the Miocene at Oak Grove, Florida, is sculptured much like *L. katherinepalmerae* but is a more orbicular shell, with a more concave anterodorsal margin and a more prominant posterior alation.

Lucina (Parvilucina) ephraimi, new species Pl. 28, figs. 9-12; Pl. 29, figs. 1-6

Shell small, fairly plump, slightly oblique, subangularly orbicular, moderately depressed posteriorly, feebly depressed anteriorly. Anterodorsal margin concave, anterior end more or less rounded, ventral margin a little produced and subangularly rounded in front of the middle, posterior end truncate, posterodorsal margin hardly convex. Beak smooth, low, subcentral, directed forward, touching the top of the cardinal process. Lunule elongate-cordate, moderately concave. Surface sculptured by 23 to 28 usually entire radial ribs crossed by fine slightly elevated concentric laminae. The relatively strong ribs are low and regular, are separated by narrower interspaces, do not extend to the beak, and are absent on the submargins. The concentric laminae are widely spaced above but become progressively closer, though not crowded, toward the base; the laminae traverse both the ribs and interspaces, impart a cancellate pattern on the upper half of the disk, and are generally higher and lamellose on the submargins. Hinge sturdy, the anterior cardinal tooth a little larger than the posterior cardinal on the left valve, the posterior cardinal much stouter than the anterior on the right valve, the laterals well developed on both valves. Inner margin evenly crenulate. Anterior muscle scar relatively long and arcuate, the posterior scar more or less oval. Pallial line simple, entire, subangulate in contour, joining the outer margin of the anterior muscle scar a short distance above the base, and joining the inner margin of the posterior muscle scar at the base.

Dimensions.—Holotype (R521a), right valve, height 4.9 mm.; width 4.9 mm.; thickness 1.8 mm. Paratype (R521c), left valve, height 4.9 mm.; width 4.9 mm.; thickness 1.6 mm. Paratype (R521b), right valve, height 4 mm.; width 4 mm.; thickness 1.7 mm. Paratype G521b, young right valve, height 2 mm.; width 2.1 mm. Paratype G521c, young left valve, height 2.9 mm.; width 2.9 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, approximately 125 meters upstream from junction with Quebrada Las Pailas. Sixteen specimens including nine right valves and seven left valves.

Other localities.—Playa Grande formation (Maiquetía member) at W-23, south flank of Punta Gorda anticline; three left valves. Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas; Two left valves and one right valve. Mare formation at W-14 on hillside above west bank of Quebrada Mare Abajo. Twenty-six specimens including 13 right valves, 12 left valves, and one doublet.

Remarks.—This new species is named in honor of Dr. E[phraim] Laurence Palmer, well-known naturalist, and professor for many years at Cornell University.

Comparisons.—Similar species are the following:

L. multilineata Tuomey and Holmes (see Mansfield, 1932, Florida Geol. Sur., Bull. No. 8, pp. 101-102, pl. 20, figs. 6-7). Middle-upper Miocene to Recent; living from North Carolina to the West Indies, near shore to 120 fathoms. The radiating ribs are finer and the concentric threads closer than on *L. ephraimi.*

L. pectinella C. B. Adams (see Clench and Turner, 1950, Occas. Papers on Mollusks, vol. 1, No. 15, p. 324, pl. 46, figs. 9-10; also Dall and Simpson, 1901, U. S. Fish Com. Bull., vol. 20 for 1900, pt. 1, p. 492, pl. 58, fig. 9). Recent, West Indies. The hinge line after the beak diverges at a lesser angle from the horizontal than on *L. ephraimi,* and the Recent shell is slightly taller than the Venezuelan fossil.

L. fontis (Maury) (1920, Bull. Amer. Paleont., vol. 8, No. 34 pp. 89-90 pl. 1). Upper Miocene ?, Knapp's No. 1 well, Terrebone Parish, Louisiana at 2000-2150 and 2250-2450 feet. The Venezuelan shell is close to *L. fontis* but is not so sturdy nor as coarsely sculptured, and the anterodorsal margin is less concave than on the Louisiana species. Also, *L. ephraimi* has two unequal cardinal teeth on the right valve (with the anterior tooth much the smaller), whereas *L. fontis* is described as having but a single cardinal, and is so illustrated; it may be, however, that the anterior cardinal of *L. fontis* is vestigial, and merges with the inner edge of the lunule.

L. yaquensis Gabb (see Maury, 1917, Bull. Amer. Paleont., vol. 5, No. 29, p. 370, pl. 35, fig. 8). Middle Miocene of the Dominican Republic. The sculpture of the Dominican fossil consists of delicate,

raised concentric laminae and almost obsolete radial riblets. The radials of *L. ephraimi* are pronounced.

L. sphaeriolus (Dall) (1903, Wagner Free Inst., Sci., Trans., vol. 3, pt. 6, p. 1382, pl. 52, fig. 15). Chipola formation (middle Miocene) of Florida. This is wider than *L. ephraimi,* and the radial sculpture is less regular.

L. approximata (Dall) (1901, U.S. Nat. Mus., Proc., vol. 23, No. 1237, pp. 828-829, pl. 39, fig. 4). Upper Pliocene to Recent, southern California to Panamá. The description and illustration of the type indicate that the beak is fuller and higher, and the ribs broader than on *L. ephraimi.*

L. diktyota (Gardner) (1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, pp. 26-27, pl. 5, figs. 2-3). Middle Miocene, Walton County, Florida. The concentric lirae are a little stronger, the anterodorsal margin is a little less concave, and the dentition is stronger than on *L. ephraimi.*

Lucina (Parvilucina) multilineata Tuomey and Holmes Pl. 29, figs. 7, 8

1857. *Lucina multilineata* "Conrad", Tuomey and Holmes, Pleiocene Fossils of South Carolina, p. 61, pl. 18, figs. 16-17.
1858. *Lucina multilineata* Tuomey and Holmes, Emmons, Report on the North Carolina Geological Survey, p. 291.
1860. *Lucina multilineata* Tuomey and Holmes, Holmes, Post-Pleiocene Fossils of South Carolina, p. 30, pl. 6, fig. 6.
1901. *Phacoides* (*Parvilucina*) *crenella* Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1237, pp. 825-826, pl. 39, fig. 2.
1903. *Phacoides* (*Parvilucina*) *multilineatus* Tuomey and Holmes, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1384.
1903. *Phacoides crenella* Dall, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 756.
1911. *Phacoides multilineatus* (Tuomey and Holmes), Vaughan, Georgia Geol. Sur., Bull. 26, p. 368.
1916. *Phacoides* (*Parvilucina*) *crenella* Dall, [in] Matson, U. S. Geol. Sur., Prof. Paper 98-L, p. 71.
1918. *Phacoides multilineatus* (Tuomey and Holmes), Mansfield, Florida State Geol. Sur., Eleventh An. Rept., pp. 115, 119.
1919. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, p. 19.
1920. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 88-89.
1921. *Lucina multilineata* Tuomey and Holmes, Lamy, Jour. Conchyl., vol. 65, p. 210.
1924. *Phacoides multilineatus* (Tuomey and Holmes), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., pp. 32, 33, 36, 38, 40.
1928. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Mansfield, U. S. Geol. Sur., Prof. Paper 150-F, p. 139.

1932. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Mansfield, Florida State Geol. Sur., Bull. No. 8, pp 101-102, pl. 20, figs. 6-7.
1934. *Lucina crenella* (Dall), and *L. multilineata* Tuomey and Holmes, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 42.
1936. *Phacoides crenella* Dall, McLean, Nautilus, vol. 49, No. 4, p. 118.
1936. *Lucina* (*Parvilucina*) *multilineata* Tuomey and Holmes, Lermond, Check List of Florida Marine Shells, Gulfport, p. 12.
1937. *Parvilucina multilineata* (Tuomey and Holmes), Chavan, Jour. Conchyl., vol. 81, p. 210.
1937. *Lucina* (*Parvilucina*) *crenella* (Dall), Smith, East Coast Marine Shells, pp. 46-47, pl. 23, fig. 14.
1938. *Phacoides multilineatus* (Tuomey and Holmes), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1940. *Phacoides multilineatus* (Tuomey and Holmes), Stubbs, Jour. Paleont., vol. 14, No. 5, p. 511.
1943. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Gardner, U. S. Geol. Sur., Prof. Paper 199-A, pp. 78-79, pl. 13, figs. 34-37.
1944. *Lucina crenella* (Dall), Hackney, Nautilus, vol. 58, No. 2, p. 58.
1945. *Phacoides crenella* Dall, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1947. *Phacoides multilineatus* (Tuomey and Holmes), Richards, Jour. Paleont., vol. 21, No. 1, p. 25.
1949. *Linga* (*Parvilucina*) *crenella* (Dall), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 32.
1952. *Lucina crenella* (Dall), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181.
1953. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, pp. 86-87.
1954. *Lucina* (*Parvilucina*) *multilineata* Tuomey and Holmes, Abbott, American Seashells, pp. 386-387, fig. 78f.
1956. *Lucina crenella* Dall, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 308, 315, 326, 353, 370, pl. 3, figs. 4a, 4b.
1958. *Phacoides* (*Parvilucina*) *multilineatus* (Tuomey and Holmes), DuBar, Florida Geol. Sur., Geol. Bull., No. 40, pp. 168, 211, 220, 222, 224, 225, 226, 227, pl. 6, fig. 2.
1959. *Lucina crenella* (Dall), Parker, Amer. Assoc. Petroleum Geol., Bull., vol. 43, No. 9, p. 2162.
1961. *Lucina multilineata* Tuomey and Holmes, Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 41.

Shell small, thin, moderately inflated and somewhat humped, suborbicular, slightly depressed posteriorly, the depression defined from the disk by a feeble radial ridge. Anterodorsal margin concave, anterior end somewhat extended and rounded, ventral margin shallowly rounded, posterior end truncate, posterodorsal margin straight, inclined from the horizontal about 40 degrees. Umbo full, moderately high, the beak slightly aft of center. Lunule cordate, moderately concave, smooth. Ligament opisthodetic, linear. Concentric sculpture consisting of thin, regular, closely spaced concentric lirae separated by scarcely wider interspaces, the lirae becoming laminar on the anterior submargin and frankly lamellose on the posterior depression. The concentric lirae override and minutely

cancellate the faint regular sublinear radii of the disk, the radials obsolete on the umbo and anterior submargin, and absent on the posterior depression. Anterior cardinal tooth of right valve thin and small, the posterior tooth also relatively small but robust and cuneiform. Anterior lateral tooth of right valve relatively short but stout, and crudely corrugated on the face, the right posterior lateral tooth a little longer and thinner as well as smooth. Inner margin gently crenulate, the crenulations distinct from the anterior lateral tooth to the posterior corner of the ventral margin, but much smaller and submicroscopic on the posterior margin proper. Muscle scars indistinct, the anterior one somewhat arcuate and narrowly lozenge-shaped but not overly long, the posterior scar seemingly rudely oval. Pallial line not visible on the single specimen.

Dimensions.—Specimen R524a, right valve, height 3.1 mm.; width 3.3 mm.; approx. thickness 1.2 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas approximately 125 meters upstream from junction with Quebrada Las Pailas. One small right valve.

Remarks.—*L. multilineata* varies somewhat in plumpness and strength of sculpture, and the single specimen cannot be distinguished from the not so plump and somewhat more weakly sculptured variants.

Range and Distribution.—Upper Miocene to Recent. Living near shore to 124 fathoms in the Gulf of México from Texas to Florida, and in the Western Atlantic from North Carolina to Brazil. As a fossil it is recorded from the Pleistocene in Louisiana, Alabama, South Carolina, Florida, and the Island of Blanquilla, Venezuela; from the Pliocene of North Carolina, South Carolina, and Florida; and from the upper Miocene from Virginia to Florida.

Lucina (Lucinisca) muricata (Spengler) Pl. 29, figs. 9-14

1798. *Tellina muricata* Spengler, Skrivt. Naturf. Selsk., vol. 4, pt. 2, p. 120, No. 62.

1795. *Tellina imbricata* Chemnitz, Syst. Conchylien-Cabinet, vol. 11, p. 207.

1795. *Tellina muricata* Spengler, Chemnitz, Syst. Conchylien-Cabinet, vol. 11, p. 209, pl. 199, figs. 1945-1946.

1815. *Tellina muricata* Spengler, Wood, General Conchology, or a description of shells, p. 185.
1817. *Tellina muricata* Spengler, Dillwyn, A Descriptive Catalogue of Recent Shells, p. 98.
1819. *Lucina scabra* Lamarck, An. sans Vert., vol. 6, p. 542.
1827. *Lucina scabra* Lamarck, Encycl. Méth., vol. 2, p. 385, pl. 285, figs. 5a-5c.
1835. *Lucina scabra* Lamarck, Deshayes, An. sans Vert., vol. 6, p. 227, No. 9.
1845. *Lucina muricata* (Spengler), d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, vol. 5, Moluscos, p. 331.
1850. *Lucina scabra* Lamarck, Reeve, Conch. Icon., vol. 6, *Lucina,* pl. 8, sp. 45.
1852. *Lucina scobinata* Récluz, Jour. Conchyl., vol. 3, p. 252, pl. 10, figs. 6, 6'.
1853. *Lucina scabra* Lamarck, Fischer, Jour. Conchyl., vol. 4, p. 414.
1858. *Lucina* (*Myrtea*) *muricata* (Spengler), H. and A. Adams. The Genera of Recent Mollusca, vol. 2, p. 468.
1864. *Lucina scabra* Lamarck, Krebs, The West Indian Marine Shells, p. 121.
1867. *Lucina muricata* (Chemnitz), Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162.
1872. *Lucina scobinata* Récluz, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 87.
1872. *Lucina muricata* (Chemnitz), Pfeiffer, Syst. Conchylien-Cabinet, vol. 11, pt. 1, pp. 276-277, pl. 42, figs. 7-8.
1878. *Lucina muricata* (Spengler), Mörch, Catalogue of West-India Shells, p. 15.
1878. *Lucina muricata* (Chemnitz), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 255.
1884. *Myrtea scabra* (Lamarck), Tryon, Structural and Systematic Conchology, vol. 3. p. 210, pl. 119, figs. 44-45.
1889. *Lucina muricata* (Chemnitz), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 66.
1889. *Lucina* (*Lucinisca*) *scabra* Lamarck, Dall. U. S. Nat. Mus., Bull. 37, p. 52.
1901. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1237, p. 809.
1901. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Dall, and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 494.
1903. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1373.
1921. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 417.
1921. *Lucina muricata* (Spengler), Lamy, Jour. Conchyl., vol. 65, pp. 175, 250.
1925. *?Phacoides* (*Lucinisca*) *roigi* Maury, Bull. Amer. Paleont., vol. 10, No. 42. pp. 319-320, pl. 29, fig. 6.
1925. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 319, 320.
1934. *Lucina* (*Lucinisca*) *muricata* (Spengler), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 41.
1936. *Lucina* (*Lucinisca*) *muricata* (Spengler), Lermond, Check List of Florida Marine Shells, Gulfport, p. 12.
1937. *Lucina (Lucinisca) muricata* (Spengler), Smith, East Coast Marine Shells, p. 46, pl. 15, fig. 3.
1937. *Lucina* (*Lucinisca*) *muricata* (Spengler), Chavan, Jour. Conchyl., vol. 81, p. 240.
1938. *Phacoides muricatum* (Spengler), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1940. *Lucina muricatus* (Spengler), Smith, World-wide Sea Shells, p. 105, fig. 1397.

1946. *Lucina* (*Lucinisca*) *muricata* (Spengler), Hertlein and Strong, Zoologica, vol. 31, pt. 3, No. 8, p. 114.
1951. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 64, pl. 13, fig. 1.
1953. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1958. *Phacoides muricatus* (Spengler), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1959. *Phacoides muricatus* (Spengler), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 11.
1961. *Phacoides* (*Lucinisca*) *muricatus* (Spengler), Warmke and Abbott, Caribbean Seashells, p. 177, pl. 36i.

Shell small, suborbicular, compressed to a little inflated, depressed on the posterior and anterior submargins, the posterior depression more pronounced than the anterior. Ventral margin usually rounded, the anterior end rounded to subtruncate, the anterodorsal margin sinuous, the posterodorsal margin gently and evenly convex, the posterior margin generally truncate, the truncation vertical to slightly oblique toward the ventral margin. Beak small, pointed forward, subcentral, sculptured by a few concentric lamellae which lose their identity on the disk. Lunule sublanceolate, more pronounced on the right valve where it is deeper and a little longer than on the left valve. Except at the beak, the surface is sculptured by fairly close radiating ridges which are often alternately larger and smaller on the disk proper, the ridges beset with fluted to spiny scales. Mature individuals bear as many as 48 ridges, and typically, the row bordering the dorsal margins has the broadest scales. On the anterior submargin the two or three radial ribs are flat and nonscaly, are separated by narrow shallow incisions, and are crossed by numerous coarse concentric striae; on the posterior submargins there are six to eight small unequal scaly ridgelets, and on the narrow ridge between the disk and the posterior submargins the spines are a little longer and sharper than elsewhere; on the disk proper the interspaces of the larger and smaller ridges are moderately deep. Hinge with a bifid anterior lateral and a bifid posterior lateral tooth, the laterals of the left valve stronger than on the right. Margins finely denticulate. Anterior muscle scar long, slightly arcuate and lozenge-shaped, the posterior scar more or less reniform. Pallial line simple, entire, uniting with the anterior muscle scar at about the middle of the outer edge, and joining the posterior one at the base of the inner edge.

Dimensions.—Specimen C518a, right valve, height 10 mm.; width 10 mm.; thickness 2.1 mm. Specimen C518b, right valve, height 7 mm.; width 7 mm.; thickness 1.8 mm. Specimen C518c, left valve, height 8.1 mm.; width 7.9 mm.; thickness 2 mm. Specimen C518d, left valve, height 7.4 mm.; width 7.5 mm.; thickness 2 mm. Specimen C523a, juvenile right valve, height 2.2 mm.; width 2 mm.; approx. thickness 0.8 mm. Specimen C529a, right valve, height 10 mm.; width 10 mm.; thickness 3 mm.

Locality.—La Salina, west of Puerto Cabello, State of Carabobo. Forty-seven specimens including 26 left valves and 21 right valves.

Remarks.—The La Salina fossils here referred to *L. muricata* (Spengler) are identical with Recent West Indian forms, notably those from Santiago, Cuba (Collection No. 84523, Academy of Natural Sciences of Philadelphia). *L. roigi* Maury from the Pliocene at Matura, Trinidad, seems to be a less profusely ribbed variant of *L. muricata,* as in other respects (and this is brought out by Maury) they are alike. Furthermore, Guppy reported *L. muricata* from both the Recent and Pliocene of Trinidad.

Range and distribution.—The range of *L. muricata* (Spengler) is from Pliocene to Recent. The living shell is found from Florida to Brazil at shallow depths to 82 fathoms. As a fossil the species occurs in the Pleistocene of Florida and Barbados, and in the Pliocene of Trinidad and of Venezuela (Collection No. 18408, U. S. National Museum).

Codakia (Lentillaria) orbicularis (Linnaeus) Pl. 30, figs. 1-8

1758. *Venus orbicularis* Linnaeus, Syst. Nat., ed. 10, p. 688.
1767. *Venus tigerina* var. Linnaeus, Syst. Nat., ed. 12, p. 1134.
1818. *Cytherea tigerina* (Linnaeus), Lamarck, An. sans Vert., vol. 5, p. 574 (part).
1850. *Lucina tigerina* (Linnaeus), Reeve, Conch. Icon., vol. 6, *Lucina,* pl. 1, sp. 3. Not of Linnaeus 1758.
1864. *Lucina tigerina* (Linnaeus), Krebs, The West Indian Marine Shells, p. 121. Not of Linnaeus 1758.
1872. *Lucina* (*Codakia*) *tigerina* (Linnaeus), Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 87 (part). Not of Linnaeus 1758.
1873. *Lucina tigerina* (Linnaeus), Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 251. Not of Linnaeus 1758.
1876. *Lucina tigrina* (Linnaeus), Guppy, Geol. Soc. London, Quart. Jour., vol. 32, p. 530. Not of Linnaeus 1758.
1878. *Lucina tigerina* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 15. Not of Linnaeus 1758.

1878. *Lucina tigrina* (Linnaeus), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 256. Not of Linnaeus 1758.
1884. *Lucina tigerina* (Linnaeus), Tryon, Structural and Systematic Conchology, vol. 3, p. 210, pl. 119, fig. 42. Not of Linnaeus 1758.
1885. *Lucina* (*Codakia*) *tigerina* (Linnaeus), Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, p. 179 (part). Not of Linnaeus 1758.
1887. *Lucina* (*Codokia*) *tigerina* (Linnaeus), Fischer, Manuel Conchyliologique et de Paléontologie Conchyliologique, p. 1143 (part). Not of Linnaeus 1758.
1889. *Lucina tigerina* (Linnaeus), Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 123, 141, pl. 1, figs. 18-19. Not of Linnaeus 1758.
1889. *Lucina tigrina* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 50. Not of Linnaeus 1758.
1889. *Lucina tigrina* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 66. Not of Linnaeus 1758.
1891. *Lucina tigrina* (Linnaeus), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47. Not of Linnaeus 1758.
1895. *Codakia tigernia* (Linnaeus), Gregory, Geol. Soc. London, Quart Jour., vol. 51, p. 292. Not of Linnaeus 1758.
1901. *Codakia orbicularis* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull. vol. 20 for 1900, pt. 1, p. 491.
1901. *Codakia orbicularis* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 23, no. 1237, p. 799.
1903. *Codakia orbicularis* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1347.
1916. *Codakia orbicularis* (Linnaeus), Thiele, Zool. Jahr., Suppl. 11, p. 129.
1917. *Codakia orbicularis* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 366, pl. 35, fig. 1.
1920. *Codakia orbicularis* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 83.
1921. *Codakia orbicularis* (Linnaeus), Lamy, Jour. Conchyl., vol. 65, p. 234, 2 text figs.
1922. *Codakia orbicularis* (Linnaeus), Remington, Nautilus, vol. 35, No. 4, p. 121.
1926. *Codakia orbicularis* (Linnaeus), Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1933. *Codakia orbicularis* (Linnaeus) var., Trechmann, Geol. Mag., vol. 70, p. 36, pl. 4, fig. 5.
1934. *Codakia orbicularis* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 42.
1935. *Codakia orbicularis* (Linnaeus), Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Codakia orbicularis* (Linnaeus), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Codakia orbicularis* (Linnaeus), McLean, Nautilus, vol. 49, No. 4, p. 118.
1936. *Codakia orbicularis* (Linnaeus), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 165.
1936. *Codakia orbicularis* (Linnaeus), Lermond, Check List of Florida Marine Shells, Gulfport, p. 12.
1937. *Codakia orbicularis* (Linnaeus), Smith, East Coast Marine Shells, p. 47, pl. 19, fig. 5.
1937. *Codakia* (*Lentillaria*) *orbicularis* (Linnaeus), Chavan, Jour. Conchyl., vol. 81, No. 4, p. 280.
1938. *Codakia orbicularis* (Linnaeus), Perry, Schwengel, and Dranga, Nautilus, vol. 52, No. 1, p. 28.

1938. *Codakia orbicularis* (Linnaeus), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 129.
1942. *Codakia orbicularis* (Linnaeus), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1946. *Codakia orbicularis* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 100.
1946. *Codakia orbicularis* (Linnaeus), Hertlein and Strong, Zoologica, vol. 31, pt. 3, No. 8, p. 117.
1949. *Codakia orbicularis* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, pt. 1, p. 33.
1951. *Codakia orbicularis* (Linnaeus), Rogers, The Shell Book, pp. 366, 500, pl. 73, fig. 2.
1952. *Codakia orbicularis* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 181.
1954. *Codakia* (*Codakia*) *orbicularis* (Linnaeus), Abbott, American Seashells, p. 390, pl. 38d.
1957. *Codakia,* Weisbord, Bull. Amer. Paleont., vol. 38, No. 165, p. 16.
1958. *Codakia* (*Ctena*) *orbicularis* (Linnaeus), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, p. 166.
1958. *Codakia* (*Codakia*) *orbicularis* (Linnaeus), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 119.
1958. *Codakia orbicularis* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Codakia orbicularis* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 11.
1961. *Codakia* (*Codakia*) *orbicularis* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Wetensch-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.
1961. *Codakia orbicularis* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 178, pl. 36g.

The Cabo Blanco fossils referred to *C. orbicularis* are compressed, oval when young but suborbicular when fully grown, with a faintly depressed posterior and a hardly rounded to subtruncate posterior margin. The beak is smooth, but the remainder of the disk is decussated by fine subequal to unequal radial cords crossed by concentric threads, the sculpture finer, closer and subscabrous on the posterior depression. Lunule nearly all on the right valve where it is deep and spoon-shaped, the deck of the lunule flattish on young shells but becoming more and more sulcate with age so that the lunule of old specimens is deeply V-shaped.

Dimensions.—Specimen S417c, entire right valve of young specimen, height 30.2 mm.; length 37.2 mm., thickness 5.2 mm. Specimen S417a, broken right valve, adult, length of fragment 53.3 mm. Specimen S417b, broken right valve, length of fragment 39.5 mm. Specimen S417d, broken left valve, length of fragment 31.8 mm. Entire specimen of medium size, left valve, height 42 mm.;

length 47 mm.; thickness 6.5 mm. Specimen D 417a, partially broken left valve, height 9 mm.; length 10 mm.; thickness 2.7 mm.

Localities.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Nine right valves, four left valves, and a number of fragments. All of the examples at this locality were collected from the *Lithothamnium* limestone. Abisinia formation at W-30, eastern edge of Playa Grande village. One young, broken left valve, the identification of which is not certain.

Remarks.—There is considerable variation in the details of the surface decussation, but comparing the hinge and other morphological features with Recent specimens of *C. orbicularis* there seems to be no significant difference.

Range and distribution.—The Recent *C. orbicularis* (Linnaeus) is found in shallow water from Texas to Brazil. In the Pleistocene, the species has been recorded from Texas, Florida, Cuba, St. Kitts, St. Eustatius, Curaçao, Aruba, and Barbados. In the Pliocene it occurs in Florida. And, in the middle Miocene it has been reported by Gabb, Guppy, and Maury from the Dominican Republic.

Codakia (Jagonia) orbiculata (Montagu) Pl. 31, figs. 1-4

1808. *Venus orbiculata* Montagu, Testacea, or Natural History of British Shells, Suppl., p. 42, pl. 29, fig. 7.
1817. *Venus orbiculata* Montagu, Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 192.
1845. *Lucina imbricatula* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 10.
1850. *Lucina occidentalis* Reeve, Conch. Icon., vol. 6, *Lucina,* pl. 7, sp. 35, errata.
1864. *Lucina pecten* Lamarck, Krebs, The West Indian Marine Shells, p. 120.
1872. *Lucina* (*Codakia*) *imbricatula* C. B. Adams, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 86.
1878. *Lucina pecten* Lamarck, Mörch, Catalogue of West-India Shells, p. 15.
1885. *Lucina* (*Codakia*) *pecten* Lamarck, Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, pp. 179-180 (part).
1889. *Lucina pecten* Lamarck, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 123, 141. Not of Lamarck.
1889. *Lucina pecten* Lamarck, Dall, U. S. Nat. Mus., Bull. 37, p. 50.
1891. *Lucina imbricatula* Adams, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1895. *Codakia* (*Myrtea*) *imbricatula* (C. B. Adams), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 292.
1901. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1237, p. 799, 822, 823.
1901. *Codakia orbiculata* (Montagu), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 491.

1903. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1350-1351 (part).
1913. *Codakia orbiculata* (Montagu), Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 496.
1920. *Codakia* (*Jagonia*) *imbricatula* C. B. Adams, Lamy, Jour. Conchyl., vol. 65, p. 249.
1920. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 83-84.
1921. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Lamy, Jour. Conchyl., vol. 65. pp. 246, 248, 249.
1923. *Codakia orbiculata* (Montagu), Clench, Nautilus, vol. 37, No. 2, p. 54.
1926. *Codakia orbiculata* (Montagu), Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1933. *Codakia imbricatula* (C. B. Adams), Trechmann, Geol. Mag., vol. 70, No. 823, p. 36.
1934. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Johnson, Boston Soc. Nat. Hist. Proc., vol. 40, No. 1, p. 42.
1936. *Lucina* (*Jagonia*) *orbiculata* (Montagu), Lermond, Check List of Florida Marine Shells, Gulfport, p. 12.
1936. *Codakia* (*Jagonia*) *orbiculata orbiculata* (Montagu), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Codakia* (*Jagonia*) *orbiculata orbiculata* (Montagu), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 165.
1936. *Codakia orbiculata* (Montagu), McLean, Nautilus, vol. 49, No. 4, p. 118.
1937. *Codakia orbiculata* (Montagu), Smith, East Coast Marine Shells, p. 47, pl. 14, figs. 8a, 8b, pl. 15, fig. 6.
1937. *Jagonia orbiculata* (Montagu), Chavan, Jour. Conchyl., vol. 81, p. 257.
1938. *Codakia orbiculata* (Montagu), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1938. *Codakia orbiculata* (Montagu) Perry, Schwengel, and Dranga, Nautilus, vol. 52, No. 1, p. 28.
1939. *Ctena orbiculata* (Montagu), Bartsch and Rehder, Smithsonian Misc. Collections, vol. 98, No. 10, p. 18.
1946. *Codakia* (*Jagonia*) *orbiculata* (Montagu), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 100.
1949. *Codakia* (*Jagonia*) *orbiculata orbiculata* (Montagu), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, pt. 1, p. 33.
1950. *Lucina imbricatula* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, p. 292, pl. 46, figs. 7-8.
1951. *Codakia* (*Jagonia*) *orbiculata* (Montagu), McLean, N. Y. Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pl. 12, fig. 3.
1954. *Codakia* (*Ctena*) *orbiculata* (Montagu), Abbott, American Seashells, p. 391, pl. 30L.
1955. *Codakia* (*Ctena*) *orbiculata* (Montagu), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 66, pl. 11, fig. 68.
1958. *Codakia orbiculata* (Montagu), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 20.
1958. *Codakia* (*Ctena*) *orbiculata* (Montagu), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 120, pl. 14r.
1959. *Codakia orbiculata* (Montagu), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 11.
1961. *Codakia* (*Jagonia*) *imbricatula* (C. B. Adams), van Regteren Altena, Koninkl-Nederl. Akad. Wetens.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.

The Recent Cabo Blanco shell is fairly small, moderately compressed, feebly depressed posteriorly, suborbicular, with an extended, nearly semicircular anterior margin, a shallowly rounded ventral margin, and a slightly curved to subtruncate posterior margin. Beak low, sharp, prosogyrate, subcentral. Lunule small, indistinct, lanceolate, slightly wider on the right valve. Disk divided into three sections by two narrow concentric rifts representing resting stages of growth. Radial ribs about 30 in all, crossed by rather thick regular concentric cords rendering the ribs transversely beaded or nodulose. The ribs are low, the main ones starting at the beak, increasing in number by division and intercalation as growth progresses. The divided and intercalated riblets are smaller than the principal ribs, and their distribution is not uniform. Some of the principal ribs are a little stouter than the others, particularly toward the posterior of the left valve and anterior of the right valve. On both valves the riblets on the posterior depression are relatively feeble. The anterior muscle scar is long and arcuately lozenge-shaped, the posterior one reniform. The pallial line is simple and entire, uniting with the anterior muscle scar near the top, and joining the posterior one at the base. The interior is faintly corrugated by the ribs, the corrugations slightly more pronounced but still feeble at the margins. The color is pale lemon yellow within and without, but the inner margins are whitish.

Dimensions.—Specimen A520a1-2, valves attached, height 12 mm.; width 12.9 mm.; thickness 5.2 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One specimen, a doublet.

Range and distribution.—The living species is found in the Western Atlantic from North Carolina to Brazil. As a fossil, *C. orbiculata* occurs in the Pleistocene of Florida, the Panama Canal Zone, St. Kitts, Curaçao, Aruba, and Barbados. Olsson and Harbison (1953, p. 79) recorded a closely related form from the Pliocene of Florida.

Remarks.—The west American analogue of *C. orbiculata* is *C. mexicana* Dall (1901, U. S. Nat. Mus., Proc., vol. 23, No. 1237, pp. 799, 822, pl. 40, fig. 6). *C. mexicana* ranges from upper Pliocene to Recent, the living shell occuring intertidally to depths of 45

fathoms from the Gulf of California to Ecuador. The Mexican shell is larger, more delicate, and more closely ribbed than *C. orbiculata.*

Codakia (Jagonia) pectinata (C. B. Adams) Pl. 31, figs. 5, 6

1847. *Lucina pectinata* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 288. Nude name.
1852. *Lucina pectinata* C. B. Adams, Contrib. to Conch., No. 12, p. 245. Not of Gmelin, 1791.
1864. *Lucina pectinata* C. B. Adams, Krebs, The West Indian Marine Shells, p. 120.
1900. *Lucina pectinata* C. B. Adams, Verrill and Bush, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 12, p. 519.
1901. *Lucina pectinata* C. B. Adams, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1237, p. 799. Not of Gmelin 1791, nor Carpenter 1857.
1903. *Lucina pectinata* C. B. Adams, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1351. In synonymy under *Codakia* (*Jagonia*) *orbiculata* (Montagu).
1921. *Lucina pectinata* C. B. Adams, Lamy, Jour. Conchyl., vol. 65, pp. 175, 250, 252.
1950. *Lucina pectinata* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, pp. 323-324, pl. 46, figs. 5-6.

Shell small, moderately tumid, obliquely suboval, inequilateral. Submargins slightly depressed, the anterior submargin broader than the posterior. Anterodorsal margin hardly concave, anterior end produced and rounded, ventral margin shallowly rounded, posterior end moderately rounded, posterodorsal margin hardly convex. Umbo full, rather high, the tip of the beak smooth, situated a little behind the middle, touching the top of the cardinal process. Lunule of right valve not well defined, elongate-cordate, slightly depressed, the rim somewhat thickened, the deck scored by fine grooves which are a continuation of the narrow concentric grooves of the disk. Sculpture consisting, from beak to base, of numerous low radial riblets (of which there are about 105 in all) finely reticulated or beaded by closely spaced concentric threads. The riblets are sepa-arated by narrow shallow grooves, tend to become obsolescent toward the base, and, along an undefined line curving down from the beak along the anterior third of the disk, the riblets on the forward side are divaricate. On the umbo, the riblets are regular and equal, but from the umbo down they increase in number by intercalation, most of the intercalated ones attaining the same size as the primaries at the ventral margin. Occasionally the riblets are finely divided at the base, and below the prodissoconch the disk

is traversed by widely separated concentric growth grooves. Posterior cardinal of right valve stout, cuneate faintly bipartite, the anterior cardinal much smaller and joined to the rim of the lunule under the beak. Lateral teeth of right valve a little unequal, the anterior one slightly the higher and broader. Inner margin of valve weakly denticulate. Anterior muscle scar fairly long, lozenge-shaped, and somewhat arcuate, the posterior one faint and seemingly ovate-lenticular. Pallial line simple, entire, uniting with the outer margin of the anterior scar at about the middle, and joining the posterior one at the base. The interior is white, the exterior off-white with a faded brownish yellow stain on the posterior submargin.

Dimensions.—Specimen A426a, right valve, height 11.4 mm.; width 12 mm.; approx. thickness 3.2 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One right valve.

Remarks.—The Venezuelan shell appears identical with Adams' type *Lucina pectinata* from Jamaica but is entirely distinct from the *pectinata* of Gmelin which is a lucinid often placed by authors in the genus *Lucina* or *Phacoides.* Dall (1901) recognized that neither the *C. pectinata* of Adams nor the later *C. pectinata* of Carpenter (1857) agreed with Gmelin's *pectinata.* In 1903 Dall placed *C. pectinata* (C. B. Adams), together with some other then recognized species, as a "variety" of *C. orbiculata* (Montagu) but stated that some of the well-marked varieties of *C. orbiculata* might eventually be raised to specific rank. In comparing Adams' type of *Lucina pectinata* with authentically identified specimens of *C. orbiculata* (Montagu), the two do seem to me to be specifically distinct, and I consider them to be separate species. *Lucina pectinata* Carpenter is now known as *Codakia* (*Jagonia*) *mexicana* Dall, and this ranges from upper Pliocene to Recent. The Recent *C. mexicana* is reported in the Eastern Pacific from Baja California, México to Ecuador.

Range and distribution.—The Recent *Codakia* (*Jagonia*) *pectinata* (C. B. Adams) ranges from the West Indies to northern South America. I have not seen any report of its occurrence as a fossil.

Codakia (Jagonia) umbonicostata, new species Pl. 31, figs. 7, 8

Shell rather small, fairly plump, subquadrate- orbicular, gently depressed posteriorly, and with a slight circumlunular depression anteriorly. Anterodorsal margin concave, anterior end slightly produced and subtruncate, ventral margin shallowly rounded, posterior end hardly convex, posterodorsal margin straight and moderately sloping. Umbo full and high, the beak central and rather obtuse. Lunule of right valve semicordate, not deeply impressed. Sculpture consists of closely spaced regular concentric lirae, and radial riblets which are pronounced on the umbo, feeble to obsolescent on the remainder of the disk, and absent on both submargins. On the umbo, the radial ribs are stronger than the concentric lirae, but on the rest of the disk the concentric markings are the more dominant. Hinge sturdy, the base of the hinge plate slightly sinuous and more or less horizontal. Cardinal process of right valve consists of a stout, lightly bifid central tooth, a rudimentary anterior tooth in the form of a lamina (not visible on the illustration) affixed under the deck of the lunule, and a low posterior ridge. On either side of the central tooth there is a triangular socket, the posterior socket relatively narrow and shallow, the anterior larger and deeper. The anterior lateral is represented by a shallow groove beneath the rim of the lunule, and the posterior lateral by a distal wedgelike thickening. Ligamental groove rather long and deep. Ventral margin crenulate, and slightly thickened at the rim. Adductor scars well impressed, the right anterior elongate, bent, and lenticular, and modified by a narrow finger-like sinus entering the outer side of the lower half, the posterior scar reniform. Pallial line strong, somewhat ragged, joining the posterior muscle scar at the middle of the base.

Dimensions.—Holotype (I519a), right valve, height 10 mm.; width 10.5 mm.; thickness 3.2 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve, the holotype.

Comparisons.—The new species is reminiscent of the middle Miocene *C. vendryesi* Dall (1903, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1348, pl. 52, fig. 4) from Bowden, Jamaica, differing

from that, however, in the obsolescence of the radial ribs below the umbo. *C. umbonicostata,* n. sp. also recalls the Bowden *Phacoides (Callucina) pauperatus oligocostatus* Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, p. 124, pl. 16, figs. 14-15), and the middle Miocene *Phacoides perplexus* Pilsbry and Johnson (1917, Acad. Nat. Sci. Philadelphia, Proc., vol. 69, pp. 197-198; and Pilsbry, 1921, *ibid,* vol. 73, p. 416, text fig. 41 and pl. 38, fig. 3) from the Dominican Republic. The first of those, *P. p. oligocostatus,* is more regularly orbicular, and less strongly costate on the umbo than the Venezuelan shell, and the second, *P. perplexus,* though sculptured in much the same manner as *C. umbonicostata,* is semicircularly rounded, instead of subtruncate, at the anterior end.

Divaricella ? species Pl. 30, fig. 9

An internal mold of a slightly inflated, orbicular shell is referred with doubt to the genus *Divaricella.*

Dimensions.—Specimen L423a, right valve, height 23 mm.; width 23.7 mm.

Locality.—Playa Grande formation (Catia member), south side of Playa Grande road about 220 meters west of W-15. One internal mold of a right valve.

Remarks.—The shape is like the Miocene to Recent *D. quadrisulcata* (d'Orbigny) (1842, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, pp. 294-295, pl. 27, figs. 34-36), as well as like that of other late Cenozoic species.

In his "Essai critique de classification des *Divaricella,*" André Chavan (1951) pointed out that certain American species of *Divaricella* were not to be classified under the *Divaricella* of von Martens but under a new genus for which he proposed the name *Divalinga.*

CHAMIDAE

Chama congregata Conrad Pl. 31, figs. 11-14; Pl. 32, figs. 1-9

1833. *Chama congregata* Conrad, Amer. Jour. Sci., 1st ser., vol. 23, p. 341.
1838. *Chama congregata* Conrad, Fossils of the Medial Tertiary of the United States, p. 32, pl. 17, fig. 2.
1857. *Chama congregata* Conrad, Tuomey and Holmes, Pleiocene Fossils of South Carolina, p. 23, pl. 7, figs. 7-10.

1862. *Chama congregata* Conrad, Acad. Nat. Sci. Philadelphia, Proc., vol. 14 (1863), p. 576.
1885. *Chama congregata* Conrad, Bush, Connecticut Acad. Arts and Sci., Trans., vol. 6, p. 478.
1889. *Chama congregata* Conrad, Dall, U. S. Nat. Mus., Bull. 37, p. 52.
1895. *Chama congregata* Conrad, Whitfield, U. S. Geol. Sur., Mon. 24, p. 65, pl. 9, figs. 14-18.
1903. *Chama congregata* Conrad, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1400-1401.
1904. *Chama congregata* Conrad, Glenn, Maryland Geol. Sur., Miocene, p. 342, pl. 91, figs. 1-3.
1917. *Chama congregatoides* Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 364, pl. 33, fig. 8.
1919. *Chama congregata* Conrad, Odhner, K. Svenska Vetenskapsakademien Handligar, vol. 59, No. 3, p. 82.
1920. *Chama congregata* Conrad, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 80-81.
1922. *Chama congregata* Conrad, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, p. 390, pl. 28, fig. 11.
1924. *Chama congregata* Conrad, Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., faunal list following p. 28, p. 33.
1932. *Chama congregata* Conrad, Mansfield, Florida Geol. Sur., Bull. No. 8, pp. 90-91, pl. 18, figs. 2, 5.
1934. *Chama congregata* Conrad, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 38.
1936. *Chama congregata* Conrad, Lermond, Check List of Florida Marine Shells, Gulfport, p. 8.
1936. *Chama congregata* Conrad, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1937. *Chama congregata* Conrad, Smith, East Coast Marine Shells, p. 44, pl. 14, fig. 4.
1938. *Chama congregata* Conrad, Pilsbry and McGinty, Nautilus, vol. 51, No. 3, pp. 73, 75-76, pl. 7, figs. 6, 10.
1939. *Chama congregata* Conrad, Oinomikado, Geol. Soc. Japan, Jour., vol. 46, No. 96, pp. 618, 628, pl. 29 (15), fig. 29.
1942. *Chama congregata* Conrad, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1942. *Chama congregata* Conrad, Richards and Harbison, Acad. Nat. Sci. Philadelphia, Proc., vol. 94, p. 193.
1943. *Chama congregata* Conrad, Gardner, U. S. Geol. Sur., Prof. Paper 199-A, pp. 9, 11.
1943. *Chama congregata* Conrad, Bayer, Nautilus, vol. 56, No. 4, pp. 117, 120, pl. 12, fig. 3.
1944. *Chama congregata* Conrad, Hackney, Nautilus, vol. 58, No. 2, p. 58.
1947. *Chama congregata* Conrad, Richards, Jour. Plaeont., vol. 21, No. 1, p. 26.
1949. *Chama congregata* Conrad, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 34.
1953. *Chama congregata* Conrad, Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Chama congregata* Conrad, Abbott, American Seashells, p. 392, pl. 37d.
1955. *Chama congregata* Conrad, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 61, pl. 10, fig. 59.
1958. *Chama congregata* Conrad, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1958. *Chama congregata* Conrad, Moore, Nautilus, vol. 7, No. 4, p. 128.
1959. *Chama congregata* Conrad, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 12.

1961. *Chama congregata* Conrad, Moore, Gulf Research Repts., vol. 1, No. 1, pp. 15, 41.
1961. *Chama congregata* Conrad, Warmke and Abbott, Caribbean Seashells, p. 179, pl. 37d.

This species is represented in the Cabo Blanco area by both Recent and fossil examples. The shell is relatively small, inequivalve, the left or attached valve deep and irregularly oval, the right or upper valve slightly convex to compressed and irregularly suborbicular. The beak of the left valve is full and gryphaeaform, and gyrates counterclockwise; the beak of the right valve is appressed and gyrates clockwise. Exterior of left valve sculptured by foliaceous and fluted concentric lamellae; the sculpture of the right valve consists of concentric lamellae on which are numerous axial wavy cords and flutings, the flutings scalloped to severely arched to tubular at their ends. Within, the margins of the valves are finely crenulate. The pallial line merges with the basal outer margin of the anterior muscle scar, but joins the base of the posterior scar a little in from its outer margin. The muscle scars are elongate and sublenticular, the anterior scar a little narrower, longer, and lower than the posterior. The upper side of the strong cardinal tooth on the hinge plate of the deep (left) valve bears eight to fourteen narrow parallel grooves or corrugations, and the edge of the tooth is recurved slightly upward; the cardinal tooth of the right valve is similarly scored on the under side. The Recent specimens are cream-white within and dirty white on the exterior, but on the best preserved shell the axial cords are reddish brown and dark brown.

Dimensions.—Recent paired shell (A436a1-2), left valve, length 20 mm.; width 15 mm.; right valve, length 15 mm.; width 13.7 mm.; thickness of doublet 12 mm. Fossil specimen S436a, right valve, length 16.7 mm.; width 13.9 mm.; thickness 7 mm. Fossil specimen S436b, right valve, length 19.9 mm.; thickness 6 mm. Fossil specimen J436a, left valve, length 28 mm.; width 24.8 mm.; thickness 15.2 mm. Fossil specimen J436b, right valve, length 17.7 mm.; width 14.6 mm.; thickness 3.5 mm. Fossil specimen 1436a, right valve, length 20.1 mm.; width 17.1 mm.; thickness 5 mm. Fossil specimen H436b, right valve, length 15.2 mm.; width 14.9 mm.; thickness 4 mm. Fossil specimen H436a, left valve, length 25.5 mm.; width 20.4 mm.; thickness 11.5 mm.

Cabo Blanco localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Ten left valves, four right valves, one doublet. Abisinia formation at W-30, eastern edge of Playa Grande village. Three right valves. Upper Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas. One right valve. Mare formation at W-25, south flank of Punta Gorda anticline. One right valve, and one left valve, the identification of which is uncertain. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Six right valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Three right valves, one left valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Sixteen right valves.

Range and distribution.—The Recent *Chama congregata* Conrad occurs from Cape Hatteras, North Carolina, to Brazil, living near shore to 52 fathoms. As a fossil it is reported from the Pleistocene of Cuba, from the Pliocene of North and South Carolina, from the late Miocene along the eastern coast of the United States from New Jersey to Florida, and from the middle Miocene of the Dominican Republic, Costa Rica, and Colombia.

Chama macerophylla Gmelin Pl. 33, figs. 1, 2

1784. [*Chama*] *Macerophylla* Chemnitz, Syst. Conchylien-Cabinet, vol. 7, pp. 101, 149, pl. 52, figs. 514-515.
1791. *Chama macerophylla* Gmelin, Syst. Nat., vol. 6, p. 3304.
1791. *Chama citrea* Gmelin, Syst. Nat., vol. 6, p. 3305.
1871. *Chama gryphoides* (*ex parte*) Linnaeus, Dillwyn, A Descriptive Catalogue of Recent Shells, p. 221.
1819. *Chama lazarus* Linnaeus, Lamarck, An. sans Vert., vol. 6, p. 93. Not of Linnaeus.
1835. *Chama lazarus* Linnaeus, Deshayes, An. sans Vert., ed. 2, vol. 6, p. 579. Not of Linnaeus.
1843. *Chama macrophylla* Gmelin, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 226.
1846. *Chama macrophylla* Gmelin, Reeve, Conch. Icon., vol. 4, *Chama,* pl. 2, sp. 6; pl. 8, sp. 6b.
1853. *Chama macrophylla* Gmelin, d'Orbigny, [in] La Sagra, Hist. phys., polit. et. nat. de l'Ile de Cuba, Mollusques, vol. 2, p. 363.
1864. *Chama macrophylla* Gmelin, Krebs, The West Indian Marine Shells, p. 117.
1864. *Chama macrophylla* Chemnitz, Guppy, Sci. Assoc. Trinidad, Trans., p. 36.
1871. *Chama macrophylla* Gmelin, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 134.

1872. *Chama macrophylla* Chemnitz, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 118.
1873. *Chama macrophylla* Gmelin, Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, pp. 251, 259.
1878. *Chama macrophylla* Chemnitz, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 272.
1878. *Chama macrophylla* Gmelin, Mörch, Catalogue of West-India Shells, p. 15.
1881. *Chama macrophylla* Gmelin, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 375.
1889. *Chama macrophylla* Chemnitz, Clessin, Syst. Conchylien-Cabinet, vol. 8, pt. 5, pp. 17-18, pl. 2, figs. 1-2.
1889. *Chama macrophylla* Gmelin, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 122, 141.
1889. *Chama macrophylla* Gmelin, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 65.
1891. *Chama macrophylla* Gmelin, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1895. *Chama macrophylla* Chemnitz, Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 292.
1901. *Chama macrophylla* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 495.
1903. *Chama macerophylla* Gmelin, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1403-1404.
1907. *Chama macrophylla* Gmelin, Verrill, Connecticut Acad. Arts and Sci., Trans., vol. 12, p. 347, pl. 35b, figs. 4, 4a.
1916. *Chama macrophylla* Gmelin, Thiele, Zool. Jahrb., Suppl. 11, p. 129.
1917. *Chama macerophylla* Chemnitz, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 23, No. 3, p. 202.
1920. *Chama macerophylla* Gmelin, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 81.
1919. *Chama macerophylla* Gmelin, Odhner, K. Svenska Vetenskapsakademien Handligar, vol. 59, No. 3, pp. 10, 78, 79, 81, pl. 4, fig. 1.
1925. *Chama macerophylla* Gmelin, Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 104-105, pl. 12, figs. 18-19.
1926. *Chama macerophylla* Gmelin, Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1933. *Chama macrophylla* Chemnitz, Trechmann, Geol. Mag., vol. 70, No. 823, p. 35.
1934. *Chama macerophylla* Gmelin, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 38.
1935. *Chama macerophylla* Gmelin, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Chama macerophylla* Gmelin, Lermond, Check List of Florida Marine Shells, Gulfport, p. 8.
1936. *Chama macerophylla* Gmelin, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1937. *Chama macerophylla* Gmelin, Smith, East Coast Marine Shells, p. 44, pl. 14, fig. 2.
1938. *Chama macerophylla* Gmelin, Pilsbry and McGinty, Nautilus, vol. 51, No. 3, p. 75, pl. 7, figs. 2, 8.
1938. *Chama macerophylla* Gmelin, Pilsbry, Nautilus, vol. 51, No. 4, p. 143.
1938. *Chama macerophylla* Gmelin, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1939. *Chama macerophylla* Gmelin, Bartsch and Rehder, Smithsonian Misc. Collections, vol. 98, No. 10, p. 18.

1942. *Chama macerophylla* Gmelin, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1943. *Chama macerophylla* Gmelin, Bayer, Nautilus, vol. 56, No. 4, pp. 117, 119-120, pl. 13, fig. 12.
1945. *Chama macrophylla* Gmelin, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Chama macerophylla* Gmelin, Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 99.
1951. *Chama macerophylla* Gmelin, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 55, pl. 11, fig. 1.
1954. *Chama macerophylla* Gmelin, Abbott, American Seashells, p. 392, pl. 37b; fig. 79b.
1955. *Chama macerophylla* Gmelin, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 62, pl. 10, fig. 60.
1958. *Chama macerophylla* Gmelin, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Chama macerophylla* Gmelin, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 12.
1959. *Chama macrophylla* Gmelin, Rodriguez, Bull. Marine Sci. of the Gulf and Caribbean, vol. 9, No. 3, p. 277.
1961. *Chama* (*Chama*) *macerophylla* Gmelin, van Retgeren Altena, Koninkl. Nederl. Wetensch.-Amsterdam, Proc., ser. B, vol. No. 2, p. 300.
1961. *Chama macerophylla* Gmelin, Warmke and Abbott, Caribbean Seashells, p. 179, pl. 4c; 37b.

Several poorly preserved right valves, both Recent and fossil, appear to represent this species. The valves are suborbicular, compressed to somewhat convex, with an appressed beak gyrating clockwise. The external sculpture consists of foliaceous concentric lamellae, the lamellae below the umbo producing broad, arched, and elongated fronds which are axially striate on the upper surface but completely smooth on the under surface. Internally, the margins are denticulate, and the pallial line seems to pass around the anterior muscle scar before joining it at the apex. The two Recent specimens are lemon-yellow on the exterior as well as on the inner margins, but the body cavity is whitish.

Dimensions.—Recent specimen A436b, right valve, length 18.9 mm.; width (excluding fronds) 18 mm.; thickness 6.6 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. One right valve. Recent, on beach southeast of Higuerote, State of Miranda. One right valve. Abisinia formation at W-30, eastern edge of Playa Grande village. Two small right valves, weathered. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One right valve, a juvenile, with neat, fairly regular frills bearing faint axial striae.

Pliocene about 6 kilometers east of Cumaná, State of Sucre (in U.S. National Museum Collection No. 18410).

Range and distribution.—The living *C. macerophylla* Gmelin is found in the Western Atlantic from Cape Hatteras, North Carolina, to northern South America where it is commonly associated with *C. congregata* Conrad. In the Pleistocene, *C. macerophylla* is recorded from Florida, Cuba, the Dominican Republic, St. Kitts, Curaçao, Barbados, Aruba, and Venezuela. In the Pliocene it was reported by Guppy (1864) from Matura, Trinidad, and by Gabb (1881) from Costa Rica. In Jamaica it occurs in the middle Miocene at Bowden.

Remarks.—This species resembles the widespread *C. congregata* Conrad, but is distinguished from that by the broader, more frondose, and axially striate foliations, and by the position of the pallial line which skirts the margin of the anterior muscle scar on *C. macerophylla* but merges with the margin at the base of the anterior muscle scar on *C. congregata.*

Chama florida Lamarck Pl. 33, figs. 3, 4

1819. *Chama florida* Lamarck, An. sans Vert., vol. 6, pp. 94-95.
1864. *Chama florida* Lamarck, Krebs, The West Indian Marine Shells, p. 117.
1872. *Chama florida* Lamarck, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 117.
1878. *Chama florida* Lamarck, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Chama florida* Lamarck, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 272.
1889. *Chama florida* Lamarck, Clessin, Syst. Conchylien-Cabinet, vol. 8, pt. 5, pp. 12-13, pl. 2, fig. 9.
1903. *Chama florida* Lamarck, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1404.
1917. *Chama florida* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 23, No. 3, pp. 204-206.
1935. *Chama florida* Lamarck, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1938. *Chama florida* Lamarck, Pilsbry and McGinty, Nautilus, vol. 51, No. 3, p. 74.
1942. *Chama florida* Lamarck, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1943. *Chama florida* Lamarck, Bayer, Nautilus, vol. 56, No. 4, pp. 117, 119, 123, pl. 12, fig. 6.
1945. *Chama florida* Lamarck, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. Ser., vol. 14, p. 77.
1958. *Chama florida* Lamarck, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Chama florida* Lamarck, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 12.
1961. *Chama florida* Lamarck, Warmke and Abbott, Caribbean Seashells, p. 180, pl. 37e.

The right valves referred to this species are rather small, moderately thick, rudely suborbicular, moderately convex to cap-shaped, with the beak prosogyrate, and the apex sometimes bulbous. The exterior is sculptured by concentric rows of short fluted foliaceous lamellae, the flutings rarely marked with faint axial striations. The interior margins are feebly but closely crenulate near the rim, and the pallial line skirts past the margin of the anterior adductor scar, joining the scar at the top. The interior is white, on some specimens stained with pink. On the exterior, the ground is white and the apex flushed a deep pink, with several deep pink interrupted radii swirling off the apex on to the disk.

Dimensions.—Specimen A661a, right valve, length 15 mm.; width 13 mm., thickness 5.3 mm.

Locality.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Five right valves.

Range and distribution.—The living shell ranges from south Florida to northern South America. As a fossil, the species has been reported from the Pleistocene of Cuba, and on the islands of Blanquilla and Cubagua, Venezuela.

Remarks.—According to Bayer (1943, Nautilus, vol. 56, No. 4, p. 117), *C. florida* Lamarck is separable from *C. sarda* Reeve by the position of the pallial line. On *C. florida* the pallial line passes around the end of the anterior adductor scar and joins it at the superior end, whereas on *C. sarda* the pallial line joins the margin of the scar at the base.

Chama sinuosa bermudensis Heilprin **Pl. 32, figs. 10, 13**

1889. *Chama Bermudensis* Heilprin, Acad. Nat. Sci. Philadelphia, Proc., vol. 41, p. 141, pl. 8, figs. 1, 1a.
1919. *Chama sinuosa bermudensis* Heilprin, Odhner, K. Svenska Vetenskapsakademien Handligar, vol. 59, No. 3, p. 77.
1938. *Chama sinuosa bermudensis* Heilprin, Pilsbry and McGinty, Nautilus, vol. 51, No. 3, p. 77.
1943. *Chama sinuosa* bermudensis Heilprin, Bayer, Nautilus, vol. 56, No. 4, pp. 118, 122, 123, pl. 14, fig. 26.

The fossil shell referred to this subspecies is large, robust, and inequivalve. Left (lower) valve deep, oblong-oval to suborbicular, with an erect cornucopia-like beak gyrating counterclockwise, the right (upper) valve convex to compressed, rudely orbicular, the

beak prosogyrate, the umbo moderately full to appressed, both valves with a faint radial depression fore and aft. External sculpture consisting of foliaceous concentric lamellae arched into hood-shaped fronds or ruffles, the fronds axially striate and in places produced into vaulted scales or flutings. The sculpture is better preserved and sharper on the upper valve as the lower valve is generally encrusted with a calcareous material. In the interior, the adductor scars are large and slightly arcuate, the anterior one merging into the cardinal process, the posterior one ending below the marginal tooth of the hinge plate. The margins of the valve are completely smooth. The pallial line joins the outer margin of the anterior adductor scar near the base.

Dimensions.—Specimen C438a, left valve, height 61 mm.; width 52 mm.; thickness 23 mm. Specimen C438b, right valve, height 40 mm.; width 41 mm.; thickness 9 mm. Largest specimen, left valve, beak decollate, height 78 mm.; width 57 mm.; thickness 36 mm.

Localities.—La Salina, west of Puerto Cabello, State of Carabobo. Four left valves, two right valves. Abisinia formation at W-30, eastern edge of Playa Grande village. A worn and broken right valve is doubtfully identified as this subspecies.

Range and distribution.—Living in Bermuda, south Florida, the Tortugas, and the Caribbean.

Pseudochama radians (Lamarck) Pl. 33, figs. 5, 6; Pl. 34, figs. 1-6

1819. *Chama radians* Lamarck, An. sans Vert., vol. 6, p. 96. Refers to Chemnitz, 1786, Syst. Conchylien-Cabinet, vol. 9, p. 145, pl. 116.
1846. *Chama ferruginea* Reeve, Conch. Icon., vol. 4, *Chama,* pl. 4, sp. 21.
1847. *Chama variegata* Reeve, Zool. Soc. London, Proc., vol. 14, p. 118.
1864. *Chama ferruginea* Reeve, *C. radians* Lamarck, and *C. variegata* Reeve, Krebs, The West Indian Marine Shells, pp. 117, 118.
1872. *Chama radians* Lamarck, Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 11g.
1878. *Chama ferruginea* Reeve, Mörch, Catalogue of West-India Shells, p. 15.
1889. *Chama ferruginea* Reeve, Clessin, Syst. Conchylien-Cabinet, vol. 8, pt. 5, pp. 22-23, pl. 9, fig. 5.
1903. *Chama ferruginea* Reeve and *C. variegata* Reeve, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1404.
1917. *Chama radians* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 23, No. 4, p. 266.
1919. *Pseudochama ferruginea* (Reeve), Odhner, K. Svenska Vetenskapsakademien Handligar, vol. 59, No. 3, pp. 39-42, pl. 1, figs. 7-8; pl. 4, figs. 38-39; pl. 5, figs. 40-45; also pp. 15, 16, 66, 74, 80, 81, 93.

1936. *Chama variegata* Reeve, Lermond, Check List of Florida Marine Shells, Gulfport, p. 8.
1938. *Pseudochama radians* (Lamarck), Pilsbry and McGinty, Nautilus, vol. 51, No. 3, pp. 77-78.
1943. *Pseudochama radians variegata* (Reeve), Bayer, Nautilus, vol. 56, No. 4, pl. 12, fig. 4.
1951. *Pseudochama radians* (Lamarck), *P. radians ferruginea* (Reeve), and *P. r. variegata* (Reeve), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 56, pl. 11, figs. 5-6.
1954. *Pseudochama radians* (Lamarck), Abbott, American Seashells, p. 393, fig. 79c, pl. 37c.
1955. *Pseudochama radians variegata* (Reeve), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 62, pl, 10. fig. 61.
1958. *Pseudochama radians* (Lamarck), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1958. *Pseudochama radians* (Lamarck), Moore, Nautilus, vol. 71, No. 4, p. 128.
1959. *Pseudochama radians ferruginea* (Reeve) and *P. r. variegata* (Reeve), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 12.
1961. *Pseudochama radians* (Lamarck), Warmke and Abbott, Caribbean Seashells, p. 180, pl. 37c.

Shell of medium size, inequivalve. Right (lower) valve deep, suborbicular to subtrigonally ovate, attached by the anterior half of the shell which is flattened in greater or less degree over a crescentic area from beak to base; left (upper) valve suborbicular or suboval, compressed. Beak of right valve gryphaeaform, gyrating clockwise; beak of left valve appressed, slightly prosogyrate. The external sculpture of the right valve is variable although all of the Playa Grande specimens are both concentrically lamellate and radially ridged on the posterior part of the shell. On three right valves the short vermiform axial ridges occur on the posterior fourth of the valve, but on another specimen these ridges are present on the posterior half of the valve, and on this specimen there are also some irregular foliations anteriorly. The concentric lamellae of the right valve are simple to frilled to fluted, and on one specimen some of the flutings project as arched spines. The external sculpture of the single left valve consists of minutely foliaceous concentric lamellae becoming incremental toward the base. On the interior, three single left valves are denticulate at the margin, but both valves of a paired specimen (A662a1-2) are smooth (except for occasional tiny pustules) even though this specimen seems to belong to the same species as the denticulate ones. The pallial line joins the base of the anterior muscle scar at the outer margin, but posteriorly it swings in to join the base of the anterior muscle scar at the outer

margin. The anterior cardinal tooth of the right valve is large, curved upward a little at the edge, and is striate on the upper surface; the posterior cardinal tooth of the right valve is arcuate and is also scored by a series of short grooves. The interior of both valves is generally white with a staining of mahogany-brown at the margin, but the whole interior of one right valve is mahogany-brown with blotches of white. The exterior of the left valve is whitish with short stripes of brown on the lower half; the exterior of the right valve is dirty white, and brown or dull purplish red.

Dimensions.—Specimen A662a1-2 (paired), right valve, height 31.5 mm.; width 27.3 mm.; thickness 17.1 mm.; left valve, height 23.6 mm.; width 27.5 mm.; thickness 5 mm. Specimen A662b, right valve, height 21.5 mm.; width 21.5 mm.; thickness 12 mm. Specimen A662c, right valve, height 20 mm.; width 18.3 mm.; thickness 6.8 mm. Specimen D439a, right valve, height 50 mm.; width 39.5 mm.; thickness 33 mm. Specimen D439b, left valve, height 33 mm.; width 33 mm.; thickness 10 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Four specimens including three right valves and one doublet. Abisinia formation at W-30, eastern edge of Playa Grande Village. Six worn or broken specimens, including five left valves and one right valve.

Range and distribution.—Living in shallow water from south Florida to northern South America. This is the first report of its occurrence as a fossil.

Remarks.—The forms *P. ferruginea* (Reeve) and *P. variegata* (Reeve) are considered ecological variants of *P. radians* by some authors but as a subspecies of *P. radians* by others. The Recent Playa Grande shells, which were collected near each other on the beach, exhibit considerable variation, and partake in one way or another of the characters of *P. radians radians,* of *P. r. ferruginea,* and of *P. r. variegata.*

Specimen D440a from the Abisinia formation represented by figures 5, 6 on Plate 34, and identified with uncertainty as *P. radians* Lamarck, may be yet another individual variant of the species. The details are obscure but the worn and immature specimen is inferred to be a right valve. The shell is small, shield-shaped in outline and tentlike in cross section, with a high medial ridge

from beak to base from which the sides slope steeply, the anterior slope straightish, the posterior concave. The turn of the beak is not defined but it seems to be incipiently clockwise. The anterior slope is nondescript and gnarly, and probably was the attached surface. The medial ridge and posterior half of the valve are sculptured by a few coarse concentric lamellae corrugated into short vermiform radial ridgelets and flutings, the termini of the flutings near the base and along the ridge projecting in places as arched spines. In the interior there is a deep linear trough under the ridge, and the entire margin of the valve is rather strongly denticulate. The muscle scars are obscure and the hinge is badly worn. The length of specimen D440a is 12.6 mm., the maximum width 10 mm., and the elevation or thickness 7.1 mm.

Pseudochama ? species Pl. 34, figs. 7, 8

Illustrated is an immature left valve referred with some doubt to the genus *Pseudochama*. The shell is small, compressed, and obliquely ovate, with a smooth plump subcircular prodissoconch facing toward the anterior. Starting at the base of the prodissoconch and extending to the base there is a low arcuate ridge with a fairly broad and gentle depression in front of it and a narrow depression behind it. The anterior half or so of the valve is sculptured by gnarly, irregular, and rather thick concentric foliations which are cordlike to gently arched on the ridge and angulately arched on the posterior quarter of the valve. In the interior the margins are smoothed, and the anterior adductor impression is long and fairly narrow. The heavy hinge apparatus is worn, and the cardinal process, which is recurved upward, appears bilobate; underneath the cardinal lobes, the anterior socket is relatively long and narrow, the posterior socket relatively high and narrow. The pallial line and posterior adductor impression are obliterated.

Dimensions.—Specimen D508a, left valve, height 8 mm.; width 6 mm.; thickness 0.8 mm.

Locality.—Abisinia formation at W-30, eastern edge of Playa Grande village. One left valve.

Remarks.—As most fossils occurring in the Pleistocene(?) Abisinia formation have survived to the Recent, this form may be

living to-day. There are two living species of *Pseudochama* in the Western Atlantic, *P. radians* (Lamarck), and *P. inezae* Bayer (1943, Nautilus, vol. 56, No. 4, pp. 118, 122-123, pl. 15), and although it is possible that the single Cabo Blanco shell is a juvenile of the former, a grading series of specimens is needed in order to make a definitive comparison.

Arcinella species "a" Pl. 34, figs. 9, 10

Included in the Cabo Blanco collection are two fragments of *Echinochama*. One of the fragments is part of a left valve, the other the apical area of a right valve. The left valve, here described, represents the back remnant of a shell which in some curious way was split through the beak and hinge parallel with the margins of the disk, thus producing the anomalous-looking smooth decklike hinge shown in the illustration. The surface is sculptured by narrow, scaly, arcuate and wavy radial ridges. On the sole specimen, which is broken away at the margins, there are seven primary ridges remaining, and of these the anteriormost seems the largest. Between the primaries there are one to six minor ridges alternating in size, the number of secondaries increasing anteriorward, the greatest number lying between the two anterior primary ridges where the intercostal area is considerably wider than elsewhere on the disk. The scales, which occur in fairly numerous irregular rows, are in the form of rounded to angular vaulted arches, and become longer and semitubular toward the margins. The grater-like texture of the *E. arcinella* race is not evident except minutely in a small area between the scales on the anteroventral portion of the valve.

Dimensions.—Specimen T442a, a partial left valve, height 16 mm.; width 12 mm.

Locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One left valve, broken.

Remarks.—It is impossible to classify this fragment with assurance. Of the American species of *Echinochama* discussed by Nicol (1952), it seems, in a subdued way, to resemble *E. arcinella olssoni* Nicol (1952, Jour. Paleont., vol. 26, No. 5, pp. 807-808, pl. 118, fig. 6) from the Armuelles formation (Pleistocene or Pliocene) of the Burica Peninsula, Panamá.

Arcinella species "b" Pl. 34, figs. 11-13

The following description pertains to a right valve with only the thick apical area remaining. On the apical area, the outer shell has been peeled away, but part of the hinge and lunule are intact. The beak is prosogyrate and flattened on the anterior side from attachment. A wide shallow sulcus is present aft of the beak, and this probably extends to the posteroventral margin of the valve. The lunule is large, sunken, semicircular, and coarsely nodular, the nodules crossed by fine concentric laminae which become incremental at the margin of the hinge. The outer layer of shell is stripped off the surface, but from the configuration of the intermediate layer, which is corrugated by six or seven low radial folds on the anterior two-thirds of the disk, it is inferred that a whole valve bears eight or nine, probably spiny, radial ribs. The intermediate layer of shell is traversed by subequal radial threads crossed by closely spaced microscopic concentric striae which tend to be arched upward in the interspaces between the radial threads. The ligamental groove is opisthodetic, parivincular, and deep. The cardinal tooth is large, strong, and upswept, is scored by heavy grooves on the inner surface, and bears fainter ridges and elongated pustules on the superior surface.

Dimensions.—Specimen G435a, apical fragment of right valve, length 14.2 mm.; width 15 mm.; thickness from umbo to cardinal tooth 10.3 mm.

Locality.—Mare formation near W-14, on hillside above west bank of Quebrada Mare Abajo. One fragment of a right valve.

Remarks.—The hinge and lunular area are virtually identical to *E. cornuta* (Conrad) (see Nicol, 1952, Jour. Paleont., vol. 26, No. 5, pp. 809-810, pl. 118, fig. 2; pl. 119, fig. 7), and the postulated number of external ribs also agrees with that Miocene to Recent species. However, whether the true surface ornamentation is comparable to that of *E. cornuta* is, of course, undeterminable. And, whether this specimen represents that opposite valve of the preceding-described *Echinochama* sp. "a" is likewise unknown.

ERYCINIDAE

Bornia tacaguana, new species Pl. 31, figs. 9, 10

Shell small, thin, subtranslucent, subequilateral, the outline rounded-subtrigonal and subisocelene, the anterior submargin slightly compressed. Anterior and posterior ends a little rounded, the ventral margin shallowly and regularly arcuate. Beak small, moderately prominent, directed forward, subcentral. Resilial pit fairly deep, narrowly triangular, the base of the resilifer arched slightly upward. Anterior lamella in hinge of right valve joined to the dorsal margin at the beak, thickened immediately below the beak, but then thinning as it swerves toward the distal end of the anterodorsal margin with which it merges just below the rim of the valve, the groove between the lamella and rim linear. The posterior lamella of the right valve is not so strong as the anterior below the beak, and the groove between it and the posterodorsal margin is a little longer, though feebler, than its anterior counterpart. External surface sculptured by fine subregular concentric lineations which are visible in the interior. Inner margins smooth. Adductor scars and pallial line not visible in the highly polished interior.

Dimensions.—Holotype (T548a), right valve, width 3.4 mm.; height 3.1 mm.; thickness 0.5 mm.

Type locality.—Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas. One right valve, the holotype.

Comparisons.—Similar species are the following:

B. triangula Dall (see Gardner, 1943, U. S. Geol. Sur., Prof. Paper 199-A, pp. 82-83, pl. 14, figs. 2-5, 10). Upper Miocene and Pliocene, Maryland to Florida, U.S.A. This is more sharply triangular than *B. tacaguana,* n. sp.

B. mactroides (Conrad) (see Glenn, 1904, Maryland Geol. Sur., Miocene, p. 330, pl. 88, figs. 9a, 9b). Later Miocene of Maryland. This is a somewhat more rounded and sturdier shell than *B. tacaguana.*

B. longipes (Stimpson) (see Dall, 1899, U. S. Nat. Mus., Proc., vol. 21, No. 1177, pp. 888-889, pl. 88, figs. 10, 11, 13). Recent in the Western Atlantic. The height is 70 per cent of the width, whereas in *C. tacaguana* the height is 80 percent.

B. barbadensis Dall (1899. U. S. Nat. Mus., Proc., vol. 21, No. 1177, p. 888). This is a large, evenly ovate, and inequilateral shell, dredged in 100 fathoms at Barbados.

B. chiclaya Olsson (1961, Panamic-Pacific Pelecypoda, p. 233, pl. 35, fig. 13). Recent in the Eastern Pacific on the coast of Peru. This has much the same outline as *B. tacaguana,* n. sp. but is a somewhat larger and slightly more inflated shell, with a truncate rather than shallowly rounded basal margin.

CARDIIDAE

Trachycardium (Dallocardia) muricatum (Linnaeus) Pl. 35, figs. 1-8

1758. *Cardium muricatum* Linnaeus, Syst. Nat., ed. 10, p. 680, No. 69.
1767. *Cardium muricatum* Linnaeus, Syst. Nat., ed. 12, p. 1123, No. 85.
1782. *Cardium muricatum* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 186, pl. 17, fig. 178.
1792. *Cardium muricatum* Linnaeus, Bruguière, Encycl. Méth., vol. 1, p. 233, pl. 297, fig. 1.
1798. *Cardium campechiense* Röding, Museum Boltenianum, p. 191, No. 407.
1818. *Cardium muricatum* Linnaeus, Lamarck, An. sans Vert., vol. 6, p. 8.
1843. *Cardium muricatum* Linnaeus, d'Orbigny, Voyage dans l'Amérique Méridionale, vol. 3, Mollusques, p. 591.
1844. *Cardium muricatum* Linnaeus, Reeve, Conch. Icon., vol. 2, *Cardium,* sp. 33.
1845. *Cardium muricatum* Linnaeus, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, vol. 5, Moluscos, p. 335.
1854. *Cardium Gossei* Deshayes, Zool. Soc. London, Proc., p. 330.
1860. *Cardium muricatum* Linnaeus, Holmes, Post-Pleiocene Fossils of South Carolina, p. 24, pl 5, fig. 3.
1864. *Cardium muricatum* Linnaeus, Krebs, The West Indian Marine Shells, p. 116.
1867. *Cardium muricatum* Linnaeus, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 163.
1871. *Cardium muricatum* Linnaeus, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 35.
1874. *Cardium muricatum* Linnaeus, Guppy, Geol. Mag., decade 2, vol. 1, p. 442.
1878. *Cardium muricatum* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Cardium muricatum* Linnaeus, Arango y Molina, Contribución al la Fauna Malacológica Cubana, p. 259.
1881. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 374.
1884. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Tryon, Structural and Systematic Conchology, vol. 3, p. 193, pl. 116, figs. 72-74.
1886. *Cardium muricatum* Linnaeus, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 270.
1889. *Cardium muricatum* Linnaeus, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 125, 141, pl. 2, fig. 23.
1889. *Cardium muricatum* Linnaeus, Simpson, Davenport Acad. Nat. Sci., Proc, vol. 5, p. 65.
1889. *Cardium muricatum* Linnaeus, Dall, U. S. Nat. Mus., Bull. 37, p. 52.
1891. *Cardium muricatum* Linnaeus, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1892. *Cardium muricatum* Linnaeus, Singley, Geol. Sur. Texas, Fourth An. Rept., p. 327.

1896. *Cardium maricatum* [*sic*] Linnaeus, Sapper, Inst. Geol. México, Bol. No. 3, p. 9.
1900. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1089-1090.
1901. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 487-488.
1901. *Cardium* (*Tachycardium*) *muricatum* Linnaeus, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1214, pp. 385-386.
1903. *Cardium muricatum* Linnaeus, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 757.
1913. *Cardium muricatum* Linnaeus, Jenkins, Amer. Philos. Soc., Proc., vol. 52, No. 211, p. 457.
1920. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 94-95.
1925. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 279-280, pl. 22, fig. 9.
1930. *Trachycardium* (*Dallocardia*) *muricatum* (Linnaeus), Stewart, Acad. Nat. Sci. Philadelphia, Spec. Publ. No. 3, p. 264.
1934 *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 45.
1934. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Maury, Amer. Mus. Nat. Hist., Bull., vol. 67, art. 4, pp. 162-163, pl. 18, fig. 4.
1935. *Cardium muricatum* Linnaeus, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Cardium muricatum* Linnaeus, McLean, Nautilus, vol. 49, No. 4, p. 118.
1936. *Cardium muricatum* Linnaeus, Richards, Nautilus, vol. 49, No. 4, p. 133.
1936. *Cardium muricatum* Linnaeus, Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1937. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Smith, East Coast Marine Shells, p. 49, pl. 17, fig. 1.
1938. *Cardium muricatum* Linnaeus, Richards, Geol. Soc. Amer., Bull., vol. 49, p. 1291.
1939. *Cardium muricatum* Linnaeus, Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 38, 39.
1939. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 13, No. 3, pp. 160-161, pl. 23, figs. 5-7.
1940. *Cardium muricatum* Linnaeus, Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Cardium muricatum* Linnaeus, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1943. *Trachycardium muricatum* (Linnaeus), Gardner, U. S. Geol. Surv., Prof. Paper 199-A, pp. 92-93, pl. 15, fig. 21.
1944. *Trachycardium muricatum* (Linnaeus), Hackney, Nautilus, vol. 58, No. 2, p. 58.
1944. *Trachycardium* (*Dallocardia*) *muricatum* (Linnaeus), Clench and Smith, Johnsonia, vol. 1, No. 13, pp. 7-9, pls. 1 and 5.
1945. *Laevicardium muricatum* (Linnaeus), van Bentham Jutting, Geol.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Cardium muricatum* Linnaeus, Stewart, Nautilus, vol. 60, No. 1, p. 19.
1946. *Trachycardium* (*Dallocardia*) *muricatum* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 100.
1946. *Cardium* (*Dallocardia*) *muricatum* Linnaeus, Hertlein and Strong, Zoologica, vol. 31, pt. 3, No. 10, p. 148.
1949. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 35.

1951. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 70-71, pl. 14, fig. 3.
1952. *Trachycardium muricatum* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 182, pl. 10, figs. 7-8.
1952. *Cardium muricatum* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 60-61.
1953. *Cardium* (*Trachycardium*) *muricatum* Linnaeus, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 101, pl. 10, fig. 4.
1953. *Laevicardium* (*Trachycardium*) *muricatum* (Linnaeus), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Trachycardium muricatum* (Linnaeus), Abbott, American Seashells, p. 397, pl. 39p.
1955. *Trachycardium muricatum* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 67, pl. 12, fig. 72.
1956. *Trachycardium muricatum* (Linnaeus), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 316, 318, 331, 353, 371, pl. 4, figs. 15a, 15b.
1958. *Trachycardium muricatum* (Linnaeus), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, p. 171.
1958. *Trachycardium muricatum* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Trachycardium muricatum* (Linnaeus), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2125, 2129, 2162, 2165, pl. 2(VI), figs. 12a, 12b.
1959. *Trachycardium muricatum* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 13.
1961. *Trachycardium muricatum* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 182, pl. 37m.

This species occurs both living and as a fossil in northern Venezuela. The Recent shells from Playa Grande (Distrito Federal) and Higuerote (State of Miranda) are broadly rayed in the interior from under the umbo to near the middle of the valve by generally three broad contiguous bands of color, the middle band golden yellow, the outer two violet or purplish red. There are 39 to 44 radial ribs on the Recent specimens, 38 on the largest fossil. The arrangement and pattern of the denticulate scales on adult examples are in accordance with the description by Dall (1900, p. 1080) and the illustrations by Clench and Smith (1944, pl. 5).

Dimensions.—Recent specimen (A498a), right valve, height 30 mm.; width 29 mm.; thickness 11.2 mm. Recent specimen (A498b), left valve, height 28.8 mm.; width 27.9 mm.; thickness 11 mm. Fossil specimen (C503a), right valve broken away at base, width 15 mm.; thickness 5.5 mm. Fossil specimen (C504a), fragment of left valve, width of fragment 9 mm.; thickness 3.1 mm. Fossil specimen (H498a), right valve, height 48 mm., width 44 mm.; thickness 15

mm. Fossil specimen (I498a), juvenile left valve, height 4.7 mm.; width 5 mm.; thickness 1.5 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Ten specimens including seven right valves and three left valves. Recent, on beach southeast of Higuerote, State of Miranda. Eight specimens including four right and four left valves. La Salina, west of Puerto Cabello, State of Carabobo. Two specimens, one a right valve, the other a fragment of a left. Mare formation at W-25, south flank of Punta Gorda anticline. One right valve. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One juvenile left valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Two fragments, one of a young right valve, and one of an adult left valve.

Remarks.—The west American counterpart of *T. muricatum* is the Pleistocene to Recent *T. senticostum* (Sowerby) (see Olsson, 1961, pp. 246-247, pl. 37, fig. 3), living from the Gulf of California to Peru in depths to 40 fathoms.

Range and distribution.—The living *T. muricatum* is recorded from North Carolina, U.S.A., to Argentina, S.A., the greatest depth 187 fathoms off Havana, Cuba. Pleistocene, in South Carolina, Florida, Louisiana (in borings), Cuba, the Yucatan Peninsula, Aruba?, Curaçao, Venezuela, and Brazil. Pliocene, in Florida, the Yucatan Peninsula, Costa Rica, Venezuela (near Cumaná, U. S. National Museum Collection No. 18408), and Trinidad?.

Trachycardium (Trachycardium) cf. **isocardia** (Linnaeus) **Pl. 35, fig. 9; Pl. 36, fig. 1**

1758. *Cardium isocardia* Linnaeus, Syst. Nat., ed. 10, p. 679, No. 66.
1767. *Cardium isocardia* Linnaeus, Syst. Nat., ed. 12, p. 1122, No. 82.
1782. *Cardium isocardia* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 182, pl. 17, figs. 174-176.
1817. *Cardium isocardia* Linnaeus, Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 18.
1845. *Cardium isocardia* Linnaeus, Reeve, Conch. Icon., vol. 2, *Cardium,* pl. 17, sp. 84.
1845. *Cardium isocardia* Linnaeus, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, vol. 5, Moluscos, p. 337.
1860. *?Cardium isocardia* Linnaeus, Holmes, Post-Pleiocene Fossils of South Carolina, p. 25, pl. 5, fig. 4.

1864. *?Cardium isocardium* Linnaeus, Guppy, Sci. Assoc. Trinidad, Trans., pp. 36, 40.
1864. *Cardium isocardia* Linnaeus, Krebs, The West Indian Marine Shells, pp. 115-116.
1871. *?Cardium isocardia* Linnaeus, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 135.
1875. *Cardium eburniferum* Guppy, Ann. Mag. Nat. Hist., ser. 4, vol. 15, p. 51, pl. 7, fig. 3.
1878. *Cardium isocardia* Linnaeus, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 258.
1878. *Cardium isocardia* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15.
1887. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1037.
1889. *Cardium isocardia* Linnaeus, Dall, U. S. Nat. Mus., Bull. 37, p. 52.
1891. *Cardium isocardia* Linnaeus, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1891. *Cardium isocardia* ? Linnaeus, Heiprin, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 143.
1900. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1085.
1901. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1214, p. 385 (part).
1901. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 488 (part).
1920. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 94 (part).
1923. *?Cardium isocardia* Linnaeus, Clench, Nautilus, vol. 37, No. 2, p. 55.
1924. *Cardium isocardia* Linnaeus, Mansfield, Florida State Geol. Survey, Fifteenth An. Rept., list following p. 28.
1925. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 277-278, pl. 22, figs. 5, 7.
1926. *Cardium isocardia* Linnaeus, Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1930. *Trachycardium isocardia* (Linnaeus), Stewart, Acad. Nat. Sci. Philadelphia, Spec. Paper No. 3, p. 263.
1934. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 45 (part).
1936. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 165.
1936. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 165.
1938. *Cardium isocardia* Linnaeus, Richards, Geol. Soc. Amer., Bull., vol. 49, p. 1291.
1939. *Cardium* (*Trachycardium*) *isocardia isocardia* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 13, No. 3, p. 159-160, pl. 23, figs. 1-2.
1943. *Trachycardium isocardia* (Linnaeus), Gardner, U. S. Geol. Sur., Prof. Paper 199-A, pp. 91-92 (part).
1944. *Trachycardium isocardia* (Linnaeus), Clench and Smith, Johnsonia, vol. 1, No. 13, pp. 3-4, pl. 2.
1945. *Laevicardium isocardia* (Linnaeus), van Bentham Jutting, Geolog.-Mijnbouk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Trachycardium isocardia* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 100.
1946. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Hertlein and Strong, Zoologica, vol. 31, pt. 3, No. 10, p. 147.

1951. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 70, pl. 14, fig. 1.
1952. *Trachycardium isocardia* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 182.
1952. *Cardium isocardia* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 59.
1953. *Cardium* (*Trachycardium*) *isocardia* Linnaeus, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 100, pl. 10, fig. 2.
1954. *Trachycardium isocardia* (Linnaeus), Abbott, American Seashells, p. 397.
1958. *Trachycardium isocardia* (Linnaeus), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, p. 170.
1958. *Trachycardium* (*Trachycardium*) *isocardia* (Linnaeus), Keen, Sea Shells of Tropical West America, pp. 114-115.
1959. *Trachycardium isocardia* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 13.
1961. *Trachycardium isocardia* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetens.-Amsterdam, Proc., Ser. B, vol. 64, No. 2, p. 300.
1961. *Trachycardium* (*Trachycardium*) *isocardia* (Linnaeus), Olsson, Panamic-Pacific Pelecypoda, p. 245.
1961. *Trachycardium isocardia* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 182, pl. 4d; 37L.

A broken right valve of a Cabo Blanco fossil seems referable to this species. The shell is robust, subquadrate, and strongly ribbed, the total number of ribs estimated at 37. Crossing the crest of the ribs over the whole of the exterior are prominent arched scales, the scales asymmetrically vaulted toward the posterior of the valve, with the broad side of the scales on the posterior side of the ribs, the vaulting more symmetrical anteriorly, the arches thickened on the anterior submargin and the base, the ventrad face of the thickened arches upturned. Interspaces deep, somewhat narrower than the ribs, traversed by crowded growth incrementals. Inner margins fluted, the internal ribs lightly grooved along the middle, extending a short distance inward. Anterior adductor impression rather faint, large, high, suboval; posterior adductor not seen.

Dimensions.—Specimen S500a, half of a right valve, complete height 66 mm.; thickness 24 mm. Specimen 1499a, a fragment of the base, length 41 mm.

Localities.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Two specimens, one of them the anterior half of a right valve, the other a large fragment. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One fragment.

Remarks.—So far as comparison can be made, the Cabo Blanco

fossil appears to be the same as the Recent Caribbean *T. isocardia* (Linnaeus). The other Recent Caribbean species of *Trachycardium* is *T. egmontianum* (Shuttleworth) (see Clench and Smith, 1944, pp. 4-5, pl. 3) but the species, although similar to, and sometimes mistaken for *T. isocardia,* has 27 to 31 ribs compared with 31 to 37 on *T. isocardia.* The west American analogue of *T. isocardia* is the Pleistocene and Recent *T. consors* (Sowerby) (see Keen, 1958, p. 114, pl. 3), and that is distinguished from *T. isocardia* by its fewer ribs (30-34) and more inflated valves.

Range and distribution.—The living *T. isocardia* (Linnaeus), according to Clench and Smith, is a Caribbean species extending from Hispaniola to northern South America. Other authors would extend the range to Florida and as far north as North Carolina, but in some instances at least, the form so identified must be the long-overlooked *T. egmontianum* (Shuttleworth). Nevertheless, the fossil *T. isocardia* has been reported by competent observers from the Pliocene of North Carolina and Florida, and the Pleistocene of South Carolina, Florida, and Louisiana. In the tropics, *T. isocardia* was reported by Guppy from the Pliocene of Trinidad (although this has not been confirmed), and Heilprin identified the species with question from the Pliocene of the Yucatan Peninsula, México. In the Pleistocene of the Caribbean area *I. isocardia* is recorded from St. Kitts, and Venezuela.

Trigoniocardia (Trigoniocardia) caboblanquensis, new species
Pl. 35, figs. 10-12; Pl. 36, figs. 2-6

Shell small, subrhomboidal, inflated, slightly oblique. Anterior end gently rounded, ventral margin shallowly arcuate to subtruncate, posterior margin almost vertically truncate, the corner of the base and posterior margin subangular, the angle a little more than 90 degrees. Posterior area fairly wide, strongly sloping, flattened to hardly concave, the umbonal ridge prominent and well differentiated. Umbo high, the beak evenly convex, incurved, prosogyrate, subcentral. Lunule small, subcordate, rather well defined, not depressed except immediately under the beak, separated from the disk by the first intercostal groove which is relatively faint, nearly smooth except for minute concentric growth lines. Escutcheon of

left valve rather narrow and lanceolate, that of the right valve somewhat broader, subelliptical, and also smooth. Dentition normal, the anterior cardinal of the left valve and the posterior cardinal of the right valve robust, upcurved, and separated from the smaller and higher secondary cardinal by a deep trigonal pit. Laterals prominent but obtuse, the anterior laterals nearer the beak than the posterior, those of the right valve separated from the dorsal margins by deep grooves; on the left valve there is a fairly deep pit in front of the anterior lateral, and a more elongated one under the rear of the posterior lateral. Adductor impressions distinct, rather large, high, the anterior one rudely and obtusely triangular, the posterior one oval to subangularly ovate. Pallial line regular, not remote from, and parallel with the margins, joining the base of the adductor impressions. Inner margins fluted. Surface sculptured by generally 19 or 20 radial ribs of which there are 7 on the posterior area and 6 extra large ones on the central area of the disk. The ribs are separated by square interspaces which are deep and half the width of the ribs on the disk, but shallower and narrower on the submargins. Within the interspaces are strong, regular, equally spaced concentric cords decussating the interradials on the disk into oblong pits. These cords are confined to the trough of the interspaces, but on the side and crest of the ribs there are crowded microscopic concentric growth striae which are generally worn off the crests. The rib forming the umbonal ridge is high and symmetrically rounded; the next three ribs forward of the ridge are asymmetrical, gently rounded on the broad crest, the posterior side with a relatively high slope; farther forward the ribs are flattened both on the disk and anterior submargin, and the interspaces become progressively narrower and shallower anteriorward. The two or three ribs behind the umbonal ridge are moderately high and more or less equal in size, with the one or two nearest the ridge sometimes faintly bipartite; the remainder of the ribs on the posterior area become progressively wider, lower, and flatter toward the posterior margin as they do on the anterior end. Here and there on both the disk and submargins, the crest of the ribs may bear a few small nodes or tubercles. In some places there may be a number of regularly spaced tubercles on a rib, in others they seem to be entirely random, and on most specimens they are wanting, either

because of having been worn off or because of inherint sporadic development. On the best preserved specimens from the Cabo Blanco area the tubercles are sparse and erratically distributed.

Dimensions.—Holotype (G496d), right valve, height 10.2 mm.; width 8.2 mm.; thickness 4.9 mm. Paratype (G496c), right valve, height 11.3 mm.; width 10.1 mm.; thickness 4.8 mm. Paratype (G496b), left valve, height 10.9 mm.; width 9.2 mm.; thickness 5.3 mm. Paratype (G496a), left valve, height 9.1 mm.; width 8.5 mm.; thickness 3.2 mm.

Type locality.—Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Forty-seven specimens including twenty-five left valves and twenty-two right valves.

Other localities.—Upper Mare formation, 115 meters south-southwest of the crossing of Quebrada Mare Abajo and the coast road. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Ten specimens including six left valves and four right valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Four specimens including two right valves and two left valves. Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. Three specimens including two left valves and one right valve.

Comparisons.—*Trigoniocardia* is abundantly represented in the late Cenozoic of the Americas, and there are a number of species to which *T. caboblanquensis,* n. sp. exhibits affinity although not comparing precisely with any of them. Listed below are the Tertiary and Quaternary species of *Trigoniocardia* from America—all of them tropical in habitat—that have come to my attention:

T. antillarum (d'Orbigny), (1842 [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, Atlas, pl. 27, figs. 53-55; 1853 (text), vol. 2, p. 309). According to Dall (1901, U. S. Nat. Mus., Proc., vol. 23, No. 1214, p. 387) and to Abbott (1958, Acad. Nat. Sci. Philadelphia, Mon. No. 11, pp. 123-124), *T. ceramidum* Dall (1886, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 269, pl. 4, fig. 6) is synonymous. Pleistocene in Barbados?, and Recent from the Bahamas to the Virgin Islands. *T. antillarum* has 16 to 18 ribs as compared with 19 to 20 on the Venezuelan fossil, and the interspaces

of *T. antillarum* are wider on the disk than on *T. caboblanquensis*, n. sp.

T. haitense haitense (Sowerby) (see Woodring, 1925, Carneige Inst. Washington, Publ. No. 366, pp. 142-143, pl. 19, figs. 8-9). Lower ? to middle Miocene. This is more oblique than *T. caboblanquensis* and has two more ribs than the Venezuelan shell.

T. haitense cercadicum Maury (1917, Bull. Amer. Paleont., vol. 5, p. 376, pl. 36, fig. 6). Lower ? Miocene of Puerto Rico, and middle Miocene of the Dominican Republic and Jamaica. This has 10 ribs on the posterior area, *T. caboblanquensis* 7.

T. haitense areciboense Hubbard (1920, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 3, pt. 1, pp. 117-118, pl. 19, fig. 9). Upper Oligocene to lower Miocene of Puerto Rico. This is a triangularly rhomboidal shell with 17 ribs.

T. thaumastum Woodring (1925, p. 144, pl. 19, figs. 12-13). Middle Miocene, Jamaica. The posterior ridge is sharply angular at the umbo; on *T. caboblanquensis* it is rounded.

T. hannai Olsson (1932, Bull. Amer. Paleont., vol. 19, No. 68, pp. 99-100, pl. 8, figs. 4, 9, 10, 11). Lower Miocene, Peru. This is slightly larger and much more sturdy than *T. caboblanquensis* and is more obtuse in outline.

T. spiekeri Hanna and Israelsky (see Olson, 1932, p. 100, pl. 8, figs. 3, 7). Tumbez formation (upper Miocene) of Peru, and Jama formation (Pliocene) of Ecuador. The outline is obliquely subovate, and the ribs are flatter than on *T. caboblanquensis.*

T. sambaicum sambaicum Maury (1917, p. 376, pl. 36, fig. 7). Lower Miocene of Puerto Rico and middle Miocene of the Dominican Republic. Twenty-seven ribs compared with 19 or 20 on *T. caboblanquensis.*

T. sambaicum portoricoensis Hubbard (1920, p. 116, pl. 19, figs. 5-6). Lower Miocene ? of Puerto Rico. Among other differences the concentric threads in the interspaces are finer than on *T. caboblanquensis.*

T. heredium Olsson (1922, Bull. Amer. Paleont., vol. 9, No. 39, p. 399, pl. 27, fig. 10). Middle Miocene, Costa Rica. This species is more sharply carinated on the umbonal ridge, and bears one more

rib on the posterior area than *T. caboblanquensis,* but otherwise the two forms are similar.

T. callopleurum Gabb (1881, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 375, pl. 47, fig. 77). Pliocene, Costa Rica. The umbonal ridge is not so well developed, nor the ribs so broad as on *T. caboblanquensis.*

T. aminense Dall (1900, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1104; 1903, pl. 48, fig. 11). Middle Miocene, Dominican Republic. The posterior end bears 10 radial ribs compared with 7 on the Venezuelan shell.

T. mirandense Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, p. 287, pl. 23, fig. 10). Lower Miocene, Venezuela. This is more sharply carinated than the Cabo Blanco shell, and all of the ribs, of which there are 22 (8 on the truncation), are conspicuously and evenly beaded.

T. carolinae Maury (1912, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 15, p. 54, pl. 9, figs. 5-6). Lower-middle Miocene and Pliocene of Trinidad. This has 17 ribs, *T. caboblanquensis* 19 or 20.

T. castum castum (Guppy) (1866, Geol. Soc. London Quart. Jour., vol. 22, pl. 582, pl. 26, fig. 4). Lower-middle Miocene, Trinidad. The umbo is narrower, and the outline more oblique than on *T. caboblanquensis.* Also there are 22 ribs on the type of *T. castum* compared with 19 or 20 on the Venezuelan species.

T. castum brassicum (1925, p. 285, pl. 23, fig. 6). Lower-middle Miocene, Trinidad. This is an elongate-oval form in contrast with *T. caboblanquensis* which is subrhomboidal.

T. manzanillense Maury (1925, pp. 235-236, pl. 23, fig. 4). Lower-middle Miocene, Trinidad. The Venezuelan *T. caboblanquensis,* n. sp. closely resembles *T. manzanillense* but differs in having one less rib on the posterior area and a shorter posterodorsal margin which curves gently, rather than subangularly, into the posterior margin.

T. perii-maris Maury (1925, p. 288, pl. 23, fig. 8). Pliocene, Trinidad. This species has 24 ribs (of which nine are on the truncation), and there is a radial depression in front of the umbonal ridge producing an embayment of the basal margin.

T. gatunense (Dall) (1900, pp. 1101-1102). Lower Tertiary ? of the Panama Canal Zone. Twenty-six ribs.

T. alicula Dall (1900, p. 1103, pl. 40, fig. 12; 1903, pl. 48, fig. 5). Middle Miocene, Florida. This is obliquely diamond-shaped whereas *T. caboblanquensis* is subrhomboidal.

T. simrothi Dall (1900, p. 1104; 1903, pl. 48, fig. 8). Middle Miocene, Florida. The interradial cords are finer than on *T. caboblanquensis,* and the rib on the umbonal ridge is flexuous instead of straight as on the Venezuelan fossil.

T. willcoxi Dall (1900, p. 1106; 1903, pl. 48, fig. 9). Pliocene, Florida. Body with nine, the posterior area with eight ribs.

T. apateticum Dall (1900, pp. 1105-1106; 1903, pl. 48, fig. 6). Middle Miocene, Florida. When perfectly intact this species is without tubercles.

T. sellardsi Gardner (1926, U. S. Geol. Sur., Prof. Paper 142-C, pp. 140-141, pl. 23, figs. 11-12). Chipola formation (middle Miocene), Florida. Nine ribs on the posterior area.

T. deadenense Mansfield (1932, Florida State Geol. Sur., Bull. No. 8, pp. 113-114, pl. 22, figs. 2-5). Late Miocene, northwest Florida. The Venezuelan *T. caboblanquensis* is close to *T. deadenense* but the Floridan shell has eight beaded ribs on the posterior area.

T. galvestonense (Harris) (1895, Bull. Amer. Paleont., vol. 1, No. 3, p. 91, pl. 1, figs. 3, 3a). Later Miocene in Galveston well, Texas, 2,443 to 2,871 feet. The Venezuelan shell is closely related to *T. galvestonense* differing slightly in having somewhat broader ribs and a shorter posterodorsal margin which curves gently into the posterior margin rather than subangularly as on the Texas species.

T. maturense Dall (1900, p. 1105; 1903, pl. 48, fig. 7). Pliocene at Matura, Trinidad. The posterior area has eight or nine ribs, *T. caboblanquensis* seven.

T. cabopasadum Pilsbry and Olsson (1941, Acad. Nat. Sci. Philadelphia, Proc., vol. 93, p. 59, pl. 12, figs. 6-7). Pliocene, Ecuador. Sculptured by 23 ribs of which 7 are on the posterior slope.

T. graniferum (Broderip and Sowerby) (see Keen, 1958, p. 118, fig. 256). Pliocene of Ecuador; Pleistocene of Baja California,

Mexico; Recent, from México to Peru in depths to 14 fathoms. This is a broader shell than *T. caboblanquensis.*

T. obovale (Sowerby) (see Keen, 1958, p. 118, fig. 257). Pliocene of Panamá and Ecuador; Pleistocene of the Tres Marías Islands, México; Recent from Baja California to Peru in depths to 40 fathoms. This is an elongately subovate form.

T. panis-sacchari van Regteren Altena (1961, pp. 202-203, figs. 1-4) from the Pleistocene of Sugar Loaf, Eustatius, has 22 to 24 radial ribs compared with 19 to 20 on *T. caboblanquensis,* has a wider and more flaring posterior area than *T. caboblanquensis,* and is larger than the Cabo Blanco species.

Trigoniocardia (Americardia) media (Linnaeus) Pl. 36, figs. 7-12

1758 *Cardium medium* Linnaeus, Syst. Nat., ed. 10, p. 678, No. 61.
1767. *Cardium medium* Linnaeus, Syst. Nat., ed. 12, p. 1122, No. 77.
1782. *Cardium medium* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 169, pl. 16, figs. 162-164.
1791. *Cardium medium* Linnaeus, Gmelin, Syst. Nat., ed. 13, p. 3246.
1792. *Cardium medium* Linnaeus, Bruguière, Encycl. Méth., p. 213, pl. 295, fig. 4.
1818. *Cardium medium* Linnaeus, Lamarck, An. sans Vert., vol. 6, p. 15.
1823. *Cardium medium* Linnaeus, Mawe, The Linnaean System of Conchology, pl. 7, fig. 1.
1825. *Cardium medium* Linnaeus, Wood, Index Testaceologicus, pl. 5, fig. 5.
1844. *Cardium medium* Linnaeus, Reeve, Conch. Icon., vol. 2, *Cardium,* pl. 6, sp. 30.
1845. *Cardium medium* Linnaeus, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 336.
1855. *Cardium medium* Linnaeus, Hanley, Ipsa Linnaei Conchylia, p. 47.
1861. *Cardium venustum* Dunker, Malakozool. Blätter, vol. 8, p. 37.
1864. *Cardium medium* Linnaeus, Krebs, The West Indian Marine Shells, p. 116.
1869. *Cardium medium* Linnaeus, Römer, [in] Syst. Conchylien-Cabinet, Neue Ausg., p. 102, pl. 4, figs. 5-7.
1878. *Cardium medium* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15.
1881. *Cardium medium* Linnaeus, Gabb, Acad. Nat. Sci. Philadelphia, Jour., 2d ser., vol. 8, p. 374.
1881. *Cardium medium* Linnaeus, Dall, Mus. Comp. Zool., Bull., vol. 9, p. 132.
1885. *Cardium (Fragum) medium* Linnaeus, Smith, Voyage of H.M.S. Challenger, Zoology, vol. 13, p. 163.
1886. *Cardium medium* Linnaeus, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 269.
1887. *Hemicardium columba* Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 93, pl. 11, figs. 26, 26a. *Fide* Dall. Olsson and Harbison (1953, p. 104, pl. 10, figs. 3, 3a, 3b, 5) consider *H. columba* to be distinct from *T. media.*
1889. *Cardium medium* Linnaeus, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 65.
1889. *Cardium medium* Linnaeus, Dall. U. S. Nat. Mus., Bull. 37, p. 52.

1889. *Cardium medium* Linnaeus, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 126, 141, pl. 1, fig. 22.
1890. *Cardium medium* Linnaeus, Linnean Soc. London, Jour., vol. 20, p. 497.
1895. *Ctenocardia* (*Fragum*) *medium* (Linnaeus), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 292.
1900. *Cardium* (*Fragum*) *medium* Linnaeus, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1101-1102.
1901. *Cardium* (*Fragum*) *medium* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 488.
1901. *Cardium* (*Fragum*) *medium* Linnaeus, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1214, p. 386.
1904. *Cardium* (*Fragum*) *medium* Linnaeus, Glenn, Maryland Geol. Sur., Miocene, p. 322, pl. 86, figs. 6a, 6b.
1913. *Cardium medium* Linnaeus, Brown and Pilsbry, Acad. Nat Sci. Philadelphia, Proc., vol. 65, p. 496.
1916. *Cardium medium* Linnaeus, Thiele, Zool. Jahrb., Suppl. 11, p. 129.
1919. *Cardium* (*Fragum*) *medium* Linnaeus, Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, p. 17.
1920. *Cardium* (*Fragum*) *medium* Linnaeus, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 96.
1922. *Cardium* (*Fragum*) *medium* Linnaeus, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 189, 194, 205, 398-399, pl. 27, fig. 6.
1925. *Cardium* (*Fragum*) *medium* Linnaeus, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 283-284, pl. 23, fig. 10.
1925. *Cardium* (*Fragum*) *medium* Linnaeus, Woodring, Carnegie Inst. Washington, Publ. No. 366, p. 140-141, pl. 19, figs. 5-6.
1926. *Cardium* (*Fragum*) *medium* Linnaeus, Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1930. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Stewart, Acad. Nat. Sci. Philadelphia, Spec. Publ. No. 3, pp. 267-268.
1933. *Cardium* (*Fragum*) *medium* Linnaeus, Trechmann, Geol. Mag., vol. 70, No. 823, p. 35.
1934. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 46.
1935. *Cardium medium* Linnaeus, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Trigoniocardia medium* (Linnaeus), McLean, Nautilus, vol. 49, No. 4, p. 118.
1936. *Cardium* (*Hemicardium*) *medium* Linnaeus, Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1936. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 166.
1937. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Smith, East Coast Marine Shells, p. 50, pl. 17, figs. 5a, 5b.
1938. *Trigoniocardia medium* (Linnaeus), Perry, Schwengel, and Dranga, Nautilus, vol. 52, No. 1, p. 28.
1939. *Cardium medium* Linnaeus, Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 17, 19, 26, 29.
1939. *Cardium* (*Americardia*) *medium* Linnaeus, McLean, Soc. Cubana Hist. Nat., Mem., vol. 13, No. 3, p. 167, pl. 25, figs. 1-2.
1942. *Cardium* (*Fragum*) *medium* Linnaeus?, Haas, Jour. Paleont., vol. 16, No. 3, p. 308.
1942. *Trigoniocardia medium* (Linnaeus), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1943. *Trigoniocardia* (*Americardia*) *media* (Linnaeus), Gardner, U. S. Geol. Sur., Prof. Paper 199-A, p. 93.

1944. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Clench and Smith, Johnsonia, vol. 1, No. 13, pp. 21-22, pl. 11, figs. 1-2.
1945. *Corculum medium* (Linnaeus), van Bentham Jutting, Geolog.-Mijnbowk Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Trigoniocardia* (*Americardia*) *media* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 100.
1949. *Corculum* (*Fragum*) *medium* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art, 1, p. 35.
1951. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 73, pl. 14, fig. 6.
1952. *Cardium medium* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 56.
1953. *Trigoniocardia* (*Americardia*) *medium* (Linnaeus), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 104.
1954. *Trigoniocardia medium* (Linnaeus), Abbott, American Seashells, pp. 398-399, pl. 39m.
1955. *Trigoniocardia media* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 68, pl. 41, fig. 293.
1958. *Trigoniocardia* (*Americardia*) *media* (Linnaeus), Keen, Sea Shells of Tropical West America, p. 119.
1958. *Americardia media* (Linnaeus), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 124.
1958. *Trigoniocardia medium* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Trigoniocardia medium* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 14.
1961. *Trigoniocardia* (*Americardia*) *media* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.
1961. *Americardia media* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 183, pl. 38b.

This species occurs both Recent and fossil in the Cabo Blanco area. The adult Recent shells are sculptured by 36 ribs of which 9 to 11 are on the posterior slope; the adult fossil specimens bear 39 to 41 ribs of which there are 9 or 10 on the posterior slope. The shell is subrhomboidal, with a prominent beak, a depressed posterior truncation which is indented at the margin below the middle, and a steeply descending umbonal ridge which is sharp at the umbo, angular to subangularly rounded below. The radial ribs of the disk are strong and regular, the interspaces deep and much narrower than the ribs; on the posterior truncation three or four of the ribs near the posterodorsal margin are wider than the others, and two or three of the ribs along the middle of the truncation are slightly narrower than those on the side of the umbonal ridge. The ribs and interspaces are crossed by numerous regular concentric lamellae arched upward on the crest of the ribs. The Recent shells are whitish

with chestnut-brown mottlings and radial stripes externally, white within.

Dimensions.—Recent specimen (A497a), left valve, height 17.9 mm.; length 16.1 mm.; thickness 6.4 mm. Fossil specimen (A497al-2), a doublet, height 29.3 mm.; length 26.1 mm.; thickness of pair 24.1 mm. Largest fossil specimen, right valve, height 36.7 mm.; length 32.9 mm.; thickness 17.8 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Three left valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline Four specimens including two right valves, one left valve, and on doublet.

Range and distribution.—Recent, North Carolina to Brazil at depths of 2 to 100 fathoms. Pleistocene in Cuba, the Panama Canal Zone, St. Kitts, St. Eustatius, Curaçao, Venezuela, and Barbados. Pliocene in North Carolina, Florida ?, and Costa Rica. Upper Miocene in Maryland, North Carolina, and South Carolina. Middle Miocene in Costa Rica, the Dominican Republic, and Jamaica.

A west American counterpart of *T. media* (Linnaeus) is *T. guanacastense* (Hertlein and Strong) (1947, Zoologica, vol. 31, pt. 3, No. 10, pp. 140-141) which ranges from Baja California to Peru, and which has been recorded from the Pliocene of Costa Rica and the Pleistocene of Ecuador.

Laevicardium ?, species Pl. 36, figs. 13, 14

Shell small, inflated, broken, probably subquadrate when whole. Beak small, low, full, and prosogyrate. Lunule not defined. Outer layer of shell with microscopic concentric wrinkles or lineations, the underlying layer with fine, hardly discernible radiating riblets. Hinge mutilated but seems to be like that of *Laevicardium.* Interior filled with sand.

Dimensions.—Specimen H550a, right valve (not complete), height 1.7 mm.; length 1.5 mm.; thickness 0.9 mm.

Locality.—Mare formation at W-25, south flank of Punta Gorda anticline. One imperfect right valve.

Remarks.—The juvenile fossil is reminiscent of the Pliocene

to Recent *L. mortoni* (Conrad) (1829, Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 6, pp. 259-260, pl. 11, figs. 5-7), but it is too small and imperfect for definitive comparison.

Papyridea aff. **soleniformis** (Bruguière) Pl. 37, figs. 1, 2

1778. *?Cardium latum* Born, Index Rerum Naturalium Caesarei Vindobonensis, p. 67.
1780. *?Cardium latum* Born, Testacea Musei Caesarei Vindobonensis, p. 48, pl. 3, fig. 9 (in the text wrongly as fig. 8, *fide* Dall).
1782. *Solen bullatus* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 65, pl. 6, figs. 49-50. Not of Linnaeus 1758, Syst. Nat., ed. 10, p. 673.
1787. *Cardium hiatus* Meuschen, Museum Geversianum, p. 442. Refers to Gualtieri 1742, Index Testarum Conchyliorum, pl. 85, fig. H.
1787. *Cardium spinosum* Meuschen (*non* Solander 1786), Museum Geversianum, p. 242. Refers to Lister 1685, Synopsis Methodicae Conchyliorum, pl. 342, fig. 179.
1789. *Cardium soleniforme* Bruguière, Encycl. Méth., vol. 1, pt. 1, p. 235.
1815. *Cardium soleniforme* Bruguière, Wood, General Conchology, N. 233, pl. 56, fig. 3.
1840. *Papyridea soleniforme* (Bruguière), Swainson, A Treatise on Malacology, p. 374.
1845. *Cardium bullatum* (Linnaeus), Reeve, Conch. Icon., vol. 2, *Cardium,* sp. 8, Not of Linnaeus 1758.
1845. *Cardium hiulcum* Reeve, Conch. Icon., vol. 2, *Cardium,* pl. 21, sp. 123.
1845. *Cardium bullatum* Lamarck, d'Orbigny, Hist. Fís., Polít., y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 337.
1862. *Cardium* (*Fulvia*) *bullatum* (Chemnitz), Chenu, Manuel de Conchyliologie et de Paléontologie Conchylologique, vol. 2, p. 109, figs. 500-502.
1864. *Cardium soleniforme* Bruguière, Krebs, The West Indian Marine Shells, p. 117.
1869. *Cardium* (*Papyridea*) *bullatum* (Chemnitz), Römer, Syst. Conchylien-Cabinet, ed. 2, vol. 10, pt. 2, p. 74, pl. 12, figs. 13-16.
1872. *Papyridea bullata* (Linnaeus), Tryon, Amer. Jour. Conch., vol. 7, pt. 4, Appendix, No. 13, p. 267. Not of Linnaeus 1758.
1878. *Cardium spinosum* Meuschen, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Cardium spinosum* Meuschen, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 259.
1881. *Papyridea bullata* (Linnaeus), Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 375. Not of Linnaeus 1758.
1884. *Cardium* (*Fulvia*) *bullata* (Linnaeus), Tryon, Structural and Systematic Conchology, vol 3, p. 192, pl. 116, fig. 78. Not of Linnaeus 1758.
1885. *Cardium* (*Papyridae*) *bullatum* (Chemnitz), Smith, Voyage H.M.S. Challenger, Zoology, vol. 13, pp. 161-162.
1889. *Papyridea bullata* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 54. Not of Linnaeus 1758.
1889. *Cardium bullatum* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 65.
1900. *Cardium* (*Papyridea*) *spinosum* Meuschen, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1106-1107.
1901. *Cardium* (*Papyridea*) *spinosum* Meuschen, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1214, p. 387.
1901. *Cardium* (*Papyridea*) *spinosum* Meuschen, Dall and Simpson, U.S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 489.

1920. *Cardium (Papyridea) spinosum* Meuschen, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 96-97.
1925. *Cardium (Papyridea) spinosum* Meuschen, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 289-290.
1931. *Cardium soleniforme Bruguière,* Grant and Gale, San Diego Soc. Nat. Hist., Mem., vol. 1, p. 311.
1935. *Cardium spinosum* Meuschen, Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Papyridea spinosa* (Meuschen), McLean, Nautilus, vol. 49, No. 4, p. 118.
1936. *Papyridea spinosum* (Meuschen), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Cardium (Papyridea) spinosum* Meuschen, Lermond, Check List of Florida Marine Shells, Gulfport, p. 8.
1938. *Papyridea spinosa* (Meuschen), Aguayo, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 12, No. 2, p. 102.
1939. *Papyridea spinosum* (Meuschen), McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 13, No. 3, pp. 164-165, pl. 24, figs. 3, 9.
1940. *Papyridea spinosum* (Meuschen), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 46.
1940. *Papyridea spinosa* (Meuschen), Smith, World-wide Sea Shells, p. 107, fig. 1414
1942. *Papyridea spinosum* (Meuschen), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol 16, No. 1, p. 39.
1944. *Papyridea hiatus* (Meuschen), Clench and Smith, Johnsonia, vol. 1, No. 13, pp. 17-18, pl. 4, figs. 3-5.
1947. *Cardium spinosum* (Meuschen), Hertlein and Strong, Zoologica, vol. 31, No. 10, p. 139.
1949. *Papyridea spinosa* (Meuschen), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 34
1950. *Papyridea soleniforme* (Bruguière), Durham, Geol. Soc. Amer., Mem. 43, 43, pt. 2, p. 80.
1951. *Papyridea hiatus* (Meuschen), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 71, pl. 15, fig. 1.
1953. *Papyridea (Papyridea) spinosa* (Meuschen), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Papyridea soleniformis* (Bruguière), Abbott, American Seashells, p. 398, pl. 39n.
1955. *Papyridea soleniformis* (Bruguière), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 68, pl. 13, fig. 74.
1956. *Papyridea soleniformis* (Bruguière), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, p. 309.
1958. *Papyridea soleniformis* (Bruguière), Keen, Sea Shells of Tropical West America, p. 118.
1958. *Papyridea soleniforme* (Bruguière), Olsson and McGinity, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Papyridea soleniformis* (Bruguière), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 13.
1961. *Papyridea hiatus* (Meuschen), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.
1961. *Papyridea soleniformis* (Bruguière), Olsson, Panamic-Pacific Pelecypoda, p. 250.
1961. *Papyridea soleniformis* (Bruguière), Warmke and Abbott, Caribbean Seashells, pp. 182-183, pl. 37j.

The Venezuelan fossil referred to *P. soleniformis* (Bruguière)

is represented by a single left valve which is worn and framentary. The hinge is unusually sturdy for the species, and the surface is traversed by about 45 radial ribs. The left anterior adductor scar is margined by a faint radial ridgelet.

Dimensions.—Specimen I512a (broken away at the ends and base), length 4.7 mm.; height 3.5 mm.; thickness 1.2 mm.

Locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One imperfect left valve.

Remarks.—The west American counterpart of *P. soleniformis* is the Pleistocene to Recent *P. aspersa* (Sowerby) (see Durham, 1950, p. 80, pl. 19, figs. 6, 19). According to Durham, *P. aspersa* may be separated from *P. soleniformis* "by more deeply channeled interspaces between the ribs, by the lesser posterior elongation, by the posterior lateral teeth being slightly closer to the beaks, and by the cardinal tooth sloping more anteriorly."

Range and distribution.—*P. soleniformis* (Bruguière) ranges from Pliocene to Recent. The living shell ranges from North Carolina, U.S.A., to Brazil. The fossil shell is recorded from the Pleistocent of Cuba and St. Kitts, and from the Pliocene of Costa Rica.

VENERIDAE

Dosinia (Dosinidia) concentrica prosapia, new subspecies Pl. 37, figs. 3-10; Pl. 38, figs. 1-4; Pl. 39, figs. 1, 2; Pl. 58, figs. 10, 11

Shell attaining a large size, moderately compressed to a little inflated, subcircular and thin when young, suborbicular to suboval and with a strong hinge plate when adult. Anterodorsal margin short and concave at the lunule, the posterodorsal margin long, gently convex, rather steeply sloping, and sharp at the edge. The greatest width generally is above the middle, whence the sides, on specimens of medium size, tend to converge toward the nearly semicircular ventral margin. On a number of specimens the greatest length is from the beak to the posterior end of the ventral margin where the valve is slightly produced. Beak subcentral, low, prosogyrate. Lunule relatively small, rather deeply depressed, cordate, marked by faint lirae which are a continuation of the concentric ribs from the umbonal area. Escutcheon absent. Exterior sculptured by flat subregular concentric ribs on the middle of the disk, the

ribs developing into raised subrounded ridges toward the extremities. There are about seven ribs to the centimeter on the middle area of the disk, but on the umbo and near the base they are closer together, those on the umbo quite regular; some of the ribs are intercalated and do not reach the margins. Hinge plate sturdy, excavated underneath, the base of the plate sharply curved downward below the anterior lateral, shallowly arcuate upward thereafter to the top of the posterior adductor scar. Ligamental platform large, flat, elongate-semielliptical, the base of the platform straight. In front of the platform, the nymph is hollowed deeply under the beak. Right valve with a small pit in front of and below the anteriormost cardinal tooth. The two right anterior cardinal teeth are close together, subparallel, and separated by a deep sublinear slit; the forward tooth of the pair is high and laminar, the hinder tooth of the pair higher, stouter, and more or less wedge-shaped, with a flat face at the slit, and a broad curved side away from the slit. The medial socket behind the latter cardinal is obliquely ovate, and after the socket there is a broad bipartite cardinal tooth, the asymmetrical sulcus dividing the tooth broad and relatively shallow, the walls on either side of the socket rather sharp. Behind the middle cardinal there is another deep narrow cleft, that bordered by a narrow ridge representing the posterior cardinal. Left valve with three divergent cardinal teeth; the anterior of these is sharp and narrowly bifid along the face, and, on the hinge plate below it, there is a small lateral node fitting into the corresponding pit of the opposite valve; the middle cardinal of the left valve is medially sulcate, and the posterior cardinal laminar; the socket between the anterior and middle cardinals is triangular, the socket between the middle and posterior teeth rather broad and sublinear. Inner anterior margin at upper end of valve broadly and shallowly concave, the concavity produced by a thickening along the front margin of the anterior adductor scar. Adductor scars large and distinct, the anterior one lenticularly ovate and narrowed above, the posterior scar broader and subpyriform. Pallial line remote from the margin and parallel with it. Pallial sinus triangular, sharply pointed at the apex on adults but blunted on juveniles, directed forward at an angle of about 45 degrees, the apex nearly reaching to the center of the valve.

Dimensions.—Holotype (T418a), right valve, length 75.5 mm.; height 75 mm.; thickness 14.5 mm. Paratype (R419a1-2), paired valves separated by a filling of calcareous sandstone, length 67 mm.; height 70.5 mm. Paratype (R419b), hinge area of left valve, height of fragment 47 mm. Paratype (I418a), hinge area of left valve, length of fragment 52 mm. Paratype (G420a1-2), young broken valves of same pair, length 36 mm.; thickness of pair 14.5 mm. Specimen K414a, a doublet (illustrated), length 71.5 mm.; height 74 mm.; thickness of pair 28 mm. Largest specimen (M415a), illustrated, an internal mold of a doublet questionably identified as *D. concentrica prosapia,* n. subsp., length 98.3 mm.; height 89 mm.; thickness 33 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One right valve, the holotype.

Other localities.—Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Three doublets, all partially broken. Mare formation, 115 meters southeast of crossing of Quebrada Mare Abajo and coast road, and 90 meters southeast of W-12. One large broken doublet. Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. Nine specimens including six poorly preserved doublets, the hinges of two right valves, and one hinge of a left valve. Playa Grande formation (Maiquetía member), in Quebrada Las Bruscas approximately 125 meters upstream from junction with Quebrada Las Pailas. Four specimens including three doublets and the hinge of a left valve. Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. One doublet, poorly preserved. Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 40 meters southeast of its intersection with the Playa Grande Yachting Club road. Nine internal molds of paired valves.

Comparisons.—This form is close to *D. concentrica concentrica* (Born) (1780, Testacea Musei Caesarei Vindobonensis, p. 71, pl. 5, fig. 5) and to *D. elegans elegans* Conrad (see Clench, 1942, Johnsonia, vol. 1, No. 3, pp. 1-2, pl. 1). According to Clench, *D. concentrica concentrica* is consistently thicker than *D. elegans elegans* in proportion to height and length and is also not so high as *D.*

e. elegans. A consistent ratio of thickness to height or length cannot be established for the few Cabo Blanco specimens, but the measurements more nearly approach those of *D. c. concentrica*. Furthermore *D. concentrica* is the older name, and I therefore relate the present Venezuelan fossil to that species rather than to *D. elegans*. Whether or not the Cabo Blanco shell is identical with *D. concentrica concentrica* is difficult to determine, but as most of the Cabo Blanco examples are a little higher than long, and *D. concentrica* a little longer than high, the subspecific name of *D. concentrica prosapia* is proposed for the Venezuelan shell here described.

Species which *Dosinia concentrica prosapia,* n. subsp. resembles are the following:

D. elegans Conrad (see Clench, 1942, Johnsonia, vol. 2, No. 3, pp. 1-2, pl. 1). Upper Miocene to Recent, east America. *D. elegans* is a little longer than high, *D. c. prosapia* a little higher than long.

D. elegans venezuelana H. K. Hodson (1927, Bull. Amer. Paleont., vol. 13, No. 49, p. 52). Widespread in the Miocene, State of Falcon, Venezuela. Adults of *D. e. venezuelana* are nearly circular and slightly longer than high, whereas adults of *D. c. prosapia* are suborbicular, and a little higher than long.

D. acetabulum Conrad (1832, Fossil Shells of the Tertiary formations of North America, p. 20, pl. 6, fig. 1). Miocene of New Jersey, Maryland, Virginia, and Florida; also reported from the middle Miocene of Panamá and Costa Rica, and from the Pliocene at Santa María Tatetla, México. As shown by Glenn (1904, Maryland Geol. Sur., Miocene, p. 315, pl. 84, fig. 1) in his illustration of a left valve, the pallial sinus of *D. acetabulum* is not so acutely triangular as that of the Cabo Blanco fossil, and is less oblique than on *D. c. prosapia.*

D. ponderosa (Gray) (see Grant and Gale, 1931, pp. 351-352, pl. 15, figs. 1a, 1b, 1c). Recent from Baja California to Peru; Pleistocene from southern California to Ecuador. The pallial sinus is not as sharply pointed as in *D. c. prosapia.*

D. ponderosa jacalitosana Arnold (1910, U. S. Geol. Sur., Bull. 396, p. 67, pl. 16, fig. 5). Miocene and Pliocene of California, U.S.A., and Baja California, México. The beak is much more prominent than on the Cabo Blanco species.

D. grandis Nelson (1870, p. 201). Upper Miocene of Peru and

Trinidad (as *D. titan* Maury), and the Pliocene of Peru (see Spieker, 1922, pp. 138-140, pl. 8, fig. 4). On shells of equivalent size the concentric ribs of *D. grandis* are wider than those of the Cabo Blanco fossil.

D. ilesca Olsson (1932, Bull. Amer. Paleont., vol. 19, No. 68, pp. 104-105, pl. 9, figs. 1-2) from the lower Miocene Montera formation of Peru is a plumper form than *D. c. prosapia.*

D. delicatissima Brown and Pilsbry (1912, p. 516, pl. 26, fig. 1). Lower Miocene of Peru and Ecuador; middle Miocene of Panamá, Colombia, Venezuela, and Ecuador. The concentric ribs are finer than on the Cabo Blanco shell, and, according to Olsson (1932, p. 103), the lunule is smooth whereas on *D. c. prosapia* it is marked by striae continuing from the disk.

Anomalocardia brasiliana (Gmelin) Pl. 38, figs. 5-8

1780. *Venus flexuosa* Born, Testacea Musei Caesarei Vindobonensis, p. 62, pl. 4, fig. 10. Not of Linnaeus, Syst. Nat., ed. 12, p. 1131, No. 121, 1767.
1791. *Venus brasiliana* Gmelin, Syst. Nat., ed. 13, p. 3289.
1818. *Cytherea macrodon* Lamarck, An. sans Vert., vol. 5, p. 580.
1818. *Cytherea lunularis* Lamarck, An. sans Vert., vol. 5, p. 580.
1834. *Venus macrodon* (Lamarck), Deshayes, An. sans Vert., vol. 6, p. 327.
1834. *Venus lunularis* (Lamarck), Deshayes, An. sans Vert., vol. 6, p. 327.
1843. *Venus macrodon* (Lamarck), Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 116, pl 9, fig. 7.
1844. *Venus lunularis* (Lamarck), Philippi, Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, vol. 1, p. 177, pl. 3, fig. 10.
1845. *Venus flexuosa* d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, vol. 5, Moluscos, pp. 314-315.
1853. *Anomalocardia flexuosa* (Born), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Muesum, pt. 1, p. 116.
1855. *Venus macrodon* (Lamarck), Sowerby, Thes. Conchyl., vol. 2, p. 717, pl. 156, fig. 88..
1863. *Venus macrodon* (Lamarck), Reeve, Conch. Icon., vol. 14, pl. 21, sp. 98b-d.
1864. *Venus flexuosa* Linnaeus, Krebs, The West Indian Marine Shells, p. 96. Not of Linnaeus.
1864. *Venus macrodon* Deshayes, Guppy, Sci. Assoc. Trinidad, Trans., p. 36.
1867. *Venus flexuosa* Linnaeus, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162. Not of Linnaeus.
1873. *Venus flexuosa* Linnaeus, Guppy, Sci. Assoc. Trinidad, Proc., vol. 2, p. 91. Not of Linnaeus.
1878. *Cytherea flexuosa* Lamarck, Mörch, Catalogue of West-India Shells, p. 15.
1883. *Venus flexuosa* Born, Dall, U.S. Nat. Mus. Proc., vol. 6, p. 344.
1884. *Venus (Cryptogramma) macrodon* (Lamarck), Tryon, Structural and Systematic Conchology, vol. 3, p. 176, pl. 113, fig. 13.
1886. *Venus flexuosa* Linnaeus, Karsten, Géologie de l'anciene Colombie bolivarienne, Vénézuéla, Nouvelle Grénade et Ecuador, p. 10. Not of Linnaeus.

1889. *?Venus flexuosus* Linnaeus, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 64. Not of Linnaeus.
1901. *Venus* (*Anomalocardia*) *flexuosa* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 484. Not of Linnaeus.
1902. *Anomalocardia brasiliana* (Gmelin), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, p. 375.
1903. *Anomalocardia brasiliana* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1306.
1913. *Anomalocardia brasiliana* (Gmelin), Jenkins, Amer. Philos. Soc., Proc., vol. 52, No. 211, p. 457.
1920. *Anomalocardia brasiliana* (Gmelin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 107.
1925. *Anomalocardia brasiliana* (Gmelin), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 317-318, pl. 29, figs. 10-11.
1926. *Anomalocardia brasiliana* (Gmelin), Weisbord, Nautilus, vol. 39, No. 3, p. 84.
1927. *Chione* (*Anomalocardia*) *brasiliana* (Gmelin), Palmer, Palaeontographica Americana, vol. 1, No. 5, p. 375 (1927), pl. 36, figs. 5-8, 15-18d, (1929).
1933. *Anomalocardia braziliana* (Gmelin), Trechmann, Geol. Mag., vol. 70, No. 823, p. 36.
1934. *Anomalocardia brasiliana* (Gmelin), Johnson, Boston Soc. Nat. Hist., Proc., vol 40, No. 1, p. 49.
1934. *Anomalocardia brasiliana* (Gmelin), Maury, Amer. Mus. Nat. Hist., Bull., vol. 67, art. 4, pp. 157-158, 164, pl. 18, fig. 6.
1936. *? Anomalocardia brasiliana* (Gmelin), Lermond, Check List of Florida Marine Shells, Gulfport, p. 4
1936. *Cytherea macrodon* Lamarck, Lamy and Fischer-Piette, Mus. Nat. Hist. nat. Paris Bull., vol. 10, No. 2, p. 174.
1937. *Anomalocardia brasiliana* (Gmelin), Smith, East Coast Marine Shells, p. 55, pl. 21, figs. 8a, 8b.
1938. *?Anomalocardia brasiliana* (Gmelin), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1946. *Anomalocardia brasiliana* (Gmelin), Jaume, Soc. Malac. "Carlos de La Torre", Rev., vol 4, No. 3, p. 101.
1946. *Anomalocardia brasiliana* (Gmelin), Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Anomalocardia brasiliana* (Gmelin), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 35.
1951. *Anomalocardia brasiliana* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 86, pl. 17, fig. 10.
1953. *Anomalocardia brasiliana* (Gmelin), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 114.
1958. *Anomalocardia brasiliana* (Gmelin), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Anomalocardia brasiliana* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 15.
1961. *Anomalocardia brasiliana* (Gmelin), Warmke and Abbott, Caribbean Seashells, p. 187, pl. 38g.

The La Salina fossils referred to this species are cuneiform, with a prominent posterior ridge which broadens toward the base to form a subangular submargin, and with a radial depression or sulcus in front of the ridge. The lunule is relatively smooth, cordate,

and hardly depressed, the escutcheon also smoothish, lanceolate, and defined by the weak ridge of the submargin. Surface more or less covered with strong subregular concentric ribs, the ribs irregular and interrupted in the depressed area, but becoming prominent again as they extend over the posterior ridge to the submargin where they play out at the edge of the escutcheon. The interspaces are wider than the concentric ribs and are traversed by low broad subregular radial cords which are particularly pronounced on one of the two specimens collected.

Dimensions.—Specimen C539a, left valve, length 12.7 mm.; height 8.9 mm.; thickness 3.3 mm. Specimen C539b, right valve, length 10.8 mm.; height 8.8 mm.; thickness 3 mm.

Locality.—La Salina, west of Puerto Cabello, State of Carabobo. Two specimens including one left valve and one right valve.

Range and distribution.—According to Abbott (1954), the Recent *A. brasiliana* (Gmelin) ranges from the West Indies to Brazil, though earlier authors have reported it as far north as North Carolina, possibly confusing it with *A. cuneimeris* (Conrad) which is similar but more elongated. The fossil *A. brasiliana* has been recorded from the Pleistocene of Florida, Barbados, and Brazil; from the Pliocene of Florida, Venezuela (near Cumaná), and Trinidad; and, according to Maury (1925, p. 318), from the upper Miocene of Trinidad on Freeport-Todd's road.

Anomalocardia venezuelana, new species Pl. 39, figs. 3-6

Shell small, subrostrate behind, subequilaterally triangular in outline, the posterior end slightly produced, the valve inflated except after the middle where it is flattened. Lunular area gently concave, the anterior end acutely rounded, the basal margin arcuate in front, subtruncate behind, the posterior end bluntly cuneate, the posterodorsal margin hardly convex, with a slope of about 45 degrees. Umbonal region swollen, the beak fairly high, situated a little in front of the middle, prosogyrate. Lunule elongate-cordate, slightly depressed, vaguely defined by the edge of the disk. Escutcheon elongate-elliptical, flattened, weakly delimited by the slight angulation at the margin of the disk, marked by faint growth striae. Surface sculpture consisting of fine subregular concentric riblets

on the umbo, succeeded below by widely spaced concentric laminae which become farther apart toward the base. There are approximately 15 riblets and 10 laminae, the latter extending to, but not over the margins of the lunule and the escutcheon, and forming a rather acute angle at the posterior rostration. The spaces between the laminae are flat and shallow, and are marked by faint microscopic striae. Hinge of right valve with three discrete cardinal teeth, the anterior one a minor lamina, the middle one small but stubbily cuneate, the posterior one relatively long and platy. Along the posterodorsal margin of the right valve there is a long groove which receives the edge of the opposite valve. Adductor scars faint, the anterior scar high and ovate, the posterior low and broadly suboval. Pallial line remote from the margin and parallel with it. Pallial sinus small, nearly erect, and bluntly triangular, the apex lying a short distance from the posterior adductor scar and embayed to about the mid-line of the scar. Ventral margin crenulate, the margins of the lunule and escutcheon more finely so.

Dimensions.—Holotype (C399a), right valve, length 2.5 mm.; height 2.1 mm.; approx. thickness 0.8 mm. Paratype (C399b), right valve, length 2 mm.; height 1.75 mm.; approx. thickness 0.7 mm.

Type locality.—La Salina, west of Puerto Cabello, State of Carabobo. Three right valves.

Comparisons.—This species is characterized by its high triangular outline, laminar ribs, and subtruncate basal margin. In general appearance it is like the Recent *A. auberiana* (d'Orbigny) from Cuba, like the short high variation of the upper Miocene to Recent *A. brasiliana* (Gmelin), and like the species referred to as *Astarte meridionalis* by Gabb (1881, p. 376, pl. 47, fig. 78) from the Pliocene near Limon, Costa Rica. All three of those species, however, are depressed in front of the posterior rostration, and their basal margin is embayed in varying degree at the depression. According to Dall (1902, U. S. Nat. Mus., Proc., vol. 26, No. 1312, p. 376) *A. auberiana* (d'Orbigny) (1842, Atlas, pl. 26, figs. 35-37; 1853, p. 277) is the same as *A. puella* (Pfeiffer) (1847, [in] Philippi, Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, vol. 2, pt. 4, p. 108), and if this is so, as also suggested by McLean (1951, p. 87, pl. 17, fig. 6), the name *auberiana* has priority. Recent specimens of *A. auberiana* from Cuba are more inflated and

more attenuate posteriorly than *A. venezuelana,* n. sp. The type of *A. meridionalis* (Gabb) has broader concentric ribs than *A. venezuelana,* and the type of the Recent *A. nesiotica* Pilsbry (1930, Academy Nat. Sci. Philadelphia, Proc., vol. 82, p. 302) from the Bahamas is much more elongated than the Venezuelan fossil.

Tivela (Tivela) mactroides (Born) Pl. 39, figs. 7-13

1681. [In] Buonanni, Ricreatione dell'ochio e della mente, pte. seconda, fig. 66.
1685. [In] Lister, Historiae sive synopsis methodicae Conchyliorum et Tabularum Anatomicarum, pl. 251, fig. 85.
1778. *Venus mactroides* Born, Index Rerum Naturalium Musei Caesarei Vindobonensis, pt. 1, p. 52.
1782. *Venus mactroides* Born, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, pp. 624-625, pl. 31, fig. 326.
1786. *Venus turgens* Solander, A Catalogue of the Portland Museum, pp. 52, 68, 103, 152 (*n.n.*)
1791. *Venus corbicula* Gmelin, Syst. Nat., ed. 13, p. 3278, No. 39.
1807. *Tivela vulgaris* Link, Beschreibung der Naturalien-Sammlung der Universität zu Rostock, pt. 3, p. 152, [*Fide* Dall 1902].
1811. *Trigona radiata* Megerle von Mühlfeld, Berlin Gesell. Naturf. Freunde Mag., vol. 5, No. 1, p. 55.
1817. *Trigona fasciata* Schumacher, Essais d'un système des habitations des vers testacés, p. 153. [*Fide* Dall 1902].
1817. *Venus mactroides* Born, Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 172, No. 33.
1818. *Cytherea corbicula* (Gmelin), Lamarck, An. sans Vert., vol. 5, p. 563.
1825. *Venus mactroides* Born, Wood, Index Testaceologicus, p. 35, No. 33.
1838. *Cytherea corbicula* Lamarck, Gray, Analyst, vol. 8, p. 304.
1847. *Cytherea corbicula* Lamarck, Chenu, Illustrations Conchyliologiques, vol. 2, p. 70, pl. 2, figs. 6, 6a, 6b.
1853. *Venus mactroides* Born, d'Orbigny, [In] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 2, pp. 266-267.
1853. *Trigona mactroides* (Born), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, p. 51.
1855. *Cytherea corbicula* Lamarck, Sowerby, Thesaurus Conchyliorum, vol. 2, p. 614, pl. 128, figs. 37-39.
1864. *Tivela mactroides* (Born), Römer, Novitates Conchologicae, ser. 2, vol. 1, suppl. 3, pp. 12-13, pl. 4, figs. 2, 2a, 2b.
1864. *Cytherea mactroides* (Born), Reeve, Conch. Icon., vol. 14, *Cytherea,* pl. 5, sp. 18a, 18b, 18c.
1864. *Venus mactroides* Born, Krebs, The West Indian Marine Shells, p. 97.
1868. *Cytherea mactroides* (Born), Pfeiffer, Syst. Conchylien-Cabinet, vol. 11, p. 46, pl. 17, fig. 3.
1878. *Cytherea mactroides* (Born), Mörch, Catalogue of West-India Shells, p. 15.
1878. *Venus mactroides* Born, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 250.
1889. *Tivela mactroides* (Born), Dall, U. S. Nat. Mus., Bull. 37, p. 56.
1900. *Meretrix (Tivela) mactroides* (Born), Dautzenberg, Soc. Zool. France, Mém., vol. 13, p. 248.
1902. *Tivela mactroides* (Born), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 349, 367-368.

1903. *Tivela corbicula* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1221.
1912. *Tivela mactroides* (Born), Jukes-Browne, Malac. Soc. London, Proc., vol. 10, p. 269, fig. 2.
1925. *Tivela mactroides* (Born), Maury, Bull. Amer. Paleont., vol. 25, No. 42, pp. 295-296, pl. 26, fig. 8; pl. 27, fig. 3.
1927. *Tivela mactroides* (Born), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 319-320, pl. 22, figs. 1, 4, 6, 15, 20, 21, (1929).
1934. *Tivela mactroides* (Born), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 47.
1934. *Tivela mactroides* (Born), Maury, Amer. Mus. Nat. Hist., Bull., vol. 68, art. 4, pp. 163-164, pl. 19, fig. 3.
1937. *Tivela mactroides* (Born), Smith, East Coast Marine Shells, p. 52, pl. 18, fig. 1.
1937. *Cytherea corbicula* (Gmelin), Lamy and Fisher-Piette, Mus. Nat. Hist. nat. Paris, Bull., vol. 9, No. 1, p. 78.
1940. *Tivela mactroides* (Born), Smith, World-wide Sea Shells, p. 108, fig. 1430.
1942. *Tivela mactroides* (Born), Fischer-Piette and Fischer, Jour. Conchyl., vol. 85, pp. 41-43.
1945. *Tivela mactroides* (Born), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1946. *Tivela mactroides* (Born), Stewart, Nautilus, vol. 60, No. 1, p. 19.
1948. *Tivela mactroides* (Born), Hertlein and Strong, Zoologica, vol. 33, pt. 4, No. 13, p. 166.
1949. *Tivela mactroides* (Born), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 36.
1951. *Tivela mactroides* (Born), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 78, pl. 15, fig. 9.
1958. *Tivela mactroides* (Born), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1961. *Tivela* (*Tivela*) *mactroides* (Born), Olsson, Panamic-Pacific Pelecypoda, p. 268.
1961. *Tivela mactroides* (Born), Warmke and Abbott, Caribbean Seashells, p. 188, pl. 39e.

The Recent Higuerote shells are robust, gibbous, tightly closed, trigonal in outline, subequilateral, with the posterior end a little narrowed and produced, and with the posterodorsal margin slightly steeper and somewhat longer than the anterodorsal margin. Umbo high and full, the beak slightly forward of the median line and strongly bent over the hinge. Lunular area broadly cordate, hardly depressed, faintly defined at the margin, often cream-colored, with a swath of chestnut near the hinge margin. Escutcheonal area not defined, elongate-cordate, often dark brown in color. Exterior smooth but with numerous concentric lineations. Interior shiny. Hinge strong, with a stout anterior lateral. Along the posterodorsal

margin there is a long groove on the right valve, and a lesser groove on the anterodorsal margin of the left valve. There are two sets of divided cardinal teeth, the posterior set coarsely serrated and more oblique than the anterior, the socket between the sets narrowly triangular. The right anterior lateral is a deep, somewhat elongate pit, the left anterior lateral an erect triangular tooth which fits into the pit of the opposite valve. Anterior muscle scar ovate, the posterior suborbicular. Pallial sinus short, oblique, "U"-shaped, well rounded at the forward end. Interior whitish but often stained a deep purple at the ends; on some specimens there are purplish hands in the umbonal cavity and a purplish tinge on part of the hinge. Exterior with alternating unequal rays of straw and chestnut, the rays of the right valve often more pronounced than those of the left valve on an individual pair.

Dimensions.—Specimen B543b, paired valves, height 41 mm.; length 48 mm.; thickness 29 mm. Specimen B543a1, right valve of doublet, height 37 mm.; length 42.5 mm.; thickness 12.8 mm. Specimen B543a2, left valve of same doublet, height 37.2 mm.; length 43 mm.; thickness 12.5 mm. Largest Recent specimen, left valve, height 44 mm.; length 52 mm.; thickness 15 mm. Specimen D546a, left valve, height 8 mm.; length 9.9 mm.; thickness 3.3 mm. This is badly worn.

Localities.—On beach, southeast of Higuerote, State of Miranda. One hundred nineteen specimens including eight doublets, forty-three right valves, and sixty-eight left valves. Abisinia formation at W-30, eastern edge of Playa Grande village. One left valve, the identification of which is not certain.

Remarks.—The Pliocene to Recent *T. byronensis* (Gray) (see Olsson, 1961, pp. 267-268, pl. 44, figs. 3, 6, 6a, 7, 8, 8a) from west America is a closely related species, and it is stated by Olsson that some specimens cannot be separated effectively if the locality is unknown.

Range and distribution.—Tivela mactroides (Born) is living in the Western Atlantic from the Florida Keys to Brazil. The fossil from the Abisinia formation (Pleistocene) referred to this species is not quite as tall as the typical Recent form but this may be due to wear. Another Pleistocene occurrence in Venezuela is recorded by van Bentham Jutting (1945, p. 78) from the Island of Margarita.

Tivela (Planitivela) venezuelana, new species Pl. 33, fig. 7; Pl. 40, figs. 1-4

Shell small, scarcely inflated, somewhat inequilateral, subtrigonally ovate, the anterior end somewhat narrowed and a little produced. Anterodorsal margin straight, anterior end sharply rounded, basal margin shallowly arcuate, posterior end well rounded, posterodorsal margin slightly convex. Beak low, situated a little behind the middle. Lunule hardly depressed, long, subelliptical, faintly defined by a narrow crease. Escutcheonal area small, narrow, arcuate, undefined. Surface smooth, marked, below the subhyaline prodissoconch, by fine concentric lineations. Hinge of right valve with a long anterior lateral groove bordered above by another fine groove along the anterodorsal margin, the two grooves separated by a thin lamina; at the base of the main lateral groove is another lamina, this connected with the anterior cardinal; the middle cardinal of the right valve is rather sturdy and narrowly wedge-shaped, and is separated from the posterior cardinal by a narrowly triangular socket; the right posterior cardinal is the largest of the triad and is shallowly sulcate. Hinge of left valve with a long anterior lateral groove similar to that of the right valve, the lamina at the base of the groove joining the left anterior cardinal which is also laminar; atop the lateral groove is another delicate groove extending along the anterodorsal margin to near the anterior end of the valve; behind the left anterior cardinal are two slightly divergent cardinal teeth, and joining the hinder one of those is a posterior lamina which borders the fine groove at the posterodorsal margin. Adductor scars faint, the anterior moderately elongate and a little arcuate, the posterior scar broadly oval. Pallial sinus dimly lined, but under proper light it can be seen to arise at the base of the posterior adductor scar, extend obliquely forward in a U-shaped outline for about a third the length of the valve, and to be well rounded at the apex. Inner edge of ventral margin smooth, slightly beveled.

Dimensions.—Holotype (J451a), right valve, height 4.1 mm.; length 5 mm.; thickness 1.3 mm. Paratype (I457a), right valve, height 6 mm.; length 8 mm.; thickness 1.8 mm. Paratype (T451a), left valve, height 3.9 mm.; length 4.8 mm.; length 4.8 mm.; thickness 1.2 mm.

Type locality.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two left valves.

Comparisons.—*Tivela venezuelana,* n. sp., as represented by four young shells, is characterized by its slightly produced anterior end and its scarcely inflated valves. It is reminiscent of the Recent Eastern Pacific *T. planulata* (Broderip and Sowerby) (see Olsson, 1961, Panamic-Pacific Pelecypoda, pp. 269-270, pl. 44, figs. 5, 5a) but is less sharply trigonal than that.

Gouldia venezuelana, new species Pl. 40, figs. 5-15

Shell small, somewhat compressed, subequilateral, rounded-subquadrate. Anterodorsal margin nearly straight, the ends of the valve well rounded, the ventral margin nearly semicircular, the posterodorsal margin straight to hardly convex. Umbonal region a little inflated, the beak subcentral, rather low, prosogyrate. Lunule large, long, and elliptical, bounded by a fine impressed line, marked by fine growth striae. Escutcheon wanting. Surface sculptured by low regular concentric riblets reticulated, particularly on the posterior half and anterior quarter of the valve, by subregular radial threads, the radii obsolescent on the middle-anterior half of the disk, the spaces enclosed by the concentric and radial elements in the form of square or rectangular pits. Base of hinge plate bowed down under the anterior lateral, more or less horizontal under the middle and posterior cardinals. Anterior lateral of right valve a small, somewhat elongated pit, with a minor lamina above and a thickened border below, the pit connected, via a shallower sulcus, with the deep interspace between the anterior and middle cardinals. Right anterior cardinal tooth platy, united above with the posterior tooth which is relatively thick and elongated; the right middle cardinal is separate, cuneate, and intermediate in size. Along the posterodorsal margin of the right valve, extending from the rear of the ligament to the curve of the posterior end, there is a narrow groove which receives the edge of the opposite valve. Hinge of left valve

with a prominent anterior lateral tooth, the groove above it strong and continuing to the top of the left anterior cardinal. The anterior and middle cardinals of the left valve are united above to form a caret, the anterior tooth sublaminar and smaller than the stout medial tooth; the left posterior cardinal is the largest of the triad, and is narrowly wedge-shaped. The anterodorsal margin of the left valve also bears a fine groove extending from near the beak along the inner edge of the lunule to the curve of the anterior end. Anterior adductor scar ovate, scarcely impressed, the posterior scar faintly visible and seemingly suboval. Pallial line well removed from the margin, embayed slightly in front of the posterior adductor scar. Margin smooth within, somewhat beveled.

Dimensions.—Holotype (S533b), right valve, length 1.6 mm.; width 1.4 mm. Paratype (S533a), estimated length 1.7 mm.; height 1.5 mm. (This specimen was broken after it was photographed). Paratype (S532a), right valve, length 2.1 mm.; height 1.9 mm. Paratype (S422a), right valve, length 3.2 mm.; height 2.8 mm. Paratype (H421a), broken left valve, length 5 mm. Paratype (H527a,) hinge area of left valve, length 4.7 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Four right valves.

Other localities.—Mare formation at W-25, south flank of Punta Gorda anticline. Two left valves.

Comparisons.—The nearest related species is the middle Miocene *G. limonensis* Olsson (1922, pp. 405-406, pl. 32, fig. 18) from Port Limon, Costa Rica, that, however, having a more orbicular outline and a more convex posterodorsal margin. The Recent *G. cerina* (C. B. Adams) (see Clench and Turner, 1950, Occas. Papers on Mollusks, vol. 1, No. 15, p. 265, pl. 44, figs. 7-8), which ranges from North Carolina, U. S. A., to Brazil, in depths of 1 to 95 fathoms, is a more trigonal shell than *G. venezuelana,* n. sp. The west American *G. californica* Dall (see Olsson, 1961, Panamic-Pacific Pelecypoda, p. 271, pl. 39, fig. 9) is strongly reticulated over the whole of the disk, whereas on the Venezuelan fossil the radial sculpture is obsolete on the middle anterior area of the disk. The Recent *G. californica* ranges from the Gulf of California to Ecuador, and occurs in the Pleistocene (as *G. stephensae* E. K. Jordan) at Magdalena Bay, Baja California, México. *Circe* (pro-

bably *Gouldia*) *bermudensis* Smith (1885, Voyage H.M.S. Challenger, Zoology, vol. 13, pp. 143-144, pl. 2, figs. 1-1b), dredged in coral mud off Bermuda at a depth of 435 fathoms, is much more delicately reticulated than *G. venezuelana*. The late Tertiary *G. metastriata* (Conrad) (see Mansfield, 1932, Florida State Geol. Sur., Bull., No. 8, pp. 119-120, pl. 23, figs. 1-2), which is known from the upper Miocene and Pliocene from Virginia to Florida, is, like *G. cerina* (C. B. Adams), a more trigonal shell than the new Venezuelan fossil.

Gouldia ? diffidentia, new species Pl. 40, figs. 16, 17

Shell minute, hyaline, subtranslucent, suboval, moderately compressed, slightly oblique, inequilateral, the anterior end produced. Anterodorsal margin long and straight, sloping at an angle of about 20 degrees from the horizontal, anterior end well rounded and a little narrowed, ventral margin arcuate, posterior end shallowly rounded, posterodorsal margin short and straight, sloping about 30 degrees from the horizontal. Umbonal region somewhat swollen, the beak directed forward, situated at about the posterior third. Lunule not defined, the escutcheon wanting. Surface sculptured by small, faint, subregular concentric riblets, but there are no radial markings. Hinge of left valve with anterior lateral and three cardinal teeth. The lateral tooth is low and laminar, the groove above it extending to the top of the anterior cardinal. The anterior and middle cardinals are united above to form a rounded apex, the anterior cardinal flaring out below and continuing along the lower margin of the groove to join the lateral lamina. Looking down to the top of the hinge, the flare of the anterior cardinal is seen to produce a spoon-shaped process. The left posterior cardinal is slightly arcuate and narrowly cuneate, the groove of the nymph behind it narrow and shallow. Adductor scars dimly outlined, the anterior one slightly arcuate and suboval, the posterior scar subangularly ovate. Pallial line arcuate, shallowly and broadly embayed in front of the posterior adductor scar. Inner margin smooth.

Dimensions.—Holotype (I510a), left valve, length 1.7 mm.; height 1.2 mm.

Type locality.—Lower Mare formation at W-13, on hillside

above west bank of Quebrada Mare Abajo. One juvenile left valve, the holotype.

Remarks.—The long anterior end, and the absence of radial striae differentiate this shell from other American species. The character of the hinge and the slight pallial sinus suggest that it pertains to the genus *Gouldia.*

Transennella caboblanquensis, new species Pl. 41, figs. 1-8

Shell small, porcelaneous, moderately inflated, oval-subtrigonal, subequilateral to inequilateral. Lunular margin slightly undulatory and bowed down slightly just before the curve of the anterior end, anterior end broadly rounded, ventral margin shallowly rounded, posterior end acutely rounded, posterodorsal margin hardly convex to slightly humped. Umbo fairly plump, the beak prosogyrate, situated a little forward of the middle. Lunule large, cordate, circumscribed by a fine shallow sulcus, and marked by microscopic concentric striae. Escutcheon not defined. Surface polished and smooth, traversed by minute, nearly obsolete concentric wrinkles. On one well-preserved specimen there are also closely spaced microscopic radial filaments here and there on the surface, but these radii have not been observed on other examples. Hinge of right valve with an elevated platy posterior cardinal and two laminar anterior cardinals separated by a deep narrow slit; in front of the right anterior set of cardinals is a binary lateral, the lower tooth fairly thick, the upper one more or less laminar, with a moderately elongate pit between them, the pit receiving the strong anterior lateral tooth of the left valve. Hinge of left valve with a laminar posterior cardinal, a moderately stout cuneate medial cardinal, and a smaller anterior cardinal, the latter two converging to unite immediately under the beak, the socket between them triangular. The muscle scars are hardly visible, the anterior one high and ovate, the posterior scar exceedingly faint and seemingly pyriform. Pallial line remote from the margin, uniting with the basal limb of the pallial sinus to form an acute angulation. Pallial sinus broad, U-shaped, the embayment slightly ascending to nearly horizontal, the limbs subparallel, the apex bluntly rounded and reaching to about the center of the valve. Inner margin somewhat beveled, bearing the grooves characteristic of the genus. These

marginal grooves are fairly coarse, two or three in number along the base, subparallel with the edge of the valve, discontinuous, with their ends overlapping, occurring from immediately in front of the beak around the margin to the rear of the nymph.

Dimensions.—Holotype (I516c), right valve, length 4.5 mm.; height 3.6 mm.; thickness 1.8 mm. Paratype (I516b), right valve, length 5.5 mm.; height 4.8 mm.; thickness 2 mm. Paratype (I516a), left valve, length 3 mm.; height 2.5 mm.; thickness 1 mm. Paratype (T517a), left valve, length of fragment 1.9 mm. Paratype (T517b), right valve, height of fragment 2.5 mm.; thickness of valve 0.9 mm. Largest specimen, left valve, not figured, length 7.7 mm.; height 6.2 mm.; thickness 2 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Four specimens including two right valves and two left valves.

Other localities.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Ten specimens including five right valves and five left valves. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One left valve. Upper mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Two specimens including one right and one left valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Four specimens including three juvenile left valves and one adult right valve.

Comparisons.—The nearest related species is the Recent *T. culebrana* (Dall and Simpson) (1901, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 486, pl. 55, fig. 5), but compared with the type of *T. culebrana* (No. 160064, U. S. National Museum), the Venezuelan fossil is not so sturdy, and is oval-subtrigonal in outline rather than subtrigonal. Also, the posterodorsal margin is slightly convex on *T. caboblanquensis,* n. sp. whereas *T. culebrana* has a longer and straighter posterodorsal margin and a slightly sharper posterior end.

Other east American species with which the Venezuelan fossil exhibits affinity are the following:

T. cubaniana (d'Orbigny) (1842, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 2, p. 278 (1853), Atlas, pl. 26, figs. 44-46). Recent from Florida to the West Indies. The concentric

lineations of the surface are stronger and more regular than on *T. caboblanquensis.*

T. gerrardi Abbott (1958, Acad. Nat. Sci. Philadelphia, Mon. No. 11, pp. 130-131, text fig. 7, pl. 4a-c). Recent, Grand Cayman Island. The union of the pallial line and pallial sinus is narrowly and acutely rounded; on *T. caboblanquensis* it is sharply angulate.

T. stimpsoni (Dall) (see Abbott, 1954, American Seashells, pp. 412-413, figs. 83a, b). Recent, North Carolina to the Bahamas; Pleistocene, Florida. The marginal grooves are more numerous and more tangential to the anterior edge of the shell than they are on *T. caboblanquensis.* Also the pallial sinus is narrower on *T. stimpsoni.*

T. conradina (Dall) (see Dall, 1902, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 348, 367, 379, pl. 13, fig. 6). Pleistocene to Recent. This is more acuminate posteriorly than the Venezuelan fossil.

T. caloosana Dall (1903, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1242-1243, pl. 57, fig. 2). Upper Miocene to Pleistocene in Florida. The shape is more oval than that of *T. caboblanquensis.*

T. carolinensis Dall (1903, p. 1242, pl. 55, fig. 4). Upper Miocene in Virginia, North Carolina, and South Carolina; Pliocene in North Carolina. The outline is nearly equilateral whereas the Cabo Blanco shell is subequilateral to inequilateral.

Transennella venezuelana, new species Pl. 41, figs. 9, 10

Shell small, moderately solid, high and obtusely trigonal, strongly inflated, subequilateral, the posterior submargin flattened. Anterodorsal margin short, straight, and steeply sloping, anterior end well rounded, ventral margin hardly arcuate, posterior end slightly narrowed and rounded, posterodorsal margin obliquely subtruncate below, convex above. Umbonal area swollen, the beak high, subcentral, prosogyrate. Lunule large, broadly elliptical, not depressed, bounded by a fine hardly impressed line, marked by faint obsolete growth lineations. Escutcheon wanting. Surface smooth but scored by faint microscopic concentric grooves and by occasional narrow sulci along lines of arrested growth. Hinge strong, the base of the hinge plate rather angulately undulatory. Left anterior lateral a high platy triangular tooth with a rounded apex,

the tooth separated from the margin by a narrow groove. The three cardinal teeth of the left valve are divergent, the anterior one thin, sharp, and slightly curved, the middle tooth high, asymmetrically wedge-shaped, and slightly sulcate, the posterior tooth laminar and affixed to the side of the nymph. Ligamental groove behind nymph narrow and moderately deep. Adductor scars dimly outlined, pyriform, the posterior scar a little broader than the anterior. Pallial line remote from and parallel with the ventral margin. Pallial sinus broad and deeply embayed, the upper line of the sinus subangulate, the apex rounded, projected nearly horizontally to a little beyond the middle of the interior. Inner margins with one to two long fine transennellid grooves, the grooves nearly parallel with the ventral margin, somewhat tangential with the lateral margins.

Dimensions.—Holotype (S552a), left valve, length 6.2 mm.; height 5.5 mm.; thickness 1.7 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve, the holotype.

Comparisons.—This is a high, obtusely trigonal, strongly inflated shell, with a broad, deep pallial sinus. Among the American species of *Transennella* listed on the preceding page, *T. venezuelana,* n. sp., is most closely related to *T. carolinensis* Dall, differing from that, however, by its higher beak, larger pallial sinus, and more tumid valves.

Macrocallista maculata (Linnaeus) Pl. 41, figs. 11-15
Pl. 42, figs. 1-6

1758. *Venus maculata* Linnaeus, Syst. Nat., ed. 10, p. 686, No. 101.
1767. *Venus maculata* Linnaeus, Syst. Nat., ed. 12, p. 1132, No. 126.
1782. *Venus maculata* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 347, pl. 33, fig. 345.
1818. *Cytherea maculata* (Linnaeus), Lamarck, An. sans Vert., vol. 5, p. 566,
1838. *Chione maculata* (Linnaeus), Gray, Analyst, vol. 8, p. 306.
1851. *Cytherea maculata* (Linnaeus), Sowerby, Thes. Conchyl., vol. 2, p. 629, pl. 131, fig. 97.
1853. *Dione maculata* (Linnaeus), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, *Veneridae,* p. 57.
1853. *Callista maculata* (Linnaeus), Mörch, Catalogus Conchyliorum Comes de Yoldi, pt. 2, p. 28.
1853. *Venus maculata* Linnaeus, d'Orbigny. [In] La Sagra, Hist. phys., polit. et. nat. l'Ile de Cuba, vol. 2, pp. 269-270.
1863. *Dione maculata* (Linnaeus), Reeve, Conch. Icon., vol. 15, pl. 3, sp. 11.
1864. *Venus maculata* Linnaeus, Krebs, The West Indian Marine Shells, p. 97.

1878. *Cytherea maculata* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 15.
1878. *Venus maculata* Linnaeus, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 250.
1881. *Callista maculata* (Linnaeus), Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, pp. 344, 372.
1888. *Cytherea maculata* (Linnaeus), Schepman, [in] Martin, Bericht über eine Reise nach Nederlandisch West-Indien und darauf gegründete Studien, Leiden: II-Geologische Studien, Appendix.
1889. *Callista maculata* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 272.
1889. *Cytherea maculata* (Linnaeus), Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 127, 141.
1889. *Cytherea* (*Callista*) *maculata* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 56.
1889. *Cytherea maculata* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 64.
1892. *Callista maculata* (Linnaeus), Singley, Geol. Survey Texas, Fourth An. Rept., p. 327.
1901. *Meretrix maculata* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 485.
1902. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, p. 369.
1903. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1256-1257.
1911. *Macrocallista maculata* (Linnaeus), Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 63, p. 370.
1916. *Macrocallista maculata* (Linnaeus), Mansfield, U. S. Nat. Mus., Proc., vol. 51, No. 2169, p. 602.
1920. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 100.
1921. *Macrocallista maculata* (Linnaeus), Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 422.
1922. *Macrocallista (Chionella) maculata* (Linnaeus), Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 406-407, pl. 31, figs. 6-7.
1923. *Macrocallista maculata* (Linnaeus), Clench, Nautilus, vol. 37, No. 2, p. 55.
1925. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 297-298, pl. 25, figs. 1, 4, 5.
1925. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), Maury, Serv. Geol. Min. Brazil, Mon. No. 4, p. 321, pl. 18, figs. 8-9.
1926. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), Gardner, U. S. Geol. Sur., Prof. Paper 142-D, pp. 160-161.
1926. *Macrocallista maculata* (Linnaeus), Weisbord, Nautilus, vol. 39, No. 3, p. 86.
1927. *Macrocallista maculata* (Linnaeus), F. Hodson, H. K. Hodson, and Harris, Bull. Amer. Paleont., vol. 13, No. 49, p. 54, pl. 32, fig. 6.
1927. *Callista* (*Callista*) *maculata* (Linnaeus), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 77-78 (1927), pl. 10, fig. 11; pl. 12, figs. 1-3, 8-9 (1929).
1929. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Anderson, California Acad. Sci., Proc., ser. 4, vol. 18, No. 4, p. 170.
1934. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 47.
1936. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Macrocallista maculata* (Linnaeus), McLean, Nautilus, vol. 49, No. 4, p. 118.

1937. *Macrocallista maculata* (Linnaeus), Smith, East Coast Marine Shells, p. 52, pl. 52, pl. 20, fig. 1.
1938. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), Vokes, Amer. Mus. Novitates, No. 988, p. 3.
1938. *Macrocallista maculata* (Linnaeus), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1291.
1939. *Macrocallista maculata* (Linnaeus), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 19, 23, 26, 39.
1939. *Macrocallista maculata* (Linnaeus), Woodring, [in] Kehrer, Amer. Assoc. Petrol. Geol., Bull., vol. 39, No. 12, p. 1853.
1940. *Macrocallista maculata* (Linnaeus), Smith, World-wide Sea Shells, p. 109, fig. 1440.
1942. *Macrocallista maculata* (Linnaeus), Clench, Johnsonia, vol. 1, No. 3, pp. 6-7, pl. 5.
1943. *Macrocallista (Chionella) maculata* (Linneaus), Rutsch, Naturforsch. Gesell. Basel, Verhandl., vol. 54, p. 102.
1945. *Pitaria maculata* (Linnaeus), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1946. *Macrocallista* (*Chionella*) *maculata* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre" Rev., vol. 4, No. 3, p. 101.
1949. *Macrocallista maculata* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, pt. 1, p. 36.
1951. *Macrocallista maculata* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 79, pl. 16, fig. 1.
1952. *Macrocallista maculata* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183.
1952. *Venus maculata* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 100.
1953. *Macrocallista (Macrocallista) maculata* (Linnaeus), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 109.
1953. *Pitar (Paradione) maculatus* (Linnaeus), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Macrocallista maculata* (Linnaeus), Abbott, American Seashells, p. 416, pls. 1b, 39e.
1955. *Macrocallista maculata* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 72, pl. 13, fig. 82.
1956. *Macrocallista maculata* (Linnaeus), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 317, 318, 367, 371.
1957. *Macrocallista maculata* (Linnaeus), Weisbord, Bull. Amer. Paleont., vol. 38, No. 165, p. 19.
1958. *Macrocallista maculata* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1958. *Macrocallista* (*Paradione*) *maculata* (Linnaeus), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, pp. 172-173.
1959. *Macrocallista maculata* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 16.
1961. *Macrocallista maculata* (Linnaeus), van Regteren Altena, Koninkl. Akad. Wetensch.-Amsterdam, Proc., Ser. B, vol. 64, No. 2, p. 300.
1961. *Macrocallista maculata* (Linnaeus), Olsson, Panamic-Pacific Pelecypoda, p. 273.
1961. *Macrocallista maculata* (Linnaeus), Warmke and Abbott, Carribean Seashells, pp. 189-190, pl. 39f.

The Cabo Blanco fossil referred to this species is porcelaneous and white, large, fairly thin, moderately compressed, flattened pos-

teriorly, the flattening generally delimited rather sharply from the disk. The majority of specimens are transversely ovate-trigonal, with some relatively broader than others, but there are a few young shells that are nearly oval in outline. On the former, the dorsal margin is humped in greater or lesser degree, and the posterior end is subangular at the curve with the basal margin. The oval form is rather regularly rounded at the ends, and the posterior flattening is very gentle. The hinge and other characteristics of the two forms are identical, and there is little question that they both pertain to the same species. Umbo moderately convex, the beak acute, prosogyrate, situated at the anterior third. Lunule elongate-cordate, hardly depressed, defined by a faintly impressed line, the right half of the lunule a little wider than the left half, marked by fine striae continuing from the disk. Escutcheon not defined. External surface smooth except for minute concentric lineations which become pronounced on the weathered surface. Ligamental platform elongate-lanceolate, the inner edge at the border of the nymph closely and finely corrugated. Dentition typical of the genus, the anterior left lateral tooth large, upright, triangular, fitting into the corresponding socket of the opposite valve. Right valve with a long faint groove starting at the angle of the posterodorsal margin and extending more than half way along the posterior margin, the edge of the left valve fitting into this groove. Anterior adductor scar high, rather strongly impressed, broadly ovate and with a fairly straight inner margin, the posterior scar inconspicuous, slightly larger than the anterior, the base of the scar acutely rounded. Pallial sinus wide, convergent in front, the sides subparallel, the apex acute, embayed nearly horizontally to the median line of the valve a little below the center. The surface layer of the shell flakes off readily and only rarely is the layer intact.

Dimensions.—Specimen G295a, left valve, length 64 mm.; height 50 mm.; thickness 14 mm. Specimen G295b, right valve, length 72.5 mm.; height 54 mm.; thickness 12 mm. Specimen G295c, left valve, length 33 mm.; height 25.7 mm.; thickness 6.8 mm. Specimen G295d, right valve, length 41.5 mm.; height 32 mm.; thickness 10 mm. Specimen G295e, left valve, length 13.9 mm.; height 10.1 mm.; thickness 2.8 mm. Specimen G295f, right valve, length 14.6 mm.; height 11.4 mm.; thickness 3.3 mm. Specimen

G295g (immature oval form), left valve, length 3 mm.; height 2.2 mm.; thickness 1.1 mm. Specimen G295h (immature oval form), length 5.8 mm.; height 4.4 mm.; thickness 1.2 mm. Specimen E295a, doublet, length 71 mm.; height 54 mm.; thickness 31.5 mm. Specimen I295a, right valve, length 33.2 mm.; height 28.4 mm.; thickness 6.6 mm. Specimen M295a, internal mold of attached pair, length 65 mm.; height 48 mm.; thickness 26 mm.

Localities.—Upper Mare formation at and near W-14, on hillside above west bank of Quebrada Mare Abajo. Three hundred forty-six specimens including sixteen doublets, one hundred fifty-seven left valves, and one hundred seventy-three right valves. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Twenty specimens including thirteen left valves, six right valves, and one doublet. Upper Mare formation, 115 meters south-southeast of crossing of Quebrada Mare Abajo and coast road and 90 meters southeast of W-12. Nine specimens including four left valves, four right valves, and one doublet. Mare formation at W-25, south flank of Punta Gorda anticline. Fifteen specimens including nine right valves and six left valves. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Forty-eight specimens (mostly young) including twenty-nine right valves and nineteen left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One right valve. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Two specimens including one right valve and one left valve. Playa Grande formation at W-26, in Quebrada Las Bruscas approximately 125 meters upstream from junction with Quebrada Las Pailas. Thirteen specimens (mostly young) including seven left valves and six right valves. Playa Grande formation (Catia member), in bluff 125 meters west of the intersection of the Playa Grande Yachting Club road and coast road. One internal mold of a paired specimen. Playa Grande formation (Catia member) at W-15, south side of Playa Grande road about 40 meters southeast of its intersection with the Playa Grande Yachting Club road. Eleven doublets, all of them internal molds. La Salina, west of Puerto Cabello, State of Carabobo. Four specimens including three left valves and one right valve. All of these specimens are immature and worn, and the identification is somewhat in doubt.

Remarks.—This fossil occurs in great numbers in the Cabo Blanco area, especially in the upper Mare formation where all sizes are found. Large specimens are rare in the lower Mare formation and in the Maiquetía member of the Playa Grande formation but are present again in abundance as molds in the Catia member of the Playa Grande formation.

The posterior flattening on the Cabo Blanco fossils is a little more pronounced than on Recent specimens of *M. maculata maculata* but otherwise the shells are identical.

Range and distribution.—Lower Miocene to Recent. Living from North Carolina, U. S. A., to Brazil, in depths to 40 fathoms. Pleistocene in South Carolina, Florida, St. Kitts, St. Eustatius, Aruba, Curaçao, and on the Island of Cubagua, Venezuela. Pliocene in Florida, Costa Rica, and Venezuela (near Cumaná, in Collection No. 18408 of the U. S. National Museum). Upper Miocene in Florida ? and Trinidad. Middle Miocene in Alabama ?, Florida, Dominican Republic, Costa Rica, Panamá, Colombia, and Venezuela. Lower Miocene in Venezuela. Miocene, Brazil.

Pitar (Pitar) albida (Gmelin) Pl. 42, figs. 7, 8

1791. *Venus albida* Gmelin, Syst. Nat., ed. 13, p. 3287.
1853. *Dione albida* (Gmelin), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, Veneridae, p. 68.
1863. *Dione albida* (Gmelin), Reeve, Conch. Icon., vol. 14, pl. 10, sp. 39.
1864. *Venus albida* Gmelin, Krebs, The West Indian Marine Shells, p. 95.
1867. *Caryatis albida* (Gmelin), Römer, Novitates Conchologicae, Suppl. 3, vol. 1, p. 91, pl. 14, fig. 4.
1885. *Cytherea albida* (Gmelin), Dall, U. S. Geol. Sur., Bull. No. 24, p. 102.
1886. *Cytherea albida* ? (Gmelin), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 276.
1889. *Cytherea albida* (Gmelin), Dall, U. S. Nat. Mus., Bull. 37, p. 56.
1901. *Meretrix albida* (Gmelin), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 485.
1902. *Pitaria albida* (Gmelin), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 370-371.
1925. *Pitaria albida* (Gmelin), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 299.
1927. *Pitaria* (*Pitaria*) *albida* (Gmelin), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 25-26, pl. 6, figs. 17, 18, 20 (1929).
1933. *Cytherea* (*Dione*) *albida* (Gmelin), Trechmann, Geol. Mag., vol. 70, No. 823, p. 35.
1934. *Pitar albida* (Gmelin), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 47.
1936. *Cytherea albida* (Gmelin), Lermond, Check List of Florida Marine Shells, Gulfport, p. 8.

1949. *Pitar* (*Pitar*) *albidum* (Gmelin), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 35.
1951. *Pitar* (*Pitar*) *albida* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 80, pl. 16, fig. 3.
1954. *Pitar* (*Pitar*) *albida* (Gmelin), Abbott, American Seashells, p. 414.
1959. *Pitar albida* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 15, 16.
1961. *Pitar* (*Pitar*) *albida* (Gmelin), Warmke and Abbott, Caribbean Seashells, p. 188, pl. 39n.

The immature shell referred to this species is small, sturdy, moderately inflated, oval-subtrigonal, subequilateral. Lunular margin slightly undulatory, anterior end a little attenuated and rather sharply rounded, ventral margin arcuate, posterior end shallowly rounded, posterodorsal margin hardly convex. Lunule elongate-cordate, outlined by the merest suggestion of an impressed line, nearly smooth except for scarcely discernible concentric growth striae. Escutcheon narrowly subelliptical, not well defined, bordered by the low subrounded edge of the disk, also nearly smooth. Umbonal region rather prominent, the beak subcentral, prosogyrate. Surface obsoletely marked by minute concentric wrinkles and scored here and there by exceedingly faint microscopic lineations. Hinge of right valve with a moderately stout, vaguely sulcate posterior cardinal, that united above to the much smaller and laminar anterior cardinal, the arch underlain by the central cardinal which is intermediate in size. The right anterior lateral is represented by a narrowish pit which receives the anterior lateral tooth of the opposite valve. Along the posterodorsal margin of the right valve there is an elongated groove into which nestles the edge of the left valve. Adductor scars scarcely visible, the anterior one seemingly ovate, the posterior seemingly oval. Pallial sinus V-shaped, projected obliquely, the blunt apex not quite reaching the median line of the valve and terminating against a faint linear crease in the interior, the crease extending from the umbonal cavity to the apex of the sinus. Ventral margin slightly and smoothly beveled within.

Dimensions.—Specimen C407a, juvenile right valve, length 1.9 mm.; height 1.7 mm.

Locality.—La Salina, west of Puerto Cabello, State of Carabobo. One juvenile right valve.

Remarks.—The identification is not certain as it is based on a single immature valve.

Range and distribution.—Recent, from Florida to Brazil, 4-25 fathoms. Pleistocene, Barbados. Pliocene, near Cumaná, Venezuela (Collection No. 18408, U. S. National Museum).

Pitar (Pitar) maiquetiensis, new species Pl. 42, figs. 9, 10

Shell small, subtranslucent, moderately inflated, oval-subtrigonal, a little inequilateral, the front end scarcely narrowed. Anterodorsal margin shallowly but evenly convex, anterior end well rounded, ventral margin arcuate, posterior end broadly rounded, posterodorsal margin slightly convex. Lunule relatively large, not depressed, cordate, bounded by a fine impressed line, microscopically striate. No escutcheon. Beak full, somewhat elevated, prosogyrate, situated a little forward of the middle. Surface somewhat glassy, marked by obsolete concentric lineations and an occasional fine concentric sulcus. Interior shiny. The right anterior lateral process of the hinge is a short pit bearing a minor denticle above and below, the lower denticle slightly the larger. Right anterior cardinal tooth narrowly wedge-shaped, united above with the posterior cardinal which is also cuneate but much larger and vaguely divided on the face; the middle cardinal of the right valve is separate, of intermediate size, and somewhat divergent with the anterior cardinal. Base of hinge plate bowed down at the anterior lateral, bowed up between the middle and posterior cardinals. Behind the posterior cardinal the nymph groove is narrow, deep, and somewhat irregular. Anterodorsal and posterodorsal margins bearing a fine groove, the posterior one longer and somewhat more prominent than the anterior. Anterior adductor scar lenticular, the posterior one not discernible. Pallial line well removed from the margin. Pallial sinus asymmetrically U-shaped, the upper limb of the sinus slightly ascending, the lower limb joining the end of the pallial line obtusely, the apex of the sinus rounded, reaching to near the center of the valve. Inner margin smooth, slightly beveled.

Dimensions.—Holotype (T515a), right valve, length 1.9 mm.; height 1.7 mm.

Type locality.—Upper Mare formation, in stream 250 meters

south-southwest of mouth of Quebrada Las Pailas. One immature right valve, the holotype.

Comparisons.—The distinguishing character of the new species is the gently and evenly convex anterodorsal margin. This serves to differentiate it from the east American *P. fulminata* (Menke) (1828, Synopsis Methodica Molluscorum . . . Museo Menkeano, ed. 2, p. 150) and from the west American *P. fluctuatus* (Sowerby) (see Olsson, 1961, Panamic-Pacific Pelecypoda, pp. 275-276, pl. 43, figs. 7, 7a; pl. 45, figs. 5, 7). The Recent *P. fulminata* (Menke) (see Abbott, 1958, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 131, pl. 4e, f) ranges from North Carolina, U. S. A., to Brazil, in depths of 1 to 170 fathoms, and the species has been recorded from the Pleistocene of Cuba. *P. fluctuatus* (Sowerby) is living from the Perlas Islands in the Gulf of Panamá southward to Santa Elena, Ecuador, in depths to 8 fathoms.

Pitar (Pitar ?) antillensis, new species Pl. 33, figs. 8, 9

Shell small, moderately inflated, obtusely subtrigonal, somewhat inequilateral, the anterior end slightly produced and a little narrowed. Anterodorsal margin slightly and regularly convex, anterior end rather acutely rounded, ventral margin gently arcuate, posterior end broadly rounded, posterodorsal margin somewhat humped. Umbonal region full, the beak subcentral, moderately high, directed forward. Lunule large, not impressed, elliptical-cordate, hardly defined. Escutcheon narrow, not developed. Surface sculptured by small faint narrow concentric riblets on the umbonal region, the riblets becoming obsolescent below where the shell is nearly smooth. Left valve with a small low laminar anterior lateral, this merging with the higher anterior cardinal tooth but defined from it by a small notch; anterior and middle cardinals united above, the anterior cardinal slightly flared below, the middle cardinal small and cuneate; left posterior cardinal thinly lamellar. Anterior adductor scar slightly curved and lozenge-shaped, the posterior scar lenticular. Pallial line shallowly arcuate, subparallel with the ventral margin from which it is well removed. The dimly discernible pallial sinus is broadly U-shaped and slightly ascending, with a well-rounded apex which reaches to a little beyond the middle of the

interior, the lower limb of the sinus not quite parallel with the pallial line, the union of the limb and the line subrounded. Inner margin smooth, although because of corrosion it has a pseudo-transennellid appearance.

Dimensions.—Holotype (1666a), left valve, length 2.7 mm.; height 2.2 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas; one young left valve, the holotype.

Comparisons.—Although much smaller, *P. antillensis,* n. sp. is somewhat reminiscent of *P. elenensis* Olsson (1961, p. 275, pl. 45, figs. 1-1b), a Recent Eastern Pacific form ranging from Panamá to northern Peru. However, the posterodorsal margin of the Venezuelan fossil is a little more arched than that of *P. elenensis,* and the lower limb of the pallial sinus is nearer the pallial line than it is on *P. elenensis.* The hinge dentition of *P. antillensis* is similar to that of the left valve of *Gouldia ? diffidentia,* n. sp. described elsewhere in this monograph, but in outline and other characters the two forms are distinct.

Pitar (Nanopitar ?) marensis, new species Pl. 42, figs. 11-14

Shell glassy, subtranslucent, oval-subtrigonal, a little inflated. Anterodorsal margin hardly convex, anterior end well rounded, ventral margin arcuate, posterior end shallowly rounded, posterodorsal margin gently and evenly convex. Lunule large, broadly elliptical, outlined by a feeble incised line, marked by faint concentric growth striae. Escutcheonal area narrow, not defined, finely striated. Umbo full, the beak moderately high, subcentral, prosogyrate. External surface faintly scored by obsolete concentric lineations and marked by an occasional stronger concentric thread. Interior shiny. In the right valve the base of the hinge plate is bowed down under the anterior lateral, bowed up at the middle cardinal. Right anterior lateral represented by a pit which is thickened below and bears a small laminar tooth above. The pit is connected with the first cardinal interspace by an arcuate channel at the base of the anterior cardinal. Right anterior cardinal thin, united tenuously under the beak to the elongate posterior cardinal which is narrowly wedge-shaped and sulcate on the face; the middle cardinal of the

right valve is separate, subparallel with the anterior cardinal, and intermediate in size. Dorsal margins of right valve with a fine elongate groove, the posterior groove longer and a little stronger than the anterior. Anterior adductor scar fairly large, ovate and high, the posterior scar seemingly broadly pyriform. Pallial line well removed from the margin. Pallial sinus a broad embayment, the apex well rounded and projecting to near the center of the valve, the upper limb of the sinus nearly horizontal, the lower limb joining the end of the pallial line at an obtuse angle. Internal ventral margin smooth and beveled.

Dimensions.—Holotype (1515b), right valve, length 1.8 mm.; height 1.5 mm. Paratype (1515a), right valve, length 1.3 mm.; height 1.15 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two right valves.

Comparisons.—The type of the subgenus *Nanopitar* is the Recent *P.* (*N.*) *pilula* Rehder (1943, U. S. Nat. Mus., Proc., vol. 93, No. 3161, pp. 188-189, pl. 19, figs. 5-10) from Lake Worth, Florida, and that is a suborbicular shell in contrast with the Venezuelan fossil *P.* (*N.*) *marensis,* n. sp., which is oval-subtrigonal in outline. The types of *P. marensis* are small and immature, and it is surmised that the adult also is a relatively small shell.

Pitar (Pitarella ?) scutellaris, new species — Pl. 33, fig. 10; Pl. 42, figs. 15, 16

Shell moderately inflated, inequilateral, subtrigonally oval, the posterior submargin somewhat flattened, the posterodorsal margin long and straight with a slope of about 40 degrees from the horizontal. Umbonal area full and rounded, the beak fairly high, prosogyrate, situated a little forward of the middle. Lunule large, diamond-shaped, bounded by a fine feebly impressed line, marked by extremely faint concentric growth striae. Escutcheon absent. Surface sculptured by close fine concentric riblets, the riblets of the inner layer of the shell sharper and more laminate. Hinge strong, consisting of an anterior lateral, three cardinals and a long, large, somewhat sunken and flattened ligamental area. The right anterior lateral consists of two low denticles separated by a small pit; the

right anterior cardinal and the posterior cardinal are united above in an arch, the arch underlain by the separate middle cardinal tooth which is asymmetrically wedge-shaped; the right anterior cardinal of the holotype is broken but it seems to be parallel with, and separated from the middle cardinal by a deep narrow cleft; the socket between the middle and right posterior cardinals is narrowly and obliquely triangular; the right posterior cardinal is bilaminar and virgated by a slit at the inner side. The character of the rest of the interior is not known.

Dimensions.—Holotype (G416a), umbonal area of a right valve, length of fragment 4.7 mm.; thickness at umbo (excluding teeth) 1.3 mm.

Type locality.—Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One broken right valve, the holotype.

Comparisons.—Although much of the single specimen is broken away, the straight slope of the posterodorsal margin, the diamond-shaped lunule, the large ligamental area, and the split posterior cardinal of the right valve, set this shell apart from other known pitarids. Somewhat similar forms are the west American *P. mexicanus* Hertlein and Strong (1948, Zoologica, vol. 33, No. 4, pp. 171-172, pl. 1, figs. 3, 8) and the Western Atlantic *P. penistonae*[17] (Heilprin) (1889, Acad. Nat. Sci. Philadelphia, Proc., vol. 41, p. 142, pl. 8, figs. 4, 4a) from Bermuda. Among other differences, the Pleistocene to Recent *P. mexicanus* has an evenly convex posterodorsal margin, and *P. penistonae* has an evenly cordate lunule. *Callocardia ammondea* Woodring (1925, pp. 151-152, pl. 20, figs. 11-12) and *Callocardia elethusa* Woodring (1925, p. 152, pl. 20, figs. 13-14) from the middle Miocene of Jamaica are more strongly inflated than *P. scutellaris,* n. sp. The Peruvian *P. tumbezana* Olsson (1932, Bull. Amer. Paleont., vol. 19, No. 68, pl. 10, figs. 1, 3) from the middle Miocene Cardalitos shale has a gently convex posterodorsal margin as has the middle Miocene *Callocardia gatunensis* Dall (1903, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1260-1261, pl. 54, fig. 1) from the Panamá Canal Zone.

---

[17]Originally named *Cytherea Penistoni* after Miss A. Peniston. To accord with the feminine gender, I take the liberty of amending the specific name to *penistonae.*

Pitar (Hysteroconcha) dione (Linnaeus) Pl. 42, figs. 17-19; Pl. 43, figs. 1-6

1758. *Venus dione* Linnaeus, Syst. Nat., ed. 10, p. 684, No. 91.
1767. *Venus dione* Linnaeus, Syst. Nat., ed. 12, p. 1128, No. 112.
1782. *Venus dione* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 282, pl. 27, figs. 271-272.
1797. *Venus dione* Linnaeus, Bruguière, Encycl. Méth., vol. 2, pl. 275, figs. 1a, b,
1818. *Cytherea dione* (Linnaeus), Lamarck, An. sans Vert., vol. 5, p. 570.
1845. *Venus dione* Linnaeus, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, vol. 5, Moluscos, p. 317.
1852. *Cytherea dione* (Linnaeus), Jay, A Catalogue of the Shells, p. 36.
1853. *Venus dione* Linnaeus, d'Orbigny, [In] La Sagra, Hist. phys., polít. et nat. l'Ile de Cuba, vol. 2, pp. 274-275.
1853. *Dione veneris* Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, p. 75.
1857. *Dione dione* (Linnaeus), H. and A. Adams, The Genera of Recent Mollusca, pl. 108, figs. 1a, b.
1858. *Cytherea dione* (Linnaeus), Beau, Ext. Rev. Coloniale, p. 24.
1863. *Dione veneris* Deshayes, Reeve, Conch. Icon., vol. 15, *Dione,* pl. 6, sp. 23.
1864. *Venus Dione* Linnaeus, Krebs, The West Indian Marine Shells, p. 96.
1868. *Dione dione* (Linnaeus), Römer, Novitates Conchologicae, Suppl. 3, vol. 1, p. 129, pl. 34, figs. 1a, b.
1878. *Cytherea dione* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 15.
1880. *Cytherea dione* (Linnaeus), Woodward, Manual of Mollusca, 4th ed., p. 474, pl. 20, fig. 8.
1887. *Meretrix* (*Dione*) *dione* (Linnaeus), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, pp. 1079-1080, pl. 20, fig. 8.
1889. *Dione dione* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 56.
1889. *Cytherea dione* (Linnaeus), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 64.
1892. *Cytherea dione* (Linnaeus), Singley, Geol. Sur. Texas, Fourth An. Rept., p. 328.
1901. *Meretrix dione* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 485-486, pl. 56, figs. 3, 10.
1902. *Pitaria* (*Hysteroconcha*) *dione* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 354, 371-372.
1903. *Pitaria* (*Hysteroconcha*) *dione* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1219, 1221, 1222, 1223, 1264, 1265, 1306.
1920. *Pitaria* (*Hysteroconcha*) *dione* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 102-103.
1925. *Pitaria* (*Hysteroconcha*) *dione* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 301, pl. 27, fig. 8.
1927. *Pitaria* (*Lamelliconcha*) *dione* (Linnaeus), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 261-262, pl. 9, figs. 1, 2, 17, 20 (1929).
1934. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1937. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Smith, East Coast Marine Shells, p. 53, pl. 18, figs. 4a, 4b.
1937. *Cytherea dione* (Linnaeus), Lamy and Fischer-Piette, Mus. Nat. Hist. nat. Paris, Bull., 2d. ser., vol. 9, No. 4, pp. 270-271.
1940. *Pitar dione* (Linnaeus), Smith, World-wide Sea Shells, p. 109, fig. 1442.
1946. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1948. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Hertlein and Strong, Zoologica, vol. 33, pt. 4, p. 174.

1949. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 36.
1951. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 81, pl. 16, fig. 6.
1952. *Pitar dione* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183.
1952. *Venus dione* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 87-88.
1954. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Abbott, American Seashells, p. 415, pl. 39f.
1958. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Keen, Sea Shells of Tropical West America, p. 130, fig. 292.
1958. *Pitar dione* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1961. *Hysteroconcha dione* (Linnaeus), Olsson, Panamic-Pacific Pelecypoda, p. 284.
1961. *Pitar* (*Hysteroconcha*) *dione* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 189, pl. 39k.

Shell triangularly ovate, moderately inflated, subsolid. Beak anterior to the middle, prosogyrate. Lunule cordate, depressed, delimited by a faintly impressed line, marked with fine threads. Ligament lodged within a large lanceolate escutcheon which is narrowly lipped at the ligamental gape but flattish to slightly convex distally forming a posterior rostration. External sculpture consisting of narrow, elevated, widely spaced concentric ribs which are higher and lamellose in front, smooth and slightly recurved on the disk, and greatly reduced on the posterior slope and escutcheon; in the interspaces there are fine faint ridglets which become more prominent on the posterior slope. At the rear edge of the disk there is a radial ridge bearing a column of spines which project outward and backward, and behind that, on a second fainter ridge, there is another column of spines, the latter generally fewer in number than on the first ridge; the spines project from the end of every second or third primary concentric rib. Left valve with three cardinal teeth, the central one heavy and shallowly bifid, and with a stout erect anterior lateral tooth which fits into a corresponding socket on the opposite valve. Right valve with three cardinal teeth, the posterior one long, arcuate and bifid, the anterior ones separated by a deep slit. Pallial sinus angulately U-shaped, embayed nearly horizontally to about the median line of the valve below the center, the apex of the sinus gently rounded to blunt. Color violet and white on the disk, violet-brown on the escutcheon, and white in the interior except at the hinge which is a pale purple.

Dimensions.—Recent specimen B397a, right valve, length 31.2 mm.; height 25 mm.; thickness 7.6 mm. Recent specimen B397b, left valve, length 36 mm.; height 28.1 mm.; thickness 7.5 mm. Largest Recent specimen, right valve, length 46.9 mm.; height 38.5 mm.; thickness 11.5 mm. Fossil specimen D403a, umbonal fragment of right valve, length 18.4 mm.; thickness 7.3 mm. Fossil specimen J397a, rear fragment of right valve, height 18.5 mm.; thickness 6 mm. Fossil specimen 1413a, anterior fragment of left valve, height 17.4 mm.

Localities.—Recent, on beach southeast of Higuerote, State of Miranda. Twelve valves including nine right and three left. Abisinia formation at W-30, eastern edge of Playa Grande village. One fragment of a right valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One fragment of a right valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One fragment of a left valve.

Remarks.—The west American analogues are *P. lupanaria* (Lesson) (see Keen, 1958, p. 130, fig. 292; and Olsson, 1961, p. 283, pl. 47, figs. 1-1c) and *P. multispinosa* (Sowerby). *P. lupanaria* ranges from Baja California to nòrthern Peru, occurring along shore to depths of 13 fathoms, and has been reported in the Pleistocene of Oaxaca, México by Palmer and Hertlein (1936, Southern California Acad. Sci., Bull., vol. 35, pt. 2, p. 73). *P. multispinosa* (see Olsson, 1961, p. 284, pl. 47, figs. 2-2d) which also ranges from México to Peru, is more slender than either *P. lupanaria* or *P. dione,* and *P. lupanaria* has vague radial markings that are not present on the Venezuelan specimens of *P. dione.*

Range and distribution.—The Recent *P. dione* ranges from the Gulf of México to Brazil. It has not been previously reported as a fossil, but in addition to the present notice of its occurrence in the Abisinia and Mare formations at Cabo Blanco, Venezuela, it is also contained in Collection No. 18408 of the U. S. National Museum, which was obtained from the Pliocene near Cumaná, State of Sucre, Venezuela.

Periglypta aff. listeri (Gray) Pl. 43, figs. 7, 8

1838. *Dosina Listeri* Gray, The Analyst, vol. 8, p. 308.
1853. *Venus Listeri* (Gray), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, p. 106.

1863. *Venus Listeri* (Gray), Reeve, Conch. Icon., vol. 12, pl. 5, sp. 14.
1864. *Venus Listeri* (Gray), Krebs, The West Indian Marine Shells, p. 97.
1878. *Venus Listeri* (Gray), Mörch, Catalogue of the West-India Shells, p. 15.
1885. *Venus listeri* (Gray), Smith, Voyage H. M. S. Challenger, Zoology, vol. 13, pp. 120, 121.
1889. *Venus listeri* (Gray), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 64.
1891. *Venus listeri* (Gray), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1902. *Cytherea* (*Cytherea*) *listeri* (Gray), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 372, 390.
1903. *Cytherea listeri* (Gray), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1275, 1276, 1279.
1920. *Cytherea listeri* (Gray), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 103.
1926. *Antigona listeri* (Gray), Weisbord, Nautilus, vol. 39, No. 3, p. 83.
1927. *Antigona* (*Dosina*) *listeri* (Gray), Palmer, Palaeontographica Americana, vol. 1, No. 5, p. 337, pl. 28, figs. 2, 11 (1929).
1933. *Chione multicostata* Sowerby var., Trechmann, Geol. Mag., vol. 70, No. 823, pp. 35-36, pl. 4, fig. 6.
1934. *Antigona listeri* (Gray), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1935. *Venus listeri* (Gray), Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Antigona listeri* (Gray), Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1936. *Antigona listeri* (Gray), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Antigona listeri* (Gray), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 166.
1937. *Antigona listeri* (Gray), Smith, East Coast Marine Shells, p. 53, pl. 21, fig. 11.
1939. *Venus listeri* (Gray), McLean, Nautilus, vol. 49, No. 4, p. 119.
1940. *Antigona listeri* (Gray), Smith, World-wide Sea Shells, p. 110, fig. 1445.
1942. *Antigona listeri* (Gray), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1945. *Venus listeri* (Gray), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1946. *Antigona listeri* (Gray), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1948. *Antigona listeri* (Gray), Hertlein and Strong, Zoologica, vol. 33, pt. 4, p. 178.
1951. *Antigona* (*Antigona*) *listeri* (Gray), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 82, pl. 16, fig. 5.
1954. *Antigona* (*Dosina*) *listeri* (Gray), Abbott, American Seashells, p. 404, pl. 32m.
1958. *Antigona* (*Dosina*) *listeri* (Gray), Abbott, Acad. Nat. Sci. Philadelphia, Mon., No. 11, p. 129.
1959. *Antigona listeri* (Gray), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 14.
1961. *Antigona* (*Periglypta*) *listeri* (Gray), Warmke and Abbott, Caribbean Seashells, p. 185, pl. 38L.

Several fragments indicate that the adult species is of moderate fullness and has a truncate posterior end. The sculpture consists of subequally spaced, elevated, finely scalloped concentric laminae

crenulated by radial ribs, and separated by deep squarish interspaces which are a little wider than the laminae except at the base where crowding occurs. The concentric laminae are platy on the middle of the disk but lamellose on the front and rear. The scallops are arched toward the umbo, the arches of the scallops more pronounced and somewhat closer on the anterior and posterior ends. On the dorsal face of the laminae there are broad low rounded radial ribs, and on the under, or ventrad side of the laminae, there are corresponding flutings; the flutings are bounded by strong narrow riblets which continue on the interspace proper although with less sharpness, and between the latter there may be locally a minor intermediate riblet. The ventral margin is crenate within. Both adductor scars are high and relatively faint. The pallial sinus is not observable on any of the fragments.

Dimensions.—1410a, fragment of anterior end of left valve, height 27.5 mm. J443a, fragment of posterior end of right valve, height 26 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Three fragments. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One fragment.

Remarks.—It is not possible to identify the Cabo Blanco fragments with certainty though there is little question of the affinity with the east American *P. listeri* (Gray). In turn *P. listeri* is the analogue of the Pleistocene to Recent *P. multicostata* (Sowerby) (see Olsson, 1961, Panamic-Pacific Pelecypoda, p. 293, pl. 50, figs. 3-3b), the slight difference lying in the outline of the posterior end of the valve which is vertical and truncated on *P. listeri,* subtruncated on *P. multicostata.* The posterior end of the Cabo Blanco fossil is more closely akin to *P. listeri.* A possible progenitor is the upper Miocene *P. mauryae* (Vokes) (Amer. Mus. Novitates, No. 988, p. 12, fig. 10) from Springvale, Trinidad, but the concentric ribs are farther apart than on either *P. listeri* or *P. multicostata.*

Range and distribution.—The living *P. listeri* ranges from Florida to northern South America. The fossil species has been reported from the Pleistocene of Cuba, Barbados, and the Island of Tortuga, Venezuela.

Antigona (Ventricolaria) aff. rigida (Dillwyn) Pl. 43, figs. 9-11

1791. *Venus rugosa* Gmelin, Syst. Nat., ed. 13, p. 3276. Not of Linnaeus, 1758.
1817. *Venus rigida* Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 164.
1818. *Venus rugosa* Lamarck, An. sans Vert., vol. 5, p. 587. Not of Linnaeus.
1845. *Venus rugosa* Chemnitz, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, vol. 5, Moluscos, p. 316.
1863. *Venus rugosa* Gmelin, Reeve, Conch. Icon., vol. 11, pl. 7, fig. 23.
1864. *Venus rugosa* Gmelin (Chemnitz) = *V. rigida* (Solander) Dillwyn, Krebs, The West Indian Marine Shells, p. 98.
1867. *Venus rugosa* Chemnitz, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162 (part).
1870. *Venus rugosa* Gmelin, Verrill, Amer. Jour. Sci., ser. 2, vol. 49, p. 221.
1878. *Venus rugosa* Gmelin, Arango, Contribución a la Fauna Cubana, p. 251. Not of Linnaeus.
1878. *Venus rugosa* Chemnitz, Mörch, Catalogue of West-India Shells, p. 15.
1881. *Venus rugosa* Gmelin, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 372. Not of Linnaeus.
1889. *Venus* cf. *rugosa* Linnaeus, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 126-127, 141. Not of Linnaeus, 1758.
1895. *Chione* (*Ventricola*) *rugosa* (Gmelin), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 292. Not of Linnaeus.
1901. ? *Venus rugosa* Gmelin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1901, pt. 1, p. 483.
1902. *Cytherea* (*Ventricola*) *rigida* (Dillwyn), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, p. 372.
1927. *Antigona* (*Circomphalus*) *rigida* (Dillwyn), Palmer, Palaeontographica Americana, vol. 1, No. 5, p. 341, pl. 30, figs. 3, 7; pl. 31, figs. 13-14, 1929.
1934. *Antigona* (*Circomphalus*) *rigida* (Dillwyn), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1936. *Antigona rigida* (Dillwyn), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 40.
1936. *Antigona rigida* (Dillwyn), Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1948. *Antigona rigida* (Dillwyn), Hertlein and Strong, Zoologica, vol. 33, pt. 4, p. 179.
1949. *Venus* (*Ventricola*) *rigida* Dillwyn, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 37.
1950. *Venus rigida* Dillwyn, Durham, Geol. Soc. Amer., Mem. 43, p. 81.
1951. *Antigona (Ventricola) rigida* (Dillwyn), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 83, pl. 17, fig. 1.
1954. *Antigona* (*Circomphalus*) *rigida* (Dillwyn), Abbott, American Seashells, p. 405.
1958. *Ventricolaria rigida* (Dillwyn), Keen, Sea Shells of Tropical West America, p. 124.
1959. *Antigona rigida* (Dillwyn), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 14.
1961. *Venus (Ventricola) rugosa* Gmelin, van Retgeren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, p. 300.
1961. *Antigona* (*Ventricolaria*) *rigida* (Dillwyn), Olsson, Panamic-Pacific Pelecypoda, p. 292.
1961. *Antigona rigida* (Dillwyn), Warmke and Abbott, Caribbean Seashells, p. 185, pl. 38m.

The form from Cabo Blanco is an internal mold of the attached

valves. The specimen is rounded-subquadrate and well inflated, with a subtruncate posterior end, a deeply arcuate lunular area, and crenulate margins. The impression of the muscle scars and pallial sinus cannot be seen.

Dimensions.—Specimen M411a, length 79 mm.; height 75 mm.; thickness of doublet 53 mm.

Locality.—Playa Grande formation (Catia member) at W-15, south side of Playa Grande road 40 meters southeast of its intersection with the Playa Grande Yachting Club road. One internal mold of a doublet.

Remarks.—The kinship of this mold to *A. rigida* (Dillwyn) is, of course, open to doubt. It is not even certain that the specimen in question is not the same species as that represented by the shell fragments which I have referred to as *Periglypta* aff. *listeri* (Gray), although the present form with its obese valves and deeply impressed lunule would seem to be more closely allied to *A. rigida* than to *P. listeri.* The west American analogue of *A. rigida* is the Pleistocene to Recent *A. isocardia* (Verrill) (see Keen, 1958, p. 124, fig. 268), but according to Verrill (1870, p. 221) it has a different and stronger hinge.

Also related to *A. rigida* is the fragment of shell illustrated as figure 11 on Plate 43. This fragment (H312a) measures 27.4 mm. in height, and was collected in the Mare formation at W-25 on the south flank of the Punta Gorda anticline. The sculpture of the fragment consists of strong subequally spaced laminar concentric ribs with deep interspaces. In the interspaces are smaller elevated concentric lamellae, the number of lamellae between the primary ribs usually three but occasionally two or four. The shell material is thick and came from a rather large adult specimen.

Range and distribution.—The present-day range of *A. rigida* (Dillwyn) is from Florida to Brazil. In the Pleistocene it has been found in St. Eustatius, Curaçao, Aruba, and Barbados. In the Pliocene it was reported by Gabb from Costa Rica. The species referred to as *A. rugosa* (Gmelin) by Olsson (1922, Bull. Amer. Paleont., vol. 9, No. 39, pp. 412-413, pl. 30, fig. 4) from the middle Miocene of Costa Rica is probably not the same as the Caribbean *A. rigida* (Dillwyn) or the west American *A. isocardia* (Verrill).

Antigona (Ventricolaria) rugatina (Heilprin) Pl. 43, figs. 12, 13

1887. *Venus rugatina* Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 92, pl. 11, fig. 24.
1889. *Venus rugosa* Gmelin var. *rugatina* Heilprin, Dall, U. S. Nat. Mus., Bull. 37, p. 54.
1901. *Venus rugatina* Heilprin, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 483.
1902. *Cytherea* (*Ventricola*) *rugatina* (Heilprin), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, p. 372.
1903. *Cytherea* (*Ventricola*) *rugatina* (Heilprin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1277.
1920. *Antigona* (*Ventricola*) *rugatina* (Heilprin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 103.
1927. *Antigona* (*Circomphalus*) *rugatina* (Heilprin), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 341-342, pl. 31, fig. 4 (1929).
1934. *Antigona* (*Circomphalus*) *rugatina* (Heilprin), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1936. *Venus rugatina* Heilprin, Lermond, Check List of Florida Marine Shells, Gulfport, p. 24.
1939. *Cytherea rugatina* (Heilprin), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 13, 19, 26, 29.
1951. *Antigona* (*Ventricola*) *rugatina* (Heilprin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 83, pl. 16, fig. 7.
1953. *Venus* (*Antigona*) *rugatina* Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1953. *Antigona* (*Ventricola*) *rugatina* (Heilprin), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 111.
1954. *Antigona* (*Circomphalus*) *rugatina* (Heilprin), Abbott, American Seashells, p. 405, pls. 32n; 38m.
1958. *Antigona* (*Ventricola*) *rugatina* (Heilprin), DuBar, Florida Geol. Sur., Bull. No. 40, p. 173. Not pl. 7, fig. 4, nor pl. 10, fig. 3 which are illustrations of *Antigona willcoxi* (Dall).
1961. *Antigona* (*Ventricolaria*) *rugatina* (Heilprin), Warmke and Abbott, Caribbean Seashells, p. 185.

The worn left valve referred to this species is moderately inflated, orbicular, slightly depressed posteriorly. The posterodorsal margin is hardly convex, the posterior end subtruncate, the ventral margin semicircular, and the anterodorsal margin at the lunular groove concave with the forward end produced and nearly horizontal. The lunule is broadly cordate, sunken, circumscribed by a narrow groove but with the inner margin elevated, sculptured by concentric lamellae. There is no escutcheon to speak of on the left valve, the area represented by a narrow feeble sulcus. The beak is moderately high, prosogyrate, subcentral. The surface sculpture consists of subequally spaced concentric lirae recurved toward the umbo, and between these there are minor concentric lamellar ridgelets numbering as many as six near the base. Vague radial threads are present locally but these probably appear from the inner layer of shell where

the outer layer has been worn off. The posterior cardinal of the left valve is arcuate and platy, the middle one stout, subrectangular, and shallowly sulcate, the anterior cardinal tooth obliquely cuneate, broadening toward the base; in front of that there is a low but fairly large tubercle. The adductor scars and pallial sinus are obliterated, but the fine crenulations of the ventral and lunular margins may still be observed.

Dimensions.—Specimen A402a, left valve, length 19.7 mm.; height 18.3 mm.; thickness 6 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One worn left valve.

Remarks.—*A. rugatina* was first described by Heilprin in 1887 from the Pliocene "Floridian" formation exposed in the Caloosahatchee River below Fort Thompson, Florida. There, according to Dall and Simpson (1901), the adult fossil may be as much as 90 cms. long, whereas adult Recent specimens are 25 to 35 mm. in length and are more orbicular than the fossil type. Among Recent examples of the species, the worn Venezuelan shell is identical to the worn Puerto Rican form illustrated by McLean (1951).

Range and distribution.—Pliocene to Recent. Living from North Carolina to Brazil at depths of 85 fathoms; Pliocene, Florida.

Chione (Chione) cancellata (Linnaeus) Pl. 44, figs. 1-8

1767. *Venus cancellata* Linnaeus, Syst. Nat., ed. 12, p. 1130. No. 118.
1782. *Venus dysera* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 294, pl. 28, figs. 287-290.
1797. *Venus cancellata* Linnaeus, Bruguière, Encycl. Méth., vol. 2, pl. 268, figs. 1a, b.
1817. *Venus cingenda* Dillwyn, A Descriptive Catalogue of Recent Shells, vol. 1, p. 161.
1818. *Venus cancellata* Linnaeus, Lamarck, An sans Vert., vol. 5, p. 588.
1822. *Venus elevata* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 272.
1828. *Venus cingenda* Dillwyn, Wood, Supplement to the Index Testaceologicus, pl. 7, fig. 6.
1832. *Venus cancellata* Linnaeus, Deshayes, Encyclopédie Méthodique, pl. 1115, pl. 268, fig. 1.
1842. *Venus cancellata* Linnaeus, d'Orbigny, Voyage dans l'Amérique Méridionale, vol. 5, pt. 3, p. 588.
1853. *Chione cancellata* (Linnaeus), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, pt. 1, p. 134.
1853. *Venus cancellata* Linnaeus, Sowerby, Thes. Conchyl., vol. 2, p. 710, pl. 54. figs. 28-31.
1857. *Venus cancellata* Linnaeus, Tuomey and Holmes, Pleiocene Fossils of South Carolina, p. 84, pl. 21, fig. 11.

1860. *Chione cancellata* (Linnaeus), Holmes, Post-Pleiocene Fossils of South Carolina, p. 35, pl. 6, fig. 14.
1863. *Venus cancellata* Linnaeus, Reeve, Conch. Icon., vol. 14, *Venus,* pl. 19, sp. 88.
1864. *Venus ziczac* Linnaeus, Krebs, The West Indian Marine Shells, p 98. Not of Linnaeus.
1864. *Venus cingenda* Dillwyn, Guppy, Sci. Assoc. Trinidad, Proc., p. 36.
1864. *Dione* (*Chamelea*) *cancellata* (Linnaeus), Meek, Smithsonian Misc. Collections, vol. 7, No. 83, p. 10.
1867. *Venus cancellata* Linnaeus, Guppy, Sci. Assoc. Trinidad, Trans., p. 162.
1871. *Chione cancellata* (Linnaeus), Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 126.
1878. *Venus ziczac* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15. Not of Linnaeus.
1886. *Venus* (*Chione*) *cancellata* Linnaeus, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 276.
1886. *Venus cancellata* Linnaeus, Karsten, Géologie de l'ancienne Colombie bolivarienne, Vénézuéla, Nouvelle Grénade et Ecuador, p. 10.
1888. *Venus cancellata* Linnaeus, Schepman, [in] Martin, Bericht über eine Reise nach Nederlandisch West Indien und darauf gegründete Studien, Leiden: II-Geologische Studien, Appendix.
1889. *Venus cancellata* Linnaeus, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 126, 141, pl. 2, figs. 24-26.
1889. *Venus cancellata* Linnaeus, Dall, U. S. Nat. Mus., Bull. 37, p. 54.
1889. *Chione cancellata* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 271.
1891. *Venus cancellata* Linnaeus, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 47.
1891. *Venus cancellata* Linnaeus, Heilprin, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 142.
1892. *Venus cancellata* Linnaeus, Singley, Geol. Sur. Texas, Fourth An. Rept., p. 327.
1895. *Chione cancellata* (Linnaeus), Harris, Bull. Amer. Paleont., vol. 1, No. 3, p. 92.
1895. *Chione* (*Omphaloclathrum*) *cancellata* (Linnaeus), Gregory. Geol. Soc. London, Quart. Jour., vol. 51, p. 292.
1896. *Venus cancellata* Linnaeus, Sapper, Inst. Geol. México, Bol. No. 3, p. 9.
1901. *Venus cancellata* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 483-484.
1902. *Chione cancellata* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 355, 373, 383, 392.
1903. *Chione* (*Chione*) *cancellata* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, pp. 1287, 1288, 1289. 1290-1291.
1903. *Venus cancellata* Linnaeus, Vanatta, Acad. Nat Sci. Philadelphia, Proc., vol. 55, p. 757.
1913. *Chione cancellata* (Linnaeus), Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 497.
1914. *Chione cancellata* (Linnaeus), Henderson and Bartsch, U. S. Nat. Mus., Proc., vol. 47, No. 2055, p. 413.
1916. *Venus cancellata* Linnaeus, Thiele, Zool. Jahrb., Suppl. 11, p. 130.
1920. *Chione cancellata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 104-105.
1922. *Chione cancellata* (Linnaeus), Johnson, Nautilus, vol. 36, No. 1, p. 11.
1923. *Chione cancellata* (Linnaeus), Clench, Nautilus, vol. 37, No. 2, p. 55.
1924. *Chione cancellata* (Linnaeus), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., Faunal List following p. 28.

1925. *Chione* (*Chione*) *cancellata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 305-306, pl. 28, figs. 1, 5.
1926. *Chione cancellata* (Linnaeus), Weisbord, Nautilus, vol. 39, No. 3, pp. 81, 84.
1927. *Chione* (*Chione*) *cancellata* (Linnaeus), F. Hodson, H. K. Hodson, and Harris, Bull. Amer. Paleont., vol. 13, No. 49, p. 61, pl. 35, fig. 5.
1927. *Chione* (*Chione*) *cancellata* (Linnaeus), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 359-360 (1927), pl. 37, figs. 1-8, 11, 15 (1929).
1933. *Chione* (*Omphaloclathrum*) *cancellata* (Linnaeus), Trechmann, Geol. Mag., vol. 70, p. 35, pl. 4, fig. 7.
1934. *Chione cancellata* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1935. *Chione cancellata* (Linnaeus), Richards, Jour. Paleont., vol. 9, No. 3, p. 256.
1936. *Venus* (*Chione*) *cancellata* Linnaeus, Lermond, Check List of Florida Marine Shells, Gulfport, p. 24.
1936. *Venus* (*Chione*) *cancellata* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 41.
1936. *Venus* (*Chione*) *cancellata* Linnaeus, Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 167.
1937. *Chione cancellata* (Linnaeus), Smith, East Coast Marine Shells, p. 53, pl. 7, fig. 5; pl. 21, fig. 5.
1938. *Chione cancellata* (Linnaeus), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 291.
1938. *Venus cancellata* Linnaeus, Lamy and Fischer-Piette, Mus. Nat. Hist. nat. Paris, Bull., 2d. ser., vol. 10, No. 4, pp. 401-402.
1939. *Chione cancellata* (Linnaeus), Mansfield, State of Florida Dept. Conserv., Geol. Bull. No. 18, pp. 13, 14, 17, 18, 19, 23, 26, 30, 35, 56, 57, 58.
1940. *Chione cancellata* (Linnaeus), Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1940. *Chione cancellata* (Linnaeus), Stubbs, Jour. Paleont., vol. 14, No. 5, p. 511.
1942. *Chione cancellata* (Linnaeus), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1944. *Chione cancellata* (Linnaeus), Hackney, Nautilus, vol. 37, No. 2, p. 58.
1945. *Venus cancellata,* Lamarck, van Bentham Jutting, Geolog.-Mijnbouk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 77.
1946. *Chione cancellata* (Linnaeus), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1949. *Chione cancellata* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 37.
1951. *Chione* (*Chione*) *cancellata* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 84, pl. 17, fig. 4.
1952. *Chione cancellata* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 182, pl. 10, figs. 16-17.
1952. *Venus cancellata* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, pp. 93-94.
1953. *Chione* (*Chione*) *cancellata* (Linnaeus), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, pp. 111-112.
1954. *Chione cancellata* (Linnaeus), Abbott, American Seashells, p. 407, pl. 39h.
1955. *Chione cancellata* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 73, pl. 14, fig. 86.
1956. *Chione cancellata* (Linnaeus), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 331, 370, pl. 4, figs. 17a, 17b.
1958. *Chione cancellata* (Linnaeus), Abbott, Acad. Nat. Sci. Philadelphia, Mon. No. 11, p. 129.

1958. *Chione cancellata* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1958. *Chione* (*Chione*) *cancellata* (Linnaeus), DuBar, Florida Geol. Sur., Geol. Bull. No. 40, pp. 173-174, pl. 7, fig. 1; pl. 8, fig. 2.
1959. *Chione cancellata* (Linnaeus), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2125, 2127, 2132, 2161, 2164, pl. 2, VI, figs. 14a, 14b.
1959. *Chione cancellata* (Linnaeus), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, pp. 14-15.
1961. *Chione cancellata* (Linnaeus), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 43.
1961. *Chione* (*Chione*) *cancellata* (Linnaeus), van Regteren Altena, Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.
1961. *Chione* (*Chione*) *cancellata* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 185, pl. 4f; 38-0.

Numerous fossil examples of this species were collected at La Salina and the Cabo Blanco area. The shell is moderately compressed to moderately inflated, subtrigonally ovate, slightly attenuated posteriorly, the disk with a feeble radial depression or flattening behind the middle. Anterior end well rounded, ventral margin generally shallowly rounded, posterior end subangularly rounded at the curve of the ventral and posterodorsal margins, the posterodorsal margin long and straight except near the beak where it forms a slight hump. Beak appressed in the adult, sharply pointed, prosogyrate, situated in front of the middle. Lunule relatively large, broadly cordate, defined by a sharply incised groove, sculptured by low radial ridges which are crossed by concentric, often lamellose striae. Escutcheon lanceolate, flat, sloping inward, narrowly lipped adjacent to the ligamental groove, marked by numerous fine longitudinal striae, delimited by the sharp edge of the disk. Hinge plate strong, the middle cardinal of the left valve the stoutest, the base of the plate bowed down somewhat beneath the anterior cardinal. Right valve with a long narrow groove along the edge of the escutcheon, the corresponding groove of the left valve a little lower and more delicate. Anterior adductor scar high, rather deeply sunken, semi-elliptical, its inner margin straight and impressed, the outer margin a little thickened; posterior adductor scar relatively faint, broader and shorter than the anterior scar, and subsquarish or suboval. The pallial sinus is a very short and rather broadly triangular embayment with a blunt or rounded apex not rising above the median line of the posterior scar, and close to but not touching the margin of the scar. The ventral and anterodorsal margins are closely crenate, the crenulations of the ventral margin occurring in pairs or clusters and obsolescent at

the rear, the denticles of the anterodorsal margin small and single, extending along the edge of the lunule and terminating above the central cardinal of the hinge. External sculpture consisting of slightly thickened elevated lamellar concentric ribs, with low strong radial cords in the interspaces, the cords themselves crossed by numerous concentric growth striae. The concentric ribs are generally widely spaced, are closely frilled on top, and prominently fluted or corrugated on their under, or ventrad side. The radial cords are single on the umbo, but below the umbo intercalary cords develop, and attain with growth the same size as the primary ones; all of the cords continue weakly up the upper, or dorsad face of the concentric ribs. Generally a number of the radial cords behind the middle of the disk are a little broader and flatter than the ones in front or at the very rear. Such coloration that still remains on some of the fossil shells is seen as narrow brown stripes or flammules crossing the escutcheon, some of the stripes straight, others curved, all of them rather widely separated.

Dimensions.—Specimen C400a, right valve, length 21 mm.; height 18.1 mm.; thickness 5.6 mm. Specimen C400b, left valve, length 23 mm.; height 21.2 mm.; thickness 4.7 mm. Specimen T400a, right valve, length 23.2 mm.; height 19.4 mm.; thickness 4.6 mm. Specimen T400b, left valve, length 32.1 mm.; height 26 mm.; thickness 8 mm. Specimen 1400a, right valve, length 17 mm.; height 15.1 mm.; thickness 3.9 mm. Specimen 1400b, left valve, length 17.8 mm.; height 15.9 mm.; thickness 4 mm. Specimen J400a, right valve, length 18.2 mm.; height 15.4 mm.; thickness 3.7 mm. Specimen J400b, left valve, length 39.4 mm.; height 33 mm.; thickness 9.4 mm.

Localities.—La Salina, west of Puerto Cabello, State of Carabobo. Two hundred eighty-seven specimens including one hundred fifty-one right valves and one hundred thirty-seven left valves. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Eleven specimens including six right valves and five left valves. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Nine specimens including five right valves and four left valves. Mare formation at W-25, south flank of Punta Gorda anticline. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Thirty-three specimens including seventeen right valves and

sixteen left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Twelve specimens including nine left valves and three right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Three specimens including two left valves and one right valve. Recent, on beach southeast of Higuerote, State of Miranda. Two left valves, the identification doubtful.

Remarks.—Although variable in shape and in details of sculpture, *Chione cancellata* (Linnaeus) is characterized by the usually widely spaced concentric ribs, and by a short, nearly erect pallial sinus. The species is locally exceedingly abundant, either living or fossil, throughout its chronologic and geographic range.

The shells from La Salina are slightly thinner than those from the Cabo Blanco area, and none of them is as large as the largest of the latter. A number of specimens from both areas are more closely and regularly ribbed concentrically than the majority of examples, but the two variants seem to represent the same species.

Range and distribution.—Miocene to Recent. The living *C. cancellata* ranges from Virginia, U. S. A., through the Gulf of México and the Caribbean Sea, to Brazil. In the Pleistocene, *C. cancellata* occurs in South Carolina, Florida, Louisiana (in well cuttings), Panamá, St. Kitts, St. Eustatius, Barbados, Curaçao, and Venezuela. In the Pliocene it is found in South Carolina, Florida, the Yucatan Peninsula of México, Venezuela (near Cumaná), and Trinidad (at Matura). The species also occurs in the Miocene of Venezuela, and has been reported from deposits of that age in South Carolina and from the Galveston well (1550-2871 feet) in Texas.

Chione (Chione) pailasana, new species, Pl. 44, figs. 9-11

Adult shell large, sturdy, rounded subtrigonal, inequilateral, nearly equivalve. Anterodorsal margin relatively short, anterior end and ventral margin rounded, posterior end acutely rounded, posterodorsal margin long and somewhat convex. Beak appressed, sharply pointed, prosogyrate, situated in front of the middle. Lunule large, cordate, slightly depressed, defined by a sharply incised groove, the half of the lunule on the right valve a little wider than on the left valve. The area of the lunule immediately under the beak is sculptured by low radial ridges crossed by a few concentric laminae,

but the ventrad area of the lunule is sculptured by numerous coarse concentric lamellae on the upper face of which there may be weak radial riblets. Escutcheon large, lanceolate, sloping inward, a little broader on the left valve than on the right, and also narrowly lipped adjacent to the ligamental groove of the left valve, delimited by the sharp raised edge of the disk, and sculptured by numerous fine longitudinal striae. Hinge plate strong, the base of the plate bowed down a little under the anterior cardinal. Dentition normal, the middle cardinal of each valve the highest. Right valve with a long narrow groove along the edge of the escutcheon into which fits the corresponding edge of the left valve. Anterior adductor scar high, rather deeply sunken, semi-elliptical, the inner margin of the scar straight, the outer margin somewhat thickened; posterior scar not so deeply impressed, broadly pyriform or subcylindrical. The pallial sinus is a short triangular embayment with a blunt apex not rising above the median line of the posterior adductor scar, and close to, but not touching the margin of the scar. The ventral and anterodorsal margins are closely crenate within, the crenulations of the ventral margin sometimes occurring in pairs or clusters, and obsolescent at the rear, the crenulations of the anterodorsal margin small and single, extending along the edge of the lunule and terminating above the central cardinal tooth of the hinge. Sculpture of the exterior consisting of up to 32 concentric ribs, the ribs of the upper two-fifths or so of the disk widely separated, the ones below subequal and closely spaced. The upper concentrics are raised and lamellar, closely frilled on top and corrugated or fluted on their ventrad side, these corrugations becoming obsolescent on the ribs toward the base of the valve. The concentrics on the lower three-fifths or so of the disk are thicker, flattened, and recurved toward the umbo, the interspaces much narrower than those on the umbonal area. However, the lower concentrics lose their flatness on the posterior fourth of the disk where they become more erect and decidedly lamellar. The interspaces of the lowest concentric ribs are lined with low sharp concentric striae or laminae, but radial markings are absent. However, the radial sculpture is pronounced on the upper area of the disk. On the umbo the radial cords are single but below the umbo intercalary cords develop, and attain with growth, the same size as the primary ones; all of the radial cords continue weakly up the

upper, or dorsad face of the concentric ribs. Generally, a number of radial cords behind the middle of the disk are a little broader and flatter than the ones in front or at the rear. Such coloration that still remains on some of the fossils is seen as narrow brown stripes or flammules crossing the escutcheon, some of the stripes straight, others curved, all of them widely spaced.

Dimensions.—Holotype (P401a), a doublet, length 47 mm.; height 43 mm.; thickness of pair 27.5 mm. Paratype (R401a), left valve, length 43.8 mm.; height 39 mm.; thickness (not including elevation of ribs) 13.2 mm.

Type locality.—Playa Grande formation (Maiquetía member), north bank of Quebrada Las Pailas, about 35 meters south of Mare Abajo fault and 150 meters southwest of junction of Maiquetía anticline with the Mare Abajo fault. Three specimens including one doublet, one right valve, and one left valve.

Other localities.—Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas, approximately 125 meters upstream from junction with Quebrada Las Pailas. One left valve.

Comparisons.—The nearest related species is the middle Miocene *Chione atlanticana* Anderson (1929, California Acad. Sci., Proc., ser. 4, vol. 18, p. 172, pl. 23, figs. 5-6) from northern Colombia, that species differing, however, in having a straighter posterodorsal margin than *C. pailasana,* n. sp., and in having a subtruncate posterior end instead of the acutely rounded one of the Venezuelan shell. The umbonal area of *C. pailasana* is similar to that of the Miocene to Recent *C. cancellata* (Linnaeus), but *C. cancellata* is less inflated, has a smaller lunule, and is always characterized by a posterior flattening of the disk not present on the new species. Also I have seen no Recent examples of *C. cancellata* with as many concentric ribs as the new species, and on none of the Recent examples of *C. cancellata* do the closely spaced concentric ribs start as high up on the disk as they do on *C. pailasana.* The Recent *C. pinchoti* Pilsbry and Olsson (Nautilus, vol. 64, No. 4, pp. 109-110, pl., g, figs. 7-8), from Limon Bay, Panamá, is a smaller, more trigonal shell, with fewer concentric ribs, and a moderately deep pallial sinus.

Chione (Chione ?) mamoensis, new species Pl. 33, figs. 11, 12; Pl. 44, figs. 12, 13; Pl. 45, figs. 1, 2

Shell small, moderately compressed to somewhat inflated, oval-subquadrate, slightly depressed posteriorly. Anterodorsal margin short and fairly straight, anterior end rounded, ventral margin shallowly arcuate, posterior end usually subtruncate, posterodorsal margin long and straight. Umbo moderately full, the beak prosogyrate, situated a little anterior to the middle. Lunule cordate, not impressed, circumscribed by a thin sharp groove, ornamented with small radial riblets which are crossed and frilled by low concentric lamellae. Escutcheon lanceolate, flat to slightly depressed medially, marked by concentric growth laminae, defined by the subangular edge of the disk, colored by a few irregular transverse streaks of faded brown. Surface reticulated by fairly regular radial cords crossed by subequally spaced concentric lirae, the lirae elevated and recurved slightly toward the umbo, but becoming laminar near the posterior end where they lie nearly flat. The gently rounded radial cords, averaging 24 in number, are mostly single and separated by subequal interspaces, but in front of the middle and toward the base, the cords are double on some specimens. Occasionally there may be an interstitial thread between the primary radii. In addition to the numerous fine concentric growth striae traversing the disk there are an average of 24 primary concentric lirae, the lirae elevated and minutely scalloped at the top on most of the disk but flatter-lying and frilly on the posterior fourth of the valve. Right valve with a minor cardinal tooth adjacent to the nymph; in front of that is a taller erect triangular cardinal tooth separated from the posterior one by a narrow sulcus; the socket in front of the middle cardinal is subtrapezoidal, the anterior tooth bordering the socket the largest of the triad and more or less cuneate in appearance; the anterior and medial cardinals converge toward the beak but do not meet; ahead of the right anterior cardinal tooth there is an arcuate socket with a small laminar tooth above it. Along the posterodorsal margin of the right valve there is a long, rather prominent groove which receives the edge of the other valve. Hinge of left valve with a minor posterior cardinal, a stout cuneate central cardinal, and a smaller and narrow anterior cardinal tapering toward the beak. Anterior adductor scar high, ovate, impressed; posterior scar faint, suboval, and with a broad low radial hump running through it on the left valve, the hump not discernible on the right valve. Pallial

sinus obscured. Ventral, anterior, and lunular margins crenulate within, the crenulations coarse and single or faintly bidenticulate along the middle of the ventral margin, then suddenly becoming finer, closer and arranged in series on the anterior end, and subsequently longer and somewhat oblique at the lunular margin.

Dimensions.—Holotype (S401a), right valve, length 13 mm.; height 11.2 mm.; thickness 4 mm. Paratype (S401b), left valve, length 11.2 mm.; height 9.7 mm.; thickness 3.3 mm. Paratype (D401a), right valve, length 10 mm.; height 9 mm.; thickness 3.7 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Eight specimens including five right valves and three left valves.

Other localities.—Abisinia formation at W-30, eastern edge of Play Grande village. One right valve.

Comparisons.—This species closely resembles the Recent *C. guatulcoensis* Hertlein and Strong (1948, Zoologica, vol. 33, p. 182, pl. 1, figs. 2, 4, 6, 10; pl. 2, figs. 1, 8, 12, 13) which ranges from México and Panamá in depths to seven fathoms, but *C. guatulcoensis* is a little more pointed posteriorly and less regularly lirate than *C. mamoensis,* n. sp., and the radial sculpture of *C. guatulcoensis* is obsolete in the medial anterior ventral area. Compared with the type of *C. mazyckii* Dall (1902, U. S. Nat. Mus. Proc. vol. 26, No. 1312, pp. 373, 382-383, pl. 13, fig. 2), a Recent species of the Western Atlantic which is reported as ranging from North Carolina, U.S.A., to Brazil, *C. mamoensis* bears more concentric lirae. The subgeneric classification of *C. mamoensis* is uncertain as the pallial sinus cannot be made out on any of the Cabo Blanco specimens.

Chione (Chione ?) laciniosa, new species Pl. 45, figs. 3-6

Shell suborbicular, somewhat inequilateral, moderately inflated, rather solid. Margin of disk in front of the beak concave, the anterior and ventral margins forming part of a circle, the posterodorsal margin long and gently convex with an overall slope of about 40 degrees from the horizontal, the union of the posterodorsal and ventral margins obtusely angulate. Umbo full, the beak fairly high, prosogyrate, situated a little forward of the middle. Lunule large, slightly appressed, elongate-cordate, sharply defined by a narrow

impressed groove, sculptured by coarse concentric lamellae bearing faint microscopic radial striations. Escutcheon narrow, hardly developed. Surface sculpture consisting of subregular concentric laminae with low radial riblets on the dorsad face, the spaces between the laminae narrow and flat, and marked by single radial threads. The concentric laminae are sharp and foliaceous, particularly at the posterior submargin, in the early stages of growth, and somewhat thickened in the adult stage, the summit of the laminae minutely scalloped. The radial threads in the interspaces are rather strong, each one terminating at the groove between the riblets at the base of the dorsad face of the laminae, but continuing up the lower, or ventrad face of the laminae. Hinge of right valve with three separate cardinal teeth, the anterior one a lamina rising from the wall under the lunular margin, the middle one stout and cuneate, the posterior tooth large, high, slightly arcuate and weakly sulcate, the groove of the nymph behind it deep. Below the posterodorsal margin of the right valve there is a narrow groove which receives the edge of the opposite valve. Adductor scars faint, the anterior suboval, the posterior subpyriform. Pallial line rather remote from, and parallel with the basal margin. The configuration of the pallial sinus cannot be made out but there is the suggestion that it is small and close to the posterior adductor scar. Ventral and lunular margins crenulated within.

Dimensions.—Holotype (I401a), immature right valve, length 2.4 mm.; height 2.3 mm.; approx. thickness 0.7 mm. Paratype (I405a), hinge area of broken adult right valve, length of fragment 3.7 mm.; approx. thickness at umbo 1.1 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two right valves, one a whole adolescent, the other a broken adult.

Comparisons.—Among the numerous allied forms, the closest perhaps is *C. morsitans* Olsson and Harbison (1953, p. 112, pl. 13, fig. 3) from the upper Miocene and Pliocene of Florida, the Venezuelan shell differing from that in its more orbicular outline. Other analogous species from east and west America are the following:

C. bainbridgensis Dall (1916, U. S. Nat. Mus., Proc., vol. 51, No. 2162, p. 499, pl. 84, figs. 5-6). Upper Oligocene and lower Miocene, southeastern United States. The union of the posterodorsal

and ventral margins is more rounded than on *C. laciniosa,* n. sp.

C. cortinaria (Rogers) (see Mansfield, 1932, Florida State Geol. Sur., Bull. No. 8, pp. 125-126, pl. 23, fig. 8). Upper Miocene in Virginia and Florida, U. S. A. The anterior and middle cardinals of the right valve are more closely approximate, and the outline of the valve more trigonal than on *C. laciniosa.*

C. cribraria (Conrad) (see Palmer, 1927, Palaeontographica Americana, vol. 1, No. 5, p. 142, pl. 38, figs. 1, 8, 9; pl. 39, figs. 3, 24, 1929). Miocene and Pliocene from Virginia to South Carolina, U. S. A. The outline is subtrigonal, that of the Venezuelan shell suborbicular.

C. guppyana Maury (1912, Acad. Nat. Sci. Philadelphia, Jour., 2 ser., vol. 15, p. 59, pl. 9, fig. 19). Miocene and Pliocene of Trinidad. The pallial sinus is deep and obtusely triangular.

C. intapurpurea (Conrad) (see Abbott, 1954, American Seashells, p. 401, pl. 39g). Pleistocene of the Gulf states; Recent from North Carolina to the West Indies. The right anterior and middle cardinals are roughly parallel, subequal in size, and separated by a deep narrow cleft; also the lunule is shorter and more broadly cordate than on *C. laciniosa.*

C. pubera Valenciennes (see Palmer, 1927, p. 141, pl. 38, figs. 2, 5, 6, 12). Recent, Gulf of México and Caribbean Sea. This is more elongated than *C. laciniosa.*

C. retugida Woodring (1925, Carnegie Inst. Washington Publ. No. 366, pp. 161-162, pl. 22, figs. 5-6). Middle Miocene of Jamaica. This is elongate-ovate whereas the Venezuelan shell is suborbicular.

C. sawkinsi Woodring (1925, pp. 159-160 pl. 21, figs. 12-14). Lower Miocene of the Dominican Republic; middle Miocene of Jamaica. The right anterior cardinal is much stouter and more rounded than on *C. laciniosa.*

C. socia Pilsbry and Johnson (1917, Acad. Nat. Sci. Philadelphia, Proc., vol. 69, p. 199; Pilsbry, 1921, *ibid,* vol. 73, p. 423, pl. 47, figs. 12, 13). Miocene of the Dominican Republic. This has fewer concentric laminae than *C. laciniosa,* and the crenulations at the middle of the ventral margin are paired.

C. spenceri Cooke (1919, Carnegie Inst. Washington, Publ. No. 291, p. 150, pl. 15, figs. 1a, b). Oligocene of Antigua. The concentric laminae "are smooth on the dorsal surface and on the upper part

of the ventral surface, but with a row of beads, contiguous to the radial ribbing, at the base of the ventral surface."

C. walli (Guppy) (1866, Geol. Soc. London, Quart. Jour., vol. 22, p. 581, pl. 26, fig. 16). Miocene in Trinidad, Colombia, and Peru. This is more trigonal in outline than *C. laciniosa.*

C. woodwardi (Guppy) (1866, p. 292, pl. 18, fig. 1). Lower Miocene of the Dominican Republic; middle Miocene of Jamaica. The right anterior cardinal is stouter and more rounded than on *C. laciniosa.*

C. californiensis (Broderip) (1835, Zool. Soc. London Proc., p. 43; Sowerby, 1855, Thes. Conchyl., vol. 2, p. 711, pl. 154, figs. 40-41). Upper Pliocene to Recent, the Recent shell ranging from California to Panamá in depths to 38 fathoms. The concentric laminae are less frilly than on *C. laciniosa.*

C. fluctifraga (Sowerby) (1855, Thes. Conchyl., vol. 2, p. 712, pl. 154, figs. 42-43). Upper Pliocene to Recent, the Recent shell ranging, mainly intertidally, from California to México. This species lacks the well-defined lunule of the Venezuelan shell.

C. oulotricha Gardner (1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, pp. 33-34, pl. 7, figs. 1-2). Middle Miocene in Ten Mile Creek, Calhoun County, Florida. More elongated than *C. laciniosa.*

C. richthofeni Hertlein and E. K. Jordan (1927, California Acad. Sci., Proc., ser. 4, vol. 16, No. 19, pp. 619-620, pl. 17, figs. 4, 7, 8). Lower Miocene of Baja California, México. The lunular area is more concave than on *C. laciniosa.*

C. temblorensis Anderson (1905, California Acad. Sci., Proc., ser. 3, vol. 2, No. 2, p. 196, pl. 14, figs. 36-38). Lower Miocene, California. The escutcheon is much more pronounced than on the Venezuelan *C. laciniosa,* n. sp.

C. undatella (Sowerby) (1835, Zool. Soc. London Proc., p. 22; 1885, Thes. Conchyl., vol. 2, p. 711, pl. 153, fig. 22). Pliocene to Recent, the Recent shell ranging from southern California to Peru in depths to 50 fathoms. The laminae are less frilly than on *C. laciniosa.*

Chione (Timoclea) tacaguana, new species — Pl. 45, figs. 7, 8; Pl. 46, figs. 1, 2

Shell small, sturdy, moderately inflated, oval-suboblong, a little

longer than high, slightly depressed posteriorly. Anterodorsal margin straight and slightly sloping, anterior end rounded, ventral margin arcuate, posterior end subtruncate, posterodorsal margin long and nearly straight. Beak moderately high, prosogyrate, situated well in front of the middle. Lunule fairly large, cordate, not impressed, circumscribed by a fine groove, sculptured by coarse concentric lamellae which overrun small radial riblets. Escutcheon elongate-elliptical, flat to hardly depressed, narrowly thickened adjacent to the ligamental groove, delimited by the angulate edge of the disk, marked by fine longitudinal striae. Surface reticulated by more or less evenly spaced radial cords crossed by numerous subequal concentric lirae, the lirae slightly wider apart on the upper middle of the disk than on the umbo or base. The radial cords number 30 or more, and from about the middle of the valve toward the rear they are medially bifurcated. The concentric lirae, of which there may be 50 or so, are laminar, minutely ruffled on the middle of the disk, scalloped, slightly overlapping and crowded on the anterior end, and more open and frilled on the posterior end. Hinge with three discrete cardinal teeth on the left valve, the anterior one narrowly cuneate, the middle stout and subrectangular, the posterior laminar and arcuate. On the right valve the posterior cardinal is laminar, the middle one high and platy, the anterior large and cuneate; in front of the right anterior cardinal there is an oblique socket bordered above by a small laminar tooth, and behind the right posterior cardinal the arcuate ligamental groove is deep and narrow. Along the posterodorsal margin of the right valve there is a strong, long, asymmetrical groove which receives the edge of the opposite valve. Anterior adductor scar impressed and ovate, the posterior scar larger but fainter, and subquadrate in outline. Pallial sinus small, subtriangular, with a rounded apex which is embayed to opposite the middle of the posterior adductor scar. Ventral and lunular margins crenulate within, the posterior end of the valve smooth. The escutcheon of the holotype is traversed transversely by five widely separated stripes of faded brown.

Dimensions.—Holotype (S401c), left valve, length 13 mm.; height 11 mm., thickness 4.2 mm. Paratype (S401d), right valve, length 11.8 mm.; height 10.4 mm.; thickness 3.9 mm. Largest

specimen, left valve, length 16.4 mm.; height 13.7 mm.; thickness 5 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Three specimens including two left valves and one right valve.

Comparisons.—The new species at once recalls the Pleistocene to Recent *C. pygmaea* (Lamarck) (see Warmke and Abbott, 1961, Caribbean Seashells, p. 186, pl. 38j), but *C. pygmaea* is more elongated and is well rounded at the posterior end rather than subtruncate as is *C. tacaguana,* n. sp. The new species is also similar to the Miocene to Recent *C. grus* (Holmes) (1860, Post-Pleiocene fossils of South Carolina, p. 37, pl. 7, fig. 5) but that is differentiated by its smaller size and by its much narrower and sunken escutcheon.

Chione (Chionopsis) subrostrata (Lamarck) Pl. 45, figs. 9-14

1818. *Venus subrostrata* Lamarck, An. sans Vert., vol. 5, p. 588.
1835. *Venus subrostrata* Lamarck, Deshayes, An. sans Vert., vol. 6, p. 343.
1846. *Venus portesiana* d'Orbigny, Voyage dans l'Amérique Méridionale, p. 556, pl. 83, figs. 1-2.
1852. *Venus Beaui* Récluz, Jour Conchyl., vol. 3, p. 412, pl. 12, figs. 15 a, b.
1864. *Venus Beauii* Récluz, Krebs, The West Indian Marine Shells, p. 95.
1889. *Venus Beaui* Récluz, Dall, U. S. Nat. Mus., Bull. 37, p. 54.
1889. *Venus beaui* Récluz, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 64.
1902. *Venus subrostrata* Lamarck, Dall, U. S. Nat. Mus., Proc., vol. 26, No. 1312, pp. 373, 393 (part).
1903. *Chione subrostrata* (Lamarck), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1289.
1910. *Chione subrostrata* (Lamarck), Dall, U. S. Nat. Mus., Proc., vol. 37, No. 1704, p. 268 (part).
1925. *Chione* (*Chione*) *subrostrata* (Lamarck), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 306.
1925. *Chione* (*Chione*) *portesiana* (d'Orbigny), Maury, Bull. Amer. Paelont., vol. 5, No. 42, p. 307, pl. 28, fig. 3; var. *beaui* Recluz, Maury, pp. 307-308, pl. 28, fig. 3.
1927. *Chione* (*Chione*) *subrostrata* (Lamarck), Palmer, Palaeontographica Americana, vol. 1, No. 5, pp. 358-359, pl. 40, figs. 3, 4, 19, 20; pl. 44, fig. 20 (1929).
1934. *Chione subrostrata* Lamarck, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 48.
1936. *Venus* (*Chione*) *subrostrata* Lamarck, Lermond, Check List of Florida Marine Shells, Gulfport, p. 24.
1937. *Chione subrostrata* (Lamarck), Smith, East Coast Marine Shells, p. 54, pl. 20, fig. 7.
1938. *Venus subrostrata* Lamarck, Lamy and Fischer-Piette, Mus. Nat. Hist. nat. Paris, Bull., 2d ser., vol. 10, No. 4, p. 402.
1945. *Venus subrostrata* Lamarck, Van Bentham Jutting, Geolog.-Mijinbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1948. *Chione subrostrata* (Lamarck), Hertlein and Strong, Zoologica, vol. 33, pt. 4, No. 13, p. 184.

1949. *Chione subrostrata* (Lamarck), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 38.
1958. *Chione subrostrata* (Lamarck), Keen, Sea Shells of Tropical West America, p. 144.

The Recent shell from Higuerote is moderately inflated, generally ovate-subtrigonal but occasionally suborbicular, the subtrigonal form slightly produced posteriorly and subangularly rounded at the curve of the posterodorsal and ventral margins, the suborbicular form with a nearly semicircular ventral margin. Beak full, prosogyrate, a little anterior to the middle. Lunule cordate, defined by a finely incised groove, sculptured by seven to nine nodulose radial cords which are crossed by concentric laminae continuing from the disk. Escutcheon elongate-elliptical, flattened, marked by numerous growth lines, the inner edge at the ligamental groove arcuate and narrowly thickened, the outer edge deliminated by the generally sharply angulate margin of the disk. Surface sculpture consisting of 20 to 40 low lamellar concentric ribs, with strong low radial cords in the interspaces, the cords crossed by numerous concentric growth striae. The concentric ribs extend from the beak to the base, are widely and subequally spaced on the umbo and central area of the disk but more closely spaced toward the ventral margin; the ribs are finely frilled along the top edge and corrugated on their ventrad face by strong short regular crenations. The radial cords are low, fairly broad, regularly spaced (although a little more crowded posteriorly), the interspaces a little narrower than the cords; on the umbonal area the radial cords appear to be single, but under the lens are seen to be compounded of one or two microscopic radii; below the umbo the cords become bipartite, and then tripartite toward the base, the divisions weak on some specimens, strong on others; on the posterior of the disk the radial cords are single. On the under, or ventrad face of the concentric ribs there are first two, and later three strong crenations of equal size, the crenations regularly disposed atop the radial cords. Hinge of left valve with a stout, somewhat sulcate middle cardinal, in front of which is an erect anterior tooth which fits into the deep narrow socket of the opposite valve. Hinge of right valve with a stout, slightly sulcate posterior cardinal, the receptor socket in front of it deep and subrectangular, the sides subparallel. Anterior adductor

scar ovate, the posterior scar broadly subcylindrical. Pallial sinus oblique, obtusely triangular, rounded at the apex which is on a line with, but considerably removed from the upper margin of the posterior adductor scar. Ventral and lunular margins finely crenulate within. The coloration is variable. Some specimens are white throughout except for a tinge of purple on the inner face of the lunule and in the cavity to the rear of the escutcheon. On most of the specimens the lunule is brownish in whole or in part, and the escutcheon flecked, flammuled, or stained chestnut-brown. Several specimens are straw-colored on the exterior and bear interrupted rays of chestnut-brown. Three specimens are mostly black and gray on the outside, with bands and flushes of blue-black and gray in the interior, these specimens also having brown on the lunule and bands of chestnut-brown crossing the escutcheon.

Dimensions.—Specimen B400a, right valve, light in color, length 21.3 mm.; height 19 mm.; thickness 5.1 mm. Specimen B400b, left valve, blackish, length 20 mm.; height 17 mm.; thickness 6 mm. Specimen A404a, right valve, worn, length 15 mm.; height 13 mm.; thickness 5 mm.

Localities.—Recent, on beach southeast of Higuerote, State of Miranda. Nine specimens including five left valves and four right valves. Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One worn right valve, the identification of which is somewhat doubtful.

Remarks.—The shells from Higuerote exhibit considerable variation in color, shape, and number of concentric lirae. The more elongated forms are like d'Orbigny's *C. portesiana,* and the suborbicular forms like *C. beaui* Récluz. Both of those, according to Palmer, are synonymous with *C. subrostrata* (Lamarck).

Range and distribution.—Recent, southern Florida to Brazil. Van Bentham Jutting (1945) reported *Chione subrostrata* as a fossil from the Quaternary at Punta Gorda, Venezuela, and although she gave no precise locality at Punta Gorda, I believe it must have been in the immedate vicinity of what I (Weisbord, 1957) have called the Punta Gorda anticline. On the south flank and near the axis of this faulted anticline a narrow fossiliferous wedge of the Mare formation (Fig. 5) is exposed. Unconformably atop this wedge are heterogeneous unfossiliferous cobble gravels. On the north flank

of the Punta Gorda anticline, and somewhat lower in elevation than the Mare wedge is the Maiquetía member of the Playa Grande formation with its included *Lithothamnium* bioherm (Figs. 6, 7) and associated mollusks. In one place or another at Punta Gorda the heterogeneous and unfossiliferous gravels unconformably overlie both the Mare and Playa Grande formations, and these gravels may well be Pleistocene in age. I did not find *Chione subrostrata* at Punta Gorda, but I would venture the opinion that the form identified as this species was collected in either the Playa Grande or Mare formation, and as I continue the study of the fossils from these formations the evidence increasingly suggests that they are pre-Pleistocene in age.

Chione (Lirophora) riomaturensis Maury — Pl. 45, figs. ,15, 16; Pl. 47, figs. 1-6

1925. *?Chione (Lirophora) latilirata* (Conrad), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 313-314, pl. 29, figs. 1, 2, 9.
1925. *Chione (Lirophora) riomaturensis* Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 314-315, pl. 29, fig. 4.
1927. *Chione (Lirophora) riomaturensis* Maury, Palmer, Palaeontographica Americana, vol. 1, No. 5, p. 389, pl. 44, fig. 9 (1929).

The Venezuelan shell referred to this Trinidad species is thick, moderately compressed, trigonal in outline, a little longer than high. Anterodorsal margin at the lunule subangularly concave, the anterior end acutely rounded, the ventral margin arcuate, the posterior end subangularly rounded, the posterodorsal margin long and straight except at the beak where it is slightly convex. Beak flattened on top, prosogyrate, situated a little forward. Lunule cordate, sunken in the middle, defined by a narrowly incised groove, the inner edge slightly elevated, marked by concentric striae which develop into low laminae with age. Escutcheon long, lanceolate, flattened to hardly concave, arcuately and weakly lipped adjacent to the ligamental groove, delimited sharply by the angulate edge of the disk, marked by numerous regular growth striae. Surface sculptured by five to fifteen concentric ribs, the number depending on the stage of development. The prodissoconch is small and smoothish, but on the umbo there are two or three widely spaced low laminar ribs, the later of these with a tendency to become recurved toward the beak. Below the umbo the ribs are broad, swollen, and billowy on adolescent speci-

mens but convex and shingle-like or older shells, the ribs on the latter rising slightly above the base of the preceding rib and separated from it by a deep narrow channel. Generally, on the umbo, there is one rib which is larger than ones immediately above it as well as the first one or two below it. Anteriorly the principal ribs terminate just before the lunular groove, but posteriorly, more often than not, the swollen ribs suddenly thin out and are continued over the posterior area as narrow elevated ridges to the border of the escutcheon. Occasionally a rib or two does not pinch out into a lamina but ends a short distance away from the border of the escutcheon. Rarely, a rib is outflung into a pointed tip at the posterior extremity. On larger specimens the face of the ribs is marked by delicate wavy concentric growth incrementals, and at the base of the ribs there are generally faint radial lineations. The interspaces themselves are smooth. Hinge strong and normal, each valve with three cardinals, the anterior one, especially that of the right valve, the smallest; on the right valve the posterior cardinal has a deep groove behind it whereas on the left valve the posterior cardinal is fused to the nymph. Nymph pitted on left valve, arrayed with small chevron-like denticles on the right valve. Along the edge of the escutcheon is a narrow groove, the groove longer and sharper on the right valve than the left. Anterior adductor scar ovate, impressed, thickened slightly at the outer margin; posterior adductor scar faint, suboval. Pallial sinus short and triangular, the apex subacute, pointed forward and upward, embayed to a point opposite the middle of the posterior adductor scar. Ventral and lunular margins closely crenate.

Dimensions.—Specimen 1398a, left valve, length 36.6 mm.; height 32.1 mm.; thickness (excluding ribs) 10 mm. Specimen H398a, right valve, length 34.7 mm.; height 28.2 mm.; thickness (excluding ribs) 7 mm. Specimen J398a, right valve, length 14.6 mm.; height 12 mm.; thickness (excluding ribs) 3.1 mm. Specimen J398b, left valve, length 14.3 mm.; height 12.3 mm.; thickness (excluding ribs) 4 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Five specimens including three right valves and two left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Four specimens

including two right valves and two left valves. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Nine specimens including five left valves and four right valves. Mare formation at W-25, south flank of Punta Gorda anticline. Five right valves.

Comparisons.—Like many of the billowy-ribbed species of the subgenus *Lirophora,* the Cabo Blanco shell referred to *C. (L.) riomaturensis* Maury exhibits considerable variation in superficial sculpture, particularly at different stages of development. Young Cabo Blanco specimens of *C. riomaturensis,* for example, also closely resemble the small Trinidad shell identified by Maury as *C. latilirata* (Conrad), though it may well be that both of Maury's forms represent the same species, one of them being the adolescent, the other the adult. However, I doubt that this species is the typical Miocene to Recent *C. latilirata* of Conrad as the ribs of *C. latilirata s.s.* (Conrad) are rather regular, and cease, without pinching out, before reaching the border of the escutcheon. The Trinidad and Venezuelan forms here referred to *C. riomaturensis* Maury are closer to the upper Miocene of Recent *C. latilirata athleta* (Conrad) (see Mansfield, 1932, Florida State Geol. Sur., Bull. No. 8, p. 130, pl. 25, figs. 8-9) although according to Conrad the ribs of *C. l. athleta* are without posterior laminae whereas on *C. riomaturensis* the ribs are often, though not always, pinched into a lamina on the posterior area near the escutcheon. On the Pleistocene and Recent *C. paphia* (Linnaeus) (see McLean, 1951, p. 86, pl. 17, fig. 9; and Fischer, 1887, p. 1084, pl. 20, fig. 7) the concentric ribs are more regular and more numerous than on *C. riomaturensis,* and each of them pinches out posteriorly into a lamina rather far removed from the escutcheon.

Other fossil analogues of *C. riomaturensis* Maury are the following:

C. chiriquiensis Olsson (1922, p. 420, pl. 32, figs. 9-10). Middle Miocene, Costa Rica. In side view, with the short axis of the valve held vertically, the lunular margin is seen to be arcuate whereas on the Cabo Blanco *C. riomaturensis* the forward end of the lunular margin is nearly straight and horizontal.

C. cartagenensis H. K. Hodson (1927, p. 63, pl. 31, fig. 4; pl. 35, fig. 6) from the Miocene at Cartagena, Colombia, and *C.*

matarucana H. K. Hodson (1927, p. 64, pl. 35, fig. 4) from the Miocene in the State of Falcon, Venezuela, do not have so steep a posterodorsal margin as does *C. riomaturensis*, and the ribs are less billowy than on *C. riomaturensis*.

C. latilirata colombiana Weisbord (1929, pp. 254-255, pl. 4, figs. 8-10). Middle Miocene, Colombia. This has more regular ribs than the Cabo Blanco shell, and none of them pinches out into a lamina near the escutcheon.

C. hendersoni Dall (see Woodring, 1925, Carnegie Inst. Washington, Publ. No. 366, pp. 163-164, pl. 22, figs. 7-10). Oligocene and lower Miocene of Puerto Rico; Lower and middle Miocene of the Dominican Republic, middle Miocene of Jamaica. The concentric ribs are more numerous and more regular than those of *C. riomaturensis*.

C. cymaina Gardner (1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, pp. 36-37, pl. 5, figs. 14-15). Middle Miocene, Florida. The ribs are broader, fewer, and even more irregular than on the Cabo Blanco *C. riomaturensis*.

Range and distribution.—Pliocene at Matura, Trinidad. The form listed by Guppy (1867, Sci. Assoc. Trinidad Proc., pt. 3, p. 189) as *Venus paphia* Linnaeus, from the Pliocene near Cumaná, Venezuela, is probably the same species as the one referred to herein as *C. riomaturensis*.

Chione (Lirophora) cultellata, new species Pl. 47, figs. 7-12

Shell small, compressed, trigonal, inequilateral. Anterodorsal margin long and hardly concave, anterior end acutely rounded to subangular, ventral margin arcuate, posterior end subangularly rounded, posterodorsal margin steeply inclined, somewhat humped at the umbo, straight and long below. Lunule scarcely depressed, ill-defined, long, narrow, subcordate to ellipical, marked by a few faint growth striae. Escutcheon long, flat, lanceolate, nearly smooth. Beak appressed, prosogyrate, subcentral. Surface sculptured, below the smooth prodissoconch, by remote, elevated, thin to laminar concentric ribs (five on the paratype) extending across the disk from the edge of the lunule to the border of the escutcheon. With growth the ribs on the main part of the disk become progressively higher, thicker at their base, and bent or recurved toward the

umbo, but along the border of the escutcheon the ribs retain their lamellar character. The wide and flattish interspaces between the ribs are nearly smooth, though they are scored with microscopic concentric lineations through which the fine radii of the inner layer of the shell may be vaguely reflected if not already bared through corrosion of the surface layer. Ligamental groove narrow and arcuate. Hinge of right valve with a small laminar anterior, a moderately stout and deltoid medial, and an elongated posterior cardinal. Cardinal teeth of left valve diverging from beneath the beak, the anterior tooth larger than that of the opposite valve, and the posterior cardinal smaller than that of the opposite valve. Along the escutcheon of the right valve there is a long narrow groove to receive the edge of the left valve. Anterior adductor scar ovate and slightly sunken, the posterior scar faint, and more or less oval. Pallial sinus U-shaped, moderately short and broad, nearly erect, the apex well rounded and embayed to a point near and a little below the top of the posterior adductor scar. The ventral margin of the valves is finely crenate within, but because of imperfect preservation, it cannot be determined whether the narrow lunular margin is also crenate.

Dimensions.—Holotype (G409a), right valve (broken along ventral margin), length 4.3 mm. Paratype (G408a), left valve, length 4.7 mm.; height 3.9 mm. Paratype (1406a), left valve, length 4 mm.; height 3.7 mm.; thickness (excluding ribs) approximately 1 mm.

Type locality.—Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Two valves, one right and one left.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo; one left valve.

Comparisons.—The nearest related species is *C. quirosensis* H. K. Hodson (1927, Bull. Amer. Paleont., vol. 13, No. 49, p. 62, pl. 35, fig. 9) from the upper Oligocene or lower Miocene in the State of Falcon, Venezuela, but the Cabo Blanco shell is more inequilateral and has a steeper posterodorsal slope than the Falcon form.

PETRICOLIDAE

Petricola (Naranio) lapicida (Gmelin) Pl. 47, figs. 13, 14

1791. *Venus lapicida* Gmelin, Syst. Nat., vol. 6, p. 3269. Chemnitz, 1788, Syst. Conchylien-Cabinet, vol. 10, p. 356, pl. 172, figs. 1664-1665.
1791. *Venus divergens* Gmelin, Syst. Nat., vol. 6, p. 3629. Chemnitz, 1788, Syst. Conchylien-Cabinet, vol. 10, p. 357, pl. 172, figs. 1666-1667.
1801. *Petricola costata* Lamarck, Syst. An. sans Vert., p. 121.
1825. *Venus lapicida* Gmelin, Wood, Index Testaceologicus, pl. 8, fig. 72.
1843. *Petricola costata* Lamarck, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 53.
1853. *Naranio costata* (Lamarck), Gray, An. Mag. Nat. Hist., vol. 11, p. 38.
1853. *Naranio lapicida* (Gmelin), Deshayes, Catalogue of the Conchifera or Bivalve Shells in the British Museum, p. 216.
1853. *Petricola divaricata* d'Orbigny, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 2, p. 265.
1864. *Petricula divaricata* (Chemnitz) and *P. lapicida* (Chemnitz), Krebs, The West Indian Marine Shells, p. 108.
1878. *Petricola lapicida* (Chemnitz), Mörch, Catalogue of West-India Shells, p. 15.
1886. *Petricola divaricata* (Chemnitz), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 276.
1889. *Petricola divaricata* (Chemnitz), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1889. *Petricola* (*Naranio*) *lapicida* (Gmelin), Dall, U. S. Nat. Mus., Bull. 37, p. 58.
1895. *Choristodon lapicidum* (Chemnitz), Gregory, Geol. Soc. London, Quart. Jour., vol. 51, p. 292.
1900. *Petricola* (*Naranaio*) *lapicida* (Gmelin), Verrill, and Bush, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 12, p. 519, pl. 63, figs. 14-15.
1900. *Petricola lapicida* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1059.
1901. *Petricola lapicida* (Gmelin), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 483.
1910. *Petricola lapicida* (Chemnitz), Jukes-Browne, Malac. Soc. London, Proc., vol. 9, pt. 3, p. 218.
1922. *Petricola* (*Naranio*) *lapicida* (Chemnitz), Lamy, Jour. Conchyl., vol. 67, No. 4, pp. 317, 318, 337-340.
1933. *Petricola lapicidum* (Chemnitz), Trechmann, Geol. Mag., vol. 70, No. 823, p. 36.
1934. *Petricola lapicida* (Gmelin), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 50.
1936. *Petricola lapicida* (Gmelin), McLean, Nautilus, vol. 49, No. 4, p. 119.
1936. *Petricola lapicida* (Gmelin), Lermond, Check List of Florida Marine Shells, Gulfport, p. 18.
1937. *Petricola lapicida* (Gmelin), Smith, East Coast Marine Shells, p. 56, pl. 25, fig. 11.
1940. *Petricola lapicida* (Gmelin), Bales, Nautilus, vol. 54, No. 2, p. 40.
1945. *Petricola lapicida* (Gmelin), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1951. *Naranio lapicida* (Gmelin), McLean, New York Acad Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, No. 1, p. 88, pl. 18, figs. 3-4.
1952. *Rupellaria lapicida* (Gmelin), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183.
1953. *Petricola* (*Petricola*) *lapicida* (Gmelin), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 121.
1954. *Petricola* (*Naranio*) *lapicida* (Gmelin), Abbott, American Seashells, pp. 419-420.

1955. *Petricola lapicida* (Gmelin), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 75, pl. 15, fig. 93.
1958. *Petricola lapicida* (Gmelin), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Petricola* (*Naranio*) *lapicida* (Gmelin), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 16.
1961. *Petricola lapicida* (Gmelin), Warmke and Abbott, Caribbean Seashells, p. 191, pl. 44e.

Shell subquadrate, slightly oblique, inflated, inequilateral, the ventral margin and posterior end more or less subtruncate. Beak moderately high, somewhat flattended on top, situated a little forward of the middle, prosogyrate. Lunule and escutcheon wanting. Teeth relatively short, consisting, on the left valve, of a laminar anterior, a broad stout bifid medial, and a platy posterior cardinal, the latter nearly parallel with and shorter than the ridge at the nymph from which it seems to be splayed off. Anterior adductor scar elliptically ovate, the posterior scar rudely orbicular. Pallial sinus wide, U-shaped, shallowly rounded at the apex, extending somewhat obliquely to slightly beyond the middle of the valve. Surface sculptured by numerous distinct radial divaricating and chevron-like threads, the disk also crossed by fine concentric growth lamellae and several narrow sulci at intervals of growth stoppage. Inner margins plain.

Dimensions.—Specimen S549a, left valve, length 12 mm.; height 11.2 mm.; thickness 3.9 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Three left valves. Also reported from Quaternary at Punta Gorda by van Bentham Jutting (1945, p. 78).

Range and distribution.—Recent from South Carolina to Brazil at depths of 68 fathoms. Smith (1885, Voyage of H.M.S. Challenger, Zoology, pp. 4, 17, 113) reported the occurrence of a few juveniles in 7 and 8 fathoms off the north coast of Australia, and the species has been recorded in the Pacific and Indian Oceans as well as in the Red Sea. As a fossil *P. lapicida* (Gmelin) is found in the Pleistocene of Barbados and the Pliocene of Florida.

Petricola (Rupellaria) typica (Jonas) Pl. 47, fig. 15; Pl. 48, figs. 1-6

1844. *Choristodon typicum* Jonas, Zeitschr. f. Malakozool., yr. 1, p. 185.
1844. *Choristodon typicum* Jonas, Molluskologische Beiträge, p. 1, pl. 7, fig. 3.

1853. *Petricola typica* (Jonas), Deshayes, Catalogue of the Conchifera or Bivalve shells in the British Museum, p. 210.
1864. *Petricula* (*Choristodon*) *typica* (Jonas), Krebs, The West Indian Marine Shells, p. 108.
1878. *Petricola* (*Choristodon*) *typica* (Jonas), Mörch, Catalogue of West India Shells, p. 15.
1880. *Petricola lithophaga* Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 248. Not of Retzius and Lamarck.
1887. *Petricola* (*Choristodon*) *typicus* (Jonas), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1089.
1889. *Choristodon robusta* Dall, U. S. Nat. Mus., Bull. 37, p. 58. Not of Sowerby.
1889. *Choristodon typicum* Jonas, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1907. *Petricola typica* (Jonas), von Ihering, Mus. Nac. Buenos Aires, An., vol. 14, p. 531.
1900. *Petricola* (*Rupellaria*) *typica* (Jonas), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1059.
1910. *Petricola typica* (Chemnitz), Jukes-Browne, Malac. Soc. London, Proc., vol. 9, pt. 3, p. 218.
1920. *Petricola* (*Rupellaria*) *typica* (Jonas), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 110.
1922. *Petricola typica* (Jonas), Lamy, Jour. Conchyl., vol. 67, No. 4, pp. 322-333.
1934. *Rupellaria typicum* (Jonas), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 50.
1935. *Petricola typica* (Jonas), Richards, Jour. Paleont., vol. 9, No. 3, p. 257.
1937. *Rupellaria typica* (Jonas), Smith, East Coast Marine Shells, p. 56, pl. 25, figs. 7a, 7b.
1939. *Petricola* (*Rupellaria*) *typica* (Jonas), Weisbord, Nautilus, vol. 39, No. 3, p. 84.
1940. *Rupellaria typica* (Jonas), Bales, Nautilus, vol. 54, No. 2, p. 40.
1942. *Rupelaria typicum* (Jonas), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1944. *Rupellaria typica* (Jonas), Hackney, Nautilus, vol. 58, No. 2, p. 58.
1945. *Petricola typica* (Jonas), van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1946. *Rupellaria typica* (Jonas), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1949. *Petricola* (*Petricola*) *typica* (Jonas), Mus. Paranaense, Arq., vol. 7, art. 1, p. 39.
1951. *Petricola typica* (Jonas), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 88, pl. 18, fig. 2.
1952. *Rupellaria typicum* (Jonas), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183, pl. 11, figs. 8-9.
1954. *Rupellaria typica* (Jonas), Abbott, American Seashells, p. 420, pl. 30e.
1955. *Rupellaria typica* (Jonas), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 76, pl. 15, fig. 94.
1958. *Rupellaria typica* (Jonas), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1961. *Rupellaria typica* (Jonas), Warmke and Abbott, Caribbean Seashells, p. 191, pl. 44b.

Shell rude, inflated, somewhat distorted, inequilateral, varying in shape from subtrapezoidal to ovate (the posterior end of the former shallowly rounded to subtruncate, the latter moderately attenuated posteriorly), the ventral margin generally obliquely

subtruncate and embayed slightly behind the middle, the embayment coinciding with a broad radial depression on the disk which forms below the umbonal region and continues to the base. Umbo rounded, the beak low, flattened on top, directed anteriorly, situated in front of the middle, the distance from the middle greater on the ovate forms than on the boxy ones. Below, and a little ahead of the beak there is a short pronounced linear sulcus. Surface sculptured by fairly sharp subequally spaced vermicular radiating ribs (of which there are as many as 46 on one of the specimens), the ribs strongest on the posterior fourth of the disk, fainter and more crowded on the anterior submargin. Crossing the ribs are fine closely spaced concentric growth lamellae, these forming small triangular vaulted arches on the basal area of the posterior submargin on adults. Hinge of right valve with two cardinals, a spikelike anterior and a platy posterior, separated by a broad open socket. Hinge of left valve with a rudimentary anterior cardinal, a stout bifid medial cardinal, and a platy posterior cardinal which is lower than and subparallel with the medial tooth. Anterior adductor scar rather long and subelliptical, the posterior scar a little smaller and more or less orbicular. Pallial sinus wide, slightly ascending, broadly and shallowly rounded at the apex, projecting forward to not quite the middle line of the valve. Ventral margin delicately crenate within. The shell color is straw without, whitish within but often stained there a pale brown in the sinus area and along the ventral margin.

Dimensions.—Specimen A506a, valves attached, length 11 mm.; height 9 mm.; thickness of pair 8.3 mm. Specimen A 506b, left valve, length 13.8 mm.; height 13 mm.; thickness 5.1 mm. Specimen A506c, right valve, length 16 mm.; height 13.5 mm.; thickness 4.6 mm. Fossil specimen D506a, incomplete right valve, length 13.3 mm.; height 11 mm., thickness 5 mm. Largest specimen (Recent), length 18.8 mm.; height 15.1 mm.; thickness 6.2 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Seventeen specimens including nine left valves, six right valves, and two doublets. Abisinia formation at W-30, eastern edge of Playa Grande village. Two poorly preserved left valves. Also reported from Quaternary at Punta Gorda by van Bentham Jutting (1945, p. 78), but the fossiliferous strata at Punta Gorda are probably pre-Pleistocene in age.

Remarks.—The west American analogue is the Pleistocene and Recent *P. robusta* Sowerby (see Keen, 1958, p. 152, fig. 349), that differing slightly from *P. typica* by its shorter pallial sinus.

Range and distribution.—The Recent *P. typica* ranges from North Carolina, U. S. A., to Brazil and Argentina. The species also occurs in the Pleistocene of Cuba, and, according to Dall, in the Pliocene of Florida.

Pleiorytis venezuelensis, new species Pl. 48, figs. 7-12

Shell small, thin, moderately inflated, subquadrate, inequilateral, the ventral margin of the left valve (1507b) warped and turned in (probably fortuitously) anteriorly. Anterior end of right valve (I5-07a, the holotype) well rounded, posterior end subtruncate, ventral margin shallowly arcuate and with a mere suggestion of a gape behind the middle where the disk below the umbonal region is slightly depressed; posterodorsal margin long, fairly straight, and moderately sloping, the anterodorsal area in front of the beak slightly concave. Umbonal region full, the beak moderately high, appressed on top, directed forward, situated near the anterior fourth of the valve. Lunule and escutcheon not developed. Externally the valve is concentrically wrinkled by uneven undulations and small subregular threads, the surface also crossed by numerous fine, wavy radial striae which are minutely granular. Hinge of right valve with a shallow ligamental sulcus bordered by a pinched and moderately elevated nymph resembling a posterior cardinal; in front of the nymph, and separated from it by a narrow slit, is a small fairly high bifid medial cardinal, and anterior to that, but below and diverging from it, is a laminar anterior cardinal. Hinge of left valve with a thin triangular posterior cardinal, a short wide triangular and seemingly bifid medial cardinal, and a short laminar spurlike anterior cardinal projecting from beneath the edge of the lunular area. Adductor scars distinct, the anterior large and arcuately ovate, the posterior scar a little smaller and subrounded, the base of both scars lying below the midline of the interior. Pallial sinus large and deep, projecting obliquely to well above the center of the valve, the apex subacute. Pallial line faint, roughly parallel with the ventral margin. Inner margins thin but built up incrementally.

Dimensions.—Holotype (I507a), right valve, length 4 mm.; height 3 mm.; thickness 1:5 mm. Paratype (1507b), left valve, length 3.7 mm.; height 3.3 mm.; thickness 1.4 mm. Paratype (T507a), right valve, length of broken specimen 4.5 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Two specimens including one right valve and one left valve.

Other localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One right valve. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One small broken right valve.

Remarks.—The distinguishing characters of this shell are the deep oblique pallial sinus, the relatively low adductor scars, and the long, moderately sloping posterodorsal margin. The form is close to *P. caroniana* (Maury) (1925, pp. 274-275, pl. 20, fig. 16) from the upper Miocene of Trinidad and to *P. delicata* (Weisbord) (1929, p. 257, pl. 5, fig. 4, as *Asaphis*) from the middle Miocene of Venezuela, the latter considered by Vokes (1938, Amer. Mus. Novitates No. 988, p. 15, fig. 11) to be the same as *P. caroniana,* and also reported from the upper Miocene of Trinidad. It is difficult to compare the Cabo Blanco shell with *P. caroniana* and *P. delicata* because of the paucity of specimens, the considerable differences in size, and the inaccessibility of the interior of the types of *P. caroniana* and *P. delicata.* Superficially, however, the young *P. venezuelensis,* n. sp. seems to be distinguishable from the adolescent holotype of *P. caroniana* and the adult topotype of *P. caroniana* by its longer, straighter, and more sloping posterodorsal margin. The superficial resemblance between *P. venezuelensis* and *P. delicata* (Weisbord) is rather close but as the interior of the type *P. delicata* is not known and the valve much larger than that from Cabo Blanco, the latter is provisionally considered distinct.

Other species with a surface sculpture similar to that of *P. venezuelensis* are the following:

Petricola multistriata Brown and Pilsbry (1912, Acad. Nat. Sci. Philadelphia Proc., vol. 64, pp. 516-517, pl. 26, fig. 2). Middle Miocene, Panama Canal Zone. This lacks the long, straight, and sloping posterodorsal margin of *Pleiorytis venezuelensis,* n. sp.

Petricola caimitica Maury (1917, Bull. Amer. Paleont., vol. 5,

No. 29, pp. 383-384, pl. 37, fig. 11). Middle Miocene, Dominican Republic. This is more orbicular than the Cabo Blanco *P. venezuelensis.*

Pleiorytis centenaria Conrad (see Gardner, 1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, p. 39, pl. 6, figs. 3-4). Upper Miocene of Virginia, North Carolina, South Carolina, and Florida. Much larger, much more prominently threaded radially, and with higher adductor scars than *P. venezuelensis.*

Petricola harrisi Dall (1900, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1060, pl. 43, fig. 1). Later Miocene, Maryland. This has an angulate pallial sinus and a high posterior adductor scar. Mansfield (1932, Florida State Geol. Sur. Bull. No. 8, p. 149) suggested that this might be a deformed specimen of *Pleiorytis centenaria* Conrad.

Pleiorytis boweni Gardner (1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, pp. 40-41, pl. 6, figs. 5, 8, 9). Middle Miocene of Florida. The pallial sinus is only slightly ascending and is truncated at the apex.

Petricola calvertensis Dall (1900, p. 1060, pl. 44, fig. 14). Later Miocene of Maryland. This has a broader, more rounded, and less oblique pallial sinus than *Pleiorytis venezuelensis,* n. sp.

Petricola tellimyalis (Carpenter) (see Pilsbry and Lowe, 1932, p. 97, pl. 13, figs. 12-13). Recent from southern California. This has a shorter and more broadly rounded pallial than *Pleiorytis venezuelensis.* (Palmer, 1958, p. 100, pl. 12, figs 1-5 holotype.)

Petricola botula Olsson (1961, Panamic-Pacific Pelecypoda, p. 317, pl. 55, figs. 7, 7a, 8). Recent from the Pacific coast of Panama. This has a large rounded pallial sinus.

Petricola charapota Olsson (1961, p. 317, pl. 54, fig. 7). Recent, along the coast of Ecuador. The posterior adductor scar is higher than on the Cabo Blanco fossil from Venezuela.

Petricola peruviana Olsson (1961, p. 315, pl. 55, fig. 9). Recent from Ecuador to northern Peru. The large rounded pallial sinus extends nearly to the middle of the shell cavity whereas the sinus of *Pleiorytis venezuelensis* is more linguiform and extends to well above the center of the interior.

TELLINIDAE

Tellina (Tellina ?) species indeterminate Pl. 48, fig. 13

Figured for the sake of completeness is the mold of a right valve on which the shell material of the umbo is adherent. The valve is thin and elongate-oval, with the merest suggestion of a posterior twist. The shell surface is smooth but marked by faint concentric undulations and lineations. The beak is appressed, fairly acute, situated a little behind the middle. The dorsal region after the beak is flattish. The nymph is prominent, coarsely scored, and lanceolate, bordered by a deep ligamental groove. Just visible through the fine sandstone matrix is a narrow but deeply bifid posterior cardinal tooth and a simple but moderately stout anterior tooth.

Dimensions.—Specimen Q446a, right valve, length 43 mm.; height 26 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. One imperfect right valve.

Remarks.—Reminiscent of the Recent Western Atlantic *T. radiata* Linnaeus (1758, Syst. Nat., ed. 10, p. 675, no. 42) but not so narrow as that.

Tellina (Eurytellina) punicea Born Pl. 48, figs. 14, 15; Pl. 49, figs. 1, 2

1780. *Tellina punicea* Born, Testacea Musei Caesarei Vindobonensis, p. 33, pl. 2, fig. 8.
1791. *Tellina punicea* Born, Gmelin, Syst. Nat., 13th ed., pt. 6, p. 32339, No. 59.
1817. *Tellina punicea* Born, Dillwyn, A Descriptive Catalogue of Recent Shells, pp. 90-91, No. 44.
1818. *Tellina punicea* Born, Lamarck, An. sans Vert., vol. 5, p. 525, No. 21 (part).
1846. *Tellina punicea* Born, Sowerby, Thes. Conchyl., p. 239, No. 33, pl. 58, fig. 89; pl. 60, fig. 154.
1846. *Tellina punicea* Born, d'Orbigny, Voyage l'Amérique Méridionale, vol. 5, pt. 3, Mollusques, pp. 535-536.
1853. *Tellina punicea* Born, d'Orbigny, [In] La Sagra, Hist. phys., polit., et nat. l'Ile de Cuba, vol. 2, pp. 243-244.
1864. *Tellina punicea* Born, Krebs, The West Indian Marine Shells, pp. 103-104.
1866. *Tellina punicea* Born, Reeve, Conch. Icon., vol. 17, pl. 12, sp. 53.
1869. *Tellina (Peronaeoderma) punicea* Born, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 87.
1871. *Tellina punicea* Born, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 97-99, pl. 25, figs. 1-3.

1873. *Tellina* (*Peronaeoderma*) *punicea* Born, Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 248 (part).
1878. *Tellina punicea* Born, Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 211, 258.
1878. *Tellina punicea* Born, Mörch, Catalogue of West-India Shells, p. 14.
1878. *Tellina punicea* Born, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 244.
1884. *Tellina* (*Peronaeoderma*) *punicea* Born, Tryon, Structural and Systematic Conchology, vol. 3, p. 168, pl. 111, fig. 57.
1887. *Tellina* (*Eurytellina*) *punicea* Born, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1147.
1889. *Tellina punicea* Born, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1900. *Tellina* (*Eurytellina*) *punicea* Born, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1210, pp. 290, 294.
1900. *Tellina* (*Eurytellina*) *punicea* Born, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1004, 1013.
1921. *Tellina punicea* Born, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 424 (part).
1940. *Tellina punicea* Born, Smith, World-wide Sea Shells, p. 115, fig. 1506.
1953. *Tellina* (*Eurytellina*) *punicea* Born, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 123.
1954. *Tellina* (*Eurytellina*) *punicea* Born, Abbott, American Seashells, p. 428.
1961. *Tellina* (*Eurytellina*) *punicea* Born, Olsson, Panamic-Pacific Pelecypoda, p. 428.
1961. *Tellina* (*Eurytellina*) *punicea* Born, Warmke and Abbott, Caribbean Seashells, p. 195, pl. 4g. 40d.

Shell fairly large, rather solid, shiny, elongate-subtrigonal in outline, somewhat compressed, subequilateral, subequivalve, gently tapering behind. Submargins slightly depressed, the anterior submargin narrow and feebly sulcate, the posterior a little wider; posterior submargin of the right valve vaguely bipartite, defined from the disk by a narrow, shallowly incised groove, the posterior submargin of the left valve bounded by a subtle rise or ridge. Anterodorsal margin hardly convex, anterior end well rounded, ventral margin subtruncate at the middle and subangulate at the rear, posterior end rather narrow and obliquely truncate, posterodorsal margin long and nearly straight, sloping at an angle of 27 to 31 degrees from the beak. Escutcheonal area flat and narrow, that of the left valve a trifle the wider; lunular area of the left valve narrow and flattish, that of the right valve linear and inflected. Beak low, pointed, situated a little anterior to the middle. Surface sculptured by flat subregular concentric fillets with faint radial lineations, the fillets of the right valve more persistent than those of the left valve; on the posterior submargin, the fillets become lamellar, and at the edge of the posterodorsal margin they cul-

minate in slightly projecting elevations before thinning out into striae on the escutcheonal area itself. Right valve with two cardinals, the posterior bilobed, the anterior rather strong and rugose but simple, the resilifer deep and narrowly triangular. Immediately in front of the right anterior cardinal there is a short embayment in the hinge plate terminating into a stubby, erect, lateral tooth; the right posterior lateral is far removed from the beak, lying near the superior end of the posterior adductor scar, and is well developed. On the left valve the anterior cardinal is bifid, the posterior one rudimentary and lamellar; in front of the left anterior cardinal the hinge plate is also shortly embayed, but both laterals are obsolete and represented by but a slight thickening. Nymph narrowly elliptical, roughened by vertical rugae, and bounded by a fairly deep groove. Interior glossy. Anterior adductor scar deep and lenticular, margined behind by a stout radial ridge, the scar marked by a line or crease running lengthwise through it and joining the pallial line proper of which it is an extension; posterior adductor scar broadly pyriform. The upper line of the pallial sinus is arcuate, rising from the inner side of the base of the posterior adductor scar, touching the inner edge of the adductor scar at its base, thence turning abruptly to join the pallial line. Pallial line simple, not far removed from the basal margin, terminating well below the posterior adductor scar. A small curved wedge is formed immediately below the base of the anterior adductor scar by the merging of the pallial lines.

Dimensions.—Specimen I448a, right valve, height 28 mm. length 44 mm.; thickness 4.6 mm. Specimen T448a, left valve, height 22.5 mm.; length 39 mm.; thickness 3 mm. Specimen T448b, left valve, height 18.8 mm.; length 34 mm.; thickness 3.1 mm. Specimen T448c, right valve, height 18.6 mm.; length 31 mm.; thickness 3 mm. Specimen J448a, young right valve, height 7 mm.; length 11 mm.; thickness 1.1 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo: Five specimens including three right valves and two left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One adult right valve, one young right valve (J448a), and one young left valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Seven specimens including four left valves

and three right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One right valve.

Remarks.—The Cabo Blanco fossil has much the same outline as *T. alternata* Say and *T. angulosa* Gmelin, but in shape as well as in other characters it is identical with, or closely related to *T. punicea* Born. On the Pliocene to Recent *T. alternata* from east America, and on the Recent Western Atlantic *T. angulosa,* the pallial sinus does not touch the anterior muscle scar, whereas on the Recent Western Atlantic *T. punicea* and on the Cabo Blanco fossil the pallial sinus does touch the anterior scar.

Other tellinids which the Cabo Blanco fossil resembles are the following:

T. georgiana Dall (1900, U. S. Nat. Mus., Proc., vol. 23, No. 1210, pp. 310-311, pl. 2, fig. 3). Recent in the Western Atlantic from the Gulf of Mexico and the West Indies. The posterodorsal margin immediately after the beak is somewhat concave whereas on the Cabo Blanco shell that margin is straight. *T. georgiana* is probably the same as *T. nitens* C. B. Adams.

T. nitens C. B. Adams (see Clench and Turner, 1950, Occas. Papers on Mollusks, vol. 1, No. 15, p. 317, pl. 44, figs. 3-4). Recent, Jamaica. This is smaller than *T. punicea,* and the posterodorsal margin is concave rather than straight as on *T. punicea.*

T. mantaensis Pilsbry and Olsson (1943, Nautilus, vol. 56, No. 3, pl. 8, figs. 1-4). Recent in the Eastern Pacific from Panamá to Ecuador. The pallial sinus does not quite reach the anterior muscle scar, and the outline of *T. mantaensis* is slightly less angular than that of the Cabo Blanco fossil.

T. cf. *punicea* Born, Toula (1911, K.-K. Geol. Reichs., Jahrb., vol. 61, pl. 31, figs. 6a, 6b). Gatun formation, Panama Canal Zone. The posterior end is subrounded rather than subtruncate obliquely as on the typical *T. punicea.*

T. roburina Dall (1900, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1024, pl. 47, fig. 9). Middle Miocene, Florida. The distal angle of the pallial sinus does not quite touch the anterior muscle scar.

T. riocanensis Maury (1917, Bull. Amer. Paleont., vol. 5, No. 29, pp. 384-385, pl. 38, fig. 3). Middle Miocene, Dominican Republic. On both valves there is a distinct anterior and posterior sulcus.

T. costaricana Olsson (1922, Bull. Amer. Paleont., vol. 9, No. 39, pp. 423-424, pl. 26, figs. 6, 9). Middle Miocene, Costa Rica. The concentric fillets are more uniform than on the Cabo Blanco shell.

Range and distribution.—The living *Tellina* (*Eurytellina*) *punicea* Born is said to range from Florida to Brazil. This is the first report of its occurrence as a fossil in northern South America, although the species, from near Cumaná, Venezuela, is contained in Collection No. 18408 of the U. S. National Museum. This collection was obtained by P. Henry and J. A. Tong in September 1931 from about 2.5 kilometers east of Cumaná, State of Sucre, Venezuela, at a point N80°E from Cumaná castle and S30°W from the village of Caiguire Abajo, in a yellowish brown sandy marl about 30 feet thick dipping steeply northward. The formation near Cumaná, to judge from the fossils, is equivalent to part of the Mare—Playa Grande sequence in the Cabo Blanco area, and is believed to be Pliocene in age.

Tellina (Eurytellina) nitens C. B. Adams Pl. 49, figs. 3-10

1845. *Tellina nitens* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 10.
1854. *Tellina nitens* C. B. Adams, Deshayes, Zool. Soc. London, Proc., p. 358, No. 187.
1864. *Tellina nitens* C. B. Adams, Krebs, The West Indian Marine Shells, p. 102.
1869. *Tellina* (*Angulus*) *nitens* C. B. Adams, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 94.
1878. *Tellina nitens* C. B. Adams, Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 211, 297.
1889. *Tellina nitida* Lamarck var. *carolinensis* Dall, U. S. Nat. Mus., Bull. 37, p. 60. Not *T. carolinensis* Conrad, 1875.
1900. *Tellina* (*Eurytellina* ?) *georgiana* Dall, U. S. Nat. Mus., Proc., vol. 23, No. 210, pp. 294, 310, pl. 2, fig. 3.
1901. *Tellina* (*Eurytellina*) *georgiana* Dall, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 479.
1920. *Tellina* (*Eurytellina*) *georgiana* Dall, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 113.
1934. *Tellina* (*Eurytellina*) *georgiana* Dall, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 51.
1936. *Tellina georgiana* Dall, Lermond, Check List of Florida Marine Shells, Gulfport, p. 22.
1936. *Tellina* (*Eurytellina*) *georgiana* Dall, McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 42.
1945. *Tellina georgiana* Dall, Smith, Nautilus, vol. 59, No. 1, pp. 35-36.
1950. *Tellina nitens* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, p. 317, pl. 44, figs. 3-4.
1956. *Tellina georgiana* Dall, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 317, pl. 7, figs. 18a, 18b.

1961. *Tellina* (*Eurytellina*) *georgiana* Dall, Warmke and Abbott, Caribbean Seashells, p. 195, pl. 40a.

The Cabo Blanco fossil is of medium size, thin, chalky white within, a little inflated, elongate-suboval, inequilateral, subequivalve, with a moderately pronounced posterior rostration. Anterodorsal margin long and nearly straight, anterior end produced and well rounded, ventral margin straightish to shallowly rounded, posterior end obliquely subtruncate, posterodorsal margin concave. Beak small, pointed, situated behind the middle. Surface shiny when fresh, sculptured by low subregular concentric fillets separated by fine incisions, the fillets or bands more distinct near the base and sides of the valve; on the posterior rostration, and especially on the right valve, the fillets develop into slightly raised coarse lamellae with fine concentric striae between them. Faintly decussating the concentric bands are microscopic radial lineations which are vertically disposed on the disk, curve outward on the anterior end, are obsolete on the rostration of the right valve and are oblique on the rostration of the left valve. The hinge is fine, and the components sharply defined. On the right valve, the posterior cardinal tooth is bilobed, the anterior tooth single and relatively strong, the resilifer deep and triangular; in front of the anterior cardinal tooth the hinge plate is embayed into a hamate arc, with an erect lateral tooth at the distal end of the arc; the right posterior lateral is farther from the beak than the anterior, and is a pointed lamina with a narrow elliptical socket behind it. On the left valve the anterior cardinal tooth is narrowly cuneate and bifid, the posterior tooth laminar and curved a little distally, the resilifer somewhat shallower than on the opposite valve; the lateral teeth of the left valve are obsolete and are represented by a slight thickening. Anterior adductor scar lenticular, marked by a thin line running through it and joining the pallial line, bordered behind by a low radial ridge broadening upward, the posterior adductor scar broadly pyriform. Upper line of pallial sinus arcuate, rising from the inner side and base of the posterior adductor scar, descending toward and not touching the anterior adductor scar on the left valve, but touching the scar on the right valve, and then curving sharply to join the pallial line with which it is confluent thereafter. The pallial line is simple, ter-

minating below the posterior adductor scar. In the interior of the left valve there is a fairly pronounced sulcus running through the posterior adductor scar and terminating at the posterior corner of the valve. Most specimens are minutely denticulate at the ventral and lateral margins within, but a few are smooth.

Dimensions.—Specimen G448a, right valve, height 12 mm.; length 21.8 mm.; thickness 2.2 mm. Specimen G448b, immature right valve, broken at posterior end, height 4.8 mm.; length 8.1 mm.; thickness 0.9 mm. Specimen G448c, left valve, height 16 mm.; length 29 mm.; thickness 2.3 mm. Specimen G448d, immature left valve, height 5.6 mm.; length 10.2 mm.; thickness about 1 mm.

Localities.—Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Twenty-four specimens including thirteen left valves and eleven right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One small right valve. Playa Grande formation (Maiquetía member), in Quebrada Las Bruscas approximately 125 meters upstream from junction with Quebrada Las Pailas. One small left valve.

Remarks.—The Cabo Blanco fossils are a trifle more elongated than the Recent *T. nitens* from Jamaica but are otherwise identical. I have compared the types of *T. nitens* C. B. Adams and *T. georgiana* Dall, and they too are identical. According to Dall, the pallial sinus of *T. georgiana* is "similar in both valves, touching the anterior adductor scar, wholly confluent below," but in my examination of the types of *T. georgiana* (No. 93777, U. S. National Museum) I found that the pallial sinus touches the anterior scar on the right valve but does not reach the anterior scar on the left valve. The same delineation occurs on the type of *T. nitens* C. B. Adams, and as the two are alike in all other characters, the name *T. nitens* has priority. *T. nitens* C. B. Adams and *T. georgiana* Dall are much like *T. punicea* Born except that the posterodorsal margin is more concave than on *T. punicea,* and the concentric markings are not so pronounced as on *T. punicea.*

Range and distribution.—*T. nitens* C. B. Adams ranges from the southern and southeastern U. S. A. to the Caribbean. It has not hitherto been recorded as a fossil.

Tellina (Eurytellina) alternata ? Say Pl. 49, figs. 11, 12

1822. *Tellina alternata* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 275.
1830. *Tellina alternata* Say, Conrad, American Marine Conchology, pl. 65, fig. 1.
1857. *Tellina alternata* Say, Toumey and Holmes, Pleiocene Fossils of South Carolina, p. 89, pl. 22, fig. 4.
1860. *Tellina alternata* Say, Holmes, Post-Pleiocene Fossils of South Carolina, p. 45, pl. 8, fig. 1.
1866. *Tellina alternata* Say, Reeve, Conch. Icon., vol. 17, pl. 12, sp. 52.
1869. *Tellina (Peronaeoderma) alternata* Say, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 86.
1871. *Tellina alternata* Say, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 102-103, pl. 25, figs. 10-12.
1871. *Tellina alternata* Say, Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 138.
1878. *Tellina alternata* Say, Bertin, Mus. Hist. Nat., Nouv. Arch. sér. 2, vol. 1, pp. 211, 260.
1881. *Tellina (Peronaeoderma) alternata* Say, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 371.
1889. *Tellina alternata* Say. Dall, U. S. Nat. Mus., Bull. 37, p. 60.
1889. *Tellina alternata* Say, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1892. *Tellina alternata* Say, Singley, Geol. Sur. Texas, Fourth An. Rept., p. 328.
1900. *Tellina (Eurytellina) alternata* Say, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1210, p. 294.
1900. *Tellina (Eurytellina) alternata* Say, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1029-1030.
1901. *Tellina (Eurytellina) alternata* Say, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 479.
1903. *Tellina alternata* Say, Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 757.
1913. *Tellina (Eurytellina) alternata* Say, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 497.
1920. *Tellina (Eurytellina) alternata* Say, Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 112-113.
1921. *Tellina alternata* Say, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 424.
1925. *Tellina alternata* Say, Clench, Nautilus, vol. 38, No. 3, p. 94.
1929. *Tellina alternata* Say, Clench, Nautilus, vol. 43, No. 1, p. 35.
1932. *Tellina (Eurytellina) alternata* Say, Mansfield, Florida State Geol. Sur., Bull. No. 8, p. 136, pl. 30, fig. 1.
1934. *Tellina (Eurytellina) alternata* Say, Salisbury, Malac. Soc. London, Proc., vol. 21, pt. 2, p. 89.
1934. *Tellina (Eurytellina) alternata* Say, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 51.
1936. *Tellina alternata* Say, Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1937. *Tellina (Eurytellina)* Say, Smith, East Coast Marine Shells, p. 57, pl. 22, fig. 4.
1938. *Tellina alternata* Say, Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1292.
1938. *Tellina alternata* Say, Smith, Nautilus, vol. 51, No. 3, p. 91.
1940. *Tellina alternata* Say, Stubbs, Jour. Paleont., vol. 14, No. 5, p. 511.

1942. *Tellina alternata* Say, Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1944. *Tellina alternata* Say, Hackney, Nautilus, vol. 58, No. 2, p. 59.
1949. *Eurytellina alternata* (Say), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 45.
1951. *Tellina* (*Arcopagia*) *alternata* Say, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 93, pl. 19, fig. 1.
1952. *Tellina alternata* Say, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 184, pl. 13, figs. 10-11.
1953. *Tellina* (*Eurytellina*) *alternata* Say, Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, pp. 123-124, pl. 14, figs. 2-3.
1954. *Tellina* (*Eurytellina*) *alternata* Say, Abbott, American Seashells, pp. 427-428, pl. 40n.
1955. *Tellina* (*Arcopagia*) *alternata* Say, Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 77-78, pl. 15, fig. 99.
1956. *Tellina alternata* Say, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 315, 326, 371, pl. 3, fig. 11; pl. 6, fig. 9.
1958. *Tellina* (*Eurytellina*) *alternata* Say, DuBar, Florida Geol. Sur., Geol. Bull. No. 40, pp. 176, 211.
1959. *Tellina alternata* Say, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1959. *Tellina alternata* Say, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 17.
1959. *Tellina alternata* Say, Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2132, 2162, pl. 4, VIII, figs. 16a, 16b.
1961. *Tellina alternata* Say, Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 45.
1961. *Tellina (Eurytellina) alternata* Say, Warmke and Abbott, Caribbean Seashells, p. 195, pl. 40h.

The fragment illustrated is of a thin fossil shell that compares closely with Recent specimens of *T. alternata* Say from Florida.

Dimensions.—Specimen R447a, left valve, length of fragment 34 mm.; height 21 mm.

Locality.—Playa Grande formation (Maiquetía member), in Quebrada Las Bruscas about 125 meters upstream from junction with Quebrada Las Pailas. A single left valve, broken.

Range and distribution.—Upper Miocene to Recent. The living shell ranges from North Carolina and the Gulf of Mexico to Brazil. In the Pleistocene, it is reported from South Carolina, Florida, Louisiana (in wells), Cuba, and the Isthmus of Panamá. In the Pliocene it is recorded from South Carolina, Florida, and Costa Rica. And, in the upper Miocene, *T. alternata* was identified in Washington and Leon Counties, Florida, by Mansfield.

Tellina (Merisca) cristallina Spengler — Pl. 49, figs. 13, 14; Pl. 50, figs. 1, 2

1795. *Tellina crystallina* Chemnitz, Syst. Conchylien-Cabinet, vol. 11, p. 210, pl. 199, figs. 1947-1948.

1798. *Tellina cristallina* Spengler, Skr. Nat. Selsk. Copenhagen, vol. 4, No. 2, p. 113.
1815. *Tellina crystallina* Wood, General Conchology, or a description of shells, p. 149.
1825. *Tellina crystallina* Wood, Index Testaceologicus, pl. 3, fig. 10.
1846. *Tellina crystallina* Chemnitz, Hanley, [*in*] Sowerby, Thesaurus Conchyliorum, vol. 1, p. 270, pl. 57, fig. 43.
1853. *Tellina schrammi* Récluz, Jour. Conchyl., vol. 4, p. 152, pl. 6, figs. 7-8.
1864. *Tellina crystallina* Chemnitz, Krebs, The West Indian Marine Shells, p. 101.
1864. *Tellina crystallina* Chemnitz, Reeve, Conch. Icon., vol. 17, pl. 22, sp. 112.
1872. *Tellina crystallina* Chemnitz, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 196-197, pl. 3, figs. 3-4; pl. 38, figs. 1-2.
1873. ? *Tellina crystallina* Chemnitz, Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 249.
1878. *Tellina crystallina* Chemnitz, Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 220, 241.
1878. *Tellina crystallina* Chemnitz, Mörch, Catalogue of West-India Shells, p. 14.
1900. *Tellina* (*Merisca*) *crystallina* Wood, Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1210, pp. 290, 302, 311-312, pl. 2, fig. 10.
1900. *Tellina* (*Merisca*) *crystallina* Wood, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1012, 1216.
1910. *Tellina crystallina* Wood, Dall, U. S. Nat. Mus., Proc., vol. 37, No. 1704, p. 270.
1917. ? *Tellina* (*Merisca*) *crystallina* Chemnitz, Maury, Bull. Amer. Paleont., vol. 5, No. 29, pp. 387-388, pl. 38, fig. 4.
1917. *Tellina* (*Merisca*) *errati* ? Pilsbry and Johnson, Acad. Nat. Sci. Philadelphia, Proc., vol. 69, p. 201.
1921. *Tellina (Merisca) errati* ? Pilsbry and Johnson, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 425, pl. 41, fig. 7.
1922. ? *Tellina* (*Merisca*) *crystallina* Wood, Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 191, 194, 249-250, pl. 26, fig. 10.
1924. *Tellina crystallina* Wood, Olsson, Nautilus, vol. 37, No. 4, p. 139.
1928. *Tellina* (*Merisca*) *crystallina* (Chemnitz), Wood, Gardner, U. S. Geol. Sur., Prof. Paper 142-E, pp. 191-192.
1932. *Tellina crystallina* Wood, Pilsbry and Lowe, Acad. Nat. Sci. Philadelphia, Proc., vol. 84, p. 132.
1934. *Tellina* (*Merisca*) *crystallina* Wood, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 51.
1936. *Tellina crystallina* Wood, Lermond, Check List of Florida Marine Shells, Gulfport, p. 22.
1937. *Tellina* (*Merisca*) *crystallina* Wood, Smith, East Coast Marine Shells, p. 57, pl. 19, fig. 8.
1941. *Tellina* (*Merisca*) *crystallina* Wood, Pilsbry and Olsson, Acad. Nat. Sci. Philadelphia, Proc., vol. 93, p. 68.
1944. *Tellina* (*Merisca*) *crystallina* Wood, Smith, Panamic Marine Shells, p. 64, fig. 834.
1949. *Tellina* (*Merisca*) *crystallina* Spengler, Hertlein and Strong, Zoologica, vol. 34, pp. 82-83.
1955. *Tellina* (*Merisca*) *crystallina* Spengler, Hertlein and Strong, Amer. Mus. Nat. Hist., Bull., vol. 107, art. 2, pp. 198-199.
1958. *Tellina* (*Merisca*) *cristallina* Spengler, Keen, Sea Shells of Tropical West America, p. 168, fig. 387.
1961. *Tellina* (*Merisca*) *cristallina* Wood, Warmke and Abbott, Caribbean Seashells, p. 196, pl. 40b.
1961. *Merisca crystallina* (Spengler), Olsson, Panamic-Pacific Pelecypoda, p. 382, pl. 70, figs. 2, 2a.

The Cabo Blanco shell is rounded-subtrigonal, inequilateral, thin, compressed, the right valve a little more flattened than the left, somewhat attenuated behind, narrowly rostrated along the posterodorsal margin, and with a shallow radial sulcus before the rostration. Anterodorsal margin hardly convex, anterior end and ventral margin rounded, the posterior end narrow and obliquely truncate, the posterodorsal margin hardly concave. Beak subcentral, erect, pointed. Prodissoconch sculptured by fine, evenly and closely spaced concentric laminae, the disk sculptured by sharp, rather distant concentric lamellae which, on the radial sulcus in front of the posterior rostration are slightly convex upward, and on the rostration itself are V-shaped. At the posterodorsal margin of the single, well-preserved right valve, the termini project slightly as in *Tellidora*. In the broad flat interspaces there are faint concentric striae and numerous scarcely visible radial lineations. The right posterior cardinal tooth is strong, cuneate, and asymmetrically bifid, the right anterior cardinal lamellar, the socket between them deep and narrowly triangular; the cardinals of the left valve are subequal, the anterior one a little the larger, both of them rendered bifid by a narrow groove, the socket between the left cardinals deep and somewhat more widely triangular than on the right valve. There are two grooved laterals on the right valve, the posterior lateral larger and somewhat farther removed from the center of the hinge than the anterior; on the single left valve the laterals are simple and obsolete. The anterior adductor scar is long and lenticular, narrowing upward, the posterior scar smaller and rounded-subquadrate. The upper line of the pallial sinus is discrepant on the valves: on the right valve it rises from the inner margin of the posterior scar as a high inverted "U," and then descends rather regularly to the lower line of the sinus without touching the base of the anterior adductor scar; on the left valve, the upper line of the pallial sinus is more irregular. Starting at the inner margin of the right posterior adductor scar there is a narrow ridgelet extending upward with some diminution in strength to the hinge plate a short distance behind the right posterior cardinal; on the left valve this ridgelet is obsolete.

Dimensions.—Specimen T454a, right valve, height 20.3 mm.; width 27 mm.; thickness 2.4 mm. Specimen J455a, upper half of a

left valve, height of fragment 13.1 mm.; width 17.4 mm.; thickness 3.2 mm.

Localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. One right valve entire. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One broken left valve.

Remarks.—The Cabo Blanco fossil agrees so well with Dall's figure of the Recent *T. crystallina* from South Carolina and with Smith's figure of the Recent *T. crystallina* from Barcelona, Venezuela, that it must be considered the same species. A number of authors also agree with Dall (1900, p. 302) that the Recent Western Atlantic and Eastern Pacific forms referred to this species are likewise identical. Gabb and Maury reported *T. crystallina* from the lower-middle Miocene of the Dominican Republic, and Olsson described it from the middle Miocene of Costa Rica. It should be pointed out that the anterodorsal margin of the Dominican fossil is truncate to slightly concave, whereas on the Recent Western Atlantic shell the anterodorsal margin is slightly convex, and it may have been for this slight difference in outline that Pilsbry and Johnson gave the Dominican fossil the name of *T. errati.* The Costa Rican fossil, on the other hand, does have a slightly convex anterodorsal margin but a rather strongly concave posterodorsal margin and a prominent embayment of the ventral margin at the posterior sulcus. Whether the small differences between the fossil and living forms referred to *T. cristallina* Spengler are due to individual variation rather than to specific differentiation is difficult to assess because of the scarcity of specimens, though there is no doubt, as pointed out by Hertlein and Strong (1949) in their excellent discussion, that they are indeed all similar.

Range and distribution.—Living in the Western Atlantic from South Carolina to northern South America, and in the Eastern Pacific from Baja California, Mexico, to Ecuador where it occurs in the intertidal zone to depths of 13 fathoms. Pleistocene at Magdalena Bay, Baja California. Pliocene in Ecuador, and near Cumaná, Venezuela (Collection No. 18408, U. S. National Museum). Middle Miocene of the Dominican Republic ? and Costa Rica ?

Strigilla pisiformis (Linnaeus) Pl. 50, figs. 3-8

1758. *Tellina pisiformis* Linnaeus, Syst. Nat., ed. 10, p. 677, No. 54.
1767. *Tellina pisiformis* Linnaeus, Syst. Nat., ed. 12, p. 1120, No. 69.
1803. *Cardium discors* Montagu, Testacea, or Natural History of British Shells, p. 84.
1846. *Tellina pisiformis* Linnaeus, Hanley, [in] Sowerby, Thesaurus Conchyliorum, p. 261, pl. 56, fig. 30.
1853. *Tellina pisiformis* Linnaeus, d'Orbigny, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 2, p. 249.
1864. *Tellina pisiformis* Linnaeus, Krebs, The West Indian Marine Shells, p. 103.
1864. *Strigilla carnaria* (Linnaeus), Guppy, Sci. Assoc. Trinidad, Trans., p. 36. Not *S. carnaria* (Linnaeus)
1867. *Strigilla carnaria* (Linnaeus), Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162. Not *S. carnaria* (Linnaeus). Matura, Trinidad.
1867. *Tellina pisiformis* Linnaeus, Reeve, Conch. Icon., *Tellina,* vol. 17, pl. 42, sp. 250.
1869. *Strigilla pisiformis* (Linnaeus), Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 99.
1872. *Tellina pisiformis* Linnaeus, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 188–189, pl. 37, figs. 1-3.
1873. *Strigilla pisiformis* (Linnaeus), Gabb, Amer. Philos. Soc. Trans., new ser., vol. 15, p. 249.
1878. *Strigilla pisiformis* (Linnaeus), Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 211, 315.
1878. *Strigilla pisiformis* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 14.
1878. *Tellina pisiformis* Linnaeus, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 244.
1889. *Strigilla pisiformis* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 62.
1900. *Strigilla pisiformis* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1210, p. 298.
1900. *Strigilla pisiformis* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1038-1039.
1901. *Strigilla pisiformis* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 482.
1917. *Strigilla pisiformis* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 389, pl. 39, fig. 6.
1921. *Strigilla pisiformis* (Linnaeus), Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 426.
1922. *Strigilla pisiformis* (Linnaeus), Olsson, Bull. Amer. Paleont., vol. 9, No. 39, pp. 426-427.
1925. *Strigilla* (*Strigilla*) *pisiformis* (Linnaeus), Woodring, Carnegie Inst. Washington, Publ. No. 366, pp. 175-176, pl. 24, figs. 17-18.
1925. *Strigilla pisiformis* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 272-273, pl. 20, fig. 13.
1934. *Strigilla pisiformis* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 53.
1936. *Strigilla pisiformis* (Linnaeus), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 42.
1936. *Strigilla pisiformis* (Linnaeus), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1937. *Strigilla pisiformis* (Linnaeus), Smith, East Coast Marine Shells, p. 60, pl. 19, figs. 9a, 9b.
1949. *Strigilla pisiformis* (Linnaeus), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 44.
1951. *Strigilla pisiformis* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 98, pl. 20, fig. 7.

1952. *Tellina pisiformis* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 52.
1954. *Strigilla pisiformis* (Linnaeus), Abbott, American Seashells, p. 429.
1958. *Strigilla pisiformis* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 21.
1961. *Strigilla pisiformis* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 197, pl. 41e.

The Recent Higuerote shells referred to this species are small, rather solid, inflated, inequilateral, subtrigonal-ovate, with a low rounded radial ridge on the posterior, and a slightly undulatory submargin on the anterior. The umbo is full, the beak appressed, situated a little anterior to the middle. Lunule small, impressed, sublanceolate. The surface of the disk is finely engraved by regular, oblique, gently curved grooves extending from the umbo to the base, meeting the ventral margin at an angle of about 45 degrees, and terminating on the posterior ridge; on that part of the posterior submargin immediately behind the posterior ridge there is another set of closely spaced grooves divaricating sharply upward in chevron-like fashion from the termini of the disk grooves, the closely spaced grooves terminating midway between the radial ridge and posterior margin; on the hindmost area adjacent to the margin there is yet another series of markings, these in the form of slightly arcuate lirae, the lirae farther apart than, and divaricating from the terminae of the closely spaced grooves. On the anterior submargin, the grooves from the disk are bent a little downward and then continue flexuously to the anterior margin. Crossing the valve are numerous microscopic concentric striae. In well-preserved specimens the interior is shiny. The right posterior cardinal tooth is sharply bifid and caret-like, the anterior cardinal platy, the cardinal socket deep and triangular. The lateral teeth are well developed, the anterior closer to the cardinal process than the posterior. The anterior adductor scar is relatively long and rudely lenticular with a ragged or unevenly scalloped inner margin, whereas the posterior scar is more or less subquadrate. The upper line of the pallial sinus is asymmetrically and subangularly curved, joining the posterior adductor scar at the middle, but running below the base of the anterior adductor scar. The shell is whitish within and without, but there is a fairly large area of pink in the umbonal cavity.

Dimensions.—Recent specimen (B466a) from Higuerote, right valve, height 7.5 mm.; width 7.8 mm.; thickness 2.6 mm. Recent

specimen (B468a), left valve, height 8 mm.; width 7.9 mm.; thickness 2.3 mm. Fossil specimen (D467a) from the Abisinia formation, right valve, height 4.6 mm.; width 5.1 mm., approx. thickness 1.2 mm.

Localities.—Recent, on beach southeast of Higuerote, State of Miranda. Four right valves, one left valve. Abisinia formation at W-30, eastern edge of Playa Grande village. One right valve, weathered.

Range and distribution.—*S. pisiformis* (Linnaeus) has been reported from the Cercado formation (lower-middle Miocene) of the Dominican Republic; from the middle Miocene of Jamaica and Costa Rica; from the Pliocene at Matura, Trinidad; from "the Pleistocene of the Antillean region generally" (Dall, 1900, p. 1039); and living from the Florida Keys to Brazil.

Strigilla carnaria (Linnaeus) Pl. 50, figs. 9-12; Pl. 51, figs. 1-6

1758. *Tellina carnaria* Linnaeus, Syst. Nat., ed. 10, p. 676, No. 51.
1767. *Tellina carnaria* Linnaeus, Syst. Nat., ed. 12, p. 1119, No. 66.
1818. *Lucina carnaria* (Linnaeus), Lamarck, An. sans Vert., vol. 5, p. 541, No. 8.
1822. *Strigilla carnaria* (Linnaeus), Turton, Conchylia dithra insularum Britanicarum, p. 117, pl. 7, fig. 15.
1847. *Strigilla areolata* Menke, Zeitschr. f. Malakozool., yr. 4, p. 188.
1853. *Tellina carnaria* Linnaeus, d'Orbigny, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 3, p. 244.
1864. *Tellina carnaria* Linnaeus, Krebs, The West Indian Marine Shells, p. 100.
1866. *Tellina carnaria* Linnaeus, Reeve, Conch. Icon., vol. 17, pt. 9, sp. 37a, 37b.
1867. *Strigilla carnaria* (Linnaeus), Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162 (part).
1869. *Strigilla carnaria* (Linnaeus), Tryon, Amer. Jour. Conch., vol. 4, pt. 5, appendix, No. 15, p. 98.
1872. *Tellina carnaria* Linnaeus, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 183-186, pl. 36, figs. 7-9.
1878. *Strigilla carnaria* (Linnaeus), Mörch, Catalogue of West-India Shells, p. 14.
1878. *Strigilla carnaria* (Linnaeus), Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 211, 3
1878. *Tellina carnaria* Linnaeus, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 242.
1884. *Strigilla carnaria* (Linnaeus), Tryon, Structural and Systematic Conchology, vol. 3, p. 170, pl. 112, figs. 71-73.
1887. *Strigilla carnaria* (Linnaeus), Fischer, Manuel Conchyliologique et de Paléontologie Conchyliologique, p. 1149, pl. 21, fig. 6.
1889. *Strigilla carnaria* (Linnaeus), Dall, U. S. Nat. Mus., Bull. 37, p. 62.
1900. *Strigilla carnaria* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 1038, 1039.

1900. *Strigilla carnaria* (Linnaeus), Dall, U. S. Nat. Mus., Proc., vol. 23, No. 1210, p. 297.
1901. *Strigilla carnaria* (Linnaeus), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 482.
1916. *Strigilla carnaria* (Linnaeus), Dall, [in] Matson, U. S. Geol. Sur., Prof. Paper 98-L, p. 177.
1920. *Strigilla carnaria* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 117.
1928. *Strigilla carnaria* (Linnaeus), Gardner, U. S. Geol. Sur., Prof. Paper 142-E, p. 198.
1934. *Strigilla carnaria* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 52.
1936. *Strigilla carnaria* (Linnaeus), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1937. *Strigilla carnaria* (Linnaeus), Smith, East Coast Marine Shells, p. 60, pl. 19, fig. 4.
1940. *Strigilla carnaria* (Linnaeus), Smith, World-wide Sea Shells, p. 115, fig. 1513.
1949. *Strigilla carnaria* (Linnaeus), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 44.
1951. *Strigilla carnaria* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 98, pl. 20, fig. 4.
1953. *Strigilla* (*Strigilla*) *carnaria* (Linnaeus), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1953. *Tellina carnaria* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 51.
1955. *Strigilla carnaria* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 83, pl. 43, fig. 306.
1958. *Strigilla carnaria* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, pp. 21, 48, pl. 5, fig. 5.
1961. *Strigilla carnaria* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 197, pl. 29f, 41d.

The Recent shells from Venezuela are subtrigonally oval, moderately compressed in the adult, thin but strong, with a fairly long truncated posterodorsal margin sloping at an angle of about 36 degrees from the horizontal. The ventral margin is rounded, the anterior end subtruncate, anterodorsal margin hardly concave, and, in front of the posterior submargin, there is a faint radial sulcus. The umbo is triangular in outline on mature specimens but fuller and more rounded on juveniles, the beak low and situated anterior to the middle. The posterior submargin is narrow and compressed, the anterior submargin broader, and gently undulatory. Outer surface of disk finely engraved by regular, slightly oblique grooves; on the posterior sulcus the grooves diverge abruptly upward in a narrow chevron-like pattern, and then curve gently to the posterior margin; on the anterior submargin the radial grooves from the disk become flexuous and continue thus to the anterior margin. The

interior of the shell is glossy, and generally there are two or three low narrow radial ridges near the rear, the ridges coinciding with the external radial sulcus, and usually more evident in the right valve than in the left. The anterior muscle scar is relatively long and lenticular, with a ragged inner margin and smooth outer margin; the posterior scar is broadly funnel-shaped with a short irregular spout at the base. The upper line of the pallial sinus is discrepant in the two valves but on both of them it rises from the inner side of the posterior scar and dips to join the base of the anterior scar at the inner margin. The lower border of the pallial sinus emerges from the base of the anterior adductor scar and continues regularly to its termination short of the posterior scar. There are two lateral teeth in each valve, the anterior one closer to the cardinal process than the posterior. The right posterior cardinal tooth is bifid and caret-shaped, the right anterior cardinal platy; on the left valve, the anterior cardinal is narrowly and shallowly bifid, the posterior one long and laminar; the socket between the cardinals is deep and triangular. The surface is colored in concentric bands of light purplish pink and pinkish white, the beaks a deep rose; the interior is a bright watermelon red with whitish margins.

The fossil specimens herein referred to *S. carnaria* are all young, small, and somewhat variable in shape and plumpness, but except for size they seem to be identical with the Recent shell.

Dimensions.—Specimen A464a1-2, a doublet, height 14.7 mm.; width 15.8 mm.; thickness of pair 7 mm. Specimen D464a, right valve, height 6 mm.; width 6.8 mm.; thickness 1.2 mm. Specimen I465a, right valve, height 4.2 mm.; width 4.8 mm.; thickness 1.4 mm. Specimen I465b, left valve, height 4.05 mm.; width 4.9 mm.; thickness 1.2 mm.

Localities.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Fourteen specimens including five right valves, four left valves, and four doublets. Recent, on beach southeast of Higuerote, State of Miranda. Nine specimens including five left valves and four right valves. Abisinia formation at W-30, eastern edge of Playa Grande village. One right valve and one juvenile left valve. Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Three immature specimens including two left valves and one right valve. Lower Mare formation,

in small stream 100 meters west of Quebrada Mare Abajo. One small left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Eight specimens including five right valves and three left valves, all of them small.

Range and distribution.—The Recent *S. carnaria* ranges from North Carolina, U.S.A., to Brazil. As a fossil, the species has been recorded in the Pleistocene by Maury from a well at Ft. Morgan, Alabama, at depths of 100-112 feet and 169-175 feet.

Although its occurrence in the Eastern Pacific has been generally denied, Olsson (1961, Panamic-Pacific Pelecypoda, pp. 387-388, pl. 73, figs. 4, 4a) recorded *S. carnaria* from Panamá to northern Peru and stated that numerous specimens of a *Strigilla* from the coasts of northern Peru and Ecuador appear identical with typical Caribbean examples of *S. carnaria* or differ merely in size and minor details of sculpture.

Macoma (Psammacoma) hybrida, new species Pl. 46, figs. 3, 4

This species is described from a single right valve.

Shell of medium size, thin, a little inflated, elongate-oval, inequilateral, tapering slightly toward the rear, rostrate behind, the rostration gently concave and bordered by a low umbonal ridge widening progressively to the basal margin; in front of the umbonal ridge is a slightly depressed radial platform, and on the forward side of that there is a fairly broad, very gentle sulcus. Anterodorsal margin long, hardly convex, and slightly inclined from the horizontal, the anterior end of the valve rather acutely rounded, the ventral margin nearly straight; at the base of the umbonal ridge the margin is shallowly embayed, and the posterior end above it subtruncate; the posterodorsal margin is straight except where it curves upward to the beak. Beak low, situated well behind the middle. Surface marked by delicate concentric bands which, on the posterior rostration, are slightly raised and sublamellar, and which, on the disk, are traversed by numerous radial lineations visible through a lens. Interior marked by numerous fine radial corrugations visible in certain light without the aid of a lens. Lateral teeth absent. Right posterior cardinal tooth strong and linearly bilobed, the anterior tooth strong, simple and somewhat arcuate, the teeth not joined at the apex, the resilifer between them deep. In front of the right

anterior cardinal there is a shallow wedge-shaped depression. The nymph behind the posterior tooth is comma-shaped, depressed, the tail attenuated posteriorly and bordered on the inner side by the slightly raised liplike edge of the hinge plate; the ligamental groove bounding the back of the nymph is fairly wide, straight, and shallow. Right anterior adductor scar long, compound-lenticular, the posterior scar broad and semicylindrical, bordered along the inner edge by a feeble radial ridge. Pallial sinus asymmetrically arcuate as it rises from the inner and upper side of the posterior adductor scar, obtusely subangular at the forward end, joining the faint pallial line about half way between the extremities of the valve. Running through the arc of the pallial sinus and extending to the ventral margin there is a narrow gentle upward crease in the interior, the crease reflecting the boundary line between the platform and sulcus on the outer surface of the valve.

Dimensions.—Holotype (I665a), right valve, height 21 mm.; length 36.2 mm.; thickness 4.1 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve, the holotype.

Comparisons.—*Macoma hybrida,* n. sp. is similar to *M. tageliformis* Dall (1900, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 1055; 1901, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 482, pl. 55, figs. 10, 11, 15), but the Pleistocene to Recent *M. tageliformis* lacks the inner rib bordering the edge of the posterior adductor scar. Also, the pallial sinus of *M. tageliformis* is higher and slightly shorter. Another allied species is the east American, Pliocene to Recent *M. brevifrons* Say (see Dall and Simpson, 1901, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, pp. 481-482, pl. 55, figs. 3, 12, 13), that, however, differing from *M. hybrida* in lacking the flattened area in front of the umbonal ridge. *M. elytrum* Keen (1958, Bull. Amer. Paleont., vol. 38, No. 172, p. 244, pl. 30, fig. 14), an Eastern Pacific form ranging from Baja California to Ecuador, is more prominently sulcate behind the middle, and is also wanting in the platform between the sulcus and the umbonal ridge.

SEMELIDAE

Semele purpurascens (Gmelin) Pl. 51, figs. 7, 8

1791. *Venus purpurascens* Gmelin, Syst. Nat., ed. 13, pt. 6, p. 3288, No. 91.
1815. *Tellina obliqua* Wood, General Conchology, pl. 61, figs. 1-2.
1818. *Amphidesma variegata* Lamarck, An. sans Vert., vol. 5, p. 490.
1821. *Amphidesma variegata* Lamarck, Sowerby, The Genera of Recent and Fossil Shells, pt. 9, fig. 1.
1845. *Amphidesma variegata* Lamarck, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 296.
1853. *Semele purpurascens* (Gmelin), Mörch, Catalogus Conchyliorum, pt. 2, p. 16.
1853. *Amphidesma obliqua* (Wood), Reeve, Conch. Icon., vol. 8, *Amphidesma,* pl. 1, sp. 5a, 5b.
1862. *Davila variegata* (Lamarck), Chenu, Manuel de Conchyliologie et de Paléontologie Conchyliologique, vol. 2, p. 80, fig. 346.
1862. *Semele ornata* Gould, Otia Conchologica, p. 239.
1864. *Semele purpurascens* (Gmelin), Krebs, The West Indian Marine Shells, p. 106.
1867. *Semele variegata* (Lamarck), Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162.
1869. *Semele variegata* (Lamarck), Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 122.
1874. *Semele ornata* Gould, Tryon, Amer. Marine Conch., p. 155.
1874. *Semele variegata* (Lamarck), Guppy, Geol. Mag., decade 2, vol. 1, p. 441.
1878. *Semele purpurascens* (Gmelin), Mörch, Catalogue of West-India Shells, p. 14.
1878. *Semele purpurascens* (Gmelin), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 246.
1881. *Semele variegatum* (Lamarck), Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 372.
1884. *Semele variegata* (Lamarck), Tryon, Structural and Systematic Conchology, vol. 3, p. 163, pl. 110, fig. 34.
1885. *Semele obliqua* (Wood), Smith, Voyage H.M.S. Challenger, Zoology, vol. 13, p. 84.
1886. *Semele obliqua* (Wood), Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 279.
1889. *Semele obliqua* (Wood), Dall, U. S. Nat. Mus., Bull. 37, p. 62.
1889. *Semele obliqua* (Wood), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 72.
1891. *Semele variegata* (Lamarck), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 48.
1900. *Semele purpurascens* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 993.
1901. *Semele purpurascens* (Gmelin), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 477.
1913. *Semele purpurascens* (Gmelin), Lamy, Jour. Conchyl., vol. 61, pp. 350-35.
1920. *Semele purpurascens* (Gmelin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 122.
1925. *Semele purpurascens* (Gmelin), Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 269-270, pl. 20, fig. 17.
1926. *Semele purpurascens* (Gmelin), Weisbord, Nautilus, vol. 39, No. 3, p. 84.
1932. *Semele purpurascens* (Gmelin), Mansfield, Florida State Geol. Sur., Bull. No. 8, pp. 145-146, pl. 30, fig. 11.
1934. *Semele purpurascens* (Gmelin), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 53.
1936. *Semele purpurascens* (Gmelin), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.

1936. *Semele purpurascens* (Gmelin), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 168.
1937. *Semele purpurascens* (Gmelin), Smith, East Coast Marine Shells, p. 61, pl. 23, fig. 12.
1940. *Davila variegata* (Lamarck), Smith, World-wide Sea Shells, p. 113, fig. 1479.
1946. *Semele purpurascens* (Gmelin), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1949. *Semele* (*Semele*) *purpurascens* (Gmelin), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 43.
1949. *Semele purpurascens* (Gmelin), Hertlein and Strong, Zoologica, vol. 34, pt. 4, No. 19, p. 248.
1951. *Semele purpurascens* (Gmelin), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 106, pl. 22, fig. 1.
1952. *Semele purpurascens* (Gmelin), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 184, pl. 13, fig. 3.
1953. *Semele purpurascens* (Gmelin), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 133.
1954. *Semele purpurascens* (Gmelin), Abbott, American Seashells, p. 435, pl. 40b.
1955. *Semele purpurascens* (Gmelin), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 84, pl. 16, fig. 104.
1956. *Semele purpurascens* (Gmelin), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 371.
1959. *Semele purpurascens* (Gmelin), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2136, 2164, pl. 6, fig. 11.
1961. *Semele purpurascens* (Gmelin), Olsson, Panamic-Pacific Pelecypoda, p. 363.

The Recent Venezuelan shell is thin and obliquely oval, with a produced and rounded anterior end. The surface is marked by delicate concentric lineations and numerous microscopic radii, crossed, on the anterior two-thirds of the valve, by fine, slightly raised, straightish threads running obliquely across the concentric markings. The pallial sinus is broadly semi-oval, extending forward about seven-tenths the length of the shell. Externally, the upper half of the valve is suffused a pale lavender; the lower half is cream-colored with purplish brown linear mottlings. The interior is glossy and whitish, with two large blotches of chocolate, one dark, the other light, and numerous purplish brown mottlings on the sides and base.

Dimensions.—Specimen A456a, left valve, height 13 mm.; length 16.7 mm., thickness 3 mm.

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. One left valve.

Remarks.—The Eastern Pacific analogue is *S. sparsilineata* Dall (1915, Acad. Nat. Sci. Philadelphia, Proc., vol. 67, p. 26) which ranges from Nicaragua to Ecuador to depths of 40 fathoms. Ac-

cording to Dall, the oblique threads are sparser on *S. sparsilineata* than on *S. purpurascens*.

Range and distribution.—*Semele purpurascens* (Gmelin) ranges from late Miocene to Recent. The Recent form extends from North Carolina, U.S.A., to Brazil. In the Pliocene, *S. purpurascens* has been recorded from Florida, Costa Rica, and Trinidad, and in the upper Miocene it was reported from the Choctawhatchee formation of Florida by Mansfield.

Semele proficua (Pulteney) Pl. 51, figs. 9-14

1767. ? *Tellina reticulata* Linnaeus, Syst. Nat., ed. 12, p. 1119.
1799. *Tellina proficua* Pulteney, Hutch. Dorset., p. 29, pl. 5, fig. 4.
1803. *Tellina proficua* Pulteney, Montagu, Testacea, or Natural History of British Shells, p. 66.
1813. *Tellina reticulata* Linnaeus, Pulteney, Catalogue Dorset., 2nd ed., p. 30, pl. 5, fig. 4.
1815. *Tellina decussata* Wood, General Conchology, p. 190, pl. 43, figs. 2-3.
1822. *Amphidesma orbiculata* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 307.
1826. *Amphidesma radiata* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 5, p. 230.
1845. *Amphidesma jayanum* C. B. Adams, Boston Soc. Nat. Hist., Proc., vol. 2, p. 10.
1845. *Amphidesma reticulata* (Chemnitz), d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, pp. 296-297.
1853. *Amphidesma reticulata* (Chemnitz), Reeve, Conch. Icon., vol. 8, *Amphidesma*, pl. 5, sp. 29.
1853. *Amphidesma decussata* (Wood), Reeve, Conch. Icon., vol. 8, *Amphidesma*, pl. 4, sp. 23.
1856. *Amphidesma radiata* Reeve, Hanley, An Illustrated and Descriptive Catalogue of Bivalve Shells, p. 342, pl. 12, fig. 8. Not of Reeve 1853.
1857. *Amphidesma orbiculata* Say, Tuomey and Holmes, Pleiocene Fossils of South Carolina, p. 94, pl. 23, fig. 4.
1860. *Semele orbiculata* (Say), Holmes, Post-Pleiocene Fossils of South Carolina, p. 51, pl. 8, fig. 9.
1860. ? *Semele radiata* (Say), Holmes, Post-Pleiocene Fossils of South Carolina, pl. 8, fig. 11.
1864. *Semele decussata* (Wood), Krebs, The West Indian Marine Shells, p. 106.
1867. *Semele carolinensis* Conrad, Amer. Jour. Conch., vol. 3, pt. 1, No. 5, p. 14.
1869. *Semele decussata* (Wood), Tryon, Amer. Jour. Conch., vol. 3, pt. 1, No. 5, p. 14.
1871. *Semele orbiculata* (Say), Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 138.
1878. *Semele reticulata* (Linnaeus) ?, Mörch, Catalogue of West-India Shells, p. 14.
1878. *Semele reticulata* (Linnaeus), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 247.
1884. *Semele reticulata* (Chemnitz), Tryon, Structural and Systematic Conchology, vol. 3, p. 163, pl. 110, fig. 35.
1887. *Semele reticulata* (Spengler), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1153, pl. 21, fig. 11.
1889. *Semele reticulata* (Gmelin), Dall, U. S. Nat. Mus., Bull. 37, p. 62.

1889. *Semele reticulata* (Lamarck), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 72.
1889. *Semele reticulata* (Gmelin), Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, p. 274.
1890. *Semele cordifornis* (Chemnitz), Smith, Linnean Soc. London, Jour., Zoology, vol. 20, p. 498.
1891. *Semele reticulata* (Gmelin), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 48.
1900. *Semele proficua* (Pulteney), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 991-992.
1900. *Semele orbiculata var. radiata* (Say), Verrill and Bush, Connecticut Acad. Arts and Sci., Trans., vol. 10, art. 12, p. 521.
1901. *Semele proficua* (Pulteney), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 477.
1913. *Semele proficua* (Pulteney), Lamy, Jour. Conchyl., vol. 61, pp. 314, 316, 331-333, 334.
1916. *Semele proficua* (Pultney), Thiele, Zool. Jahr., Suppl. 11, p. 131.
1920. *Semele proficua* (Pulteney), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 121-122.
1924. *Semele proficua* (Pulteney), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., pp. 37, 39, 40.
1925. *Semele proficua* (Pulteney), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 269, pl. 21. fig. 5.
1926. *Semele proficua* (Pulteney), Weisbord, Nautilus, vol. 39, No. 3, p. 84.
1934. *Semele proficua* (Pulteney), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 53.
1935. *Semele orbiculata* (Say), Richards, Jour. Paleont., vol. 9, No. 3, p. 257.
1936. *Semele proficua* (Pulteney), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1936. *Semele proficua* (Pulteney), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 42.
1936. *Semele proficua* (Pulteney), Clench and McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 3, p. 168.
1937. *Semele proficua* (Pulteney), Smith, East Coast Marine Shells, p. 61, pl. 23, fig. 11.
1938. *Semele proficua* (Pulteney), Richards, Geol. Soc. Amer., Bull., vol. 49, pt. 2, p. 1292.
1940. *Semele proficua* (Pulteney), Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Semele proficua* (Pulteney), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 39.
1944. *Semele proficua* (Pulteney), Hackney, Nautilus, vol. 58, No. 2, p. 59.
1945. *Semele decussata* (Wood), van Bentham Jutting, Geolog.-Mijnbouk. Genootschap Nederland en Kolonien, Geol. Ser., vol. 14, p. 78.
1946. *Semele proficua* (Pulteney), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 101.
1949. *Semele* (*Semele*) *proficua* (Pulteney), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 43.
1950. *Amphidesma jayanum* C. B. Adams, Clench and Turner, Occas. Papers on Mollusks, vol. 1, No. 15, p. 298, pl. 43, figs. 3-4.
1951. *Semele proficua* (Pulteney), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 106, pl. 21, fig. 9.
1952. *Semele proficua* (Pulteney), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 184, pl. 13, figs. 4–5.
1952. *Semele proficua* (Pulteney), Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 50.
1954. *Semele proficua* (Pulteney), Abbott, American Seashells, p. 434, pl. 40g.

1955. *Semele proficua* (Pulteney), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 84, pl. 16, fig. 103.
1956. *Semele proficua* (Pulteney), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 315, 326, 353, 371, pl. 3, figs. 9a, 9b.
1958. *Semele proficua* (Pulteney), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1959. *Semele proficua* (Pulteney), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 19.
1959. *Semele proficua* (Pulteney), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2125, 2161, pl. 2, VI, figs. 18a, 18b.
1961. *Semele proficua* (Pultney), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 46.
1961. *Semele proficua* (Pulteney), Olsson, Panamic-Pacific Pelecypoda, p. 370.
1961. *Semele* aff. *proficua* (Pulteney), van Regteren Altena, Konikl, Nederl. Akad. Wetens.-Amsterdam, Proc., ser. B, vol. 64, No. 2, p. 300.

Shell suborbicular, nearly equilateral, a little longer in front, subinflated. Beak low, slightly behind the middle, a narrow sunken lunule in front of it. Posterior gently flexed, sometimes with a faint narrow radial ridge or two on the broad submargin. Sculpture consisting of fine raised narrow concentric riblets and closely spaced wrinkle-like radial threads in the interspaces. Interior glossy. Hinge plate relatively short, the lateral teeth close to the cardinals. Right valve with two slightly divergent cardinals and two laterals, the posterior lateral slightly the stouter. Left valve with two cardinals, the anterior the stronger, and two subequal laterals. Ligamental area prominent, elliptical, depressed. Pallial sinus regular, "U"-shaped, extending upward and forward slightly past the middle line of the valves. Color straw without, whitish within, the interior flecked with lavendar at the umbo.

Dimensions.—Specimen A424a, right valve, height 21.6 mm.; length 23.1 mm.; thickness 4.2 mm. Specimen A 424b, left valve, height 14 mm.; length 16 mm.; thickness 2.2 mm. Specimen J425a, height 17.3 mm.; length 19.7 mm.; thickness 3.5 mm. (left valve).

Locality.—Recent, on beach of Playa Grande Yachting Club, Distrito Federal. Five specimens including three right valves and two left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One left valve, weathered. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve.

Range and distribution.—Pliocene to Recent. Living in shallow water from North Carolina to Brazil; Pleistocene in South Caroli-

na, Florida, St. Kitts?, Cuba, and Venezuela. Pliocene in South Carolina and Florida.

Remarks.—Olsson (1961) observed that the type of *S. mediamericana* Pilsbry and Lowe (1932, p. 92, pl. 12, figs. 1a, 1b, 2), purportedly from the Pacific coast of Nicaragua, evidently was collected from the Caribbean coast of that country and is the same as *S. proficua* (Pulteney).

Semelina nuculoides (Conrad) Pl. 52, figs. 1, 2

1841. *Amphidesma nuculoides* Conrad, Amer. Jour. Sci., 1st ser., vol. 41, p. 347.
1845. *Amphidesma nuculoides* Conrad, Fossils of the Medial Tertiary of the United States, p. 73, pl. 41, fig. 6.
1863. *Abra nuculoides* (Conrad), Acad. Nat. Sci. Philadelphia, Proc., vol. 14, p. 574.
1864. *Abra nuculoides* (Conrad), Meek, Smithsonian Misc. Collections, vol. 7, No. 183, p. 11.
1889. *Semele nuculoides* (Conrad), Dall, U. S. Nat. Mus., Bull. 37, p. 62.
1889. *Semele nuculoides* (Conrad), Dall, U. S. Nat. Mus., Proc., vol. 12, No. 773, pp. 274-275, pl. 14, fig. 5.
1900. *Semele nuculoidea* (Conrad), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 986, 994.
1901. *Semele* (*Semelina*) *nuculoides* (Conrad), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 477.
1913. *Semele nuculoides* (Conrad), Lamy, Jour. Conchyl., vol. 61, p. 316.
1919. *Semele nuculoides* (Conrad), Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, p. 19.
1920. *Semele* (*Semelina*) *nuculoides* (Conrad), Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 123.
1932. *Semele* (*Semelina*) *nuculoides* (Conrad), Mansfield, Florida State Geol. Sur., Bull. No. 8, p. 146, pl. 30, fig. 9.
1934. *Semele nuculoides* (Conrad), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 53.
1936. *Semele nuculoides* (Conrad), Lermond, Check List of Florida Marine Shells, p. 20.
1937. *Semele nuculoides* (Conrad), Smith, East Coast Marine Shells, p. 61, pl. 10, fig. 7.
1942. *Semele* (*Semelina*) *nuculoides* (Conrad), Gardner, U. S. Geol. Sur., Prof. Paper 199-A, pp. 102-103, pl. 17, figs. 18-21.
1949. *Semele* (*Semelina*) *nuculoides* (Conrad), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 43.
1951. *Semele nuculoides* (Conrad), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 107, pl. 22, fig. 3.
1953. *Semelina nuculoides* (Conrad), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 134.
1955. *Semele nuculoides* (Conrad), Perry and Schwengel, Marine Shells of the Western Coast of Florida, pp. 84-85, pl. 16, fig. 105.
1958. *Semele nuculoides* (Conrad), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1959. *Semele nuculoides* (Conrad), Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 19.

1961. *Semele nuculoides* (Conrad), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 46.
1961. *Semelina nuculoides* (Conrad), Olsson, Panamic-Pacific Pelecypoda, p. 375.

Shell small, moderately inflated, elongate-nuculoid in outline, longest and a little oblique anteriorly. Beak low, near the posterior end. Surface sculptured by closely spaced subregular concentric lirae (some of them not reaching the margins), separated by interspaces which are a little wider than the lirae at the umbo but narrower than the lirae below; in the interspaces on the lower half of the anterior end, as well as elsewhere, there are obsolescent microscopic radial striae. Hinge of left valve with a sharp, elevated, cuneate and bifid anterior cardinal tooth; behind that there is a deep triangular socket, and after the socket a shallower subrhomboidal chondrophore, the chondrophore bordered by the posterior cardinal. The left posterior cardinal tooth is a thickened lamina situated above the posterior adductor scar; the left lateral tooth is represented by a slight thickening far down the anterodorsal edge above the anterior adductor scar. Anterior adductor scar moderately elongate and more or less elliptical, the posterior scar impressed and subquadrate. The pallial sinus is large, arising at the inner margin of the posterior adductor scar, embayed to about 0.3 mm. from the anterior adductor scar, the lower limb of the sinus a narrowish finger-like projection extending toward the rear about two-thirds the length of the valve, the posterior end of the limb bluntly rounded; the lower line of the limb parallels the ventral margin of the valve and continues to join the lower end of the anterior adductor scar. Inner margin smooth. Lunular area narrow, elongate, elliptical, sunken slightly below the border of the disk. Escutcheonal area relatively short, sublinear, slightly depressed.

Dimensions.—Specimen S458a, height 2.9 mm.; length 4.3 mm.; approx. thickness 1.1 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve.

Remarks.—According to Dall (1900, p. 994), certain variants of *S. nuculoides,* chiefly among Recent specimens, are marked by faint radial striations, and such occur on the Venezuelan fossil.

Range and distribution.—Semelina nuculoides (Conrad) ranges

from upper Miocene to Recent. The living form is found from Cape Hatteras, North Carolina, to Brazil, occurring off the west coast of Florida in six to seven fathoms. In the Pleistocene, Maury reported it from New Orleans, Louisiana, in the Gymnasium Club well at 1200 feet. In the Pliocene, *S. nuculoides* occurs in North Carolina, and Florida, and in the upper Miocene, in Virginia, North Carolina, and Florida.

DONACIDAE

Donax denticulatus Linnaeus Pl. 52, figs. 3-8

1758. *Donax denticulata* Linnaeus, Syst. Nat., ed. 10, p. 683, No. 86.
1767. *Donax denticulatus* Linnaeus, Syst. Nat., ed. 12, p. 1127, No. 107.
1782. *Donax denticulata* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, pp. 262-264, pl. 26, figs. 256-257.
1825. *Donax denticulata* Linnaeus, Wood, Index Testaceologicus, pl. 6, fig. 8.
1854. *Donax denticulata* Linnaeus, Reeve, Conch. Icon., vol. 8, *Donax,* pl. 7, sp. 48a-c.
1864. *Donax denticulata* Linnaeus, Krebs, The West Indian Marine Shells, p. 99.
1866. *Donax denticulata* Linnaeus, Sowerby, Thes. Conchyl., vol. 3, p. 281, figs. 32-36.
1869. *Donax denticulatus* Linnaeus, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 108.
1869. *Donax denticulatus* Linnaeus, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 3, pp. 21-24, pl. 2, figs. 4-5., pl. 5, figs 1-7.
1878. *Donax denticulata* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Donax denticulatus* Linnaeus, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 247.
1879. *Donax* (*Chion*) *denticulatus* Linnaeus, Bertin, Mus. Hist. Nat., Nouv. Arch., sér. 2, pp. 81-82.
1884. *Donax denticulatus* Linnaeus, Tyron, Structural and Systematic Conchology, vol. 3, p. 172, pl. 112, figs. 80-81.
1886. *Donax denticulatus* Linnaeus, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1102, pl. 21, fig. 19.
1889. *Donax denticulatus* Linnaeus, Dall, U. S. Nat. Mus., Bull. 37, p. 58.
1889. *Donax denticulatus* Linnaeus, Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 63.
1891. *Donax denticulatus* Linnaeus, Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 48.
1892. *Donax denticulata* Linnaeus, Dall, Nautilus, vol. 5, No. 11. p. 125.
1900. *Donax denticulata* Linnaeus, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 963,965.
1901. *Donax denticulata* Linnaeus, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 476.
1914. *Donax denticulata* Linnaeus, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 20, No. 6, p. 340.
1920. *Donax denticulata* Linnaeus, Maury, Bull. Amer. Paleont., vol. 8, No. 34, p. 128.
1934. *Donax denticulata* Linnaeus, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 54.
1936. *Donax denticulata* Linnaeus, McLean, Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 10, No. 1, p. 40.

1937. *Donax denticulata* Linnaeus, Smith, East Coast Marine Shells, p. 62, pl. 25, fig. 3.
1940. *Donax denticulatus* Linnaeus, Smith, World-wide Sea Shells, p. 113, fig. 1481.
1940. *Donax denticulata* Linnaeus, Richards, Soc. Venezolana Cienc. Nat., Bol., vol. 6, No. 46, p. 306.
1943. *Donax denticulata* Linnaeus, Richards, Jour. Paleont., vol. 17, No. 1, p. 121.
1945. *Donax denticulatus* Linnaeus, van Bentham Jutting, Geolog.-Mijnbouwk, Genootschap Nederland en Kolonien, Geol. Ser., vol. 14, p. 78.
1949. *Donax denticulatus* Linnaeus, Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 41.
1951. *Donax denticulata* Linnaeus, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 105, pl. 21, fig. 7.
1952. *Donax denticulatus* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 83.
1952. *Donax denticulata* Linnaeus, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183.
1954. *Donax denticulata* Linnaeus, Abbott, American Seashells, p. 438, pl. 30p.
1958. *Donax denticulata* Linnaeus, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1959. *Donax denticulata* Linnaeus, Nowell-Usticke, A Check List of the Marine Shells of St. Croix, p. 19.
1961. *Donax denticulatus* Linnaeus, Warmke and Abbott, Caribbean Seashells, p. 201, pl. 4L; 42d.

The Recent shell from Higuerote occurs in two forms, one with a relatively high trigonal outline, the other narrower and more elongated. On the former, the embayment of the ventral margin is short and slight, and sometimes not present; on the latter it is longer and generally somewhat more pronounced. Except for the average smaller size of the elongated variant, the two forms are otherwise identical, and there seems no doubt that they are conspecific. The species is characterized by a low narrow arcuate angulation on the posterior truncation, the angulation dividing the truncation into two unequal and sharply defined areas. The area adjacent to the posterior ridge is sculptured by five to seven neat radial riblets with numerous regularly spaced threads in the interspaces; the marginal area is somewhat wider and is sculptured by rather strong vermicular concentric cords between which are narrower subregular radial lirae. Both valves are marked by a faint radial depression in front of the posterior ridge, the depression broader and gentler on the elongated form. Inner margins crenulated, the denticles extending from near the posterior lateral tooth around the base to the anterior end where they become obsolescent and cease at the curve of the anterior end and the anterodorsal margin

which is smooth. The base is finely serrated, the pallial sinus large and subangulately rounded. The anterior lateral of the hinge is longer than the posterior. The coloration is highly variable. Some specimens are a plain white, straw, salmon, or flesh on the surface, others are broadly or narrowly rayed in brown, gray, lavender or purple. The shiny interior is usually suffused wholly or in part with deep purple, and there is an occasional specimen with bright orange in the body cavity.

Dimensions.—Specimen B469a, left valve, length 29.3 mm.; height 20.5 mm.; thickness at posterior ridge 6.9 mm. Specimen B469b, right valve, length 20.8 mm.; height 15 mm.; thickness at posterior ridge 5 mm. Specimen B469c, left valve, length 25.4 mm.; height 18.7 mm.; thickness at posterior ridge 6 mm. Specimen B469d, right valve, length 27.3 mm.; height 20.3 mm.; thickness at posterior ridge 6.8 mm. Average elongated form, length 22 mm.; height 13 mm.; thickness at posterior ridge 5 mm.

Locality.—On beach, southeast of Higuerote, State of Miranda. One hundred fifty specimens including ninety-seven left valves and fifty-three right valves.

Range and distribution.—The living *Donax denticulatus* Linnaeus is a near-shore species ranging from Brazil through the West Indies to perhaps as far north as the Florida Keys. As a fossil it has been found in the Pleistocene of Colombia and Venezuela.

Donax striatus Linnaeus Pl. 52, figs. 9-17

1767. *Donax striata* Linnaeus, Syst. Nat., ed. 12, p. 1127, No. 106.
1772. *Donax striata* Linnaeus, Knorr, Vergnugen der Angen und des Gemuths . . ., pt. 6, pl. 7, fig. 7.
1782. *Donax striata* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 6, pp. 261-262, pl. 26, fig. 255.
1818. *Donax caianensis* Lamarck, An. sans Vert., vol. 5, p. 550.
1841. *Donax caianensis* Lamarck, Delessert, Recueil de coquilles décrites par Lamarck dans son Histoire Naturelle des Animaux sans Vertébres et non encore figurées, pl. 6, figs. 13a, 13b.
1845. *Donax cayanensis* Lamarck, d'Orbigny, [in] La Sagra, Hist. Fís., Polít., y Nat. Isla de Cuba, pt. 2, vol. 5, Moluscos, p. 308.
1853. *Donax flexuosus* Gould, Boston Jour. Nat. Hist., vol. 6, p. 395, pl. 15, fig. 8. Not of Cooper 1888.
1854. *Donax lamarckii* Deshayes, [in] Reeve, Conch. Icon, vol. 8, *Donax,* pl. 5, sp. 27.
1855. *Donax striata* Linnaeus, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 82, pl. 14, fig. 32.
1864. ?*Donax cayennensis* Lamarck, Krebs, The West Indian Marine Shells, p. 99.

1864. *Donax striata* Linnaeus, Guppy, Sci. Assoc. Trinidad, Trans., pp. 164, 167.
1866. *Donax striata* Linnaeus, Sowerby, Thes. Conchyl., vol. 3, p. 309, pl. 281, fig. 52.
1867. *Donax striata* Linnaeus, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 162.
1869. *Donax* (*Serrula*) *striatus* Linnaeus, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 15, p. 113.
1869. *Donax striatus* Linnaeus, Römer, Syst. Conchylien-Cabinet, vol. 10, pt. 3, pp. 12-13, pl. 5, figs. 8-10.
1878. *Donax striata* Linnaeus, Mörch, Catalogue of West-India Shells, p. 15.
1879. *Donax striatus* Linnaeus, Bertin, Mus. Hist. Nat., sér. 2, Nouv. Arch., p. 94.
1892. *Donax striata* Linnaeus, Dall, Nautilus, vol. 5, No. 11. p. 125.
1900. *Donax striata* Linnaeus, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 968.
1914. *Donax striata* Linnaeus, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 20, No. 6, p. 338.
1924. *Donax striata* Linnaeus, Strong, Nautilus, vol. 37, No. 3, p. 83.
1925. *Donax striata* Linnaeus, Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 268.
1934. *Donax striata* Linnaeus, Maury, Amer. Mus. Nat. Hist., Bull., vol. 67, art. 4, pp. 165-166, pl. 19, fig. 5.
1945. *Donax striatus* Linnaeus, van Bentham Jutting, Geolog.-Mijnbouwk. Genootschap Nederland en Kolonien, Geol. ser., vol. 14, p. 78.
1952. *Donax striatus* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, pt. 1, pp. 81-82.
1954. *Donax striata* Linnaeus, Abbott, American Seashells, p. 438.
1958. *Donax striatus* Linnaeus, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1961. *Donax striatus* Linnaeus, Warmke and Abbott, Caribbean Seashells, p. 202, pl. 42h.
1961. *Donax striatus* Linnaeus, Olsson, Panamic-Pacific Pelecypoda, pp. 340, 343.

The Recent Higuerote shell referred to this species is wedge-shaped, moderately solid, trigonal in outline, produced anteriorly, characterized by a sharply carinated posterior ridge and a flat to slightly concave posterior truncation with a nearly vertical slope. The posterodorsal margin descends more steeply than the anterodorsal margin. Anterior end narrowed and well rounded, ventral margin subangularly arcuate with a downsag near the middle, the margin behind the sag truncate to hardly embayed. The corner at the ventral and posterodorsal margins is acute, and the posterior end is short and truncated. In front of the posterior ridge there is a slight radial depression, and often another barely discernible one before the anterior end. Beak sharp, fairly high, flattened on top, opisthogyrate, situated at the posterior third. On the hinge there is an oval ligamental fosset immediately under the beak, the hinge plate turned up at the distal end of it. The laterals are prominent,

the groove between them on the right valve deeper on the posterior set than on the anterior. Cardinals of left valve subequal, divergent, united above, the socket separating them triangular; on the right valve the central cardinal is stout, the anterior one minor. Inner margins regularly crenulated, the denticles extending around the edge from the posterior lateral to where the anterior end merges with the anterodorsal margin, which itself is smooth. Rim of basal margin serrated by the termini of the external ribs. Adductor impressions distinct, the anterior one narrowly pyriform, the posterior transversely oval. Pallial sinus U-shaped, projected horizontally to near the middle line of the interior, the apex rounded. Pallial line fairly close to the margin posteriorly, more remote anteriorly, the line bowed up where it meets the end of the sinus, the upper line of the sinus and hinder end of the pallial line subparallel. Exterior of disk sculptured by low flat narrow radial riblets which are more distinct in front of the posterior ridge than they are anteriorly. The posterior truncation is sculptured by 19 to 23 equal to subequal neat radial cords which are sometimes faintly crenate, the interspaces crowded with microscopic concentric striae. The rib forming the carina of the posterior ridge is strong and usually doubled toward the base. The color is plain white, gray, light yellow, salmon or pale lavender on the surface, and usually deep purple and white in the interior, although occasional specimens are pinkish or ashy within.

Dimensions.—Specimen B470a, valves attached, length 26.3 mm.; height 16.4 mm., max. thickness of pair 11.5 mm. Specimen B470b, a young doublet, length 12.3 mm.; height 7.9 mm.; max. thickness of pair 5.2 mm. Specimen B470c, left valve, length 25.9 mm.; height 17 mm.; thickness at posterior ridge 5 mm. Specimen B470d, right valve, length 23.3 mm.; height 14.1 mm., thickness at posterior ridge 4.6 mm. Specimen B470el-2, paired valves, length 28.1 mm.; height 18.2 mm.; max. thickness of pair 12.2 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. Twenty-seven specimens including thirteen left valves, ten right valves, and four doublets.

Remarks.—*D. striatus* is at once differentiated from *D. denticulatus* by its flat, rather than angulated posterior slope, and the slope is uniformly sculptured longitudinally.

Range and distribution.—The Recent *D. striatus* ranges from Brazil to the southern Caribbean. As a fossil it has been reported from the Pleistocene in Colombia and on the coast of Rio Grande do Norte in Brazil, and by Guppy from the Pliocene at Matura, Trinidad. As pointed out by Hanley, the figure of *D. caianensis* Lamarck portrayed by Delessert and based on the original Lamarckian specimens, agrees so well with *D. striatus* Linnaeus, that they may be the same.

Donax higuerotensis, new species Pl. 53, figs. 1-9

Shell relatively narrow, inequilateral, oblong subtrigonal in outline, about twice as long as high, produced anteriorly. Anterodorsal margin gently sloping, nearly parallel with the anterior half of the ventral margin; posterodorsal margin moderately steep, slightly humped above the posterior lateral tooth, hardly concave distally; corner of posterodorsal and ventral margins rounded to subtruncate; posterior half of ventral margin shallowly embayed, the anterior half gently arcuate; anterior end a little narrowed and well rounded. Posterior ridge subrounded to subangulate, the posterior slope slightly convex adjacent to the ridge, flattened to hardly concave toward the margin. Between the posterior ridge and middle of the disk there is a broad shallow radial depression. Beak low, appressed on top, situated aft of the middle. Laterals of left valve prominent, the anterior lateral tooth longer than the posterior. Between the beak and the posterior lateral the hinge plate is upswept on both valves. Central cardinal of right valve stout, joined above to the smaller anterior cardinal which diverges nearly horizontally. Cardinals of left valve subequal, joined above, diverging equally from the apex. Interior shiny. Inner margins crenulated, the denticles extending around the edge from the posterior lateral to where the anterior end and anterodorsal margin meet, the anterodorsal margin itself smooth. Anterior adductor scar pyriform, the posterior transversely suboval, lying athwart the posterior angle. Pallial sinus U-shaped, extending forward horizontally to a little before the mid-line of the valve, the apex broadly rounded. Pallial line fairly close to the margin near the posterior corner, becoming more remote from the margin on its course to the base of the anterior adductor scar, the line bowed up where it meets the pallial sinus, the after end of the

pallial line nearly parallel with the upper line of the sinus. Entire surface sculptured by radial riblets, those on the disk faint, flat, and narrow, the ones (22 to 24) on the posterior truncation thinner and much more distinct. On the left valve the radial riblets on the truncation are more or less equal, but on the right valve there are five or six adjacent to the posterior ridge that are slightly broader than the others. Crowded microscopic concentric striae traverse the surface, the striae much more distinct in the intercostal spaces of the posterior slope than elsewhere. The basal rim of the valves is finely serrated by the projecting termini of the external riblets. On the exterior the ground color is generally dull white but sometimes buff, with concentric bands and stripes of gray, or lavender, or pale purple, or rarely, light yellow. Excepting those which are monotone in color, all specimens exhibit a broad, usually single but occasionally double ray of ground color diverging sharply from the beak, the ray confined to the radial depression of the valve and broadening to the base. In the interior of the valve this ray shows up in white, generally with purple on either side.

Dimensions.—Holotype (B471a), paired valves, length 25 mm.; height 12.2 mm.; max. thickness of pair 7.5 mm. Paratype (B471b), left valve, length 23 mm.; height 10.7 mm.; thickness at posterior ridge 4 mm. Paratype (B471c), right valve, length 22 mm.; height 10.9 mm.; thickness at posterior ridge 4 mm.

Type locality.—Recent, on beach southeast of Higuerote, State of Miranda. Fifty-four specimens including thirty right valves, twenty-three left valves, and one doublet.

Other localities.—Unnamed (as of November 1961) Recent specimens of this species are contained in the collections of the U. S. National Museum from Cienaga, near Santa Marta, Colombia (U. S. N. M. No. 444095), and from Chaguaramas Bay, Trinidad (U. S. N. M. No. 518549). Higuerote, in Venezuela, lies on the coast between those localities but nearer Trinidad.

Comparisons.—Donax higuerotensis, n. sp. is found on the beach at Higuerote together with *D. striatus* Linnaeus, but is differentiated from *D. striatus* by its consistently more elongated outline, by its longer and more prominent embayment of the ventral margin behind the middle, and by its more pronounced radial depression of the disk above the embayed margin. The type (No. 51589, Academy of

Natural Sciences of Philadelphia) of *D. protractus* Conrad (1849, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 1, p. 208) from Florida is smaller, thinner, and not as definitely rayed from umbo to base as is *D. higuerotensis*. *D. mediamericana* Pilsbry (1919, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, pp. 222-223, pl. 11, fig. 10) from Livingston, Guatemala, is, as later acknowledged by Pilsbry (1920, Acad. Nat. Sci. Philadelphia, Proc., vol. 72, p. 195), a variant of *D. striatus* Linnaeus, with the altitude three-fifths of the length compared to an altitude of slightly less than half the length on *D. higuerotensis*. The nearest Eastern Pacific analogue is *D. culter* Hanley (see Keen, 1958, Sea Shells of Tropical West America, p. 185, fig. 448), but that is less robust and more flexuous than *D. higuerotensis*.

Range and distribution.—Donax higuerotensis, n. sp., is presently known from northern South America.

Donax vagus, new species Pl. 53, figs. 10, 11

Shell small, fairly solid, moderately inflated, obtusely trigonal in outline, inequilateral, somewhat produced and attenuated anteriorly. Anterodorsal margin long and straight, with a slope of about 35 degrees from the horizontal, the anterior end well rounded, the ventral margin shallowly arcuate but with a slight downsag near the middle, the posterodorsal margin slightly convex. Posterior ridge low and rounded, merging evenly with the relatively narrow posterior area which itself is a little convex basally but with a nearly vertical slope above. Beak low and appressed, situated about two-fifths of the length of the shell from the posterior end. Although the surface sculpture is nearly obliterated it is seen to consist, on the disk, of low faint narrow radial riblets typical of the genus, with vestiges of riblets also appearing on the posterior slope. Hinge of left valve consisting of a short elevated posterior lateral tooth close to the beak and a long slender anterior lateral more distant from the beak. The central cardinals of the left valve are subequal, united above, diverging equally from the apex, the subumbonal socket between them triangular. Anterior adductor scar gently impressed, fairly low, narrowly subpyriform, rather sharply attenuated above, the posterior scar scarcely visible, oval, also fairly low, lying astride the posterior angle of the interior. Pallial sinus not visible.

Inner margins denticulate, the crenulations extending from near the posterior lateral around the rim of the valve to where the anterior end meets the anterodorsal margin.

Dimensions.—Holotype (I542a), left valve, length 5.1 mm.; height 3.6 mm.; max. thickness 1.4 mm.

Type Locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One left valve, the holotype.

Comparisons.—The want of a sharply carinated posterior ridge immediately distinguishes the new species from *D. denticulatus* Linnaeus and *D. striatus* Linnaeus. Among other Recent species, *D. vagus,* n. sp. is reminiscent of *D. texasianus* Philippi (1847, Zeitschr. f. Malakozool., yr. 4, p. 77) and *D. roemeri* Philippi (1848, Zeitschr. f. Malakozool., yr. 5, p. 147), but those are slightly narrower forms with a subangular rather than rounded posterior ridge. Among fossil species, *D. vagus* resembles *D. chuckatuckensis* Gardner (1943, U.S. Geol. Survey Prof. Paper 199-A, p. 106, pl. 23, figs. 6-7) from the upper Miocene Yorktown formation of Virginia. *D. chuckatuckensis,* however, has a somewhat more posterior beak than *D. vagus* and is a slightly narrower and flatter shell. The Pliocene *D. moenensis* Gabb (1881, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 8, pp. 371-372, pl. 47, fig. 72) from Costa Rica is also similar, but *D. moenensis* is a more delicate shell, has a slightly concave anterodorsal margin whereas that of *D. vagus* is straight, and the anterior end of the Costa Rican species is more attenuated than on the Venezuelan shell.

Donax marensis, new species Pl. 53, figs. 12, 13

Shell small, thin, slightly inflated, inequilateral, somewhat produced and moderately attenuated anteriorly. Anterodorsal margin long and straight, with a slope of near 30 degrees from the horizontal; anterior end bluntly rounded, ventral margin feebly arcuate; posterior end subtruncate, posterodorsal margin hardly convex. Prodissoconch subtranslucent. Beak low, opisthogyrate, situated a little posterior to the mid-line of the valve. Posterior ridge low and obtuse, the posterior slope not compressed. Exterior polished, sculptured by narrow, regular, microscopic, subsurficial radial riblets, the riblets on the posterior slope finer than those on the disk. Lateral teeth of right valve well developed, the posterior set shorter and nearer the

beak than the anterior set. Central cardinal tooth small, stout, and subcuneate, the higher anterior cardinal much thinner and with a slope subparallel with the margin; behind the central cardinal is a sublinear socket against which the hinge plate is upturned in the manner characteristic of the genus. Base of hinge plate between the laterals nearly horizontal. Adductor scars indistinct, the anterior seemingly suboval, the posterior broadly diamond-shaped and lying astride the posterior angle. Pallial sinus and pallial line not visible. Basal margin finely serrate.

Dimensions.—Holotype (T472a), right valve, length 2.7 mm.; height 2 mm.

Type locality.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Mare Abajo. One juvenile right valve, the holotype.

Comparisons.—*D. marensis,* n. sp. is more fragile, less inflated, and with a gentler posterior slope than *D. vagus,* n. sp. described on the preceding page. *D. marensis* resembles the young of the upper Miocene to Recent *D. fossor* Say (see Gardner, 1943, U. S. Geol. Survey Prof. Paper 199-A, pp. 106-107, pl. 23, figs. 2, 11) but is a thinner shell than that, and the posterior end proper is subtruncate rather than subrounded as on *D. fossor.*

SANGUINOLARIIDAE

Sanguinolaria (Psammotella) operculata (Gmelin) Pl. 53, figs. 14-17

1782. *Tellina rufescens* Chemnitz, Syst. Conchylien-Cabinet, vol. 6, p. 105, pl. 11, fig. 97.
1791. *Tellina operculata* Gmelin, Syst. Nat., ed. 13, vol. 1, p. 3235.
1791. *Tellina rufescens* Gmelin, Syst. Nat., ed. 13, vol. 1, p. 3238.
1815. *Tellina operculata* Gmelin, Wood, General Conchology, p. 165, pl. 42, fig. 1.
1878. *Tellina rufescens* Chemnitz, Mörch, Catalogue of West-India Shells, p. 14.
1887. *Tellina* (*Psammotella*) *operculata* (Gmelin), Fischer, Manuel de Conchyliologie et de Paléontologie Paleontologique, p. 1147.
1898. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Dall, Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 58, 62.
1900. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 973, 978.
1917. *Sanguinolaria* (*Psammotella*) *rufescens* (Gmelin), Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 393.
1920. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 125-126.
1922. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Olsson, Bull. Amer. Paleont., vol. 9, No. 39, p. 433.

1934. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Johnson, Boston Soc. Nat. Hist., vol. 40, No. 1, p. 54.
1943. *Sanguinolaria operculata* (Gmelin), Stewart, Nautilus, vol. 60, p. 19.
1949. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Lange de Morretes, Arq. Mus. Paranaense, vol. 7, art. 1, p. 43.
1950. *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin), Hertlein and Strong, Zoologica, vol. 35, pt. 4, No. 19, p. 221.
1952. *Sanguinolaria operculata* (Gmelin), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 183.

Shell elongate, ovate, the height about half the length, inequilateral, subequivalve, the right valve inflated and a little twisted, the left valve flattish and somewhat more tapering. Behind, the valves are gently rostrated by a low subrounded radial ridge, the posterior submargin adjacent to the ridge slightly concave, the area in front of the ridge a little depressed, the depression widening rapidly toward the base. Anterodorsal margin straight, nearly horizontal, short to moderately long, the anterior end well rounded, the basal margin subtruncate at the middle but embayed at the posterior depression, the posterior end narrowed and obliquely truncate, the posterodorsal margin subtruncate away from the hinge, straight to hardly concave at the hinge. Beak low, pointed, situated a little behind the middle. Surface marked by numerous fine concentric lineations which are obsolescent on the umbo and faint on the disk, but crowded, low, and sublamellar on the posterior submargin. Traversing the lower half of the disk but absent on the posterior submargin are feeble, rather closely spaced subregular shallow radial grooves. Ligament external, the nymph platform lanceolate and roughened by numerous vertical rugae. Right cardinal teeth forming a caret, the posterior tooth cuneate, strongly bifid, curving a little outward, and larger than the anterior, the anterior tooth also roughly cuneate but simple. The hinge plate on the right valve forms a slightly thickened upswept lip at the rear of the nymph. On the left valve the anterior cardinal is also bifid, and fits into the triangular socket of the right valve; the left posterior cardinal is more or less lamellar, and fits into the groove of the posterior tooth of the right valve. Anterior muscle scar lenticular, posterior scar broadly subcylindrical. Pallial sinus ample, the upper line rising slightly from the inner edge of the posterior muscle scar, then descending and later turning in to join the pallial line at about the middle of its length on the right valve. On fresh

shells the interior is glossy, and the ventral margin finely crinkled. Extending from a little above the posterior adductor scar, and passing along the inner edge of the scar to a little above the ventral margin, there is a feeble radial ridge at the termination of which there is a whitish node. Within, the color of the valves is generally a uniform pink but sometimes peach, with the margins a deeper tone of the same hue. The surface is colored in bands of lighter and darker pink, the umbo suffused a darker rose.

Dimensions.—Specimen B445a, right valve, height 34 mm.; length 65.5 mm.; approx. thickness 10.2 mm. Specimen B445b, a broken doublet, the larger fragment (right valve) 34 mm. in length. The umbonal area of a large broken left valve is 4 mm. in thickness. Largest specimen, a right valve, height 36 mm.; length 70.5 mm.; approx. thickness 10 mm.

Locality.—On beach, southeast of Higuerote, State of Miranda. Twenty-two specimens including seventeen right valves, four doublets all with the attached valves broken, and one left valve with the sides and base broken away.

Remarks.—*Sanguinolaria operculata* (Gmelin) is narrower and more elongate than the Recent Western Atlantic *S. sanguinolenta* (Gmelin) but is close to the Recent Eastern Pacific *S. bertini* Pilsbry and Lowe (1932, p. 91, pl. 10, figs. 7-8), differing perhaps in the somewhat greater angle that the upper line of the pallial sinus on *S. operculata* joins the pallial line, and perhaps, as suggested by Hertlein and Strong, in the greater distance of confluence of the lines on *S. operculata.* A fossil species that is closely related to both *S. operculata* and *S. bertini* is *S. smithwoodwardi* Maury (1917, Bull. Amer. Paleont., vol. 5, No. 29, pp. 393-394, pl. 38, figs. 1-2) from the middle Miocene of the Dominican Republic. There is a slight difference in shape between the right valve of *S. smithwoodwardi* and the Recent Higuerote specimens of *S. operculata,* and, according to Maury, the left valve of *S. smithwoodwardi* (of which she had 10 examples) is marked only by delicate concentric striae instead of both the delicate concentric and radial lineations that are discernible on the Higuerote left valve. The middle Miocene *S. alouatta* Olsson (1922, Bull. Amer. Paleont., vol. 9, No. 39, pp. 432-433, pl. 29, figs. 5-6) is another fossil relative of *S. operculata,* but that too differs in outline, with the anterdorsal margin of the right valve and the

posterodorsal margin of the left valve being more concave than on the respective valves of *S. operculata.*

Range and distribution.—Recent in the Western Atlantic from the Gulf of Mexico ? to Brazil.

Tagelus plebeius (Solander) Pl. 54, figs. 1-4

1685. *Chama angustior,* etc., Lister, Historiae sive synopsis methodicae conchyliorum et tabularum anatomicarum, pl. 421, fig. 265.
1786. *Solen plebejus Solander,* A Catalogue of the Portland Museum, pp. 42, 101, 156.
1794. *Solen gibbus* Spengler, Skrivt. Nat. Selsk. Copenhagen, vol. 3, p. 104.
1795. *Solen guineensis* Chemnitz, Syst. Conchylien-Cabinet, vol. 11, p. 202, pl. 198, fig. 1937.
1817. *Siliquaria notata* Schumacher, Essai d'un nouveau système des habitations des vers testacés, Copenhagen, p. 129, pl. 7, figs. 2-3.
1817. *Solen guineensis* Chemnitz, Dillwyn, A Descriptive Catalogue of Recent Shells, p. 62.
1818. *Solen caribaeus* Lamarck, An. sans Vert., vol. 5, p. 454.
1819. *Solen declivis Turton,* A Conchological Dictionary of the British Islands, p. 164, fig. 80.
1822. *Psammobia declivis* (Turton), Conchylia Dithyra Insularum Brtitannicarum, p. 91.
1823. *Solen plebeius* Solander, Dillwyn, Index Conch., ed. 3, p. 22.
1827. *Solecurtus caribaeus* (Lamarck), Blainville, Dictionnaire des sciences naturelles, vol. 49, p. 420.
1831. *Solecurtus caribaeus* Blainville, Conrad, American Marine Conchology, p. 22, pl. 4, fig. 3.
1835. *Solen guineensis* Chemnitz, Wood, General Conchology, p. 129.
1841. *Solecurtus caribaeus* (Lamarck), Gould, A Report on the Invertebrates of Massachusetts, p. 30.
1843. *Solecurtus caribaeus* (Lamarck), Mighels, Boston Jour. Nat. Hist., vol. 4, p. 312.
1843. *Solen caribaeus* Lamarck, De Kay, Zoology of New York, pt. 5, p. 243, fig. 302.
1846. *Cultellus caribaeus* (Lamarck), Conrad, Amer. Jour. Sci., ser. 2, vol. 1, p. 404.
1856. *Siliquaria gibba* (Spengler), H. & A. Adams, The Genera of Recent Mollusca, vol. 2, p. 347, Not pl. 93, figs. 5, 5a.
1858. *P [anopea] caribaeus* Emmons, Report on the North Carolina Geological Survey, p. 299, fig. 228a.
1860. *Siliquaria caribaea* (Blainville), Holmes, Post-Pleiocene Fossils of South Carolina, p. 54, pl. 8, fig. 14.
1862. *Siliquaria carolinensis* Conrad, Acad. Nat. Sci. Philadelphia, Proc., vol. 14, p. 571 (part).
1864. *Solen gibbus* Spengler, Krebs, The West Indian Marine Shells, p. 112.
1868. *Siliquaria gibba* (Spengler), Conrad, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 9, p. 23.
1870. *Tagelus gibbus* (Spengler), Dall, Boston Soc. Nat. Hist., Proc., vol. 13, p. 251.
1871. *Siliquaria gibba* (Spengler), Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, pp. 138-139.
1874. *Solecurtus caribaeus* (Lamarck), Sowerby, [in] Reeve, Conch. Icon., pl. 4, sp. 21a, 21b.
1878. *Solen gibbus* Spengler, Mörch, Catalogue of West-India Shells, p. 14.

1887. *Tagelus caribaeus* (Lamarck), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1107, pl. 22, fig. 9.
1889. *Tagelus gibbus* (Spengler), Dall, U. S. Nat. Mus., Bull. 37, p. 58, pl. 55, fig. 3; pl. 56, fig. 3.
1889. *Solecurtus gibbosus* (Spengler), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 71.
1891. *Tagelus gibbus* (Spengler), Baker, Acad. Nat. Sci. Philadelphia, Proc., vol. 43, p. 48.
1892. *Tagelus gibbus* (Spengler), Singley, Geol. Sur. Texas, Fourth An. Rept., p. 328.
1898. *Tagelus gibbus* (Spengler), Dall, Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 59, 60, 61.
1900. *Tagelus gibbus* (Spengler), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 983.
1901. *Tagelus gibbus* (Spengler), Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 475.
1906. *Tagelus gibbus* (Spengler), Clark, Maryland Geol. Sur., Pliocene and Pleistocene, p. 200, pl. 57, figs. 1-4.
1906. *Solecurtus* (*Tagelus*) *gibbus* (Spengler), Böse, Inst. Geol. México, Bol. No. 22, p. 83, pl. 12, fig. 2.
1914. *Tagelus gibbus* (Spengler), Henderson and Bartsch, U. S. Nat. Mus., Proc., vol. 47, No. 2055, p. 413.
1919. *Tagelus gibbus* (Spengler), Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., vol. 71, p. 19.
1920. *Tagelus gibbus* (Spengler), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 126-127.
1924. *Tagelus gibbus* (Spengler), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., list following p. 28.
1927. *Tagelus gibbus* (Spengler), Wood, Nautilus, vol. 41, No. 1, p. 15.
1929. *Tagelus gibbus* (Spengler), Johnson, Nautilus, vol. 42, No. 3, p. 84.
1929. *Tagelus gibbus* (Spengler), Richards, Nautilus, vol. 43, No. 2, p. 64.
1934. *Tagelus gibbus* (Spengler), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 54.
1935. *Tagelus gibbus* (Spengler), Richards, Jour. Paleont., vol. 9, No. 3, p. 257.
1936. *Tagelus gibbus* (Spengler), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1936. *Tagelus gibbus* (Spengler), McLean, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 10, No. 1, p. 42.
1937. *Tagelus gibbus* (Spengler), Smith, East Coast Marine Shells, p. 64, pl. 25, fig. 4.
1938. *Tagelus gibbus* (Spengler), Richards, Geol. Soc. Amer. Bull., vol. 49, p. 1292.
1940. *Tagelus gibbus* (Spengler), Smith, World-wide Sea Shells, p. 116, fig. 1518.
1940. *Tagelus gibbus* (Spengler), Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1942. *Tagellus gibbus* (Spengler), Jaume and Pérez Farfante, Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 16, No. 1, p. 40.
1943. *Tagelus gibbus* (Spengler), Jacobson, Nautilus, vol. 56, No. 4, p. 142.
1944. *Tagelus gibbus* (Spengler), Hackney, Nautilus, vol. 58, No. 2, p. 59.
1946. *Tagelus gibbus* (Spengler), Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Tagelus* (*Tagelus*) *gibbus* (Spengler), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 43.
1951. *Tagelus gibbus* (Spengler), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 103-104, pl. 21, fig. 6.
1952. *Tagelus gibbus* (Spengler), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 184, pl. 12, fig. 9.

1953. *Tagelus* (*Tagelus*) *gibbus* (Spengler), Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1954. *Tagelus plebeius* (Solander), Abbott, American Seashells, p. 440, pl. 30d.
1955. *Tagelus plebeius* (Solander), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 87, pl. 17, fig. 110.
1956. *Tagelus plebeius* (Solander), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 318 (as. *T. gibbus*), 319, 326, 371, pl. 3, figs. 7a, 7b.
1958. *Tagelus caribaeus* (Lamarck), Keen, Sea Shells of Tropical West America, p. 192.
1958. *Tagelus plebeius* (Solander), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1959. *Tagelus plebeius* (Solander), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 43, No. 9, pp. 2119, 2161, 2166, pl. 1, II, figs. 8a, 8b.
1961. *Tagelus plebeius* (Solander), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 47.
1961. *Tagelus plebeius* (Solander), Warmke and Abbott, Caribbean Seashells, p. 203, pl. 42n.

The Recent Higuerote shell referred to this species is moderately large, thin, oblong, and subequilateral. Postumbonal portion of shell a little narrower than the preumbonal by reason of a slight downwarp of the posterodorsal margin behind the beak. Posterior end subangularly rounded, anterior end shallowly rounded; basal margin truncate, sometimes hardly embayed behind the middle, the embayment coinciding with the broad feeble radial depression on the lower half of the valve; anterodorsal margin with a slight slope. Beak low, nearly central. Posterior area delimited by a low obscure radial ridge extending from the umbo to the ventral margin; there is also a faint radial swelling delimiting the anterior submargin from the disk. Hinge with two slender projecting cardinals in each valve. Anterior adductor impression elongated, subtrigonal, and tapering upward, the posterior impression broadly pyriform, both impressions high. Pallial line remote from the ventral margin. Pallial sinus large, extending horizontally a little beyond the median line of the valve, the apex of the sinus rounded. Surface sculptured by irregular concentric growth lines. Periostracum dull brown, puckered by fine irregular concentric wrinkles and rather widely spaced thin irregular radial wrinkles at the base. Color white on the exterior and interior.

Dimensions.—Specimen B492a, right valve, length 51.5 mm.; height 18.7 mm.; thickness 5.2 mm. Specimen B492b, left valve (broken away posteriorly and basally) length 37.7 mm.; thickness 4 mm.

Locality.—On beach, southeast of Higuerote, State of Miranda. Six specimens including five right valves and one left valve.

Remarks.—The Higuerote shell has much the same configuration as the late Miocene to Recent east American *T.* (*Mesopleura*) *divisus* (Spengler), but there is no indication whatsoever of the characteristic internal radial rib of that species. The west American analogue of *T. plebeius* is the Pleistocene to Recent *T. affinis* (C. B. Adams) (see Turner, 1956, Occas. Papers on Mollusks, vol. 2, No. 20, p. 29, pl. 19, figs. 17-18), but according to the original description given by Adams there is one tooth in the left valve and two in the right, whereas on *T. plebeius* there are two teeth in each valve.

Range and distribution.—The chronologic range of *T. plebeius* is late Miocene to Recent. The living shell ranges from Cape Cod, Massachusetts, to Brazil. In the Pleistocene it is recorded from Massachusetts, Maryland, South Carolina, Florida, and Louisiana. In the Pliocene it is reported from North Carolina, South Carolina, Florida, and México. In the upper Miocene it occurs in Virginia.

SOLENIDAE

Solen (Solena) obliquus Spengler Pl. 54, figs. 5, 6

1794. *Solen obliquus* Spengler, Skrivt. Nat. Selsk. Copenhagen, vol. 3, p. 92.
1818. *Solen ambiguus* Lamarck, An. sans Vert., vol. 5, p. 452.
1828. *Solen obliquus* Spengler, Wood, Index Testaceologicus, Supplement, pl. 11, fig. 17.
1864. *Solen obliquus* Spengler, Krebs, The West Indian Marine Shells, p. 112.
1868. *Solena obliquus* (Spengler), Conrad, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 9, p. 27.
1874. *Solen ambiguus* Lamarck, Sowerby, [in] Reeve, Conch. Icon., vol. 19, pl. 5, sp. 21b, c.
1878. *Solena obliqua* Spengler, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 239.
1878. *Solen obliquus* Spengler, Mörch, Catalogue of the West-India Shells, p. 14.
1884. *Solena obliqua* (Spengler), Tryon, Structural and Systematic Conchology, vol. 3, p. 130, pl. 106, fig. 7.
1887. *Solen* (*Hypogella*) *ambiguus* Lamarck, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1110.
1899. *Solen* (*Solena*) *obliquus* Spengler, Dall, U. S. Nat. Mus., Proc., vol. 22, No. 1185, p. 107.
1900. *Solen* (*Solena*) *obliquus,* Spengler, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, pp. 949, 954.
1901. *Solen* (*Solena*) *obliquus* Spengler, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 475.
1917. *Solen* (*Solena*) *obliquus* Spengler, Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 394.
1925. *Solen* (*Solena*) *obliquus* Spengler, Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 267, pl. 18, fig. 12.

1930. *Solen obliquus* Spengler, Stewart, Acad. Nat. Sci. Philadelphia, Spec. Publ. No. 3, p. 290.
1932. *Solen ambiquus* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 4, No. 4, p. 431.
1951. *Solen obliquus* Spengler, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 109, pl. 22, fig. 9.
1958. *Solen* (*Solena*) *obliquus* Spengler, Keen, Sea Shells of Tropical West America, p. 206.
1960. *Solen* (*Solena*) *obliquus* Spengler, Olsson, Panamic-Pacific Pelecypoda, p. 420.
1961. *Solen obliquus* Spengler, Warmke and Abbott, Caribbean Seashells, p. 203, pl. 43i.

Shell solid, elongate-rectangular, the long posterodorsal margin parallel with the ventral margin, the short posterodorsal margin somewhat sloping; anterior end obliquely subtruncate, longer below, rounded at the corner with the base, angulated at the corner with the anterodorsal margin, the posterior end squarely truncated. Beak low, situated one-sixth the length of the shell from the anterior end. Left valve with one cuneate cardinal tooth which is bordered behind by a deep narrow furrow. Anterior muscle scar horizontally disposed, elongate-reniform, placed under the beak, the posterior scar suboval, lying about three-eighths the length of the shell from the posterior end. Pallial line long, subparallel with the ventral margin but slightly descending, joined to the base of the anterior muscle scar by a short vertical line, and joined to the apex of the short pallial sinus which lies below, and does not project beyond the posterior muscle scar. Anterior half of valve sculptured by rude horizontal growth lines which are squared off and continue vertically at the anterior end; extending from the umbo obliquely toward the posterior of the valve are a series of faint tan rays, the lowest of which divides the valve obliquely in two; the horizontal growth lines on the anterior half of the shell abut against the lowest ray, veering therefrom abruptly, nearly vertically, and slightly arcuately to the dorsal margin. Periostracum brown, and wrinkled to conform with the growth lines on the surface of the shell. The color of the two Higuerote specimens is off-white both within and without.

Dimensions.—Specimen B489a, left valve, length 90 mm.; height 23 mm.; thickness 5 mm.

Locality.—Recent on beach southeast of Higuerote, State of Miranda. Two left valves.

Remarks.—The Eastern Pacific analogue of *S. obliquus* is the

Recent *S. rudis* C. B. Adams (see Turner, 1956, p. 83, pl. 19, figs. 1-2) which ranges from Costa Rica to Peru. However, the ratio of height to length is 1 to 4-1/2 on *S. rudis,* 1 to 4 on *S. obliquus;* furthermore, the beak is one-seventh of the length of the valve from the anterior extremity on *S. rudis,* one-sixth on *S. obliquus.*

Range and distribution.—Solen obliquus Spengler is recorded from Miocene to Recent. The living shell is Caribbean in habitat, extending from Cuba and Puerto Rico to northern South America. Internal molds of a form assumed to be this species were collected by me in 1925 from a limestone of Pleistocene or Pliocene age west of Tunkas, in the State of Yucatan, México. In the Pliocene, *S. obliquus* has been found at Matura, Trinidad, and in the Miocene, a fragment of a shell closely resembling the Recent *S. obliquus,* was collected by Maury in the Río Cana at Caimito, Dominican Republic.

Solen species Pl. 54, figs. 7-10

The following description is reconstructed from a number of fragments.

Shell moderately thin but strong, subcylindrical, narrow and much elongated, the length estimated at 4-1/2 to 5 times the height, the valves tapering slightly toward the posterior end. Dorsal margin long and straight, ventral margin shallowly arcuate, posterior end hardly rounded to subtruncate, anterior end not seen. On none of the fragments is the hinge conserved, but it is inferred to be terminal. Posterior muscle scar broadly trigonal, the anterior scar narrow, elongated, slightly arcuate, and more or less parallel with the dorsal margin. Pallial line distant from the base, long, subparallel with the ventral margin but ascending a little from the front to the apex of the pallial sinus which it joins. Pallial sinus short, projecting horizontally, the upper limb of the sinus joined to the posterior muscle scar, the apex not extending beyond the midline of the scar. Another line, representing the dorsal edge of the body of the animal, runs irregularly parallel with the dorsal margin; this line joins the upper anterior angle of the posterior scar, but runs above the anterior muscle scar, possibly joining the latter at its anterior tip. Surface sculptured by fine growth lines, the lines on the anterior half of the valve conforming with the outline of the valve; dividing the

valve obliquely there is a hardly discernible division, descending from front to rear, along which the lines of growth veer abruptly, the upper lines vertically arcuate to the dorsal margin, the lower lines divaricating horizontally.

Dimensions.—Specimen I490a, posterior portion of left valve, length 55 mm.; height 13 mm.; thickness 5.4 mm. Specimen T490a, posterior portion of right valve, length 42 mm.; height 14.3 mm.; thickness 6 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Four fragments. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Two fragments. Upper Mare formation, in stream 250 meters south-southwest of the mouth of Quebrada Las Pailas. Four fragments.

Remarks.—The Cabo Blanco specimens are too fragmentary to be definitively compared. The Pliocene to Recent *S. viridis* Say, among other slight differences, is smaller and thinner. The Recent *S. tehuelcus* d'Orbigny from Brazil and Argentina is also similar, but it too is a more fragile shell, as is the Miocene to Recent *S. rosaceus* Carpenter from west America.

Solecurtus cumingianus (Dunker) Pl. 54, figs. 11, 12

1861. *Macha cumingiana* Dunker, Zool. Soc. London, Proc. for 1861, p. 425.
1868. *Macha Cumingiana* Dunker, Conrad, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 9, p. 24.
1881. *? Tagelus lineatus* Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 370, pl. 47, fig. 71.
1889. *Solecurtus* (*Macha*) *Cumingiana* (Dunker), Dall, U. S. Nat. Mus., Bull. 37, p. 70.
1898. *Mactra multilineata* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 923. pl. 28, fig. 15. (*Mactra* by typographical error).
1900. *Psammosolen Cumingianus* (Dunker), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 5, p. 961; pt. 4, pl. 28, fig. 15 (1898).
1920. *Psammosolen* (*Azor*) *cumingianus* (Dunker), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 127-128.
1934. *Psammosolen cumingianus* (Dunker), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 55.
1936. *Psammosolen* (*Macha*) *cumingianus* (Dunker), Lermond, Check List of Florida Marine Shells, Gulfport, p. 20.
1949. *Solecurtus cumingianus* (Dunker), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 43.
1950. *Solecurtus cumingianus* (Dunker), Hertlein and Strong, Zoologica, vol. 35, pt. 4, No. 19, p. 229.
1952. *Psammosolen cumingianus* (Dunker), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 184.
1953. *Solecurtus cumingianus* (Dunker), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 137.
1954. *Solecurtus cumingianus* (Dunker), Abbott, American Seashells, pp. 444-445.

1956. *Solecurtus cumingianus* (Dunker), Parker, Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 309, 371.
1958. *Solecurtus cumingianus* (Dunker), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1961. *Solecurtus cumingianus* (Dunker), Warmke and Abbott, Caribbean Seashells, p. 203, pl. 43h.

The following description pertains to the right valve.

Shell moderately thin and convex, narrowly oblong, the length about 2-1/2 times the height. Dorsal and ventral margins perfectly parallel, the ends of the valve shallowly rounded. Anterior submargin delimited by a broad radial swelling or ridge, the middle of the disk with a broad but feeble depression near the base. Beak low, situated at the anterior third, slightly opisthogyrate. Hinge of right valve with two cardinals seemingly united above, the anterior cardinal nearly vertical, the posterior one oblique, the socket between them deep and obliquely subelliptical. Anterior adductor impression pear-shaped, the posterior subangularly cylindrical. Pallial line remote from ventral margin, joining the base of the anterior adductor impression. Pallial sinus long, linguiform, extending horizontally forward for about two-thirds the length of the valve from the posterior end, the lower line of the sinus confluent with the pallial line a little behind the middle of the valve, the upper line joining the inner angle of the posterior adductor impression. Surface sculptured predominantly by fine and coarse irregular concentric striae or wrinkles, the striae crossing several disjointed thin radial riblets or wrinkles on the posterior submargin, the riblets descending from below the umbonal region to near the posterior end; similar but obsolescent radial threads are present on the lower half of the anterior submargin; diverging from their apex at the beak are two faint linear impressions which extend to the ventral margin. The posterior half of the right valve is scored by widely spaced, sharp, zigzag to vermicular grooves slanting down from the dorsal side toward the front; under a lens shorter, closer, but less continuous grooves are seen on the anterior half of the valve, slanting down toward the rear. Apparently the pattern of these grooves is variable as on the anterior half of another Cabo Blanco specimen the grooves form a connected series of small chevron-like triangles.

Dimensions.—Specimen I491a, right valve, length 61 mm.; height 24.7 mm.; thickness 8.1 mm.

Localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One right valve. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. One specimen, the posterior half of a right valve. Playa Grande formation (Maiquetía member) at W-26, in Quebrada Las Bruscas approximately 125 meters upstream from its junction with Quebrada Las Pailas. One specimen, the anterior half of a right valve.

Remarks.—Dall listed *S. lineatus* (Gabb) as synonymous with *S. cumingianus* (Dunker), and although the two are alike, the type of *S. lineatus* is a thinner shell than *S. cumingianus*, and there is a more pronounced radial depression across the middle of the valve than on *S. cumingianus*.

Range and distribution.—*Solecurtus cumingianus* (Dunker) is reported as ranging from Pliocene to Recent. The living shell extends from North Carolina, U.S.A., to Brazil. The fossil is recorded from the Pliocene of Florida and Costa Rica.

MACTRIDAE

Mactra (Mactrellona ?) iheringi (Dall) Pl. 55, figs. 1, 2

1897. *Mactrella iheringi* Dall, Nautilus, vol. 10, No. 11, pp. 121-123.
1902. *Mactrella iheringi* Dall, U. S. Nat. Mus., Proc., vol. 24, No. 1264, p. 510, pl. 32, fig. 8.
1915. *Mactrella iheringi* Dall, Nautilus, vol. 29, p. 62.
1917. *Mactra* (*Mactrella*) *iheringi* Dall, Lamy, Jour. Conchyl., vol. 63, p. 265.
1949. *Mactrella iheringi* Dall, Lange de Morrestes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 41.

A single worn and broken left valve is referred to this species. The shell is thin, convex, large, broadly oval, bluntly pointed posteriorly, and with a slight gape in the ventral margin near the posterior end. The pallial sinus is long and sublinguiform, extending horizontally to a little beyond the median line of the valve, the apex of the sinus rounded. The exterior is straw-colored with a band of faded gray around the margin, the gray reflected through to the interior.

Dimensions.—Specimen B554a, left valve, length 52 mm.; thickness 21 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. One left valve, broken away at the umbo.

Remarks.—Dall's original description is as follows:

Shell thin, white, inflated, with small and prominent beaks, externally with fine concentric, and a few irregular, radial lines, and a silky-yellowish epidermis, the beaks median, smooth, with an obsolete posterior keel, the lunular region widely and deeply impressed; hinge of the subgenus, the pallial sinus angular, reaching to the vertical of the beaks. Lon. 65.0; alt. 52.0; diam. 32.0 mm.

Range and distribution.—Recent, northern coast of South America to Brazil.

Mulinia cleryana (d'Orbigny) Pl. 55, figs. 3-6

1846. *Mactra Cleryana* d'Orbigny, Voyage l'Amérique Méridionale, vol. 5, pt. 3, p. 510.
1852. *Mactra guadelupensis* Récluz, Jour. Conchyl., ser. 2, vol. 3, p. 249, pl. 10, figs. 4-4'.
1853. *Mactra guadelupensis* Récluz, Petit, Jour. Conchyl., ser. 2, vol. 4, p. 414.
1856. *Mulinea portoricensis* Shuttleworth, Jour. Conchyl., ser. 2, vol. 5, pp. 174-175.
1856. *Mulinea portoricensis* Shuttleworth, H. & A. Adams, The Genera of Recent Mollusca, vol. 2, p. 380.
1858. *Mactra guadelupensis* Récluz, Beau, Ext. Rev. Coloniale, p. 26.
1864. *Mactra donacaeformis* Krebs (*non* Gray), and *M. guadelupensis* Récluz, Krebs, The West Indian Marine Shells, p. 105.
1864. *Mactra guadeloupensis* Récluz, Krebs, The West Indian Marine Shells, p. 105.
1868. *Mulinea portoricensis* Shuttleworth, Conrad, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 10, p. 31.
1868. *Mactra guadelupensis* Récluz, Conrad. Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 10, p. 32.
1868. *Trigonella Guadelupensis* (Récluz), Conrad, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 10, p. 37.
1873. *Gnathodon guadelupensis* (Récluz), Sowerby, [in] Reeve, Conch. Icon., vol. 19, pl. 1, sp. 2.
1873. *Gnathodon Cantrainei* Récluz (MSS), Sowerby, [in] Reeve, Conch. Icon., vol. 19, pl. 1, sp. 3.
1883. *Gnathodon Cantrainei* Récluz, Gundlach, Soc. Española Hist. Nat., An., vol. 12, pp. 280, 322.
1884. *Mactra portoricensis* (Shuttleworth), Weinkauff, Syst. Conchylien-Cabinet, p. 30, pl. 10, figs. 3-4.
1884. *Mactra guadelupensis* Récluz, Weinkauff, Syst. Conchylien-Cabinet, p. 33, pl. 11, figs. 1-3.
1894. *Mulinia guadelupensis* (Récluz), Dall, U. S. Nat. Mus., Proc., vol. 17, No. 988, pp. 104-105.
1894. *Mulinia guadelupensis* (Récluz), Dall, Nautilus, vol. 8, No. 3, p. 27.
1917. *Mulinia guadelupensis* (Récluz), Lamy, Jour. Conchyl., ser. 4, vol. 17 (63), pp. 341-342.
1946. *Mulinia guadeloupensis* (Récluz), Stewart, Nautilus, vol. 60, No. 1, p. 19.
1949. *Mulinia guadeloupensis* (Récluz), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 40.
1961. *Mulinia portoricensis* Shuttleworth, Warmke and Abbott, Caribbean Seashells, p. 204, pl. 43d.

Shell of medium size and thickness, inflated, subequilaterally triangular in outline, with a narrow but fairly sharp posterior carination bounding the rather wide posterior area, and with a faint anterior angulation bounding the wide lunular area. Dorsal margins sloping about equally, anterior end subangularly rounded, ventral margin shallowly subarcuate to subsinuous except at the rear where it is obliquely subtruncate to hardly embayed, posterior corner slightly attenuated, posterior end short and obtusely angulated. Disk with a faint radial sulcus or depression in front of the posterior carination. Posterior submargin with one or two feeble ridgelets diverging from the umbo, the after ridgelet bounding the large subelliptical escutcheonal area which is twice as wide as the submargin proper. Lunule not defined, the greater lunular area or submargin elliptical, bounded by the faint angulation descending from the umbo. Umbo full, rather sharply divergent. Beaks high, subcentral, acutely downcurved, directed slightly forward at the tip, the dorsal margins projecting beyond them to form a ledge which keeps the beaks well apart when the valves are closed; on the ledge there is a somewhat asymmetrical caret-like area, the tip of the beak bisecting the apex of the caret, the sides of the caret defined by a faint groove on the right valve, the posterior side of the caret on the left valve depressed and bordered by a small elevated ridge. External surface shiny, sculptured by concentric striae and fine wrinkles, exhibiting here and there stronger grooves representing periods of arrested growth, the striae finer, closer, and more regular on the escutcheonal and lunular areas. In addition, the disk is seen under a lens to be marked by numerous short irregular vermicular and divaricating radii which impart a shagreen effect to the surface. Hinge equipped with strong lateral teeth, the grooves of the right valve receiving the elevated teeth of the left. Anterior and posterior cardinal teeth of the right valve laminar, not coalescent above, diverging at a little less than 90 degrees, the anterior cardinal oblique to the dorsal margin, the posterior vertical. Resilium of right valve deeply sunken, pear-shaped, overhung by the dorsal margin. Cardinals of left valve fused into a tentlike process, the posterior arm of the process nearly vertical, the anterior divergent, the process with a small triangular pit below it; there is a thin accessory lamina proximate to, and parallel with the posterior arm, and after that is the

sunken resilium. Interior glossy. Adductor impressions somewhat depressed, the anterior semi-elliptical, the posterior suboval. Pallial line parallel with the margin, the pallial sinus low (about a fourth of the altitude of the valve in from the margin), linguiform, joining the pallial line in an acutely rounded end, the upper line of the sinus horizontal and somewhat sinuous, the apex of the sinus narrowly rounded and projecting to about two-fifths the width of the valve in from the posterior end. Most of the shells are cream and gray-black on the surface, the gray-black occurring as concentric bands on the lower half of the valve and on the sides of the umbonal area; the interior is white, with the darker tone of the exterior reflected through.

Dimensions.—Specimen B545a, right valve, length 23 mm.; height 18.3 mm.; thickness 5.2 mm. Specimen B545b, left valve, length 24.2 mm.; height 21 mm.; thickness 6.9 mm. Largest specimen, a left valve, length 32.1 mm.; height 26.9 mm.; thickness 10.1 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. Forty-one specimens including twenty-four left valves and seventeen right valves.

Remarks.—The Venezuelan shell is identical to the species labeled, in one collection or another as *M. cleryana* (d'Orbigny), *M. guadelupensis* (Récluz), or *M. portoricensis* Shuttleworth. The synonymy presented in this work follows that of Dall and Lamy who combine *M. guadelupensis, M. portoricensis, M. cantrainei* (Récluz), and *M. donacaeformis* Krebs (not Gray). Warmke and Abbott apply the name *M. portoricensis* to the Puerto Rican form, and this does seem to be a little different than the original illustration of *M. guadelupensis* from Guadeloupe Island in the Antilles. Nevertheless, the species is a variable one, and if all the forms mentioned are indeed synonymous, *M. cleryana* has priority, though it was not figured by D'Orbigny. The original description of *M. cleryana* is as follows:

N.° Mactre de Cléry, *Mactra Cleryana,* d'Orb., 1846

M. testâ triangulari, compressâ, tenui, concentricè, substriatâ, albâ, epidermide fuscescente; latere buccali brevi, angulato; latere anali externè, subcarinato. *Dimensions:* Longueur, 28 mill. Par rapport à la longueur: largeur 79/100; épaisseur 53/100; longueur de la région anale, 58/100; angle apical, 98 degrés. *Coquille* triangulaire, assez comprimée, mince, pourvese de quelques stries fines d'accroissement, et d'un épiderme trés-mince, lui-même strié, presque équi-

latérale; le côte anal est plus long, anguleux et pourvu en dehors d'une carène assez prononcée. Le côte buccal est arrondi et étroit.

Elle est propre aux environs de Rio de Janeiro (Brésil), où elle a été recueille par M. Cléry, et nous a été communiquée par M. Petit de la Saussaye.

Range and distribution.—Living, West Indies to Brazil.

Labiosa (Raeta) aff. plicatella (Lamarck) Pl. 55, figs. 7, 8

1818. *Lutraria plicatella* Lamarck, An. sans Vert., vol. 5, p. 470.
1822. *Lutraria canaliculata* Say, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 310.
1828. *Mactra campechensis* Gray, [in] Wood, Supplement to the Index Testaceologicus, fig. 3.
1831. *Lutraria canaliculata* Say, Conrad, American Marine Conchology, p. 46, pl. 10, fig. 1.
1835. *Lutraria plicatella* Lamarck, Deshayes, An. sans Vert., vol. 6, p. 93.
1837. *Lutraria campechensis* Gray, Loudon's Mag. Nat. Hist., new ser., vol. 1, p. 375.
1842. *Lutraria plicatella* Lamarck and *L. canaliculata* Say, Hanley, An Illustrated and Descriptive Catalogue of Bivalve Shells, p. 27.
1843. *Lutraria canaliculata* Say, De Kay, Nat. Hist. New York Zool., Mollusca, p. 232, pl. 31, fig. 298.
1846. *Lavignon papyracea* d'Orbigny, Voyage l'Amérique Méridionale, p. 527. Not of Chemnitz, *fide* Lamy, 1917.
1853. *Raëta campechensis* Gray, An. Mag. Nat. Hist., ser. 2, vol. 11, p. 43.
1854. *Mactra canaliculata* (Say), Reeve, Conch. Icon., vol. 8, *Mactra,* sp. 122.
1856. *Raëta canaliculata* (Say), Chenu, Manuel de Conchyliologie, vol. 2, p. 62, fig. 251.
1860. *Labiosa canaliculata* (Say), Holmes, Post-Pleiocene Fossils of South Carolina, p. 43, pl. 7, fig. 13.
1867. *Raeta canaliculata* (Say), Conrad, Amer. Jour. Conch., vol. 3, pt. 3, No. 10, Supplement, p. 41.
1871. *Raeta canaliculata* (Say), Coues, Acad. Nat. Sci. Philadelphia, Proc., vol. 23, p. 137.
1884. *Labiosa* (*Raeta*) *canaliculata* (Say), Tryon, Structural and Systematic Conchology, vol. 3, p. 161, pl. 110, fig. 25.
1889. *Labiosa canaliculata* (Say), Dall, U. S. Nat. Mus., Bull. 37, p. 64.
1889. *Labiosa canaliculata* (Say), Simpson, Davenport Acad. Nat. Sci., Proc., vol. 5, p. 72.
1892. *Labiosa canaliculata* (Say), Singley, Geol. Sur. Texas, Fourth An. Rept., p. 330.
1894. *Labiosa canaliculata* (Say), Dall, Nautilus, vol. 8, No. 3, p. 28.
1894. *Labiosa* (*Raeta*) *canaliculata* (Say), Dall, Malac. Soc. London, Proc., vol. 1, p. 212.
1895. *Labiosa canaliculata* (Say), Harris, Bull. Amer. Paleont., vol. 1, No. 3, p. 94.
1898. *Labiosa* (*Raëta*) *canaliculata* (Say), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, pp. 882, 907.
1903. *Labiosa canaliculata* (Say), Vanatta, Acad. Nat. Sci. Philadelphia, Proc., vol. 55, p. 757.
1913. *Lutraria plicatella* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 19, p. 347.
1914. *Labiosa* (*Raeta*) *canaliculata* (Say), Henderson and Bartsch, U. S. Nat. Mus., Proc., vol. 47, No. 2055, p. 413.

1917. *Labiosa* (*Raeta*) *plicatella* (Lamarck, Lamy, Jour. Conchyl., vol. 63, pp. 353-354, 363, pl. 7, fig. 6.
1920. *Labiosa* (*Raeta*) *canaliculata* (Say), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 137-138.
1923. *Raeta canaliculata* (Say), Clench, Nautilus, vol. 37, No. 2, p. 54.
1924. *Labiosa canaliculata* (Say), Mansfield, Florida State Geol. Sur., Fifteenth An. Rept., list following p. 28.
1926. *Labiosa* (*Raeta*) *canaliculata* (Say), Weisbord, Nautilus, vol. 39, No. 3, pp. 82, 84.
1931. *Anatina* (*Raëta*) *plicatella* (Lamarck), Grant and Gale, San Diego Soc. Nat. Hist., Mem., vol. 1, pp. 407-408.
1934. *Labiosa* (*Raeta*) *canaliculata* (Say), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 56.
1936. *Labiosa* (*Raeta*) *canaliculata* (Say), Smith, Nautilus, vol. 49, No. 4, p. 135.
1936. *Anatina* (*Raeta*) *canaliculata* (Say), Lermond, Check List of Florida Marine Shells, Gulfport, p. 6.
1937. *Anatina canaliculata* (Say), Smith, East Coast Marine Shells, p. 65, pl. 26, fig. 3.
1938. *Labiosa canaliculata* (Say), Richards, Geol. Soc. Amer., Bull., vol. 49, p. 1292.
1940. *Labiosa* (*Raeta*) *canaliculata* (Say), Stenzel, Nautilus, vol. 54, No. 1, p. 21.
1946. *Anatina* (*Raeta*) *canaliculata* (Say), Jaume, Soc. Malac. "Carlos de La Torre," Rev., vol. 4, No. 3, p. 102.
1949. *Labiosa* (*Raeta*) *plicatella* (Lamarck), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 41.
1950. *Anatina* (*Raëta*) *canaliculata* (Say), Hertlein and Strong, Zoologica, vol. 35, pt. 4, No. 19, p. 236.
1951. *Labiosa* (*Raeta*) *plicatella* (Lamarck), Rogers, The Shell Book, pp. 333 (as *L. canaliculata* Say), 499.
1953. *Raeta canaliculata* (Say), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, p. 143.
1954. *Labiosa plicatella* (Lamarck), Abbott, American Seashells, p. 449, pl. 32q.
1955. *Anatina* (*Raeta*) *plicatella* (Lamarck), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 90, pl. 18, fig. 117.
1961. *Labiosa plicatella* (Lamarck), Moore, Gulf Research Repts., vol. 1, No. 1, pp. 16, 47.
1961. *Raeta plicatella* (Lamarck), Olsson, Panamic-Pacific Pelecypoda, p. 332.

The single specimen, consisting of an attached pair of valves, is broken and worn. The thin valves are plump anteriorly, compressed posterior to the middle. The surface is sculptured by smooth subregular concentric lirae, and the lirae and interspaces are covered by numerous fine vermicular radial threads.

Dimensions.—Specimen Q463a, a broken doublet, height 26 mm.; thickness 18 mm.

Locality.—Playa Grande formation (Maiquetía member) at W-4, Quebrada Las Pailas. One imperfect doublet.

Remarks.—The species cannot be identified with certainty but

it is close to *L. plicatella* (Lamarck) as well as to the Miocene to Recent *L. undulata* (Gould) (see Hertlein and Strong, 1950, Zoologica, vol. 35, pt. 4, No. 19, pp. 235-236; and Olsson, 1961, Panamic-Pacific Pelecypoda, p. 332, pl. 56, figs. 6a, 6b). *L. plicatella* is distinguished from *L. undulata* in having the beak somewhat nearer the posterior end. The Cabo Blanco fossil also superficially resembles the middle Miocene *L. gardnerae* Spieker (1922, Johns Hopkins Univ. Studies in Geol., No. 3, pp. 168-169, pl. 10, fig. 10) from Peru and Colombia, and the form referred to by Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, p. 331, pl. 31, fig. 9) as *Thracia* (*Cyathodonta*) *meridionalis* (Guppy). According to Rutsch (1943, Naturforschenden Gesellschaft Verhandl., vol. 54, p. 126, pl. 6, fig. 4) Maury's *Thracia meridionalis* from the Springvale Miocene of Trinidad is not the same as *Raeta meridionalis* Guppy (Agric. Soc. Trinidad and Tobago, Soc. Paper No. 454, vol. 11, pl. 2, fig. 1) also from the Springvale Miocene of Trinidad but is, rather, the same as *Thracia tristani* Olsson (Bull. Amer. Paleont., vol. 9, No. 39, p. 383, pl. 20, fig. 3) from the middle Miocene of Costa Rica. In the same publication mentioned above, Rutsch (pp. 121-122, pl. 4, fig. 3) refers *Raeta meridionalis* Guppy to *Anatina* (*Raeta*) cf. *undulata* (Gould).

Range and distribution.—The living *L. plicatella* ranges from New Jersey, U.S.A., to Brazil. In the Pleistocene the species has been recorded from Texas, Louisiana, Florida, and South Carolina; in the Pliocene it occurs in Florida; and in the upper Miocene it has been reported from Texas (in the Galveston well) and Florida.

MESODESMATIDAE

Ervilia nitens venezuelana, new subspecies — Pl. 55, figs. 9-14; Pl. 56, figs. 1-8

Shell small, longer than high, inequilateral, triangularly oval, compressed to scarcely inflated, the posterior end produced and slightly narrowed. Ventral margin gently rounded, anterior and posterior ends well rounded, the dorsal margins straightish, the anterodorsal margin a little shorter and descending at a slightly greater angle. Immature specimens are thin and translucent, adults relatively thin. Beak in front of the middle, full and projecting

above the hinge on young specimens, subacute and appressed on mature specimens. Surface marked by delicate concentric lineations or fine subregular concentric fillets, crossed, on a number of examples, by numerous microscopic radii. On the holotype and several other specimens, the radial striae are more pronounced on the hinder part of the valve and ephemeral on the rest of the valve; on some specimens the radii are ephemeral throughout, and on others they cannot be seen at all. Interior glossy. On the right valve, the broad triangular chondrophore is bordered anteriorly by a strong protruberant cuneate cardinal tooth and posteriorly by a lower and smaller tooth; the lateral grooves of the right valve are delicate, the posterior the longer. The lunule of the right valve is rudimentary and linear, the escutcheon short and vestigial, the dorsal margin immediately aft of the escutcheon thin and slightly convex upward. On the left valve, the lunule is slightly depressed and wider than on the right valve; the escutcheon is flattish and hardly developed; the chondrophore is triangular with the base slightly convex upward; in front of the chondrophore there is a deeper, narrowly triangular socket which receives the right anterior cardinal tooth of the right valve, the posterior edge of the socket developed as a sharp laminar ridge. The laterals of the left valve are absent or vestigial, the inner edge of the dorsal margins fitting into the grooves of the right valve. Muscle scars faint, the anterior irregularly pear-shaped, the posterior semicylindrical. Pallial sinus "U"-shaped, bluntly rounded in front, embayed more or less parallel with the long axis of the valve and extending forward to near the median vertical of the interior; the margin of the sinus obliquely truncates the pallial line posterior to the middle, the sinus margin continuing some distance below the cut-off of the pallial line.

Dimensions.—Holotype (J449a), right valve, height 5.3 mm.; length 7.3 mm.; thickness 1.3 mm. Paratype (J449b), left valve, height 5.6 mm.; length 9 mm.; thickness 1.3 mm. Paratype (G449a), right valve, height 5.3 mm.; length 7.8 mm.; approx. thickness 1.2 mm. Paratype (G449b), young left valve, height 2.8 mm.; length 4.1 mm.; thickness 0.9 mm. Paratype (I449a), right valve, height 4.4 mm.; length 6.7 mm.; thickness 1 mm. Paratype (T449a), juvenile right valve, height 2.5 mm.; length 3.8 mm.;

thickness 0.9 mm. Paratype (T453a), juvenile left valve, height 2.2 mm.; length 3.3 mm.; thickness 0.8 mm.

Type locality.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Fifteen specimens including six right valves and nine left valves.

Other localities.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Twenty-one specimens including fourteen right valves and seven left valves. Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Four specimens including three right valves and one left valve. Upper Mare formation, in stream 250 meters south-southeast of mouth of Quebrada Las Pailas. Eighteen specimens including ten right valves and eight left valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. Twenty-nine specimens including fifteen left valves and fourteen right valves.

Comparisons.—The new subspecies differs from *E. nitens nitens* (Montagu) (See Maxwell Smith, 1937, East Coast Marine Shells, p. 66, pl. 26, figs. 10a, 10b) in being more compressed and a little more elongate. It differs from *E. subcancellata* E. A. Smith (1885, Voyage of H.M.S. Challenger, Zoology, vol. 13, pp. 80-81, pl. 6, figs. 2-2b) in lacking the thickening, which, rising beneath the umbo, descends to the inner side of the anterior muscle scar. Both *E. nitens s. s.* and *E. subcancellata* are Recent Western Atlantic species.

Ervilia antilleana, new species Pl. 56, figs. 9-12

Shell small, solid, compressed, suboval, inequilateral, the posterior end produced and slightly narrowed. Ventral margin shallowly rounded, the anterior and posterior ends well rounded, the anterodorsal margin straight, the posterodorsal margin hardly convex on young specimens, straight to hardly concave on adults. Beak in front of the middle, the apex full and projecting a little above the hinge. Surface marked by fine concentric lineations or fillets, crossed on a few examples by closely spaced microscopic radial striae on the posterior part of the valve. Interior typically with three low broad diverging ridges originating beneath the hinge, one of the ridges descending to the inner side of the anterior muscles scar, another to

the inner side of the posterior muscle scar, and the third descending obliquely rearward to near the top of the pallial sinus. On a number of specimens, however, the interior ridges are absolescent. Right valve with a triangular chondrophore, the anterior cardinal tooth strong, cuneate, and protruberant, the posterior cardinal lower and smaller. Lateral grooves of the right valve rather well developed, the hinder a little stronger and longer. On the left valve, the chondrophore is triangular, with a deeper and narrower triangular socket in front of it, and the lateral grooves are rudimentary. The muscle scars are somewhat depressed, the anterior pear-shaped, the posterior semicylindrical. The pallial sinus is "U"-shaped, well rounded in front, embayed more or less parallel with the long axis of the valve, and extending forward to not quite the median vertical; the margin of the sinus obliquely truncates the pallial line aft of the middle, the margin continuing some distance below the cut-off of the pallial line.

Dimensions.—Holotype (G450a), right valve, height 2.3 mm.; length 3.4 mm.; approx. thickness 0.8 mm. Paratype (G450b), left valve, height 1.5 mm.; length 2.2 mm.; approx. thickness 0.7 mm.

Type locality.—Upper Mare formation at W-14, on hillside above west bank of Quebrada Mare Abajo. Eight specimens including seven right valves and one left valve.

Other localities.—Upper Mare formation, in stream 250 meters south-southwest of mouth of Quebrada Las Pailas. Eight specimens including seven right valves and one left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Four specimens including two right valves and two left valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Four right valves. Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One right valve.

Comparisons.—This species occurs with the preceding *E. nitens venezuelana,* and there are occasional specimens which are difficult to distinguish from that. Generally, however, *E. antilleana,* n. sp. may be discriminated from *E. n. venezuelana* by its flatter, sturdier, and whiter shell, by the somewhat stronger development of the lateral grooves, and by the broad radial internal ridges arising beneath the hinge. The new species is also close to the Recent *E. subcancellata* E. A. Smith (1885, Voyage of H.M.S. Challenger, Zoology,

vol. 13, 80-81, pl. 6, figs. 2-2b), but the valves are more compressed. The Pliocene to Recent *E. concentrica* (Gould) (see McLean, 1951, p. 112, pl. 23, fig. 3) is more inflated, has a more concave posterodorsal margin, and is more trigonal in outline than *E. antilleana,* n. sp. *E. valhosierr* Gardner (1928, U.S. Geol. Surv., Prof Paper 142-E, pp. 225-226, pl. 34, figs. 6-9) from the middle Miocene Chipola formation of Florida is a more triangular shell with a lower and more appressed beak.

Ervilia caribbeana, new species Pl. 56, figs. 13, 14

Shell small, subequilateral, moderately inflated, trigonal in outline, the anterodorsal margin hardly convex, the posterodorsal margin straight and a little longer, the slope of the dorsal margins about equal, the ends of the valve well rounded, the basal margin gently arcuate. Beak small, smooth, full, opisthogyrate, situated slightly forward of the middle. Below the prodissoconch the surface is sculptured by fine raised subregular concentric lirae separated by wider interspaces, the interspaces, especially those on the posterior end and toward the base, but to some extent those on the forward end as well, marked by numerous microscopic threads. Left valve with a broadly triangular rather shallow chondrophore; in front of the chondrophore is a deep narrowly triangular socket, the tooth between the chondrophore and socket rather thin, sharp, and elevated. Nymph more or less triangular, somewhat pointed at the middle of the inner edge, bounded by a moderately pronounced groove. The lateral grooves of the left valve are scarcely perceptible and virtually obsolete. Neither the pallial sinus nor the muscle scars are discernible but there is a low ridge descending from beneath the hinge along the inner margin of the anterior muscle scar; in certain light a faint thickening is also observed descending from beneath the middle of hinge, and there is yet another feebler swelling near the inner margin of the left posterior scar.

Dimensions.—Holotype (S459), young left valve, height 1.8 mm.; length 2.6 mm.; approx. thickness 0.8 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-23, north flank of Punta Gorda anticline. One left valve, the holotype.

Comparisons.—This form is close to the Recent Western Atlantic *E. subcancellata* Smith (1885, Voyage of H.M.S. Challenger, Zoology, vol. 13, pp. 80-81, pl. 6, figs. 2-2b) and to the middle Miocene *E. gabbi* Woodring (1925, Carnegie Inst. Washington, Publ. No. 366, p. 185, pl. 25, figs. 17-18) from Jamaica. It is more trigonal, and the ends more acutely rounded than on *S. subcancellata,* and is less inflated and slightly less attenuate posteriorly than *E. gabbi.* From *E. nitens venezuelana,* n. subsp. and *E. antilleana,* n. sp. the present form is distinguished by its sharper concentric lirae.

Ervilia mareana, new species — Pl. 56, figs. 15, 16; Pl. 57, figs. 1, 2

Shell small, subequilateral, suboval, broadly and gently rostrate behind, moderately inflated. Anterodorsal margin straightish to hardly convex, anterior end blunt above, basal margin evenly arcuate, posterior end obliquely subtruncate, posterodorsal margin straight. Prodissoconch plump and smooth, the beak subcentral, projecting slightly above the hinge. Sculpture consisting of flattish subregular concentric ribs separated by slightly narrower interspaces, and of radial striae which are scarcely visible on the posterior end and obscure elsewhere. Hinge of right valve rather strong, the anterior cardinal tooth obliquely bifid, and well developed, the inner prong the stouter; chondrophore triangular, the tooth along the posterior margin smaller than the prong along the anterior margin. Nymph small, more or less diamond shaped. Lateral grooves of right valve delicate, the posterior slightly the larger. Interior glossy. Right anterior muscle scar narrowly pear-shaped, bordered along the inner margin by a faint narrow ridge extending to the under side of the hinge. Right posterior muscle scar and pallial sinus not visible.

Dimensions.—Holotype (I452a), right valve, length 2.85 mm.; height 2.1 mm.; approx. thickness 1.1 mm. Paratype (J452a), right valve, length 3.8 mm.; height 2.7 mm.; approx. thickness 1.1 mm.

Type locality.—Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. Three right valves.

Other localities.—Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. Two right valves including the paratype which is damaged at margin behind the beak.

Comparisons.—*E. mareana*, n. sp. is fuller at the umbo than *E. nitens* (Montagu), and is more equilateral than the Pliocene to Recent *E. concentrica* Gould. *E. mareana*, n. sp. is suboval in outline whereas *E. rostratula* Rehder and *E. subcancellata* E. A. Smith are subtrigonal. Compared with the other species of *Ervilia* described from the Cabo Blanco area, *E. mareana* is more equilateral than *E. nitens venezuelana*, n. subsp., is more inflated and thinner than *E. antilleana*, n. sp., and is more broadly ribbed than *E. caribbeana*, n. sp. *E. mareana* is less attenuate posteriorly than the middle Miocene *E. gabbi* Woodring, and the dorsal margins are less steeply descending than on the Jamaican form.

CORBULIDAE

Corbula (Juliacorbula) aequivalvis Philippi Pl. 57, figs. 3-6

1836. *Corbula aequivalvis* Philippi, Archiv f. Naturgeschichte, vol. 2, p. 227, pl. 7, fig. 4.
1842. *Corbula cubaniana* d'Orbigny, [in] La Sagra, Hist., phys., polit., et nat. l'Ile de Cuba, Atlas, pl. 26, figs. 51-54; text, vol. 5, p. 322, 1845; vol. 2, p. 283, 1853.
1852. *Corbula Knoxiana* C. B. Adams, Contrib. to Conchology, No. 12, pp. 238-239.
1864. *Corbula cubaniana* d'Orbigny, Krebs, The West Indian Marine Shells, p. 109.
1864. *Corbula Knoxiana* C. B. Adams, Krebs, The West Indian Marine Shells, p. 110.
1867. *Corbula cubaniana* d'Orbigny, Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 161.
1869. *Corbula equivalvis* Philippi, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 13, p. 64.
1869. *Corbula Knoxiana* C. B. Adams, Tryon, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 13, p. 65.
1878. *Corbula cubaneana* d'Orbigny, Mörch, Catalogue of West-India Shells, p. 15.
1878. *Corbula aequivalvis* Philippi, Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 252.
1886. *Corbula cubaniana* d'Orbigny, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 313, pl. 1, figs. 3-3c.
1889. *Corbula cubaniana* Orbigny, Dall, U. S. Nat. Mus., Bull. 37, p. 70, pl. 1, figs. 3-3c.
1901. *Corbula aequivalvis* Philippi, Dall and Simpson, U. S. Fish Com., Bull., vol. 20 for 1900, pt. 1, p. 473.
1913. *Corbula aequivalvis* Philippi, Brown and Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 497.
1921. *Corbula knoxiana* C. B. Adams, Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 427.

1925. *Corbula cubaniana* d'Orbigny, Maury, Bull. Amer. Paleont., vol. 10, No. 42, pp. 255-256, pl. 20, figs. 2-4.
1932. *Corbula* (*Tenuicorbula*) *aequivalvis* Philippi, Olsson, Bull. Amer. Paleont., vol. 19, No. 68, p. 142.
1934. *Corbula cubaniana* Orbigny, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 57.
1938. *Corbula cubaniana* d'Orbigny, Perry, Schwengel, and Dranga, Nautilus, vol. 52, No. 1, p. 28.
1941. *Corbula aequivalvis* Philippi, Lamy, Jour. Conchyl., vol. 84, No. 2, p. 129.
1943. *Corbula cubaniana* d'Orbigny, Gardner, U. S. Geol. Sur., Prof. Paper 199-A, p. 141.
1943. *Corbula* (*Tenuicorbula*) *aequivalvis* Philippi, Rutsch, Naturforschenden Gesell. Basel, Verhandl., vol. 54, p. 125.
1949. *Aloidis* (*Caryocorbula*) *cubaniana* (Orbigny), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 47.
1950. *Corbula Knoxiana* C. B. Adams, Clench and Turner Occas. Papers on Mollusks, pp. 299-300, pl. 47, figs. 11-12.
1951. *Corbula aequivalvis* Philippi, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, pp. 114-115, pl. 23, fig. 7.
1953. *Corbula* (*Caryocorbula*) *cubaniana* Orbigny, Haas, Fieldiana-Zoology, vol. 34, No. 20, p. 203.
1953. *Juliacorbula cubaniana* (d'Orbigny), Olsson and Harbison, Acad. Nat. Sci. Philadelphia, Mon. No. 8, pp. 148, 149.
1955. *Corbula cubaniana* d'Orbigny, Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 91, pl. 44, fig. 310.
1958. *Corbula aequivalvis* Philippi and *Juliacorbula knoxiana* C. B. Adams, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1961. *Corbula aequivalvis* Philippi, Warmke and Abbott, Caribbean Seashells, p. 207, text fig. 31g.

The fossils referred to this species are small, subtrapezoidal, inequilateral, inflated, subequivalve. Although there are no paired valves in the collection, it is inferred that the right valve is slightly overlapping as there is a groove developed parallel with, and proximate to the margins except on the posterior end where it is absent. This groove engages the rim of the left valve. Anterodorsal margin nearly straight, anterior end well rounded, ventral margin hardly arcuate to subtruncate, posterior end nearly vertical truncated, posterodorsal margin slightly convex. Rostral keel acute, extending from the beak to the base. Area behind rostrum somewhat concave, set at an angle of 90 degrees or more from the disk. Posterior area with a gentle, arcuate upfold or angulation diverging from the keel at the beak, extending to and broadening toward the base where it is placed about a third of the width of the posterior slope in from the keel. On the posterior area bordering the escutcheon there is a narrow crenated ridglet. A gentle radial

depression is present on the disk from the umbo to the middle of the basal margin. Beak low, flattened on top, prosogyrate, subcentral. Lunule suggested but not defined by the obsolescence of the ribs continuing thereon from the disk. Escutcheon sublanceolate, perhaps a little larger on the left valve, defined by a narrow ridglet, marked by faint continuations of the ribs from the posterior area. External sculpture consisting of 38 or so strong, more or less equal concentric ribs continuing from near the anterior margin over the disk and posterior area to the edge of the escutcheon. The ribs are prominent but smaller, subregular, and more closely spaced on the posterior area; on the upper half of the valve the ribs are flexuous where they cross the rostral keel, but on the lower half the ribs run straight across the keel. On the disk there are a few faint microscopic secondaries between the main ribs, and on the best preserved specimens there are numerous surficial microscopic radial striae on the posterior area, such striae appearing also on the disk where the surface is worn to expose the under layer of shell. Hinge tooth of right valve strong, cuneate, flattened in front, upturned and curved in toward the beak at the apex, the apex elevated a little above the beak. Behind that tooth the resilial pit is large and deep. Hinge of left valve with an upcurved laminar tooth, in front of which, and directly below the beak, is an obtusely triangular socket. Adductor impressions distinct, the anterior one arcuate and narrowly lenticular, the posterior one subpyriform, lying on the posterior slope a short distance in from the interior groove, the groove representing the internal correlative of the rostral keel. Pallial line regular, joining the base of both adductors at the inner side, the line occasionally bowed up slightly at the middle.

Dimensions.—Specimen C535a, right valve, length 12.3 mm.; height 8 mm.; thickness 3.6 mm. Specimen C535b, left valve, length 10.2 mm.; height 7 mm.; thickness 2.8 mm.

Locality.—La Salina, west of Puerto Cabello, State of Carabobo. Twenty-eight specimens including sixteen right valves and twelve left valves.

Remarks.—The fossils from La Salina are identical to the Recent *C. knoxiana* C. B. Adams from Jamaica, and that, as well as *C. cubaniana* d'Orbigny, is considered the same as the earlier-named *C. aequivalvis* Philippi.

Range and distribution.—Recent, from Florida to Brazil. Pleistocene in the Panama Canal Zone. Pliocene, at Matura, Trinidad. Antecedents are *C. aequivalvis stainforthi* Rutsch (1943, pp. 124-125, pl. 3, figs. 8-9) from the upper Miocene of Trinidad, and *C. knoxiana fossilis* Pilsbry (1921, p. 427, pl. 46, fig. 14) from the middle Miocene of the Dominican Republic.

Corbula (Caryocorbula) cf. **lavalleana** d'Orbigny Pl. 57, figs. 7-14

1842. *Corbula Lavaleana* d'Orbigny [in] La Sagra, Hist. phys., polit., et nat. l'Ile de Cuba, Atlas, pl. 27, figs. 9-12.
1845. *Corbula Lavalleana* d'Orbigny, [in] La Sagra, Hist. Fís., Polít. y Nat. Isla de Cuba, vol. 5, Moluscos, p. 323.
1853. *Corbula Lavalleana* d'Orbigny, [in] La Sagra, Hist. phys., polit. et nat. l'Ile de Cuba, vol. 2, p. 284.
1864. *Corbula Lavalleana* d'Orbigny, Krebs, The West Indian Marine Shells, p. 110.
1867. *Corbula Lavalleana* d'Orbigny, Schramm, Cat. Coq. Guadeloupe, p. 18.
1873. *?Corbula Lavaleana* d'Orbigny, Gabb, Amer. Philos. Soc., Trans., new ser., vol. 15, p. 253.
1881. *Corbula Lavaleana* d'Orbigny, Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, pp. 343, 371.
1898. *Corbula Lavalleana* Orbigny, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 849.
1917. *Corbula Lavaleana* d'Orbigny, Maury, Bull. Amer. Paleont., vol. 5, No. 29, p. 396.
1941. *Corbula* (*Cuneocorbula*) *Lavalleana* d'Orbigny, Lamy, Jour. Conchyl., vol. 84, p. 231.
1951. *?Corbula lavalleana* d'Orbigny, McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 115.

Shell small, fairly solid, inflated, ovate-subtrigonal in outline, rostrate behind, inequilateral, subequivalve. The base of the right valve is somewhat incurved, and this, together with the gutter near the margin of the right valve, suggests that it incloses or overlaps the left valve at its rim. Anterodorsal margin straight, anterior end symmetrically rounded, ventral margin subtruncate to shallowly arcuate (the arcuate form embayed slightly in front of the posterior ridge), posterior end produced and obtusely pointed, posterodorsal margin hardly sinuous. Central area of disk evenly inflated, but before the posterior ridge there may be a slight radial depression. Posterior ridge angulate to subangulate, the posterior area a little concave, sloping more steeply near the beak than at the base. Beak moderately low, appressed on top, subcentral, prosogyrate. Lunule not defined. Escutcheon on right valve narrow and

bordered by a faint ridge. Sculpture consisting of irregular obsolescent concentric folds on the umbonal area, these developing into stronger subregular and subsinuous lirae or riblets below, a few of the lirae on the disk discontinuous, the continuous ones extending from the anterior margin to the faint ridge bordering the escutcheon; on the posterior area the lirae are a little sharper and closer together. On a number of specimens and especially where the surface is worn, there are fine subequally and rather widely spaced radial filaments on the disk, the filaments crowded on the posterior slope. Hinge of right valve with a strong cuneate upturned tooth, rounded in front, incurved at the apex which rises a little above the beak; behind the tooth there is a large deep subtrigonal pit. Hinge of left valve with an upturned platy cardinal, in front of which is a triangular socket. Body cavity deep, its posterior margin, particularly on the right valve, warped and thickened. Adductor scars distinct, situated on the marginal platforms of the interior, the anterior scar reniform, the posterior suboval. Pallial line distinct, running closer to the margin posteriorly than anteriorly, joining the base of the adductor scars at their inner side, the line forming an abrupt angle of more than 90 degrees where it turns before joining the posterior scar. The gutter along which the valves are closed is nearer and parallel with the margin anteriorly, a little farther from the margin and subparallel with it behind the middle.

Dimensions.—Specimen C536a, right valve, length 9.8 mm.; height 7 mm.; thickness 4 mm. Specimen C536b, left valve, length 10.2 mm.; height 6.1 mm.; thickness 3.9 mm.

A few young shells, tentatively referred to this species, were collected in the Cabo Blanco area, and the measurements of the ones illustrated are as follows: Specimen T536a, right valve, length 5.5 mm.; height 3.8 mm.; thickness 1.7 mm. Specimen J536a, left valve, length 5.8 mm.; height 3.8 mm.; thickness 1.7 mm. Specimen I537a, left valve, length 5.9 mm.; height 3.8 mm.; thickness 1.9 mm.

Localities.—La Salina, west of Puerto Cabello, State of Carabobo. Seventeen specimens including fourteen right valves and three left valves.

The Cabo Blanco localities of the young specimens referred to above are as follows: upper Mare formation, in stream 250 meters west-southwest of the mouth of Quebrada Las Pailas. Two right

valves. Lower Mare formation, in small stream 100 meters west of Quebrada Mare Abajo. One left valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One left valve.

Remarks.—Except perhaps for the somewhat more widely spaced radial filaments than are shown on D'Orbigny's illustration of *C. lavalleana,* the La Salina fossils from Venezuela seem to be identical with D'Orbigny's Recent shell from Cuba. Also, the La Salina fossils cannot be distinguished from the Recent shells labeled *C. lavalleana* in the Museum of Comparative Zoology, No. 183924, from Haiti. D'Orbigny stated that his *C. lavalleana* could be differentiated from his *C. caribaea* by the occurrence on the former of radial striae, but as such striae are seen on some examples and not on others of the same species, it may be, as suggested by McLean, that *C. lavalleana* is a radially striate variation of the prior-named *C. caribaea.* McLean suggested that *C. swiftiana* C. B. Adams may also be a synonym of *C. caribaea,* and I would add that *C. kjoeriana* C. B. Adams (see Dall, 1886, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 316, pl. 1, figs. 6-6b; and Clench and Turner, 1950, Occas. Papers on Mollusks, vol. 1, No. 15, pp. 298-299, pl. 47, figs. 1-2) is likewise hardly distinguishable from the *C. caribaea-lavalleana* complex. *C. daphnis* Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, p. 256, pl. 20, fig. 10) from the Matura Pliocene of Trinidad is yet another closely allied species, though according to Maury the radial sculpture of *C. daphnis* is absent.

Corbula cf. *lavalleana* from La Salina also resembles the following species:

C. contracta Say (1822, Acad. Nat. Sci. Philadelphia, Jour., ser. 1, vol. 2, p. 312). Pliocene to Recent. Typically, the basal margin of *C. contracta* is contracted near the middle; this contraction is not present on *C.* cf. *lavalleana.*

C. cala Gardner (1936, State of Florida Dept. Conserv., Geol. Bull. No. 14, pp. 46-47, pl. 8, figs. 8-12). Middle Miocene Shoal River formation, Florida. This is differentiated from the Venezuelan examples of *C.* cf. *lavalleana* by the acute angle of the pallial line where it turns to join the posterior muscle scar.

C. dominicensis Gabb (see Pilsbry, 1921, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 427, pl. 46, figs. 12-13). Middle Miocene

of the Dominican Republic. According to Gabb, *C. dominicensis* is a thin shell whereas the adults of *C.* cf. *lavalleana* from La Salina are robust. According to Pilsbry the number of ribs on the posterior half of the disk is nearly doubled by splitting. This does not occur on the Venezuelan specimens.

C. urumacoensis F. Hodson (1931, Bull. Amer. Paleont., vol. 16, No. 59, pp. 25-26, pl. 12, figs. 1-7). Upper-middle Miocene, State of Falcon, Venezuela. The concentric sculpture is much finer than on the La Salina fossils.

C. democraciana F. Hodson (1931, Bull. Amer. Paleont., vol. 16, No. 59, pp. 26-27, pl. 11, figs. 1-6). Upper-middle Miocene, State of Falcon, Venezuela. On the posterior slope of the left valve there is a small keel bordering a rather well-defined and moderately large escutcheon. The escutcheon of the adult La Salina shell is ill defined, and the concentric ribs on the disk are smaller than on *C. democraciana.*

Range and distribution.—Corbula lavalleana d'Orbigny is a Recent Caribbean species. The Recent *C. caribaea* d'Orbigny is reported from Florida to Brazil. The fossil *C. caribaea* is known from the Pliocene of Trinidad and from the Pliocene near Cumaná, Venezuela (U. S. National Museum Collection No. 18408).

Corbula (Notocorbula) bruscasensis, new species Pl. 46, figs. 5, 6

The following description pertains to the left valve.

Shell small, the valves unequal, the left valve inferred to be inclosed by, and snugged into the larger and more tumid right valve. Left valve fairly thin, moderately inflated, subtrigonal in outline, subequilateral, with a vague subrounded posterior ridge. Dorsal margins sloping nearly equally, the anterodorsal margin hardly convex, the posterodorsal margin straight; anterior end rounded, posterior end somewhat obliquely subtruncate, the ventral margin horizontally truncated behind the middle, arcuate as it meets the anterior end. Beak low, subcentral, prosogyrate. Lunule and escutcheon not defined. Surface sculptured by narrow subregular concentric lirae and a few microscopic concentric striae in the interspaces, the lirae strongest at the middle of the valve. Under certain light the surface also seems to be traversed by occasional obsolescent radial

filaments which do not reach the umbo, but the disposition of the radials cannot be determined. Hinge with an upturned laminar chondrophore, in front of which, directly under the beak, is a subtriangular socket. Adductor scars faint, the anterior one obtusely subquadrate, the posterior obtusely subtriangular. Pallial line remote from the margin, running from the inner angle at the base of the anterior adductor scar, subparallel with the ventral margin to below the posterior adductor scar where, on its shallowly sigmoidal course to join the inner angle of the scar, it is embayed to form a short subrounded sinus.

Dimensions.—Holotype (R667a), left valve, length 3 mm.; height 2.5 mm.

Type locality.—Playa Grande formation (Maiquetía member) at W-26, Quebrada Las Bruscas approximately 125 meters upstream from its junction with Quebrada Las Pailas. One young left valve, the holotype.

Comparisons.—This species is close to the following:

C. krebsiana C. B. Adams (see Dall, 1886, Mus. Comp. Zool. Bull., vol. 12, No. 6, pp. 314-315, pl. 1, figs. 4-4b). Recent, Florida to the Caribbean at depths of 3 to 85 fathoms. The concentric markings are less prominent and more numerous than the lirae on *C. bruscasensis,* n. sp.

C. disparilis d'Orbigny (1842, [in] La Sagra, Hist. phys., polit., et nat. l'Ile de Cuba, Atlas, pl. 27, figs. 1-4; text, vol. 2, p. 283, 1853. Spanish ed., vol. 5, Moluscos, p. 322, 1845). Authors consider *C. operculata* Philippi (1848, Zeitschr. f. Malakozool., yr. 5, p. 13) and *C. philippii* Smith (1885, Voyage of H.M.S. Challenger, Zoology, vol. 13, pp. 33-34, pl. 7, figs. 4-4b) to be synonymous. Pliocene to Recent, the Recent shell occurring at depths of 5 to 805 fathoms from North Carolina to northern South America. This is a sturdier and more strongly sculptured shell than *C. bruscasensis,* with a more sharply truncated posterior end on the left valve, and with a less sigmoidal pallial sinus than on the Venezuelan fossil.

C. caloosae Dall (1898, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 853, pl. 36, fig. 16). Pliocene, Florida. The left valve is smoother, or with finer concentric growth lines than on *C. bruscasensis,* and the posterior ridge is sharper than on *C. bruscasensis.*

C. zuliana F. Hodson (1931, Bull. Amer. Paleont., vol. 16, No.

59, pp. 22-23, pl. 10, figs. 1-3, 5). Upper Oligocene-lower Miocene, District of Miranda, State of Zulia, Venezuela. The posterior end of the left valve is more definitely truncated than on *C. bruscasensis*, but otherwise the left valves of both species are much alike.

Corbula (Notocorbula) puntagordensis, new species Pl. 57, figs. 15, 16

The following description is based on a single specimen which is a young left valve.

Left valve small, well inflated, solid, subequilateral, subquadrate in outline. Anterior submargin compressed, posterior slope moderately steep and slightly concave, the umbonal or posterior ridge broad and rounded. Anterodorsal margin with a slope of about 20 degrees, the posterodorsal margin with a slope of about 40 degrees, the latter somewhat the longer. Anterior end rounded, ventral margin shallowly arcuate, posterior end nearly vertically truncate. Umbo full and broad, the beak moderately high, a little forward of the middle, prosogyrate. The surface is sculptured by microscopic concentric growth wrinkles, the disk also marked by eight or nine irregularly spaced threadlike radial riblets, the riblets a little closer on the anterior half than on the posterior, all of them originating below the beak and extending to the basal margin. Hinge with a thick, somewhat projecting, and slightly upturned chondrophore which seems to be vaguely sulcate on top, and in front of the chondrophore is a triangular socket immediately under the beak. Adductor scars faint, the anterior subovate and slightly arcuate, the posterior seeming to be broadly and angulately oval. Pallial line regular, a little removed from, and parallel with the ventral margin, developing into a small sinus with a rounded apex before joining the posterior adductor scar. It is inferred that the left valve is inclosed by, and snugged into the right valve, of which there are no examples in the collection.

Dimensions.—Holotype (H551a), left valve, length 2.9 mm.; height 2.6 mm.; thickness 1.3 mm.

Type locality.—Mare formation at W-25, south flank of Punta Gorda anticline. One young left valve, the holotype.

Comparisons.—This species is similar to the form known variously as *C. disparilis* d'Orbigny, *C. operculata* Philippi, and *C.*

philippii Smith, but comparing the Punta Gorda fossil with Recent specimens of *C. disparilis* from Cuba and from off the east coast of Florida, it is seen that the left valve of *C. disparilis* is slightly less obese and somewhat more elongate, that it has a wider and shallower pallial sinus, that its anterodorsal margin is a little concave, and that often there are as many as 11 radial riblets (although the type of *C. philippii* from off Bermuda has 8). Left valves of *C. vieta* Guppy, described by Guppy (1886, Geol. Soc. London Quart. Jour., vol. 22, pp. 582-583, pl. 26, fig. 6) as *Erycina tensa,* from the lower Miocene Manzanilla formation of Trinidad are more compressed than *C. puntagordensis,* n. sp., bear a few more radiating riblets, and have a more pointed umbo. The left valve of *C. heterogena* Dall (see Woodring, 1925, Carnegie Inst. Washington, Publ. No. 366, pp. 187-188, pl. 26, figs. 3-4) from the middle Miocene of Jamaica and the Panamá Canal Zone has a more laminar and more recurved chondrophore than *C. puntagordensis,* and the radial riblets are more numerous. The left valve of *C. isla-trinitatis* Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, pp. 253-254, pl. 19, figs. 10) from the upper Miocene Springvale formation of Trinidad has a sharper umbonal ridge, fewer radial riblets, and a narrower umbonal area than *C. puntagordensis.* The present form differs from *C. bruscasensis,* n. sp. in having a thicker shell, stronger hinge, simpler pallial sinus, less pronounced concentric lirae, and a subobblong rather than subtrigonal outline.

Remarks.—Authors differ in the identification, priority, and synonymy of the Recent Western Atlantic species known variously as *Corbula* (*Varicorbula*) *disparilis* d'Orbigny, *C. operculata* Philippi, and *C. philippii* Smith. *C. disparilis* was first named and illustrated by D'Orbigny in 1842 in the Atlas of La Sagra's "Histoire physique, politique et naturelle de l'Ile de Cuba" on plate 27, figures 1-4. It was later described in the Spanish edition of the text on page 322, 1845, and in the French edition of the text in volume 2, p. 283, 1853. As pointed out by Olsson and Harbison (1953, p. 148), "Recent Florida shells commonly identified as *C. disparilis* d'Orbigny, do not agree well with the original description and figures of that species, which indicate a form with nearly equal valves and high prominent umbones and beaks," and it is true that the original figures do not indicate the highly discrepant valves of a notocorbulid. In 1848,

Philippi (Zeitschr. f. Malakozool., yr. 5, p. 13) described, but did not illustrate his *C. operculata.* In 1885, E. A. Smith (Voyage H.M.S. Challenger, Zoology, vol. 13, pp. 33-34, pl. 7, figs. 4-4b) described and figured admirably his *C. philippii,* and remarked that "In the inequality of the valves it resembles *Corbula operculata* Philippi, from St. Thomas Island, but differs from that species in size, form, the absence of the double keel in the right valve, and in the different sculpture of the left." In 1886, Dall (Mus. Comp. Zool., Bull., vol. 12, No. 6, pp. 314-315, pl. 1, figs. 4-4b) synonymized both *C. operculata* Philippi and *C. philippii* Smith, stating his reasons thusly:

> "Those who consult d'Orbigny's figures will observe that they differ from the shell figured by my friend Smith in representing the valves as nearly equal, and also in the absence of epidermal radiations on the smaller valves and the carina on the larger one. But I infer from d'Orbigny's remarks, that he had only separated valves, and probably those which had lost their epidermis; and it is probable that the artist represented two valves together which did not belong together. The carina is a variable feature in this species, as in *C. nucleus.* At all events, the specimens I have are certainly the same as *C. philippi* Smith, and I believe them to be the species described by d'Orbigny. The species extends northward to Cape Hatteras, and the smaller valve is frequently of a pink color or pinkish brown. It reaches a length of 8.0 mm. and is variable in its proportions and sculpture. I have no doubt that it is the *operculata* of Philippi, but the *C. Krebsiana* of C. B. Adams is a different and more delicate species."

Despite Dall's atypical illustrations, no less an authority than Lamy (1941, Jour. Conchyl., vol. 84, No. 3, pp. 218-219) subscribed to Dall's opinion, although later conchologists, among them Abbott (1954, pp. 456-457), would refer to the species in question as [*Notocorbula*] *operculata* (Philippi).

PHOLADIDAE

Martesia striata (Linnaeus) Pl. 58, figs. 1-3

1758. *Pholas striatus* Linnaeus, Syst. Nat., ed. 10, p. 669, No. 12.

1758. *Pholas pusillus* Linnaeus, Syst. Nat., ed. 10, p. 670, No. 14.
1765. *Pholas conoides* Parsons, Philos. Trans., vol. 55, p. 1, pl. 1.
1767. *Pholas striatus* Linnaeus, Syst. Nat., ed. 12, p. 1111, No. 22.
1785. *Pholas striatus* Linnaeus, Chemnitz, Syst. Conchylien-Cabinet, vol. 8, p. 364, pl. 102, figs. 864-866.
1799. *Pholas nanus* 'Solander' Pulteney, Catalogue of the Birds, Shells, . . . Plants of Dorsetshire, p. 27.
1813. *Pholas nanus* 'Solander' Pulteney, Catalogue of the Birds, Shells, . . . Plants of Dorsetshire, 2d ed., p. 27, pl. 1, fig. 7.
1815. *Pholas falcata* Wood, General Conchology, p. 84, pl. 16, figs. 5-7.
1818. *Pholas clavata* Lamarck, An. sans Vert., vol. 5, p. 446.
1826. *Pholas tenuistriata* Blainville, Dictionnaire des Sciences Naturelles, vol. 39, p. 531. Based on Encycl. Méth., 1792, Atlas, vol. 2, pl. 170, figs. 4-8.
1827. *Pholas decussata* 'Valenciennes' Bory de Saint-Vincent, Tableau Encycl. Méth., Atlas, vol. 1, p. 145, pl. 170, figs. 1-3.
1827. *Pholas atomus* 'Valenciennes' Bory de Saint-Vincent, Tableau Encycl. Méth., Atlas, vol. 1, p. 145, pl. 170, figs. 4-8.
1827. *Pholas striata* Linnaeus, Brown, Illustrations of the Recent Conchology of Great Britain and Ireland, pl. 8, figs. 5, 8.
1828. *Pholas ovum* Wood, Supplement to Index Testaceologicus, p. 2, pl. 1, fig. 4.
1841. *Pholas striata* Linnaeus, Reeve, Conchologica Systematica, vol. 1, p. 44, pl. 24, fig. 2.
1842. *Pholas Hornbeckii* d'Orbigny, [in] La Sagra, Hist. phys., polit., et nat., l'Ile de Cuba, Atlas, pl. 25, figs. 23-25; text, vol. 2, p. 217 (1853).
1846. *Penitella xylophaga* Valenciennes, Voyage Autour du Monde, Atlas Zool., Mollusques, pl. 24, fig. 2. Not *Pholas xylophaga* Deshayes 1835.
1849. *Pholas striata* Linnaeus, Sowerby, Thes. Conchyl., vol. 2, pt. 10, p. 494, pl. 104, figs. 40-42; pl. 105, figs. 43-44.
1849. *Pholas teredinaeformis* Sowerby, Thes. Conchyl., vol. 2, pt. 10, p. 490, pl. 108, figs. 97-98.
1849. *Pholas corticaria* 'Gray' Sowerby, Thes. Conchyl., vol. 2, pt. 10, p. 495, pl. 108, figs. 94-96.
1850. *Pholas rosea* C. B. Adams, Contrib. Conch., No. 5, pp. 75-76.
1853. *Pholas Beauiana* Récluz, Jour. Conchyl., vol. 4, p. 49, pl. 2, figs. 1-3.
1856. *Martesia striata* (Linnaeus), H. and A. Adams, The Genera of Recent Mollusca, vol. 2, p. 330, pl. 90, figs. 5-5a.
1862. *Martesia striata* (Linnaeus), Tryon, Acad. Nat. Sci. Philadelphia, Proc., vol. 14, pp. 92, 220.
1864. *Pholas striata* Linnaeus, Krebs, The West Indian Marine Shells, p. 114.
1867. *Martesia striata* (Linnaeus), Guppy, Sci. Assoc. Trinidad, Proc., pt. 3, p. 161.
1868. *Martesia striata* (Linnaeus), Tryon, Amer. Jour. Conch., vol. 3, pt. 3, Appendix, No. 8, p. 10.
1872. *Pholas striata* (Linnaeus), Sowerby, [in] Reeve, Conch. Icon., pl. 8, sp. 32a-c.
1878. *Pholas striata* Linnaeus, Mörch, Catalogue of West-India Shells, p. 14.
1878. *Martesia striata* (Linnaeus), Arango y Molina, Contribución a la Fauna Malacológica Cubana, p. 236.
1881. *Martesia striata* (Linnaeus), Gabb, Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 8, p. 370.
1887. *Martesia striata* (Linnaeus), Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1136, pl. 23, fig. 21.

1889. *Martesia striata* (Linnaeus), Dall, U.S. Nat. Mus., Bull. 37, p. 72.
1889. *Martesia striata* (Linnaeus), Morlet, Jour. Conchyl., vol. 37, p. 173.
1889. *Martesia striata* (Linnaeus), Crosse and Fischer, Jour. Conchyl., vol. 37, p. 294.
1893. *Martesia striata* (Linnaeus), Clessin, Syst. Conchylien-Cabinet, vol. 11, pt. 4a, p. 45, pl. 10, figs. 2-3.
1898. *Martesia striata* (Linnaeus), Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 820.
1898. *Martesia striata* (Linnaeus), Melvill and Standen, Jour. Conch., vol. 9, p. 84.
1901. *Martesia striata* (Linnaeus), Hedley, Australian Assoc. Advancement Sci., vol. 8, p. 249, pl. 10, figs. 10-11.
1905. *Martesia striata* (Linnaeus), Johnson, Nautilus, vol. 18, p. 100, fig. 1.
1906. *Martesia striata* (Linnaeus), Melvill and Standen, Zool. Soc. London, Proc., p. 845.
1909. *Martesia curta* Sowerby, Dall, U.S. Nat. Mus., Proc., vol. 37, No. 1704, p. 161. Not of Sowerby 1834.
1920. *Martesia striata* (Linnaeus), Maury, Bull. Amer. Paleont., vol. 8, No. 34, pp. 144-145.
1924. *Martesia striata* (Linnaeus), Miller, Univ. California Publ. Zool., vol. 26, p. 146, pl. 8, figs. 1-5.
1924. *Pholas cupula* Yokoyama, Imperial Univ. Tokyo, Jour. College Sci., vol. 45, art. 1, p. 37, pl. 2, fig. 15.
1925. *Martesia striata* (Linnaeus), Lamy, Jour. Conchyl., vol. 69, pp. 194-205.
1927. *Martesia striata tokyoensis* Yokoyama, Imperial Univ. Tokyo, Jour. Faculty Sci., sect. 2, vol. 1, pt. 10, p. 428, pl. 48, figs. 2-3.
1930. *Pholas striatus* Linnaeus, Stewart, Acad. Nat. Sci. Philadelphia, Spec. Publ. No. 3, p. 295.
1932. *Martesia pulchella* Yokoyama, Imperial Univ. Tokyo, Jour. Faculty Sci., sect. 2, vol. 3, pt. 6, p. 238, pl. 2, fig. 5.
1934. *Martesia striata* (Linnaeus), Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 58.
1936. *Hiata infelix* Zetek and McLean, Nautilus, vol. 49, p. 110.
1936. *Martesia striata* (Linnaeus), Lermond, A Check List of Florida Marine Shells, Gulfport, p. 14.
1937. *Martesia striata* (Linnaeus), Smith, East Coast Marine Shells, p. 69, fig. 37.
1938. *Martesia hawaiiensis* Dall, Bartsch and Rehder, Bernice P. Bishop Mus., Bull., No. 153, p. 205, pl. 52, figs. 1-7.
1940. *Martesia striata* (Linnaeus), Smith, World-wide Sea Shells, p. 124, figs. 1591a-c.
1945. *Martesia* (*Martesia*) *striata* (Linnaeus), Bartsch and Rehder, Smithsonian Misc. Collections, vol. 104, No. 11, pp. 4-5, pl. 1, figs. 1-2; pl. 3, figs. 19-20.
1945. *Martesia* (*Diploplax*) *americana* Bartsch and Rehder, Smithsonian Misc. Collections, vol. 104, No. 11, p. 13, pl. 2, figs. 1-2; pl. 3, figs. 3-4.
1945. *Martesia* (*Diploplax*) *funisicola* Bartsch and Rehder, Smithsonian Misc. Collections, vol. 104, No. 11, p. 14, pl. 3, figs. 1-2, 13-14.
1945. *Mesopholas intusgranosa* Taki and Habe, Venus, vol. 14, p. 110.
1945. *Mesopholas nucicola* Taki and Habe, Venus, vol. 14, p. 110.
1949. *Martesia striata* (Linnaeus), Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 49.

1950. *Martesia intercalata* Carpenter, Hertlein and Strong, Zoologica, vol. 35, No. 19, p. 250. Not of Carpenter 1857.
1951. *Martesia striata* (Linnaeus), McLean, New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, p. 19, pl. 24, fig. 5.
1952. *Martesia striata* (Linnaeus), Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 185.
1952. *Pholas striata* Linnaeus, Dodge, Amer. Mus. Nat. Hist., Bull., vol. 100, art. 1, p. 26.
1954. *Martesia striata* (Linnaeus), Abbott, American Seashells, pp. 464-465, pl. 32w.
1955. *Martesia striata* (Linnaeus), Perry and Schwengel, Marine Shells of the Western Coast of Florida, p. 95, pl. 19, figs. 127a,b.
1955. *Martesia* (*Martesia*) *striata* (Linnaeus), Turner, Johnsonia, vol. 3, No. 34, pp. 103-111, pls. 35, 61-64.
1958. *Martesia striata* (Linnaeus), Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 39, No. 177, p. 22.
1958. *Martesia striata* (Linnaeus), Keen, Sea Shells of Tropical West America, pp. 216-218, fig. 550.
1961. *Martesia striata* (Linnaeus), Olsson, Panamic-Pacific Pelecypoda, p. 446, pl. 79, figs. 6-7a.
1961. *Martesia striata* (Linnaeus), Warmke and Abbott, Caribbean Seashells, p. 209, pl. 44j.

The callum and mesoplax are broken away on the single Venezuelan specimen from Higuerote, but all other characters are the same as in *Martesia striata* (Linnaeus). The color is white.

Dimensions.—Specimen B505a, length 24 mm.; height 11.6 mm.; thickness 6 mm.

Locality.—Recent, on beach southeast of Higuerote, State of Miranda. One left valve.

Remarks.—The references to and synonymy of this ubiquitous species as given in this work are by no means complete. Full information on this and other pholads are to be found in the classic by Turner (1954-1955) in Johnsonia, volume 3. Voluminous references to *Martesia striata* and to other species considered as synonyms of *Martesia striata* by Turner, are given by Lamy (1925) in the Journal de Conchyliologie.

Range and distribution.—The Recent *Martesia striata* (Linnaeus), a wood borer, is a subtemperate to tropical species inhabiting the Atlantic, Pacific, and Indian Oceans. Among late Cenozoic occurrences, the fossil is reported from Japan, and from the Pliocene of Costa Rica and Trinidad in the Americas.

PERIPLOMATIDAE

Periploma margaritacea (Lamarck) Pl. 58, figs. 4-9; Pl. 59, figs. 1-2

1797. *Corbula* sp. Bruguière, Encycl. Méth., pl. 230, figs. 6a-b.
1801. *Corbula margaritacea* Lamarck, Syst. An. sans Vert., p. 137.
1817. *Periploma inaequivalvis* Schumacher, Essais d'un nouveau système des habitations des vers testacés, p. 116, pl. 5, figs. 1a-b.
1818. *Anatina trapezoides* Lamarck, An. sans Vert., vol. 5, p. 464.
1825. *Osteodesma trapezoidalis* Blainville, Man. Malac. et Conchyl., p. 660, pl. 75, fig. 8.
1832. *Periploma trapezoides* (Lamarck), Deshayes, Encycl. Méth., vol. 3, p. 733.
1835. *Anatina trapezoides* Lamarck, Deshayes, An. sans Vert., 2d ed., vol. 6, p. 79.
1835. *Periploma trapezoides* (Lamarck), Deshayes, An. sans Vert., 2d ed., vol. 6, p. 80.
1839. *Periploma trapezoides* (Lamarck), Couthouy, Boston Jour. Nat. Hist., vol. 2, p. 160.
1842. *Thracia inequalis* C. B. Adams, Amer. Jour. Sci., vol. 43, p. 143.
1843. *Periploma trapezoides* Deshayes, C. B. Adams, Amer. Jour. Sci., vol. 44, p. 420.
1843. *Periploma inaequavalvis* Schumacher, Deshayes, Tr. élém. conch., vol. 1, pt. 2, p. 219, pl. 8, figs. 15-19.
1843. *Anatina trapezoides* Lamarck, Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 20.
1846. *Periploma inaequivalvis* Schumacher, d'Orbigny, Voyage Amérique Méridionale, vol. 5, p. 513.
1852. *Periploma margaritacea* (Lamarck), Mörch, Catalogus Conchyliorum Comes de Yoldi, pt. 2, p. 31.
1853. *Periploma trapezoides* (Lamarck), Petit de la Saussaye, Jour. Conchyl., vol. 4, p. 414.
1856. *Periploma trapezoides* (Lamarck), Hanley, An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, p. 329, pl. 10, fig. 32.
1856. *Periploma inaequivalvis* Schumacher, H. and A. Adams, The Genera of Recent Mollusca, vol. 2, p. 361, pl. 96, figs. 2a-2b.
1862. *Periploma trapezoides* (Lamarck), Chenu, Man. Conchyl. et Paléont. Conchyliologique, vol. 2, p. 38, figs. 167-169.
1864. *Periploma inaequivalvis* Schumacher, Krebs, The West Indian Marine Shells, p. 108.
1867. *Periploma trapezoides* Deshayes, Schramm, Cat. Coq. Guadeloupe, p. 19.
1869. *Anatina trapezoides* Lamarck, Conrad, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 12, p. 51.
1869. *Periploma inaequivalvis* Schumacher, Conrad, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 12, p. 51.
1879. *Periploma inaequivalvis* Schumacher, Guppy, Quart. Jour. Conch., vol. 2, p. 162.
1884. *Periploma inaequivalvis* Schumacher, Tryon, Structural and Systematic Conch., vol. 3, p. 145, pl. 108, figs. 57-59.
1886. *Periploma inaequivalvis* Schumacher, Dall, Mus. Comp. Zool., Bull., vol. 12, No. 6, p. 305.
1887. *Periploma inaequivalvis* Schumacher, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1170.
1889. *Periploma inaequivalvis* Schumacher, Dall, U.S. Nat. Mus., Bull. 37, p. 64.

1903. *Periploma inaequivalvis* Schumacher, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1528.
1920. *Periploma inaequivalvis* Schumacher, Maury, Bull. Amer. Paleont., vol. 8, No. 34.
1925. *Anatina trapezoides* Lamarck, Lamy, Mus. Nat. Hist. nat. Paris, Bull., vol. 31, p. 375.
1926. *Periploma inaequivalvis* Schumacher, Gardner, U.S. Geol. Sur., Prof. Paper 142-A, p. 61.
1931. *Periploma margaritacea* (Lamarck), Lamy, Jour. Conchyl., vol. 75, pt. 4, pp. 304-306.
1934. *Periploma inaequivalvis* Schumacher, Johnson, Boston Soc. Nat. Hist., Proc., vol. 40, No. 1, p. 30.
1940. *Periploma trapezoides* (Lamarck), Smith, World-wide Sea Shells, p. 101, fig. 1364.
1943. *Periploma inaequivalvis* Schumacher, Gardner, U.S. Geol. Sur., Prof. Paper 199-A, p. 42.
1949. *Periploma inaequivalve* Schumacher, Lange de Morretes, Mus. Paranaense, Arq., vol. 7, art. 1, p. 50.
1952. *Periploma inaequivalvis* Schumacher, Pulley, Texas Jour. Sci., vol. 4, No. 2, p. 185.
1954. *Periploma inaequivalvis* Schumacher, Abbott, American Seashells, p. 473.
1958. *Periploma inaequivalvis* Schumacher, Olsson and McGinty, Bull. Amer. Paleont., vol. 39, No. 177, p. 22.
1960. *Periploma inaequivalvis* Schumacher, Olsson, Panamic-Pacific Pelecypoda, p. 460.

Shell thin, moderately inflated, somewhat distorted, transversely suboval to subquadrate in outline, inequilateral, slightly inequivalve (the right valve a little shorter but a little higher than the left), the valves when closed with a gape at the posterior end. On the suboval form the anterodorsal margin is short, the anterior end is obliquely subtruncate, the ventral margin of the right valve is shallowly arcuate but on the left valve obliquely truncated in front, the posterior end is subangularly rounded, and the posterodorsal margin is long, gently sloping, and hardly concave. The beak on the suboval form is situated well toward the anterior end. On the subquadrate form the anterodorsal margin is flared upward a little, the anterior end is ragged and subtruncate, the ventral margin is rounded in front and obliquely truncated behind, the posterior end is nearly vertically truncated, and the posterodorsal margin is hardly concave. The beak on the subquadrate form is low, and situated somewhat in advance of the middle. Posterior area fairly broad, slightly sulcate, defined from the disk by a low ridge descending from the umbo to the posterior corner of the ventral margin, the dorsal edge of the posterior area faintly ridged against the ill-defined, slightly depressed, narrow escutcheonal area. Interior nacreous.

Hinge with a small but greatly thickened oval chondrophore, the face of which is more or less concave. An internal ridge diverges from under the hinge a short distance toward the posterior end. Adductor scars shiny, the anterior elongated and narrowly lenticular, the posterior broader and subpyriform. Pallial line moderately remote from the margin. Pallial sinus broad, asymmetrically embayed to a distance of about one-third the length of the valve from the posterior end, the lower limb of the sinus swinging back to join the pallial line with which it forms a narrow, recumbent, U-shaped indentation with a more or less rounded apex. Body cavity with faint concentric undulations reflected through from the exterior, and studded with small scattered nodules. The external sculpture consists of low irregular concentric undulations, and over the whole of the surface there are crowded minute granulations. The color of the Recent shell is white within and dull white on the exterior. The periostracum is brown.

Dimensions.—Specimen A558a 1-2, paired; right valve of pair (A558a-1), length 13.3 mm.; height 8.4 mm.; left valve of pair (A558a-2), length 13.9 mm.; height 8.1 mm.; thickness of pair 5.5 mm. Specimen A534a (subquadrate form), length 14.3 mm.; height 15.1 mm.; thickness 2.5 mm. Fossil specimen (I509a), fragment of right valve, heighth of fragment 9 mm.

Localities.—Recent, on beach at Playa Grande Yachting Club, Distrito Federal. Two specimens, one collected as an attached pair, the other a laterally foreshortened right valve. Lower Mare formation at W-13, on hillside above west bank of Quebrada Mare Abajo. One fragment of a right valve.

Range and distribution.—The living P. *inaequivalvis* (= *P. margaritacca*) ranges from the Antilles to Brazil. If there is a previous record of its occurrence as a fossil, it has escaped my notice.

THRACIIDAE

Cyathodonta cf. tristani Olsson Pl. 59, figs. 3-6

1922. *Thracia* (*Cyathodonta*) *Tristani* Olsson, Bull. Amer. Paleont., vol. 9, No. 39, p. 383, pl. 20, fig. 3.
1925. *Thracia* (*Cyathodonta*) *meridionalis* (Guppy), Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 331, pl. 31, fig. 9. Not *Raeta meridionalis* Guppy, 1910, Agr. Soc. Trinidad and Tobago Soc. Paper No. 454, p. 8, pl. 2, fig. 1 (*fide* Rutsch, 1943).

1943. *Thracia* (*Cyathodonta*) *tristani* Olsson, Rutsch, Naturf. Gesell. Basel, Verhandl., vol. 54, p. 126, pl. 6, fig. 4.

The Cabo Blanco form referred to this species is described from three imperfect molds of paired valves. Shell thin, large, suboval, inequilateral, inequivalve, the right valve larger and more convex than the left, the beak of the right valve rising above and curved over the beak of the left valve. The left valve of our largest specimen (M462a) is broadly and shallowly depressed medially but this is probably due to crushing as the other two specimens, though not so complete, do not display this character. Anterodorsal margin long, nearly straight, and gently sloping, anterior end broadly rounded, ventral margin shallowly arcuate, posterior end obliquely truncate, posterodorsal margin somewhat concave. Posterior submargin depressed, the submargin broader on the left valve than on the right, the depression, or rostration bounded by the umbonal ridge of the disk. On the right valve there is a narrow sulcus in front of the umbonal ridge, but this is not present on the left valve. Beaks low and flattened, situated slightly behind the middle. Sculpture consisting of moderately large subregular concentric lirae or undulations which are about as wide as their intervals, the lirae on the two smaller specimens forming a slight angulation along a line at about the anterior third of the disk; the lirae extend over the whole of the disk from the beak to the ventral margin but cease at the umbonal ridge of both valves and are obsolescent in the sulcus fronting the umbonal ridge on the right valve. It is surmised that on the surface of the shell proper the undulations are somewhat tangential to the concentric growth lines, and that there are also minute lineolate granules, but as the concentric undulations on the molds are impressed from the inner surface of the valves the external ornamentation cannot be seen on the specimens at hand. The hinge characters are not known.

Dimensions.—Specimen M462a, an internal mold of an attached pair with the beaks and posterior end broken away, length 62 mm.; height 50 mm.; thickness of pair 24 mm. Specimen L460a, an internal mold of an attached pair with the base missing, length 34 mm.; thickness of pair 10 mm.

Localities.—Playa Grande formation (Catia member) at W-15,

south side of Playa Grande road 40 meters southeast of its intersection with the Playa Grande Yachting Club road. Two incomplete doublets. Playa Grande formation (Catia member), south side of Playa Grande road about 220 meters west of W-15. One incomplete doublet.

Remarks.—Considering normal variability, the poor preservation, and the distortion of all specimens (including the type), the Cabo Blanco shell seems to agree with *C. tristani* except perhaps in not being quite as long relative to height. Rutsch has shown that Maury's *C. meridionalis* from the upper Miocene of Trinidad is the same as *C. tristani* from Costa Rica and has further suggested that Olsson's *C. tristani* may eventually prove, with better material for comparison, to be identical with *C. gatunensis* (Toula) (1909, K.-k. Geol. Reichsanst. Jahrb., vol. 58, p. 757, text fig. 15) from the middle Miocene of the Panama Canal Zone. The Recent west American analogue of *C. tristani* is *C. undulata* Conrad (see Keen, 1958, Sea Shells of Tropical West America, p. 232, fig. 595), but that has a nearly vertically truncated posterior end compared with the oblique truncation of the Cabo Blanco shell.

Range and distribution.—*C. tristani* Olsson occurs in the middle Miocene of Costa Rica and of Venezuela (Paraguaná Peninsula), and in the upper Miocene Springvale formation of Trinidad.

PHOLADOMYIDAE

Pholadomya cf. **candida** Sowerby Pl. 59, figs. 7, 8

1823. *Pholadomya candida* Sowerby, The Genera of Recent and Fossil Shells, No. 19, fig. 184.
1847. *Pholadomya candida* Sowerby, Gray, Zool. Soc. London, Proc., p. 194.
1858. *Pholadomya candida* Sowerby, H. and A. Adams, The Genera of Recent Mollusca, vol. 3, pl. 97, fig. 1.
1864. *Pholadomya candida* Sowerby, Krebs, The West Indian Marine Shells, p. 111.
1868. *Pholadomya candida* Sowerby, Conrad, Amer. Jour. Conch., vol. 4, pt. 5, Appendix, No. 12, p. 56.
1872. *Pholadomya candida* Sowerby, [in] Reeve, Conch. Icon., vol. 18, pl. 1, sp. 1a-c.
1878. *Pholadomya candida* Sowerby, Mörch, Catalogue of West-India Shells, p. 14.
1884. *Pholadomya candida* Sowerby, Tryon, Structural and Systematic Conchology, vol. 3, p. 151, pl. 108, figs. 76-77.
1887. *Pholadomya candida* Sowerby, Fischer, Manuel de Conchyliologie et de Paléontologie Conchyliologique, p. 1179, pl. 22, fig. 15.

1889. *Pholadomya candida* Sowerby, Lorié, Samml. Geol. Reichs-Mus. Leiden, ser. 2, vol. 1, pp. 128-129, 141, pl. 2, figs. 34a, b.
1903. *Pholadomya candida* Sowerby, Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 6, p. 1532.
1909. *Pholadomya candida* Sowerby, Dall, Nautilus, vol. 22, p. 116.
1925. *Pholadomya candida* Sowerby, Maury, Bull. Amer. Paleont., vol. 10, No. 42, p. 333.
1930. *Pholadomya candida* Sowerby, Stewart, Acad. Nat. Sci. Philadelphia, Special Publ. No. 3, p. 300.
1940. *Pholadomya candida* Sowerby, Smith, World-wide Sea Shells, pp. 100-101, figs. 1353a-c.

Shell large, thin, subnacreous, elongated and somewhat obliquely suboval, moderately inflated. Anterior end short, hardly rounded, the valves seemingly with a narrowly lanceolate gape in front of the beak; ventral margin shallowly arcuate; posterior end a little broader than the anterior, somewhat alated, and gaping; posterodorsal margin long and moderately concave. Umbonal area full, the beaks situated just behind the anterior end, and appressed on top. The sculpture consists of a dozen or so radial ribs crossed by more numerous and fairly regular low concentric lirae which produce crenations at the intersections with the radials. The radial ribs are subequal to unequal on the lower half of the valve (where they enlarge gradually toward the base) but are regular and equal in size on the umbonal area. The radial ribs are absent on the anterior fifth of the valve, are strongest on the middle of the disk, and become obsolescent on the posterior slope. The concentric lirae are pronounced on the umbo, where, together with the radial riblets they form a decussated pattern but are fainter toward the base. The interior is inaccessible.

Dimensions.—Specimen M357a, paired valves, length 104 mm.; height (beak to base along anteriormost radial) 72 mm.; thickness of pair 61 mm.

Locality.—Playa Grande formation (Catia member) at W-15, south side of Playa Grande road, 45 meters southeast of its intersection with the Playa Grande Yachting Club road. Two specimens, both of them doublets with a filling of calcareous sandstone.

Remarks.—So far as can be determined with the imperfectly preserved specimens, the Cabo Blanco fossil seems to be the same as the Recent Caribbean *P. candida* Sowerby. There are only a few specimens of any of the late Cenozoic species of *Pholadomya* from

tropical America, and none of them is perfect. Furthermore, the illustrations of *P. candida* by authors suggest that there is considerable variation in details of sculpture, so that all of the known fossil species are similar to one variant or another of the Recent *P. candida.* Therefore, the Cabo Blanco fossil also resembles the following later Tertiary species of *Pholadomya* of the southern Caribbean area:

P. walli Maury (1925, Bull. Amer. Paleont., vol. 10, No. 42, pp. 332-333, pl. 31, figs. 8, 11). Earlier Miocene (Machapoorie) of Trinidad.

P. sawkinsi Maury (1925, pp. 333-334, pl. 31, fig. 10). Earlier Miocene (Machapoorie) of Trinidad.

P. falconensis F. and H. Hodson (1927, Bull. Amer. Paleont., vol. 13, No. 49, p. 44, pl. 26, fig. 6; pl. 27, figs. 1-2). Miocene, State of Falcon, Venezuela.

P. walli Maury is an exceedingly ventricose shell, but otherwise, to judge from the incomplete specimen, it is much like *P. candida* Sowerby. *P. sawkinsi* Maury is a smaller shell, but as noted by Maury herself, is close to the typical *P. candida,* and if not the same species as that, may be a precursor. *P. falconensis* F. and H. Hodson is relatively broader than *P. candida* and bears more numerous radial riblets than the typical *P. candida.* Vokes (1938, Amer. Mus. Novitates, No. 988, pp. 17-18) reported *Pholadomya* species from the upper Miocene Springvale formation of Trinidad which has the general outline of *P. sawkinsi* Maury but sculptural details that closely approximate those of *P. falconensis* F. and H. Hodson.

Range and distribution.—The Recent *P. candida* Sowerby is a Caribbean species. As a fossil it occurs in the Pleistocene of Aruba.

BIBLIOGRAPHY

Abbott, R. Tucker

1950. *The Molluscan fauna of the Cocos-Keeling Islands, Indian Ocean.* Raffles Mus., Bull. No. 22, pp. 68-98.

1955. *The Titean R. Peale collection.* Nautilus, vol. 68, No. 4, pp. 123-126, pl. 4.

1959. *The family Vasidae in the Indo-Pacific.* Indo-Pacific Mollusca, vol. 1, No. 1, pp. 15-32, pls. 1-10.

1960. *The genus Strombus in the Indo-Pacific.* Indo-Pacific Mollusca, vol. 1, No. 2, pp. 33-146, pls. 11-117.

1961. *The genus Lambis in the Indo-Pacific.* Indo-Pacific Mollusca, vol. 1, No. 3, pp. 147-174, pls. 118-134.

Adam, W., and Leloup, E.

1938-39. *Resultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique.* Mus. Roy. Hist. nat. Belgique, Mém., hors sér., vol. 2, No. 19, *Prosobranchia et Opisthobranchia,* pp. 1-209, pls. 1-8 (1938); No. 20, *Gastropoda-Pulmonata, Scaphopoda et Bivalvia,* pp. 1-126, 5 figs., pls. 1-7, 1 map (1939).

Adams, Arthur

1850c. *Description of new species of the genus Cumingia, with some additional characters.* Zool. Soc. London, Proc., pt. 18, pp. 24-25.

1850d. *Monographs of Cyclostrema, Marryat, and Separatista, Gray, two genera of gasteropodous mollusks.* Zool. Soc. London, Proc., pt. 18, pp. 41-45.

1850e. *Monograph of Phos, a genus of gasteropodous Mollusca.* Zool. Soc. London, Proc., pt. 18, pp. 152-155.

1850f. *A monograph of Modulus, a genus of gasteropodous Mollusca, of the family Littorinidae.* Zool. Soc. London, Proc., pt. 18, pp. 203-204.

1863. *On the genera and species of Fossaridae found in Japan.* Zool. Soc. London, Proc. for 1863, pp. 110-113.

1864. *On some new genera and species of Mollusca from the seas of China and Japan.* Ann. Mag. Nat. Hist., ser. 3, vol. 15, pp. 307-310.

1865. *On some new genera of Mollusca from the seas of Japan.* Ann. Mag. Nat. Hist., ser. 3, vol. 15, pp. 322-324.

Adams, A. C., and Kendall, W. C.

1891. *Report upon an investigation of the fishing grounds off the west coast of Florida.* U.S. Fish Com., Bull., vol. 9 for 1890, pp. 289-312.

Adams, Arthur, and Reeve, Lovell

1848-50. *Mollusca.* [In] A. Adams, *The zoology of the voyage of H.M.S. Samarang; under the command of Captain Sir Edward Belcher.* London, pt. 1, i-x + 24 pp., pls. 1-9 (1848); pt. 2, pp. 25-44, pls. 10-17 (1850); pt. 3, pp. 45-87, pls. 18-24 (1850).

Adams, Charles Baker

1842. *Description of a new species of Thracia.* Assoc. Amer. Geol. and Natural., art. 3, p. 145, figs.

Adams, Henry

1861a. *Descriptions of some new genera and species of shells from the collection of Hugh Cuming, Esq.* Geol. Soc. London, Proc. for 1861, pp. 383-385.

1861b. *Description of a new genus of shell from the collection of Hugh Cuming, Esq.* Zool. Soc. London, Proc. for 1861, p. 272.

BIBLIOGRAPHY

Adams, George Irving

1908. *An outline review of the geology of Peru.* Smithsonian Inst., Ann. Rept. for 1908, pp. 385-430, 5 maps, text figs.

Adanson, M.

1757. *Histoire naturelle du Sénégal. Coquillages.* Paris, viii + 275 pp., 19 pls., 1 map

Agassiz, Louis

1848,1854. *Bibliographia Zoologiae et Geologiae. A general catalogue of all books, tracts, and memoires on zoology and geology.* Roy Soc., London, vol. 1, 506 pp. (1848); vol. 2, 604 pp. (1854); vol. 3, 657 pp. (1854); vol. 4, 604 pp. (1854).

Aguilera, José G., and Ordoñez, Ezequiel

1893. *Datos para la Geología de Mexico.* Tacubaya, 87 pp.

Ameghino, Florentino

1903. *L'âge des formations sédimentaires de Patagonia.* Soc. Cientif. Argentina, An., vols. 50, 54, 231 pp.

1911. *L'âge des formations sédimentaires Tertiaires de l'Argentine en relation avec l'antiquité de l'homme. Note supplémentaire.* Mus. Nac. Buenos Aires, An., ser. 3, vol. 15 (22), pp. 169-179.

American Malacological Union

1940. *Scientific contributions made from 1882 to 1939 by Henry A. Pilsbry, Sc.D.* Amer. Malac. Union, 63 pp.

Anderson, Frank Marion, and Martin, Bruce

1914. *Neocene record in the Temblor Basin, California, and Neocene deposits of the San Juan District, San Luis Obispo County.* California Acad. Sci., Proc., ser. 4, vol. 4, pp. 15-112, pls. 1-10.

Andre, Marc

1943. *Liste des publications scientifiques de Edouard Lamy.* Abbeville, 21 pp.

Angas, G. F.

1877. *Descriptions of one genus [Mysilla] and twenty-five species of marine shells from New South Wales.* Zool. Soc. London, Proc. for 1877, pp. 171-177, pl. 26.

Anthony, J. W.

1955. *Geological stratigraphy. Geochronology.* Univ. Arizona Phys. Sci. Bull., No. 2, pp. 82-86.

Apgar, A.

1891. *Mollusks of the Atlantic Coast of the United States to Cape Hatteras.* New Jersey Nat. Hist. Soc., Jour., vol. 2, No. 2, pp. 75-162, 3 pls.

Aradas, Andrea, and Benoit, Luigi

1870. *Conchigliologica vivente marina della Sicilia.* Catania, 321 pp., 5 pls.

d'Argenville, Antoine Joseph Dezallier

1742, 1757, 1780. *L'histoire naturelle . . . de la Société Royale des Sciences de Montpelier.* Paris. Second edition, Paris, 1757. Third edition [by MM. de Favanne de Montcervelle, père et fils], Paris, 3 vols., 1780.

Arango y Molina, Rafael

1862. *Description d'espèces nouvelles de' l'Ile de Cuba.* Jour. Conchyl., vol. 10, pp. 408-410.

Arnold, Ralph, and Anderson, Robert

1910. *Geology and oil resources of the Coalinga District, California.* U.S. Geol. Sur., Bull. 398, 354 pp., 52 pls.

Bahamonde N., Nibaldo

1950. *Moluscos marinos colectados en Tarapacá.* Investig. Zool. Chilenos, No. 2, pp. 9-11.

Baker, Frank Collins

1895. *Preliminary outline of a new classification of the family Muricidae.* Chicago Acad. Sci., Bull., vol. 2, No. 2, pp. 169-189.

1897. *Critical notes on the Muricidae.* Acad. Sci. St. Louis, Trans., vol. 7, No. 16, pp. 371-391.

1903. *Note on Murex marcoensis Sowerby.* Nautilus, vol. 17, pp. 88-89.

Baker, Fred

1925. *A new species of mollusk (Dentalium hannai) from Lower California, with notes on other forms.* California Acad. Sci. Proc., 4th ser., vol. 14, No. 4, pp. 83-87, pl. 10.

Balch, Francis Noyes

1899. *List of marine Mollusca of Coldspring Harbor, Long Island, with descriptions of one new genus and two new species of nudibranchs.* Boston Soc. Nat. Hist., Proc., vol. 29, No. 7, pp. 133-162, pl. 1.

Bales, Blenn Rife

1942. *Albinos of Muricidea ostrearum Conrad.* Nautilus, vol. 56, No. 1, pp. 35-36.

Bandy, O. L.

1958. *Dominant molluscan faunas of the San Pedro Basin, California.* Jour. Paleont., vol. 32, pp. 703-714, figs.

Barker, R. W.

1933. *Notes on the Tablazo faunas of S. W. Ecuador.* Geol. Mag., vol. 70, pp. 84-90, 1 fig.

Barnard, K. H.

1958. *Contributions to the knowledge of South African marine Mollusca. Pt. 1. Gastropoda: Prosobranchiata; Toxoglossa.* South African Mus., Ann., vol. 44, pt. 4, pp. 73-163, figs. 1-30, pl. 2.

Barnes, D. H.

1824. *Notice of several species of shells.* Lyc. Nat. Hist. New York, Ann., vol. 1, pp. 131-140, pl. 9.

Bartrum, J. A.

1919. *New fossil Mollusca.* New Zealand Inst., Trans., vol. 51, pp. 96-100, pl. 7.

Bartsch, Paul

1908. *A new shipworm from the United States.* Biol. Soc. Washington, Proc., vol. 21, pp. 211-212.

1909. *More notes on the family Pyramidellidae.* Nautilus, vol. 23, pp. 54-59.

1918. *A new marine mollusk of the genus Cerithiopsis from Florida.* Biol. Soc. Washington, Proc., vol. 31, pp. 135-136.

1920c. *A new shipworm.* Biol. Soc. Washington, Proc., vol. 33, pp. 69-70.

1923. *Additions to our knowledge of shipworms.* Biol. Soc. Washington, Proc., vol. 36, pp. 95-101.

1945. *The west Pacific species of the molluscan genus Aforia.* Washington Acad. Sci., Jour., vol. 35, No. 12, pp. 388-393.

1947a. *A monograph of the west Atlantic mollusks of the family Aclididae.* Smithsonian Misc. Collections, vol. 106, No. 20, publ. 3868, 29 pp., 6 pls.

1947b. *The little hearts (Corculum) of the Pacific and Indian oceans.* Pacific Sci., vol. 1, No. 4, pp. 221-226, pls. 1-2.

Bartsch, Paul, and Rehder, Harald A.

1945. *The west Atlantic boring mollusks of the genus Martesia.* Smithsonian Misc. Collections, vol. 104, No. 11, publ. 3804, 16 pp., 3 pls.

Bartsch, Paul, Rehder, Harald Alfred, and Shields, Beulah E.

1946. *A bibliography and short biographical sketch of William Healy Dall.* Smithsonian Misc. Collections, vol. 104, No. 15, 96 pp., 1 pl.

Baughman, J. L.

1948. *An annotated bibliography of oysters with pertinent material on mussels and other shellfish and an appendix on pollution.* Texas A. & M. Research Found., 794 pp.

Bavay, Arthur

1905. *Sur quelques espèces nouvelles, mal connues ou faisant double emploi dans le genre Pecten.* Jour. Conchyl., vol. 53, pp. 18-30, pl. 2.

1911. *Une marginellidée nouvelle de Cuba.* Mus. Nat. Hist. nat. Paris, Bull., vol. 17, No. 4, pp. 240-243, fig. 1.

1936. [In] Lamy, Edouard, *Catalogue des Pectenidae vivants du Muséum National d'Histoire Naturelles de Paris déterminés par feu A. Bavay.* Jour. Conchyl., vol. 79, pp. 306-321

Bayle, E.

1879. *Liste recticative de quelques noms de genre.* Jour. Conchyl., vol. 27, pp. 34-35.

1880. *Liste recticative de quelques noms de genres et d'espèces.* Jour. Conchyl., vol. 27, pp. 240-251.

Beal, C.

1948. *Reconnaissance of the geology and oil possibilities of Baja California, México.* Geol. Soc. Amer., Mem., vol. 31, pp. i-x + 138, pls. 1-11.

de la Beche, H. T.

1829. *Remarks on the geology of Jamaica.* Geol. Soc. London, Trans., ser. 2, vol. 2, pp. 142-194, pls. 18-22.

Beets, C.

1941. *Eine jungmiocäne Mollusken-Fauna von der Halbinsel Mangkalihat, Ost-Borneo (nebst Bemerkungen über andere Faunen von Ost-Borneo; die Leitfossilien-Frage).* Geol.-Mijnbouwk. Genootschap Nederland en Koloniën Verhandl., Geol. ser., vol. 13, pt. 1, pp. 1-218, pls. 1-9.

1950. *Précis des espèces fossiles du genre Cryptomya Conrad.* Basteria, vol. 14, Nos. 1-2, pp. 16-20, fig. 1.

Behre, E. H.

1950. *Annotated list of the fauna of the Grand Isle region (1928-1946).* Occas. Papers Marine Lab., No. 6, pp. 1-66.

Bellardi, Luigi

1875. *Monografia delle Nuculidi trovate finora vei terreni Terziari del Piemonte e della Liguria.* Torino, 32 pp., 1 pl.

1876. *Descrizione di un nuovo genere [Sabatia] della famiglia delle Bullidae fossile del terreno Pliocenico inferiore del Piemonte e della Liguria.* Soc. Malac. Italiana, Bull., vol. 2, pp. 207-210.

Belletante, Henri

1954. *Catalogue des Cymatiidae du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 94, Nos. 2-3, pp. 70-96.

van Bentham Jutting, Tera

1927. *Marine molluscs of the Island of Curaçao.* Bijdr. Dierk. Kon. Zool. Gen., Natura Artis Magistra Amsterdam, vol. 25, pp. 1-36, figs. 1-5.

Bentson, Herdis

1940. *A systematic study of the fossil gastropod Exilia.* Univ. California Publ., Bull. Dept. Geol. Sci., vol. 25, No. 5, pp. 199-238, pls. 1-3, 1 table.

Bernard, Félix

1896b. *Études comparatives sur la coquille des lamellibranches Condylocardia type nouveau de lamellibranches.* Jour. Conchyl., vol. 44, pp. 189-206, pl. 6.

Berry, Edward W.

1918c. *Paleogeographic significance of the Cenozoic floras of equatorial America.* Geol. Soc. Amer., Bull., vol. 29, pp. 631-636.

1921a. *Tertiary fossil plants from Costa Rica.* U.S. Nat. Mus., Proc., vol. 59, pp. 169-185, pls. 22-26.

1928. *A palm fruit from the Miocene of western Panama.* Washington Acad. Sci., Jour., vol. 18, pp. 455-457, 1 fig.

1945. *Fossil floras from southern Ecuador.* Johns Hopkins Univ. Studies Geol., No. 14, pp. 1-150, pls. 6-10.

Berry, Samuel Stillman

1944. *A second California Dimya.* Malac. Soc. London, Proc., vol. 26, pt. 1, pp. 25-26, figs. 1-4.

1957. *Notices of new Eastern Pacific Mollusca. I.* Leaflets in Malacology, vol. 1, No. 14, pp. 75-78.

Bertin, Victor

1878. *Revision des Tellinidés du Muséum d'Histoire Naturelle, Paris.* Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 1, pp. 201-361, pls. 8-9.

1880. *Revision des Garidées du Muséum d'Histoire Naturelle, Paris.* Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 3, pp. 57-129, pls. 4-5.

1881. *Revision des Donacidées du Muséum d'Histoire Naturelle, Paris.* Mus. Hist. Nat., Nouv. Arch., sér. 2, vol. 4, pp. 57-129, pls. 3-4.

Bigelow, H. B.

1926. *Plankton of the offshore waters of the Gulf of Mexico.* U. S. Bur. Fish., Bull., vol. 40, pt. 2, pp. 1-509, figs. 1-134.

Binney, W. G.

1863-64. *Bibliography of North American conchology previous to the year 1860.* Smithsonian Misc. Collections, vol. 5, vii + 650 pp.; vol. 9, v + 306 pp.

Biondi, Salvatore

1859. *Descrizione di alcune specie malacologiche nuove che vivono ne nostro littorale.* Accad. Gioenia Sci. Nat. Catania, Atti, ser. 2, vol. 14, pp. 115-122, 1 pl.

Bizet, Edouard

1892. *Catalogue des mollusques . . . dans le Département de la Somme.* Soc. Linnéenne du Nord de France, Mém., vol. 8, pp. 262-405.

Blaney, Dwight

1904. *List of shell-bearing Mollusca of Frenchman's Bay, Maine.* Boston Soc. Nat. Hist., Proc., vol. 32, No. 2, pp. 23-41, pl. 1.

Bois-Reymond Marcus, Eveline de

1956. *On some Prosobranchia from the coast of São Paulo.* Bol. Inst. Oceanográfico, vol. 7, Nos. 1-2, pp. 3-28, pls. 1-4.

Boissevain, Maria

1906. *The Scaphopoda of the Siboga Expedition treated together with the known Indo-Pacific Scaphopoda. Mollusca II.* Siboga Expeditie, vol. 28, 76 pp., 6 pls., 39 text figs.

Bolten, J. F.

1798. *Museum Boltenianum . . . pars secunda continens Conchylia sive Testacea univalvia, bivalvia & multivalvia.* Hamburg, viii + 199 pp.

Boone, Lee

1928. *Scientific results of the First Oceanographic Expedition of the "Pawnee" 1925. Mollusca from tropical East American seas.* Bingham Oceanogr. Coll., Bull., vol. 1, art. 3, pp. 1-20, figs. 1-5.

Borchert, Aloys

1901. *Die Molluskenfauna und das Alter der Paraná-Stufe.* Stuttgart, 78 pp., 5 pls.

Bosc, L. A. G.
1901. *Histoire naturelle des coquilles.* Paris, vol. 3.
Böse, Emilio
1905. *Reseña acerca de la geología de Chiapas y Tabasco.* Inst. Geol. Mexico, Bol., vol. 20, 116 pp., 9 pls.
1907. *Sobre algunos fósiles Pleistocénicos en la Baja California recogidos por el Sr. Dr. E. Angermann.* Inst. Geol. Mexico, Parergones, vol. 2, No. 2, pp. 41-45.
de Boury, Eugène
1911. *Sur les Scalaria du Chili.* Rev. Chilena Hist. Nat., año 15, No. 1, pp. 33-37.
1912-13. *Description de Scalidae nouveaux ou peu connus.* Jour. Conchyl., vol. 60, pp. 169-196 (1912); pp. 270-322 (1913), pls. 7-10.
1913. *Observations sur quelques espèces ou sous-genres de Scalidae.* Jour. Conchyl., vol. 61, pp. 65-112.
Bowles, Edgar
1939. *Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coast Plain of North America.* Jour. Paleont., vol. 13, No. 3, pp. 267-336, pls. 31-34.
Bousfield, E. L.
1958. *Littoral marine arthropods and mollusks collected in western Nova Scotia, 1956.* Nova Scotian Inst. Sci., Proc., vol. 24, pt. 3, pp. 303-325, fig. 1.
1960. *Canadian Atlantic Sea Shells.* Nat. Mus. Canada, 72 pp., 133 figs.
Bousfield, E. L., and Leim, A. H.
1958. *The fauna of Minas Basin and Minas Channel.* Nat. Mus. Canada, Bull. No. 166, Contrib. to Zool., pp. 1-29, figs. 1-3.
Bradley, W. H., and Cooke, Peter
1959. *Living and ancient populations of the clam Gemma gemma in a Maine coast tidal flat.* Fish and Wildlife Serv., Fishery Bull. 137, pp. 305-334, figs. 1-18.
Branner, John Casper
1919. *Outlines of the geology of Brazil to accompany the Geologic Map of Brazil.* Geol. Soc. Amer., Bull., vol. 30, pp. 189-338, pls. 7 (colored map), 8-10.
Brown, C. Barrington
1879. *On the Tertiary deposits on the Solimoes and Javary Rivers in Brazil.* Geol. Soc. London, Quart. Jour., vol. 35, pp. 77-82.
Brocchi, G. B.
1814. *Conchiologia fossile Subapennina con osservazioni geologiche sugli Apennini e sul suolo adiacente.* Milano, 2 vols., 712 pp., 16 pls.
Bronn, H. G.
1832. *Ergebnisse meiner naturhistorisch-ökonomischen Reisen. Zweyter Theil: Skizzen und Ausarbeitungen über Italien nach einem zweiten Besuche in Jahre 1827.* Heidelburg, Leipzig, xviii + 686 pp., 3 pls.
Brooks, Stanley T.
1933. *Natica sancti-vicentii, sp. nov.* Carnegie Mus., Ann., vol. 21, No. 4, p. 413, fig. 1.
Brown, [Captain] Thomas
1835. *Description of a new British shell—The clouded scallop—Pecten nebulosus.* Edinburgh Jour. Nat. Hist., vol. 1, p. 9, text fig.
Bruff, Stephen C.
1946. *The paleontology of the Pleistocene molluscan fauna of the Newport Bay area, California.* Univ. California Publ., Bull. Dept. Geol. Sci., vol. 27, pp. 213-240, 12 figs.

Brugnone, G. A.

1862. *Memoria sopra alcuni pleurotomi fossili dei dintorni di Palermo.* Palermo, 41 pp., 2 pls.

1877. *Osservazione critiche sul catalogo delle conchiglie fossili di Monte Pellegrino e Ficarazzi del March. di Monterosato.* Soc. Malac. Italiana, Bull., vol. 3, pp. 17-46.

Bucknill, C. E. R.

1924. *On Turbonilla powelli, nov. spec.* Malac. Soc. London, Proc., vol. 16, pt. 3, p. 122, fig.

1927. *Description of two new species of marine gasteropod.* New Zealand Inst., Trans., vol. 58, pp. 312, pl. 35.

Burkenroad, M. D.

1933. *Pteropoda from Louisiana.* Nautilus, vol. 47, pp. 54-57.

Burn, Robert

1960a. *A bivalve gastropod.* Nature, vol. 186, No. 4719, p. 179.

1960b. *Australian bivalve gastropods.* Nature, vol. 187, No. 4731, pp. 44-46, 14 text figs.

Bush, Katherine J.

1883. *Catalogue of Mollusca and Echinodermata dredged on the coast of Labrador by the expedition under the direction of Mr. W. A. Stearns in 1882.* U. S. Nat. Mus., Proc., vol. 6, pp. 236-247, pl. 9.

1893. *Report on the Mollusca dredged by the "Blake" in 1880, including descriptions of several new species.* Mus. Comp. Zool., Bull., vol. 23, pp. 199-244, pls. 1-2.

1909a. *Notes on the family Pyramidellidae.* Amer. Jour. Sci., ser. 4, vol. 27, pp. 475-484, figs. 1-12.

1909b. *A new Bela from Frenchman's Bay, Maine.* Nautilus, vol. 23, pp. 61-62, 1 fig.

Button, Fred L.

1902. *West American Cypraeidae.* Jour. Conch., vol. 10, No. 8, pp. 254-258.

Butterlin, Jacques

1960. *Géologie générale et régionale de la Republique d'Haiti.* Inst. Htes. Amérique Latine, Trav. et Mém., No. 6, 194 pp., 17 figs., 18 pls., 15 tables, 1 geol. map.

Cameron, Roderick

1961. *Shells.* [In] *Pleasures and Treasures.* New York, G. P. Putman's Sons, 128 pp., 32 pls., 95 figs.

Campbell, G. Bruce

1961. *Colubrariidae (Gastropoda) of tropical west America, with a new species.* Nautilus, vol. 74, No. 4, pp. 136-142.

Carcelles, Alberto R.

1938. *Moluscos del contenido estomocal de "Astropecten cingulatus" Sladen.* Physis, vol. 12, pp. 251-266, pls. 1-2.

1939. *"Pectunculus longior" y "Mesodesma mactroides" de la Argentina y Uruguay.* Physis, vol. 17, pp. 735-743, figs. 1-3.

1941a. *"Pododesmus" de la Argentina y Uruguay.* Physis, vol. 19, pp. 5-10, pls. 1-2.

1941b. *"Erodona mactroides" en el Rio de La Plata.* Physis, vol. 19, pp. 11-21, 1 pl.

1942. *Nota sobre el mejillon "Aulacomya magellanica" (Chemnitz).* Physis, vol. 19, pp. 180-190, pls. 1-2.

1943a. *Sobre las variaciones de Pitaria rostrata (Koch).* Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 1, No. 7, pp. 1-10, pls. 1-3.

1943b. *Observaciones sobre Trophon varians (d'Orbigny)*. Inst. Mus. Univ. Nac. La Plata, Notas Mus. La Plata, Zoología, vol. 8, No. 72, pp. 431-437, pls. 1-3.
1944a. *Las especies del género Capulus Montfort 1810, en aguas Argentinas*. Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 1, No. 9, pp. 1-5, figs. 1-2.
1944b. *Nota sobre algunos moluscos Magallañicos obtenidos frente al Río de La Plata*. Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 1, No. 19, pp. 1-11, pl. 1.
1944c. *Nuevos datos sobre el contenido estomocal de "Astropecten cingulatus" Sladen*. Physis, vol. 19, pp. 461-472.
1944d. *Catálogo de los moluscos marinos de Puerto Quequén (República Argentina)*. Inst. Univ. Nac. La Plata, Rev. Mus. La Plata, nueva serie, sección Zoología, vol. 3, pp. 233-309, pls. 1-15.
1945a. *Las especies actuales de "Tegula" en la República Argentina*. Physis, vol. 20, pp. 31-40, figs. 1-19.
1945b. *Nota sobre los moluscos citados Darwin, Ameghino y Bravard para la formación pampeana de Puerto Belgrano, República Argentina*. Physis, vol. 20, pp. 41-49.
1946a. *Notas sobre dos especies Argentinas de Marginellidae*. Inst. Mus. Univ. Nac. La Plata, Notas Mus. La Plata, Zoología, vol. 11, No. 92, pp. 51-57.
1946b. *Observaciones sobre algunas especies actuales y fósiles de Trophon*. Mus. Univ. Nac. La Plata, Notes Mus. La Plata, vol. 11, Zoología, No. 93, pp. 59-89, figs. 1-13.
1947a. *Notas sobre algunos gastrópodos marinos del Uruguay y la Argentina*. Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 2, No. 40, pp. 1-27, pls. 1-7.
1947b. *Notas sobre algunos bivalvos Argentinos. I. Notas sobre Plicatula mesembrina Dall*. Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 2, No. 41, pp. 1-10, figs. 1-3, pl. 1.
1950. *Catálogo de los moluscos marinos de la Patagonia*. Mus. Nahuel Huapi Perito Dr. Francisco P. Moreno, An., pp. 41-100, pls. 1-6, map.
1953. *Nuevas especies de gastrópodos marinos de las repúblicas oriental del Uruguay y Argentina*. Mus. Hist. Nat. Montevideo, Comunic. Zoológicas, vol. 4, No. 70, pp. 1-16, pls. 1-5.
1954a. *Especies sudamericanas de Argobuccinum Burguière 1792*. Inst. Nac. Investig. Cienc. Nat. y Mus. Argentino Cienc. Nat. "Bernardino Rivadavia", Rev., Cienc. Zoológicas, vol. 2, No. 15, pp. 243-254, 1 pl.
1954b. *Observaciones sobre los géneros Nucella, Chorus, y Concholepas*. Inst. Nac. Investig. Cienc. Nat. y Mus. Argentino Cienc. Nat. "Bernardinao Rivedavia", Rev., Cienc. Zoológicas, vol. 2, No. 16, pp. 254-275, pls. 1-5.

Carcelles, Alberto, and Parodiz, Juan José

1939. *"Dorsaninae" Argentinas y Uruguayas*. Physis, vol. 17, pp. 745-769, figs. 1-6, 1 pl.

Carcelles, A. R., and Williamson, S. I.

1951. *Catálogo de los moluscos marinos de la Provincia Magallanica*. Inst. Nac. Investig. Cienc. Nat. y Mus. Argentino Cienc. Nat. "Bernardino Rivadavia", Rev., Cienc. Zoológicas, vol. 2, pp. 225-383.

Carlson, C. E.

1925. *Geological notes on a part of southern Trinidad, B.W.I.* Econ. Geol., vol. 20, pp. 152-167.

Carpenter, Horace F.

1889. *A catalogue of the shell-bearing Mollusca of Rhode Island.* Providence, 2d ed., 7 pp.

1901-02. *The shell-bearing Mollusca of Rhode Island.* Nautilus, vol. 15, pp. 92-96, 104-107, 113-115, 130-132.

Carpenter, Philip Pearsall

1863. *Review of Prof. C. B. Adams's Catalogue of the shells of Panama from the type specimens.* Zool. Soc. London, Proc., pp. 1-31, 339-369.

Carson, Carlton M.

1925. *Some new species from the Pliocene of southern California with a few changes in nomenclature.* Southern California Acad. Sci., Bull., vol. 24, pt. 2, pp. 31-35, pl. 1.

Cary, L. R.

1906. *A contribution to the fauna of the coast of Louisiana.* Gulf Biol. Sta. Louisiana, Bull., vol. 6, pp. 50-59.

Casey, Thomas L.

1904. *Notes on the Pleurotomidae with descriptions of some new genera and species.* Acad. Sci. St. Louis, Trans., vol. 14, No. 5, pp. 123-170.

Chapman, F., and Singleton, F. A.

1925. *A revision of the Cainozoic species of Glycymeris in southern Australia.* Roy. Soc. Victoria, Proc., vol. 37, new ser., pt. 1, art. 2, pp. 18-60, pls. 1-4.

Chace, E. P.

1958. *A new mollusk from San Felipe, Baja California.* San Diego Soc. Nat. Hist., Trans., vol. 12, No. 19, pp. 233-234, fig. 1.

1958b. *The marine molluscan fauna of Guadalupe Island, Mexico.* San Diego Soc. Nat. Hist., Trans., vol. 12, No. 19, pp. 319-332, fig. 1.

Chase, Philip W.

1933. *The geology along the Perene and Tambo Rivers of eastern Peru.* Jour. Geol., vol. 41, pp. 513-526.

Chaster, G. W., Knight, G. A. F., Melvill, J. C., and Hoyle, W. E.

1901. *List of British marine Mollusca and Brachiopoda.* Jour. Conch., vol. 10, pp. 9-27.

Chavan, André

1940. *Sur deux nouveaux groupes de Carditidae.* Jour. Conchyl., vol. 84, pp. 97-102, figs. 1-2.

1946. *Nouvelles notes sur les Jagonia (Lamellibranches).* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 4, pp. 345-347.

Chenu, James Charles

1842-53. *Illustrations conchyliologiques ou description et figures de tout les coquilles connues vivants et fossiles, classées suivant le système de Lamarck modifié d'apres les progrès de la science, et comprenant les genres nouveaux et les espèces récement découvertes.* Paris, 4 vols., 215 pp., 481 pls.

1845. *Bibliothèque Conchyliologique. Le Conchyliologiste Universel ou figures des coquilles jusqu'a présent inconnues recueillies en divers voyages a la mer du sud depuis l'année 1764 par Thomas Martin. Ouvrage revu par J. C. Chenu.* Ser. 1, vol. 2, pp. vi+32, pls. 1-56.

Clapp, W. F.

1923. *A new species of Teredo from Florida.* Boston Soc. Nat. Hist., Proc., vol. 37, pp. 31-38, 1 fig., pls. 3-4.

Clarke, Arthur H.

1954. *Shell bearing marine mollusks of Cape Ann, Massachusetts.* Nautilus, vol. 67, No. 4, pp. 112-120, pl. 9, right fig.

1959. *New abyssal mollusks from off Bermuda collected by Lamont Geological Observatory research vessels.* Malac. Soc. London, Proc., vol. 33, pt. 5, pp. 231-238, 1 text fig., pl. 13.

Clench, William J.

1928. *Venus mercenaria var. notata Say.* Nautilus, vol. 14, pp. 120-124.

1951. *Busycon coarcticum Sowerby.* Occas. Papers on Mollusks, vol. 1, No. 16, pp. 405-412, pl. 50.

1955. *A new Murex from Matanzas, Cuba.* Breviora, No. 44, 2 pp., figs. 1-3.

Clench, William J., and Aguayo, Carlos Guillermo

1939. *A new Orthaulax from western Cuba.* Soc. Cubana Hist. Nat. "Felipe Poey", Mem., vol. 13, No. 5, pp. 357-358, pls. 47-48.

Clench, William J., and Smith, Lillian Cassat

1944. *The family Cardiidae in the Western Atlantic.* Johnsonia, vol. 1, No. 13, 32 pp., 13 pls.

Clessin, Stephan

1887-89. *Die Familie der Chamiden. Chama.* [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, pts. 360, 362, 366, vol. 8, No. 5, pp. 1-16, pls. 3-10.

Mytilacea. [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, pt. 361, vol. 8, No. 3, pp. 125-132, pls. 33-34.

Cardita. [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, pts. 356, 360, vol. 10, No. 1, pp. 17-60, pls. 6-13.

Solenacea. [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, pts. 361, 362, 364, 366, vol. 11, No. 3, pp. 17-96, pls. 8-25.

1890-91. *Die Familie Malleacea.* [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, vol. 8, No. 1, 108 pp., 50 pls.

1893-95. *Die Familie Gastrochaenidae.* [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, vol. 11, No. 4a, 57 pp., 21 pls.

1904. *Die Familie Vermetidae.* [In] Martini and Chemnitz, Syst. Conchylien-Cabinet, vol. 6, No. 6, 124 pp., 15 pls.

Cleve, P. T.

1871. *On the geology of the North-Eastern West India islands.* Kongl. Svenska Vetenskabs-Akad. Handligar, vol. 9, No. 12, 48 pp., 2 pls.

1881. *Outline of the geology of the NE. West Indian islands.* New York Acad. Sci., Trans., vol. 1, pp. 21-24.

1882. *Outline of the geology of the Northeastern West India islands.* New York Acad. Sci., Ann., vol. 2, pp. 185-192, pl. 17.

Cockerell, Theodore D. A.

1894. *A list of the Brachiopoda, Pelecypoda, Pteropoda and Nudibranchiata of Jamaica, living and extinct.* Nautilus, vol. 7, pp. 103-107, 113-118.

Coe, W. R.

1953. *Resurgent populations of littoral marine invertebrates and their dependence on ocean currents and tidal currents.* Ecology, vol. 34, No. 1, pp. 225-229, fig. 1.

1955. *Ecology of the bean clam Donax gouldi on the coast of southern California.* Ecology, vol. 36, No. 3, pp. 512-514, figs.

Coen, S. G.

1940. *Sul genere "Astarte" J. Sowerby 1811.* Pontifica Academia Scientarum, Acta, vol. 4, No. 24, pp. 199-202, pls. 1-2.

Colman, John

1932. *A statistical test of the species concept in Littorina.* Biol. Bull., vol. 62, No. 3, pp. 223-243, 11 figs., 8 tables.

Comfort, A.

1957. *The duration of life in mollusks.* Malac. Soc. London, Proc., vol. 32, pt. 6, pp. 219-241, 2 figs., 1 table.

Conchological Club of Southern California

1944. *Distribution list of the West American marine mollusks from San Diego to the Polar Sea.* Conch. Club Southern California, Los Angeles, Minutes, No. 35, pp. 3-14a, 21 text figs.

Conklin, Edwin G.

1898. *Environmental and sexual dimorphism in Crepidula.* Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 435-444, pls. 21-23.

Conrad, Timothy A.

1831. *American Marine Conchology; or descriptions and coloured figures of the shells of the Atlantic coast of North America.* Philadelphia, 40 pp., 8 pls.

1834c. *Description of a new species of Hinnita.* Acad. Nat. Sci. Philadelphia, Jour., 1st ser., vol. 7, pp. 182-183, pl. 14.

1838. *Fossils of the Medial Tertiary of the United States.* Philadelphia, 89 pp., 49 pls.

1848c. *Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi; with an appendix.* Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 1, pp. 111-134, pls. 11-14.

1849. *Descriptions of new fossil and Recent shells of the United States.* Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 1, pp. 207-209.

1850. *Description of one new Cretaceous and seven new Eocene fossils.* Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 2, pp. 39-41, 1 pl.

1956. *Descriptions of eighteen new Cretaceous and Tertiary fossils.* Acad. Nat. Sci. Philadelphia, Proc., vol. 7, pp. 265-268.

1857e. *Descriptions of three new genera; twenty-three new species of middle Tertiary fossils from California, and one from Texas.* Acad. Nat. Sci. Philadelphia, Proc., vol. 8, pp. 312-316.

1862. *Description of new genera, subgenera, and species of Tertiary and Recent shells.* Acad. Nat. Sci. Philadelphia, Proc., vol. 14, pp. 284-291.

1866e. *Descriptions of new marine bivalve Mollusca.* Amer. Jour. Conch., vol. 2, pt. 3, No. 6, pp. 280-281, pl. 15.

1867. *Paleontological miscellanies.* Amer. Jour. Conch., vol. 3, pt. 1, No. 4, pp. 5-7.

Cooke, C. Wythe

1928. *New Vicksburg (Oligocene) mollusks from Mexico.* U. S. Nat. Mus., Proc., vol. 73, No. 2731, art. 10, pp. 1-11, pls. 1-2.

1961. *Cenozoic and Cretaceous echinoids from Trinidad and Venezuela.* Smithsonian Misc. Collections, vol. 142, No. 4, Publ. No. 4459, 35 pp., 14 pls.

Cooper, J. E., and Preston, H. B.

1910. *Diagnoses of new species of marine and freshwater shells from the Falkland Islands, including descriptions of two new genera of marine Pelecypoda.* Ann. Mag. Nat. Hist., ser. 8, vol. 5, pp. 110-114, pl. 4.

Cossmann, Alexandre Edouard Maurice

1886. *Catalogue des coquilles fossiles de l'éocène des environs de Paris.* Soc. Roy. Malac. de Belgique, Ann., vol. 21, pp. 17-186, pls. 1-8.

1899. *Description de quelques coquilles de la formation Santacruzienne en Patagonie.* Jour. Conchyl., vol. 47, pp. 223-242.

Cotton, Bernard C.

1932. *Notes on Australian Mollusca, with descriptions of new genera and new species.* South Australia Mus., Rec., vol. 4, No. 4, pp. 537-547, figs. 1-9.

Cotton, Bernard C., and Godfrey, Frank K.

1933. *South Australian shells, Pt. 8, Scaphopoda.* The South Australian Naturalist, pp. 135-150.

1934. *South Australian Shells. Pt. 10, Fissurellidae.* The South Australian Naturalist, pp. 41-56, pl. 1.

1945. *A catalogue of the cone shells (Conidae) in the South Australian Museum.* South Australian Mus., Rec., vol. 8, pp. 229-280.

Cotton, Bernard C., and Wood, Nelly Hooper

1935. *The correlation of Recent and fossil Turritellidae of southern Australia.* South Australian Mus., Rec., vol. 5, No. 3, pp. 369-387, figs. 1-7.

Coues, Elliott, and Yarrow, H. C.

1878. *Notes on the natural history of Fort Macon, N. C., and vicinity (No. 5).* Acad. Nat. Sci. Philadelphia, Proc., vol. 30, pp. 120-148.

Cox, Leslie Reginald

1929a. *Notes on the Mesozoic family Tancrediidae, with descriptions of several British upper Jurassic species, and of a new genus Eodonax.* Ann. Mag. Nat. Hist., ser. 10, vol. 3, pp. 569-594, pls. 13-14.

1929b. *Notes on the post-Miocene Ostreidae and Pectinidae of the Red Sea region.* Malac. Soc. London, Proc., vol. 18, pp. 165-209.

1930. *Miocene Mollusca. Pliocene Mollusca. Post-Pliocene Mollusca.* [In] *Reports on geological collections from the coastlands of Kenya Colony made by Miss M. McKinnon Wood.* Geol. Dept. Hunterian Mus. Glasgow Univ., Mon., pp. 103-164, pls. 12-15.

1948. *Neogene Mollusca from the Dent Peninsula, British North Borneo.* Schweizerische Palaeont. Gesell., Abhandl., vol. 66, No. 2, pp. 1-70, 3 figs., pls. 1-6.

1960a. *Thoughts on the classification of the Gastropoda.* Malac. Soc. London, Proc., vol. 33, pt. 6, pp. 239-261.

1960b. *Thoughts on the classification of the Bivalvia.* Malac. Soc. London, Proc., vol. 34, pt. 2, pp. 60-88, 2 figs.

Cox, L. R., and Rees, W. J.

1960. *A bivalve gastropod.* Nature, vol. 185, No. 4715, pp. 749-751.

Crosse, H.

1865c. *Description d'espèces nouvelles.* Jour. Conchyl., vol. 13, pp. 27-32.

1867a. *Descriptions d'espèces nouvelles.* Jour. Conchyl., vol. 15, pp. 64-68.

1867b. *Description d'un genre nouveau de la famille des Fissurellidae: Semperia.* Jour. Conchyl., vol. 15, pp. 74-78, pl. 2, fig. 20.

1869. *Diagnoses molluscorum novorum.* Jour. Conchyl., vol. 17, pp. 183-188.

1872. *Note sur quelques formes remarquables de Marginella provenant de la côte Atlantique du Sahara.* Jour. Conchyl., vol. 20, pp. 215-217.

1875. *Description du nouveau genre, Berthelinia.* Jour. Conchyl., vol. 23, pp. 79-81, pl. 2, fig. 3.

Crosse, H., and Fischer, P.

1890. *Mission scientifique au Mexique et Amérique Centrale. Zoologie,* pt. 7, *Mollusques,* vol. 2, pp. 497-505, pl. 62.

Cundall, Frank

1902. *Bibliographia . . . Jamaicensis.* Kingston, 84 pp. *Supplement,* 1907, 38 pp.

1909. *Bibliography of the West Indies (exclusive Jamaica).* The Inst. of Jamaica, 179 pp.

Dakin, William John

1928. *The anatomy and phylogeny of Spondylus.* Roy. Soc. London, Proc., ser B., vol. 103, pp. 337-354, figs 1-7.

Dall, William Healy

1870d. *Revision of the Mollusca of Massachusetts.* Boston Soc. Nat. Hist., Proc., vol. 13, pp. 240-257.

1880. *Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico and in the Caribbean Sea, 1877-79, by the U. S. Coast Survey Steamer Blake, Lieutenant-Commander Sigsbee, U.S.N., and Commander J. R. Bartlett, U.S.N., commanding. V. General conclusions from a preliminary examination of the Mollusca.* Mus. Comp. Zool., Bull., vol. 6, pp. 85-93.

1886c. *Report on the mollusks collected by L. M. Turner at Ungava Bay, North Labrador, and from the adjacent Arctic seas.* U. S. Nat. Mus., Proc., vol. 9, pp. 202-208, figs. 1-3.

1887. [*Shells found in the Antilles*]. Conch. Exchange, vol. 2, pp. 9-10.

1889e. *Notes on the anatomy of Pholas (Barnea) costata Linné and Zirphaea crispata Linné.* Acad. Nat. Sci. Philadelphia, Proc., vol. 41, pp. 274-276.

1891a. *On a new subgenus of Meretrix with descriptions of two new species from Brazil.* Nautilus, vol. 5, No. 3, pp. 26-29, 2 figs.

1891b. *On some marine mollusks from the southern coast of Brazil.* Nautilus, vol. 5, pp. 42-44; vol. 6, pp. 109-111.

1892a. *On the species of Donax of eastern North America.* Nautilus, vol. 5, pp. 125-127.

1892b. *On an undescribed Cytherea from the Gulf of Mexico.* Nautilus, vol. 5, No. 12, pp. 134-135.

1894h. *Cruise of the steam yacht "Wild Duck" in the Bahamas, January to April, 1893, in charge of Alexander A'gassiz. II. Notes on the shells collected.* Mus. Comp. Zool., Bull., vol. 25, No. 9, pp.113-124, 1 pl.

1894i. *Report on the Mollusca and Brachiopoda dredged in deep water, chiefly near the Hawaiian Islands, with illustrations of hitherto unfigured species from northwest America.* U. S. Nat. Mus., Proc., vol. 17, pp. 675-733, 2 figs., pls. 23-32.

1895. *Three new species of Macoma from the Gulf of Mexico.* Nautilus, vol. 9, pp. 32-34.

1896e. *The mollusks and brachiopods of the Bahama Expedition of the State University of Iowa.* State Univ. Iowa, Nat. Hist. Bull., vol. 4, No. 1, pp. 12-127, 1 pl.

1896f. *Report on the mollusks collected by the International Boundary Commission of the United States and Mexico, 1892-1894.* U. S. Nat. Mus., Proc., vol. 19, No. 1111, pp. 333-379, pls. 31-33.

1896g. *On some new species of Scala.* Nautilus, vol. 9, pp. 111-112.

1896h. *On the American species of Ervilia.* Nautilus, vol. 10, pp. 25-27.

1896i. *On the American species of Cyrenoidea.* Nautilus, vol. 10, pp. 51-52.

1897d. *On a new form of Polygira from New Mexico.* Nautilus, vol. 11, No. 1, pp. 2-3.

1897e. *Synopsis of the Pinnidae of the United States and the West Indies.* Nautilus, vol. 11, No. 1, pp. 25-26.

1898e. *On the genus Halia of Risso.* Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 190-192.

1898f. *A new species of Terebra from Texas.* Nautilus, vol. 12, pp. 44-45.

1901d. *Synopsis of the family Tellinidae and of the North American species.* U. S. Nat. Mus., Proc., vol. 23, No. 1210, pp. 285-326, pls. 2-4.

1902d. *Note on the names Elachista and Pleurotomaria.* Nautilus, vol. 15, p. 127.

1902e. *On the genus Gemma, Deshayes.* Jour. Conch., vol. 10, No. 8, pp. 238-243.
1903f. *Review of the classification of the Cyrenacea.* Biol. Soc. Washington, Proc., vol. 25, pp. 335-346.
1905d. *Fossils of the Bahama Islands, with a list of non-marine mollusks.* Geogr. Soc. Baltimore, 47 pp., pls. 11-13.
1907a. *A review of the American Volutidae.* Smithsonian Misc. Collections, vol. 48, No. 1663, pt. 3, pp. 341-373.
1907b. *Three new species of Scala from California.* Nautilus, vol. 20, No. 11, pp. 127-128.
1907c. *A new Cerithium from the Florida Keys.* Nautilus, vol. 21, No. 1, pp. 22-23.
1907d. *On the synonomic history of the genus Clava Martyn and Cerithium Bruguière.* Acad. Nat. Sci. Philadelphia, Proc., vol. 59, pp. 363-369.
1907e. *Description of new species of shells, chiefly Buccinidae, from the dredgings of the U.S.S. "Albatross" during 1906, in the Northwestern Pacific, Bering, Okhotsk, and Japanese seas.* Smithsonian Misc. Collections, vol. 50, pp. 139-173.
1908d. *A new West Indian Nitidella.* Nautilus, vol. 22, pp. 31-32.
1909d. *Paradione n. n. vice Chionella.* Malac. Soc. London, Proc., vol. 8, p. 197.
1910d. *List of shells collected by Dr. John I. Northrop in the Bahamas, identified by Professor William Healy Dall, Smithsonian Institution,* pp. 99-102. [In] J. I. Northrop, *A Naturalist in the Bahamas.* New York, Columbia University Press, xv + 281 pp., illustr.
1912c. *Note on the genus Panope, Ménard.* Malac. Soc. London, Proc., vol. 10, pt. 1, pp. 34-35.
1913c. *Note on the generic name Pectunculus.* Malac. Soc. London, Proc., vol. 10, pp. 255-256.
1914e. *Mollusca from South Georgia* [In] *A report on the South Georgia Expedition.* Mus. Brooklyn Inst. Arts and Sci., Sci. Bull., vol. 2, No. 4, pp. 69-70.
1915h. *An index to the Museum Boltenianum.* Smithsonian Inst., Publ. 2360, 64 pp.
1918e. *Pleistocene fossils of Magdalena Bay, Lower California, collected by Charles Russell Orcutt.* Nautilus, vol. 32, pp. 23-26.
1919c. *The Mollusca of the Arctic coast of America collected by the Canadian Arctic Expedition west from Bathurst Inlet, with an appended report on a collection of Pleistocene fossil Mollusca.* Canadian Arctic Expedition Rept., Ottawa, vol. 8, pt. A, 29 pp., 3 pls.
1920. *Pliocene and Pleistocene fossils from the Arctic coast of Alaska and the auriferous beaches of Nome, Norton Sound, Alaska.* U. S. Geol. Sur., Prof. Paper 125-C, pp. 23-37, pls. 5-6.
1921c. *Nomenclatural notes.* Nautilus, vol. 35, pp. 49-50.
1921d. *New shells from the Pliocene or early Pleistocene of San Quentin.* West American Scientist, vol. 19, No. 3, pp. 21-24.
1921d. *Species named in the Portland catalogue.* Nautilus, vol. 34, pp. 97-100, 124-132.
1922f. *Fossils of the Olympia Peninsula.* Amer. Jour. Sci., ser. 5, vol. 4, pp. 305-314.
1923e. *Notes on Drupa and Morula.* Acad. Nat. Sci. Philadelphia, Proc., vol. 75, pp. 203-206.
1925e. *Note on the species of Petricolaria of the eastern coast of the United States.* Biol. Soc. Washington, Proc., vol. 38, p. 90.
1926a. *A new Margarites from Greenland.* Biol. Soc. Washington, Proc., vol. 39, p. 59.

1926b. *A new Pecten from Colombia.* Biol. Soc. Washington, Proc., vol. 39, pp. 61-62.

Dall, William Healy, and Bartsch, Paul

1903. *The paleontology and stratigraphy of the Marine Pliocene and Pleistocene of San Pedro, California. LXIV. Family Pyramidellidae.* California Acad. Sci., Mem., vol. 37, pp. 269-366, pls. 1-2.

1913. *New species of mollusks from the Atlantic and Pacific coasts of Canada.* Victoria Mem. Mus., Bull., vol. 1, pp. 139-146, pl. 10.

Daudin, F. M.

1800. *Recueil de mémoires et de notes sur les espèces inédites ou peu connes de mollusques, der vers et de zoophytes.* Paris, 50 pp., 4 pls.

Dautzenberg, Philippe

1889. *Contribution à la faune malacologique des Iles Acores.* [In] *Résultats des campagnes scientifiques accomplies sur son yacht par Albert Ier, Prince de Monaco.* Monaco, fasc. 1, 112 pp., 4 pls.

1892. *Description d'une espèce nouvelle du genre Chama provenant des côtes océaniques de France.* Soc. Sci. Nat. de l'ouest de la France, Bull., vol. 2.

1895. *De l'existence du genre Berthelinia Crosse à l'epoque actuelle.* Soc. Zool. France, Bull., vol. 20, pp. 37-38, text figs. A, B.

1896. *Liste de mollusques du Chili.* Soc. Sci. Chile, Actas, vol. 6, pp. lxiv-lxvii.

1900. *Croisières du yacht Chazalie dans l'Atlantique. Mollusques.* Soc. Zool. France, Mém., vol. 13, pp. 145-265, pls. 9-10.

1923. *Liste préliminaire des mollusques marins de Madagascar.* Jour. Conchyl., vol. 68, pp. 21-74.

1935. *Résultats scientifiques du voyage aux Indes Orientales Néerlandais de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. Gasteropodes marins. I, famille Terebridae. II, famille Mitridae.* Mus. Roy. Hist. Nat. Belgique, Mém., hors sér., vol. 2, pp. 1-208, pls. 1-4.

Dautzenberg, Philippe, and Bavay, A.

1912. *Les Lamellibranches de l'Expedition du Siboga. Mollusca III. Lamellibranchiata. Partie systématique I. Pectinidés.* Siboga-Expeditie, vol 29, 41 pp., 2 pls.

Dautzenberg, Philippe, and Bouge, J.-L.

1933. *Les mollusques testacés marins des établissements Française de l'Océanie.* Jour. Conchyl., vol. 77, pp. 41-108, 145-326, 351-469.

Dautzenberg, Philippe, and Dollfus, G. F.

1904. *Études critiques sur la nomenclature avec examen des genres Pectunculus et Glycimeris.* Jour. Conchyl., vol. 52, No. 2, pp. 109-122.

Dautzenberg, Philippe, and Fischer, Pierre Marie Henri

1897. *Dragages effectués par l'Hirondelle et par la Princess-Alice, 1888-1896.* Soc. Zool. France, Mém., vol. 10, pp. 139-234, pls. 3-7.

1905. *Mollusques provenant des dragages effectués à l'ouest de l'Afrique.* [*In*] *Résultats des campagnes scientifiques accomplies sur son yacht par Albert Ier, Prince de Monaco.* Monaco, fasc. 32, pp. 1-125, 5 pls.

1913. *Sur quelques types de Garidés de la collection de Lamarck existant au Muséum de Paris.* Jour. Conchyl., vol. 41, pp. 215-228, pls. 6-7.

Davenport, C. B.

1903. *Comparison of some Pectens from the east and west coasts of the United States.* Mark Anniversary Volume, art. 6, pp. 121-136, pl. 9.

Davidson, T.

1874. *Note on two Tertiary species of Brachiopoda from the island of St. Bartholomew, one of the N.E. West Indian islands.* Geol. Mag., ser. 2, vol. 1, pp. 158-159, pl. 8, figs. 11-12.

Davies, A. Morley

1933. *The basis of classification of the Lamellibranchiata.* Malac. Soc. London, Proc., vol. 20, pt. 6, pp. 322-326.

Davis, C. Abbott

1904. *Notes on the Mollusca of the Bermuda Islands.* Nautilus, vol. 17, No. 11, pp. 125-130, pl. 4.

De Kay, J. E.

1843. *Zoology of New York, or the New York fauna. Pt. 5, Mollusca.* Albany, 271 pp., 40 pls.

Dell, R. K.

1950a. *Notes on the taxonomy and distribution of some New Zealand Mollusca with description of four new species.* Dominion Mus., Rec. Zool., vol. 1, No. 3, pp. 21-28, figs. 1-10.

1950b. *A Tertiary molluscan fauna from Waikowhai, Manukau Harbour, Auckland.* Dominion Mus., Rec. Zool., vol. 1, No. 4, pp. 29-37, figs. 1-10.

1950c. *The molluscan genus Venustas in New Zealand waters.* Dominion Mus., Rec. Zool., vol. 1, No. 5, pp. 39-54, figs. 1-12.

1951. *A deep water molluscan fauna from off Banks Peninsula.* Canterbury Mus., Rec., vol. 6, No. 1, pp. 53-60, figs. 1-17.

1952a. *A revision of the molluscan fauna of the Hurupi beds, southern Wairarapa.* Dominion Mus., Rec. Zool., vol. 1, No. 8, pp. 71-86, figs. 1-21.

1952b. *A deep water molluscan fauna from the Tasman Sea.* Dominion Mus., Rec. Zool., vol. 1, No. 10, pp. 99-107, figs. 1-11.

1952c. *New marine Mollusca from the Cook Strait area and southern New Zealand.* Roy. Soc. New Zealand, Trans., vol. 79, pts. 3-4, pp. 412-418, pls. 84-85, text fig. 1.

1953. *A molluscan fauna from the Chatham Rise, New Zealand.* Dominion Mus., Rec. Zool., vol. 2, pt. 1, pp. 37-50, figs. 1-22.

1955. *A synopsis of the Nuculanidae with check lists of the Australasian Tertiary and Recent species.* Dominion Mus., Rec. Zool., vol. 2, pt. 3, pp. 123-134.

1956. *Some new off-shore Mollusca from New Zealand.* Dominion Mus., Rec. Zool., vol. 3, pt. 1, pp. 27-59, figs. 1-65.

Deshayes, Gérard Paul

1863. *Catalogue des mollusques de l'Ile de la Réunion (Bourbon).* [In] Maillard, L., *Notes sur l'Ile de Réunion (Bourbon).* Paris, pt. 2, annexe E, 144 pp., 14 pls.

Des Moulins, Charles

1832. *Description d'une nouveau genre de coquille vivante, bivalve, des mers du Chili.* Soc. Linnéenne Bordeaux, Actes, vol. 5, pp. 83-92.

Detweiler, John D.

1915. *Preliminary notes on the Mollusca of St. Andrews and vicinity, New Brunswick.* Dept. Marine and Fisheries, Fisheries Branch, Sessional Paper No. 39b, Contrib. Canadian Biol., Suppl., pp. 43-46.

Dexter, Ralph W.

1942. *Notes on the marine Mollusca of Cape Ann, Massachusetts.* Nautilus, vol. 56, No. 2, pp. 57-61.

DeLong, James H., Jr.

1941. *The paleontology and stratigraphy of the Pleistocene at Signal Hill, Long Beach, California.* San Diego Soc. Nat. Hist., Trans., vol. 9, pp. 229-252, 4 figs.

Dias da Rocha, Francisco

1908. *Boletim do Muzeu Rocha.* Vol. 1, No. 1, xviii + 155 pp.

1911. *Boletim do Muzeu Rocha.* Vol. 1, No. 2, xi + 119 pp.

Dixon, C. J.

1955a. *Geology of southern British Honduras, with notes on adjacent areas.* Belize, B. H., 85 pp. + bibliog. + index, 21 photos, 1 col. geol. map, 4 maps.

Dodge, Henry

1950. *Hiatella Daudin versus Saxicava Fleuriaude Bellevue.* Nautilus, vol. 64, No. 1, pp. 27-33.

1956. *A historical review of the mollusks of Linnaeus. Pt. 4. The genus Buccinum and Strombus of the class Gastropoda.* Amer. Mus. Nat. Hist., Bull., vol. 101, art. 3, pp. 153-312.

1958. *A historical review of the mollusks of Linnaeus. Pt. 6. The genus Trochus of the class Gastropoda.* Amer. Mus. Nat. Hist., Bull., vol. 116, art. 2, pp. 157-223.

1959. *Evidential factors in the identification of the Linnaean Mollusca.* Linnean Soc. London, Jour., Zoology, vol. 44, pp. 170-179.

Doello-Jurado, Martin

1915. *Algunos moluscos marinos Terciarios procedentes de un pozo surgente cerca de La Plata.* Physis, vol. 1, pp. 592-598.

1917a. *Notas sobre "Acanthina Calcar" (Martyn).* Physis, vol. 3, No. 14, pp. 271-283, figs. 1-3.

1917b. *Nota sobre "Turritella americana" (Bavard).* Physis, vol. 3, No. 14, pp. 283-287.

1918a. *Nota preliminar sobre la presencia de algunas especies de la fauna Magallánica frente a mar del Plata.* Physis, vol. 4, pp. 119-125.

1918b. *Dos nuevas especies de bivalvos marinos.* Physis, vol. 4, pp. 259-273, figs. 1-10.

1919a. *Dos nuevas especies de bivalvos marinos.* Mus. Hist. Nat. Montevideo, Comunic., Zool., vol. 3, No. 57, pp. 1-8, 1 fig., 1 pl.

1919b. *Une nouvelle espèce de "Miltha" du Tertiaire de l'Argentine.* Physis, vol. 4, pp. 558-562, 2 figs.

1922. *Un nuevo "Mytilus" fósil del Terciario de Patagonia.* Soc. Cientif. Argentina, An., vol. 94, 7 pp., 2 figs.

Dollfus, A., and Mont-Serrat, E. de

1868. *Voyage géologique dans les Républiques de Guatemala et de Salvador.* Paris, ix+539 pp., 18 pls.

Dollfus, Gustave F.

1909. *Étude critique sur quelques coquilles fossiles du Bordelais.* Soc. Linnéenne, Actes, vol. 62, pp. 335-379, pls. 11-15.

Doty, Maxwell S.

1957. *Rocky intertidal surfaces.* Geol. Soc. Amer., Mem. 67, vol. 1, pp. 535-585, 18 figs., 1 pl.

Douglas, James Archibold

1933. *The geology of the Marcapata valley in eastern Peru.* Geol. Soc. London, Quart. Jour., vol. 89, pp. 308-348, pls. 27-33.

Douvillé, Henri

1912. *Classification des lamellibranches.* Soc. Géol. France, Bull., sér. 4, vol. 12, pt. 7, pp. 419-467.

Ducros de Saint-Germain, A. M. P.

1857. *Revue critique du genre Oliva de Bruguière.* Ann. Scient., vol. 30, pp. 289-402.

Duméril, André Marie Constant

1806. *Zoologie analytique ou méthode naturelle de classification des animaux.* Paris.

Dunker, Wilhelm Bernhard Rudolph Hadrian

1852. *Aviculacea nova.* Zeitschr. f. Malakozool., yr. 9, pp. 73-80.

1853a. *Diagnoses molluscorum novarum.* Zeitschr. f. Malakozool., yr. 10, pp. 58-60, 95-96, 110-112.

1953b. *Index molluscorum quae in itinere ad Guineem inferiorem collegit Georgius Tams.* Novitates Conchologicae, Abbild. u. Beschr. neuer Conchylien, Suppl. 2, 74 pp., 10 pls.

1857a. *Mollusca nova collectonis Cumingiana.* Zool. Soc. London, Proc. for 1856, pp. 354-358.

1857b. *Mytilacea nova collectonis Cumingiana.* Zool. Soc. London, Proc. for 1856, pp. 358-366.

1861. *Solenacea nova collectonis Cumingiana.* Zool. Soc. London, Proc., pp. 418-427.

1862. *Species nonnullae Bursarum vel Ranellarum collectonis Cumingiana.* Zool. Soc. London, Proc., pp. 238-240.

1858-70. *Mollusca Marina.* Novitates Conchologicae, Abtheil 2, pp. iv + 144, 45 col. pls.

1871. *Mollusca nova Musei Godeffroy Hamburgensis.* Malakozool. Blätter, vol. 18, pp. 150-175.

1872-80. *Die Gattung Avicula.* Syst. Conchylien-Cabinet, vol. 7, pt. 3, pp. 1-58, pls. 1-18 (1872); pp. 59-68, pls. 19-24 (1879); pp. 69-84, pls. 25-27 (1880).

Durham, John Wyatt, and Allison, Edwin C.

1960. *Symposium. The biogeography of Baja California and adjacent seas. Pt. 1. The geologic history of Baja California and its marine faunas.* Syst. Zool., vol. 9, No. 2, pp. 47-91, 7 figs., 9 tables.

Duval, A.

1840. *Réflexions sur le genre Planaxe, et indication de deux espèces d'une variété nouvelle.* Zool. Soc. Cuvierienne, Rev., vol. 3, p. 107.

Eales, Nellie B.

1923. *British Antarctic ("Terra Nova") Expedition, 1910. Natural history report. Mollusca. Pt. 1-Gastropoda, Prosobranchia, Scaphopoda, and Pelecypoda.* British Mus. (Nat. Hist.), Zoology, vol. 7, No. 1, pp. 1-46, 42 figs.

Eames, F. E., and Cox, L. R.

1956. *Some Tertiary Pectinacea from East Africa, Persia, and the Mediterranean region.* Malac. Soc. London, Proc., vol. 32, pp. 1-68, 20 pls.

Emerson, William K.

1951b. *Nomenclatural notes on the Scaphopoda: The subgenus Dentale Da Costa.* Nautilus, vol. 65, No. 1, pp. 17-20.

1954. *Notes on the scaphopod mollusks: Rectification of nomenclature.* Biol. Soc. Washington, Proc., vol. 67, pp. 183-188.

1956c. *Upwelling and associated marine life along Pacific Baja California, Mexico.* Jour. Paleont., vol. 30, pp. 393-397, 1 fig.

1957. *Three new Tertiary scaphopods, with a review of extinct western North American Siphonodentaliidae.* Jour. Paleont., vol. 31, No. 5, pp. 985-991, pl. 126, figs. 1-5.

1958. *Notes on the scaphopod mollusks: Rectifications of nomenclature II.* Biol. Soc. Washington, Proc., vol. 71, pp. 91-94.

1960a. *Results of the Puritan-American Museum of Natural History Expedition to western Mexico. 2. Pleistocene invertebrates from Ceralvo Island.* Amer. Mus. Novitates, No. 1995, pp. 1-6.

1960b. *Pleistocene invertebrates from near Punta San José, Baja California.* Amer. Mus. Novitates, No. 2002, pp. 1-7.

1960c. *Pliocene and Pleistocene invertebrates from Punta Rosalía, Baja California.* Amer. Mus. Novitates, No. 2004, pp. 1-8.

1960. *Remarks on some Eastern Pacific muricid gastropods.* Amer. Mus. Novitates, No. 2009, pp. 1-15, figs. 1-7.

Emerson, William K., and Addicott, Warren O.

1958. *Pleistocene invertebrates from Punta Baja, Baja California, Mexico.* Amer. Mus. Novitates, No. 1909, 11 pp., 2 figs.

Emerson, William K., and Chace, Emery P.

1959. *Pleistocene mollusks from Tecolate Creek, San Diego, California.* San Diego Soc. Nat. Hist., Trans., vol. 12, pp. 335-346, 3 figs.

Engelmann, Wilhelm

1846. *Bibliotheca Historico-Naturalis.* Reprinted 1960, Engelmann and Wheldon & Wesley Ltd., viii + 786 pp.

Eudes-Deslongchamps, Jacques Amand

1859. *Catalogue des cirrhipèdes, des mollusques et des rayonnés recueillis par M. E. Déplanche, chirurgien auxilliaire de la Marine Impériale, pendant la campagne de l'aviso à vapeur le Rapide.* Soc. Linnéenne Normandie, Bull., vol. 4, 50 pp.

Falconer, J. D.

1902. *Evolution of the Antilles.* Scottish Geogr. Mag., vol. 18, pp. 369-379, 1 pl.

Faustino, Leopoldo A.

1928. *Summary of Philippine marine and freshwater mollusks.* Philippine Bur. Sci., Mon. No. 25.

Feruglio, Egidio

1936. *Nota preliminar sobre algunas nuevas especies de moluscos del supracretáceo y Terciario de la Patagonia.* Inst. Mus. Univ. Nac. La Plata, Notas Mus. La Plata, vol. 1, Paleontología, No. 6, pp. 277-300, pls. 1-2.

Férussac, André Etienne Just Paschal Joseph François d'Audebord

1820-22. *Tableaux systématique des animaux mollusques classés en familles naturelles, dans lesquels on à établi la concordance de tous les systèmes; suivis d'un prodrome générale pour tous les mollusques terrestres ou fluviatiles, vivants ou fossiles.* Paris, xiii + 110 pp.

Férussac, André Etienne, and Deshayes, Gérard Paul

1819-51. *Histoire naturelle générale et particulière des mollusques terrestres et fluviatiles tant des espèces que l'on trouve aujourd'hui vivantes, que des dépouilles fossiles de celles qui n'existent plus; classés d'après les charactères essentiels que presentent ces animaux et leurs coquilles.* Vol. 1, pp. 1-40 (1839), 41-376 (1850), 377-402 (1851), pls 1-30 (1819). Vol. 2, pp. 1-96 (1819), 96a-3 (1823), 96'-96-24 (1851), 97-100 (1820 or 1821), 101-128 (1832?), 129-152 (1839?), 153-184 (1851); pt. 2, pp. 1-260 (1851). Atlas, vol. 2, pt. 4, pls. 1-166; fossiles, pls. 1-5.

Ferreira, Candido Simoes

1960. *Contribuição à paleontolgia do Estado do Para. Revisão da familia Pectinidae formacão Pirabas (Miocene Inferior) com a descricão de novas espécies. VI. Mollusca-Pelecypoda.* Mus. Nac., Arq., vol. 50, pp. 135-166, pls. 1-4.

Ferreira, Candido Simoes, and Rodrigues da Cunha, Osvaldo

1957. *Contribuição à paleontologia do Estado do Para. Novos invertebrados fósseis e redescrições de mais duas espécies da formação Pirabas. III. Mollusca-Gastropoda.* Mus. Paraense Emilio Goeldi, Bol., nov. ser., Geologia, No. 4, pp. 1-33, pls. 1-2.

Field, Richard M.

1931. *Geology of the Bahamas.* Geol. Soc. Amer., Bull., vol. 42, pp.759-784, maps, photographs.

Filice, F. P.

1958. *Invertebrates from the estaurine portion of San Francisco Bay and some factors influencing their distribution.* Wasmann Jour. Biol., vol. 16, pp. 159-211.

Finlay, H. J.

1924a. *New shells from New Zealand Tertiary beds.* New Zealand Inst., Trans., vol. 55, pp. 450-479, pls. 48-50.

1924b. *Some necessary changes in New Zealand Mollusca.* Malac. Soc. London, Proc., vol. 16, pt. 2, pp. 99-107.

1926. *New shells from New Zealand Tertiary beds. Pt. 2.* New Zealand Inst., Trans., vol. 56, pp. 227-258, pls. 55-60.

1927. *A further commentary on New Zealand molluscan systematics.* New Zealand Inst., Trans., vol. 57, pp. 320-485, pls. 18-23.

1928. *The Recent Mollusca of the Chatham Islands.* New Zealand Inst., Trans., vol. 59, pp. 232-286, pls. 28-43.

1930a. *Invalid Molluscan names.* New Zealand Inst., Trans., vol. 61, pp. 37-48.

1930b. *New shells from New Zealand Tertiary beds. Pt.* 3. New Zealand Inst., Trans., vol. 61, pp. 49-84, pls. 1-6.

1930c. *Notes on recent papers dealing with the Mollusca of New Zealand.* New Zealand Inst., Trans., vol. 61, pp. 248-258, pl. 46.

1931. *On Austrosassia, Austroharpa, and Austrolithes, new genera: with some remarks on the gastropod protoconch.* New Zealand Inst., Trans., vol. 62, pp. 7-19.

Fischer, Paul

1857. *Études sur un groupe de coquilles de la famille des Trochidae.* Jour. Conchyl., vol. 2, pp. 42-53, 168-176, 284-288.

1858a. *Études sur les Pholades.* Jour. Conchyl., vol. 3, pp. 47-58, 169-177, 242-253.

1858b. *Enumération monographique des espèces du genre Dreissena.* Jour. Conchyl., sér. 2, vol. 7, pp. 123-124, pl.

1858c. *Descriptions d'espèces nouvelles.* [*Helix, Achatina, Solenomya, and Anomalocardia*]. Jour. Conchyl., vol. 3, pp. 184-187.

1861. *Ueber das Thier der Gattung Perna.* Jour. Conchyl., vol. 9, pp. 19-28.

1864. *Note sur le genre Pernostrea.* Jour. Conchyl., vol. 12, pp. 362-368.

1873. *Sur la coquille embryonnaire des Xenophora.* Jour. Conchyl., vol. 21, pp. 123-124.

1875. *Remarques sur la coloration générale des coquilles de la côte occidentale d'Amérique.* Jour. Conchyl., vol. 29, pp. 31-35.

1881. *Note sur le genre Olivella.* Jour. Conchyl., vol. 29, pp. 31-35.

1882. *Diagnoses d'espèces nouvelles de mollusques recueillis dans le cours des expéditions scientifiques de l'aviso le Travailler (1880-1882).* Jour. Conchyl., vol. 30, pp. 49-53, 273-277.

1883. *Diagnoses d'espèces nouvelles de mollusques recueillis dans le cours de l'expédition scientifique du Talisman (1883).* Jour. Conchyl., vol. 31, pp. 391-394.

Fischer, Paul-Henri

1958. *Un lamellibranche à répartition "bipolaire", Mytilus edulis L.* Soc. Biogéogr., Compte Rendu, vol. 35, No. 303, pp. 12-15.

1960. *Sur l'ontogénèse des gastéropodes.* Géol. Soc. France, Bull., sér. 7, vol. 1, No. 7, pp. 734-737, fig. 1.

Fischer-Piette, E., and Fischer, Paul-Henri

1939. *Révision des espèces vivantes de Sunetta du Muséum National d'Histoire Naturelle.* Jour. Conchyl., vol. 83, Nos. 2-3, pp. 181-213, 1 text fig., pl. 6, figs. 39-43.

1942. *Revision des espèces vivantes de Tivela et Eutivela du Muséum National d'Histoire Naturelle.* Jour. Conchyl, vol. 85, pp. 1-49, figs. 1-2.

Fleming, C. A.

1944. *Molluscan evidence of Pliocene climate change in New Zealand.* Roy. Soc. New Zealand, Trans., vol. 74, pt. 3, pp. 207-220.

1948. *New species and genera of marine Mollusca from the Southland Fiords.* Roy. Soc. New Zealand, Trans., vol. 77, pt. 1, pp. 72-92, pls. 4-8, 1 fig.

1950a. *The genus Pecten in the West Pacific.* Jour. Conchyl., vol. 90, pp. 276-282, pl. 1.

1950b. *New Zealand Recent Thyasiridae (Mollusca).* Roy. Soc. New Zealand, Trans., vol. 78, pts. 2-3, pp. 251-254, pl. 25.

1951. *Some Australian Mollusca in the British Museum (Natural History).* Roy. Soc. New Zealand, Trans., vol. 79, pp. 126-139, pls. 15-20.

Fleuriau de Bellevue, C.

1802. *Extrait d'un mémoire sur quelques nouveau genres de mollusques.* Jour. Phys., vol. 54, pp. 345-355.

Flores, G.

1952. *Geology of northern British Honduras.* Amer. Assoc. Petrol Geol., Bull., vol. 36, No. 12, pp. 404-409, 1 fig., 3 tables.

Fluck, H. W.

1906. *Shell-collecting on the Mosquito Coast of Nicaragua-VI.* Nautilus, vol. 20, No. 1, pp. 1-4.

Foerste, Aug. F.

1893. *Studies on the Chipola Miocene of Bainbridge, Georgia, and of Alum Bluff, Florida, with an attempt at correlation of certain Grand Gulf group beds with marine Miocene beds eastward.* Amer. Jour. Sci., vol. 46, No. 274, ser. 3, pp. 244-254.

de Folin, A. G. Léopold

1885. *Constitution méthodique rationelle et naturelle de la famille des Chemnitzidae.* Soc. d'Agric., Hist. Nat. et Arts Utiles de Lyon, séance 20 mars 1883, 16 pp.

Fontannes, C. F.

1878. *Les terrains Tertiaires du Basin de Visan.* [*Études stratigraphiques et paléontologiques pour servir à histoire de la période Tertiaire dans le basin du Rhone*]. *Pt. 3.* Soc. Agric. Lyon, An., vol. 5, No. 1, pp. 11-26, pls. 1-4.

Ford, John

1889. *Notes on Crepidula.* Acad. Nat. Sci. Philadelphia, Proc., vol. 41, pp. 345-346.

Foster, Richard W.

1935. *Arca barbata Linn.* Nautilus, vol. 49, No. 2, p. 64.

1937. *Notes on Anomia aculeata Müller.* Nautilus, vol. 50, No. 3, pp. 102-103.

1946a. *The genus Mya in the Western Atlantic.* Johnsonia, vol. 2, No. 20, pp. 29-35, pls. 17-21.

Frenguelli, Joaquín

1935. *El género "Conus" en el Patagoniano inferior de Comodoro Rivadavia (Chubut).* Inst. Mus. Univ. Nac. La Plata, Notas Mus. La Plata, vol. 1, Paleontología, No. 4, pp. 151-157, 2 figs.

Freneix, Suzanne

1960. *Remarques sur l'ontogénie du ligament et de la charnière de quelques espèces de lamellibranches (Noetidae et Carditidae).* Soc. Géol. France, Bull., sér. 7, No. 7, pp. 719-729, pls. 33-34.

Friele, Herman

1882. *The Norwegian North-Atlantic Expedition. Mollusca. I. Buccinidae.* Christiania, pp. 1-38, pls. 1-6.

1886. *The Norwegian North-Atlantic Expedition. Mollusca. II.* Christiania, pp. 1-44, pls. 7-12.

Friele, Herman, and Grieg, James A.

1876-78. *Den Norske Nordhaus Exped.* Vol. 7, Zoology. Mollusca 3., viii + 131 pp., map.

1877. *Preliminary report on Mollusca from the Norwegian North Atlantic Expedition in 1876.* Nytt Mag. Natur., vol. 23, No. 3, pp. 1-10, pl. 6.

1886. *The Norwegian North-Atlantic Expedition. Mollusca. III.* Christiania, pp. 1-132.

Frierson, L. S.

1914. *A new pearly freshwater mussel of the genus Hyria from Brazil.* U. S. Nat. Mus., Proc., vol. 47, No. 2053, p. 363, pl. 12.

Fulton, Hugh Coomber

1915. *A list of the Recent species of Spondylus Linné.* Quart. Jour. Conchol., vol. 14, pp. 331-338, 353-362.

1922. *A list of the species and genera of recent Mollusca first described in "Le Naturaliste."* Malac. Soc. London, Proc., vol. 15, pp. 19-31.

Gabb, William More

1860a. *Descriptions of new species of American Tertiary and Cretaceous fossils.* Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 4, pp. 375-406, pls. 67-69.

1874a. *Notes on the geology of Costa Rica.* Amer. Jour. Sci., ser. 3, vol. 7, pp. 438-439.

1874b. *Notes on the geology of Costa Rica.* Amer. Jour. Sci., ser. 3, vol. 8, pp. 388-390.

1895. *Informe sobre la exploración de Talamanca verificada durante los años de 1873-74.* Inst. Fís. Geog. Nac. Costa Rica, An., vol. 5 (1892), pp. 67-90.

Gale, H. R.

1928. *West coast species of Hinnites.* San Diego Soc. Nat. Hist., Trans., vol. 5, pp. 91-94.

Ganong, W. F.

1886. *The marine Mollusca of New Brunswick.* Nat. Hist. Soc. New Brunswick, Bull., No. 6, pp. 1-16.

Gardner, Julia Anna

1940. *New Rangia from upper Miocene of western Gulf Province.* Amer. Assoc. Petrol. Geol., Bull., vol. 24, No. 3, pp. 476-477, figs. 1-2.

Gaskoin, J. S.

1848. *Descriptions of new species of the genus Cypraea.* Zool. Soc. London, Proc., pp. 90-98.

1849. *Descriptions of seven new species of Marginella and two of Cypraea.* Zool. Soc. London, Proc., pp. 17-23.

1852. *Descriptions of twenty species of Columbella, and one species of Cypraea.* Zool. Soc. London, Proc., pp. 2-14.

Gatliff, J. H., and Gabriel, C. J.

1911. *On some new species of Victorian marine Mollusca.* Roy. Soc. Victoria, Proc., new ser., vol. 24, pt. 1, pp. 187-192, pls. 46-47.

Gazin, C. L.

1957. *Exploration for the remains of giant ground sloths in Panama.* Smithsonian Inst., Ann. Rept for 1956, pp. 341-354, 7 figs., 8 pls.

Gibson, Thomas G.
1961. *Revision of the Turridae of the Miocene St. Mary's formation of Maryland.* Jour. Paleont., vol. 36, No. 2, pp. 225-246, pls. 40-42, 7 text figs.

Gignoux, Maurice
1913. *Les formations marines Pliocènes et Quaternaires de l'Italie du sud et de Sicile.* Lyon Univ., Ann., new ser., sect. 1, No. 26, 693 pp., 42 text figs., 21 pls.

Gigoux, Enrique Ernesto
1934. *Los moluscos de Altacama.* Rev. Crilena Hist. Nat., año 38, pp. 274-286.
1937. *La Oliva peruviana* Lamarck. Mus. Nac. Hist. Nat., Bol., vol. 16, pp. 3-10, figs. 1-60.

Gillett, Suzette
1960. *Observations sur de jeunes coquilles de mollusques du Pliocène saumâtre du Llobregat (Barcelone).* Soc. Géol. France, Bull., sér. 7, vol. 1, No. 7, pp. 731-733, pls. 35-36.

Ginsburg, Robert N.
1953. *Intertidal erosion of the Florida Keys.* Bull. Marine Sci. Gulf and Caribbean, vol. 3, No. 1, pp. 55-69.

Glen, William
1959. *Pliocene and lower Pleistocene of the western part of the San Francisco Peninsula.* Univ. California Publ., Dept. Geol. Sci., vol. 36, No. 2, pp. 147-198, pls. 15-17, 5 text figs.
1960. *Pliocene fresh-water gastropods from San Mateo County, California.* Jour. Paleont, vol. 34, No. 6, pp. 1207-1209, text fig. 1.

Glibert, Maxime
1945. *Faune malacologique du Miocène de la Belgique. I. Pélécypodes.* Mus. Roy. Hist. Nat. Belgique, Mém. 103, 266 pp., 12 pls.
1954. *Pleurotomes du Miocène de la Belgique et du Bassin de la Loire.* Inst. Roy. Sci. Nat. Belgique, Mém. 129, 75 pp., 7 pls.

Goldfuss, G. A.
1833-36. *Petrefacta Germaniae.* Dusseldorf, vol. 2, pt. 4, pp. 1-68, pls. 72-96 (1833); pt. 5, pp. 69-140, pls. 97-121 (1836).

Gould, Augustus Addison
1855. *Descriptions of shells from the Gulf of California and the Pacific coasts of Mexico and California.* Boston Soc. Nat. Hist., Jour., vol. 6, art. 24, pp. 1-35, pls. 14-16.

Grateloup, J. P. S. de
1840-47. *Conchyliologie fossile des terrains Tertiaires du Bassin del'Adour.* Bordeaux, vol. 1, *Univalves,* xx + 84 + 12 pp., 48 pls.

Grau, Gilbert
1959. *Pectinidae of the Eastern Pacific.* Allan Hancock Pacific Expeditions, Univ. Southern California Press, Los Angeles, vol. 23, pp. i-viii + 308, 57 pls.
1960. *A new Chlamys from the South Pacific.* Nautilus, vol. 74, No. 1, pp. 15-18, pl. 2.

Gray, George Melton
1933. *Observations on Montacuta percompressa* Dall. Nautilus, vol. 46, No. 3, pp. 76-79.

Gray, John Edward
1842. *Synopsis of the Contents of the British Museum.* London, 44th ed.

Gregg, Wendell Oliver
1938. *Pecten pugetensis at Newport Bay, California.* Nautilus, vol. 51, No. 4, pp. 118-119.

de Gregorio, Antonio

1883. *Moderne nomenclature des coquilles des gastéropodes et des pélécypodes.* Palerme, 20 pp., 1 pl.

1884. *Studi su talune conchiglie Mediterranee viventi e fossili con una rivista del gen. Vulsella.* Soc. Malac. Italiano, Bull., vol. 10, pp. 36-288, pls. 1-5.

1890. *Monographie de la faune Éocènique de l'Alabama.* Ann. Géol. et Paleont., pt. 7, pp. 1-156, pls. 1-17; pt. 8, pp. 157-316, pls. 18-46.

Gregory, John Walter

1889. *Cystechinus crassus, a new species from the radiolarian marls of Barbados, and the evidence it affords as to the age and origin of these deposits.* Geol. Soc. London, Quart. Jour., vol. 45, pp. 640-650.

1892a. *The relations of the American and European echinoid faunas.* Geol. Soc. Amer., Bull., vol. 3, pp. 101-108.

1892b. *Archaeopneustes abruptus, a new genus and species of echinoid from the Oceanic series in Barbados.* Geol. Soc. London, Quart. Jour., vol. 48, pp. 163-165, pl. 4.

1892c. *The microscopic structure of some Trinidad rocks.* Geol. Soc. London, Quart. Jour., vol. 48, pp. 538-541.

1895. *Contributions to the paleontology and physical geography of the West Indies.* Geol. Soc. London, Quart. Jour., vol. 51, pp. 255-312, pl. 11.

1929a. *The theory of permanent oceans and continents.* Geol. Soc. London, Quart. Jour., vol. 85, pp. 68-122.

1929b. *Dendroseris n. gen. and other corals from Trinidad.* Geol. Mag., vol. 66, pp. 65-68, pl. 8.

de Greve, Leonard

1938. *Eine Mollusken fauna aus dem Neogen von Iquitos am Oberen Amazonas in Peru.* Schweizerischen Palaeont. Gesell., Abhandl., vol. 61, pp. 1-133, pls. 1-10.

Grieg, James A.

1921. *Remarks on Verrill's North American Alvania (Cingula) jan-mayeni (Friele).* Bergens Mus. Aarbok, Naturvidensk Raekke No. 8, pp. 2-9, figs. 1-4.

Gunter, Gordon

1948. *The genera of living oysters.* Anat. Rec., vol. 101, No. 4, p. 39.

1950. *The generic status of living oysters and the scientific name of the common American species.* Amer. Midland Naturalist, vol. 43, No. 2, pp. 438-449.

1951. *The species of oysters of the Gulf, Caribbean and the West Indian region.* Bull. Marine Sci. Gulf and Caribbean, vol. 1, No. 1, pp. 40-45.

Haas, Fritz

1930-31. *Versuch einer Kritischen Sichtung der südamerikanischen Najaden, hauptsächlich an Hand der Sammlung des Senckenberg-Museums. I.* Senckenbergiana, vol. 12, pp. 175-195, figs. 1-23; vol. 13, pp. 87-110, figs. 33-37.

1932. *Beiträge zur Kenntnis der Verbreitung südamerikanischer Najaden.* Arch. Molluskenk., vol. 64, Nos. 4-5, pp. 167-170, pl. 12.

1941. *Malacological notes-II.* Field Mus. Nat. Hist., Zoology, vol. 24, No. 17, pp. 167-174, pl. 2.

1949. *On some deepsea mollusks from Bermuda.* Inst. Catalana Hist. Nut. Butil., vol. 37, pp. 69-72, figs. 1-6.

Habe, Tadashige

1951. *Genera of Japanese Shells. Pelecypoda. No. 1.* Pp. 1-96, 192 text figs.

Hägg, Richard

1910. *Interglaziale und postglaziale Meeresmollusken aus Feuerland und Südpatagonien als beweis für ein wärmeres Klima als das jetzige.* Arkiv för Zoologi, K. Svenska Vetenskapsakad. i Stockholm, vol. 7, No. 1, pp. 1-26.

Hamlin, Charles E.

1884. *Results of an examination of Syrian molluscan fossils, chiefly from the Range of Mount Lebanon.* Mus. Comp. Zool., Mem., vol. 10, No. 3, pp. 1-68, pls. 1-6

Hancock, Albany

1846. *A list of shells dredged on the west coast of Davis's Strait; with notes and descriptions of eight new species.* An. and Mag. Nat. Hist., ser. 1, vol. 18, pp. 323-338, pl. 5.

Hanley, Sylvanus

1843a *On new species of Donax and Mya.* Zool. Soc. London, Proc., pt. 11, pp. 5-7.

1843b. *On new species of Solen and Mesodesma.* Zool. Soc. London, Proc., pt. 11, pp. 101-102.

1844a. *Descriptions of new species of Mytilacea, Amphidesma, and Odostomia.* Zool. Soc. London, Proc., pt. 12, pp. 14-18.

1844b. *Descriptions of new species of Cytherea.* Zool. Soc. London, Proc., pt. 12, pp. 109-110.

1844c. *Descriptions of new species of Cyrena, Venus, and Amphidesma.* Zool. Soc. London, Proc., pt. 12, pp. 159-162.

1860c. *On some new species of Nuculaceae in the collection of Hugh Cuming, Esq.* Zool. Soc. London, Proc., pp. 370-371.

Hanna, G. Dallas

1939. *Exotic Mollusca in California.* Dept. Agric. State of California, Bull., vol. 28, No. 5, pp. 298-321, pls. A-D.

Hanna, G. Dallas, and Hertlein, Leo George

1961. *Large Terebras (Mollusca) from the Eastern Pacific.* California Acad. Sci., Proc., ser. 4, vol. 30, No. 3, pp. 67-80, pls. 6-7.

Hanna, Marcus A.

1926. *Geology of the La Jolla quadrangle, California.* Univ. California Publ., Bull. Dept. Geol. Sci., Vol. 16, pp. 187-246, 7 pls., 1 map.

Harrison, J. V.

1953. *The Geology of the Santa Elena Peninsula in Costa Rica, Central America.* Seventh Pacific Sci. Congress, Proc., vol 2, pp. 102-114.

Hart, C. F.

1872. *On the Tertiary basin of the Marañón.* Amer. Jour. Sci. and Arts, ser. 3, vol. 4, pp. 53-58.

Hayasaka, Shozo

1960. *Large-sized oysters from the Japanese Pleistocene and their paleoecological implications.* Science Reports Tohoku Univ., Sendai, Japan, 2d ser. (Geology), special vol. No. 4, pp. 356-370, pls. 37-38, 7 figs., table 1.

Hedley, Charles

1899a. *The Mollusca of Funafuti. Pt. 2. The Pelecypoda and Brachiopoda.* Australian Mus., Mem., No. 3, pp. 489-510, figs. 50-57.

1899b. *A zoogeographic scheme of the mid-Pacific.* Linnaean Soc. New South Wales, Proc., vol. 24, pp. 391-417.

1902. *Scientific results of the trawling expedition of H. M. C. S. "Thetis." Mollusca. Part I.* Australian Mus., Mem., vol. 4, pp. 287-324, figs. 39-60.

1906. *The Mollusca of Mast Head Reef, Capricorn Group, Queensland.* Linnaean Soc. New South Wales, Proc. for 1906, vol. 31, pt. 1, pp. 453-479, pls. 36-38.
1909. *Mollusca from the Hope Islands, North Queensland.* Linnaean Soc. New South Wales, Proc., vol. 34, pp. 420-466, pls. 36-44, 1 map.
1911. *Mollusca.* British Antarctic Expedition (1907-9), Biology, vol. 2, pt. 1, pp. 1-8, 1 pl.
1913. *Studies on Australian Mollusca. Part XI.* Linnaean Soc. New South Wales, Proc., vol. 38, No. 2, pp. 258-339, 4 pls.
1915. *A preliminary index of the Mollusca of Western Australia.* Roy. Soc. Western Australia, Jour., vol. 1, 77 pp.
1916. *Mollusca.* Australian Antarctic Expedition., ser. C., Zoology and Botany, vol. 4, pt. 1, pp. 1-80, pls. 1-9.
1917. *Studies on Australian Mollusca. Pt. 13.* Linnaean Soc. New South Wales, Proc., vol. 41 (1916), pt. 4, pp. 680-719, pls. 46-52.
1918. *A check-list of the marine fauna of New South Wales. Pt. 1. Mollusca.* Roy. Soc. New South Wales, Jour. and Proc., vol. 51, 120 pp.
1920. *Concerning Edenttelina.* Malac. Soc. London, Proc., vol. 14, pp. 74-76, figs. 1-8.
1922. *A revision of the Australian Turridae.* Australian Mus., Rec., vol. 13, pp. 213-359, pls. 42-56.
1934. *Revision of the Australian Pinnidae.* Australian Mus., Rec., vol. 14, pp. 141-153, 3 pls.

Heilprin, Angelo

1881. *Remarks on the molluscan genera Hippagus, Verticordia and Pecchiolia.* Acad. Nat. Sci. Philadelphia, Proc., vol. 33, pp. 423-428.
1886. *A new species of Aplysia.* Acad. Nat. Sci. Philadelphia, Proc., vol. 38, p. 364.
1888. *Contributions to the natural history of the Bermuda Islands.* Acad. Nat. Sci. Philadelphia, Proc., vol. 40, pp. 302-328, pls. 14-16.
1889a. *The Bermuda Islands.* Philadelphia, 231 pp., 19 pls.
1889b. *On some new species of Mollusca from the Bermuda Islands.* Acad. Nat. Sci. Philadelphia, Proc., vol. 41, pp. 141-142, pl. 8.

Henderson, John B., and Bartsch, Paul

1914. *Littoral marine mollusks of Chincoteague Island, Virginia.* U. S. Nat. Mus., Proc., vol. 47, No. 2055, pp. 411-421, pls. 13-14.

Herrmannsen, August Nicolaus

1853. *On some genera of shells, established in 1807 by the late H. F. Link.* Zool. Soc. London, Proc. for 1851, pp. 228-233.

Hertlein, Leo George

1928a. *Preliminary report on the paleontology of the Channel Islands, California.* Jour. Paleont., vol. 2, No. 2, pp. 142-157, pls. 22-25.
1928b. *Pecten (Patinopecten) lohri, new name for Pecten oweni Arnold, a Pliocene species from California.* Nautilus, vol. 47, pp. 62-64.
1929. *Three new specific names for west American Mollusca.* Jour. Paleont., vol. 3, No. 3, pp. 295-296.
1931a. *Additional Pliocene and Pleistocene fossils from Lower California.* Jour. Paleont., vol. 5, No. 4, pp. 365-367.
1933a. *Three preoccupied names in the Pectinidae.* Nautilus, vol. 47, No. 2, pp. 62-64.
1936c. *The dates of publication of C. H. Küster and W. Kobelt's monograph of Spondylus and Pecten, in volume 7, part 2, of the Systematisches Conchylien-Cabinet.* An. Mag. Nat. Hist., ser. 10, vol. 17, pp. 158-160.

1940. *Additions to the range of Pecten caurinus Gould.* Nautilus, vol. 54, No. 2, pp. 68-69.
1957. *Pliocene and Pleistocene fossils from the southern portion of the Gulf of California.* Southern California Acad. Sci., Bull., vol. 56, pt. 2, pp. 57-75, pl. 13.

Hertlein, Leo George, and Emerson, William K.

1956. *Marine Pleistocene invertebrates from near Puerto Penasco, Sonora, Mexico.* San Diego Soc. Nat. Hist., Trans., vol. 12, pp. 154-178, pl. 12, 2 maps.
1957. *Additional notes on the invertebrate fauna of Clipperton Island.* Amer. Mus. Novitates, No. 1859, 9 pp., 1 fig.
1959. *Pliocene and Pleistocene megafossils from the Tres Marías Islands.* Amer. Mus. Novitates, No. 1940, 15 pp., 5 figs.

Hertlein, Leo George, and Strong, A. M.

1947. *Description of a new species of Trophon from the Gulf of California.* Southern California Acad. Sci., Bull., vol. 46, pt. 2, pp. 79-80, pl. 18.
1955a. *Essays in the natural sciences in honor of Captain Allan Hancock on the occasion of his birthday July 26, 1955. Marine mollusks collected at the Galápagos Islands during the voyage of the Velero III, 1931-1932.* Univ. Southern California Press, Los Angeles, pp. 111-145, pl. A.
1957. *Pliocene and Pleistocene fossils from the southern portion of the Gulf of California.* Southern California Acad. Sci., Bull., vol. 56, pt. 2, pp. 57-75, pl. 13.

Higgins, H. H.

1877. *Mollusca of the Argo Expedition to the West Indies, 1876.* Literary and Philos. Soc. Liverpool, Proc., vol. 31, pp. 405-423, pl. 1.

Hill, Howard R.

1954. *Variation in the olive shells of tropical west America.* Nautilus, vol. 68, No. 2, pp. 66-69.

Hinds, Richard Brinsley

1843g. *On new species of Neaera.* Zool. Soc. London, Proc., pp. 75-79.
1844h. *Descriptions of new species of Triton, Solarium, and Corbula.* Zool. Soc. London, Proc., pt. 12, pp. 21-26.
1844i. *Descriptions of new species of Ringicula and Neaera from the cabinets of Sir E. Belcher and Hugh Cuming, Esq.* Zool. Soc. London, Proc., pt. 12, pp. 96-98.
1844j. *Description of a new species of Solarium, from the collection of Mr. Cuming.* Zool. Soc. London, Proc., pt. 12, p. 158.

Hoffmeister, William S.

1938. *Aspect and zonation of the molluscan fauna in the La Rosa and Lagunillas formations, Bolivar Coastal Fielda, Venezuela.* Bol. Geol. y Minería, vol. 2, Nos. 2-4, pp. 103-122 (English ed.).

Hoffstetter, Robert

1948. *Notas sobre el Cuaternario de la Peninsula de Santa Elena (Ecuador). II. Pelecypoda de tercer Tablazo.* Bol. Información Ciencia Nac., vol. 2, Nos. 13-14, pp. 67-83.
1949. *Moluscos subfósiles de los estanques de sal de Salina (Pen. de Santa Elena, Ecuador). Comparación con la fauna actual del Ecuador.* Inst. Cienc. Nac., Bol., año 1, No. 1, pp. 3-79, figs. 1-19.
1952. *Moluscos subfósiles de los estanques de sal del Salinas (Pen. de Santa Elena, Ecuador).* Inst. Cienc. Nac., Bol., año 1, No. 1, pp. 5-79, 19 figs.

Hoffstetter, Robert, et al.

1960. *Lexique Stratigraphique International, vol. 5, Amérique Latine, No. 2a, Amérique Centrale,* 366 pp., 8 geol. maps.

Hubbard, J. W., and Smith, Sanderson

1865. *Catalogue of the Mollusca of Staten Island, N. Y.* Lyc. Nat. Hist. New York, Ann., vol. 8, pp. 3-5.

Hubendick, Bengt

1956. *A conchological survey of the genus Plecotrema (Gastropoda, Ellobiidae).* Malac. Soc. London, Proc., vol. 32, pt. 3, pp. 110-126, pl. 23.

Hutton, Frederick Wollaston

1873. *Catalogue of the marine Mollusca of New Zealand, with diagnoses of the species.* Colonial Mus. and Geol. Survey Dept., Wellington, 116 pp.

1880. *Manual of the New Zealand Mollusca. A systematic and descriptive catalogue of the marine and land shells of the soft mollusks and Polyzoa of New Zealand and the adjacent islands.* Colonial Mus. and Geol. Survey Dept., Wellington, 223 pp.

1884a. *Revision of the Recent Lamellibranchiata of New Zealand.* Linnaean Soc. New South Wales, Proc., vol. 9, pp. 511-534.

1884b. *Revision of the marine taeniglossate and ptenoglossate Mollusca of New Zealand.* Linnaean Soc. New South Wales, Proc., vol. 9, pp. 932-944.

1885. *Revision of the toxoglossate Mollusca of New Zealand.* Linnaean Soc. New South Wales, Proc., vol. 9, pp. 115-118.

Hyatt, Alphaeus

1892. *Remarks on the Pinnidae.* Boston Soc. Nat. Hist., Proc., vol. 35, pp. 335-346.

von Ihering, Hermann

1896. *Zur Kenntnis der südamerikanischen Voluta und ihrer Geschichte.* Deutsch. Malakozool., Gesell., Nachrichtsblatt, Nos. 7-8, pp. 93-99.

1897b. *A Ilha de S. Sebastoão.* Mus. Paulista, Rev., vol. 2, pp. 129-170, pl. 2, text figs.

1899. *Die Conchylien der patagonischen Formation.* N. Jahrb. f. Min., Geol. u. Palaeont., vol. 2, pp. 1-46, pls. 1-2.

1902a. *Die Photinula-Arten der Magellan Strasse.* Deutsch. Malakozool. Gesell., Nachrichtsblatt, Nos. 5-6, pp. 97-104.

1902b. *Historia de los Ostras Argentinas.* Mus. Nac. Buenos Aires, An., vol. 7, pp. 109-123, figs. 1-9.

1902c. *On the molluscan fauna of the Patagonian Tertiary.* Amer. Philos. Soc., Proc., vol. 41, No. 169, pp. 132-137, pl. 19.

1905. *Les mollusques fossiles du Tertiaire et du Crétacé Supérieur de l'Argentine. I. Les mollusques de l'étage Rocanéen.* Mus. Nac. Buenos Aires, An., ser. 3, vol. 7, pp. 1-36, pls. 1-3.

1908a. *Lotorium felipponei sp. n.* Malacologie de l'Uruguay, Buenos Aires, pp. 5-6, figs. a,b.

1908b. *Mollusques du Pampéen de Mar del Plata et Chapalmalán recueillis par M. le Dr. Florentino Ameghino en 1908.* Mus. Nac. Buenos Aires, An., ser. 3, vol. 10, pp. 429-438.

1909. *Nouvelles recherches sur la formation Magellanienne.* Mus. Nac. Buenos Aires, An., ser. 3, vol. 12, pp. 27-43.

1914. *Catalogo de moluscos cretaceos e terciarios da Argentina da collecção do autor.* Rev. Mus. Paulista, Notas Preliminares, vol. 1, No. 3, pt. 1, pp. 1-113, pls. 1-3.

1921. *Die Geschichte der Venus-Muscheln.* Archiv. f. Molluskenkunde, No. 3, pp. 125-139.

1927b. *Die Gattung Mesodesma Desh.* Archiv. f. Molluskenkunde, vol. 59, pp. 250-255.

Imbrie, John

1956. *Biometrical methods in the study of invertebrate fossils.* Amer. Mus. Nat. Hist., Bull., vol. 108, art. 2, pp. 217-252.

Ingram, William Marcus

1949. *A check list of the Limacidae, Endodontidae, Arionidae, Succineidae, Pupillidae, Valloniidae, Carychiidae, and Truncatellidae of California.* Southern California Acad. Sci., Bull., vol. 48, pt. 1, pp. 19-34.

Iredale, Tom

1913. *A collation of the molluscan parts of the synopses of the contents of the British Museum, 1838-1845.* Malac. Soc. London, Proc., vol. 10, pt. 4, pp. 294-309.

1916. *On some new and old molluscan generic names.* Malac. Soc. London, Proc., vol. 12, No. 1, pp. 27-37.

1925. *Mollusca from the continental shelf of eastern Australia.* Australian Mus., Rec., vol. 14, pp. 243-270, pls. 41-43, 1 map.

1929b. *Queensland molluscan notes, No. 1.* Queensland Mus., Mem., vol. 9, pp. 261-297, pls. 30-31.

1930a. *More notes on the marine Mollusca of New South Wales.* Australian Mus., Rec., vol. 17, pp. 384-407, pls. 62-65.

1930b. *Queensland molluscan notes, No. 2.* Queensland Mus., Mem., vol. 10, pp. 73-88, pl. 9.

1931. *Australian molluscan notes, No. 1.* Australian Mus., Rec., vol. 18, pp. 201-235, pls. 22-25.

1936. *Australian molluscan notes, No. 2.* Australian Mus., Rec., vol. 19, pp. 267-340, pls. 20-24.

1937. *The Middleton and Elizabeth Reefs, South Pacific Ocean. Mollusca.* Australian Zool., vol. 8, pp. 232-261, pls. 15-17.

Iredale, Tom, and Laseron, C. F.

1957. *The systematic status of Ctiloceras and some comparative genera.* Roy. Zool. Soc. New South Wales, Proc., pp. 97-109, pls. 1-2.

Jackson, Henry, Jr.

1908. *The Mollusca of North Haven, Maine.* Nautilus, vol. 21, No. 12, pp. 142-144.

Jackson, Robert Tracy

1890. *The phylogeny of the Pelecypoda. The Aviculidae and their allies.* Boston Soc. Nat. Hist., Mem., vol. 4, pp. 277-400.

1918. *Fossil Echini of the Panama Canal Zone and Costa Rica.* U. S. Nat. Mus., Bull. 103, pp. 103-116, pls. 46-52.

Jacobson, Morris K., and Emerson, William K.

1961. *Shells of the New York City Area.* Larchmont, pp. i-xviii + 142, text figs.

Jacot, Arthur Paul

1919. *Some marine Mollusca about New York City.* Nautilus, vol. 30, pp. 90-94.

1920a. *On the marine Mollusca of Staten Island, N. Y.* Nautilus, vol. 33, pp. 111-115.

1920b. *Notes on marine Mollusca about New York City.* Nautilus, vol. 34, pp. 59-60.

1921. *Some marine molluscan shells of Beaufort and vicinity.* Elisha Mitchell Sci. Soc., Jour., vol. 36, pp. 129-145, pls. 11-13.

Jameson, H. L.

1901. *On the identity and distribution of the mother-of-pearl oysters; with a revision of the subgenus Margaritifera.* Zool. Soc. London, Proc., pp. 372-394, figs. 92-95.

Jay, John C.

1857. *Report on the shells collected by the Japanese Expedition.* [In] *Perry, M. C., Narrative of the Expedition of an American Squadron to the China Seas and Japan.* Washington, vol. 2, pp. 291-297, 5 pls.

Jeannet, A.

1928. *Contribution à l'étude des Echinides tertiaires de la Trinité et du Vénézuéla.* Soc. Paléont. Suisse, Mém., vol. 48, pp. 1-48, 6 pls., 12 text figs.

Jeffreys, John Gwyn

1874. *On some species of Japanese marine shells and fishes, which inhabit also the North Atlantic.* Linnean Soc. London, Jour., Zoology, vol. 12, pp. 100-109.

1876a. *New and peculiar Mollusca of the Pecten, Mytilus, and Arca families procured in the "Valorous" Expedition.* Ann. Mag. Nat. Hist., ser. 4, vol. 18, pp. 424-436.

1876b. *Preliminary report of the biological results of a cruise in H.M.S. "Valorous" to Davis Strait in 1875.* Roy. Soc. London, Proc., vol. 25, pp. 177-230, pls. 2-4.

1877. *New and peculiar Mollusca of the Eulimidae and other families of Gastropoda, as well as of the Pteropoda, procured in the "Valorous" Expedition.* Ann. Mag. Nat. Hist., ser. 4, vol. 19, pp. 317-339.

1878-1885. *On the Mollusca procured during the "Lightning" and "Porcupine" Expeditions, 1868-1870.* Zool. Soc. London, Proc. for 1878, pt. 1, pp. 393-416, pls. 22-23; for 1879, pt. 2, pp. 553-588, pls. 45-46; for 1881, pts. 3-4, pp. 693-724, 922-962, pls. 61, 70-71; for 1882, pt. 5, pp. 656-687, pls. 49-50; for 1883, pt. 6, pp. 88-115, pls. 19-20; for 1884, pt. 7, pp. 111-149, pls. 9-10; for 1884, pt. 8, pp. 341-372, pls. 26-28; for 1885, pt. 9, pp. 27-63, pls. 4-6.

Johnson, Charles Willison

1890. *An annotated list of the shells of St. Augustine, Fla.* Nautilus, vol. 3, pp. 103-105.

1903. *Some notes on the genus Fulgur.* Nautilus, vol. 17, pp. 73-75.

1904. *Panopea bitruncata Conrad.* Nautilus, vol. 18, pp. 73-75, pl. 4.

1905. *On the species of Martesia of the eastern United States.* Nautilus, vol. 18, pp. 100-103, figs. 1-3.

1915a. *Fauna of New England. List of the Mollusca.* Boston Soc. Nat. Hist., Occas. Papers, vol. 7, No. 13, 231 pp.

1918. *The Avicula candeana of d'Orbigny, from Bermuda.* Nautilus, vol. 32, pp. 37-39, pl. 3.

Johnson, J. Harlan

1961. *Limestone-building Algae and Algal Limestones.* Colorado School of Mines, xi + 297 pp., 139 pls.

Johnson, Richard I.

1949. *Jesse Wedgwood Mighels, with a bibliography and a catalogue of his species.* Occas. Papers on Mollusks, vol. 1, No. 4, pp. 213-231, pl. 27.

Jonas, J. H.

1844a. *Neue Trochus-Arten.* Zeitschr. f. Malakozool., pp. 113-116.

1844b. *Bemerkungen über einige der von Lamarck in seiner "Histoire naturelle des animaux sans vertébres" aufgeführten Conchylien-Arten mit besonderer Rücksicht auf die Zusätze des Herrn Deshayes.* Zeitschr. f. Malakozool., pp. 135-39.

1844c. *Neue Trochoideen.* Zeitschr. f. Malakozool., pp. 181-185.

1844-45. *Vorläufige Diagnosen neuer Conchylien, welche ausführlicher beschrieben und abgebildet nächstens erscheinen werden.* Zeitschr. f. Malakozool., pp. 33-37, 185-186 (1844); pp. 65-67, 168-173 (1845).

1845. *Conchyliologische Notizen.* Zeitschr. f. Malakozool., pp. 181-185.

1846a. *Molluskologische Beiträge.* Geb. Naturw. Hamburg, Abhandl., vol. 1, pp. 99-130, pls. 7-11.

1846b. *Descriptions of new species of shells.* Zool. Soc. London, Proc., vol. 14, pp. 34-36.
1846c. *Descriptions of two new shells* [*Pyrula ideolum, Anomia naviformis*]. Zool. Soc. London, Proc., vol. 14, pp. 120-121.
1849. *Description of a new species of Thracia* [*T. magnifica*]. Zool. Soc. London, Proc., p. 170, pl. 6, fig. 7.

Jones, J. Matthew

1877. *Mollusca of Nova Scotia.* Nova Scotian Inst. Nat. Sci., Proc. and Trans., vol. 4, pp. 321-330.

Jordan, Eric Knight

1932. *A new species of Crassatellites from the Gulf of California.* Nautilus, vol. 46, No. 1, pp. 9-10.
1936. *The Pleistocene of Magdalena Bay, Lower California.* Dept. Geol. Stanford. Univ., Contrib., vol. 1, pp. 101-173, 3 pls.

Jordan, Eric Knight, and Hertlein, Leo George

1926a. *Expedition to the Revillagigedo Islands, Mexico, in 1925. No. 4. A Pliocene fauna from Maria Madre Island, Mexico.* California Acad. Sci., Proc., ser. 4, vol. 15, pp. 195-207, pl. 22.

Jousseaume, Félix Pierre

1884a. *Monographie des Triforidae.* Soc. Malac. France, Bull., vol. 1, pp. 217-270, pl. 4.

Jukes-Browne, Alfred John

1908. *Genera of Veneridae in Cretaceous and older Tertiary deposits.* Malac. Soc. London, Proc., vol. 8, pt. 3, pp. 148-177, pl. 6.
1909. *The application of the names Gomphina, Marcia, Hemitapes, and Katelysia.* Malac. Soc. London, Proc., vol. 8, pt. 4, pp. 233-246, pl. 10.

Jukes-Browne, A. J., and Harrison, J. B.

1889. *Tertiary chalk in Barbados.* Nature, vol. 39, p. 607.

Kanakoff, George P.

1953. *A new fossil shell* [*Diodora constantiae*] *from the Palos Verdes sand.* Southern California Acad. Sci., Bull., vol. 52, pt. 2, pp. 67-70, pls. 12-13.

Kaspar, Josef

1913. *Beiträge zur Kenntnis der Familie der Erycíniden und Carditiden.* Zool. Jahrb., Suppl. 13, pp. 545-625, figs. A-Z, A'-F'.

Kay, Alison

1960. *Generic revision of the Cypraeinae.* Malac. Soc. London, Proc., vol. 33, pt. 6, pp. 278-279, 8 text figs., table 1.

Keen, Angeline Myra

1936. *A new pelecypod genus of the family Cardiidae.* San Diego Soc. Nat. Hist., Trans., vol. 8, No. 17, pp. 119-120.
1943. *New mollusks from the Round Mountain silt (Temblor) Miocene of California.* San Diego Soc. Nat. Hist., Trans., vol. 10, No. 2, pp. 25-60, pls. 3-4, figs. 1-5.
1960a. *A bivalve gastropod.* Nature, vol. 186, No. 4722, pp. 406-407.
1960c. *Vermetid gastropods and marine intertidal zonation.* The Veliger, vol. 3, No. 1, 2 pp.
1960d. *New Phyllonotus from the Eastern Pacific.* Nautilus, vol. 73, No. 3, pp. 103-109, pl. 10.
1961a. *What is Anatina anatina?* The Veliger, vol. 4, No. 1, pp. 9-12, figs. 1-5.
1961b. *A proposed reclassification of the gastropod family Vermetidae.* British Mus. (Nat. Hist.), Bull., Zoology, vol. 7, No. 3, pp. 183-213, figs. 1-33, pls. 54-55.
1962. *Nomenclatural notes on some west American mollusks, with proposal of a new species name.* The Veliger, vol. 4, No. 4, pp. 178-180.

Keen, A. Myra, and Morton, J. E.
1960. *Some new African species of Dendropoma (Vermetidae: Mesogastropoda).* Malac. Soc. London, Proc., vol. 34, No. 1, pp. 36-51, 5 figs., 3 pls.

Keen, A. Myra, and Smith, Allyn G.
1961. *West American species of the bivalved gastropod genus Berthelinia.* California Acad. Sci., Proc., ser. 4, vol. 30, No. 2, pp. 47-66, figs. 1-33, 1 pl.

Keep, Josiah
1935. *West Coast Shells. Revised by J. L. Baily, Jr.* Stanford University, 350 pp., 334 text figs.

Kindle, E. M.
1917. *Notes on the bottom environment of the marine invertebrates of western Nova Scotia.* Ottawa Naturalist, vol. 30, No. 12, pp. 149-154.
1918. *Notes on the habits and distribution of Teredo navalis on the Atlantic coast of Canada.* Biol. Contrib., Sessional Papers, No. 38a, pp. 93-101, figs. 1-2.

Kindle, E. M., and Whittaker, E. J.
1918. *Bathymetric check-list of the marine invertebrates of eastern Canada with an index to Whiteaves' Catalogue.* Dept. Naval Service, Sessional Papers, No. 38a, pp. 229-294.

Kingsley, J. S.
1901. *Preliminary catalogue of the marine invertebrates of Casco Bay, Maine.* Portland Soc. Nat. Hist., Proc., vol. 2, 159-183.

Kira, Tetsuaki
1955. *Coloured Illustrations of the Shells of Japan.* Osaka, 204 pp., 67 pls., text figs.

Kisch, B. S.
1959. *La collection de Chemnitziidae du marquis De Folin au Muséum National d'Histoire Naturelle. Description de Turbonilla corpulens. Catalogue des espèces publiées par De Folin.* Jour. Conchyl., vol. 99, No. 3, pp. 89-112.
1960. *Les mollusques décrits par De Folin - à part les Caecidae et Chemnitziidae - avec catalogue.* Jour. Conchyl., vol. 100, pp. 137-162.

Klein, Jacobi Theodori
1753. *Tentamen Methodi Ostracologicae sive dispositio naturalis Cochlidum et Concharum in suas classes, genera et species, iconibus singulorum Generum aeri incilis illustrata accedit Lucubratiuncula de formatione, cremento et coloribus testarum quae sunt Cochlidum et Concharum. Tum Commentariolum in locum Plinii Hist. Nat. Libr. IX. Cap. XXXIII de Concharum differentiis denique sciagraphia Methodi ad Genus Serpentium ordinate digerendum.* Dedicatio, 1 p; Praefatio 3 pp.; Cochlidum. Tabula Synoptica, 3 pp.; Methodus Ostracologica, 177 pp.; Indiculus, 2 pp.; Nomenclator, 3 pp.; Index Rerum, 6 pp.; Index Rerum Polyglottus, 12 pp.; Clavis Figurarum, 4 pp.; Lucubratiuncula de Formatione, Cremento et Coloribus Testarum: Praefatio, 5 pp.; Summaria, 1 p.; Cochlidum et Concharum, 44 pp.; Commentariolum in locum Plinii, 16 pp.; Sciagraphia Methodi, 2 pp., pls. 1-12.

Knorr, Georg Wolfgang
1757-1772. *Vergnugen der Angen und des Gemüths in vorstellung einer allgemeinen Sammlung von Schnecken un Muscheln und andern Geschöpfen welche im Meer gefunden verden.* Nürnberg. First ed. (1757), pp. 1-39, pls. 1-30. Zweyter Theil (1764), 56 pp., + Systematischer Register 15 pp., + Nachschrift 1 p., 30 pls.

Dritter Theil (1768), 52 pp., 30 pls. Vierter Theil (1769), pp. 1-48 + Systematischen Registers 14 pp., 30 pls. Funfter Theil (1771), 46 pp., + Vorbericht wegen des Linnaischen Registers 4 pp., + Linnaisch Register, pp. 5-13, 30 pls. Sechster Theil (1772), 76 pp., + Systematischen Registers 18 pp., + Linnaischen Registers 11 pp., + Allgemeines Register 100 pp., 40 pls.

Kobelt, Wilhelm

1881-86. *Die Gattung Crassatella Lam.* Syst. Conchylien-Cabinet, vol. 10, pt. 1A, pp. 1-16, pls. 1-6 (1881); pp. 17-41, pls. 7-9 (1886).

1886-88. *Die Gattungen Spondylus und Pecten.* Syst. Conchylien-Cabinet, vol. 7, pt. 2, pp. 129-296, pls. 37-72.

1891. *Die Gattung Arca L.* Syst. Conchylien-Cabinet, vol. 8, pt. 2, pp. 1-238, pls. 1-49.

Kornicker, Louis S., and Armstrong, Neal

1959. *Mobility of partially submerged shells.* Inst. Marine Sci. Univ. Texas, Publ., vol. 6, pp. 171-185, 14 figs.

Kornicker, Louis S., Bonet, F., Cann, Ross, and Haskin, Charles M.

1959. *Alacran Reef, Campeche Bank, México.* Inst. Marine Sci. Univ. Texas, Publ., vol. 6, pp. 1-22, 20 figs.

Korobkov, I. A.

1954. *Handbook on, and systematic guide to the Tertiary Mollusca. Lamellibranchia.* State Sci.-Tech. Publishing Agency Oil and Mineral Fuel Literature, Leningrad, 444 pp., 96 pls. (In Russian).

Kotaka, Tamio

1960. *Similarity in the turritellid phylogeny in the later Cenozoic.* Tohoku Univ., Sendai, Japan, Sci. Reports, 2d ser. (Geology), Special vol. No. 4, pp. 301-308, 4 text figs.

Kuroda, Tokubei

1928. *Catalogue of the shell-bearing Mollusca of Amami-Oshima (Oshima, Osumi).* Kagoshima, 126 pp.

1929-35. *An Illustrated Catalog of the Japanese Shells. Parts 1-16.* 154 pp.

1960. *A Catalogue of Molluscan Fauna of the Okinawa Islands.* Pp. 1-106, pls. 1-3.

Kuroda, Tokubei, and Habe, Tadashige

1952. *Check List and Bibliography of the Recent Marine Mollusca of Japan.* Tokyo, 210 pp., 1 chart, 1 map.

Küster, H. C.

1842-59. *Die Gattung Spondylus und Pecten.* Syst. Conchylien-Cabinet, vol. 7, pt. 2, pp. 1-128, pls. 1-36.

Küster, H. C., and Kobelt, W.

1839-78. *Die Geschwäntzen und bewehrten Purpurschnecken (Murex, Ranella, Tritonium, Trophon, Hindsia).* Syst. Conchylien-Cabinet, vol. 3, pt. 2, pp. 1-336, pls. 1-83.

Küster, H. C., and Weinkauff, H. C.

1837-75. *Die Familie der Coneae oder Conidae.* Syst. Conchylien-Cabinet, vol. 4, pt. 2, pp. 1-413, pls. A, 1-71.

Ladd, Harry S.

1934. *Geology of Vitilevu, Fiji.* Bernice P. Bishop Mus., Bull., No. 119, pp. 1-263, figs. 1-11, pls. 1-44.

Lahille, F.

1895. *Contribución al estudio de las Volutas Argentinas.* Mus. La Plata, Rev., vol. 6, pp. 293-332, pls. 1-12.

Lamy, Edouard

1903. *Sur une variété de l'Arca rhombea Born.* Mus. Nat. Hist. nat. Paris, Bull., vol. 9, No. 8, pp. 393-397, figs. 1-4.

1905. *Gastropodes prosobranches recueillis par l'Expedition Antarctique Français du Dr. Charcot.* Mus. Nat. Hist. nat. Paris, Bull., vol. 11, No. 6, pp. 475-483, figs. 1-5.
1906a. *Lamellibranches recueillis par l'Expedition Antarctique Français du Dr. Charcot.* Mus. Nat. Hist. nat. Paris, Bull., vol. 1, pp. 44-52.
1906b. *Sur quelques mollusques des Orcades du Sud.* Mus. Nat. Hist. nat. Paris, Bull., vol. 12, No. 2, pp. 121-126.
1907a. *Liste des coquilles marines recueillies par M. Ch. Gravier à l'Ile San Thome.* Mus. Nat. Hist. nat. Paris, Bull., vol. 13, No. 2, pp. 145-154, 1 fig.
1907b. *Coquilles marines recueillies par M. le Dr. Nevu-Lemaire pendant la mission de Créqui Montfort et Sénéchal de la Grange dans l'Amérique du Sud.* Mus. Nat. Hist. nat. Paris, Bull., vol. 13, No. 7, pp. 530-539.
1908a. *Coquilles marines recueillies par M. le Dr. Neveu-Lemaire pendant la mission de Créqui-Montfort et Sénéchal de la Grange dans l'Amérique du Sud.* Mus. Nat. Hist. nat. Paris, Bull., vol. 14, No. 1, pp. 44-53.
1908b. *Description d'un lamellibranche nouveau des Iles Malouines.* Mus. Nat. Hist. nat. Paris, Bull., vol. 14, No. 2, pp. 128-129.
1908c. *Liste des mollusques recuellis par M. Ch. Gravier à Bergen (Norvège).* Mus. Nat. Hist. nat. Paris, Bull., vol. 14, No. 7, pp. 380-383.
1910a. *Mollusques marins recueillis par le Dr. Rivet à Payta (Pérou).* [In] Mission du Service Géographique de l'Armée pour la mésure d'un arc de méridien équatorial en Amérique du Sud, 1899-1906. Paris, vol. 9, Zoologie, No. 3, pp. C79-C91.
1910b. *Mollusques recueillis par M. Rallier du Baty aux Iles Kerguelen.* Mus. Nat. Hist. nat. Paris, Bull., vol. 16, No. 4, pp. 198-204, fig. 1.
1910c. *Mission dans l'Antarctique dirigée par M. le Dr. Charcot (1908-1910). Collections recueillies par M. le Dr. Liouville. Gastropodes prosobranches et Scaphopode.* Mus. Nat. Hist. nat. Paris, Bull., vol. 16, No. 6, pp. 318-324.
1910d. *Mission dans l'Antarctique dirigée par M. le Dr. Charcot (1908-1910). Collections recueillies par M. le Dr. Jacques Liouville. Pélécypodes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 16, No. 7, pp. 388-394.
1911a. *Sur quelques mollusques de la Géorgie du Sud et des Iles Sandwich du Sud.* Mus. Nat. Hist. nat. Paris, Bull., vol. 17, No. 1, pp. 22-37, figs. 1-3.
1911b. *Liste des Pectunculus conservées avec étiquettes de Lamarck dans les collections du Muséum de Paris.* Mus. Nat. Hist. nat. Paris, Bull., vol. 17, No. 6, pp. 431-435.
1912a. *Notes synonymiques sur les Amphidesma de Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 3, pp. 159-165.
1912b. *Sur les espèces de Lamarck appartenant au genre Mesodesma Deshayes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 4, pp. 245-253, 1 fig.
1912c. *Note sur le Mesodesma mactroides Deshayes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 5, pp. 312-316, figs. 1-3.
1912d. *Note sur les espèces rapportées au sous-genre Capsa H. et A. Adams, 1856.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 6, pp. 369-372.
1912e. *Sur le genre Pleurodon ou Nucinella S. Wood, avec description d'une espèce nouvelle.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 7, pp. 429-433, figs. 1-3.

1912f. *Sur deux espèces de lamellibranches appartenant au genre Litigiella Monterosato.* Mus. Nat. Hist. nat. Paris, Bull., vol. 18, No. 8, pp. 511-513, 2 figs.
1913a. *Notes sur les espèces Lamarckiennes de Garidae.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 1, pp. 19-25, 57-65.
1913b. *Mollusques et Brachiopodes de la croisière du Pourquoi-Pas? dans les mers du Nord.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 1, pp. 21-24.
1913c. *Note sur quelques coquilles du genre Crassatella déterminés par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 2, pp. 99-105.
1913d. *Note sur les espèces rangées par Lamarck dans son genre Lutraria.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 6, pp. 343-349.
1913e. *Note sur le Cyclas australis Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 7, pp. 466-468.
1913f. *Mollusques testacés et Brachiopodes de la croisière 1913 du Pourquoi-Pas? dans l'Atlantique et dans les mers boréales.* Mus. Nat. Hist. nat. Paris, Bull., vol. 19, No. 8, pp. 594-603.
1913g. *Révision des Scrobicularidae vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 61, pp. 243-368, No. 3, pl. 8, text figs.
1914a. *Notes sur les espèces Lamarckiennes de Garidae.* Mus. Nat. Hist. nat. Paris, Bull., vol. 20, No. 1, pp. 19-25; No. 2, pp. 57-65.
1914b. *Notes sur les espèces du genre Mactra décrites par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 20, No. 3, pp. 127-135; No. 4, pp. 239-247.
1914c. *Notes sur les espèces rangées par Lamarck dans ses genres Donax et Capsa.* Mus. Nat. Hist. nat. Paris, Bull., vol. 20, No. 5, pp. 286-292; No. 6, pp. 338-346.
1915a. *Note sur le Semele nuculoides Conrad.* Mus. Nat. Hist. nat. Paris, Bull., vol. 21, No. 1, pp. 17-18, fig. 1.
1915b. *Mollusques recueuillis aux Iles Kerguelen par M. Loranchet (Mission Rallier du Baty, 1913-1914).* Mus. Nat. Hist. nat. Paris, Bull., vol. 21, No. 2, pp. 68-76.
1915c. *Notes sur les espèces Lamarckiennes appartenant au genre Lucina Bruguière.* Mus. Nat. Hist. nat Paris, Bull., vol. 21, No. 4, pp. 130-136; No. 5, pp. 154-155.
1915d. *Sur quelques espèces de Cardita figurées par Valenciennes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 21, No. 6, pp. 195-200.
1915e. *Notes sur les espèces Lamarckiennes des genres Cyprina, Cypricardia, Hiatella et Isocardia.* Mus. Nat. Hist. nat. Paris, Bull., vol. 21, No. 7, pp. 244-252.
1916a. *Notes sur les espèces rangées par Lamarck dans les genres Venericardia et Cardita.* Mus. Nat. Hist. nat. Paris, Bull., vol. 22, No. 1, pp. 50-58, 116-121.
1916b. *Description d'un lamellibranche nouveau du Golfe de Californie.* Mus. Nat. Hist. nat. Paris, Bull., vol. 22, No. 8, pp. 443-445, figs. 1-3.
1916c. *Révision des Crassatellidae vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 62, pp. 197-270, pl. 6. figs.
1917a. *Notes sur les espèces Lamarckiennes du genre Chama.* Mus. Nat. Hist. nat. Paris, Bull., vol. 23, No. 3, pp. 201-207, 265-271.
1917b. *Notes sur les espèces du genre Spondylus décrites par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 23, No. 5, pp. 318-324; No. 6, pp. 403-409.
1917c. *Révision des Mactridae vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 63, No. 3, pp. 173-275; No. 4, pp. 291-411, pls. 6-7, figs.

1918. *Notes sur quelques espèces de Purpura déterminées par Blainville dans la collection du Muséum de Paris.* Mus. Nat. Hist. nat. Paris, Bull., vol. 24, No. 5, pp. 352-357; No. 6, pp. 425-430.

1919a. *Les Moules et les Moidioles de la Mer Rouge (d'aprés les matériaux recueillis par M. le Dr. Jousseaume).* Mus. Nat. Hist. nat. Paris, Bull., vol. 25, pp. 40-45, 109-114, 173-178.

1919b. *Les Lithodomes de la Mer Rouge (d'après les matériaux recueillis par M. le Dr. Jousseaume).* Mus. Nat. Hist. nat. Paris, Bull., vol. 25, pp. 252-257.

1919c. *Notes sur les espèces Lamarckiennes du genre Lima Bruguière, 1792.* Mus. Nat. Hist. nat. Paris, Bull., vol. 25, No. 6, pp. 480-486.

1919d. *Notes sur les espèces du genre Plicatula décrites par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 25, No. 7, pp. 510-513.

1919e. *Révision de Astartidae vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 64, pp. 70-119, figs.

1920a. *Notes sur les espèces rangées par Lamarck dans son genre Modiola.* Mus. Nat. Hist. nat. Paris, Bull., vol. 26, No. 1, pp. 61-67; No. 2, pp. 149-154; No. 3, pp. 232-238.

1920b. *Notes sur les espèces de Mytilus décrites par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 26, No. 4, pp. 330-335; No. 5, pp. 415-421; No. 6, pp. 520-526.

1920c. *Révision des Cypricardiacea et des Isocardiacea vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 64, pp. 259-307, pl. 8, figs.

1921a. *Sur quelques Pholades figurées par Valenciennes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 27, No. 2, pp. 178-183.

1921b. *Notes sur les espèces de Saxicava décrites par Lamarck.* Mus. Nat. Hist. nat. Paris, Bull., vol. 27, pp. 361-365.

1921c. *Notes sur les espèces rangées par Lamarck dans son genre Petricola.* Mus. Nat. Hist. nat. Paris, Bull., vol. 27, pp. 432-436.

1922a. *Notes sur les espèces rangées par Lamarck dans son genre Venerupis.* Mus. Nat. Hist. nat. Paris, Bull., vol. 28, pp. 82-86.

1922b. *Notes sur les espèces Lamarckiennes de Teredo (Taret).* Mus. Nat. Hist. nat. Paris, Bull., vol. 28, pp. 177-181.

1922c. *Notes sur les espèces Lamarckiennes de Pholas.* Mus. Nat. Hist. nat. Paris, Bull., vol. 28, pp. 243-245.

1922d. *Notes sur les espèces Lamarckiennes appartenant à la famille des Gastrochaenidae.* Mus. Nat. Hist. nat. Paris, Bull., vol. 28, pp. 307-311.

1922e. *Note sur les Mytilus strigatus Hinds, falcatus d'Orbigny et sinuatus Dunker.* Mus. Nat. Hist. nat. Paris, Bull., vol. 28, pp. 373-375.

1922f. *Révision des Carditacea vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 66, pp. 218-368, pls. 7-8, figs.

1923. *Révision des Venerupis et des Petricola vivants du Muséum d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 67, pp. 275-358, pl. 3, figs.

1924a. *Notes sur les espèces Lamarckiennes d'Ostrea.* Mus. Nat. Hist. nat. Paris, Bull., vol. 30, pp. 92-99, 151-158, 231-238, 316-320.

1924b. *Révision des Saxicavidae et des Gastrochaenidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 68, pp. 218-248, 261-319.

1925a. *Notes sur les espèces rangées par Lamarck dans le genre Mya Linné.* Mus. Nat. Hist. nat. Paris, Bull., vol. 30, pp. 494-496.

1925b. *Notes sur les espèces rangées par Lamarck dans son genre Anatina.* Mus. Nat. Hist. nat. Paris, Bull., vol. 31, pp. 372-378.

1925c. *Révision des Pholadidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 69, pp. 19-51, 79-103, 136-168, 193-222, figs.
1925d. *Révision des Gastrochaenidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 68, pp. 284-319.
1926a. *Notes sur le espèces rangées par Lamarck dans le genre Corbula Bruguière.* Mus. Nat. Hist. nat. Paris, Bull., vol. 32, pp. 81-85.
1926b. *Mollusques testacés de la croisière 1925 du Pourquoi-Pas? dans l'Atlantique et des Mers Boréales.* Mus. Nat. Hist. nat. Paris, Bull., vol. 32, pp. 179-181.
1926c. *Note sur le genre Basterotia Mayer 1859 (Mollusques Lamellibranches).* Mus. Nat. Hist. nat. Paris, Bull., vol. 32, pp. 503-508, 1 fig.
1926d. *Révision des Myidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 70, pp. 151-185, figs.
1928a. *Révision de Lyonsiidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 70, pp. 237-264, 2 text figs.
1928b. *Révision des Chama vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 71, pp. 293-383.
1928c. *Les Huîtres de la Republique Argentine.* Mus. Nat. Hist. nat. Paris, Bull., vol. 34, pp. 101-104.
1929a. *Notes sur quelques lamellibranches de la Martinique.* Mus. Nat. Hist. nat. Paris, Bull., ser. 2, vol. 1, No. 3, pp. 201-208.
1930b. *Coquilles recueillies au Pérou, par M. le Dr. Vergne.* Rev. Chilena Hist. Nat., pp. 95-97.
1931c. *Liste de coquilles recueillies par M. E. Aubert de rue aus Iles Kerguelen, St. Paul et la Nouvelle-Amsterdam.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 3, No. 6, pp. 517-520.
1932a. *Notes sur les espèces Lamarckiennes de Tridacnidae.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 4, No. 3, pp. 307-312.
1932b. *Notes sur les espèces Lamarckiennes de Solenidae.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 4, No. 4, pp. 427-437.
1932c. *Notes sur les espèces Lamarckiennes du genre Pinna Linné.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 4, No. 7, pp. 895-902.
1933. *Notes sur les espèces Lamarckiennes du genre Pinna.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 5, No. 5, pp. 393-399.
1934b. *Révision des Pandoridae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 78, pp. 95-124.
1934c. *Révision des Anatina vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 78, pp. 145-168, pl. 1.
1935a. *Notes sur les espèces Lamarckiennes des genres Crenatula, Malleus et Vulsella.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 7, No. 1, pp. 64-70.
1935b. *Notes sur les espèces Lamarckiennes des genres Avicula et Meleagrina.* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 7, No. 2, pp. 127-134.
1935c. *Les genre Chamostrea Roissy.* Jour. Conchyl., vol. 80, pp. 322-328.
1936. *Note sur le Cytherea callosa Conrad (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 8, No. 2, pp. 158-159.
1937a. *Sur le dimorphisme sexuel des coquilles.* Jour. Conchyl., vol. 81, pp. 283-301, figs. 1-10.
1937b. *Notes sur les espèces Lamarckiennes de Katelysia (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 1, pp. 73-76.

1940. *Notes sur les espèces Lamarckiennes d'Anomia (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 12, No. 6, pp. 344-347.
1940-41. *Révision des Corbulidae vivants du Muséum National d'Histoire Naturelle de Paris.* Jour. Conchyl., vol. 84, No. 1, pp. 5-33, 6 text figs.; No. 2, pp. 121-141; No. 3, pp. 211-254.
1941. *Note sur la distribution géographique du Columbella cribraria (Moll. Gastrop.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 13, No. 4, pp. 306-308.
1941-42. *Notes sur les espèces Lamarckiennes de Cardium (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 13, No. 5, pp. 458-463; No. 6, pp. 561-566; vol. 14, No. 1, pp. 63-68; No. 2, pp. 126-129; No. 3, pp. 228-232; No. 5, pp. 346-348.

Lamy, Edouard, and André, Marc

1932. *Notes sur les espèces Lamarckiennes de Cirripèdes.* Soixante-cinquiènne Congrès des Sociétés Savantes, pp. 212-228.

Lamy, Edouard, and Fischer-Piette, E.

1937a. *Notes sur les espèces Lamarckiennes de Tivela (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 1, pp. 77-81.
1937b. *Notes sur les espèces Lamarckiennes de Meretrix (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 2, pp. 156-158.
1937c. *Notes sur les espèces Lamarckiennes de Callista (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 3, pp. 212-216.
1937d. *Notes sur les espèces Lamarckiennes d'Amiantis, d'Hysteroconcha et de Lioconcha (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 4, pp. 270-271.
1937e. *Notes sur les espèces Lamarckiennes de Pitar (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 5, pp. 326-329.
1937f. *Notes sur les espèces Lamarckiennes de Circe (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 9, No. 8, pp. 384-386.
1938a. *Notes sur les espèces Lamarckiennes de Crista (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 1, pp. 82-85.
1938b. *Notes sur les espèces Lamarckiennes d'Anomalocardia (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 2, pp. 173-175.
1938c. *Notes sur les espèces Lamarckiennes d'Antigona (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 3, pp. 292-297.
1938d. *Notes sur les espèces Lamarckiennes de Venus s. str. et de Chione (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 4, pp. 401-405.
1938e. *Notes sur les espèces Lamarckiennes de Timoclea (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 5, pp. 509-511.
1938f. *Notes sur les espèces Lamarckiennes de Clausinella, de Salacia, de Protothaca, et de Samarangia (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 10, No. 6, pp. 611-614.
1939a. *Notes sur les espèces Lamarckiennes de Venus (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 11, No. 1, pp. 140-141.
1939b. *Notes sur les espèces Lamarckiennes de Marcia et d'Hemitapes (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 11, No. 2, pp. 258-262.
1939c. *Notes sur les espèces Lamarckiennes de Paratapes et de Tapes (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 11, No. 3, pp. 314-317.
1939d. *Notes sur les espèces Lamarckiennes de Polititapes (Moll. Lamellibr.).* Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 11, No. 4, pp. 405-408.

1939e. *Notes sur les espèces Lamarckiennes d'Amygdala et de Pullastra (Moll. Lamellibr.)*. Mus. Nat. Hist. nat. Paris, Bull., sér. 2, vol. 11, No. 5, pp. 461-466.

Langdon, Daniel W., Jr.

1889. *Some Florida Miocene.* Amer. Jour. Sci., ser. 3, vol. 38 (138), No. 226, art. 44, pp. 322-324.

Lange de Morretes, Frederico

1938. *Duas especoies novas de moluscos marinhos do Brasil.* Livro Jubilar do Prof. Lauro Travassos, Rio de Janeiro, pp. 329-332, pl. 1.

1940a. *Algunas palavras sôbre novas ocoriências e maior distribuição de moluscos na costa do Brasil.* Rev. Indústria Animal, nov. ser., vol. 3, No. 4, pt. 131, pp. 184-187.

1940b. *Novos moluscos marinhos do Brasil.* Arq. Zoologia Estado São Paulo, vol. 2, art. 7, pp. 251-256, pls. 1-2.

1943. *Contribuição ao estudo da fauna Brasileira de moluscos. Resultados de uma pequena coleção de moluscos obtida pela excursão cientifica realizada pelo Instituto Oswaldo Cruz em Outubro de 1938.* Papéis Alvulsos Dept. Zool. Secretaria Agric., pp. 111-126.

1949. *Ensaio de catálogo dos moluscos do Brasil.* Mus. Paranaense, Arq., vol. 7, art. 1, pp. 5-216.

Laseron, Charles F.

1954. *Revision of the New South Wales Turridae (Mollusca).* Roy. Zool. Soc. New South Wales, Australian Zoological Handbook, 56 pp., 12 pls.

1956. *The families Rissoinidae and Rissoidae (Mollusca) from the Solanderian and Dampierian zoogeographical provinces.* Australian Jour. Marine and Freshwater Research, vol. 7, No. 3, pp. 384-484, figs. 1-227.

1957. *A new classification of the Australian Marginellidae (Mollusca), with a review of species from the Solanderian and Dampierian zoogeographical provinces.* Australian Jour. Marine and Freshwater Research, vol. 8, No. 3, pp. 274-311, figs. 1-84.

1958a. *The care of small shells in the collection.* Roy. Zool. Soc. New South Wales, Proc., pp. 92-94.

1958b. *Liotiidae and allied molluscs from the Dampierian zoogeographical province.* Australian Mus., Rec., vol. 24, No. 11, pp. 165-182, figs. 1-87.

Laws, C. R.

1930. *New Tertiary Mollusca from New Zealand. No. 1.* New Zealand Inst., Trans., vol. 61, pp. 547-553, pls. 89-91.

1932. *New Tertiary Mollusca from New Zealand. No. 2.* New Zealand Inst., Trans., vol. 62, pp. 183-202, pls. 26-32.

1933. *New Tertiary Mollusca from Timaru District, South Canterbury, N. Z.* Roy. Soc. New Zealand, Trans., vol. 63, pp. 315-329, pls. 29-33.

1935. *The genus Erato in the Tertiary of New Zealand.* Roy. Soc. New Zealand, Trans., vol. 65, pp. 17-22, pl. 3.

1937a. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 1. The genus Turbonilla.* Roy. Soc. New Zealand, Trans., vol. 66, pp. 402-422, pls. 32-33.

1937b. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 2. The genus Chemnitzia.* Roy. Soc. New Zealand, Trans., vol. 66, pp. 47-70, pls. 13-14.

1937c. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 3. Further turbonillid genera.* Roy. Soc. New Zealand, Trans., vol. 67, pp. 166-184, pls. 34-35.

1937d. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 4. The syrnolid genera.* Roy. Soc. New Zealand, Trans., vol. 67, pp. 303-315, pls. 43-44.
1938a. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 5. The eulimellid genera.* Roy. Soc. New Zealand, Trans., vol. 68, pp. 51-59, pl. 9.
1938b. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 6. The genus Odostomia.* Roy. Soc. New Zealand, Trans., vol. 69, pp. 191-209, pls. 16-18.
1939. *The molluscan faunule et Pakaurangi Point, Kaipara. No. 1.* Roy. Soc. New Zealand, Trans., vol. 68, pp. 468-503, pls. 42-47.
1940a. *Paleontological study of Nukumaruan and Waitotaran rocks near Wanganui.* Roy. Soc. New Zealand, Trans., vol. 70, pt. 1, pp. 34-56, pls. 5-7.
1940b. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 7. Further odostomid genera.* Roy. Soc. New Zealand, Trans., vol. 70, pp. 150-160, pls. 13-14.
1941a. *Review of the Tertiary and Recent Neozelanic pyramidellid molluscs. No. 8. The pyrgulinid genera and the genus Evalea.* Roy. Soc. New Zealand, Trans., vol. 71, pp. 6-22, pls. 1-2.
1941b. *The molluscan faunule at Pakaurangi Point, Kaipara. No. 2.* Roy. Soc. New Zealand, Trans., vol. 71, pt. 2, pp. 134-151, pls. 16-19.
1944. *The molluscan faunule at Pakaurangi Point, Kaipara. No. 3.* Roy. Soc. New Zealand, Trans., vol. 73, pt. 4, pp. 297-312, pls. 43-45.

Lea, Henry Carey

1844. *Descriptions of some new species of marine shells, inhabiting the coast of the United States.* Boston Jour. Nat. Hist., vol. 5, No. 2, pp. 285-290, pl. 24.
1847. *Description of eight new species of shells, native to the United States.* Amer. Jour. Sci. and Arts, vol. 42, pp. 106-112, pl. 1.

Leidy, Joseph

1888. *Remarks on the fauna of Beach Haven, N. J.* Acad. Nat. Sci. Philadelphia, Proc., vol. 40, pp. 329-333.

Lemche, Henning

1959. *Neopilina.* Univ. Madrid, Rev., vol. 8, Nos. 29-31, pp. 411-442, figs. 1-12.

Lermond, Norman Wallace

1909a. *A catalogue of the land, fresh-water, and marine Mollusca of Maine.* Fourth An. Rept. State Entomologist, Maine, pp. 217-262.
1909b. *Shells of Maine. A catalogue of the land, fresh-water and marine Mollusca of Maine.* State Entomologist of Maine, An. Rept., vol. 5, pp. 25-70.
1936. *Check List of Florida Marine Shells.* Gulfport, 56 pp.

Lermond, Norman Wallace, and Horton, A. H.

1930. *A bibliography of the Recent Mollusca of Maine, 1605-1930.* Maine Naturalist, vol. 10, pp. 49-73, 100-121.

Letson, Elizabeth

1905. *Check list of the Mollusca of New York.* New York State Mus., Bull. 88, Zoology, 112 pp.

Linsley, James H.

1845. *Catalogue of the shells of Connecticut.* Amer. Jour. Sci. and Arts, 1st ser., vol. 48, No. 2, art. 6, pp. 271-286, 5 figs. in text.

Liver, J.

1958. *Quantitative beach research. I. The "left-right phenomenon": sorting of lamellibranch valves on sandy beaches.* Basteria, vol. 22, pp. 22-51.

Löbbecke, Th.

1881-87. *Cancellaria. Nebst Anhang, Admete, von W. Kobelt.* Syst. Conchylien-Cabinet, vol. 4, pt. 4, pp. 1-108, pls. 1-24.

Locard, Arnould

1888. *Contributions à la fauna malacologique Francaise. Pt. XI. Monographie des espèces appartenant au genre Pecten.* Soc. Linn. Lyon, Ann., new ser., vol. 34, pp. 133-287.

1898. *Mollusques testacés.* [In] *Expéditions scientifiques du Travailleur et du Talisman pendant les années 1880, 1881, 1882, 1883.* Paris, vol. 2, pp. 369-482, pls. 15-18, 1 map.

Ludbrook, N. H.

1954a. *Scaphopoda.* British Mus. (Nat. Hist.). The John Murray Expedition 1933-1934, Scientific Reports, vol. 10, No. 2, pp. 91-120, pl. 1.

1954b. *The molluscan fauna of the Pliocene strata underlying the Adelaide Plains. Pt. 1.* Roy. Soc. South Australia, Trans., vol. 77, 64 pp.

1955. *The molluscan fauna of the Pliocene strata underlying the Adelaide Plains. Pt. 2-Pelecypoda.* Roy. Soc. South Australia, Trans., vol. 78, pp. 18-87, pls. 1-6.

1957. *The Molluscan fauna of the Pliocene strata underlying the Adelaide Plains. Pt. 4-Gastropoda (Turritellidae to Struthiolariidae).* Roy. Soc. South Australia, Trans., vol. 80, pp. 17-58, pls. 1-4.

Ludbrook, N. H., and Steel, T. M.

1961. *A late Tertiary bivalve gastropod from South Australia.* Malac. Soc. London, Proc., vol. 34, pt. 4, pp. 228-230, pl. 12.

Lyell, Charles

1833. *Principles of Geology, being an attempt to explain the former changes of the earth's surface, by reference to causes now in operation.* London, John Murray, pp. i-xxxi + 398 + Appendix I, pp. 2-52, Appendix II, pp. 53-83, Index, pp. 85-109, 93 Figs., 4 pls., 1 geol. map.

Lynge, H.

1909. *The Danish Expedition to Siam 1899-1900. IV. Marine Lamellibranchiata.* K. Danske Vidensk. Selskabs., Skr., ser. 7, Nat. Math. Afd., vol. 5, pp. 97-299, pls. 1-5, 1 map.

Mabille, Jules, and Rochebrune, A. T.

1889. *Mollusques.* [In] *Mission scientifique du Cap Horn.* Paris, vol. 6, pt. 2, 143 pp., 9 pls.

MacDonald, D. F.

1819a. *Notes on the stratigraphy of Panama and Costa Rica.* Amer. Assoc. Petrol. Geol., Bull., vol. 3, pp. 363-366.

MacGintie, Nettie

1959. *Marine Mollusca of Point Barrow, Alaska.* U. S. Nat. Mus., Proc., vol. 109, No. 3412, pp. 59-208, 27 pls.

MacNeil, F. Stearns

1935. *Fresh-water mollusks from the Catahoula Sandstone (Miocene) of Texas.* Jour. Paleont., vol. 9, No. 1, pp. 10-17, pls. 3-5.

1936. *A new crassatellid from the Waccamaw formation of North and South Carolina and the Caloosahatchee marl of Florida.* Washington Acad. Sci., Jour., vol. 26, No. 12, pp. 528-529, figs. 1-3.

1951. *Cenozoic megafossils of northern Alaska.* U. S. Geol. Sur., Prof. Paper 294-C, pp. 99-126, 7 pls.

Macpherson, J. Hope

1959. *New gasteropods from North Australia.* Nat. Mus. Melbourne, Mem., No. 24, pp. 51-57, 1 pl.

Mallard, A. E.

1903. *Sur un lamellibranche nouveau, parasite des Synaptes.* Mus. Nat. Hist. nat. Paris, Bull., vol. 9, pp. 342-346.

Manger, G. Edward

1934. *The geology of San Quintin Bay.* Johns Hopkins Studies Geol., No. 11, pp. 273-303, 1 pl.

Mansfield, Wendell Clay

1932c. *Faunal zones in the Miocene Choctawhatchee formation of Florida.* Washington Acad. Sci., Jour., vol. 22, pp. 84-88.

1936a. *Additional notes on the molluscan fauna of the Pliocene Croatan Sand of North Carolina.* Jour. Paleont., vol. 10, No. 7, pp. 665-668.

Marchant, Stephen

1961. *A photogeological analysis of the structure of the western Guayas Province, Ecuador: with discussion of the stratigraphy and Tablazo Formation, derived from surface mapping.* Geol. Soc. London, Quart. Jour., vol. 17, pt. 2, pp. 215-232, figs. 1-3, pl. 8, (photogeological map).

Marchesini Santos, Maria Eugenia C.

1958. *Equinóides miocênicos du formação Pirabas.* Dept. Nac. Prod. Min., Div. Geol. e Min., Bol. No. 79, pp. 1-24, pls. 1-5.

Marcus, Eveline and Ernst

1960a. *On Hastula cinerea.* Fac. Fil., Ciên., Letr. Univ. S. Paulo, Bol. No. 260, Zoologia No. 23, pp. 25-66, 5 pls.

1960b. *On Siphonaria hispida.* Fac. Fil., Ciên., Letr. Univ. S. Paulo, Bol. No. 260, Zoologia No. 23, pp. 107-140, 4 pls.

1960c. *On Tricolia affinis cruenta.* Fac. Fil., Ciên., Letr. Univ. S. Paulo, Bol. No. 260, Zoologia No. 23, pp. 171-211, 6 pls.

Marcus, E.

1956a. *On some Prosobranchia from the coast of São Paulo.* Inst. Oceanogr. São Paulo, Bol., vol. 7, pts. 1-2, pp. 3-29.

1956b. *Notes on Opisthobranchia.* Inst. Oceanogr. São Paulo, Bol., vol. 7, pts. 1-2, pp. 31-78, 8 pls.

1958. *On Western Atlantic opisthobranchiate gastropods.* Amer. Mus. Novitates, No. 1906, pp. 1-82, 111 figs.

Marks, J. Glenn

1952. *Especies vivientes de moluscos que se encuentran en las formaciones Terciarias de Venezuela.* Acta Cientifica Venezolana, vol. 3, No. 4, pp. 135-136, figs. 1-8.

Marrat, Frederick Price

1876. *Descriptions of five new Marginellae.* Jour. Conch., vol. 1, pp. 136-137.

Marshall, William Blanchard

1915. *Three new species of Anodontites from Brazil.* U.S. Nat. Mus., Proc., vol. 49, No. 2122, pp. 527-529, pls. 67-69.

1917. *New and little-known species of South America fresh-water mussels of the genus Diplodon.* U.S. Nat. Mus., Proc., vol. 53, No. 2209, pp. 381-388, pls. 50-55.

1922. *New pearly fresh-water mussels from South America.* U.S. Nat. Mus., Proc., vol. 61, No. 2437, art. 16, 9 pp., 3 pls.

1924a. *New pearly fresh-water mussels from Mexico and Uruguay.* U.S. Nat. Mus., Proc., vol. 63, No. 2485, art. 16, 4 pp., 3 pls.

1924b. *New species of mollusks of the genus Chilina.* U.S. Nat. Mus., Proc., vol. 66, No. 2550, 5 pp., 1 pl.

1924c. *New Uruguayan mollusks of the genus Corbicula.* U.S. Nat. Mus., Proc., vol. 66, No. 2552, 12 pp., 2 pls.

1925. *Microscopic sculpture of pearly fresh-water mussel shells.* U.S. Nat. Mus., Proc., vol. 67, No. 2576, art. 4, 14 pp. 4 pls.

1926a. *New fossil fresh-water mollusks from Florida.* U.S. Nat. Mus., Proc., vol. 68, art. 11, 4 pp., 1 pl.
1926b. *New land and fresh-water mollusks from Central and South America.* U.S. Nat. Mus., Proc., vol. 69, No. 2638, art. 12, 12 pp., 3 pls.
1927a. *A new genus and two new species of South American fresh-water mussels.* U.S. Nat. Mus., Proc., vol. 71, No. 2678, 4 pp., 2 pls.
1927b. *New species of mollusks of the genus Corbicula from Uruguay and Brazil.* U.S. Nat. Mus., Proc., vol. 72, No. 2699, 7 pp., 1 pl.
1928a. *New fossil pearly fresh-water mussels from deposits on the upper Amazon of Peru.* U.S. Nat. Mus., Proc., vol. 74, art. 3, pp. 1-6, pl. 1.
1928b. *New fresh-water and marine shells from Brazil and Uruguay.* U.S. Nat. Mus., Proc., vol. 74, art. 17, pp. 1-7, pls. 1-4.
1929. *New fossil and fresh-water mollusks from the Reynosa formation of Texas.* U.S. Nat. Mus., Proc., vol. 76, No. 2798, art. 1, pp. 1-6, pl. 1.
1930a. *New land and fresh-water mollusks from South America.* U.S. Nat. Mus., Proc., vol. 77, No. 2825, art. 2, pp. 1-7, pls. 1-2.
1930b. *Type of Anodontites Bruguière.* Nautilus, vol. 43, No. 4, pp. 128-130.
1930c. *Former and present terms used in describing fresh-water mussels.* Nautilus, vol. 44, No. 2, pp. 41-42.
1931a. *Anodontites: A genus of South and Central American and Mexican pearly fresh-water mussels.* U.S. Nat. Mus., Proc., vol. 79, No. 2889, art. 23, pp. 1-16, pl. 1.
1931b. *Ruganodontites, a new subgenus of South American pearly fresh-water mussels.* Nautilus, vol. 45, No. 1, pp. 16-20.
1933. *New fresh-water gastropod mollusks of the genus Chilina of South America.* U.S. Nat. Mus., Proc., vol. 82, No. 2949, art. 8, pp. 1-6, pl. 1.

Marshall, William B., and Bowles, Edgar O.

1932. *New fossil fresh-water mollusks from Ecuador.* U.S. Nat. Mus., Proc., vol. 82, No. 2946, art. 5, pp. 1-7, pl. 1.

von Martens, C. E.

1881. *Mittheilungen über Mehrere von Sr. Maj. Schiff Gazelle von der Magalhaenstrasse-Insel mitgebrachte Meeres-Conchylien.* Gesell. Naturf. Freunde zu Berlin, Sitzungs-Bericht, vol. 17, No. 5, pp. 75-80.

von Martens, Eduard, and Pfeffer, Georg

1886. *Die Mollusken von Süd-Georgien nach der Ausbeute der Deutschen Station 1882-83.* Wissensch. Anstalten Hamburg, Jahrb., vol. 3, pp. 65-135, pls. 1-4.

Martin, Bruce

1916. *The Pliocene of middle and northern California.* Univ. California Publ., Bull. Dept. Geol. Sci., vol. 9, No. 15, pp. 215-259.

Martin, Karl

1879-80. *Die Tertiärschichten auf Java. Palaeontologischer Theil.* Leiden, 164 pp., 28 pls., 1 geol. map, Allgemeiner Theil, 51 pp., Anhang, 6 pp.
1895-1906. *Die Fossilien von Java. Mollusca. Gasteropoda.* Samml. Geol. Reichs-Mus. Leiden, neue Folge, vol. 1, pts. 1-5, *Bulla-Murex,* pp. 1-132, pls. 1-20 (1895); pts. 6-8, *Ocinebra-Telescopium,* pp. 133-220, pls. 21-33 (1899); pt. 9, *Modulus-Delphinula,* pp. 221-281, pls. 34-41 (1905); *Nachtrag zu den Gastropoden,* pp. 282-325, pls. 42-45.

1909-1922. *Die Fossilien von Java. Lamellibranchiata.* Samml. Geol. Reichs-Mus. Leiden, neue Folge, vol. 1, pt. 2, No. 1, *Ostrea-Pinna,* pp. 333-356, pls. 46-50 (1909); No. 2, *Pinna-Cucullaea,* pp. 357-386, pls. 51-54 (1910); No. 3, *Die Mollusken der Njalindungschichten,* pp. 446-470, pls. 58-59 (1921); No. 4, pp. 471-496, pls. 60-61 (1922).

Martins, E. von

1880. *Beitrage zu Meeresfauna der Insel Mauritius und der Seychellen. Mollusken.* Pp. 181-346, pls. 19-22.

Martin-Kaye, P. H. A.

1951. *Sorting of lamellibranch valves on beaches in Trinidad, B. W. I.* Geol. Mag., vol. 88, pp. 432-434.

Marwick, John

1923. *The genus Glycymeris in the Tertiary of New Zealand.* New Zealand Inst., Trans., vol. 54, pp. 63-80, 7 pls.

1924a. *Paleontological notes on some Pliocene Mollusca from Hawke's Bay.* New Zealand Inst., Trans., vol. 55, pp. 191-201, pls. 16-17.

1924b. *The Tertiary and Recent Naticidae and Naricidae of New Zealand.* New Zealand Inst., Trans., vol. 55, pp. 545-579, pls. 55-60.

1926a. *New Tertiary Mollusca from North Taranaki.* New Zealand Inst., Trans., vol. 56, pp. 317-331, pls. 73-75.

1926b. *The Veneridae of New Zealand.* New Zealand Inst., Trans., vol. 57, pp. 567-635, pls. 34-54, 3 figs.

1928. *The Tertiary Mollusca of the Chatham Islands, including a generic revision of the New Zealand Pectinidae.* New Zealand Inst., Trans., vol. 58, pp. 432-506, 148 figs.

1931. *The Tertiary Mollusca of the Gisborne District.* Dept. Sci. and Indust. Research, Geol. Survey Branch, Palaeont. Bull. No. 13, pp. 1-77, pls. 1-18.

1934. *Some New Zealand Tertiary Mollusca.* Malac. Soc. London, Proc., vol. 21, pt. 1, pp. 10-21, pls. 1-2.

1938. *Notocallista and its allies.* Roy. Soc. New Zealand, Trans., vol. 68, pp. 60-81, pls. 10-14.

1944. *New Zealand fossil and Recent Cardiidae (Mollusca).* Roy. Soc. New Zealand, Trans., vol. 74, pt. 3, pp. 255-272, pls. 35-37.

1953. *A Pliocene fossil found living by the Galathea Expedition.* New Zealand Jour. Sci. and Tech., Section B, vol. 35, No. 1, pp. 109-112, figs. 1-6.

1957. *Generic revision of the Turritellidae.* Malac. Soc. London, Proc., vol. 32, pt. 4, pp. 144-166, figs. 1-53.

Maton, William George, and Rackett, Thomas

1807. *A descriptive catalogue of the British testacea.* Linnean Soc. London, Trans., vol. 8, pp. 17-250, pls. 1-5.

Matson, George Charleton

1916. *The Pliocene Citronelle formation of the Gulf Coastal Plain.* U. S. Geol. Sur., Prof. Paper 98-L, pp. 167-192.

Mattox, N. T.

1949. *Studies on the biology of the edible oyster Ostrea rhizophorae Guilding in Puerto Rico.* Ecol. Monogr., vol. 19, pp. 339-356.

May, W. L.

1921. *A Check-list of the Mollusca of Tasmania.* Hobart, 114 pp.

1923. *W. L. May's Illustrated Index of Tasmanian Shells.* Hobart, 2 pp., 47 pls.

Maycock, James D.

1821. *Geological description of Barbados, with a map of the island.* Quart. Jour. Sci., Lit. and Arts, vol. 11, pp. 10-20, pl. 1.

Mazyck, William Gaillard

1915. *Oliva litterata Lamarck.* Nautilus, vol. 28, No. 12, pp. 139-140.

McLean, Richard A.

1935. *Panomya arctica Lamarck.* Nautilus, vol. 49, No. 1, pp. 34-35.

1936a. *A new deep-water Lucina from Maryland.* Nautilus, vol. 49, No. 3, p. 87.

1936b. *Panope bitruncata Conrad at Sanibel, Florida.* Nautilus, vol. 49, No. 3, p. 104.

1936c. *Some marine bivalves from the Bahama Islands.* Nautilus, vol. 49, No. 4, pp. 116-119.

1939a. *Note on the genus Lucina in the Western Atlantic.* Nautilus, vol. 52, No. 3, pp. 88-89.

1939b. *Ostrea virginica Gmelin from Cape Breton Island.* Nautilus, vol. 52, No. 3, p. 107.

1939c. *The Cardiidae of the Western Atlantic.* Soc. Cubana Hist. Nat. "Felipe Poey," Mem., vol. 13, No. 3, pp. 157-173, pls. 23-26.

1941. *The oysters of the Western Atlantic.* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 67, pp. 1-14.

1942. *The sculpture of inaequivalve mollusks.* Nautilus, vol. 55, No. 4, pp. 142-143.

1951. *The Pelecypoda or bivalve mollusks of Porto Rico and the Virgin Islands.* New York Acad. Sci., Scientific Survey of Porto Rico and the Virgin Islands, vol. 17, pt. 1, pp. 1-183, pls. 1-26.

McLean, Richard A., and Schwengel, Jeanne

1944. *A new Modiolaria from Florida.* Nautilus, vol. 58, No. 1, pp. 16-17, pl. 1, fig. 10.

Meek, Fielding Badford

1876. *A report on the invertebrate Cretaceous and Tertiary fossils of the upper Missouri country.* Report of the United States Geological Survey of the Territories (Hayden), vol. 9, pp. i-lxiv + 629, pls. 1-45.

1877. *Paleontology.* Report of the geological exploration of the fortieth parallel (King), vol. 4, pt. 1, pp. 1-197, pls. 1-17.

Melvill, James Cosmo

1881. *List of Mollusca obtained in South Carolina and Florida, principally in the Island of Key West, 1871-1872.* Jour. Conch., vol. 3, Nos. 5-6, pp. 155-173.

1900. *Descriptions of two species of Cypraea, both of the subgenus Trivia, Gray.* An. Mag. Nat. Hist., ser. 7, vol. 6, pp. 207-210, 4 figs.

1904. *Description of twenty-three species of Gastropoda from the Persian Gulf of Oman, and Arabian Sea, dredged by M. F. W. Townsend, of the Indo-European telephone service, in 1903.* Malac. Soc. London, Proc., vol. 6, pp. 51-60, pl. 5.

1906. *A revision of the species of Cyclostremidae and Liotiidae occuring in the Persian Gulf and north Arabian Sea.* Malac. Soc. London, Proc., vol. 7, pp. 20-28, pl. 3.

1917. *A revision of the Turridae (Pleurotomidae) occurring in the Persian Gulf, Gulf of Oman, and north Arabian Sea, as evidenced mostly through the results of dredgings carried out by F. W. Townsend 1893-94.* Malac. Soc. London, Proc., vol. 12, pp. 140-201, pls. 8-10.

1923. *Descriptions of twenty-one species of Turridae (Pleurotomidae) from various localities, in the collection of Mr. E. R. Sykes.* Malac. Soc. London, Proc., vol. 15, pp. 162-171, pls. 4-5.

1925. *Descriptions of nine new species of Mitridae.* Malac. Soc. London, Proc., vol. 16, pt. 5, pp. 215-219, pl. 10.

1927. *Descriptions of eight new species of the family Turridae and of a new species of Mitra.* Malac. Soc. London, Proc., vol. 17, pp. 149-155, pl. 12.

Melvill, James Cosmo, and Standen, Robert

1898. *Notes on a collection of marine shells from Lively Island, Falklands, with a list of species.* Jour. Conch., vol. 9, pp. 97-105.

1899. *Report on the marine Mollusca obtained during the first expedition of Prof. A. C. Hadden to the Torres Straits, in 1888-89.* Linnean Soc. London, Jour., vol. 27, pp. 150-206, pls. 10-11.

1901. *Mollusca collected by Mr. Rupert Vallentin at Stanley Harbour, Falkland Isles.* Jour. Conch., vol. 10, pp. 43-47.

1907. *The marine Mollusca of the Scottish National Antarctic Expedition.* Roy Soc. Edinburgh, Trans., vol. 46, pp. 119-157, 1 pl.

1912. *The marine Mollusca of the Scottish National Antarctic Expedition. Pt. 2,* Roy. Soc. Edinburgh, Trans., vol. 48, pp. 333-366, 1 pl.

1916a. *Note on Trichotropis antarctica Melvill and Standen (non Thiele.).* Jour. Conch., vol. 15, p. 90.

1916b. *Description of a new rissoid shell from the Antarctic region.* Jour. Conch., vol. 15, pp. 120-121.

Melvill, James Cosmo, and Sykes, E. R.

1898. *Notes on a second collection of marine shells from the Andaman Islands, with descriptions of new forms.* Malac. Soc. London, Proc., vol. 3, pp. 35-38, pl. 3.

Menard de La Groye, F. J.-B.

1807. *Mémoire sur un nouveau genre de coquille bivalve-équivalve de la famille des Solenoïdes, intermédiaire aux Solens et aux Myes, voisin par conséquent des Glycimères; sur deux grandes espèces qui s'y rapportent; et accessoirement sur une riche dépôt de fossiles d'Italie, où se trouve celle qui a donne lieu à l'establisement de ce genre.* Mus. Hist. Nat. Paris Ann., vol. 9, 37 pp., pl. 12.

Mermod, G.

1950. *Les types de la collection Lamarck au Muséum Genève. Mollusques vivants. I.* Rev. Suisse Zool., vol. 57, pp. 687-756, figs. 1-50.

1953. *Les types de la collection Lamarck au Muséum de Genève. Mollusques vivant. IV.* Rev. Suisse Zool., vol. 60, pp. 131-204, figs. 154-300.

Merrill, George P.

1897. *Notes on the geology and natural history of Lower California.* Rept. U. S. Nat. Mus. for 1895, pp. 969-994, pls. 1-10.

Mestayer, M. K.

1916. *Preliminary list of Mollusca from dredgings taken off the northern coasts of New Zealand.* New Zealand Inst., Trans., vol. 48, pp. 122-128, pl. 12.

1918. *The occasional occurrence of Australian and South Sea Island Mollusca in New Zealand.* New Zealand Jour. Sci. and Tech., pp. 102-104.

1919. *New species of Mollusca, from various dredgings taken off the coast of New Zealand, the Snares Islands, and the Bounty Islands.* New Zealand Inst., Trans., vol. 51, pp. 130-135, pl. 8.

Metcalf, Maynard M.

1904. *Neritina virginea variety minor.* Amer. Naturalist, vol. 38, Nos. 451-452, pp. 565-569, 1 pl.

Meuschen, F. C.

1787. *Museum Geversianum, sive index rerum naturalium continens instructissimam copiam pretiossimerum omnis generis ex tribus*

regnis naturae obiectorum quam dum in vivis erat magna diligentia multaque cura comparavit vir amplissimus Abrahamus Gevers. Rotterdam, iv + 659 pp.

Mickleborough, J.

1893. *A check-list of mollusks (Pelecypoda and Gasteropoda) found in waters adjacent to Long Island.* Brooklyn Inst. Arts and Sci., Zool. Dept., 16 pp.

Mighels, Jesse W.

1841-44. *Descriptions of six species of shells regarded as new.* Boston Soc. Nat. Hist., vol. 1, pp. 129-130. Boston Jour. Nat. Hist., 5 pp., pl. 16.

Descriptions of new N. American shells. Boston Soc. Nat. Hist., Proc., vol. 1, pp. 187-190. Boston Jour. Nat. Hist., vol. 4, pp. 345-349.

1843. *Catalogue of the marine, fluviatile, and terrestrial shells of the State of Maine.* Boston Jour. Nat. Hist., vol. 4, pp. 308-344.

Mighels, Jesse W., and Adams, Charles Baker

1841. *Descriptions of twenty-five new species of New England shells.* Boston Soc. Nat. Hist., Proc., vol. 1, pp. 48-51.

1842. *Description of twenty-four species of the shells of New England.* Boston Jour. Nat. Hist., vol. 4, No. 1, pp. 37-54, pl. 4.

Mitchell, G. J.

1922. *Geology of the Ponce District.* New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 1, pp. 229-300, map, sections.

Mitchell, J. D.

1894. *List of Texas Mollusca collected by J. D. Mitchell.* Victoria, pp. 1-22.

Mittre, H.

1850a. *Notice sur le genre Cypricarde.* Jour. Conchyl., vol. 1, pp. 277-288.

1850b. *Description de Natices nouvelles.* Jour. Conchyl., vol. 1, pp. 379-402, pl. 12, figs. 6-7; pl. 13, figs. 6-7, 9-10; pl. 14, figs. 1-11.

Monterosato, T. A. Marchese di

1869. *Description d'un Dolium méditteranéen nouveau.* Jour. Conchyl., vol. 17, pp. 228-230, pl. 12.

1874. *Recherches conchyliologiques, effectuées au Cap Santo Vito, en Sicile, et supplément.* Jour. Conchyl., vol. 22, pp. 243-282, 359-364.

1875. *Poche nota sulla conchiologia Mediterranea.* Palermo, 15 pp.

1878a. *Note sur quelques coquilles draguées dans les eaux de Palerme.* Jour. Conchyl., vol. 26, pp. 143-160.

1878b. *Note sur quelques coquilles provenant des côtes d'Algerie (supplément).* Jour. Conchyl., vol. 26, pp. 313-321.

1878c. *Enumerazione e sinonimia delle conchiglie mediterranee.* Sci. Nat. Econ. Palermo, Giorn., vol. 13, pp. 61-115.

1883. *Conchiglie littorali mediterranee.* Nat. Siciliano, vol. 3, pp. 87-91.

1889. *Coquilles marines Marocaines.* Jour. Conchyl., vol. 37, pp. 20-40.

1892a. *Monografia dei Vermeti del Mediterraneo.* Soc. Malac. Italiana, Bull., vol. 17, Nos. 1-3, pp. 7-48, 7 pls.

1899. *Revision de quelques Pecten des mers d'Europe.* Jour. Conchyl., vol. 47, pp. 182-193.

Moore, Donald R.

1957. *A note on Cuna dalli.* Nautilus, vol. 70, No. 4, pp. 123-125, pl. 8, figs. 3-4.

1958a. *Additions to Texas marine Mollusca.* Nautilus, vol. 71, No. 4, pp. 124-128.

1958b. *Notes on Blanquilla Reef, the most northerly coral formation in the western Gulf of Mexico.* Inst. Marine Sci. Univ. Texas, Publ., vol. 5, pp. 151-155.

1961. *The marine and brackish water Mollusca of the State of Mississippi.* Gulf Research Reports, vol. 1, No. 1, pp. 1-56, 3 figs., 1 map.

Moore, Hilary

1958. *Marine Ecology.* New York, John Wiley & Sons, xi +491 pp., figs., tables.

Moore, Raymond C., Lalicker, Cecil G., and Fischer, Alfred G.

1952. *Invertebrate Fossils.* New York, Toronto, London, xiii + 766 pp., figs.

Mörch, Otto Andreas Lowson

1868. *Faunula Molluscorum Islandiae. Oversigt Islands Blöddyr.* Vidensk Meddel. Naturhist., Forening i Kjöbenhavn 1868, pp. 185-227.

1870. *Übersicht der von Lorentz Spengler beschriebenen Conchylien.* Malakozool. Blätter, vol. 17, pp. 99-124.

1874. *Synopsis Familiae Scalidarum Indiarum Occidentalium. Oversigt over Vestindiens Scalarier.* Vidensk Meddel. Naturhist., Forening i Kjöbenhavn, No. 17, pp. 1-19.

Morrison, J. P. E.

1943. *A new type of fresh-water clam from British Guiana.* Nautilus, vol. 57, No. 2, pp. 46-52, pl. 8.

Morse, Edward S.

1869. *Appendix to report on Mollusca.* Peabody Acad. Sci., First Ann. Rept. for 1869, pp. 76-77, 2 figs.

1871. *Remarks on the relations of Anomia.* Boston Soc. Nat. Hist., Proc., vol. 14, pp. 150-153.

1919b. *New forms of Caecum in New England.* Nautilus, vol. 32, pp. 73-77, pl. 5.

1920. *On certain fossil shells in the Boulder Clay of Boston Basin.* Amer. Jour. Sci., 4th ser., vol. 49, No. 291, pp. 157-165, figs. 1-3.

Morton, J. E.

1953. *Vermicularia and the turritellids.* Malac. Soc. London, Proc., vol. 30, No. 3, pp. 80-86, 3 figs.

Müller, O. F.

1776. *Zoologiae Danicae prodromus seu animalium Daniae et Norvegiae indigenarum, characteres, nomina, et synonyma imprimis popularium.* Havniae, xxxii + 82 pp.

Müllerried, F. K. G.

1945. *Contribución a la geología de México y Noroeste de la América Central.* México, viii + 80 pp., 11 figs.

Murray, Grover E.

1961. *Geology of the Atlantic and Gulf Coastal Province of North America.* Harper and brothers, xvii + 692 pp., figs.

Nicklès, Maurice

1950. *Mollusques testacés marins de la côte occidentale d'Afrique.* Manuels Ouest-Africains, vol. 2, x + 269 pp., 464 figs.

1955. *Scaphopodes et lamellibranches récoltés dans l'Ouest Africian.* Atlantide Rept., No. 3, pp. 93-237, 9 pls.

Newell, Norman D., Imbrie, John, Purdy, Edward G., and Thurber, David L.

1959. *Organism communities and bottom facies, Great Bahama Bank.* Amer. Mus. Nat. Hist., Bull., vol. 117, art. 4, pp. 181-228, figs. 1-17, 6 tables, pls. 58-69.

Nicol, David

1950a. *Recent species of the lucinoid pelecypod Fimbria.* Washington Acad. Sci., Jour., vol. 40, No. 3, pp. 82-87, figs. 1-9.

1950b. *Recent species of the prionodont pelecypod Cucullaea.* Washington Acad. Sci., Jour., vol. 40, No. 10, pp. 338-343, figs. 1-9.

1951a. *Recent species of the veneroid pelecypod Arctica.* Washington Acad. Sci., Jour., vol. 41, No. 3, pp. 102-106, figs. 1-4.
1951b. *Recent species of the cyrenoid pelecypod Glossus.* Washington Acad. Sci., Jour., vol. 41, No. 4, pp. 142-146, figs. 1-5.
1954a. *Nomenclatural review of genera and subgenera of Cucullaeidae.* Jour. Paleont., vol. 28, No. 1, pp. 76-101.
1955. *Morphology of Astartella, a primitive heterodont pelecypod.* Jour. Paleont., vol. 29, pp. 155-158.
1956a. *The taxonomic significance in gaps in pelecypod morphology.* Syst. Zool., vol. 5, p. 143.
1958a. *A survey of inaequivalve pelecypods.* Washington Acad. Sci., Jour., vol. 48, pp. 56-62.
1958b. *The pelecypod Euloxa: Observations on new localities.* Washington Acad. Sci., Jour., vol. 48, pp. 153-157, 1 fig.
1958c. *Trends and problems in pelecypod classification (the genus and subgenus).* Washington Acad. Sci., Jour., vol. 48, pp. 285-293, 2 figs.
1958d. *Notes on prionodont pelecypods.* Washington Acad. Sci., Jour., vol. 48, p. 309.

Nilsson-Cantell, C. A.

1939. *Recent and fossil balanids from the north coast of South America.* Capita Zoologica's Gravenhage, vol. 8, pt. 4, No. 3, pp. 1-7, map.

Nobre, Augusto

1905. *Mollusques et Brachiopodes du Portugal. I Céphalopodes, Gastropodes, Scaphopodes.* Sciencias Naturaes, Annaes, vols. 3-8 (1896-1903), 147 pp.
1930a. *Materiais para o estudo da fauna dos Açores.* Inst. Zool. Univ. Pôrto, pp. 1-108, pls. 1-80, 24 figs.
1930b. *Moluscos terrestres, fluviais e das aguas salobras de Portugal.* Ministério da Agricultura. Direcção Geral dos Servicos Florestais e Aguícolas, pp. 1-259, pls. 1-21, 42 text figs.
1931. *Moluscos terrestres, fluviais e das aguas salobras do Arquipélago da Madeira.* Inst. Zool. Univ. Pôrto, pp. 1-208, pls. 1-4, 95 text figs.
1932a. *Brachiopodes de Portugal.* Anais da Faculdade de Ciências do Porto, vol. 17, pp. 1-20, pl. 1.
1932b. *Moluscos marinhos de Portugal.* Inst. Zool. Univ. Pôrto, pp. 1-463, pls. 1-80, 9 text figs.

Nomura, Sitihei

1935a. *On some Tertiary Mollusca from northeast Honsyû, Japan. Pt. 2. Fossil Mollusca from the vicinity of Ogino, Yama-gun, Hukusima-ken.* Saito Ho-On-Kai Mus., Res. Bull. No. 5, Geol., No. 2, pp. 101-130, pls. 5-7.
1935b. *Catalogue of the Tertiary and Quartery Mollusca from the Island of Taiwan (Formosa) in the Institute of Geology and Paleontology, Tôhoku Imperial University, Sendai, Japan. Pt. 2. Scaphopoda and Gastropoda.* Tôhoku Imperial Univ., Sendai, Japan, Sci. Rept., ser. 2, Geol., vol. 18, pp. 53-228, pls. 6-10.

North, F. K.

1951. *On the type of Pseudamussium and other notes on pectinid nomenclature.* Jour. Paleont., vol. 25, pp. 231-236.

Nyst, Pierre Henri

1862. *Notice sur deux coquilles nouvelles du genre Crassatelle, suive d'un tableau des espèces vivantes et fossiles décrites par les auteurs, avec l'indication des depôts dans lesquels ces dernières ont été recueillies.* Acad. Roy. Belgique, Bull., vol. 14, No. 8, 13 pp.

Ockelmann, W. K.
1958. *The zoology of East Greenland. Marine Lamellibranchiata.* Meddelser om Grønland, vol. 122, No. 4, 256 pp., 3 pls., 28 figs.
Odhner, Nils Hjalmar
1919. *Contribution à la fauna malacologique de Madagascar.* K. Svensk. Vetenskaps. Akad., Ark. f. Zool., vol. 12, No. 6.
1924. *New Zealand Mollusca. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-1916.* Saertryk Vidensk. Medd. Dansk Naturh., Foren., vol. 77, pt. 19, pp. 1-90, 24 figs., 2 double pls.
1926. *Die Opisthobranchien.* Wiss. Ergebn. Schwed. Südpolar-Exped., vol. 2, pp. 1-100.
1931a. *Die Scaphopoden.* Wiss. Ergebn. Schwed. Südpolar-Exped., vol. 2, No. 5, pp. 1-8.
1931b. *Beiträge zur Malakozoologie der Kanarischen Inseln: Lamellibranchien, Cephalopoden, Gastropoden.* Ark. f. Zool., vol. 23A, No. 14, pp. 1-116, pls. 1-2.
1953. *Identifications of Linnaean shells in Museum Ludovicae Ulricae.* Mimeographed, pp. 1-27.
Okada, Y. K.
1960. *Encyclopedia Zoologica illustrated in Colors. Vol. III.* Tokyo, 200 pp., + 38 pp. of Index, 91 pls., 21 pp. of text figs.
Oken, Lorenz
1815. *Okens Lehrbuch der Naturgeschichte.* Leipzig, Jena, vol. 3, Zoologie, sect. 1, *Fleischose Thiere,* 842 pp., 40 pls.
Oleksyshyn, John
1960. *Some new species of Miocene Mollusca from Maryland and Virginia.* Pennsylvania Acad. Sci., Proc., vol. 34, pp. 101-106, 8 figs.
de Oliveira, Lejeune
1950. *Levantamento biogeográfico da Baía de Guanabara.* Inst. Oswaldo Cruz, Mem., vol. 48, pp. 363-391, figs. 1-19.
de Oliveira Roxo, M. G.
1924. *Breve noticia sobre os fosseis terciarios do Alto Amazonas.* Serv. Geol. e Min. Brasil, Bol. No. 1, pp. 41-62, 1 pl.
1937. *Fosseis Pliocenios do Rio Juruá, Estado do Amazonas.* Serv. Geol. do Brasil, Bol. No. 11, pp. 1-52.
Oliver, W. R. B.
1915. *The Mollusca of the Kermadec Islands.* New Zealand Inst., Trans., vol. 47 (1914), pp. 509-568, pls. 9-12.
1923. *Notes on New Zealand Pelecypods.* Malac. Soc. London, Proc., vol. 15, pt. 4, pp. 179-188, 2 figs.
Olsson, Axel A.
1961. *Mollusks of the tropical Eastern Pacific particularly from the southern half of the Panamic-Pacific faunal province (Panamá to Peru). Panamic-Pacific Pelecypoda.* Paleont. Research Inst., 574 pp., 86 pls.
Olsson, Axel A., and Wurtz, C. B.
1951. *New Colombian naiades, with observations on other species.* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 239, pp. 1-9, figs. 1-12.
Oostingh, C. H.
1925. *Report on a collection of Recent shells from Obi and Halmahera (Molluccas).* Landbouwhoogeschool Wageningen Meded., vol. 29, pt. 1, pp. 1-362.
Orcutt, C. A., and Dall, W. H.
1885. *Notes on the mollusks of the vicinity of San Diego, Cal., and Todos Santos Bay, Lower California.* U.S. Nat. Mus., Proc., vol. 8, pp. 534-552, 1 pl.

Ortmann, Arnold E.

1898. *Preliminary report on some new marine Tertiary horizons discovered by Mr. J. B. Hatcher near Punta Arenas, Magellanes, Chile.* Amer. Jour. Sci., vol. 6, art. 49, pp. 478-482.

1899. *The fauna of the Magellanian beds of Punta Arenas, Chile.* Amer. Jour. Sci., vol. 8, art. 49, pp. 427-432.

1900. *Synopsis of the collections of invertebrate fossils made by the Princeton Expedition to southern Patagonia.* Amer. Jour. Sci., vol. 10, art. 37, pp. 368-381.

Oyama, Katura

1944. *Classification of the genus Propeamussium.* Venus, vol. 13, pp. 240-254.

Pace, S.

1902a. *On the anatomy and relationships of Voluta musica Linn.; with notes upon certain other supposed members of the Volutidae.* Malac. Soc. London, Proc., vol. 5, pp. 21-31.

Packard, Earl L.

1916. *Mesozoic and Cenozoic Mactrinae of the Pacific coast of North America.* Univ. California Publ., Bull. Dept. Geol., vol. 9, No. 16, pp. 261-360, pls. 12-35.

Paetel, Friedrich

1890. *Die Acephalen und die Brachiopoden.* [In] Catalog der Conchylien-Sammlung von Fr. Paetel. Berlin, vol. 3, 256 pp. + Index of xxxii pp.

Pallary, Paul

1900. *Coquilles marines du littoral du Départment d'Oran.* Jour. Conchyl., vol. 48, pp. 211-422, pls. 6-8.

1904. *Addition à la faune malacologique Golfe de Gabès.* Jour. Conchyl., vol. 52, pp. 212-248.

1938. *Les mollusques marins de la Syrie.* Jour. Conchyl., vol. 82, pp. 5-58.

Palmer, E. Laurence

1940. *Atlantic and Gulf Coast shells.* Nature Mag., vol. 33, No. 6, pp. 341,248, pls. 1-4.

Palmer, Katherine Van Winkle

1938. *Neocene Spondylii from the southern United States and tropical America.* Palaeontographica Americana, vol. 2, No. 8, pp. 147-156, pls. 16-18.

Parker, Robert H.

1956. *Macro-invertebrate assemblages as indicators of sedimentary environments in East Mississippi Delta region.* Amer. Assoc. Petrol. Geol., Bull., vol. 40, No. 2, pp. 295-376, 32 figs., 8 pls.

Parodiz, Juan José

1939. *Las especies de "Crepidula" de las costas Argentinas.* Physis, vol. 17, pp. 685-709, figs. 1-8, 1 pl.

1942. *Transgressiones oceánicas y fauna del mar epicontinental Argentino.* Geográfica Americana Rev., año 9, vol. 18, pp. 203-211, figs.

1948. *Sobre "Ostrea" actuales y Pleistocénicas de Argentina y su ecología.* Mus. Argentino Cienc. Nat. "Bernardino Rivadavia", Comunicaciones, ser. Cienc. Zool., No. 6, pp. xiv + 22, pls. 1-3.

1955. *Una nueva especie de Triphora del Uruguay (Moll. Prosobr.)* Neotropica, vol. 1, No. 4, pp. 59-60, 1 fig.

Pearse, A. S.

1936. *Estuarine animals at Beaufort, North Carolina.* Elisha Mitchell Sci. Soc., Jour., vol. 52, No. 2, pp. 174-222, pls. 15-16.

Pearse, A. S., and Williams, Louis G.

1951. *The biota of the reefs off the Carolinas.* Elisha Mitchell Sci. Soc., Jour., vol. 67, No. 1, pp. 133-161.

Pelseneer, P.

1903. *Résultats du voyage du S. Y. 'Belgica.' Zoologie. Mollusques (Amphineures, Gastropodes, et Lamellibranches).* Anvers, 85 pp., pls. 1-9.

Perkins, George

1869. *Molluscan fauna of New Haven. Pt. 1, Cephalopoda and Gasteropoda. Pt. 2, Acephala and Bryozoa.* Boston Soc. Nat. Hist., Proc., vol. 13, pp. 109-164, 2 figs.

Perry, Louise M.

1936. *A marine tenement.* Science, vol. 84, No. 2172, pp. 156-157.

Petit de la Saussaye, S.

1850a. *Notice sur le genre Cyclostoma, et catalogue des espèces appartenant à ce genre.* Jour Conchyl., vol. 1, pp. 36-55, pl. 3, figs. 2, 5-7, 10; pl. 4, figs. 2-3,7.

Petterd, W. F.

1886. *New species of Tasmanian marine shells.* Roy Soc. Tasmania, Papers and Proc. for 1885, pp. 320-321.

Pfeffer, G.

1866. *Mollusken, Krebse und Echinodermen von Cumberland-Sund nach der Ausbeute der Deutschen Nordexpedition, 1882 und 1883.* Jahr. Wiss. Anst. Hamburg, vol. 3, pp. 25-50, figs. 1-6.

Pfeiffer, Louis

1840a. *Kritisches Register zu Martini und Chemnitz's Systematischen Konchylien-Kabinet.* Kassel, viii + 112 pp.

1849a. *Descriptions of twelve new species of Vitrina and Succinea, from the collection of H. Cuming, Esq.* Zool. Soc. London, Proc., pp. 132-134.

1849b. *Descriptions of thirty new species of Tornatellina, Cylindrella, and Clausilia, from the collection of H. Cuming, Esq.* Zool. Soc. London, Proc., pp. 134-141.

1841-72. *Die Familie der Venus Muscheln, Veneracea. Nebst einem Anhange, enthaltend die Chemnitz'schen Lucinen, Galateen und Corbis.* Syst. Conchylien-Cabinet, vol. 11, pt. 1, pp. 1-3, pls. 1-3, 5-10 (1841); pls. 11-15 (1842); pp. 32-56, pls. 4, 16-24 (1868); pp. 57-160, pls. 25-34 (1869); pp. 161-224, pls. 35-38 (1870); pp. 225-302, pls. 39-42 (1872).

Philippi, E.

1900. *Beiträge zur Morphologie und Phyogenie der Lamellibranchier. Pt. 2. Zur Stammesgeschichte der Pectiniden.* Deutsch. Geol. Gessel., Zeitschr., vol. 52, pp. 64-117, 24 text figs.

Philippi, Rudolphus Amandus

1836. *Beschreibung einiger neuen Conchylien-Arten (Vermetus spiratus, Diplodonta semiaspera, Tellina sulcata, Corbula aequivalvis, Chama cancellata) und Bemerkungen über die Gattung Lacuna, Turton.* Archiv f. Naturg., vol. 2, pp. 337-368.

1837. *Pododesmus, ein neues Genus der Acephalen.* Archiv f. Naturg., vol. 3, pp. 385-387, pl. 9, figs. 1a-d.

1841. *Bemerkungen über einige Linnéische Conchylien-Arten welchen von den Späten Conchyliologen verkannt sind.* Archiv f. Naturg., vol. 7, pp. 258-276.

1845b. *Bemerkungen über einige Muschelgeschlechter, deren Thiere wenig bekannt sind.* Archiv f. Naturg., vol. 11, pp. 185-196.

1845c. *Bemerkungen über die Mollusken-Fauna von Massachusetts.* Zeitschr. f. Malakozool., yr. 2, pp. 68-79.

1856. *Ueber die Conchylien der Magellans-Strasse.* Malakozool. Blätter, vol. 3, pp. 157-173.
1868. *Conchylia nova potissimum Magellanica.* Malakozool. Blätter, vol. 15, pp. 222-226.
1893. *Die Mactra-Arten Chiles.* Mus. Nac. Chile, An., pp. 1-9, pls. 1-3.

Pijpers, P. J.

1931a. *The occurrence of foreign pebbles on the isle of Bonaire.* Konink. Akad. Wetensch. Amsterdam, Proc., vol. 34, No. 1, pp. 169-174, 1 map.
1931b. *Some remarks on the geology of the surroundings of "Ronde Klip" (East Curaçao).* Konink. Akad. Wetensch. Amsterdam, Proc., vol. 34, No. 7, pp. 1023-1027, geol. sketch map.
31, pp. 1023-1027.
1931c. *Bonaire.* Leidsche Geol. Meded., vol. 5 (Martin Feestbundel), pp. 704-708, sketch-map.
1931d. *Over de geologie van het eiland Bonaire.* Handel 23ste Nederl. Nat. en Geneesk. Congress, pp. 265-266.
1931e. *Over de geologie van Bonaire.* Geol. en Mijnbouw., vol. 10, pp. 144-145.
1933. *Geology and paleontology of Bonaire (D. W. I.).* Geogr. en Geol. Meded., Physiogr.-Geol. Reeks No. 8, 103 pp., 11 pls., map.

Pilsbry, Henry Augustus

1889. *Littoral mollusks from Cape Fairweather, Patagonia.* Amer. Jour. Sci., vol. 17, pp. 126-128, pl. 1.
1890. *Trochidae, new and old.* Acad. Nat. Sci. Philadelphia, Proc., vol. 42, pp. 343-344, text figs. 1-2.
1891a. *Sea shells of the Jersey Shore.* Asbury Park, 40 pp., figs.
1897a. *Patagonian Tertiary fossils.* Acad. Nat. Sci. Philadelphia, Proc., vol. 49, pp. 329-330, 1 fig.
1898a. *Margarita sharpii, a new Alaskan gastropod.* Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 486-487, fig. 1.
1900a. *A new Calliostoma from Florida.* Nautilus, vol. 12, pp. 129-130.
1900b. *Purpura coronata Lamarck in America.* Nautilus, vol. 12, p. 130.
1900c. *Species of Chlorostoma of southern and eastern Patagonia.* Nautilus, vol. 13, No. 10, pp. 110-112.
1905a. *A new brackish-water snail from New England.* Nautilus, vol. 19, pp. 90-91, 1 fig.
1911a. *A new Ecphora of the Chesapeake Miocene.* Acad. Nat. Sci. Philadelphia, Proc., vol. 63, pp. 438-439.
1919. *Mollusca from Central America and Mexico.* Acad. Nat. Sci. Philadelphia, Proc., vol. 71, pp. 212-223, pl. 11.
1924. *Miocene and Pleistocene Cirripedia from Haiti.* U.S. Nat. Mus., Proc., vol. 65, art. 2, 3 pp., 1 pl.
1930. *List of land and freshwater mollusks collected on Andros, Bahamas.* Acad. Nat. Sci. Philadelphia, Proc., vol. 82, pp. 297-302, figs. 1-2.
1931g. *A new race of Neritina reclivata Say.* Nautilus, vol. 45, No. 2, pp. 67-68, 1 fig.
1934d. *Notes on the gastropod genus Liotia and its allies.* Acad. Nat. Sci. Philadelphia, Proc., vol. 85, pp. 375-381, pl. 13.

Pilsbry, Henry Augustus, and Olsson, Axel A.

1935b. *Tertiary fresh-water mollusks of the Magdalena Embayment, Colombia.* Acad. Nat. Sci. Philadelphia, Proc., vol. 87, pp. 7-39, pls. 2-5. Reprinted in Spanish, Acad. Colombiana Cienc. Exactas, Fís. y Nat., Rev., vol. 4, pp. 410-417, without plates, 1941.

Pittier, H.

1890. *Apuntamientos para la historia natural de Costa Rica. Mollusca,* Inst. Fís. Geogr. Mus. Nac. Costa Rica, An., vol. 3, pp. 123-126.

Plate, L.

1908a. *Die Solenoconchen der "Valdivia Expedition."* Wissenschaftliche Ergebnisse Deutschen Tiefsee-Exped., vol. 9, No. 3, pp. 339-361, pl. 30.

1908b. *Die Scaphopoden der Deutschen Südpolar Exped. (1901-3).* Wissenschaftliche Ergebnisse Deutschen Südpolar Exped., vol. 10, pp. 1-6.

1908c. *Scaphopoden.* Résultats du Voy. du S. Y. 'Belgica' en 1895-9, pp. 1-4.

Platt, Rutherford

1949. *Shells take you over world horizons.* Nat. Geogr. Mag., vol. 96, pp. 33-84, 31 col. pls.

Powell, A. W. B.

1927b. *Deep-water Mollusca from south-west Otago, with descriptions of 2 new genera and 22 new species.* Canterbury Mus., Rec., vol. 3, pt. 2, pp. 113-124, pls. 21-23.

1929. *The Recent and Tertiary species of the genus Buccinulum in New Zealand, with a review of related genera and families.* New Zealand Inst., Trans., vol. 60, pp. 57-101, 132 figs., 4 pls.

1931a. *Waitotaran faunules of the Wanganui System, and descriptions of Mollusca from the New Zealand Pliocene.* Auckland Inst. Mus., Rec., vol. 1, No. 2, pp. 85-112, pls. 10-14.

1931b. *Descriptions of some new species of Recent Mollusca mainly from the sub-Antarctic islands of New Zealand.* Canterbury Mus. Rec., vol. 3, pp. 371-376, 2 figs., pls. 52-53.

1932a. *On some New Zealand pelecypods.* Malac. Soc. London, Proc., vol. 20, pt. 1, pp. 65-72, pl. 6.

1932. *The Recent Marginellidae of New Zealand, with descriptions of some new species.* New Zealand Inst., Trans., vol. 62, pp. 203-214, pls. 33-36.

1933b. *On five new species of Recent New Zealand Mollusca.* Malac. Soc. London, Proc., vol. 20, pt. 4, pp. 194-198, figs. 1-4, pl. 16.

1933c. *New pelecypod Mollusca from northern New Zealand.* Malac. Soc. London, Proc., vol. 20, pt. 4, pp. 199-206, text fig. 16, pls. 17-18.

1933d. *The marine Mollusca of the Chatham Islands.* Auckland Inst. Mus., Rec., vol. 1, No. 4, pp. 181-208, pls. 33-36.

1933e. *Marine Mollusca from the Bounty Islands.* Canterbury Mus., Rec., vol. 4, pp. 29-39, pl. 6.

1933f. *Two new molluscs of the Pectinidae from 600 to 700 fathoms, four hundred miles west of New Plymouth.* New Zealand Inst., Trans., vol. 63, pp. 370-372, pl. 40.

1933g. *New species of marine Mollusca from the subantarctic islands of New Zealand.* Malac. Soc. London, Proc., vol. 20, pt. 5, pp. 232-236, figs. 1-4, pl. 20.

1934a. *New Recent and Tertiary Nuculanidae from New Zealand.* Malac. Soc. London, Proc., vol. 21, pt. 4, pp. 252-255, pl. 27.

1934b. *Five new species of pelecypod Mollusca from New Zealand.* Malac. Soc. London, Proc., vol. 21, pt. 4, pp. 255-258, pl. 28.

1934c. *Gasteropods new to the New Zealand fauna; with descriptions of six new species and a new subspecies.* New Zealand Inst., Trans., vol. 64, pp. 154-160, pls. 21-22.

1934d. *Upper Pliocene fossils from Cape Runaway.* Auckland Inst. Mus., Rec., vol. 1, No. 6, pp. 327-240, pls. 76-78.

1937. *New species of marine Mollusca from New Zealand.* [In] Great Britain. Discovery Committee. Discovery Reports, Cambridge, vol. 15, pp. 153-222, pls. 45-56.

1938a. *A Pliocene molluscan faunule from Castle Point,* and *Additions to the Recent molluscan fauna of New Zealand.* Auckland Inst. Mus., Rec., vol. 2, No. 3, pp. 157-164, 3 text figs., pls. 38-39; pp. 165-170, pl. 40.

1938b. *Tertiary molluscan faunules from the Waitemata beds.* Roy. Soc. New Zealand, Trans., vol. 68, pp. 362-379, pls. 38-40.
1938c. *Additions to the Recent molluscan fauna of New Zealand.* Auckland Inst. Mus., Rec., vol. 2, No. 3, pp. 167-170, pl. 40.
1939. *The Mollusca of Stewart Island.* Auckland Inst. Mus., Rec., vol. 2, No. 4, pp. 211-238.
1940. *The marine Mollusca of the Aupourian Province, New Zealand.* Roy. Soc. New Zealand, Trans., vol. 70, pt. 3, pp. 205-208, 1 text fig., pls. 28-33.
1944. *The Australian Tertiary Mollusca of the family Turridae.* Auckland Inst. Mus., Rec., vol. 3, No. 1, 68 pp., 7 pls.
1946a. *New species of New Zealand Mollusca from the South Island, Stewart Island, and Chatham Islands.* Auckland Inst. Mus., Rec., vol. 3, No. 2, pp. 137-144, pls. 11-12.
1946b. *The Shellfish of New Zealand.* Second ed., 106 pp., 26 pls.
1950. *Mollusca from the continental shelf, eastern Otago.* Auckland Inst. Mus., Rec., vol. 4, No. 1, pp. 73-81, pl. 7.
1951. *Antarctic and subantarctic Mollusca. Pelecypoda and Gastropoda.* Discovery Reports, vol. 26, pp. 47-196, text figs. A-N, pls. 5-10.

Powers, Sydney

1918. *Notes on the geology of eastern Guatemala and northwestern Spanish Honduras* Jour. Geol., vol. 36, pp. 507-523.

Prashad, B.

1932. *The Lamellibranchia of the Siboga Expedition. Pelecypoda. Mollusca III. Systematic part II. Pelecypoda (exclusive of the Pectinidae).* Siboga- Expeditie, vol. 29, 334 pp., 9 pls.

Preston, H. B.

1912. *Characters of six new pelecypods and two new gastropods from the Falkland Islands.* Ann. Mag. Nat. Hist., ser. 8, vol. 9, pp. 636-640, pl. 21.
1913. *Descriptions of fifteen new species and varieties of marine shells from the Falkland Islands.* Ann. Mag. Nat. Hist., ser. 8, vol. 11, pp. 218-223, pl. 4.
1916. *Descriptions of eight new species of marine Mollusca from the South Shetland Islands.* Ann. Mag. Nat. Hist., ser. 8, vol. 18, pp. 269-272, pl. 13.

Prime, Temple

1860a. *Synonymy of the species of Cyrenella, a genus of Mollusca belonging to the family of the Lucinidae.* Boston Soc. Nat. Hist., Proc., vol. 7, pp. 1-3.
1860b. *Synonymy of the known species of Rangia, a genus of the family Mactracea.* Boston Soc. Nat. Hist., Proc., vol. 7, pp. 3-4.
1862. *Description of a new species of Mollusca of the genus Venus.* Lyc. Nat. Hist. New York, Ann., vol. 7, pp. 3-4.

Priolo, O.

1956a. *Molluschi del porto di Catania.* Soc. Tosc. Sci. Nat. (B), Atti, vol. 63, pp. 9-13.
1956b. *Nuova revisione delle conchiglie marine de Sicilia.* Accad. Gioenia, Atti, ser. 6, vol. 10, pp. 55-97, 219-254, 1 pl.

Pulteney, Richard

1799. *Catalogues of the Birds, Shells, and some of the more rare Plants of Dorsetshire. From Hutchins, History of that county.* London, 2d ed., 1813, folio.

Quayle, D. B.

1960. *The intertidal bivalves of British Columbia.* British Columbia Provincial Mus., Dept. Education, Handbook No. 17, 104 pp., pls.

Rafinesque, Constantine Schmaltz

1820. *Monografie des coquilles bivalves fluviatiles de la rivière Ohio.* Gén. Sci. Phys. Bruxelles, Ann., vol. 5, pp. 287-322, 3 pls.

Ramírez, Ricardo

1950. *Descripción de algunos moluscos del Miocene del Valle del Cibao de la República Dominicana.* Publ. Univ. Santo Domingo, ser. 4, No. 1, 58 pp.

1956. *Paleontología Dominicana.* Publ. Univ. Santo Domingo, ser. 4, No. 2, pp. 1-26, pls. 1-8.

Rang, Sander

1832. *Notice sur la Galathée, genre de mollusque acéphale du la famille des Conchacés* Ann. Sciences Naturelles, vol. 24, 13 pp., pl. 5.

Ranson, Gilbert

1939. *Le provinculum de la prodissoconque de quelques Ostréides.* Mus. Nat. Hist. nat. Paris, Bull., vol. 11, No. 3, pp. 318-331, 4 fig., 1 pl.

1942. *Note sur la classification des Ostréides.* Soc. Géol. France, Bull., sér. 5, vol. 12, pp. 161-164.

1943. *Observation sur quelques Ostréides actuels et fossiles.* Soc. Géol. France, Bull., sér. 5, vol. 13, pp. 289-294, pl. 11.

1948. *Prodissoconques et classification des Ostréides vivants.* Mus. Roy. Hist. Nat. Belgique, Bull., vol. 24, No. 42, 12 pp., figs. 1-7.

1950. *La chambre promyaire et la classification zoologique des Ostréides.* Jour. Conchyl., vol. 90, pp. 195-200.

Rathbun, M. J.

1918. *Decapod crustaceans from the Panama region.* U.S. Nat. Mus., Bull. 103, pp. 123-184, pls. 54-66.

Raven, Chr. P.

1958. *Morphogenesis. The Analysis of Molluscan Development.* New York, i-xii + 311 pp., 66 figs.

Ravenel, Edmund

1834. *Catalogue of Recent Shells in the Cabinet of Edmund Ravenel.* Charleston, 20 pp.

1848. *Echinidae, Recent and fossil, of South Carolina.* Amer. Paleont., Tertiary, pp. 1-4.

1859. *Description of three new species of univalves, Recent and fossil.* Elliott Soc., Proc., pp. 280-282.

1860. *Tellinidae of South Carolina.* Elliott Soc., Proc., pp. 33-40.

Récluz, C. A.

1842a. *Description de neuf espèces de Nérites nouvelles, suive d'observations sur les N. cornea et dubia.* Soc. Zool. Cuviérienne Rev., vol. 5, pp. 73-79.

1842b. *Description de plusieurs espèces de Nérites nouvelles vivantes.* Soc. Zool. Cuviérienne, Rev., vol. 5, pp. 177-184.

1843a. *On new species of Nerita.* Zool. Soc. London, Proc., pt. 11, pp. 71-73.

1843b. *On new species of Narica.* Zool. Soc. London, Proc., pt. 11, pp. 136-141.

1843c. *Descriptions of new species of Navicella, Neritina, Nerita and Natica, in the collection of Hugh Cuming, Esq.* Zool. Soc. London, Proc., pt. 11, pp. 197-214.

1843d. *Description de deux coquilles nouvelles.* Soc. Zool. Cuviérienne, Rev., vol. 6, p. 261.

1843e. *Monographie du genre Syndosmya, et examen des genres Ligule, Abra, et Amphidesme.* Soc. Zool. Cuviérienne, Rev., vol. 6, pp. 292-299, 359-369.

1844a. *Monographie du genre Ervilla, Turton.* Soc. Zool. Cuviérienne, Rev., vol. 7, pp. 85-86, pls. 95-96 [in Mag. Zool.].

1844b. *Prodrome d'une monographie du genre Erycina.* Soc. Zool. Cuviérienne, Rev., vol. 7, pp. 291-299, 325-336.

1845. *Description de quelques nouvelles Nérites fluviatile du cabinet de Hugh Cuming.* Zool. Soc. London, Proc., pp. 119-122.

1846a. *Description de plusieurs animaux mollusques bivalves, soit nouveaux, soit incomplètement connus.* Soc. Zool. Cuviérienne, Rev., vol. 9, pp. 8-12, 48-55, 146-151.
1846b. *De la famille des Lithophages, Lam.* Soc. Zool. Cuviérienne, Rev., vol. 9, pp. 405-425.
1847. *Description de plusieurs animaux mollusques, soit nouveaux, soit incomplètement connus.* Soc. Zool. Cuviérienne, Rev., vol. 10, pp. 336-343.
1848. *Description d'un nouveau genre de coquilles bivalve nommé Septifère.* Soc. Zool. Cuviérienne, Rev., vol. 11, pp. 275-279.
1850a. *Des Néritines, section des Crépidiformes.* Jour. Conchyl., vol. 1, pp. 58-75.
1851a. *Catalogue des espèces du genre Sigaret (Sigaretus, Lk.).* Jour. Conchyl., vol. 2, pp. 163-191, pl. 6, figs. 1-6, 12-14.
1851b. *Description de quelques coquilles nouvelles.* Jour. Conchyl., vol. 2, pp. 194-216.
1851c. *Notice sur la Natica canrena des auteurs.* Jour. Conchyl., vol. 2, pp. 251-254.
1852. *Description de coquilles nouvelles.* Jour. Conchyl., vol. 3, pp. 249-256, pl. 10.
1854. *Description de plusieurs coquilles nouvelles.* Jour. Conchyl., vol. 3, pp. 408-414.
1856. *Histoire du genre Natica.* Jour. Conchyl., vol. 1, pp. 43-64.
1857. *Note sur la famille des Lithophages, Lamarck.* Jour. Conchyl., vol. 2, pp. 15-24.

Reeve, Lovell Augustus

1842a. *Monograph of Crassatella, a genus of acephalous mollusks.* Zool. Soc. London, Proc., pt. 10, pp. 42-46.
1842c. *Monograph of the genus Tornatella.* Zool. Soc. London, Proc., pt. 10, pp. 58-62.
1842d. *On the genus Phorus, a group of agglutinating mollusks of the family Turbinacea.* Zool. Soc. London, Proc., pt. 10, pp. 160-163.
1842e. *Descriptions of new species of shells belonging to the genera Trochus and Turbo.* Zool. Soc. London, Proc., pt. 10, pp. 184-186.
1842f. *Descriptions of new species of shells figured in the 'Conchologica Systematica.'* Zool. Soc. London, Proc., pt. 10, pp. 187-202.
1843a. *On new species of Pleurotoma and Pectunculus.* Zool. Soc. London, Proc., pt. 11, pp. 31-34.
1843b. *On a new species of Cyclostoma.* Zool. Soc. London, Proc., pt. 11, p. 46.
1843c. *On new species of Conus and Pectunculus.* Zool. Soc. London, Proc., pt. 11, pp. 79-81.
1843d. *On new species of Delphinula and a new Voluta.* Zool. Soc. London, Proc., pt. 11, pp. 141-144.
1843e. *On new species of Conus, Pleurotoma, Pectunculus, Cardita, and Cypricardia.* Zool. Soc. London, Proc., pt. 11, pp. 168-197.
1843f. *Descriptions by Mr. Lovell Reeve of new species of shells figured in the 'Conchologica Systematica'.* Zool. Soc. London, Proc. for 1842, pp. 197-200.
1844a. *Descriptions of thirty-three new species of Arca.* Zool. Soc. London, Proc., pt. 12, pp. 39-48.
1844b. *Monograph of the genus Myadora.* Zool. Soc. London, Proc., pt. 12, pp. 91-94.
1844c. *Descriptions of new species of Triton, collected chiefly by Hugh Cuming, Esq.* Zool. Soc. London, Proc., pt. 12, pp. 109-122.
1844d. *Descriptions of new species of Arca, from the cabinet of Hugh Cuming, Esq.* Zool. Soc. London, Proc., pt. 12, pp. 123-128.

1844e. *Descriptions of new species of Ranella.* Zool. Soc. London, Proc., pt. 12, pp. 136-137.
1844f. *Descriptions of new species of Mitra and Cardium.* Zool. Soc. London, Proc., pt. 12, pp. 167-187.
1848a. *On Fastigiella, a new genus of shells of the Lamarckian family Canalifera.* Zool. Soc. London, Proc., pp. 14-15.
1848b. *Descriptions of new species of Turbo, chiefly from the collection of Hugh Cuming, Esq.* Zool. Soc. London, Proc., pp. 49-52.

van Regteren Altena, C. O.
1941. *The marine Mollusca of the Kendeng beds (East Java). Gastropoda, pt. 2 (families Planaxidae-Naticidae inclusive).* Leidsche Geol. Meded., vol. 12, No. 1, pp. 1-86, figs. 1-24.
1961. *The Mollusca from the limestone of Brimstone Hill, St. Kitts, and Sugar Loaf and White Wall, St. Eustatius, Lesser Antilles.* Koninkl. Nederl. Akad. Wetensch.-Amsterdam, Proc., ser. B, vol. 64, No. 2, pp. 288-304, 1 pl.

Rehder, Harald Alfred
1950. *Congeria leucopheata (Con.) in the Hudson River.* Nautilus, vol. 50, No. 4, p. 143.
1952. *The publication dates of Kobelt's "Illustriertes Conchylienbuch."* Nautilus, vol. 66, No. 2, pp. 59-60.

Richards, Horace Gardiner
1930a. *Notes on barnacles from Cape May, New Jersey.* Acad. Nat. Sci. Philadelphia, Proc., vol. 82, pp. 143-144.
1936b. *Fauna of the Pleistocene Pamlico formation of the southern Atlantic Coastal Plain.* Geol. Soc. Amer., Bull., vol. 47, pp. 1611-1656, 4 pls., 1 fig.
1939a. *Marne Pleistocene of the Gulf Coastal Plain: Alabama, Mississippi, and Louisiana.* Geol. Soc. Amer., Bull., vol. 50, pt. 1, pp. 297-316, 3 pls.
1939b. *Marine Pleistocene of Texas.* Geol. Soc. Amer., Bull., vol. 50, pt. 2, pp. 1885-1898, pls. 1-3.
1948. *Tertiary invertebrate fossils from newly discovered localities in North and South Carolina. Pt. 1.* Acad. Nat. Sci. Philadelphia, Notulae Naurae, No. 207, pp. 1-11, pls. 1-4.
1950. *Geology of the coastal plain of North Carolina.* Amer. Philos. Soc., Trans., new ser., vol. 40, pt. 1, 83 pp., 76 figs.
1955. *The geological history of the Cayman Islands.* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 284, pp. 1-11, 1 fig.

Ricketts, E. F., and Calvin, J.
1948. *Between Pacific Tides.* Stanford University, rev. ed., xxvii + 365 pp., 46 pls., 129 figs.

Rivera, R.
1953. *Pleistocene mollusks from Ecuador and Peru.* Conchological Club Southern California, Minutes, No. 129, pp. 5-15.

Riveros-Zuñiga, Francisco
1951a. *Catálogo descriptivo de Fisurelidos Chilenos.* Rev. Biol. Marina, vol. 3, pp. 89-148, 54 figs.
1951b. *Cypraea (Aricia) caput serpentis Linne en la Isla Pascua.* Rev. Biol. Marina, vol. 3, pp. 154-156.
1951c. *El area de distribución de Chorus giganteus Less., 1829 y algunas de sus diferencias morfológicas.* Rev. Biol. Marina, vol. 3, pp. 157-161, 2 figs.

Riveros-Zuñiga, Francisco, and González Reyes, Juan
1950. *Catálogo descriptivo de veneridos Chilenos.* Rev. Biol. Marina, vol. 2, pp. 117-160, figs. 22-44.

Rivers, J. J.

1891. *A new volutid shell (Scaphella arnheimi) from Monterey Bay.* California Acad. Sci., Proc., ser. 3, vol. 3, p. 107.

Roberts, R. J., and Irving, E. M.

1957. *Mineral deposits of Central America with a section on manganese deposits of Panama, by F. S. Simons.* U.S. Geol. Sur., Bull. 1034, 205, pp., 16 pls. 15 figs.

Robertson, Robert

1957a. *A study of Cantharus multangulus (Philippi), with notes on Cantharus and Pseudoneptunea (Gastropoda: Buccinidae).* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 300, pp. 1-10, figs. 1-19.

1957b. *Publication dates of Troschel's "Das Gebiss der Schnecken."* Nautilus, vol. 70, No. 4, pp. 136-138.

1958b. *The family Stenacmidae.* Nautilus, vol. 72, No. 2, pp. 68-69.

1959b. *The subgenus Halopsephus Rehder, with notes on the Western Atlantic species of Turbo and the subfamily Bothropomatinae Thiele.* Washington Acad. Sci., Jour., vol. 47, pp. 316-319, 3 figs.

1959c. *Observations on the spawn and veligers of conchs (Strombus) in the Bahamas.* Malac. Soc. London, Proc., vol. 33, pt. 4, pp. 164-171, pl. 11, text figs. 1-2.

1959d. *The mollusk fauna of Bahamian mangroves.* Amer. Malac. Union, Bull., No. 26, pp. 22-23.

1961a. *Review of pyramidellid hosts, with notes on an Odostomia parasitic on a chiton.* Nautilus, vol. 74, No. 3, pp. 85-91, figs. 1-9.

1961b. *A second Western Atlantic Rissoella and a list of species in the Rissoellidae.* Nautilus, vol. 74, No. 4, pp. 131-136, pl. 9.

1961c. *The feeding of Strombus and related herbivorous marine gastropods: With a review and field observations.* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 343, pp. 1-9, 1 fig.

de Rochebrune, A. T., and Mabille, J.

1885. *Diagnoses de mollusques nouveaux, recueillis par les membres de la mission du Cap Horn.* Soc. Phil. Paris, Bull., vol. 9, pp. 100-111.

1889. *Cephalopoda, Gastropoda et Lamellibranchiata.* Mission Scientifique du Cap Horn (1882-3), vol. 6, Zool., pp. 1-126, pls. 1-8.

Romanes, J.

1912a. *Geological notes on the peninsula of Nicoya, Costa Rica.* Geol. Mag., ser. 5, vol. 9, No. 6, pp. 258-265, 1 fig.

Römer, Eduard

1841, 1869-70. *Die Familie der Dreiecks—oder Stumpfmuscheln, Donacidae.* Syst. Conchylien-Cabinet, vol. 10, pt. 3, pp. 1-8, pl. 1 (1841); pp. 1-32, pls. 2-7 (1869); pp. 33-122, pls. 8-21a (1870).

1857. *Kritische Untersuchung der Arten des Molluskengeschlechts Venus bei Linné und Gmelin mit Berücksichtigung der später beschriebenen Arten.* Marburg, xiii + 135 pp.

1867. *Kritische Uebersicht aller zum Subgenus Chione gehörenden Arten von Venus.* Malakozool. Blätter, vol. 14, pp. 28-62, 92-126.

1870-73. *Die Familie der Tellmuscheln, Tellinidae.* Syst. Conchylien-Cabinet, vol. 10, pt. 4, pp. 1-291, pls. 1-52.

Rosewater, Joseph

1961. *The family Pinnidae in the Indo-Pacific.* Indo-Pacific Mollusca, vol. 1, No. 4, pp. 175-226, pls. 135-171.

Rossmassler, E. A., and Kobelt, W.

1835-1913. *Iconographie der Land-und Susswasser-Mollusken.* Vols. 1-21.

Rosso, Samuel W.

1952. *Some differences in the bivalve fauna of Ocean Springs, Mississippi, and Grand Isle, Louisiana.* Louisiana Acad. Sci., Proc., vol. 15, pp. 62-64.

Roux, Polydore

1828. *Iconographie conchyliologique ou recueil de planches lithographiées et colorées représentant les coquilles marines, fluviatiles, terrestres et fossiles, décrit par de Lamarck, Sowerby, Swainson, de Ferrussac, de Blainville, Risso, etc., et autres inédites.* Vol. 1, 8 pp., 9 pls.

Rutsch, Rolf F.

1942. *Beiträge zur Kenntnis tropisch-amerikanischer Tertiärmollusken. VII. Larkinien (Arcidae) aus dem jungtertiär von Trinidad.* Eclogae Geol. Helvetiae, vol. 35, No. 2, pp. 213-223, pl. 8.

Rutten, L. M. R.

1931c. *Our paleontologic knowledge of the Netherlands West Indies.* Leidsche Geol. Meded., vol. 5, pp. 651-672.

1934. *Oude Land en Zee-Verbindingen in midden-Amerika en West-Indië.* Koninkl. Nederl. Aardrijks. Genootschap, Tijdschr., vol. 51, pp. 351-600, 5 figs., map, table.

1935a. *Alte Land-und Meeresverbindungen in West-Indien und Zentralamerika.* Geol. Rundschau, vol. 26, Nos. 1-2, pp. 65-94, 3 figs., 1 pl.

1935b. *Über den Antillenbogen.* Koninkl. Akad. Wetensch. Amsterdam, Proc., vol. 38, No. 10, pp. 1046-1058, 3 figs.

1938. *Bibliography of West Indian geology.* Geogr. en Geol. Meded., Physiogr.-Geol. Reeks No. 16, 103 pp.

1940c. *New data on the smaller islands north of Venezuela.* Nederl. Akad. Wetensch. Amsterdam, Proc., vol. 43, pp. 820-827, figs.

Salisbury, A. E.

1929. *A twice pre-occupied generic name.* Malac. Soc. London, Proc., vol. 18, p. 255.

1953. *Mollusca of the University of Oxford Expedition to the Cayman Islands, 1938.* Malac. Soc. London, Proc., vol. 30, pp. 39-54.

Sapper, K.

1937. *Mittelamerika.* Handbuch regionalen Geologie, vol. 8, No. 29, pt. 4a, 160 pp., 10 pls., 15 figs.

Sars, G. O.

1872. *On some remarkable forms of animal life from the great deeps off the Norwegian coast. I.* Univ. Programm K. Norske Univ. Christiania for 1869, vol. 1, vii + 82 pp., 6 pls.

1878. *Mollusca regionis articae Norvegiae. Bijdrag til Kundskalen om Norges Arktiske Fauna. I.* Christiania, xvi + 466 pp., 52 pls., 1 map.

Sars, Michael

1861. *Om Siphodentalium vitreum en ny slaegt og art af Dentalidernes familie.* Christiania Univ.-Program for Første Halvaar, 29 pp., 3 pls.

1870. *Bidrag til kundskab om Christianiafjordens fauna. II.* Nytt Mag. Nat., vol. 17, pp. 113-226, pls. 8-13.

Sassi [as Sasso], A.

1827. *Saggio geologico sopra il bacino terziario di Albenga.* G. Ligust. Sci. Lett. Art. Genova, vol. 1, No. 5, pp. 467-484.

Schaufelberger, P.

1933. *Un estudio geológico de la Meseta Central occidental. Apuntes de geología.* San José, 15 pp.

Scheltema, Rudolf S., and Truitt, R. V.

1954. *Ecological factors related to the distribution of Bankia gouldi Bartsch in Chesapeake Bay.* Chesapeake Biol. Lab., Publ. No. 100, 31 pp.

Schenck, Hubert G.

1961. *Guiding principles in stratigraphy.* Geol. Soc. India, Jour., vol. 2, 10 pp.

Schepman, M. M.
1908-13. *Mollusca II. The Prosobranchia of the Siboga Expedition.* Siboga-Expeditie, vol. 28. *Pt. 1. Rhipidoglossa and Docoglossa, with an appendix by Prof. R. Bergh,* 107 pp., 9 pls., 3 text figs. *Pt. 2. Taenioglossa and Ptenoglossa,* 123 pp., 7 pls. *Pt. 3. Gymnoglossa,* 13 pp., 1 pl. *Pt. 4. Rhachioglossa,* 117 pp., 4 pls. *Pt. 5. Toxoglossa,* 88 pp., 6 pls., 1 text fig. *Pt. 6. Pulmonata and Opisthobranchia Tectibranchiata tribe Bullomorpha,* 42 pp., 2 pls.

Schepman, M. M., and Nierstrasz, H. F.
1909. *Mollusca II. Parasitische Prosobranchia der Siboga-Expedition.* Siboga-Expeditie, vol. 28, 76 pp., 6 pls., 39 text figs.

Schilder, F. A.
1935. *Revision of the Tertiary Cypraeacea of Australia and New Zealand.* Malac. Soc. London, Proc., vol. 21, pt. 6, pp. 325-355, figs. 1-50.

Schilder, F. A., and Tomlin, J. R. le Brocton
1931. *Re-discovery of a rare cowry.* Malac. Soc. London, Proc., vol. 19, pt. 6, pp. 274-275.

Schmidt, F. C.
1818. *Versuch über die beste Einrichtung zur Aufstellung, Behandlung und Aufbewahrung der verschiedenen Naturkörper und Gegen stände der Kunst, verzüglich der Conchylien-Sammlungen.* Gotha, v + 252 pp.

Schramm, A.
1869. *Catalogue des coquilles et des crustacées de la Guadeloupe, envoyés a l'exposition universelle de 1867.* Basse-Terre, Imprimerie du Gouvernement, 2 pp.

Schwengel, Jeanne S.
1942c. *A new Floridan Calliostoma (Astele).* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 106, 2 pp., 1 fig.

Scopoli, Giovanni Antonio
1777. *Introductio ad historium naturalem sistens genera Lapidum, Plantarum et Animalium hactenus detecta, caracteribus essentiabilus donata, in tribus divisa, subinde ad leges naturae.* Prague, *Mollusca,* pp. 386-400.

Scudder, H.
1864. *Notes on the geology of Cuba and the Isle of Pines.* Boston Soc. Nat. Hist., Proc., vol. 10, pp. 47-49.

Seguenza, Giuseppe
1862. *Paleontologia malacologica della rocce terziarie del distretto di Messina studiata vei suoi rapporti zoölogici e geognostici.* Accad. Asperanti Nat. Napoli, Ann., ser. 3, vol. 2, pp. 77-95.
1876a. *Cenne intorno alle Verticordie fossili del Plioceno Italiano.* R. Accad. Sci. Napoli, Rend., vol. 15, pp. 104–115, map.
1876b. *Studii stratigrafici sulla formazione Pliocenica dell'Italia meridionale.* R. Comitato Geol. Italia, Bol., vol. 7, pp. 7-15, 179-189.
1877. *Nuculidi terziare rinvenute nelle provincie meridionali d'Italia.* R. Accad. Lincei Roma, Mem., ser. 3, vol. 1, pp. 1163-1200, pls. 1-5.
1880. *Le formazione terziarie nella provincia di Reggio (Calabria).* R. Accad. Lincei Roma, Mem., ser. 3, vol. 6, pp. 1-446, pls. 1-17.

Semmes, Douglas R.
1919. *The geology of the San Juan District, Porto Rico.* New York Acad. Sci. Scientific Survey of Porto Rico and the Virgin Islands, vol. 1, pt. 1, pp. 1-110, 23 figs., geol. map.

Sharff, R. F.
1922. *On the origin of the West Indian fauna.* Dierk Amsterdam Bijdr., Weber Feestbundel., pp. 65-72.

Sherborn, Carolo Davies

1936. *An index to the authors (other than Linnaeus) mentioned in the Catalogue of the Works of Linnaeus preserved in the libraries of the British Museum.* London, 2d ed., 1933, pp. 1-59.

Shimer, H. A., and Shrock, R. R.

1944. *Index Fossils of North America.* New York, London, ix + 837 pp., 303 pls.

Shrock, Robert R., and Twenhofel, William H.

1953. *Principles of Invertebrate Paleontology.* New York, Toronto, London, 2d ed., xx + 816 pp., figs.

Shuttleworth, Robert James

1856. *Description de nouvelles espèces. Première décade: espèces nouvelles pour la faune des Antilles.* Jour. Conchyl., sér. 2, vol. 5, pp. 168-175.

Sievers, W.

1895. *Zur Kenntniss Puerto Rico's.* Geogr. Gesell. Hamburg, Mitth. 1891-92, pp. 217- 236, map.

1903. *Süd und Mittelamerika.* Hamburg, 2d ed., xii + 665 pp., 144 figs., 11 maps, 20 pls.

1914. *Süd und Mittelamerika.* Hamburg, 3d ed., xi + 567 pp., 54 figs., maps, sections, diagrams, 26 pls.

Simpson, Charles T.

1887a. *Record of a two-day's dredging cruise in Tampa Bay, Florida.* Conch. Exchange, vol. 1, pp. 44, 52-53.

1887b. *On a new Florida Natica.* Conch. Exchange, vol. 2, p. 51.

1895. *Distribution of land-and freshwater mollusks in the West Indian region and their evidence with regard to past changes of land and sea.* U. S. Nat. Mus., Proc., vol. 17, pp. 423-450, pl. 16.

Smith, Allyn G.

1961a. *Note on the bivalved gastropod Berthelinia limax (Kawaguti and Baba).* The Veliger, vol. 3, No. 3, pp. 80-81.

1961b. *Notes on the habitat of Berthelinia spec. nov. from the vicinity of La Paz, Baja California, Mexico.* The Veliger, vol. 3, No. 3, pp. 81-82.

Smith, Edgar A.

1875b. *Descriptions of some new shells from Kerguelen's Island.* Ann. Mag. Nat. Hist., ser. 4, vol. 16, pp. 62-73.

1877a. *On the Mollusca collected during the Arctic Expedition of 1875-76.* Ann. Mag. Nat. Hist., ser. 4, vol. 20, pp. 131-146, 2 figs.

1877b. *Account of the zoological collection made during visit of H. M. S. 'Petrel' to the Galapagos Islands. Mollusca.* Zool. Soc. London, Proc., pp. 69-73, pl. 11, figs. 6-8.

1879. *Transit of Venus Expeditions. Mollusca.* Roy. Philos. Soc. London, Trans., vol. 168, pp. 167-192.

1880b. *On the genus Myodora Gray.* Zool. Soc. London, Proc., pp. 578-587, pl. 53.

1880c. *Descriptions of five new species of shells from Uruguay.* Ann. Mag. Nat. Hist., ser. 5, vol. 6, pp. 319-322.

1881c. *On the genus Gouldia of C. B. Adams, and on a new species of Crassatella.* Zool. Soc. London, Proc., No. 32, pp. 498-491.

1890a. *Report on the marine molluscan fauna of the Island of St. Helena.* Zool. Soc. London, Proc., pp. 247-317, pls. 21-24.

1891b. *Descriptions of new species of shells from the 'Challenger' Expedition.* Zool. Soc. London, Proc., pp. 436-445, pls. 34-35.

1891c. *Remarks upon the genus Pythina of Hinds and the species which have been referred to it, upon Mysella of Angas, and the description of a new species of Mylitta.* Ann. Mag. Nat. Hist. for 1891, pp. 227-236, pl. 13A.

1892. *Descriptions of shells from Mauritius and California.* Ann. Mag. Nat. Hist., ser. 6, vol. 9, No. 51, art. 39, pp. 255-256, 2 figs.
1893. *Observations on the genus Sphenia, with descriptions of new species.* Ann. Mag. Nat. Hist., ser. 6, vol. 12, pp. 277-281, pl. 15A.
1895a. *Natural history notes from H. M. Indian Marine Survey steamer "Investigator," Commander C. F. Oldham, R. N. Series 2, No. 20. Report upon some Mollusca dredged in the Arabian Sea during the season 1894-95.* Ann. Mag. Nat. Hist., ser. 6, vol. 16, pp. 1-19, 262-265, pls. 1-12.
1895b. *A list of land and freshwater Mollusca of Trinidad.* Jour. Conch., vol. 8, pp. 231-251.
1898. *On a small collection of marine shells from New Zealand and Mac-Quarie Island, with descriptions of new species.* Malac. Soc. London, Proc., vol. 3, pt. 1, pp. 20-25, figs. 1-9.
1900. *On Callocardia and Vesicomya.* Malac. Soc. London, Proc., vol. 4, pt. 2, pp. 81-83, 2 figs.
1902a. *Description of a new species of Gomphina from New Zealand.* Jour. Malac., vol. 9, No. 4, pp. 109-110, 2 figs.
1902b. *Report on the collections of Mollusca made in the Antarctic during the voyage of the 'Southern Cross.'* Pt. 7, *Mollusca,* pp. 201-213, pls. 24-25.
1905a. *On a small collection of Mollusca from Tierra del Fuego.* Zool. Soc. London, Proc., pp. 333-339.
1905b. *Mollusca from Tierra del Fuego.* Malac. Soc. London, Proc., vol. 6, pt. 6, pp. 333-339, figs. 1-7.
1906. *Natural history notes from R. I. M. S. "Investigator." On Mollusca from the Bay of Bengal and the Arabian Sea.* Ann. Mag. Nat. Hist., ser. 7, vol. 18, pp. 157-175, 245-264.
1907a. *Mollusca and Brachiopoda.* Nat. Antarctic Exped. ('Discovery'), Nat. Hist., vol. 2, pp. 1-112, pls. 1-3.
1907b. *Lamellibranchiata.* Nat. Antarctic Exped. ('Discovery'), Nat. Hist., vol. 2, pp. 1-7, pls. 2-3.
1915b. *Mollusca. Pt. 1. Gastropoda, Prosobranchia, Scaphopoda and Pelecypoda.* British Antarctic ('Terra Nova') Exped. (1910), Zoology, vol. 2, No. 4, pp. 61-112, pls. 1-2.
1915c. *A list of Australian Mactridae, with a description of a new species.* Malac. Soc. London, Proc., vol. 11, pp. 137-151.

Smith, Ernest Rice

1923. *Three new brackish-water Pliocene Mollusca from Louisiana.* Indiana Acad. Sci., Proc., pp. 135-136.

Smith, Lillian C.

1945. Notes on the family Cardiidae. Occas. Papers on Mollusks, No. 4, pp. 29-32.

Smith, Maxwell

1909. *A Sicilian collection.* Nautilus, vol. 22, pp. 128-135.
1960. *Universal Shells. Marine-freshwater-land.* Asheville, 254 pp.

Smith, Sanderson

1860. *On the Mollusca of Peconic and Gardiner's Bays, Long Island, New York.* Lyc. Nat. Hist. New York, Ann., vol. 7, pp. 147-168.
1865. *Catalogue of the Mollusca of Little Gull Island, Suffolk County, New York.* Lyc. Nat. Hist. New York, Ann; vol. 7, 2 pp.
1870. *Report on the Mollusca of Long Island, N. Y., and of its dependencies.* Lyc. Nat. Hist. New York, Ann., vol. 9, pp. 377-407, figs. 1-6. (With Temple Prime)

Solem, Alan

1954. *Living species of the pelecypod family Trapeziidae.* Malac. Soc. London, Proc., vol. 31, pt. 2, pp. 64-84, pls. 5-7.

Soot-Ryen, Tron

1932a. *The Norwegian zoological expedition to the Galapagos Islands 1925, conducted by Alf Wolleback. II. Pelecypods from Floreana (Sancta Maria), Galapagos Islands.* Meddel. Zool. Mus. Oslo, No. 27, pp. 313-324, pls. 1-2.

1932b. *Pelecypoda, with a discussion of possible migrations of Arctic pelecypods in Tertiary times.* [In] The Norwegian North Polar Expedition with the "Maud" 1918-25, Scientific Results, vol. 5, No. 12, 135 pp., 2 pls.

1951a. *Scientific results of the Norwegian expeditions 1927-1928 et sqq., instituted and financed by Consul Lars Christensen. No. 32. Antarctic pelecypods.* Norske Videnskaps-Akademi i Oslo, pp. 1-46, 1 pl.

1952a. *Choromytilus, a new genus in the Mytilidae.* Soc. Malacológica, vol. 8, No. 3, pp. 121-122.

1952b. *Laternula elliptica (King and Broderip 1831) from the Pecten-conglomerate, Cockburn Island.* Kungl. Svenska Vetenskapsakad., Ark f. Zoologi, ser. 3, vol. 4, No. No. 9, pp. 163-164, pl. 1.

1952c. *New Tertiary Pelecypoda from Punta Arenas.* Arkiv f. Zoologi, vol. 4, No. 15, pp. 307-310, pl. 1.

1957b. *Preliminary diagnoses of new genera and species of pelecypods from Chile.* Astarte, No. 16, 5 pp.

1959. *Reports of the Lund University Chile Expedition 1948-49. Pelecypoda.* Lund Univ. Ärsskrift, ser. 2, vol. 55, No. 6, pp. 1-86, pls. 1-4.

1960. *Pelecypods from Tristan da Cunha.* Results Norwegian Sci. Exped. to Tristan da Cunha, No. 49, 47 pp., 3 pls., 9 figs.

Soulsby, B. H.

1903-40. *Catalogue of the books, manuscripts, maps and drawings in the British Museum (Natural History).* British Museum, vol. 1 (A-D), pp. 1-500 (1903); vol. 2 (E-K), pp. 501-1038 (1904); vol. 3 (L-O), pp. 1039-1494 (1910); vol. 4 (P-SN), pp. 1495-1956 (1913); vol. 5, pp. 1957-2403 (1915); vol. 6, Supplement (A-I), pp. 1-511 + Addenda and Corrigenda of vols. 1 and 2, 48 pp. (1922); vol. 7, Supplement (J-O), pp. 1-967 (1933); vol. 8, Supplement, pp. 1-1480 (1940).

1933. *A catalogue of the works of Linnaeus (and publications more immediately relating thereto) preserved in the libraries of the British Museum (Bloomsbury) and the British Museum (Natural History) (South Kensington).* London, 2d ed., xi + 246 pp., + addenda and corrigenda 65 pp., + index pp. 67-68.

de Souza Lopes, H.

1958. *Sobre "Turbonilla (Pyrgiscus) dispar" Pilsbry, 1897 (Gastropoda, Pyramidellidae).* Brasil Biol. Rev., vol. 18, No. 1, pp. 17-21, figs. 1a-11c.

de Souza Lopes, H., and Alvarenga, M.

1955. *Contribuiçao ao conhecimento dos moluscos da Ilha Fernando de Noronha-Brasil.* Inst. Oceanográfico Bol., vol. 6, Nos. 1-2, pp. 157-196, pls. 1-3.

de Souza Lopes, H., and de Sã Cardoso, Paulo

1958. *Sobre um novo gastrópodo Brasileiro do gênero "Solariella" Wood, 1842 (Trochidae).* Brasil Biol. Rev., vol. 18, No. 1, pp. 59-64, figs. 1-3.

Sowerby, George Brettingham (first of name)

1828. *Observations on the shells of an acephalous molluscum of the family Pectinidae, for which the generic name of Hinnites has been proposed by M. DeFrance; together with the characters of several species.* Zool. Jour., vol. 3, pp. 67-72.

1843. *On new species of Cyclostoma in the collection of H. Cuming, Esq.* Zool. Soc. London, Proc., pt. 11, pp. 29-31, 59-66.
1844a. *Descriptions of new species of Columbella, from the collection of High Cuming, Esq.* Zool. Soc. London, Proc., pt. 12, pp. 48-53.
1844b. *Descriptions of six new species of Voluta.* Zool. Soc. London Proc., pt. 12, pp. 149-152.

Sowerby, George Brettingham, Jr. (second of name)

1841c. *Description of eight new species of Ranella.* Zool. Soc. London, Proc., pt. 9, pp. 51-53.
1842. *Descriptions of new species of the genus Pecten, figured in Sowerby's 'Thesaurus Conchyliorum.'* Zool. Soc. London, Proc., pt. 10, pp. 163-165.
1843. *Descriptions of new species of Lima.* Zool. Soc. London, Proc., pt. 11, p. 23.
1844a. *Descriptions of new species of Scalaria collected by Hugh Cuming, Esq.* Zool. Soc. London, Proc., pt. 12, pp. 10-14.
1844b. *Continuation of descriptions of Scalaria.* Zool. Soc. London, Proc., pt. 12, pp. 26-31.
1846a. *Descriptions of Tertiary fossil shells from South America.* [In] Darwin, Charles R., Geological observations on South America, being the third part of the geology of the Voyage of the Beagle . . . during the years 1832 to 1836. Appendix, pp. 249-264.
1848a. *Descriptions of some new species of Ovulum in the collection of Mr. Cuming.* Zool. Soc. London, Proc., pp. 135-136.
1848b. *Descriptions of some new species of Cancellaria in the collection of Mr. Cuming.* Zool. Soc. London, Proc., pp. 136-138.
1849a. *On a new species of Pholadidae, with notices of several new species and of a remarkable specimen of Pholas calva in Mr. Cuming's collection.* Zool. Soc. London, Proc., pp. 160-162, pl. 5.
1888. *Descriptions of fourteen new species of shells.* Linnean Soc. London, Jour., Zoology, vol. 20, pp. 395-400, pl. 25.
1897. *On three new shells from the collection of Mr. B. C. Thomas of Brest.* Malac. Soc. London, Proc., vol. 2, No. 4, pp. 137-138, pl. 11.
1900. *Descriptions of two new species of shells—Murex marcoensis and Cassis booleyi.* Jour. Malac., vol. 7, pp. 162-163, 2 figs.
1904 *Mollusca of South Africa.* Dept. Agric., Marine Investigations in South Africa, vol. 2, pp. 93-100, pl. 2; pp. 213-232, pls. 3-5.

Springer, J. W.

1924. *A Tertiary crinoid from the West Indies.* U. S. Nat. Mus., Proc., vol. 65, art. 3, 8 pp., 1 pl.

Staadt, J. L.

1956. *Observations on the subgeneric classification of Calliostoma.* Jour. Conchyl., Vol. 96, pp. 119-120.

Stahl, Augistin

1882. *Fauna de Puerto Rica.* Imprenta del Boletin Mercantil, p. 242.

Stearns, Robert Edwards Carter

1867d. *Shells collected at San Juanico, Lower California, by William M. Gabb.* California Acad. Sci., Proc., vol. 5, pp. 131-132.
1867e. *Shells collected at Loreto, Lower California by W. M. Gabb, in February 1867.* California Acad. Sci., Proc., vol. 5, p. 132.
1869. *On a new species of Pedipes from Tampa Bay, Florida.* Boston Soc. Nat. Hist., Proc., vol. 13, pp. 108-109, 1 fig.
1872. *Descriptions of new species of marine mollusks from the coast of Florida.* Conch. Memoranda, No. 11, pp. 2-4.
1873e. *Descriptions of new marine shells from the west coast of Florida.* Acad. Nat. Sci. Philadelphia, Proc., vol. 25, pp. 344-347, figs. 1-4.
1893e. *Scientific results of explorations by the U. S. Fish Commission steamer Albatross.* U. S. Nat. Mus., Proc., vol. 16, pp. 353-450, pls. 51-52.

Steinbeck, J., and Ricketts, E. F.
1941. *Phylum Mollusca.* [In] *Sea of Cortez.* New York, x + 598 pp., 40 pls., 2 charts.

Steinmann, G., and Wilckens, Otton
1908. *Kreide-und Tertiärfossilen aus den Magellansländern gesammelt von der Schwedischen Expedition 1895-1897.* K. Svenska Vetenskapsakad. Stockholm, Ark. f. Zool., vol. 4, No. 6, pp. 1-118, pls. 1-7, 7 text figs.

Stenzel, H. B.
1947. *Nomenclatural synopsis of supraspecific groups of the family Ostreidae (Pelecypoda, Mollusca).* Jour. Paleont., vol. 21, No. 2, pp. 165-185.

Stephenson, T. A., and Stephenson, Anne
1949. *The universal features of zonation between tide-marks on rocky coasts.* Jour. Ecology, vol. 37, No. 2, pp. 289-305.
1950. *Life between tide-marks in North America. I. The Florida Keys.* Jour. Ecology, vol. 38, No. 2, pp. 354-402.
1954. *The Bermuda Islands.* Endeavor, vol. 13, No. 50, pp. 72-80, 4 pls.

Stimpson, William
1851a. *Descriptions of two new species of shells from Massachusetts Bay, namely: Spiralis gouldii and Thracia couthouyi, and a Holothuria.* Boston Soc. Nat. Hist., Proc., vol. 4, pp. 7-9.
1863. *Synopsis of the marine Invertebrata collected by the late Arctic Expedition, under Dr. I. I. Hayes.* Acad. Nat. Sci. Philadelphia, Proc., vol. 15, pp. 138-142.
1865a. *Review of the northern Buccinums and remarks on some other northern marine mollusks. Part. 1.* Canadian Naturalist, vol. 2, pp. 364-389.

Stoliczka, Ferdinand
1868. *The Gastropoda of the Cretaceous of southern India.* Geol. Survey India, Mem., Paleont. Indica, Cretaceous fauna, vol. 2, xiii + 498 pp., pls. 1-28.
1870-71. *The Pelecypoda, with a review of all known genera of this class, fossil and Recent.* Geol. Survey India, Mem., Paleont. Indica, Cretaceous fauna, vol. 3, xxii + 538 pp., pls. 1-50.

Storer, D. H.
1838. *Description of a new species of Nucula from Massachusetts Bay.* Boston Jour. Nat. Hist., vol. 2, pp. 122-125, 1 fig.

Strebel, H.
1904-07. *Beiträge zur Kenntnis der Mollusken Fauna der Magalhaen-Provinz.* Zool. Jahrb., Abt. Systemat., vol. 21, pp. 171-248, pls. 3-4 (1904); vol. 21, suppl. 8, pp. 121-166, pl. 5 (1905); vol. 22, pp. 575-666, pls. 21-24 (1905); vol. 24, pp. 91-174, pls. 7-13 (1906); vol. 25, pp. 79-196, pls. 1-8 (1907).
1908. *Die Gastropoden.* Wiss. Ergeb. Schwed. Südpolar-Exped. (1901-03), vol. 6, pp. 1-112, pls. 1-6.

Stuardo B., José
1960. *La familia Glycimeridae (Bivalvia) en Chile.* Biol. Marina Rev., vol. 10, Nos. 1-3, pp. 133-142, 1 pl.

Stutchbury, Samuel
1837. *On Cypraecássis, a proposed new genus of univalve shells, for the reception of certain species of Bruguière's genus Cássis.* Mag. Nat. Hist., new ser., vol. 1, pp. 214-217, 2 figs.

Sumner, F. B., Osburn, R. C., and Cole, L. J.
1913. *A biological survey of the waters of Woods Hole and vicinity. Pt. I, Sect. 1, Physical and zoological.* U. S. Bur. Fisheries, vol. 31, pt. 1, pp. 1-441, 227 charts. *Pt. II, Sect. 3. A catalogue of the marine fauna,* Vol. 31, pt. 2, pp. 545-794.

Suter, Henry

1908. *Descriptions of new species of New Zealand Mollusca.* New Zealand Inst., Trans., vol. 40, pp. 360-373, pls. 28-30.

1913. *Descriptions of two new marine shells from New Zealand.* Canterbury Mus., Rec., vol. 2, No. 1, pp. 57-58, figs. 1-2.

1913-15. *Manual of the New Zealand Mollusca.* Wellington, xxiii + 1120 pp., Atlas 72 pls.

Sverdrup, H. U., Johnson, M. W., and Fleming, R. H.

1942. *The Oceans, their Physics, Chemistry and General Biology.* New York, x + 1087 pp., 265 text figs.

Sykes, E. R.

1906. *On the dates of publication of Sowerby's "Mineral Conchology" and "Genera of Recent and Fossil Shells."* Malac. Soc. London, Proc., vol. 7, pp. 191-194.

Tegland, Nellie May

1929. *Correlation and affinities of certain species of Pitaria.* Univ. California Publ., Bull. Dept. Geol. Sci., vol. 18, No. 10, pp. 275-290, pls. 21-23.

Teisseire, Augusto

1928. *Contribución al estudio de la geología y de la paleontología de la República del Uruguay. Region de Colonia.* Montevideo, 153 pp., 27 photogr., 12 pls., 2 maps.

von Teppner, Wilfried

1922. *Lamellibranchiata tertiaria, Anisomyaria, 2.* Fossilium Catalogus, vol. 1, pt. 15, pp. 67-296.

Thalmann, Hans E.

1935. *Die miozöne Tuxpan-Stufe im Gebiete zwischen Rio Tuxpan und Rio Tecolutla (Staat Veracruz, Ost-Mexico).* Eclogae Geol. Helvetiae, vol. 28, No. 2, pp. 543-546.

Thiele, Johannes

1903 *Die beschalten Gastropoden der Deutschen Tiefsee-Expedition, 1898–99.* Wiss. Ergebn. 'Valdiva,' vol. 7, pp. 147-174, pls. 6-9

1912a. *Scissureliden und Fissurelliden.* Syst. Conchylien-Cabinet, vol. 2, pt. 4a, pls. 1-4.

1912b. *Die antarktischen Schnecken und Muscheln.* [In] Deutsche Südpolar-Exped. 1901-03, vol. 13, pp. 183-285, 9 pls.

1920. *Familia Limidae.* Syst. Conchylien-Cabinet, vol. 7, pt. 2a, 66 pp., 10 pls.

1924a. *Revision des Systems Trochacea.* Zool. Mus. Berlin, Mitteil., vol. 11, No. 1, pp. 47-74.

1924b. *Ueber die Systematic der Columbelliden.* Archiv f. Molluskenfunde, vol. 56, pp. 200-210, 1 pl.

1925. *Gastropoda der Deutsche Tiefsee-Expedition. 2.* Wiss. Ergebn. 'Valdivia,', vol. 17, No. 2, pp. 26-382, pls. 13-46.

1929-35. *Handbuch der systematischen Weichtierkunde.* Jena, vol. 1, pt. 1, pp. 1-376 (1929); pt. 2, pp. 377-778, figs. 1-783 (1931); vol. 2, pt. 3, pp. 779-1022 (1934); pt. 4, pp. 1023-1154, figs. 784-879 (1935).

Thomas, Abram Owen

1919. *Notes on the geology of Barbados and Antigua.* Iowa Univ. Studies in Nat. Hist., vol. 8, pp. 127-136, 213-219.

Thompson, Fred G.

1957. *A collection of mollusks from northern Venezuela.* Mus. Zool. Univ. Michigan, Occas. Papers, No. 591, pp. 1-10, pls. 1-2.

Thompson, J. M.

1954. *The genera of oysters and the Australian species.* Australian Jour. Marine and Freshwater Research, vol. 5, No. 1, pp. 132-168, pls. 1-11.

Thomson, J. H.

1867. *Description of a new species of Montacuta.* Amer. Jour. Conch., vol. 3, pt. 1, No. 8, p. 33, pl. 1, fig. 15.

Tippenhauer, L. Gentil

1893. *Die Insel Haiti.* Leipzig, xviii + 693 pp., 30 figs., 35 pls.

1899. *Geologische Studien in Haiti.* Peterm. Mitth. *I. Aus der südwestlichen Halbinsel,* pp. 26-29, pl. 3. *II. Aus der nordwestlichen Halbinsel,* pp. 153-155, pl. 10. *III. Geologische Studien zwischen Port au Prince, Jacmel, Baient und Grand Goave,* pp. 201-204, pl. 13.

1901. *Beiträge zur Geologie Haitis.* Peterm. Mitth. *IV. Die Erzfundstätten von Terre Neuve und Gonaives,* pp. 121-127, pl. 10. *V. Das La Selle Gebirge, die Cul de Sac Ebene und das Salzseengebiet,* pp. 169-178, pls. 13-14. *VI. Das Lignitlager von Maïssade und der Aufstieg vom Zentralplateau und Gonaives und von Norden aus,* pp. 193-199, pls. 15-16.

1909. *Neuer Beitrag zur Topographie, Bevölkerungskunde und Geologie Haitis.* Peterm. Mitth., pp. 49-57, pl. 5.

Tomlin, J. R. le Brocton

1916a. *Notes on Marginella.* Jour. Conch., vol. 15, p. 43.

1931a. *Notes from the British Museum-I. Dates of certain species of Donax and Mesodesma.* Malac. Soc. London, Proc., vol. 19, No. 3, pp. 295-308, pls. 46-47.

1945. *Hawaiian types* [of] *Terebra.* Conch. Club Southern California, Minutes, No. 43, p. 40.

Tomlin, J. R. le Brocton, and Shackleford, L. J.

1914-15. *The marine Mollusca of São Thomé. I.* Jour. Conch., vol. 14, pp. 239-256 (1914); pp. 267-276 (1915).

Townsend, Charles Haskins

1916. *Scientific results of the expedition to the Gulf of California in charge of C. H. Townsend, by the U. S. Fisheries steamship "Albatross" in 1911, Commander G. H. Burrage, U.S.N., commanding. Voyage of the Albatross to the Gulf of California in 1911.* Amer. Mus. Nat. Hist., Bull., vol. 35, art. 24, pp. 399-476.

Trechmann, C. T.

1932a. *Notes on Brimstone Hill, St. Kitts.* Geol. Mag., vol. 69, pp. 241-258, pls. 12-13.

1932b. *Brimstone Hill, St. Kitts.* Geol. Mag., vol. 69, p. 430.

Troschel, F. H.

1856-93. *Das Gebiss der Schnecken zur Begründung einer Natürlichen Classification untersucht von Dr. F. H. Troschel.* Vol. 1, pt. 1, pp. 1-72, pls. 1-4 (1856); pt. 2, pp. 73-112, pls. 5-8 (1857); pt. 3, pp. 113-152, pls. 9-12 (1858); pt. 4, pp. 153-196, pls. 13-16 (1861); pt. 5, pp. 197-252 + i-viii, pls. 17-20 (1863); vol. 2, pt. 1, pp. 1-48, pls. 1-4 (1865); pt. 2, pp. 49-96, pls. 5-8 (1867); pt. 3, pp. 97-132, pls. 9-12 (1869); pt. 4, pp. 133-180, pls. 13-16 (1875); pt. 5, pp. 181-216, pls. 17-20 (1878); pt. 6, pp. 217-246, pls. 21-24 (1879); pt. 7, pp. 249-334, pls. 25-28 (1891, by Thiele); pt. 8, pp. 337-409 + title + i-ix, pls. 29-32, (1893, by Thiele).

Tryon, George Washington, Jr.

1862a. *On the classification and synonymy of the Recent species of Pholadidae.* Acad. Nat. Sci. Philadelphia, Proc., vol. 14, pp. 191-221.

1862b. *Description of a new genus and species of Pholadidae.* Acad. Nat. Sci. Philadelphia, Proc., vol. 14, pp. 449-451, 1 fig.

1862c. *Monograph of the family Teredidae.* Acad. Nat. Sci. Philadelphia, Proc., vol. 14, pp. 453-482.

1872j. *Descriptions of new species of marine bivalve Mollusca.* Acad. Nat. Sci. Philadelphia, Proc., vol. 2, p. 130, pl. 6.

1873. *American Marine Conchology: or, descriptions of the shells of the Atlantic coast of the United States from Maine to Florida.* Philadelphia, vi + 208 pp., 44 pls.
1886. *Family Vermetidae.* [In] Man. Conch., vol. 8, pp. 163-191, pls. 49-58.

Tucker-Rowland, Helen I.
1938a. *A preliminary survey of the nomenclatural units of the Tertiary Pectinidae.* Mus. Roy. Hist. Nat. Belgique, Bull., vol. 14, No. 49, pp. 1-15.
1938b. *New subgenus and genus of Tertiary pectinids.* Jour. Conch., vol. 21, pp. 81-82.

Turner, Ruth D.
1955a. *Scaphopods of the Atlantis dredgings in the Western Atlantic with a catalogue of the scaphopod types in the Museum of Comparative Zoology.* Woods Hole Oceanagr. Inst., Contrib. No. 779, pp. 309-320.
1956c. *Notes on Xylophaga Washingtona Bartsch and on the genus.* Nautilus, vol. 70, No. 1, pp. 10-12.
1961. *Pleurotomariidae in Bermuda waters.* Nautilus, vol. 74, No. 4, pp. 162-163.

Turner, Ruth D., and Rosewater, Joseph
1958. *The family Pinnidae in the Western Atlantic.* Johnsonia, vol. 3, No. 38, pp. 285-326, pls. 149-171.

Turton, William
1819. *A Conchological Dictionary of the British Islands.* London, xxvi+ 272 pp., 28 pls.

Turton, W. H.
1932. *The Marine Shells of Port Alfred, S. Africa.* Oxford Univ. Press, xvi + 331 pp., 70 pls.

Vaillant, Leon
1865. *Recherches sur la faune malacologique de la baie de Suez.* Jour. Conchyl., vol. 13, pp. 97-127.
1871. *Recherche sur la synonymie des espèces placées par de Lamarck dans les genres Vermet, Serpule, Vermilie.* Mus. Nat. Hist. nat. Paris, Nouv. Arch., sér. 1, vol. 7, pp. 181-201.

Valentine, James W.
1956. *Upper Pleistocene Mollusca from Potrero Canyon, Pacific Palisades, California.* San Diego Soc. Nat. Hist., Trans., vol. 12, pp. 181-205, pl. 13, 1 map.
1960. *Pleistocene molluscan notes, 3. Rocky coast faunule, Bahia San Quentin, Mexico.* Nautilus, vol. 74, No. 1, pp. 18-23.
1961. *Paleoecologic molluscan geography of the Californian Pleistocene.* Univ. California Publ. Geol. Sci., vol. 34, No. 7, pp. 309-442, 16 text figs.

Vanatta, Edward G.
1899b. *Melampus floridanus Shuttl.* Nautilus, vol. 12, p. 107.
1914. *Modiolus demissus Dillw. and var. granosissimus Sby.* Nautilus, vol. 28, p. 35.

Van der Schalie, Henry
1933. *Notes on the brackish water bivalve Polymesoda caroliniana (Bosc).* Mus. Zool. Univ. Michigan, Occas. Papers, No. 258, pp. 1-8, pl. 1, map.
1948. *The land and fresh-water mollusks of Puerto Rico.* Mus. Zool. Univ. Michigan, Misc. Publ. No. 70, 134 pp., 14 pls.

Van Hyning, Thompson
1945. *A new Strombus from Florida.* Mollusca, vol. 1, No. 7, pp. 95-98, 4 figs.

Vaughan, Thomas Wayland
1899. *Some Cretaceous and Eocene corals from Jamaica.* Mus. Comp. Zool., Bull., vol. 34, pp. 227-250, pls. 36-41.

1900. *A Tertiary coral reef near Bainbridge, Georgia.* Science, n. s., vol. 12, pp. 873-875.
1902. *Earliest Tertiary coral reefs in the Antilles and the United States.* Science, n. s., vol. 15, pp. 506-507.
1905. *A critical review of the literature on the simple genera of Madreporaria Fungida, with a tentative classification.* U. S. Nat. Mus., Proc., vol. 28, pp. 371-424.
1913a. *Studies of the geology and of the Madreporaria of the Bahamas and of southern Florida.* Carnegie Inst. Washington, Yearbook, vol. 11, pp. 153-162.
1913b. *Remarks on the geology of the Bahamas and on the Bahamian oolites.* Washington Acad. Sci., Jour., vol. 3, pp. 302-304.
1914c. *The platform of barrier coral reefs.* Amer. Geogr. Soc., Bull., vol. 46, pp. 426-429.
1914d. *Sketch of the geologic history of the Florida coral reef tract and comparison with other coral reef areas.* Washington Acad. Sci., Jour., vol. 4, pp. 26-34.
1914e. *Memorandum on the geology of the groundwater of the island of Antigua (B.W.I.).* West Indian Bull. 14, pp. 276-279.
1914f. *Investigations of the geology and geologic processes of the reef tracts and adjacent areas in the Bahamas and Florida.* Carnegie Inst. Washington, Yearbook, vol. 12 for 1913, pp. 183-184.
1914g. *Coral reefs and reef corals of the southeastern United States, their geologic history and significance.* Geol. Soc. Amer., Bull., vol. 26, pp. 58-60.
1915a. *The geologic significance of the growth rate of the Floridan and Bahaman shoal-water corals.* Washington Acad. Sci., Jour., vol. 5, pp. 591-600.
1915b. *Geological investigations in the Bahamas and southern Florida.* Carnegie Inst. Washington, Yearbook, vol. 13 for 1914, pp. 227-233.
1915-18. *Study of the stratigraphic geology and of the fossil corals and associated organisms in several of the smaller West Indian islands.* Carnegie Inst. Washington, Yearbook, vol. 13 for 1914 (1915), pp. 358-369; vol. 14 for 1915 (1916), pp. 368-373; vol. 15 for 1916 (1917), p. 359; vol. 16 for 1917 (1918), p. 319.
1916a. *The corals and coral reefs of the Gulf of Mexico and the Caribbean Sea.* Science, n. s., vol. 43, pp. 250-251.
1916b. *Some littoral and sublittoral physiographic features of the Virgin and northern Leeward Islands and their bearing on the coral reef problem.* Washington Acad. Sci., Jour., vol. 6, pp. 53-66.
1917a. *Chemical and organic deposits of the sea.* Geol. Soc. Amer., Bull., vol. 28, pp. 935-944, pls. 47-48.
1918a. *Correlation of the Tertiary geologic formations of the southeastern United States, Central America, and the West Indies.* Washington Acad. Sci., Jour., vol. 8, pp. 268-276.
1919a. *Corals and formation of coral reefs.* Smithsonian Inst. Washington, An. Rept. for 1917, pp. 189-276, 37 pls.
1919b. *Fossil corals from Central America, Cuba, and Porto Rico, with an account of the American Tertiary, Pleistocene and Recent coral reefs.* U. S. Nat. Mus., Bull., vol. 103, pp. 189-524, pls. 68-153.
1920a. *Study of the stratigraphic geology and of the fossil corals and associated organisms in several of the smaller West Indian islands.* Carnegie Inst. Washington, Yearbook, vol. 18 for 1919, pp. 345-346.
1920b. *Stratigraphy of the Virgin Islands of the U. S. and Culebra and Vieques Island.* Geol. Soc. Amer., Bull., vol. 31, pp. 216-217.
1921. *Correlation of the Tertiary formations of Central America and the West Indies.* First Pan-Pacific Sci. Conf., Proc., pp. 819-844.
1922. *Stratigraphic significance of the species of West Indian fossil Echini.* Carnegie Inst. Washington, Publ. No. 306, pp. 107-122.

1923a. *On the relative value of species of smaller Foraminifera for the recognition of stratigraphic zones.* Amer. Assoc. Petrol. Geol., Bull., vol. 7, pp. 517-531.
1925a. *Recent progress in the study of the tectonic features of the West Indies and Central America.* Pan-Pacific Sci. Congress, Proc. for 1923, vol. 1, pp. 735-741.
1925b. *Recent additions to knowledge of the correlation of the Tertiary geologic formations of northeast Mexico, Central America, the West Indies, northern South America, and Lower California.* Pan-Pacific Sci. Congress, Proc. for 1923, vol. 1, pp. 864-870.
1925c. *Coral reefs and submerged platforms.* Second Pan-Pacific Sci. Congress, Proc., vol. 2, pp. 1128-1134.
1926. *Notes on the igneous rocks of the northeast West Indies and of the geology of the island of Anguilla.* Washington Acad. Sci., Jour., vol. 16, pp. 345-358.

Vaughan, T. Wayland, and Hofmeister, John Edward

1925. *New species of fossil corals from the Dominican Republic.* Mus. Comp. Zool., Bull., vol. 67, pp. 315-326, 4 pls.
1926. *Miocene corals from Trinidad.* Carnegie Inst. Washington, Publ. No. 344, pp. 105-134, 5 pls.

Vayssière, A.

1917. *Recherches zoologiques et anatomiques sur les mollusques amphineures et gastéropodes (opisthobranches et prosobranches).* Deuxième Expéd. Antarctique Française (1908-10), pp. 1-50, pls. 1-4.

Vélain, Charles

1876. *Sur la faune malacologique des île Saint-Paul et Amsterdam.* Acad. Sci. Paris, Comptes Rendus, vol. 83, pp. 284-287.
1877a. *Observations génèrales sur la faune des deux iles suivies d'une description des mollusques.* Arch. Zool. Expér. Gén., vol. 6, pp. 1-144, pls. 1-5, figs. 1-9.
1877b. *Expédition française aux îles Saint-Paul et Amsterdam. Zoologie. Description des mollusques.* Arch. Zool. Expér. Gén., vol. 6, pp. 96-144, 4 pls.

Verany, J. B.

1846. *Catalago degli animali invertebrati marini del golfo di Genova e Nizza.* Genova, 30 pp., 3 pls.

Verástegui, Pedro

1953. *The pelecypod genus Venericardia in the Paleocene and Eocene of western North America.* Palaeontographica Americana, vol. 3, No. 25, pp. 395-506, pls. 40-61, charts 1-3.

Verkriizen, T. A.

1877. *Mollusca dredged and collected by T. A. Verkriizen in 1876, in the neighborhood of St. John's, Newfoundland, including a few species obtained from the Bay of Fundy.* St. John's, N. F., 10 pp.
1881. *Bericht über meinen Besuch der grossen Bank von Neufundland in Sommer 1880.* Deutsch. Malakozool. Gesell., Jahrb., vol. 8, pp. 2-20, pls. 3-4.

Vermunt, L. W. J., and Rutten, M. G.

1931a. *Geology of central Curaçao.* Konink. Akad. Wetensch. Amsterdam, Proc., vol. 34, pp. 271-276.
1931b. *Geology of the surroundings of "St. Martha" and "St. Kruis," Curaçao.* Konink. Akad. Wetensch. Amsterdam, Proc., vol. 34, pp. 558-563.
1931c. *Some remarks on the geology of N. Curaçao.* Konink. Akad. Wetensch. Amsterdam, Proc., vol. 34, pp. 1028-1031.

Verrill, Addison E.

1873a. *Results of recent dredging expeditions on the coast of New England.* Amer. Jour. Sci., ser. 3, vol. 5, pp. 1-16, 98-106.

1873b. *Report upon the invertebrate animals of Vineyard Sound and the adjacent waters with an account of the physical characters of the region.* Rept. U. S. Fish Com., vol. 1, pp. 295-778, 38 pls., 1 map.

1878a. *Notice of recent additions to the marine faunas of the eatern coast of North America.* Amer. Jour. Sci., ser. 3, vol. 16, pp. 207-215.

1878b. *Notice of recent additions to the marine fauna of the eastern coast of North America. No. 2.* Amer. Jour. Sci., ser. 3, vol. 16, pp. 371-378.

1879a. *Notice of recent additions to the marine fauna of the eastern coast of North America. No. 3.* Amer. Jour. Sci., ser. 3, vol. 17, pp. 239-243.

1879b. *Notice of recent additions to the marine fauna of the eastern coast of North America. No. 7.* Amer. Jour. Sci., ser. 3, vol. 18, 18, pp. 468-470.

1880a. *Notice of recent additions to the marine fauna of the eastern coast of North America. Pts. 2-3.* U. S. Nat. Mus., Proc., vol. 3, pp. 356-409.

1880b. *Notice of recent additions to the marine fauna of the eastern coast of North America. No. 8.* Amer. Jour. Sci., ser. 3, vol. 19, pp. 137-140.

1880c. *Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England. A*mer. Jour. Sci., ser. 3, vol. 20, pp. 390-403.

1882a. *Notice of recent additions to the marine fauna of the eastern coast of North America. Pt. 4. Additions to the deep-water Mollusca, taken off Martha's Vineyard, in 1880 and 1881.* U. S. Nat. Mus., Proc., vol. 5, pp. 315-343.

1882b. *Notice of the remarkable fauna occupying the outer banks off the southern coast of New England, No. 7, and of some additions to the fauna of Vineyard Sound.* Amer. Jour. Sci., ser. 3, vol. 24, pp. 360-371.

Verrill, Addison E., and Smith, S. I.

1873. *Report upon the invertebrate animals of Vineyard Sound and the adjacent waters, with an account of the physical characters of the region.* U. S. Fish Com., Rept. for 1871-1872, pt. 1, pp. 295-778.

Vignon, P.

1931. *Les dents du labre et les raports qu'elles nouent avec les sillons, les cordons et les varices chez les gastéropodes.* Jour. Conchyl., vol. 75, pp. 242-267, pls. 1-2.

Vinson, G. L.

1962. *Upper Cretaceous and Tertiary stratigraphy of Guatemala.* Amer. Assoc. Petrol. Geol., Bull., vol. 46, No. 4, pp. 425-456, 14 figs.

Vokes, Harold Ernest

1941. *Geological observations in the Lebanon Mountains of western Asia.* Geol. Soc. Amer., Bull., vol. 52, pp. 1715-1732, 3 figs.

1944. *The validity of the molluscan genus Caestocorbula Vincent.* Amer. Jour. Sci., No. 242, pp. 614-623, pl. 1.

1945. *Protodonax, a new Cretaceous molluscan genus.* Jour. Paleont., vol. 19, No. 3, pp. 295-308, pls. 46-47.

1956. *Notes on, and rectifications of, pelecypod nomenclature.* Jour. Paleont., vol. 30, No. 3, pp. 762-765.

1957a. *Geography and geology of Maryland.* Indiana Dept. Geol., Bull., vol. 19, xiv + 243 pp., 28 pls., figs.

1957b. *Miocene fossils of Maryland.* Indiana Dept. Geol., Bull., vol. 20, vii + 85 pp., 31 pls.

1957c. *Miocene fossils of Maryland.* Maryland Dept. Geol. Mines, and Water Resources, Bull., vol. 20, 85 pp., 30 pls.

Vredenburg, E. W.

1925. *Description of Mollusca from the post-Eocene Tertiary formation of northwestern India. Cephalopoda, Opisthobranchiata, Siphonostomata.* Geol. Sur. India, Mem., vol. 50, pp. 1-350, pls. 1-13.

1928. *Descriptions of Mollusca from the post-Eocene Tertiary formation of northwestern India. Gastropoda (in part) and Lamellibranchiata.* Geol. Sur. India, Mem., vol. 50, pt. 2, pp. i-xiii, 351-462.

Warmke, Germaine, and Abbott, R. Tucker

1953. *The gross anatomy and occurrence in Puerto Rico of the pelecypod Yoldia perprotracta.* Washington Acad. Sci., Jour., vol. 43, No. 8, pp. 260-261, figs. 1-2.

1961. *Caribbean Seashells.* Livingston Publishing Co., Narberth, Pa., i-x + 346 pp., 44 pls., 19 distrib. maps.

Watson, Robert Boog

1879. *Mollusca of the "Challenger" Expedition, pts. 2-4.* Linnean Soc. London, Jour., vol. 14, pp. 508-529, 586-605.

1881. *Mollusca of H.M.S. 'Challenger' Expedition, pt. 7.* Linnean Soc. London, Jour., vol. 15, pp. 245-274.

1883. *Mollusca of H.M.S. 'Challenger' Expedition, pt. 6.* Linnean Soc. London, Jour., vol. 17, pp. 26-40, 1 fig.

1886. *Report on the Scaphopoda and Gasteropoda collected by H.M.S. Challenger during the years 1873-76.* Voyage of H.M.S. Challenger, Zoology, vol. 15, pp. 1-675; appendix, pp. 676-680; geographical distribution, pp. 691-722; index, pp. 723-756; pls. 1-50.

Weaver, Charles Edward

1949. *Geology of the coast ranges immediately north of the San Francisco Bay region, California.* Geol. Soc. Amer., Mem. 35, ix + 242 pp, 10 pls.

Weber, Maurice

1915. *Monographie des hirudinées Sud-Americains.* Neuchatel, 134 pp., 6 pls.

Weinkauff, H. C., and Kobelt, Wilhelm

1875-87. *Die Familie Pleurotomidae.* Syst. Conchylien-Cabinet, vol. 4, pt. 3, pp. 1-248, pls. A, 1-42.

Weisbord, Norman E.

1962. *Late Cenozoic gastropods from northern Venezuela.* Bull. Amer. Paleont., vol. 42, No. 193, 672 pp., 48 pls., 2 text figs.

Wells, Harry W. and Mary Jane

1961. *Three species of Odostomia from North Carolina, with description of a new species.* Nautilus, vol. 74, No. 4, pp. 159-157, figs. 1-7.

Wells, John W.

1960. *A Pleistocene marine mollusk in central New York.* Nautilus, vol. 74, No. 1, pp. 26-28.

Wenz, W.

1938-60. *Handbuch der Paläozoologie Gastropoda. Allgemeiner Teil und Prosobranchia,* vol. 6, pt. 1, viii + 240 pp., 471 pp. (1938); pt. 2, *Prosobranchia,* pp. 241-480, figs. 472-1235 (1938); pt. 3, *Prosobranchia,* pp. 481-720, figs. 1236-2083 (1939); Pt. 4, *Prosobranchia,* pp. 271-960, figs. 2084-2787 (1940); pt. 5, *Prosobranchia,* pp. 961-1200, figs. 2788-3416 (1941); pt. 6, pp. 1201-1506, figs. 3417-4211 (1943); pt. 7, *Prosobranchia,* xii + pp. 1507-1639 (1944); vol. 6, pt. 2, *Euthyneura,* xii + 600 pp., figs. 1-211 (1959); pp. 601-834, figs. 212-824 (1960).

Weyl, B.

1953. *Geologische streifzüge durch Westindien und Mittelamerika.* Frankfurt, 96 pp., 96 figs.

1957. *Contribución a la geología de la Cordillera de Talamanca de Costa Rica (Centro América).* Inst. Geogr., ii + 77 pp., 15 figs. 2 photos.

Wheat, S. C.
1913. *A Long Island Acmaea, and a new variety of Urosalpinx cinerea.* Brooklyn Inst. Arts and Sci., Bull., vol. 2, pp. 17-20, pl. 1.

White, Charles A.
1882-83. *A review of the fossil Ostreidae of North America.* U. S. Geol. Sur., Ann. Rept. for 1882-83, pp. 273-333.

White, F. A.
1896. *Some notes on Florida Mollusca.* Nautilus, vol. 10, p. 40.

Whiteaves, Joseph Frederick
1872. *Notes on a deep-sea dredging expedition around the island of Anticosti, in the Gulf of St. Lawrence.* Ann. Mag. Nat. Hist., vol. 4, No. 10, pp. 341-354.
1893. *Notes on some marine Invertebrata from the coast of British Columbia.* Ottawa Naturalist, vol. 7, pp. 133-137, 1 pl.
1901. *Catalogue of the marine Invertebrata of Eastern Canada.* Geol. Survey Canada, 272 pp.

Wiedenmayer, C.
1938. *Comparison of Maturin and Maracaibo sedimentary basins, Venezuela.* Bol. Geol. Min., vol. 1, Nos. 2-4, pp. 209-235.

Wiedey, L. W.
1928. *Notes on the Vaqueros and Temblor formations of the California Miocene, with descriptions of new species.* San Diego Soc. Nat. Hist., Trans., vol. 5, pp. 95-182, pls. 9-21.
1929. *Some previously unpublished figures of type mollusks from California.* Nautilus, vol. 43, No. 1, pp. 21-26, pl. 1.

Wilbur, Karl M.
1960. *Shell structure and mineralization in molluscs.* Amer. Assoc. Adv. Sci., Publ. No. 64, pp. 15-40.

Wilkens, Guy L.
1954. *The Cracherode shell collection.* British Mus. (Nat. Hist.) Historical Series, Bull., vol. 1, No. 4, pp. 123-184, pls. 23-25, figs. 1-5.

Willet, George
1931. *Three new marine mollusks from Catalina Island, California.* Nautilus, vol. 45, pp. 65-678, pl. 4.
1946a. *Additional notes on the Pliocene molluscan fauna of Los Angeles City.* Southern California Acad. Sci., Bull., vol. 45, pt. 1, pp. 28-32.
1946b. *A new mollusk of the genus Solariella from Alaska.* Southern California Acad. Sci., Bull., vol. 45, pt. 1, pp. 32-33, pl. 7.
1948. *Four new gastropods from the upper Pleistocene of Newport Bay Mesa, Orange County, California.* Southern California Acad. Sci., Bull., vol. 47, pt. 1, pp. 17-21, pl. 4.

Willis, T. R.
1861. *Catalogue of the marine shells of Nova Scotia.* Boston Soc. Nat. Hist., Proc., vol. 8, pp. 61-62.

Wilson, J. Howard
1905. *The Pleistocene formations of Sankaty Head, Nantucket.* Jour. Geol., vol. 13, No. 8, pp. 713-734, figs. 1-11.

Winckworth, R.
1929a. *Notes on nomenclature, pt. 3. The genotypes selected by Fleming in 1818 and 1822.* Malac. Soc. London, Proc., vol. 18, pp. 224-228.
1929b. *Marine Mollusca from South India and Ceylon. III. Pinna. With an index to the Recent species.* Malac. Soc. London, Proc., vol. 18, pp. 276-297.
1930a. *Notes on nomenclature. 5. Some new names for British marine bivalves.* Malac. Soc. London, Proc., vol. 19, pp. 14-16.

1930b. *Notes on nomenclature. 6. Lima and allied genera.* Malac. Soc. London, Proc., vol. 19, pt. 3, pp. 115-116.
1932. *The British marine Mollusca.* Jour. Conch., vol. 19, pp. 211-252.
1934. *Names of British Mollusca—III.* Jour. Conch., vol. 20, pp. 9-15, 51-53.
1936. *Marine Mollusca from South India and Ceylon. X. Further notes on Pinna.* Malac. Soc. London, Proc., vol. 22, pp. 20-23.

Winkley, H. W.
1908. *A new Caecum.* Nautilus, vol. 22, p. 54.
1909. *New England Pyramidellidae with description of a new species.* Nautilus, vol. 23, pp. 39-40, 1 fig.

Wolf, Teodoro
1892. *Geografía y Geología del Ecuador, publicada por orden del supremo gobierno de la República.* Leipzig, 671 pp.

Wood, Searles V.
1848-56. *A monograph of the Crag Mollusca, or descriptions of shells from the middle and upper Tertiaries of the east of England. Pt. 1, Univalves; pts. 2-4, Bivalves.* Palaeontographical Soc., pt. 1, vol. 1, xii + 208 pp., 21 pls. (1848); pt. 2, vol. 4, 150 pp., 12 pls. (1850); pt. 3, vol. 7, pp. 151-216, pls. 13-20 (1853); pt. 4, pp. 217-341, pls. 21-31 (1856).

Wood, Willard M., and Raymond, William T.
1891. *Mollusks of San Francisco County.* Nautilus, vol. 5, No. 5, pp. 54-58.

Woodring, Wendell P.
1958a. *Geology of Barro Colorado Island, Canal Zone.* Smithsonian Misc. Collections, vol. 135, No. 3, publ. 4304, 39 pp., 3 pls.

Woodring, Wendell P., and Malavassi V., Enrique
1961. *Miocene Foraminifera, mollusks, and a barnacle from the Valle Central, Costa Rica.* Jour. Paleont., vol. 35, No. 3, pp. 489-497, pls. 69-70, 1 text fig.

Woolman, Lewis S.
1898. *Fossil mollusks and diatoms from the Dismal Swamp, Virginia and North Carolina; indication of the geological age of the deposit. With notes on the diatoms, by Charles S. Boyer.* Acad. Nat. Sci. Philadelphia, Proc., vol. 50, pp. 414-428.

Wurtz, Charles B.
1950. *Quadrula (Quincuncina) guadalupensis sp. nov. (Unionidae: Pelecypoda).* Acad. Nat. Sci. Philadelphia, Notulae Naturae, No. 224, pp. 1-3, figs. 1-5.

Yen, T.-C.
1942. *A review of Chinese gastropods in the British Museum.* Malac. Soc. London, Proc., vol. 24, pp. 170-289, pls. 11-28.

Zetek, James, and McLean, Richard Alfred
1936. *Hiata, a new genus of the family Pholadidae, from the Pacific at Panama, with a description of a new species.* Nautilus, vol. 49, No. 4, pp. 110-111.

PLATES

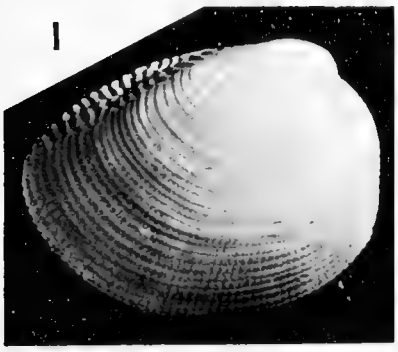
Explanation of Plate 1

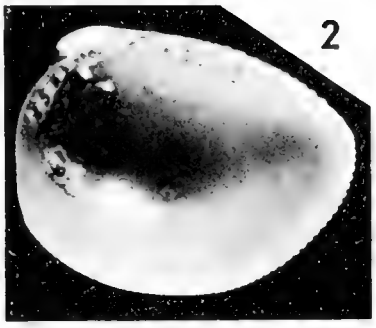
Figure — Page

1-6. **Nucula (Nucula) venezuelana** Weisbord, n. sp. 36
Figs. 1, 2, holotype (G479a). 26465 PRI. Exterior and interior of left valve. Length 2.7 mm.; height 2.1 mm., thickness 0.75 mm. Upper Mare formation. Figs. 2-4, paratype (G479b). 26466 PRI. Exterior and interior of young left valve. Length 2.1 mm.; height 2 mm.; thickness 0.6 mm. Upper Mare formation. Figs. 5, 6, paratype (G479c). 26467 PRI. Exterior and interior of right valve. Length 1.8 mm.; height 1.6 mm.; thickness 0.6 mm. Upper Mare formation.

7-10. **Nucula (Ennucula) mareana** Weisbord, n. sp. 39
Figs. 7, 8, holotype (G478a). 26468 PRI. Exterior and interior of left valve. Length 4.4 mm.; height 3.3 mm.; thickness 0.9 mm. Upper Mare formation. Figs. 9, 10, paratype (G478b). 26469 PRI. Exterior and interior of right valve. Length 4 mm.; height 3.1 mm.; thickness 0.75 mm. Upper Mare formation.

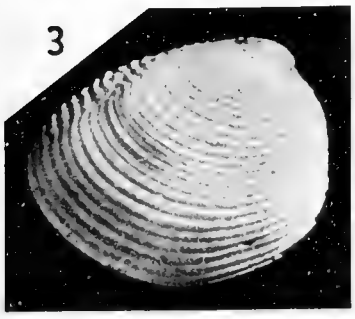
11-17. **Nuculana (Saccella) karlmartini** Weisbord, n. sp. 41
Fig. 11, holotype (1473a). 26470 PRI. Attachhed valves. Length 12.2 mm.; height 6.8 mm.; thickness 5 mm. Lower Mare formation. Figs. 12, 13, paratype (1473b). 26471 PRI. Interior and exterior of right valve. Length 10.2 mm.; height 5.5 mm.; thickness 2.1 mm. Lower Mare formation. Figs. 14, 15, paratype (I473c). 26472 PRI. Interior and exterior of left valve. Length 11.4 mm.; height 6.8 mm.; thickness 2 mm. Lower Mare formation. Figs. 16, 17, paratype (G473c). 26473 PRI. Exterior and interior of young left valve. Length 4.1 mm.; height 2.6 mm.; thickness 0.8 mm. Upper Mare formation.

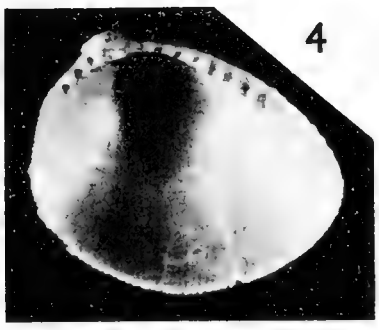

1

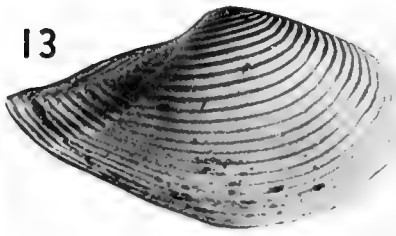

2

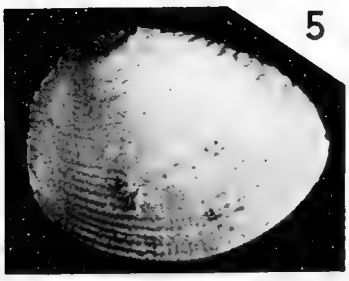

11

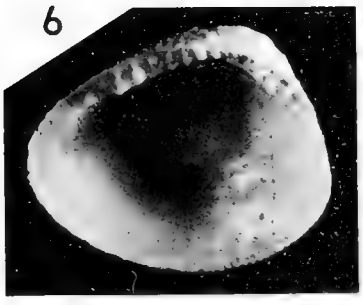

12

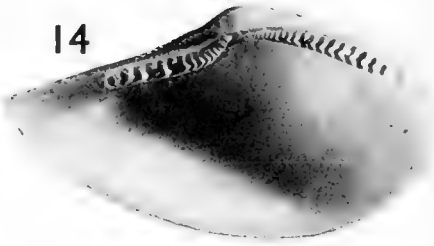

3

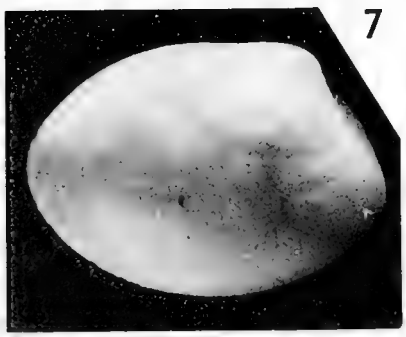

4

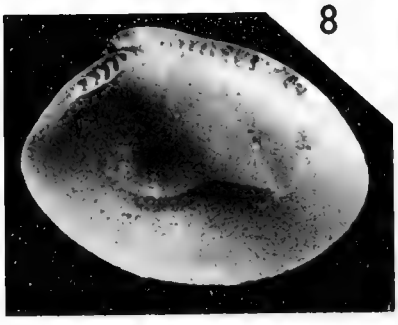

13

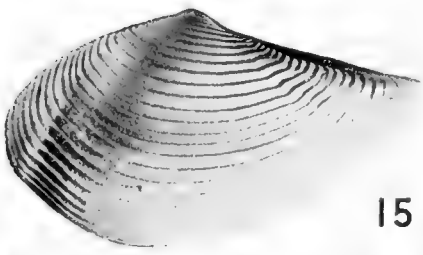

5

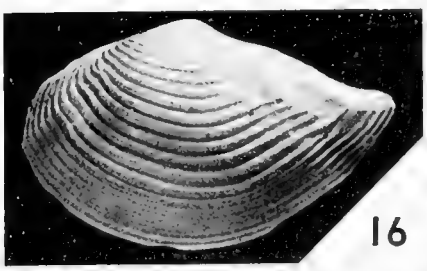

6

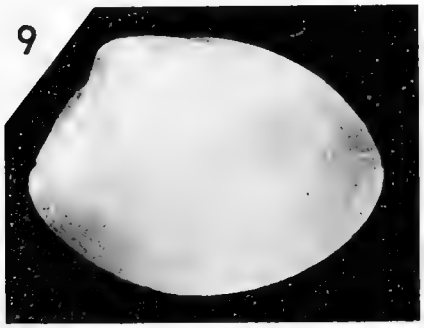

14

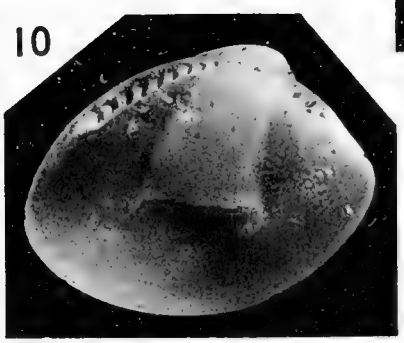

7

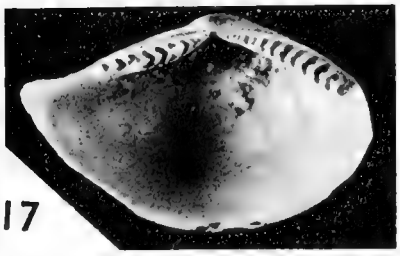

8

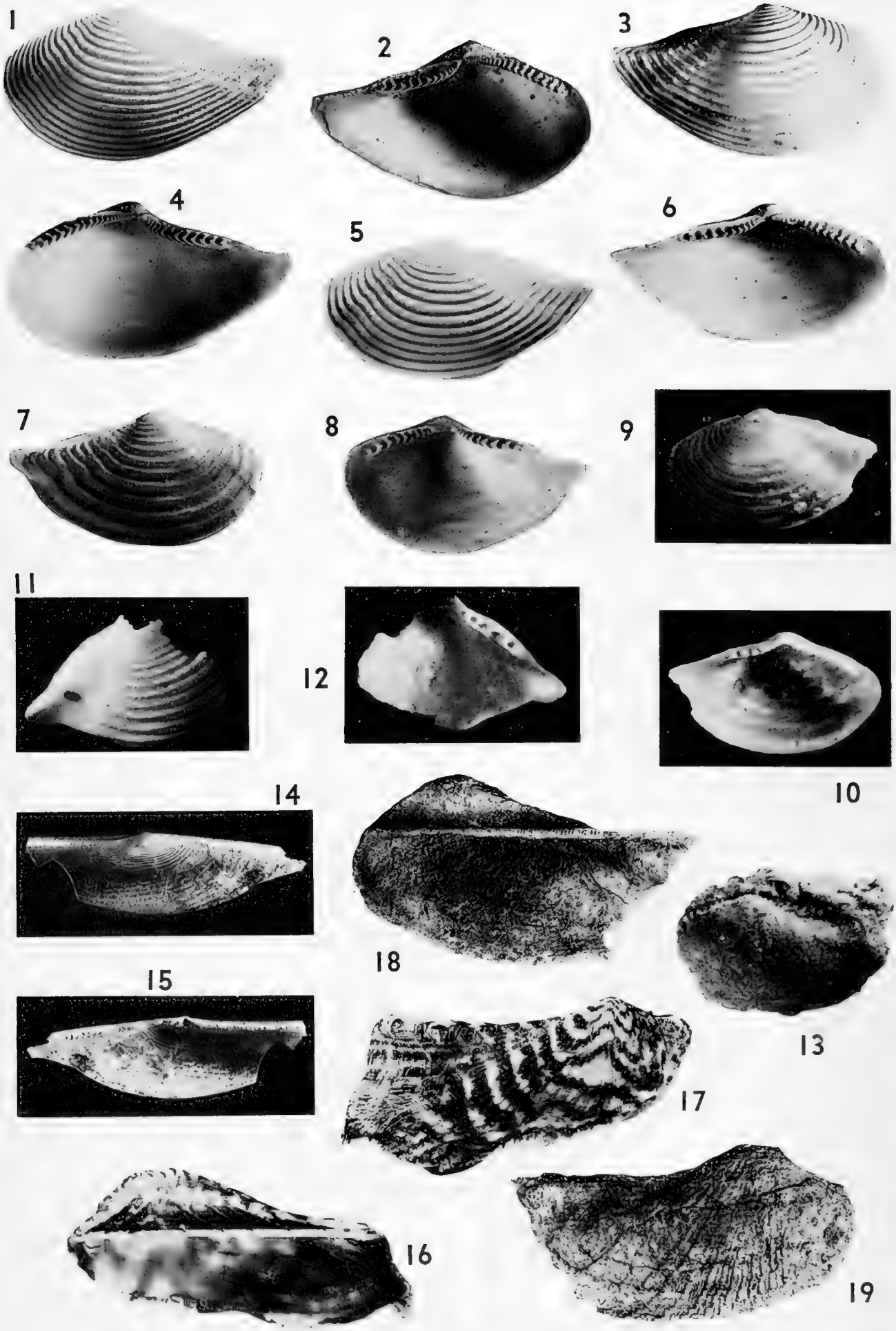

15


16


9


10


17


1
2
3
4
5
6
7
8
9
11
12
10
14
18
13
15
17
16
19

Explanation of Plate 2

Figure — Page

1-4. **Nuculana (Saccella) karlmartini** Weisbord, n. sp. 41
Figs. 1, 2, paratype (G473d). 26474 PRI. Exterior and interior of left valve. Length 8.8 mm.; height 4.9 mm.; thickness 2 mm. Upper Mare formation. Figs. 3, 4, paratype (G473e). 26475 PRI. Exterior and interior of right valve. Length 9.5 mm.; height 5.1 mm.; thickness 2 mm. Upper Mare formation.

5-10. **Nuculana (Saccella) axelolssoni** Weisbord, n. sp. 43
Figs. 5, 6, holotype (G474a). 26476 PRI. Exterior and interior of left valve. Length 6.3 mm.; height 3.5 mm.; thickness 0.8 mm. Upper Mare formation. Figs. 7, 8, paratype (G474b). 26477 PRI. Exterior and interior of young right valve. Length 4.5 mm.; height 2.4 mm.; thickness 0.8 mm. Upper Mare formation. Figs. 9, 10, paratype (G474c). 26478 PRI. Exterior and interior of juvenile left valve. Length 2.4 mm.; height 1.3 mm.; thickness 0.3 mm. Upper Mare formation.

11,12. **Nuculana (Saccella) marella** Weisbord, n. sp. 45
Holotype (F475a). 26479 PRI. Exterior and interior of juvenile right valve. Length of broken specimen 1.3 mm.; width 0.9 mm. Upper Mare formation.

13. **Nuculana (Saccella)** species 45
Specimen O476a. 26480 PRI. Internal mold of left valve. Length 4.5 mm.; height 2.9 mm. Playa Grande formation (Catia member).

14,15. **Adrana** cf. **tellinoides** (Sowerby) 47
Specimen T544a. 26481 PRI. Exterior and interior of broken right valve. Length 9.5 mm.; height 2.7 mm. Upper Mare formation.

16,17. **Arca (Arca) zebra** Swainson 50
Specimen A369aa. 26482 PRI. Interior and exterior of right valve. Length 50 mm.; height 20.3 mm.; thickness 12.2 mm. Recent.

18,19. **Arca (Arca) zebra abisiniana** Weisbord, n. subsp. 54
Holotype (D368a). 26483 PRI. Interior and exterior of right valve. Length 61 mm.; height 34 mm.; thickness 20.5 mm. Abisinia formation.

Explanation of Plate 3

Figure — Page

1-8. **Arca (Arca) imbricata** Bruguière 54

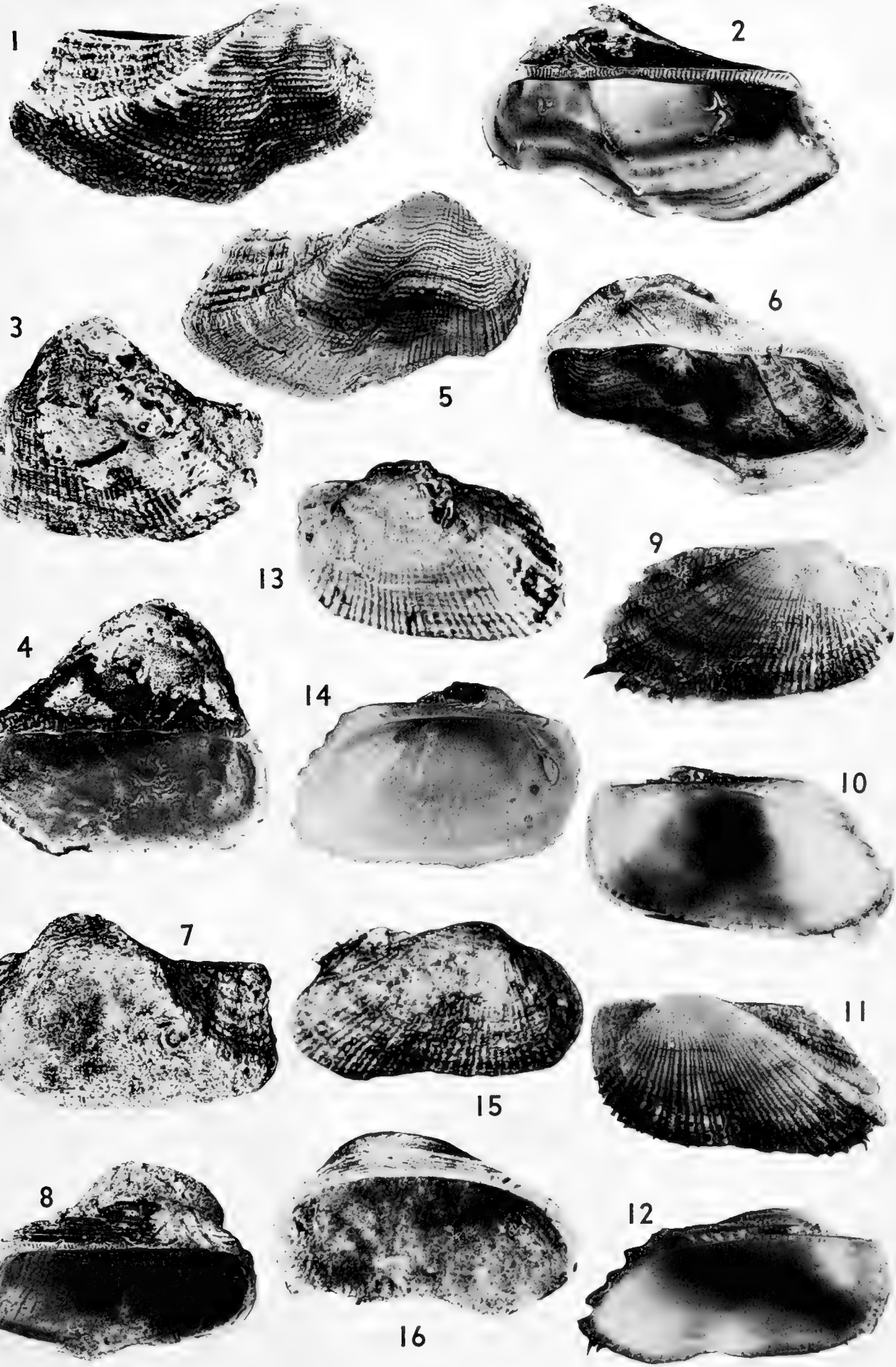
Figs. 1, 2, specimen A369a. 26484 PRI. Exterior and interior of right valve. Length 50 mm.; height 24.5 mm.; thickness 16 mm. Recent. Figs. 3, 4, specimen A371a. 26485 PRI. Exterior and interior of left valve. Length 37.8 mm.; height 32.3 mm.; thickness 19.8 mm. Recent. Figs. 5, 6, specimen C369a. 26486 PRI. Exterior and interior of right valve. Length 66.6 mm.; height 33.6 mm.; thickness 18 mm. Guaiguaza clay. Figs. 7, 8, specimen D371a. 26487 PRI. Exterior and interior of left valve. Length 40 mm.; height 29 mm.; thickness 18.8 mm. Abisinia formation.

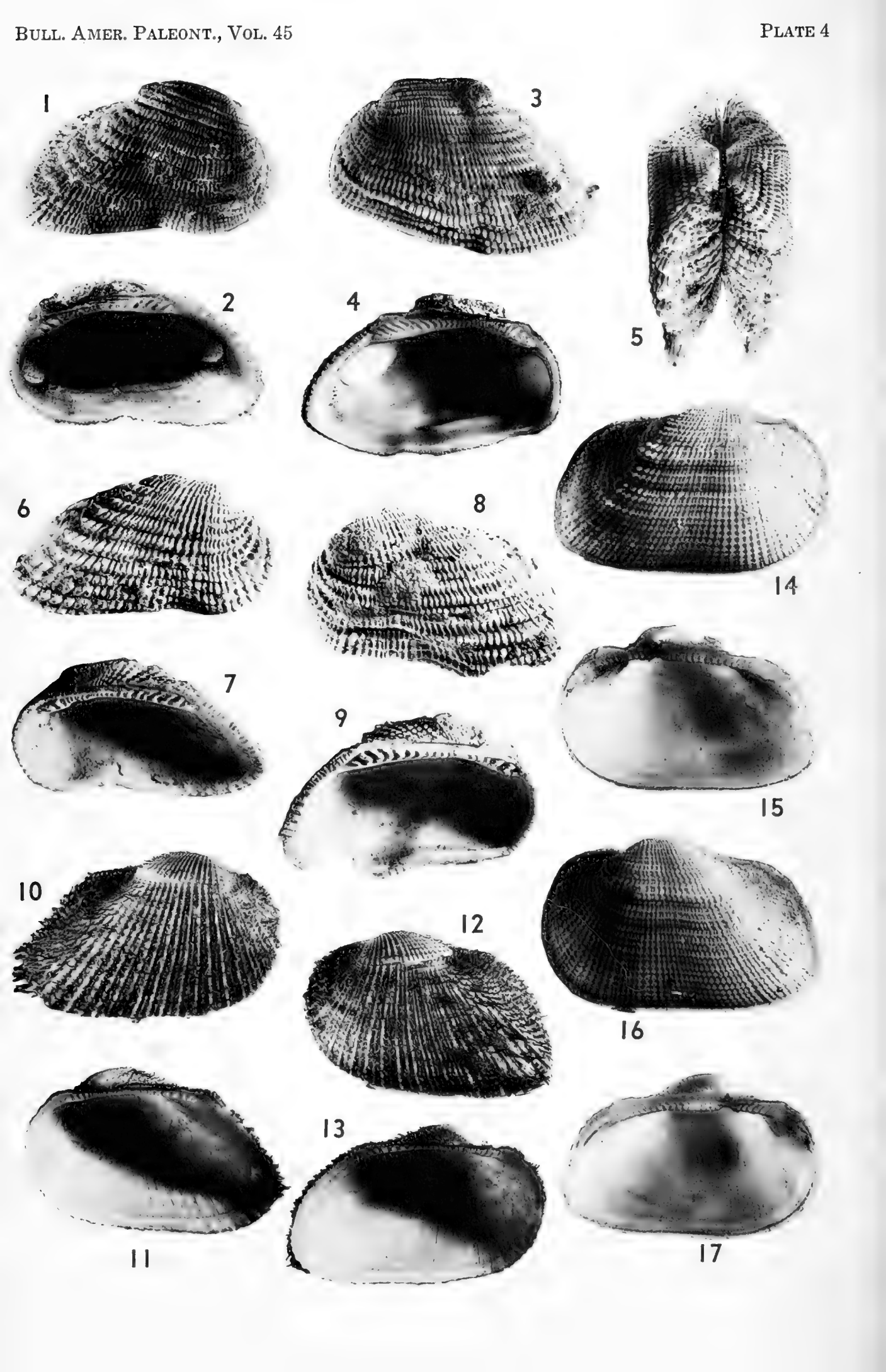
9-14. **Barbatia (Barbatia) candida** (Helbling) 58

Figs. 9, 10, specimen A391a1. 26488 PRI. Young right valve of pair, exterior and interior views. Length 13.4 mm.; height 7.2 mm. Recent. Figs. 11, 12, specimen A391a2. 26489 PRI. Young left valve of same pair as above, exterior and interior views. Length 13.4 mm.; height 7.2 mm.; thickness of both valves attached 5.6 mm. Recent. Figs. 13, 14, specimen A388a. 26490 PRI. Exterior and interior of left valve. Length 29 mm.; height 19.5 mm.; thickness 8 mm. Recent.

15,16. **Barbatia (Barbatia) candida** (Helbling) ? 58

Specimen D381a. 26491 PRI. Exterior and interior of right valve. Length 31 mm.; height (base broken away) 17.9 mm.; thickness 9.6 mm. Abisinia formation.


1
2
5
3
6
13
9
4
14
10
7
15
11
8
16
12


1
3
5
2
4
14
6
8
7
9
15
10
12
16
11
13
17

Explanation of Plate 4

Figure — Page

1-9. **Barbatia (Acar) dominguensis** (Lamarck) 61
Figs. 1, 2, specimen A385a. 26492 PRI. Exterior and interior of right valve. Length 13.5 mm.; height 10.3 mm.; thickness 5.7 mm. Recent. Figs. 3, 4, specimen A385b. 26493 PRI. Exterior and interior of left valve. Length 20 mm.; height 12 mm.; thickness 5.8 mm. Recent. Fig. 5, specimen A385c. 26494 PRI. Exterior of attached valves. Length 12 mm.; height 9 mm.; thickness of paired valves 7.4 mm. Recent. Figs. 6, 7, specimen D385a. 26495 PRI. Exterior and interior of right valve. Length 12 mm.; height 6 mm.; thickness 3.4 mm. Abisinia formation. Figs. 8, 9, specimen D385b. 26496 PRI. Exterior and interior of left valve. Length 12.9 mm.; height 7.5 mm.; thickness 4.1 mm. Abisinia formation.

10-13. **Barbatia (Fugleria) tenera** C. B. Adams 64
Figs. 10, 11, specimen A389a1. 26497 PRI. Exterior and interior of right valve of pair. Length 19 mm.; height 13 mm.; thickness of paired valves 9.5 mm. Recent. Figs. 12, 13, specimen A389a2. 26498 PRI. Exterior and interior of left valve of same pair as above. Recent.

14-17. **Arcopsis adamsi "Shuttleworth"** (E. A. Smith) 65
Figs. 14, 15, specimen A386a1. 26499 PRI. Exterior and interior of right valve of pair. Length 11.6 mm.; height 11.6 mm.; thickness of paired valves 6.7 mm. Recent. Figs. 16, 17, specimen A386a2. 26500 PRI. Exterior and interior of left valve of same pair as above. Recent.

Explanation of Plate 5

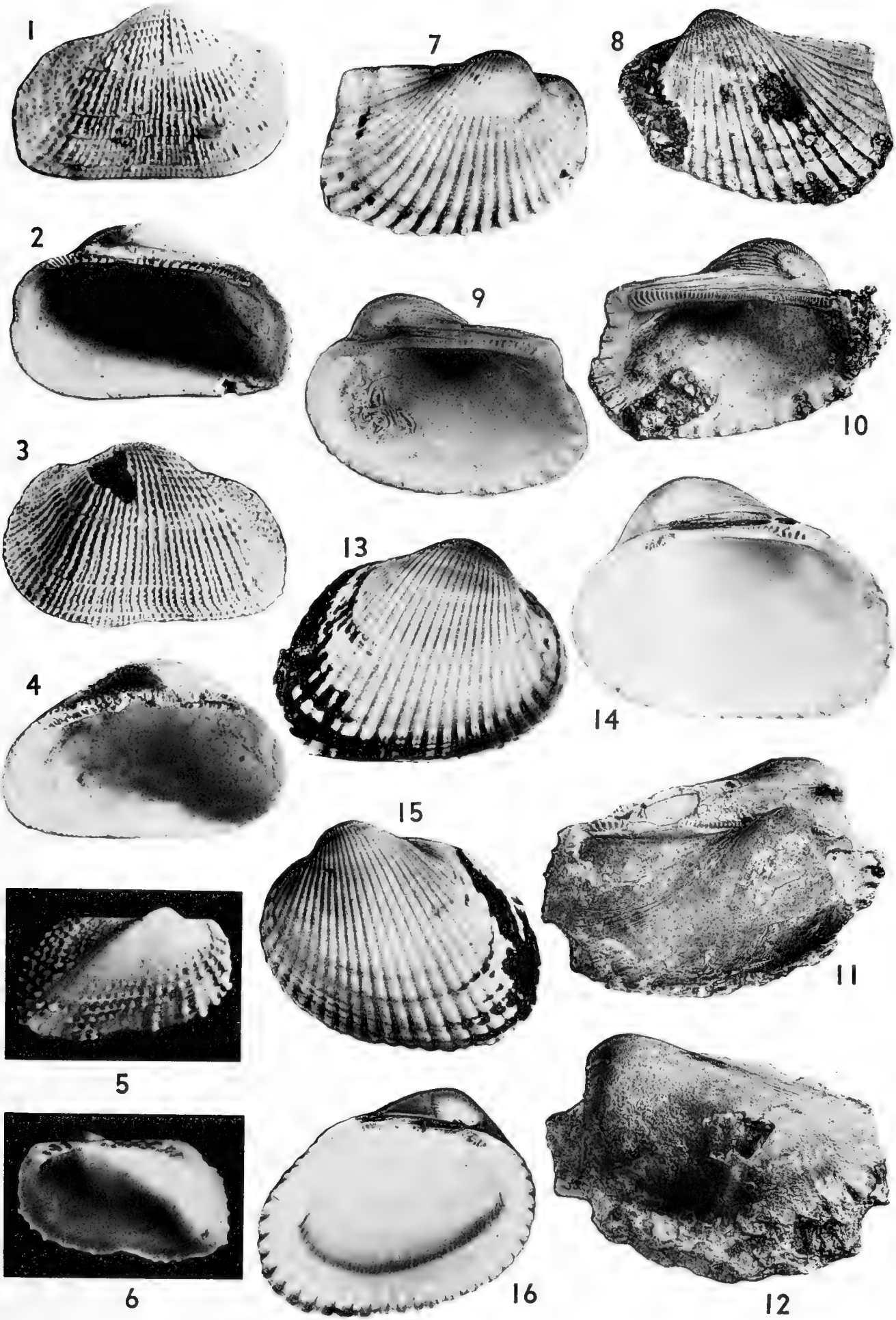
Figure — Page

1-6. **Arcopsis adamsi "Shuttleworth"** (E. A. Smith) 65
Figs. 1, 2, specimen C386a. 26501 PRI. Exterior and interior of right valve. Length 9.7 mm.; height 6.2 mm.; thickness 3 mm. Guaiguaza clay. Figs. 3, 4, specimen C386b. 26502 PRI. Exterior and interior of right valve. Length 10.1 mm.; height 6.8 mm.; thickness 3.5 mm. Guaiguaza clay. Figs. 5, 6, specimen C396a. 26503 PRI. Exterior and interior of right valve of juvenile. Length 2.4 mm.; height 1.5 mm. Guaiguaza clay.

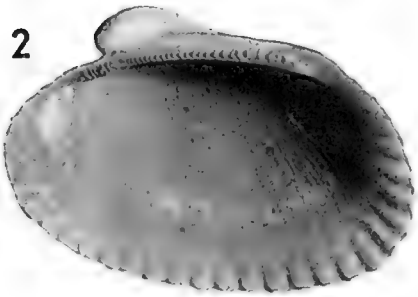
7-10. **Anadara (Larkinia) notabilis** (Röding) 69
Figs. 7, 8, specimen A382a. 26504 PRI. Exterior and interior of right valve. Length 30 mm.; height 22.3 mm.; thickness 9.5 mm. Recent. Figs. 9, 10, specimen S382a. 26505 PRI. Exterior and interior of left valve. Length 40 mm.; height 28.2 mm.; thickness 13.5 mm. Playa Grande formation (Maiquetía member).

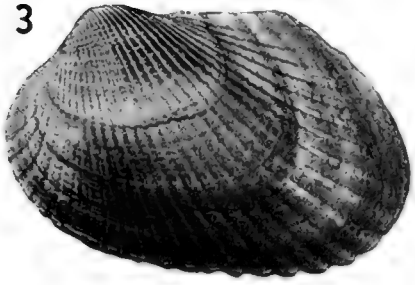
11,12. **Anadara (Larkinia)** species 72
Specimen M367a. 26506 PRI. Internal mold of attached valves. Length 67 mm.; height 42 mm.; thickness 38 mm. Fig. 11, view of right valve and beak of left valve. Fig. 12, view of left valve of pair. Playa Grande formation (Catia member).

13-16. **Anadara (Lunarca) ovalis** (Bruguière) 72
Figs. 13, 14, specimen A372a. 26507 PRI. Exterior and interior of right valve. Length 35 mm.; height 27 mm.; thickness 12 mm. Recent. Figs. 15, 16, specimen A372b. 26508 PRI. Exterior and interior of left valve. Length 32.5 mm.; height 25 mm.; thickness 10 mm. Recent.


1
7
8
2
9
10
3
13
14
4
15
11
5
16
6
12


1


2


3


4

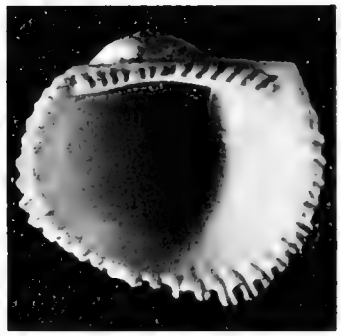

5


6

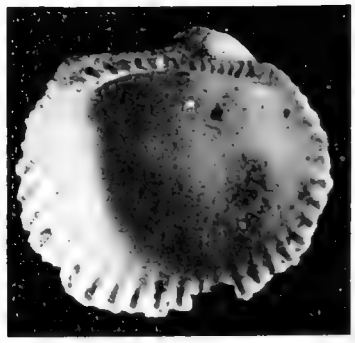

7

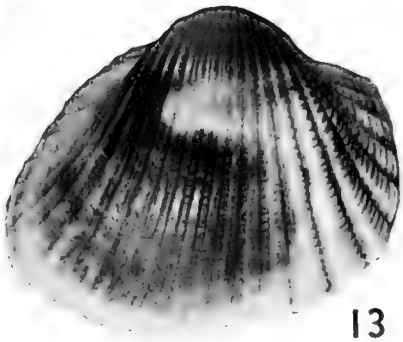

8

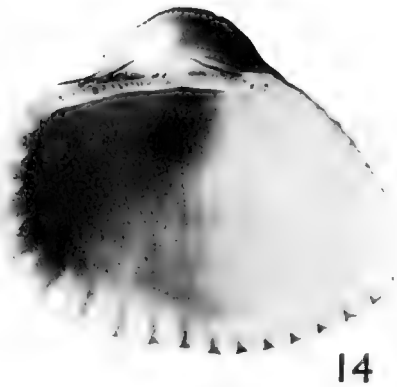

9

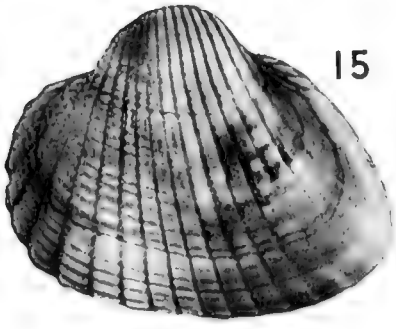

10

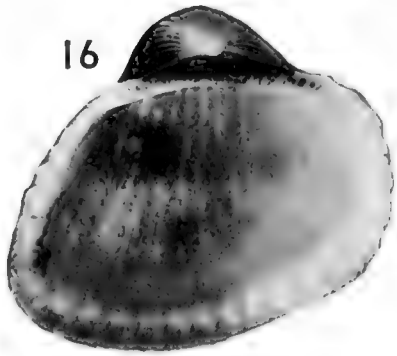

11


12


13


14


15


16

Explanation of Plate 6

Figure — Page

1-4. **Anadara (Lunarca) ovalis** (Bruguière) 72

Figs. 1, 2, specimen T384a. 36509 PRI. Exterior and interior of right valve. Length 39 mm.; height 27 mm.; thickness 11 mm. Upper Mare formation. Figs. 3, 4, specimen T384b. 26510 PRI. Exterior and interior of left valve. Length 33 mm.; height 20.5 mm.; thickness 10 mm. Upper Mare formation.

5-8. **Anadara (Lunarca ?) caboblanquensis** Weisbord, n. sp. 77

Figs. 5, 6, holotype (Q394a. 26511 PRI. Exterior and interior of left valve. Length 2.1 mm.; height 1.8 mm.; thickness 0.8 mm. Playa Grande formation (Maiquetía member). Figs. 7, 8, paratype (T394a). 26512 PRI. Exterior and interior of left valve. Length 1.8 mm.; height 1.5 mm.; thickness 0.5 mm. Upper Mare formation.

9-12. **Anadara (Lunarca ?) mareana** Weisbord, n. sp. 78

Figs. 9, 10, holotype (J393a). 26513 PRI. Exterior and interior of right valve. Length 3.6 mm.; height 3 mm.; thickness 1.5 mm. Lower Mare formation. Figs. 11, 12, paratype (J393b). 26514 PRI. Exterior and interior of left valve. Length 3.7 mm.; height 3.4 mm.; thickness 1.3 mm. Lower Mare formation.

13-16. **Anadara (Cunearca) brasiliana** (Lamarck) 79

Figs. 13, 14, specimen A373a. 26515 PRI. Exterior and interior of right valve. Length 35 mm.; height 29 mm.; thickness 12.2 mm. Recent. Figs. 15, 16, specimen A373b. 26516 PRI. Exterior and interior of left valve. Length 39 mm.; height 32 mm.; thickness 14 mm. Recent.

Explanation of Plate 7

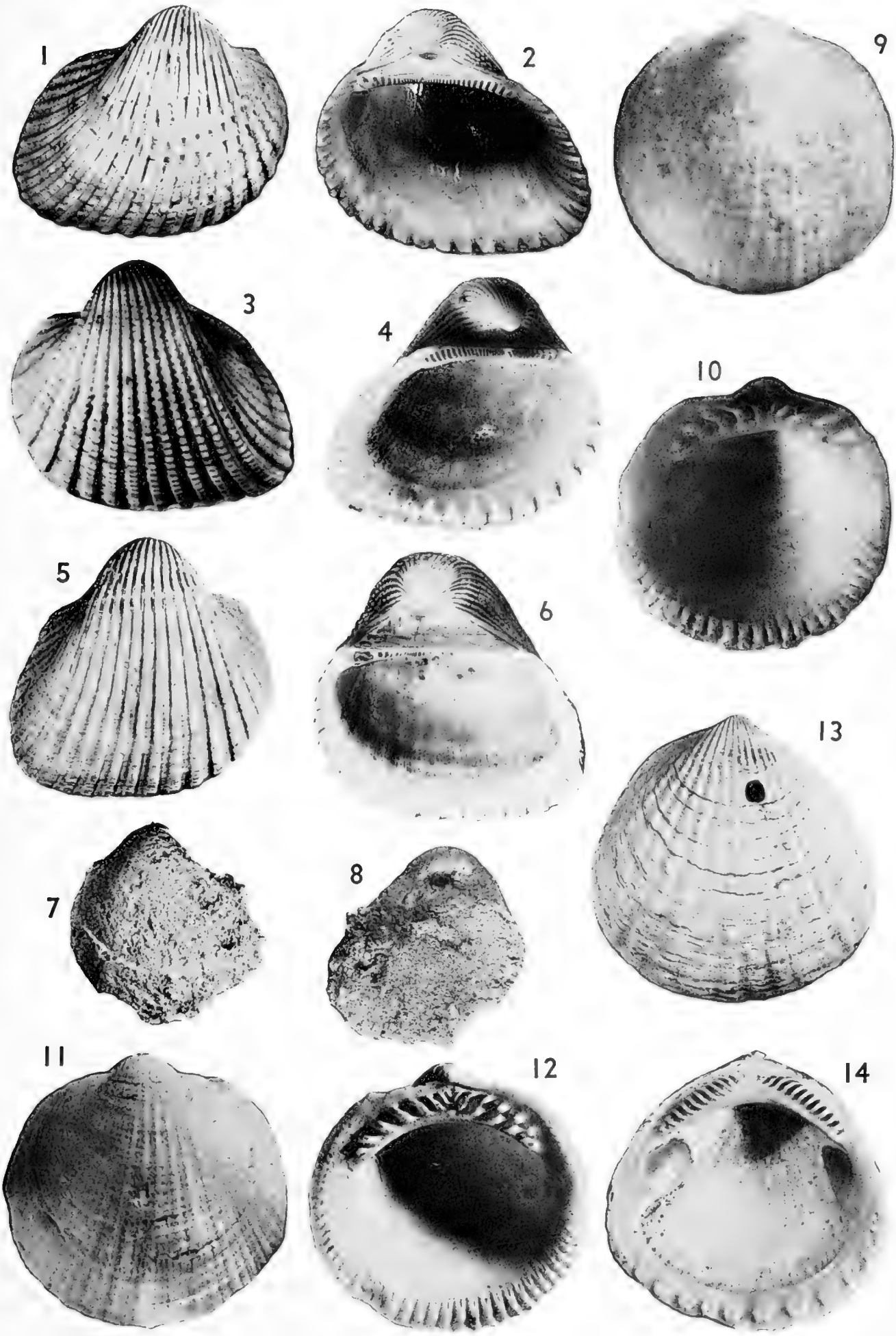
Figure — Page

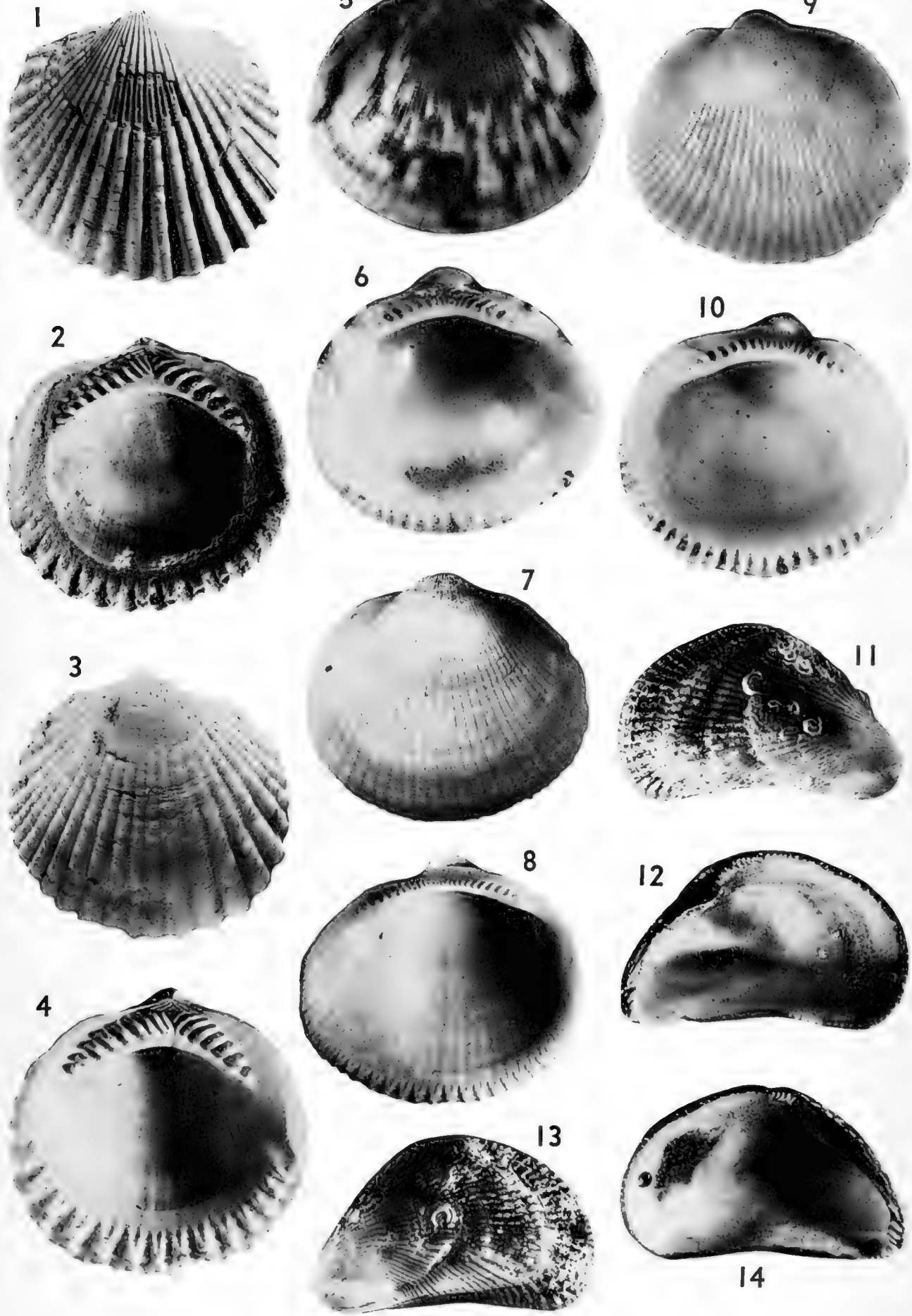
1-6. **Anadara (Cunearca) cumanensis** (Dall) 84
Figs. 1, 2, specimen R374a. 26517 PRI. Exterior and interior of right valve. Length 28.5 mm.; height 27.5 mm.; thickness 12.4 mm. Playa Grande formation (Maiquetía member). Figs. 3, 4, specimen R374b. 26518 PRI. Exterior and interior of left valve. Length 27.5 mm.; height 26 mm.; thickness 11.3 mm. Playa Grande formation (Maiquetía member). Figs. 5, 6, specimen I377a. 26519 PRI. Exterior and interior of right valve. Length 35.6 mm.; height 37.6 mm.; thickness 18 mm. Lower Mare formation.

7,8. **Anadara (Cunearca)** species indeterminate 86
Specimen M370a. 26520 PRI. Internal mold of left valve. Length 25.5 mm.; height 25 mm.; thickness 10.5 mm. Playa Grande formation (Catia member).

9-12. **Glycymeris (Glycymeris) undata** (Linnaeus) 86
Figs. 9, 10, specimen J482a. 26521 PRI. Exterior and interior of right ? valve. Length 6.5 mm.; height 6.3 mm.; thickness 2 mm. Lower Mare formation. Figs. 11, 12, specimen S484a. 26522 PRI. Exterior and interior of right valve. Length 10.8 mm.; height 10.6 mm.; thickness 3.5 mm. Playa Grande formation (Maiquetía member).

13,14. **Glycymeris (Tucetona) pectinata** (Gmelin) 89
Specimen G481a. 26523 PRI. Exterior and interior of left valve. Length 24.6 mm.; height 24.5 mm.; thickness 6.1 mm. Mare formation.


1
2
9
3
4
10
5
6
13
7
8
11
12
14


1
2
3
4
5
6
7
8
9
10
11
12
13
14

Explanation of Plate 8

Figure — Page

1-4. **Glycymeris (Tucetona) pectinata** (Gmelin) 89
Figs. 1, 2, specimen G481b. 26524 PRI. Exterior and interior of right ? valve. Length 16 mm.; height 16 mm.; thickness 4.2 mm. Mare formation. Figs. 3, 4, specimen G481c. 26525 PRI. Exterior and interior of young left ? valve. Length 7.2 mm.; height 7 mm.; thickness 3 mm. Mare formation.

5-10. **Glycymeris (Glycymerella) decussata** (Linnaeus) 92
Figs. 5, 6, specimen A480a. 26526 PRI. Exterior and interior of right valve. Length 19.5 mm.; height 17 mm.; thickness 5.2 mm. Recent. Figs. 7, 8, specimen I480a. 26527 PRI. Exterior and interior of left valve. Length 34 mm.; height 30 mm.; thickness 16 mm. Lower Mare formation. Figs. 9, 10, specimen I480c. 26528 PRI. Exterior and interior of right valve. Length 18 mm.; height 16.8 mm.; thickness 5.4 mm. Lower Mare formation.

11-14. **Brachidontes (Ischadium) recurvus** (Rafinesque) 95
Specimen A556a1-2. 26529 PRI. Paired valves. Length 9.7 mm.; width 6 mm.; thickness of doublet 5.1 mm. Figs. 11, 12, exterior and interior of right valve. Figs. 13, 14, exterior and interior of left valve. Recent.

Explanation of Plate 9

Figure — Page

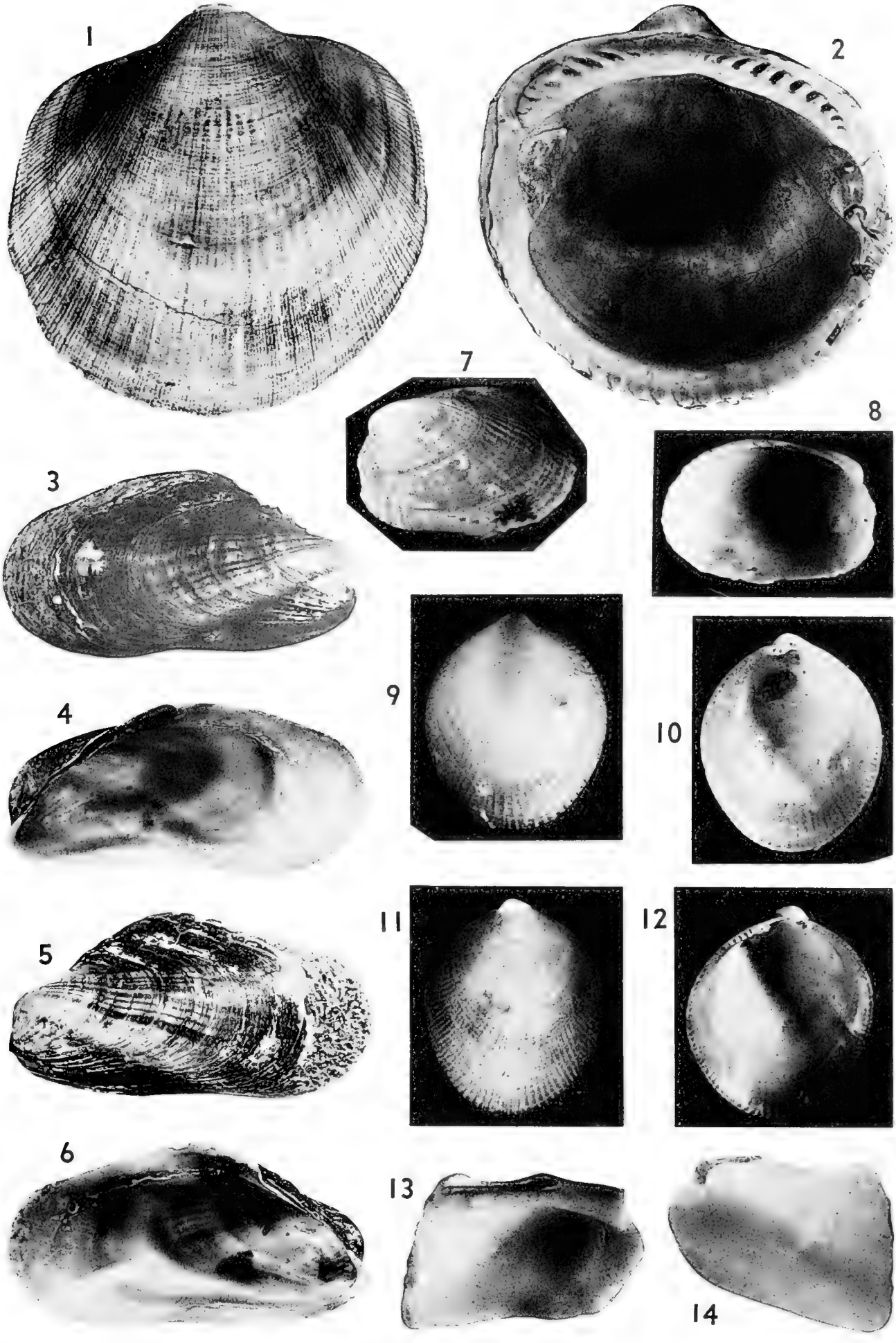
1,2. **Glycymeris (Glycymerella) decussata** (Linnaeus) 92
Specimen J480a. 26530 PRI. Exterior and interior of large right valve. Length 58 mm.; height 57.8 mm.; thickness 21 mm. Lower Mare formation.

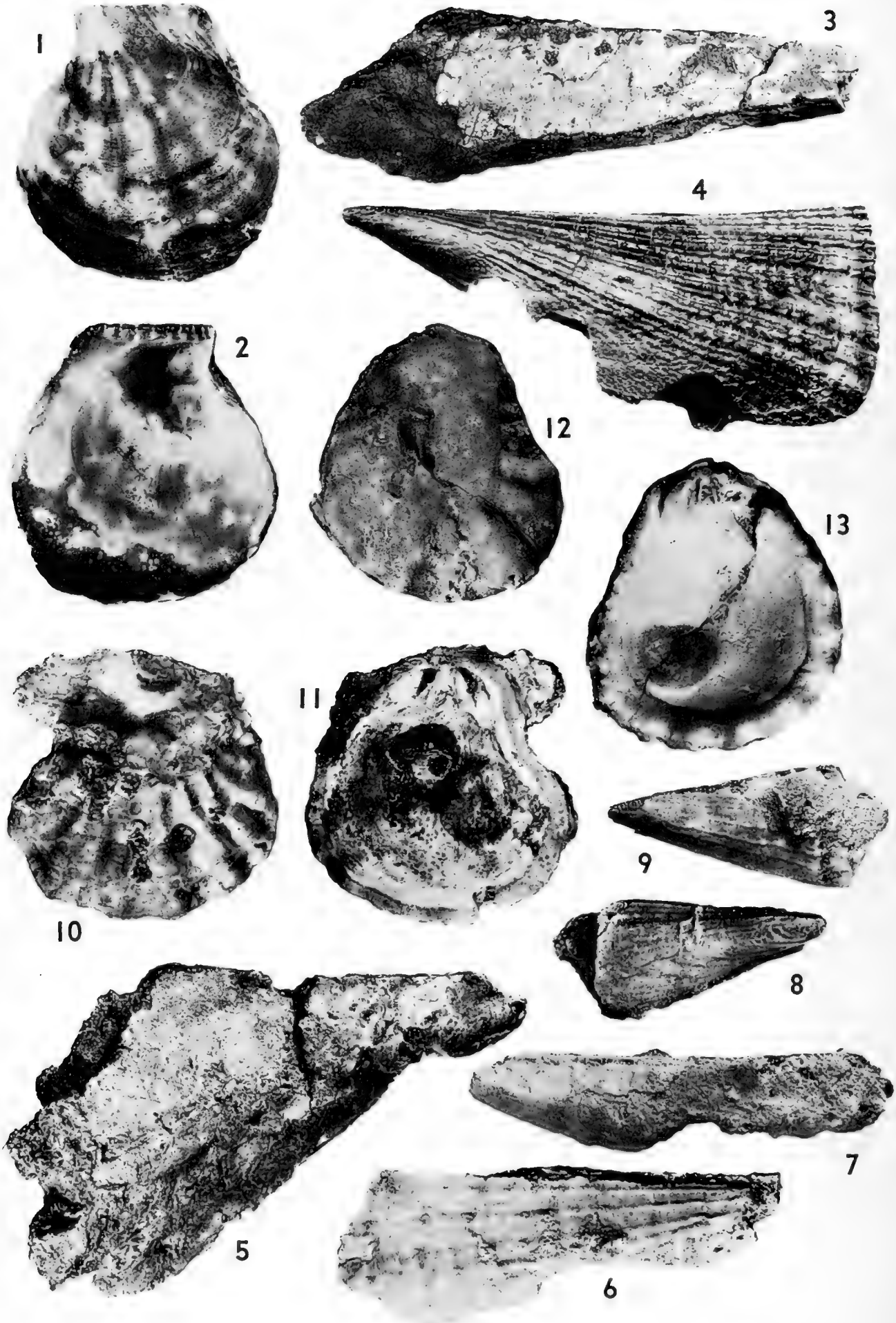
3-6. **Modiolus americanus** Leach 98
Specimen A555a1-2. 26531 PRI. Paired valves. Length 41 mm.; width 21 mm.; thickness of doublet 18 mm. Figs. 3, 4, exterior and interior of right valve. Figs. 5, 6, exterior and interior of left valve. Recent.

7,8. **Musculus lateralis** (Say) 100
Specimen I514a. 26532 PRI. Exterior and interior of left valve. Length 2.1 mm.; height 1.5 mm. Lower Mare formation.

9-12. **Crenella divaricata** (d'Orbigny) 102
Figs. 9, 10, specimen R487a. 26533 PRI. Exterior and interior of right valve. Length 3.1 mm.; width 2.7 mm.; thickness 0.75 mm. Playa Grande formation (Maiquetía member). Figs. 11, 12, specimen R487b. 26534 PRI. Exterior and interior of left valve. Length 2.9 mm.; width 2.4 mm.; thickness 0.7 mm. Playa Grande formation (Maiquetía member).

13,14. **Lioberus ? marensis** Weisbord, n. sp. 105
Holotype (I511a). 26535 PRI. Interior and exterior of broken left valve. Length (incomplete) 5 mm.; max. width 3 mm.; thickness 1.3 mm. Lower Mare formation.


1
2
7
8
3
9
10
4
11
12
5
6
13
14


1
3
4
2
12
13
11
9
10
8
7
5
6

Explanation of Plate 10

Figure — Page

1,2. **Isognomon alatus** (Gmelin) 106
Specimen B560a. 26536 PRI. Exterior and interior of left valve. Height 40 mm.; width 37.8 mm.; thickness 3 mm. Recent.

3. **Pinna** aff. **carnea** Gmelin 107
Specimen G359a. 26537 PRI. External view of right valve of attached pair. Length (broken away at ends and sides) 145 mm. Mare formation.

4. **Atrina (Servatrina) seminuda** (Lamarck) 109
Specimen B358a. 26538 PRI. External view of left valve of attached pair. Length (anterior tip broken away) 78.5 mm. Recent.

5. **Atrina (Servatrina** ?) aff. **seminuda** (Lamarck) 110
Specimen M360a. 26539 PRI. Internal mold of pair. View of right valve. Length (broken off anteriorly and posteriorly) 137 mm.; max. width 87 mm.; thickness 43 mm. Playa Grande formation (Catia member).

6-9. **Atrina (Servatrina) serrata** ? Sowerby 111
Figs. 6, 7, specimen L361a. 26540 PRI. Attached valves, broken and with rock filling. Length 54.5 mm. Fig. 6, view of right valve. Fig. 7, view of left valve. Playa Grande formation (Catia member). Figs. 8, 9, specimen L361b. 26541 PRI. Anterior end of attached valves. Length 40.5 mm. Fig. 8, view of right valve. Fig. 9, view of left valve. Playa Grande formation (Catia member).

10-13. **Plicatula gibbosa** Lamarck 113
Figs. 10, 11, specimen S433a. 26542 PRI. Exterior and interior of right valve. Height 31 mm.; width 27 mm.; thickness 13 mm. Playa Grande formation (Maiquetía member). Figs. 12, 13, specimen T434a. 26543 PRI. Exterior and interior of left valve. Height 19.5 mm.; width 17.3 mm.; thickness 6 mm. Upper Mare formation.

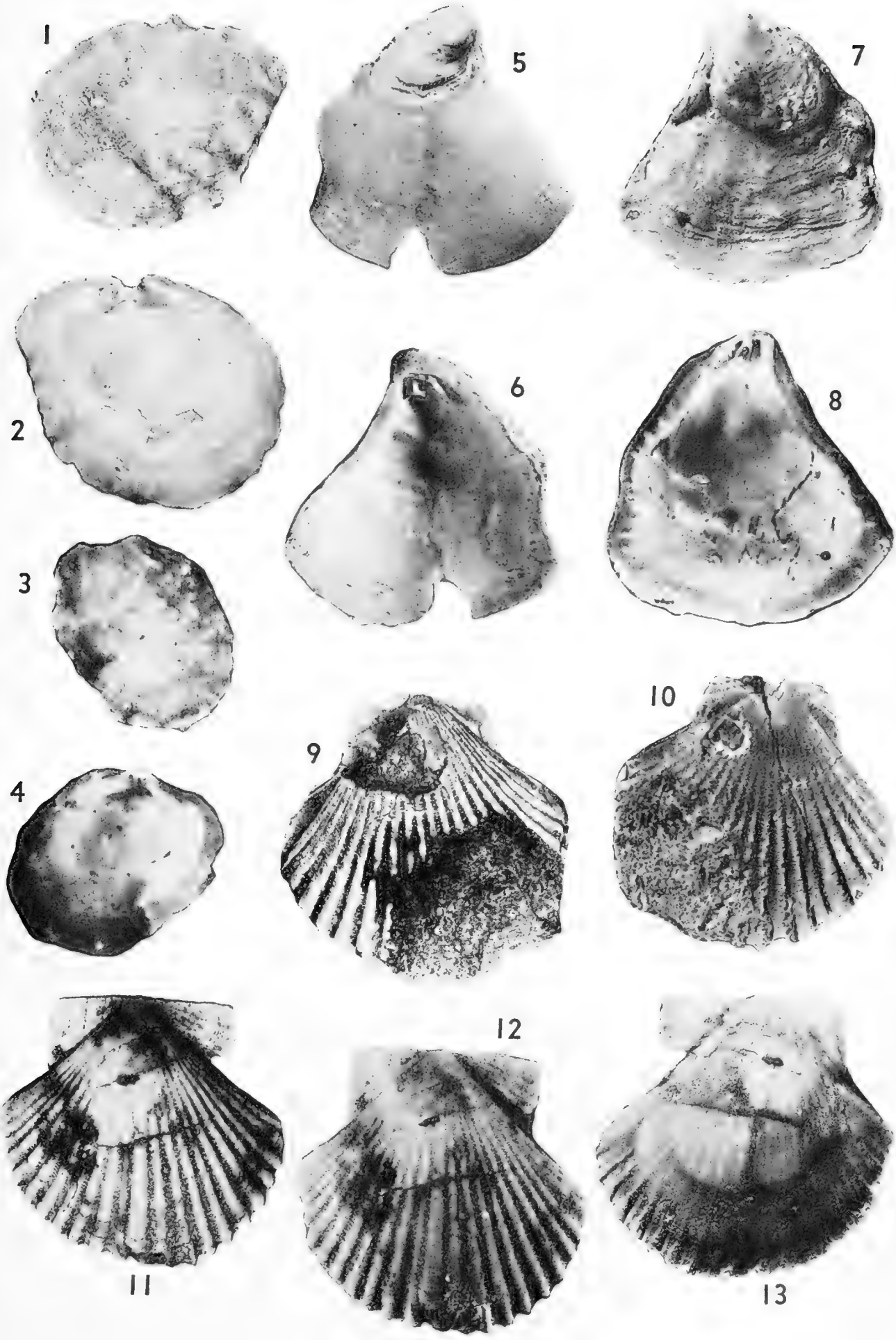
Explanation of Plate 11

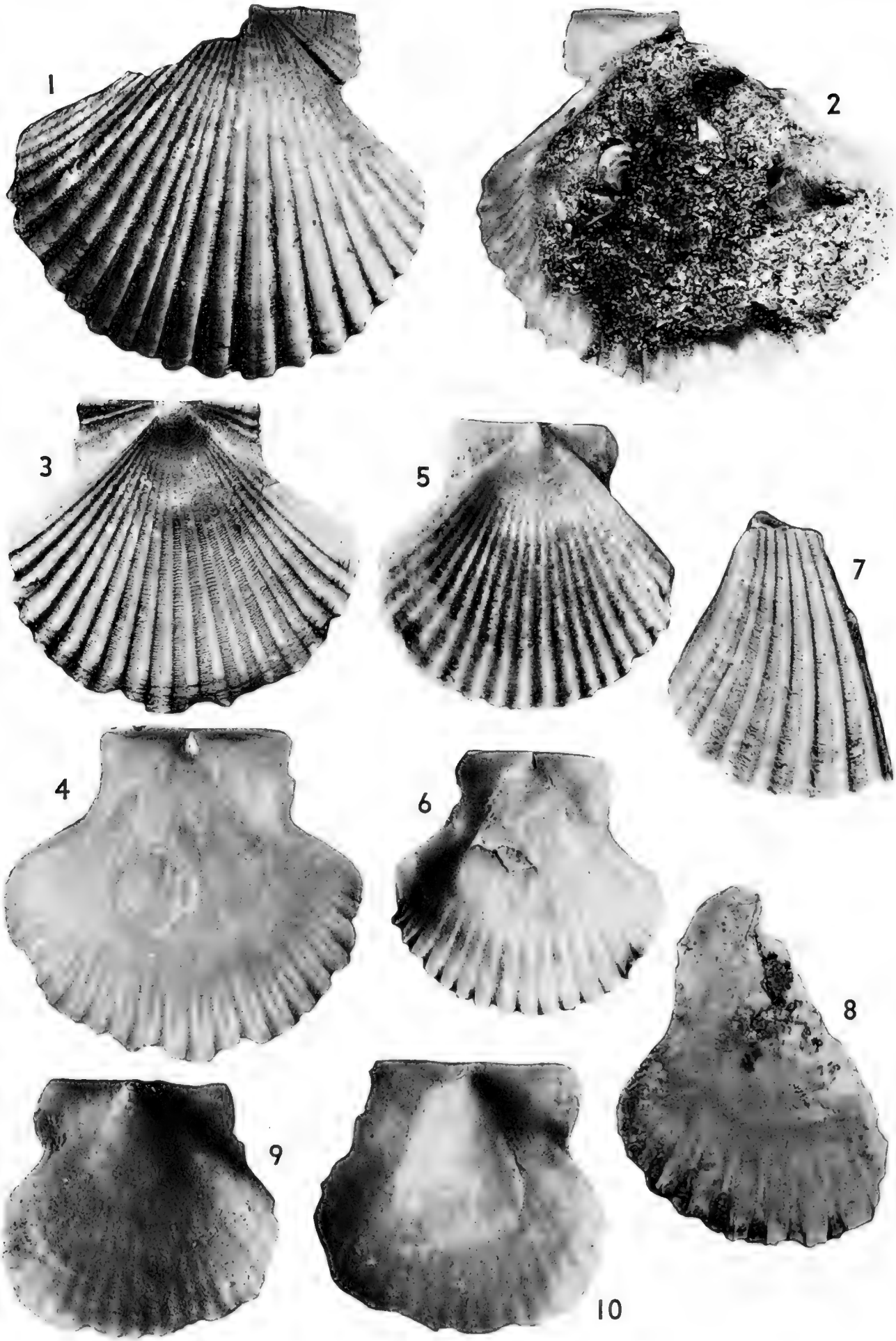
Figure — Page

1-4. **Plicatula venezuelana** Weisbord, n. sp. 117
Figs. 1, 2, holotype (S432a). 26544 PRI. Exterior and interior of left valve. Height 16.7 mm.; width 20.3 mm.; thickness 2.6 mm. Playa Grande formation (Maiquetía member). Figs. 3, 4, paratype (R432a). 26545 PRI. Exterior and interior of immature right ? valve. Height 1.8 mm.; width 1.9 mm.; thickness 0.5 mm. Playa Grande formation (Maiquetía member).

5-8. **Plicatula caribbeana** Weisbord, n. sp. 118
Holotype (H431a1-2). 26546 PRI. Figs. 5, 6 (H431a1), exterior and interior of right valve of pair. Height 8.2 mm.; width 7.7 mm.; thickness of paired valves 2.6 mm. Figs. 7, 8 (H431a2), exterior and interior of left valve of pair. Mare formation.

9-13. **Pecten (Pecten) catianus** Weisbord, n. sp. 119
Figs. 9, 10, holotype (K330a). 26547 PRI. Attached valves with rock filling. Height 36.2 mm.; width 36.9 mm. Fig. 9, external view of right valve. Fig. 10, external view of left valve. Playa Grande formation (Catia member). Figs. 11-13, paratype (K332a). 26548 PRI. Right valve. Height 23.3 mm.; width 33.6 mm.; thickness 7.6 mm. Figs. 11, 12, views of exterior. Fig. 13, view of interior. Playa Grande formation (Catia member).


1
5
7
2
6
8
3
9
10
4
12
11
13


1
2
3
5
7
4
6
8
9
10

Explanation of Plate 12

Figure — Page

1,2. **Pecten (Pecten) caribeus** Weisbord, n. sp. 121
Holotype (G344a). 26549 PRI. Exterior and interior of right valve. Height 43.8 mm.; width 47.9 mm.; thickness 16.5 mm. Mare formation.

3-6. **Pecten (Pecten) maiquetiensis** Weisbord, n. sp. 124
Figs. 3, 4, holotype (T329a). 26550 PRI. Exterior and interior of left valve. Height 34.3 mm.; width 38.2 mm. Upper Mare formation. Figs. 5, 6, paratype (J329a). 26551 PRI. Exterior and interior of left valve. Height 22.1 mm.; width 22.4 mm. Lower Mare formation.

7,8. **Pecten (Pecten)** species 126
Fig. 7 (K330b). 26552 PRI. Exterior of broken left valve. Height 35 mm. Playa Grande formation (Catia member). Fig. 8 (O330a). 26553 PRI. Interior of broken left valve. Height 53 mm. Playa Grande formation (Catia member).

9,10. **Pecten (Pecten ?) remulus** Weisbord, n. sp. 127
Holotype (S345a). 26554 PRI. Exterior and interior of immature left valve. Height 8 mm.; width 8.3 mm. Playa Grande formation (Maiquetía member).

Explanation of Plate 13

Figure — Page

1-6. **Pecten (Euvola) ziczac caboblancoensis** Druckerman, n. sp. 128

Fig. 1, topotype (U324a). 26555 PRI. External view of right valve. Height 67 mm.; width 60 mm.; thickness 25 mm. Playa Grande formation (Catia member). Figs. 2, 3, topotype (K324a). 26556 PRI. Exterior and interior of broken right valve. Height 38 mm.; thickness 12 mm. Playa Grande formation (Catia member). Figs. 4, 5, hypotype (I327a). 26557 PRI. Exterior and interior of small left valve. Height 26.2 mm.; width 26.2 mm. Lower Mare formation. Fig. 6, hypotype (H327a). 26558 PRI. Exterior of left valve. Height 37.6 mm.; width 37.6 mm. Mare formation.

7-9. **Pecten (Amusium) papyraceus** (Gabb) 131

Figs. 7, 8, specimen L326b. 26559 PRI. Interior and exterior of left valve. Height 47 mm.; thickness 5 mm. Playa Grande formation (Catia member). Fig. 9, specimen L326a. 26560 PRI. Right valve of pair, with hinge of left valve showing behind. Height of right valve 69 mm.; width 77 mm.; thickness of paired valves 14 mm. Playa Grande formation (Catia member). See Pl. 14, fig. 1 for left valve of doublet.


1
9
2
3
6
4
5
7
8


8
9
2
5
4
6
11
1
3
10
7

Explanation of Plate 14

Figure — Page

1. **Pecten (Amusium) papyraceus** (Gabb) 131
Specimen L326a. 26560 PRI. Exterior of left valve of pair. Height 71 mm.; width 76 mm. See Pl. 13, fig. 9 for right valve of same pair. Playa Grande formation (Catia member).

2,3. **Pecten (Amusium) marensis** Weisbord, n. sp. 136
Holotype (G326a). 26562 PRI. Exterior and interior of juvenile left valve. Height 19 mm.; width 18.1 mm.; thickness 0.8 mm. Mare formation.

4-7. **Chlamys (Chlamys) ornata** (Lamarck) 137
Figs. 4, 5, specimen A325a. 26563 PRI. Exterior and interior of right valve. Height 16.5 mm.; width 18.4 mm.; thickness 2.1 mm. Recent. Figs. 6, 7, specimen A325b. 26564 PRI. Exterior and interior of left valve. Height 16.3 mm.; width 14.1 mm.; thickness 2.2 mm. Recent.

8-11. **Chlamys (Chlamys) benedicti** Verrill and Bush 139
Figs. 8, 9, specimen L337a. 26565 PRI. Exterior and interior of right valve. Height 17 mm.; width 15 mm.; thickness 2.5 mm. Playa Grande formation (Catia member). Figs. 10, 11, specimen L337b. 26566 PRI. Exterior and interior of left valve. Height 13.9 mm.; width 12.2 mm.; thickness 2.1 mm. Playa Grande formation (Catia member).

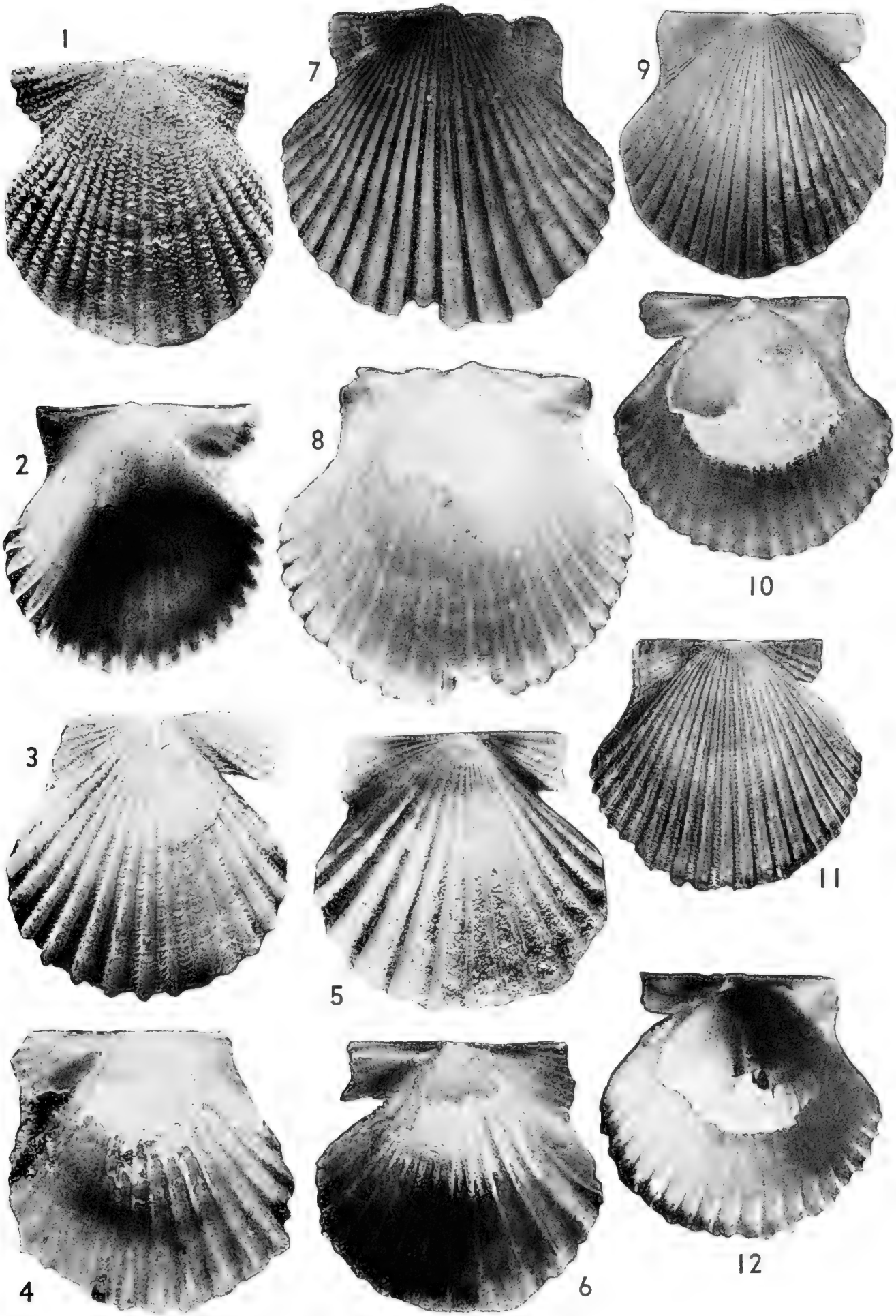
Explanation of Plate 15

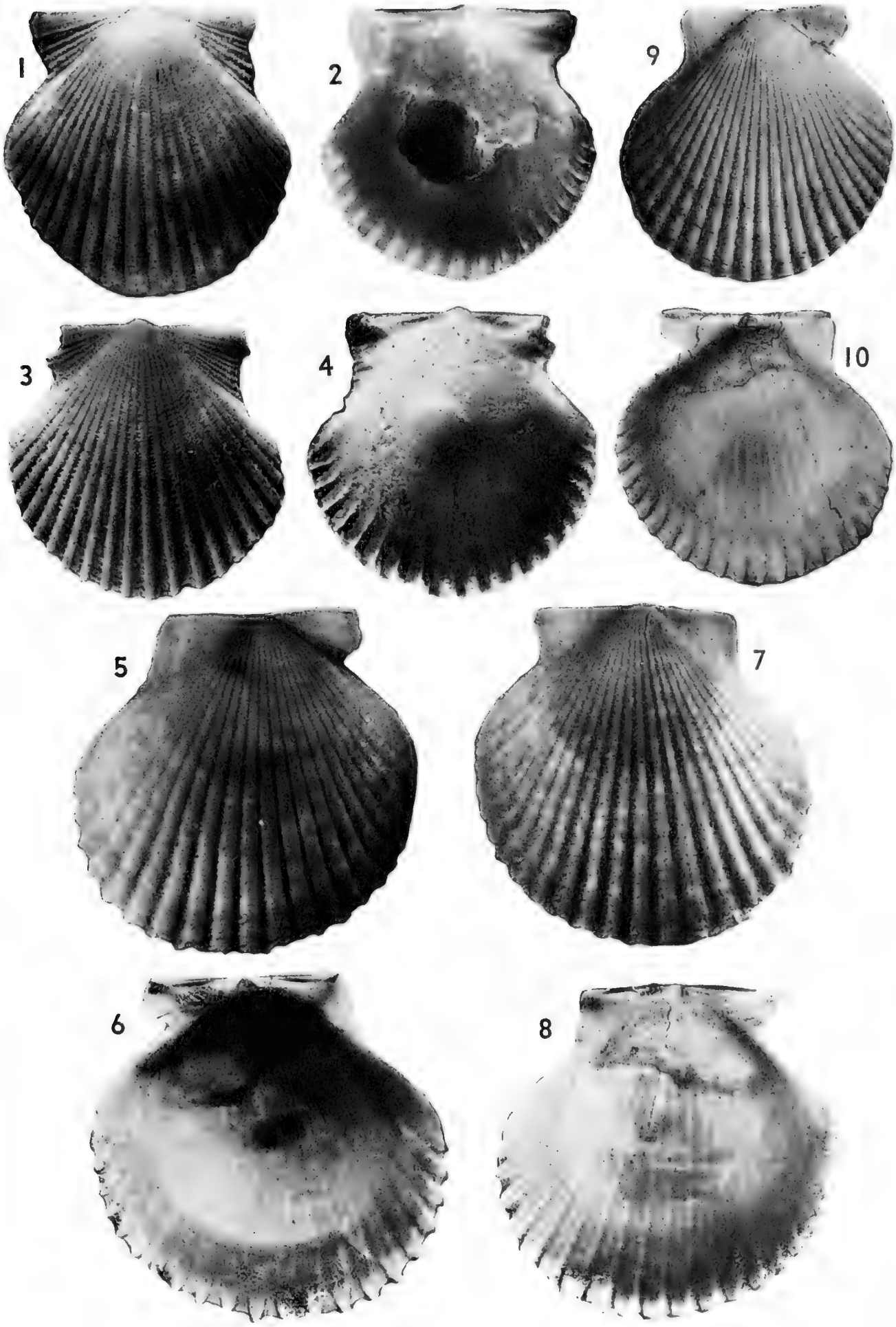
Figure — Page

1,2. **Aequipecten muscosus** (Wood) 142
Specimen K339a. 26567 PRI. Exterior and interior of left valve. Height 12.1 mm.; width 11.9 mm.; thickness 2 mm. Playa Grande formation (Catia member).

3-6. **Chlamys (Leptopecten) desultoria** Weisbord, n. sp. 145
Figs. 3, 4, holotype (G342a). 26568 PRI. Exterior and interior of right valve. Height 10.3 mm.; width 10.3 mm.; thickness 1.1 mm. Mare formation. Figs. 5, 6, paratype (J342a). 26569 PRI. Exterior and interior of right valve. Height 9.6 mm.; width 9.8 mm.; thickness 2 mm. Lower Mare formation.

7-12. **Chlamys (Argopecten) gibbus antecessor** Weisbord, n. subsp. .. 148
Figs. 7, 8, holotype (T344a). 26570 PRI. Exterior and interior of left valve. Height 32 mm.; width 33.5 mm.; thickness 10.2 mm. Upper Mare formation. Figs. 9, 10, paratype (G344c). 26571 PRI. Exterior and interior of right valve. Height 18.7 mm.; width 18.7 mm.; thickness 6.8 mm. Mare formation. Figs. 11, 12, paratype (I344a). 26572 PRI. Exterior and interior of right valve. Height 17.5 mm.; width 17.8 mm.; thickness 4 mm. Lower Mare formation.


1
7
9
2
8
10
3
5
11
4
6
12


1
2
9
3
4
10
5
7
6
8

Explanation of Plate 16

Figure — Page

1-4. **Chlamys (Argopecten) gibbus antecessor** Weisbord, n. subsp. .. 148

Figs. 1, 2, paratype (J344a). 26573 PRI. Exterior and interior of left valve. Height 12.5 mm.; width 11.8 mm.; thickness 2 mm. Lower Mare formation. Figs. 3, 4, paratype (L340a). 26574 PRI. Exterior and interior of left valve. Height 12.2 mm.; width 11.8 mm.; thickness 2.1 mm. Playa Grande formation (Catia member).

5-10. **Chlamys (Argopecten) imitata** Weisbord, n. sp. 152

Figs. 5-8, holotype (L331a1-2). 26575 PRI. Paired valves. Figs. 5, 6, exterior and interior of right valve of pair. Height 36.9 mm.; width 36.9 mm.; thickness of valves attached 19 mm. Figs. 7, 8, exterior and interior of left valve of pair. Height 37.1 mm.; width 37.1 mm. Playa Grande formation (Catia member). Figs. 9, 10, paratype (U331a). 26576 PRI. Exterior and interior of right valve. Height 27.9 mm.; width 27.9 mm.; thickness 5.4 mm. Playa Grande formation (Catia member).

Explanation of Plate 17

Figure — Page

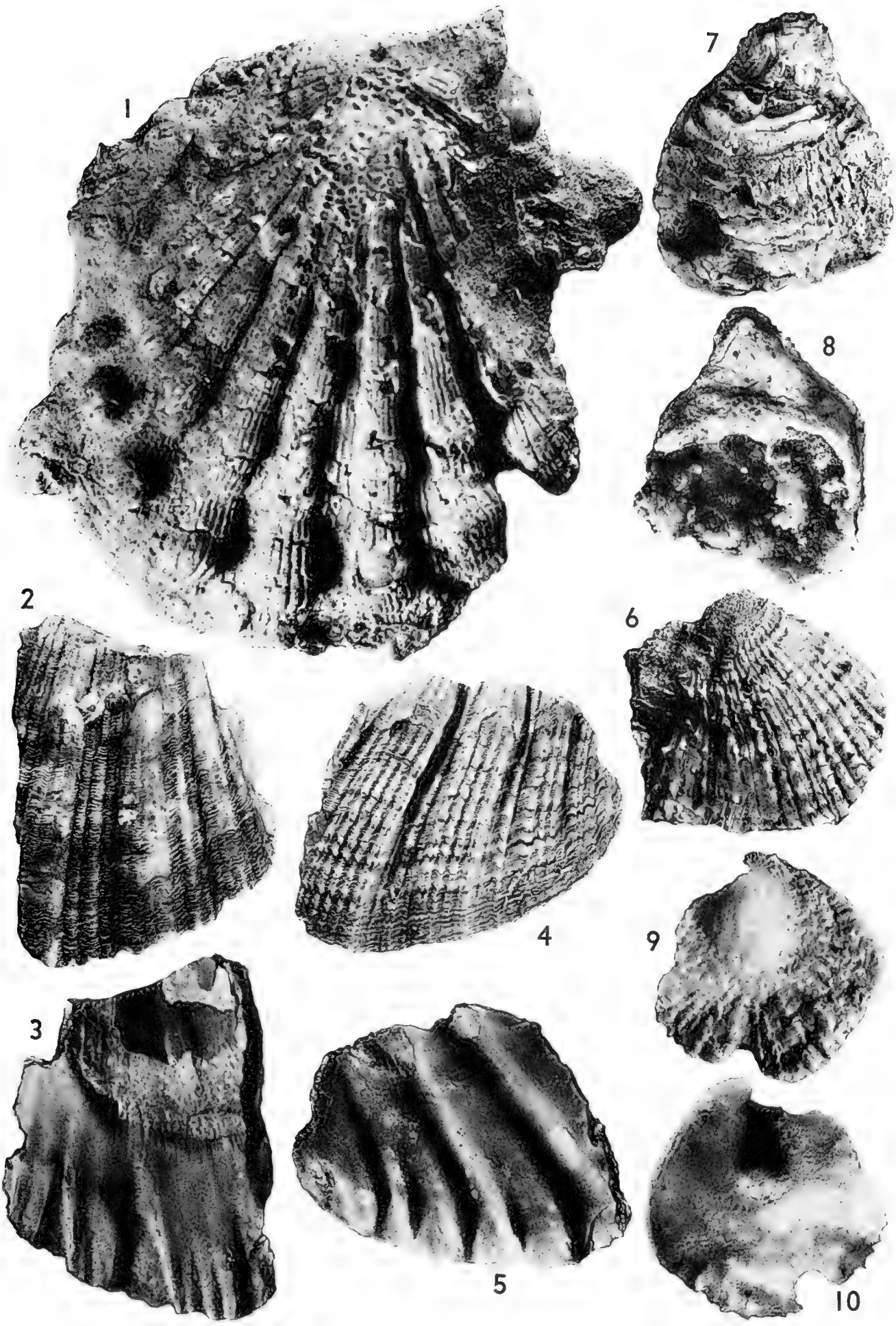
1. **Lyropecten (Nodipecten) nodosus** ? (Linnaeus) 156
Specimen N322a. 26577 PRI. Right valve. Height 103 mm. Playa Grande formation (Catia member).

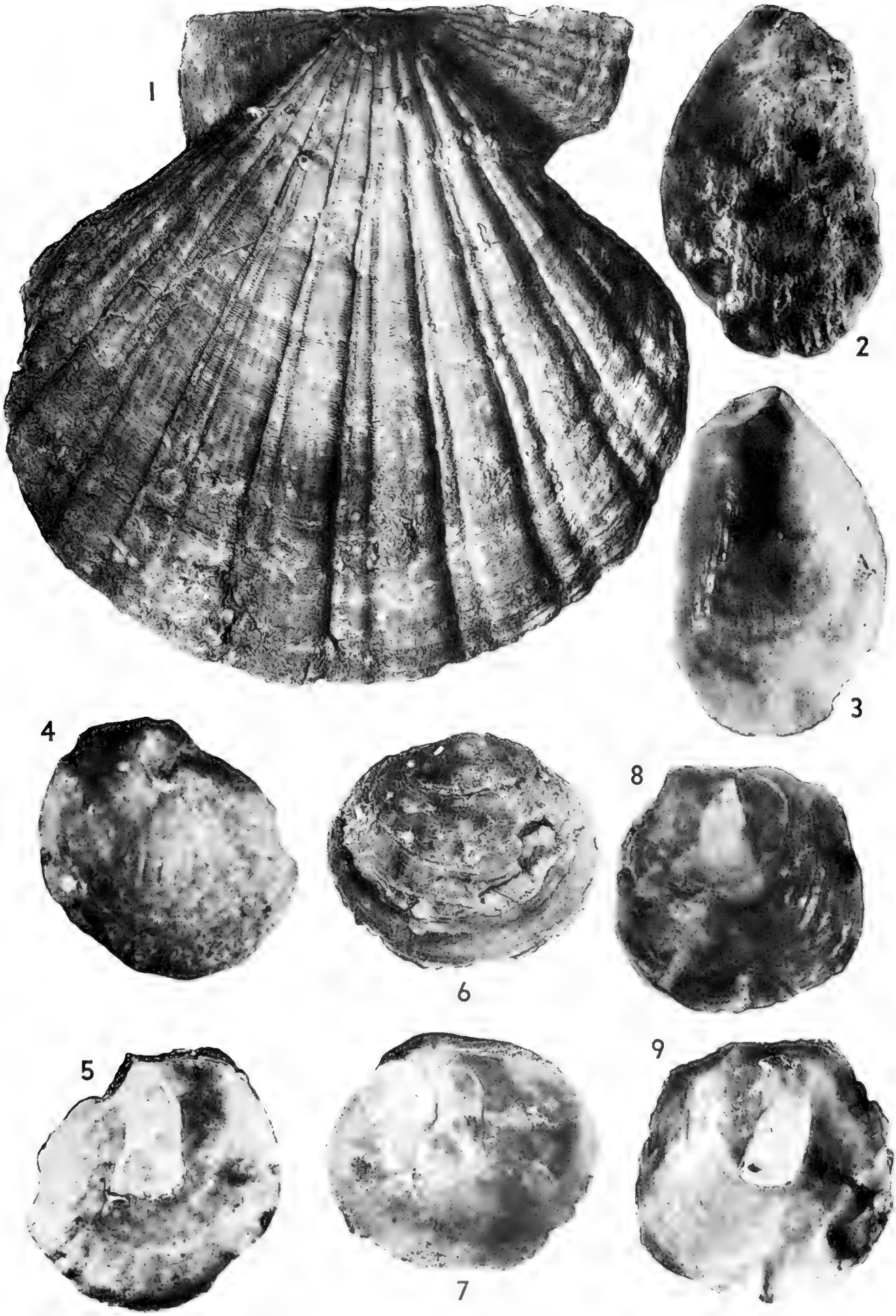
2,3. **Lyropecten (Nodipecten)** species "a" 162
Specimen I323a. 26578 PRI. Exterior and interior of fragment. Height of fragment 66 mm. Lower Mare formation.

4,5. **Lyropecten (Nodipecten)** species "b" 162
Specimen O321a. 26579 PRI. Exterior and interior of fragment. Width of fragment 59 mm.; height 52 mm. Playa Grande formation (Catia member).

6-8. **Spondylus americanus** Hermann 163
Figs. 6, 7, specimen O441a. 26580 PRI. Exterior and interior of umbonal area and beak of right valve. Height 42 mm. Playa Grande formation (Catia member). Fig. 8, specimen O356a. 26581 PRI. Part of umbonal area. Height 36.5 mm. Playa Grande formation (Catia member).

9,10. **Anomia mareana** Weisbord, n. sp. 169
Paratype (J444a). 26582 PRI. Exterior and interior of juvenile left valve. Height 6.3 mm.; width 7.7 mm.; thickness 1 mm. Lower Mare formation.


1
2
3
4
5
6
7
8
9
10


1
2
3
4
6
8
5
7
9

Explanation of Plate 18

Figure — Page

1. **Lyropecten (Nodipecten) arnoldi** Aguerrevere 159
Specimen M320a. 26583 PRI. Exterior of right valve. Height 147 mm.; width 148 mm.; length of hinge line 97 mm.; thickness 35 mm. Playa Grande formation (Catia member).

2,3. **Lima (Limaria) pellucida** C. B. Adams 167
Specimen A559a. 26584 PRI. Exterior and interior of right valve. Height 21 mm.; width 13.5 mm.; thickness 4 mm. Recent.

4-9. **Anomia mareana** Weisbord, n. sp. 169
Figs. 4, 5, holotype (T362b). 26585 PRI. Exterior and interior of left valve. Height 24.8 mm.; width 23.9 mm.; thickness 7 mm. Upper Mare formation. Figs. 6, 7, paratype (T362a). 26586 PRI. Exterior and interior of left valve. Height 36 mm.; width 40.2 mm.; thickness 15 mm. Upper Mare formation. Figs. 8, 9, paratype (G362b). 26587 PRI. Exterior and interior of left ? valve. Height 25.2 mm.; width 26.5 mm.; thickness 1.7 mm. Mare formation.

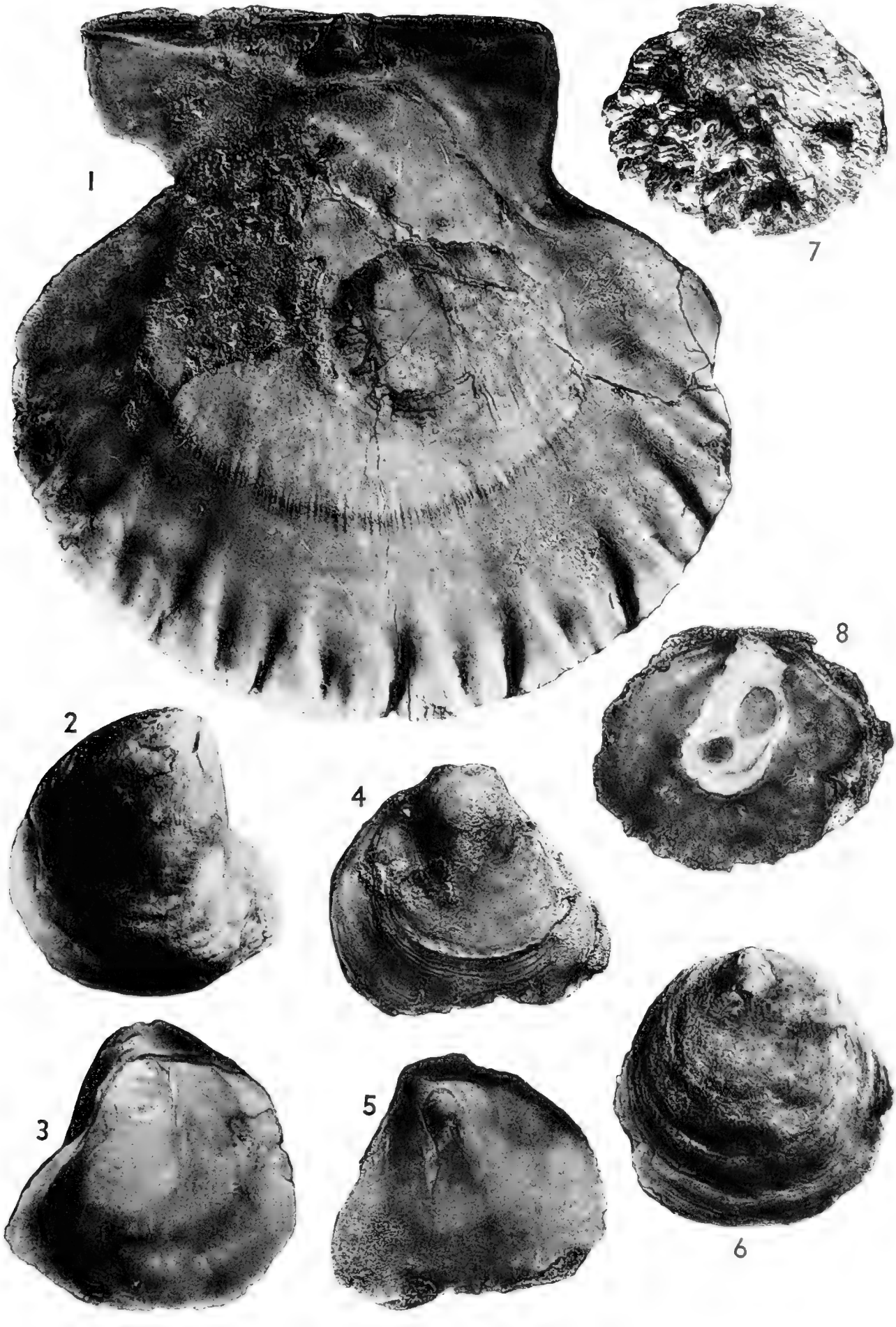
Explanation of Plate 19

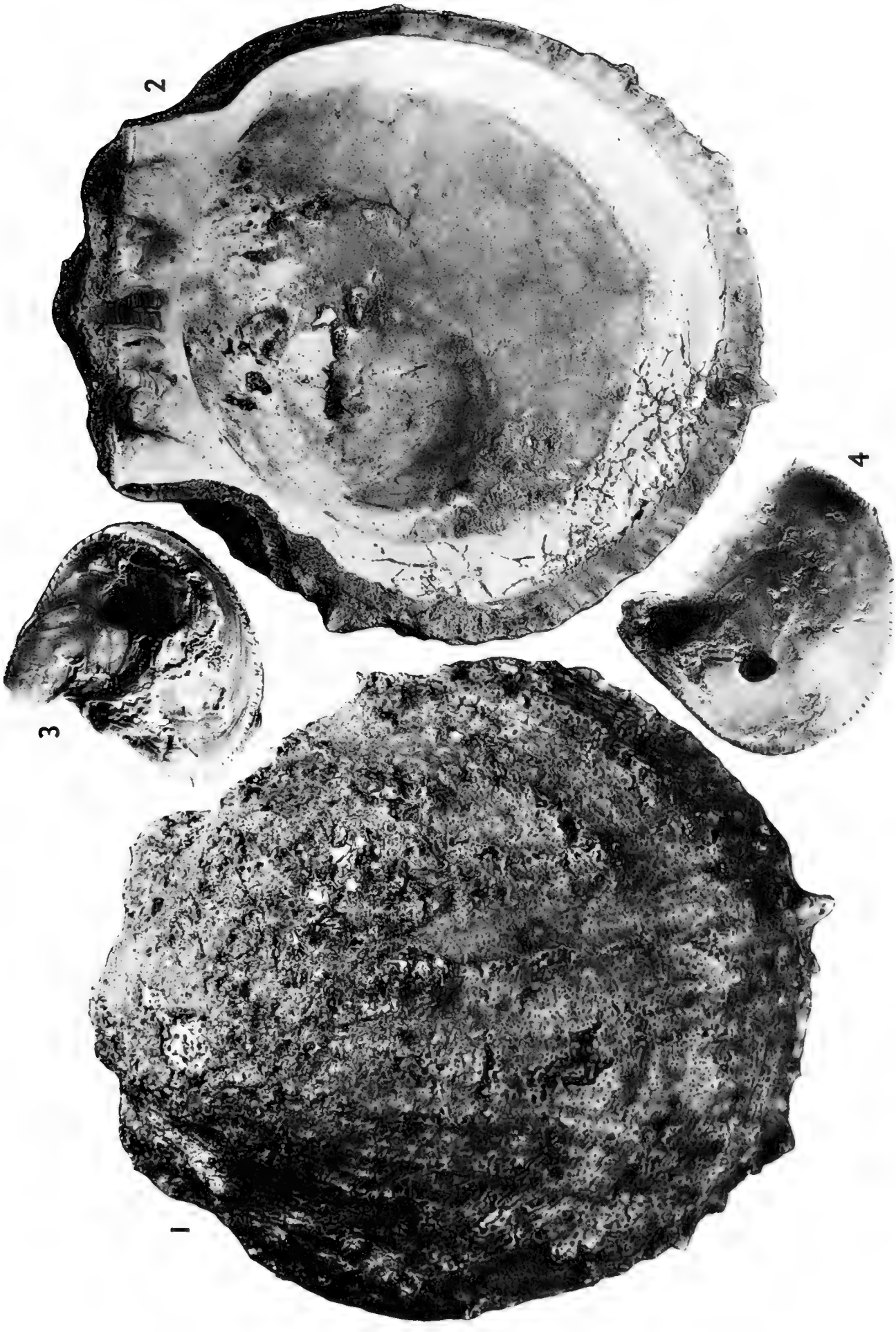
Figure — Page

1. **Lyropecten (Nodipecten) arnoldi** Aguerrevere 159
Specimen M320a. 26583 PRI. Interior of right valve. Height 147 mm.; width 148 mm.; length of hinge line 97 mm.; thickness 35 mm. Playa Grande formation (Catia member).

2-6. **Anomia catiana** Weisbord, n. sp. 171
Figs. 2, 3, holotype (K362a). 26589 PRI. Exterior and interior of left valve. Height 33 mm.; width 32 mm.; thickness 10 mm. Playa Grande formation (Catia member). Figs. 4, 5, paratype (K362b). 26590 PRI. Exterior and interior of left valve. Height 32.8 mm.; width 38.3 mm.; thickness 7.2 mm. Playa Grande formation (Catia member). Fig. 6, paratype (K362c). 26591 PRI. External view of left valve. Height 31 mm.; width 30.2 mm.; thickness 5.5 mm. Playa Grande formation (Catia member).

7,8. **Pododesmus rudis** (Broderip) 173
Specimen G362a. 26592 PRI. Exterior and interior of left valve. Height 38.2 mm.; width 44.8 mm.; thickness 4.7 mm. Mare formation.


1
2
3
4
5
6
7
8


2
4
3
1

Explanation of Plate 20

Figure — Page

1,2. **Spondylus americanus** Hermann 163
Specimen S354a. 26593 PRI. Exterior and interior of left valve. Height 123 mm.; width 111 mm.; thickness approx. 45 mm. Playa Grande formation (Maiquetía member).

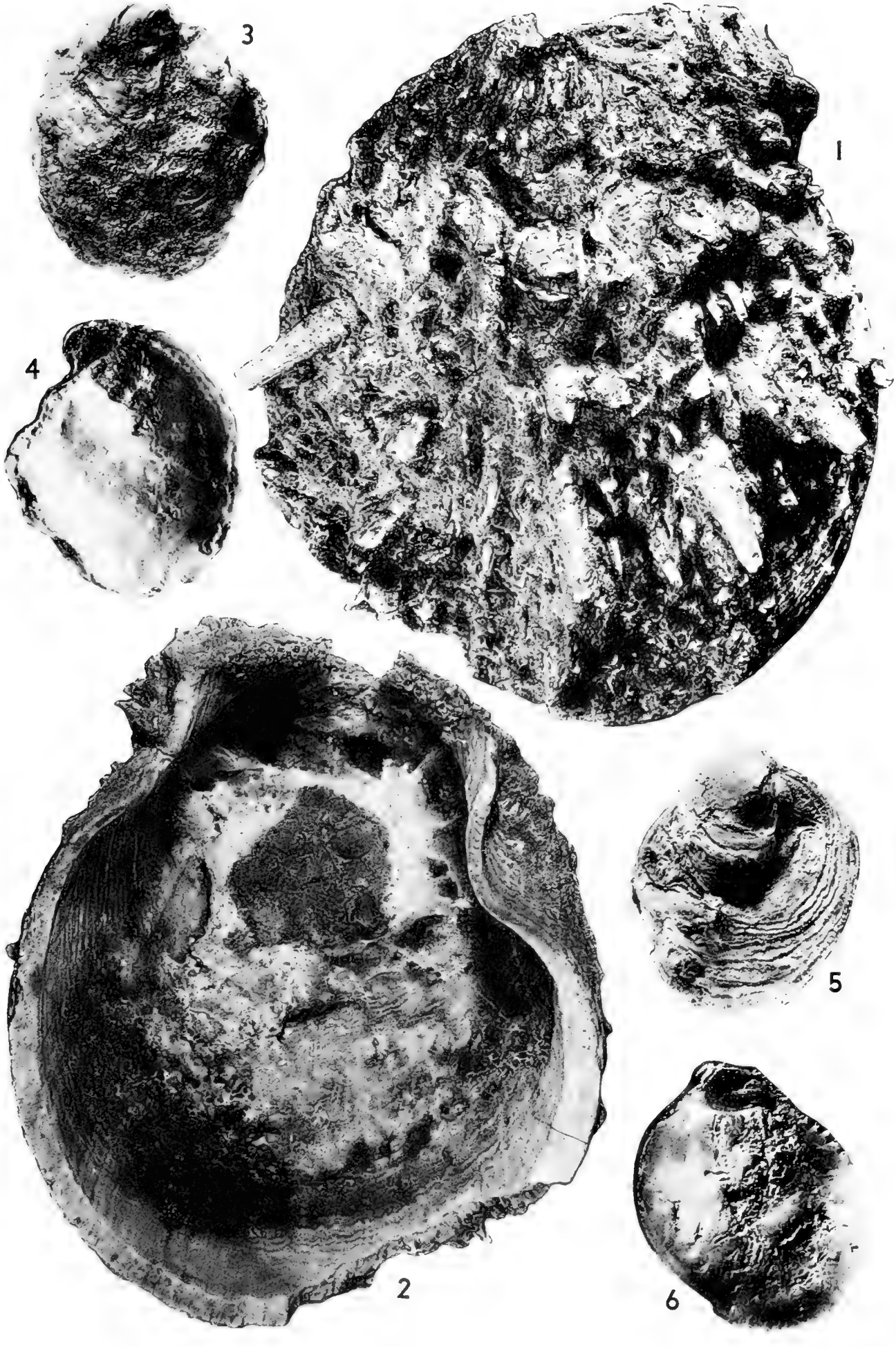
3,4. **Ostrea (Ostrea) libella** Weisbord, n. sp. 176
Paratype (C351d). 26594 PRI. Exterior and interior of right valve. Height 13.7 mm.; width 15 mm.; thickness 2 mm. Guaiguaza clay.

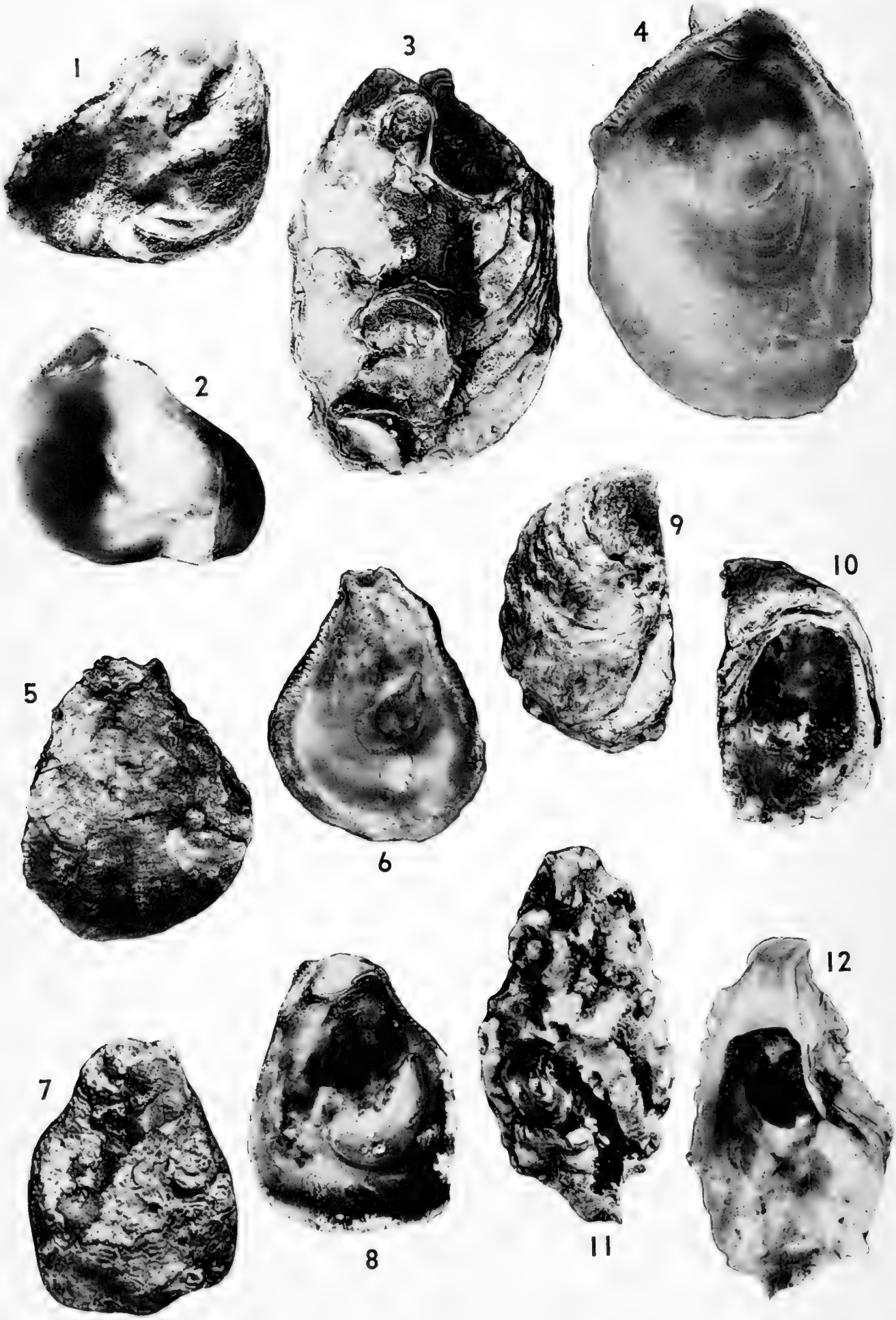
Explanation of Plate 21

Figure — Page

1,2. **Spondylus americanus** Hermann 163
Specimen O355a. 26595 PRI. Exterior and interior of right ? valve. Height 130 mm.; width 108 mm. Playa Grande formation (Catia member).

3-6. **Ostrea (Ostrea) libella** Weisbord, n. sp. 176
Figs. 3, 4, holotype (C351e). 26596 PRI. Exterior and interior of left valve. Height 11.5 mm.; width 10 mm.; thickness 2.2 mm. Guaiguaza clay. Figs. 5, 6, paratype (C351a). 26597 PRI. Exterior and interior of left valve. Height 11.4 mm.; width 10 mm.; thickness 2.9 mm. Guaiguaza clay.


3
1
4
2
5
6


1
2
3
4
5
6
7
8
9
10
11
12

Explanation of Plate 22

Figure — Page

1,2. **Ostrea (Ostrea) pannucea** Weisbord, n. sp. 177
Holotype (Q349a). 26598 PRI. Exterior and interior of right valve. Length 13.5 mm.; width 9 mm. Playa Grande formation (Maiquetía member).

3-8. **Ostrea (Ostrea) lixula** Weisbord, n. sp. 177
Figs. 3, 4, holotype (O350a). 26599 PRI. Exterior and interior of right valve. Length 55.4 mm.; width 37 mm. Playa Grande formation (Catia member). Figs. 5, 6, paratype (O350b). 26600 PRI. Exterior and interior of right valve. Length 33.5 mm.; width 25.8 mm. Playa Grande formation (Catia member). Figs. 7, 8, paratype (J347a). 26601 PRI. Exterior and interior of right valve. Length 32 mm.; width 24.8 mm. Lower Mare formation.

9-10. **Ostrea (Ostrea) caraboboensis** Weisbord, n. sp. 180
Holotype (C437a). 26602 PRI. Exterior and interior of left valve. Height 21 mm.; width 12.3 mm.; thickness 9.5 mm. Guaiguaza clay.

11,12. **Ostrea (Crassostrea) virginica** Gmelin 181
Specimen B352b. 26603 PRI. Exterior and interior of left valve. Length 47.4 mm.; width 25.5 mm.; thickness 13.4 mm. Recent.

Explanation of Plate 23

Figure — Page

1. **Nuculana (Jupiteria ?)** species 47
Specimen O476b. 26604 PRI. Internal mold. Length 4.5 mm.; height 3.2 mm. Playa Grande formation (Catia member).

2-5. **Anadara (Cunearca) chemnitzi** (Philippi) 82
Figs. 2, 3, specimen A659a. 26605 PRI. Exterior and interior of right valve. Length 20 mm.; height 18.6 mm.; thickness 8.4 mm. Recent. Fig. 4, specimen A659b. 26606 PRI. Exterior of left valve. Length 19 mm.; height 18.7 mm.; thickness 8 mm. Recent. Fig. 5, specimen A659c. 26607 PRI. Anterior view of right valve and of a portion of the periostracum showing flexible spines. Length 22.9 mm.; height 22.5 mm.; thickness 10 mm. Recent.

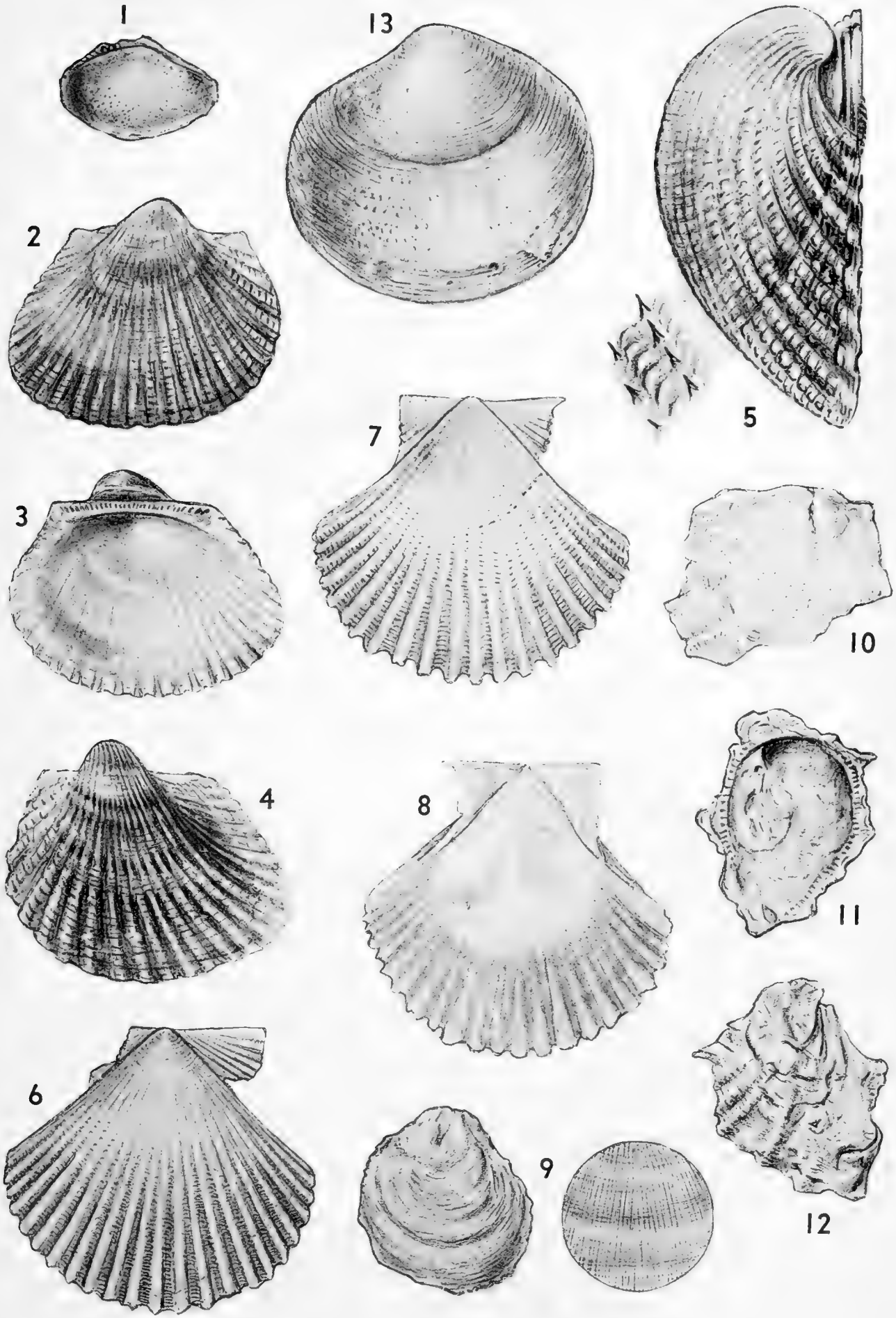
6-8. **Pecten (Pecten) caribeus** Weisbord, n. sp. 121
Fig. 6, paratype (I344c). 26608 PRI. Exterior of young right valve. Height 27.3 mm.; width 29.2 mm.; thickness 9.6 mm. Lower Mare formation. Figs. 7, 8, paratype (J344b). 26609 PRI. Exterior and interior of right valve. Height 30.9 mm.; width 32.9 mm.; thickness 11.1 mm. Lower Mare formation.

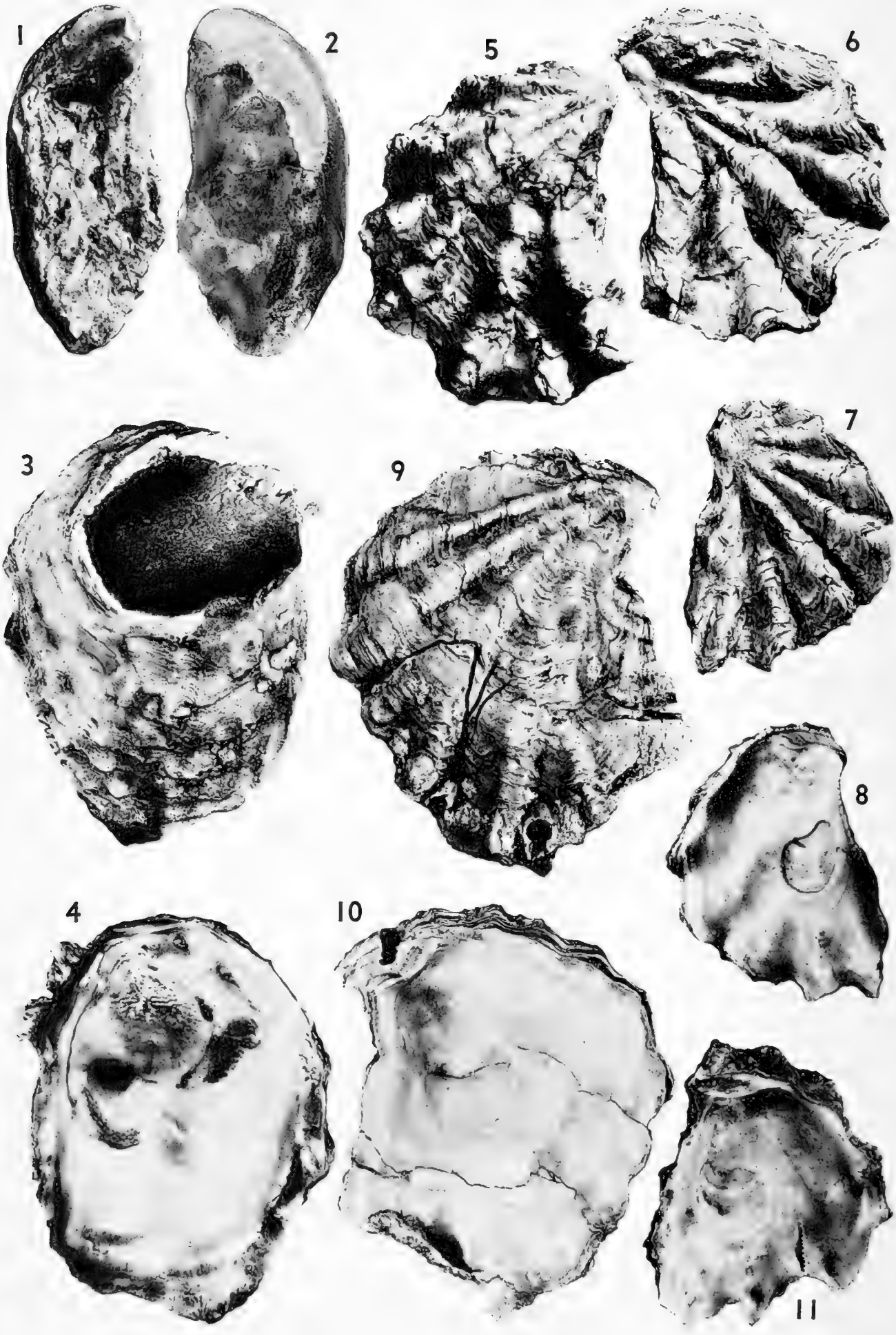
9. **Anomia catiana** Weisbord, n. sp. 171
Paratype (K362d). 26610 PRI. External view of left valve, and detail of microscopic sculpture. Height 26.6 mm.; width 25 mm.; thickness 4.5 mm. Playa Grande formation (Catia member).

10. **Pododesmus rudis** (Broderip) 173
Specimen G362c. 26611 PRI. External view of immature right valve. Height 10.8 mm.; thickness 2.2 mm. Mare formation.

11-12. **Ostrea (Ostrea) carabobensis** Weisbord, n. sp. 180
Paratype (C437b). 26612 PRI. Exterior and interior of left valve. Height 17.2 mm.; width 11.5 mm.; thickness 8 mm. Guaiguaza clay.

13. **Diplodonta (Phlyctiderma) semiaspera** Philippi 213
Specimen A664a. 26613 PRI. External view of left valve. Height 10 mm.; width 11 mm.; thickness 5 mm. Recent.


1
13
2
5
7
3
10
4
8
11
6
9
12


1
2
5
6
3
9
7
8
4
10
11

Explanation of Plate 24

Figure — Page

1,2. **Ostrea (Crassostrea)** species 184
Specimen B352a. 26614 PRI. Exterior and interior left valve. Length 54.5 mm., width 25.2 mm.; thickness 11 mm. Recent.

3,4. **Ostrea (Crassostrea) rhizophorae** Guilding 185
Specimen B353a. 26615 PRI. Exterior and interior of left valve. Length 76.4 mm.; width 58.7 mm.; thickness 26.5 mm. Recent.

5-11. **Ostrea (Alectryonia) vespertina venezuelana** Weisbord, n. subsp. 187
Figs. 5, 6, holotype (N346b). 26616 PRI. External views of paired valves. Height 48 mm.; width 39 mm.; thickness of pair 17 mm. Fig. 5, left valve; fig. 6, right valve. Playa Grande formation (Catia member). Figs. 7, 8, paratype (N346a). 26617 PRI. Exterior and interior of right valve. Height 44 mm.; width 31 mm.; thickness 9 mm. Playa Grande formation (Catia member). Figs. 9, 10, paratype (N346d). 26618 PRI. Exterior and interior of left valve. Height 63 mm.; width 57 mm.; thickness 20 mm. Playa Grande formation (Catia member). Fig. 11, paratype (N346e). 26619 PRI. Interior of left valve. Height 39 mm.; width 31 mm.; thickness 11 mm. Playa Grande formation (Catia member).

Explanation of Plate 25

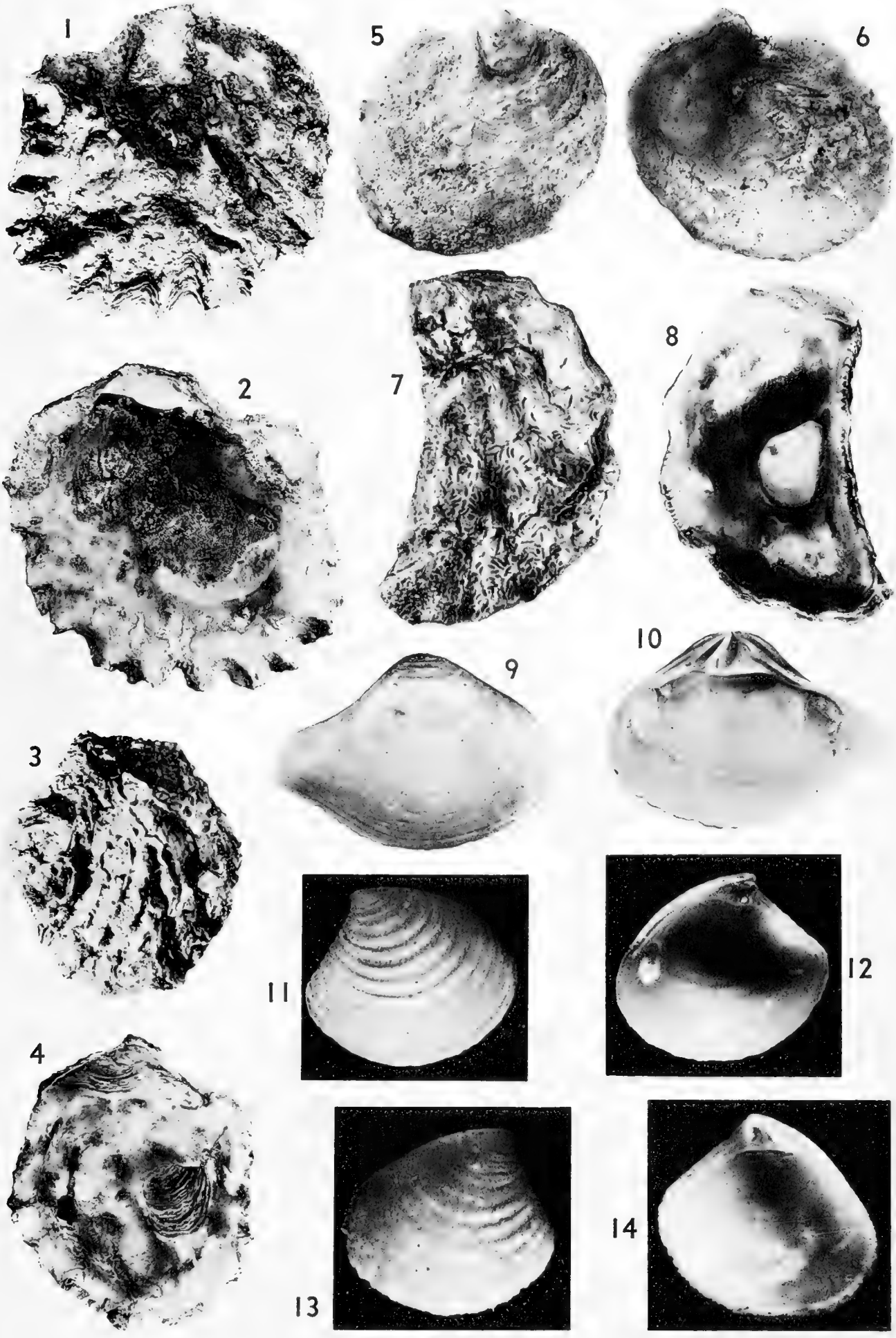
Figure — Page

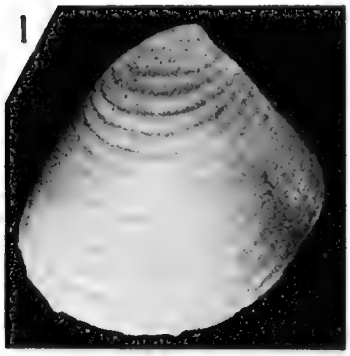
1-6. **Ostrea (Alectryonia ?) caboblanquensis** Weisbord, n. sp. 190
Figs. 1, 2, holotype (S346a). 26620 PRI. Exterior and interior of right valve. Height 61.5 mm.; width 59.7 mm.; thickness 14 mm. Playa Grande formation (Maiquetía member). Figs. 3, 4, paratype (O346a). 26621 PRI. Exterior and interior of right valve. Height 51 mm.; width 43 mm.; thickness 12.7 mm. Playa Grande formation (Catia member). Figs. 5, 6, paratype (M430a). 26622 PRI. Exterior and interior of juvenile right valve. Height 9 mm.; width 10 mm.; thickness 2 mm. Playa Grande formation (Catia member).

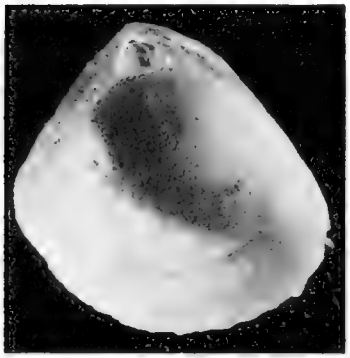
7,8. **Ostrea (Agerostrea ?) antecursor** Weisbord, n. sp. 192
Holotype (R348a). 26623 PRI. Exterior and interior of right valve. Length 44.4 mm.; width 25 mm. Playa Grande formation (Maiquetía member).

9,10. **Eucrassatella (Hybolophus) antillarum** (Reeve) 194
Specimen I488a. 26624 PRI. Exterior and interior of right valve. Length 41 mm.; height 28.7 mm.; thickness 6.7 mm. Lower Mare formation.

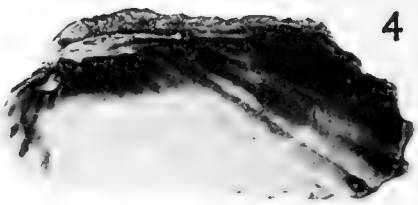
11-14. **Crassinella aduncata** Weisbord, n. sp. 197
Figs. 11, 12, holotype (I485a). 26625 PRI. Exterior and interior of right valve. Height 2.3 mm.; width 2.7 mm.; thickness 0.8 mm. Lower Mare formation. Figs. 13, 14, paratype (I485b). 26626 PRI. Exterior and interior of left valve. Height 1.9 mm.; width 2.1 mm.; thickness 0.6 mm. Lower Mare formation.

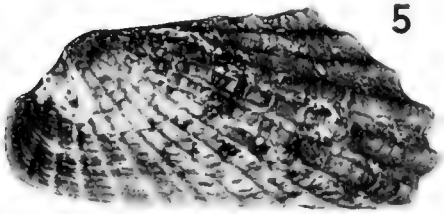

1
5
6
2
7
8
10
9
3
11
12
4
13
14

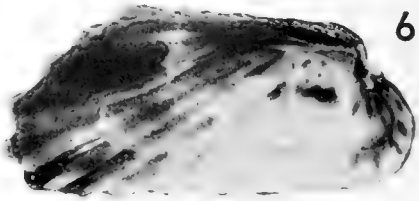

1

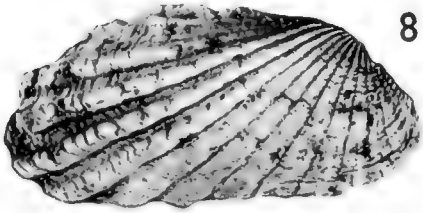

2

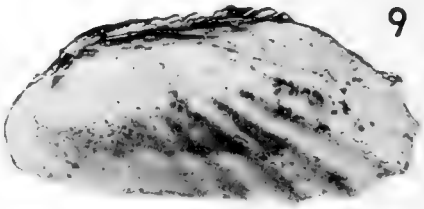

3


4

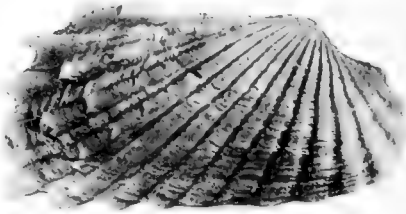

5


6

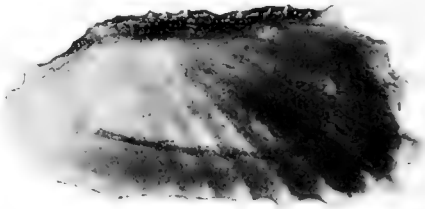

8

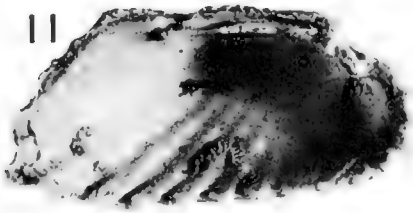

9

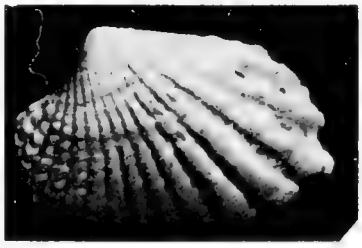

7

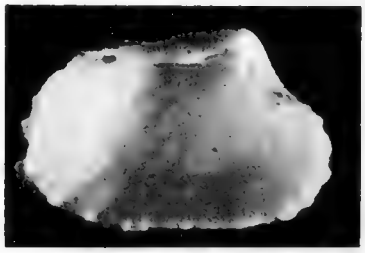

12

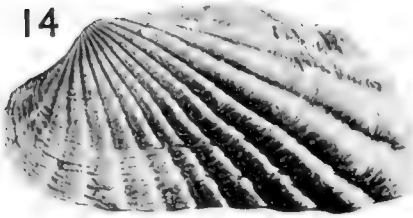

10

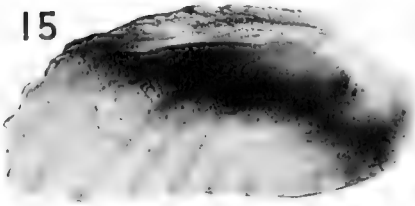

13


11


16


17


14


15


18


19

Explanation of Plate 26

Figure — Page

1,2. **Crassinella triquetra** Weisbord, n. sp. 199
Holotype (I486a) 26627 PRI. Exterior and interior of left valve. Height 3 mm.; width 2.9 mm.; thickness 0.9 mm. Lower Mare formation.

3-17. **Cardita (Carditamera) gracilis** Shuttleworth 200
Figs. 3-6, specimen A540a1-2. 26628 PRI. Paired valves. Height 11.8 mm.; length 26 mm.; thickness of attached valves 10 mm. Figs. 3, 4, interior and exterior of right valve. Figs. 5, 6, interior and exterior of left valve. Recent. Fig. 7, specimen A540b. 26629 PRI. Dorsal view of attached valves. Height 9.1 mm.; length 19.5 mm.; thickness 6.7 mm. Recent. Figs. 8, 9, specimen D540a. 26630 PRI. Exterior and interior of right valve. Height 11 mm.; length 23 mm.; thickness 5.8 mm. Abisinia formation. Figs. 10, 11, specimen D540b. 26631 PRI. Exterior and interior of left valve. Height 7.2 mm.; length 14.4 mm.; thickness 5.1 mm. Abisinia formation. Figs. 12, 13, specimen J540a. 26632 PRI. Exterior and interior of right valve. Height 8.2 mm.; length 17.4 mm.; thickness 3.2 mm. Lower Mare formation. Figs. 14, 15, specimen J540b. 26633 PRI. Exterior and interior of left valve. Height 9.1 mm.; length 18.1 mm.; thickness 4.1 mm. Lower Mare formation. Figs. 16, 17, specimen I541a. 26634 PRI. Exterior and interior of juvenile left valve. Height 1.4 mm.; length 2.4 mm.; thickness 0.5 mm. Lower Mare formation.

18,19. **Venericardia (Glyptoactis) wendellwoodringi** Weisbord, n. sp. 203
Figs. 18, 19, holotype (T493a). 26635 PRI. Exterior and interior of right valve. Height 24.2 mm.; width 23.9 mm.; thickness 11.2 mm. Upper Mare formation.

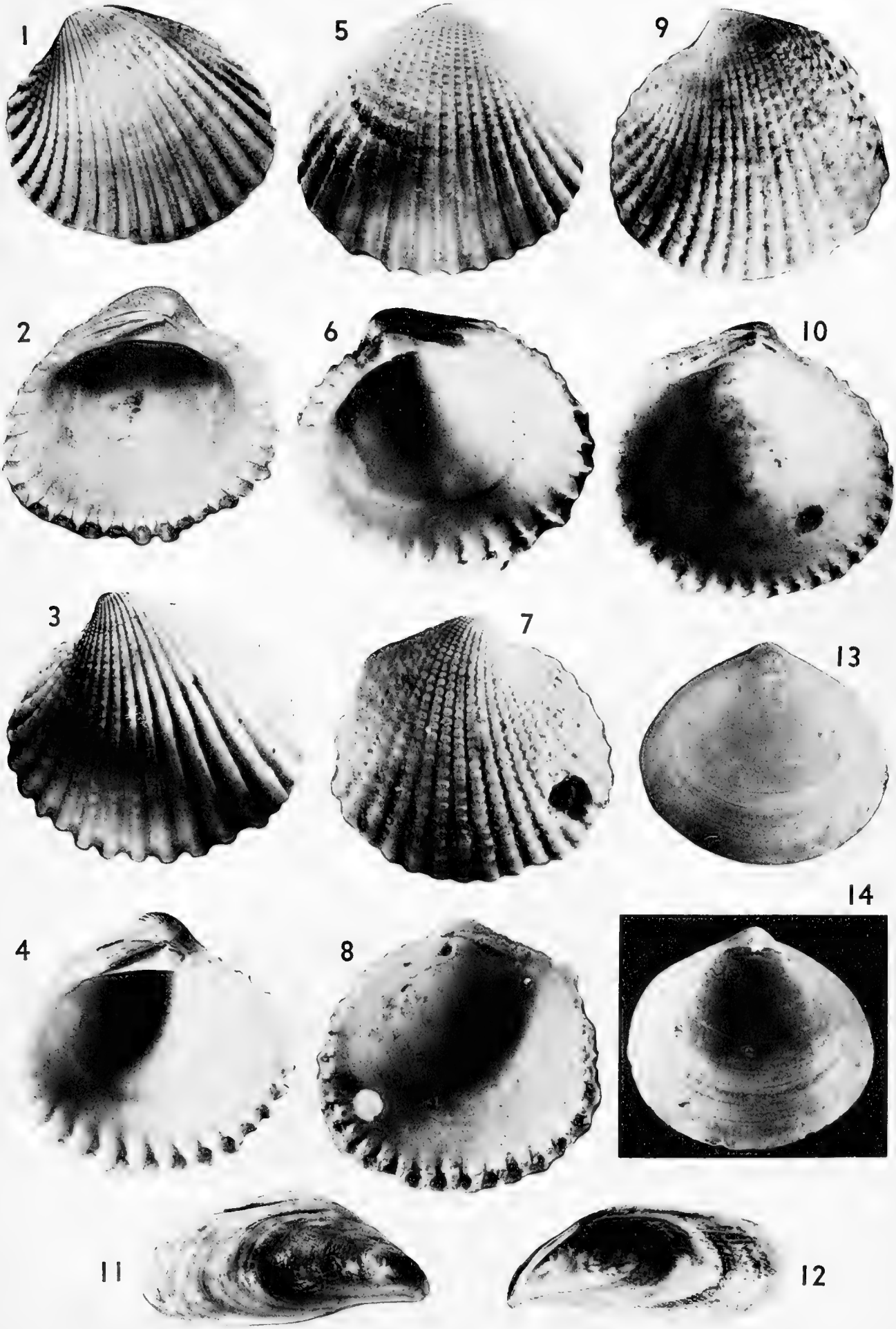
Explanation of Plate 27

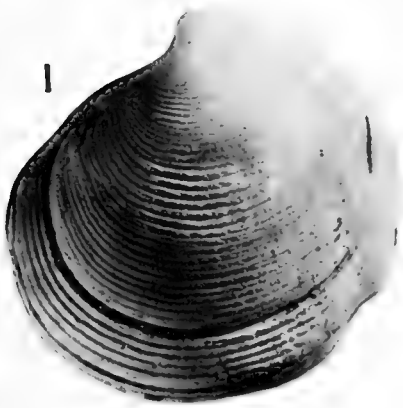
Figure — Page

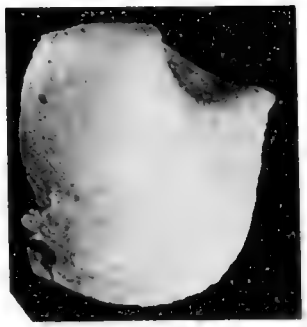
1-10. **Venericardia (Glyptoactis) wendellwoodringi** Weisbord, n. sp. 203
Figs. 1, 2, paratype (I493b). 26636 PRI. Exterior and interior of left valve. Height 18.2 mm.; width 20.2 mm.; thickness 7 mm. Lower Mare formation. Figs. 3, 4, paratype (T493b). 26637 PRI. Exterior and interior of young left valve. Height 11.7 mm.; width 12.1 mm.; thickness 4.1 mm. Upper Mare formation. Figs. 5, 6, paratype (I493a). 26638 PRI. Exterior and interior of young right valve. Height 11.1 mm.; width 12 mm.; thickness 4.3 mm. Lower Mare formation. Figs. 7, 8, paratype (J494a). 26639 PRI. Exterior and interior of juvenile right valve. Height 4.7 mm.; width 4.8 mm.; thickness 2 mm. Lower Mare formation. Fig. 9, paratype (T494a). 26640 PRI. Exterial view of juvenile left valve. Height 3 mm.; width 3 mm.; thickness 1.2 mm. Upper Mare formation. Fig. 10, paratype (S494a). 26641 PRI. Internal view of juvenile left valve. Height 6.5 mm.; width 6.6 mm.; thickness 2.1 mm. Playa Grande formation (Maiquetía member).

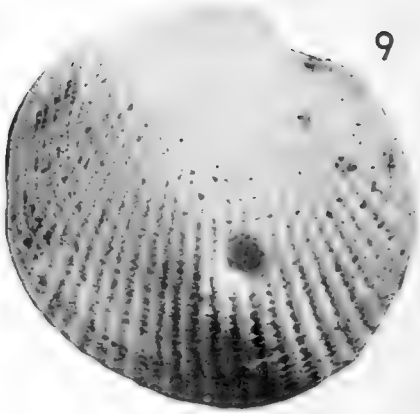
11,12. **Mytilopsis leucopheatus** ? Conrad 206
Specimen B557a. 26642 PRI. Exterior and interior of right valve. Length 32 mm.; width 14.5 mm.; thickness 6.6. mm. Recent.

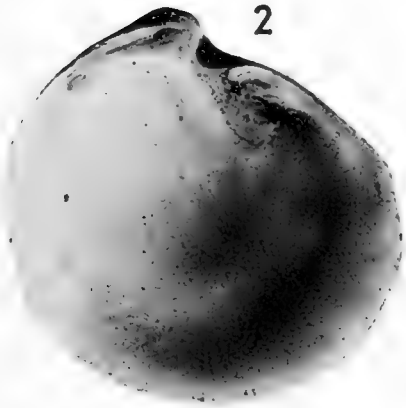
13,14. **Diplodonta (Diplodonta) mareana** Weisbord, n. sp. 211
Holotype (J428a). 26643 PRI. Exterior and interior of left valve. Height 3.7 mm.; width 3.8 mm.; thickness 0.9 mm. Lower Mare formation.

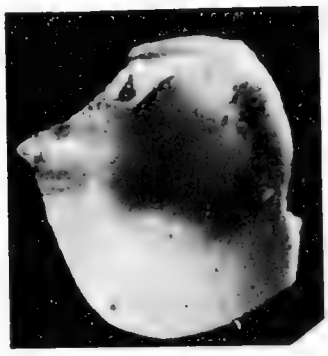

1
5
9
2
6
10
3
7
13
14
4
8
11
12

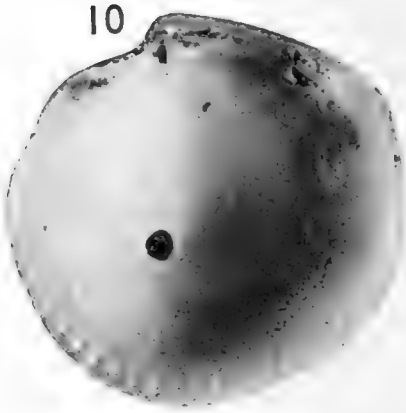

1

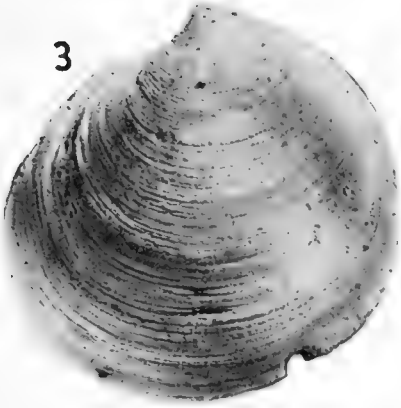

5

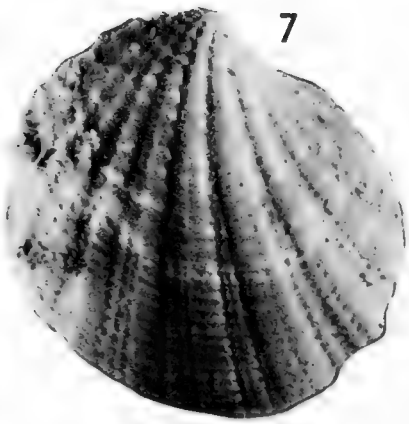

9

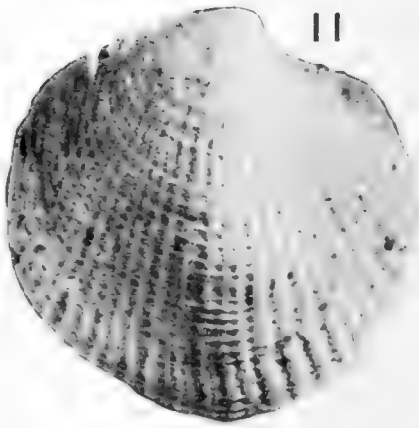

2

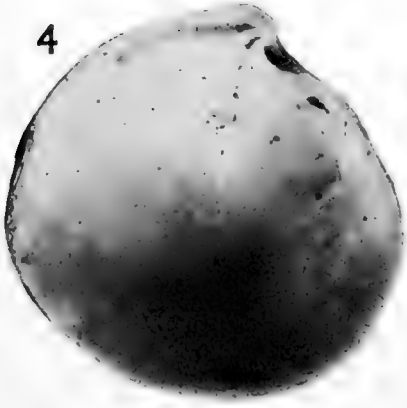

6

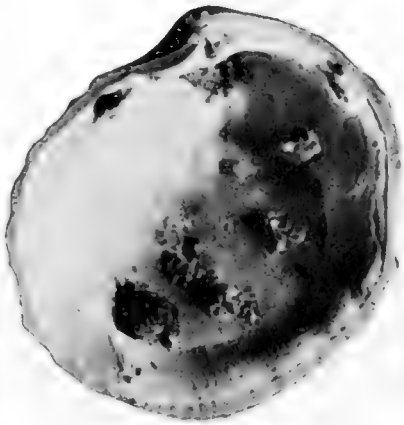

10

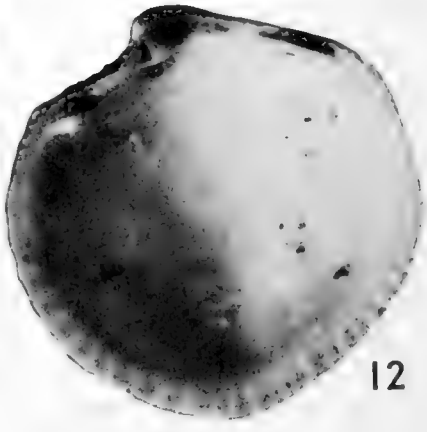

3


7


11


4


8


12

Explanation of Plate 28

Figure — Page

1-4. **Lucina (Cavilinga) trisulcata blanda** (Dall and Simpson) 214
Figs. 1, 2, specimen I528a. 26644 PRI. Exterior and interior of left valve. Height 7.2 mm.; width 7.4 mm.; thickness 2.3 mm. Lower Mare formation. Figs. 3, 4, specimen J427a. 26645 PRI. Exterior and interior of left valve. Height 9.3 mm.; width 9.2 mm.; thickness 2.6 mm. Lower Mare formation.

5,6. **Lucina (Callucina** ?) species 216
Specimen R525a. 26646 PRI. Exterior and interior of broken right valve. Height of fragment 1.7 mm.; width 1.5 mm. Playa Grande formation (Maiquetía member).

7,8. **Lucina (Bellucina) katherinepalmerae** Weisbord, n. sp. 217
Holotype (H526a). 26647 PRI. Exterior and interior of right valve. Height 5 mm.; width 4.4 mm.; thickness 1.9 mm. Mare formation.

9-12. **Lucina (Parvilucina) ephraimi** Weisbord, n. sp. 219
Figs. 9, 10, holotype (R521a). 26648 PRI. Exterior and interior of right valve. Height 4.9 mm.; width 4.9 mm.; thickness 1.8 mm. Playa Grande formation (Maiquetía member). Figs. 11, 12, paratype (R521b). 26649 PRI. Exterior and interior of right valve. Height 4 mm.; width 4 mm.; thickness 1.7 mm. Playa Grande formation (Maiquetía member).

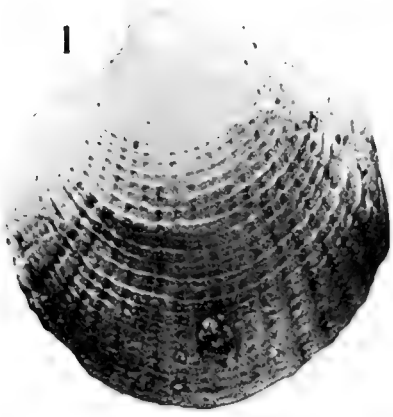
Explanation of Plate 29

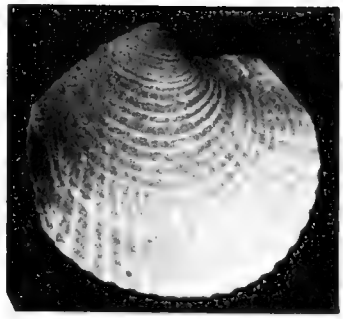
Figure — Page

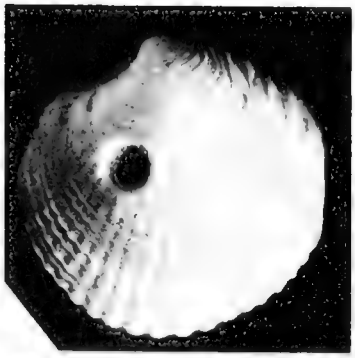
1-6. **Lucina (Parvilucina) ephraimi** Weisbord, n. sp. 219
Figs. 1, 2, paratype (R521c). 26650 Exterior and interior of left valve. Height 4.9 mm.; width 4.9 mm.; thickness 1.6 mm. Playa Grande formation (Maiquetía member). Figs. 3, 4, paratype (G521b). 26651 Exterior and interior of juvenile right valve. Height 2 mm.; width 2.1 mm. Mare formation. Figs. 5, 6, paratype (G521c). 26652 PRI. Exterior and interior of juvenile left valve. Height 2.9 mm.; width 2.9 mm. Mare formation.

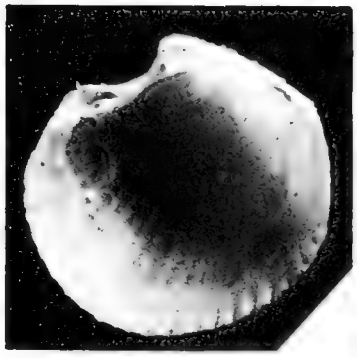
7,8. **Lucina (Parvilucina) multilineata** Tuomey and Holmes 221
Specimen R524a. 26653 PRI. Exterior and interior of right valve. Height 3.1 mm.; width 3.3 mm.; thickness 1.2 mm. Playa Grande formation (Maiquetía member).

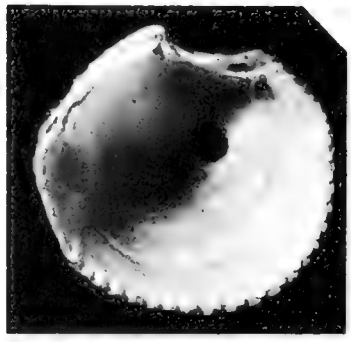
9-14. **Lucina (Lucinisca) muricata** (Spengler) 223
Figs. 9, 10, specimen C529a. 26654 PRI. Exterior and interior of right valve. Height 10 mm.; width 10 mm.; thickness 3 mm. Guaiguaza clay. Figs. 11, 12, specimen C518d. 26655 PRI. Exterior and interior of left valve. Height 7.4 mm.; width 7.5 mm.; thickness 2 mm. Guaiguaza clay. Figs. 13, 14, specimen C523a. 26656 PRI. Exterior and interior of juvenile right valve. Height 2.2 mm.; width 2 mm.; thickness 0.8 mm. Guaiguaza clay.

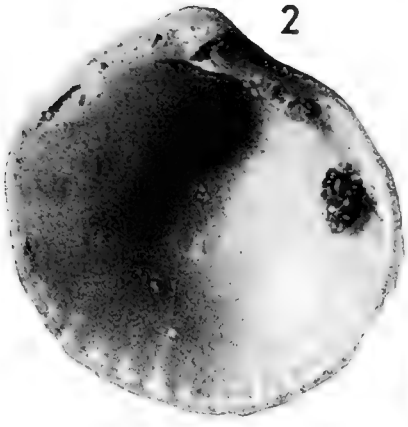

1


3

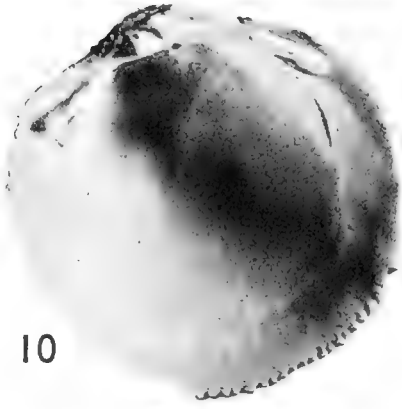

5


4

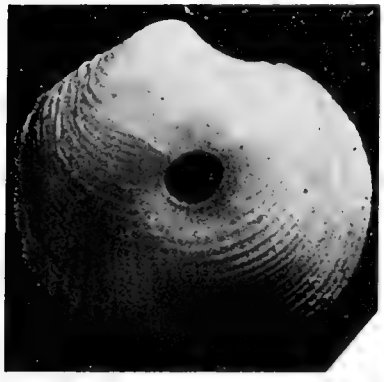

6


2

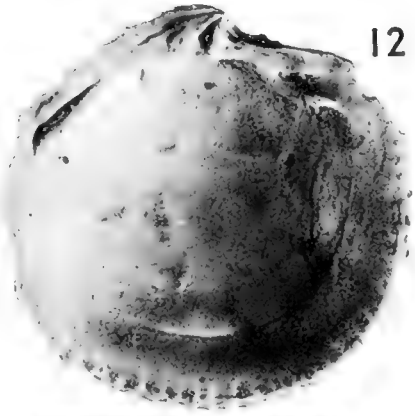

9

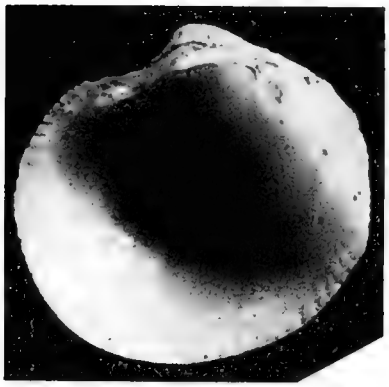

10

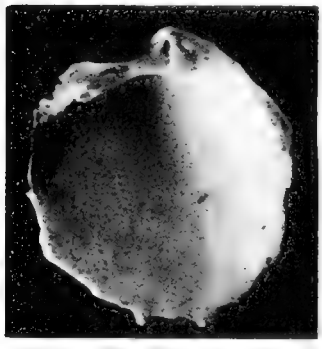
7

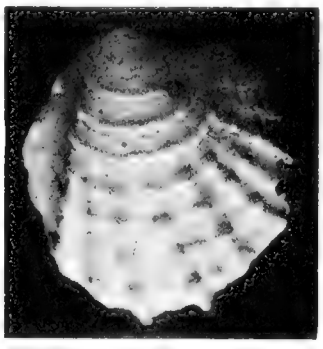


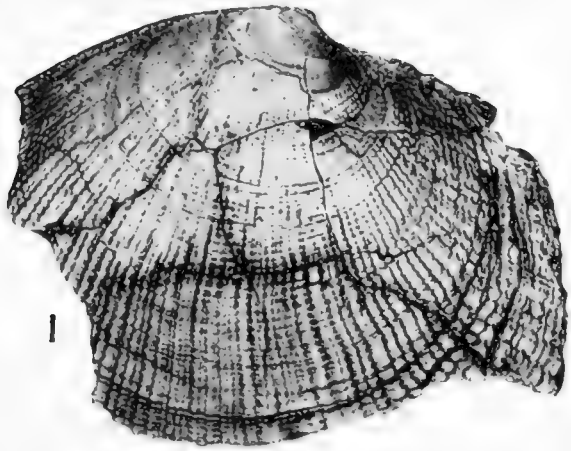

11

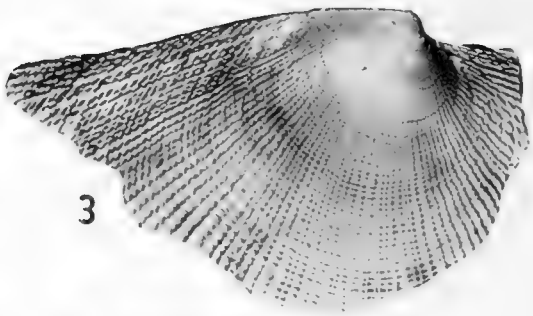

12

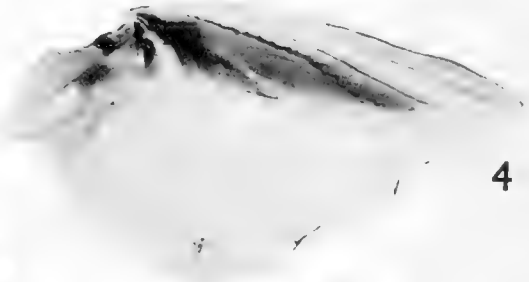

8


13

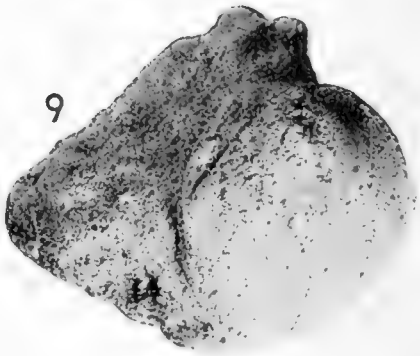

14

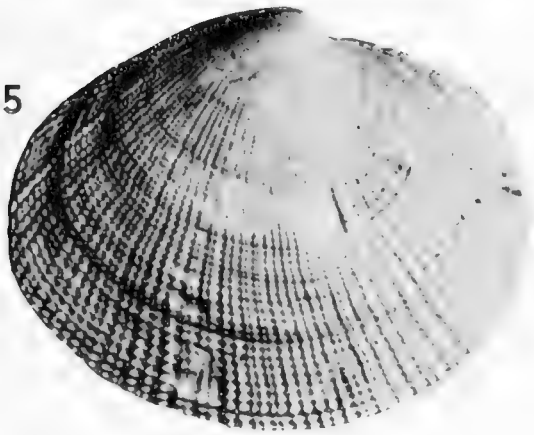

1

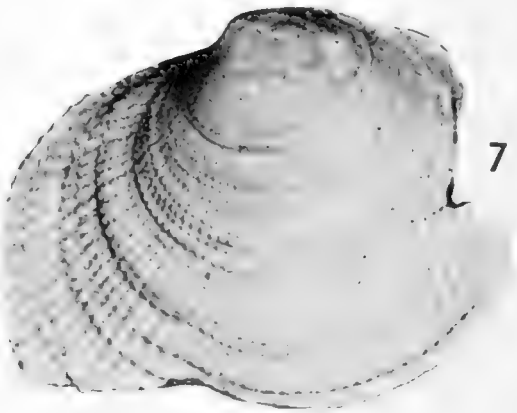

3

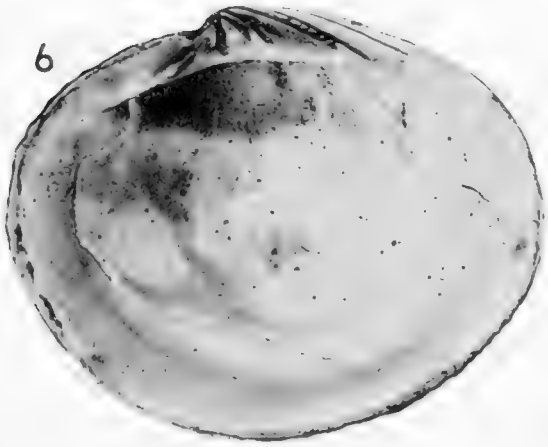

4

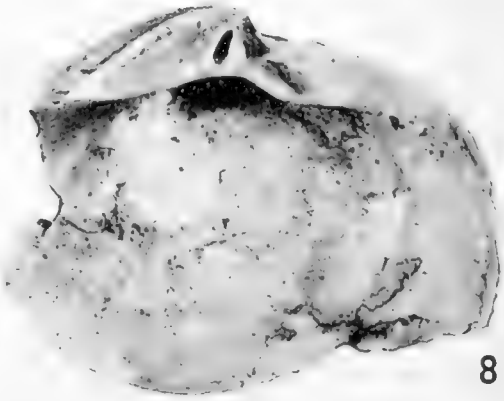

2


9


5


7


6


8

Explanation of Plate 30

Figure — Page

1-8. **Codakia (Lentillaria) orbicularis** (Linnaeus) 226

Figs. 1, 2, specimen S417a. 26657 PRI. Exterior and interior of broken right valve. Length 53.3 mm. Playa Grande formation (Maiquetía member). Figs. 3, 4, specimen S417b. 26658 PRI. Exterior and interior of broken right valve. Length 39.5 mm. Playa Grande formation (Maiquetía member). Figs. 5, 6, specimen S417c. 26659 PRI. Exterior and interior of young right valve. Height 30.2 mm.; length 37.2 mm.; thickness 5.2 mm. Playa Grande formation (Maiquetía member). Figs. 7, 8, specimen S417d. 26660 PRI. Exterior and interior of broken left valve. Length 31.8 mm. Playa Grande formation (Maiquetía member).

9. **Divaricella** ? species 237

Specimen L423a. 26661 PRI. Internal mold of right valve. Height 23 mm.; width 23.7 mm. Playa Grande formation (Catia member).

Explanation of Plate 31

Figure — Page

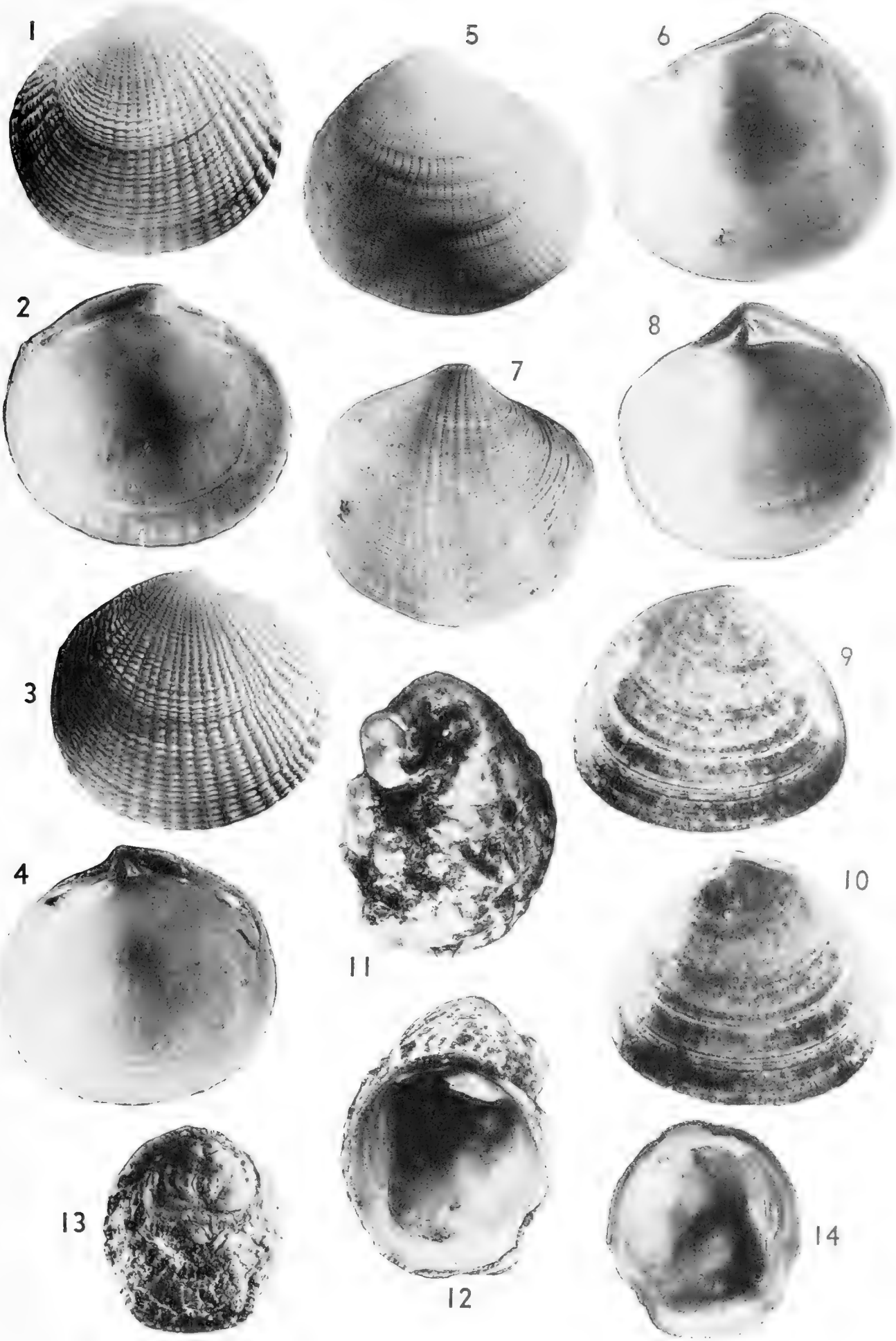
1-4. **Codakia (Jagonia) orbiculata** (Montagu) 229
Specimen A520a1-2. 26662 PRI. Paired valves. Height 12 mm.; width 12.9 mm.; thickness of pair 5.2 mm. Figs. 1, 2 (A520a1), exterior and interior of left valve. Figs. 3, 4 (A520a2), exterior and interior of right valve. Recent.

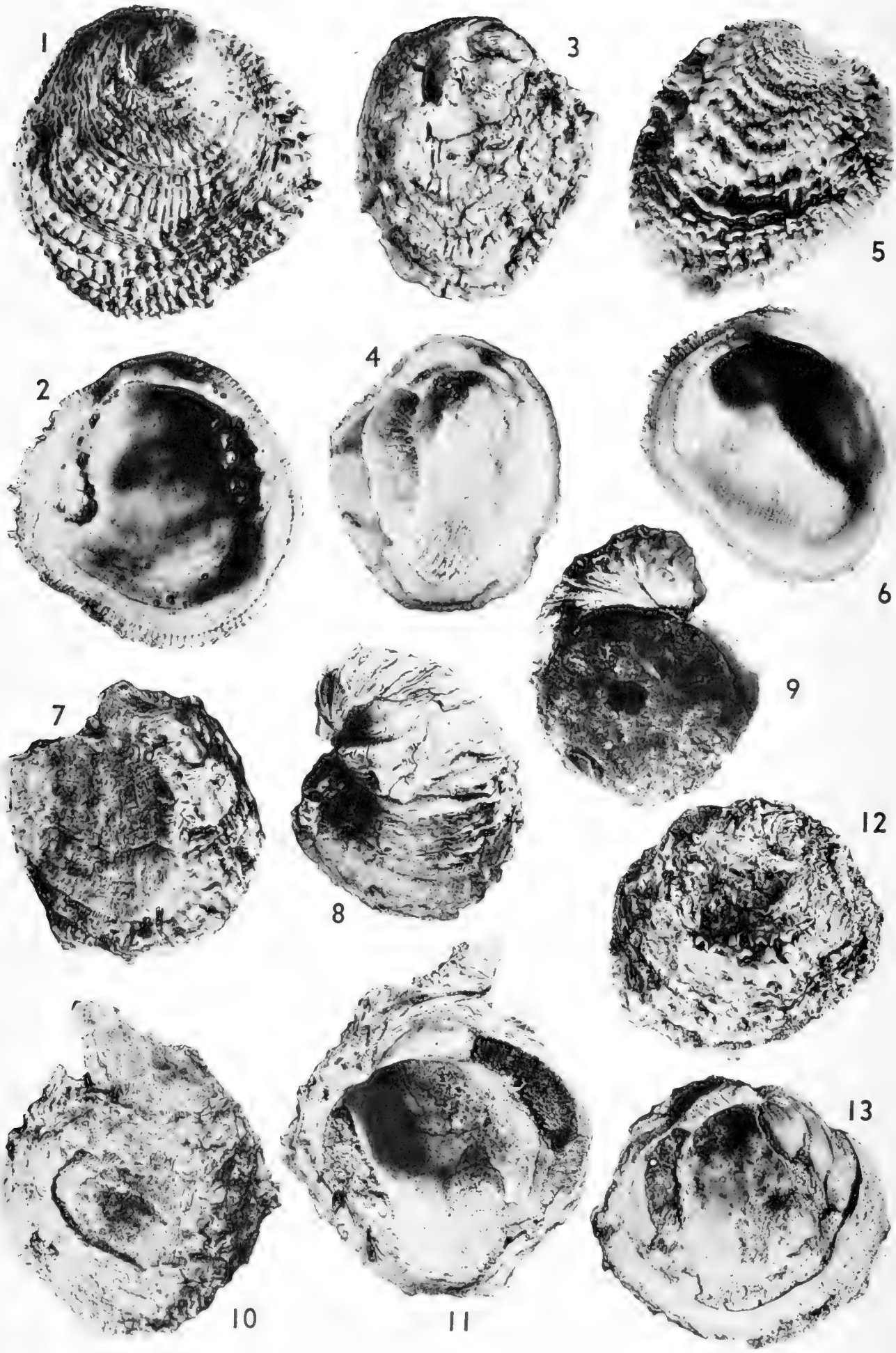
5,6. **Codakia (Jagonia) pectinata** (C. B. Adams) 234
Specimen A426a. 26663 PRI. Exterior and interior of right valve. Height 11.4 mm.; width 12 mm.; thickness 3.2 mm. Recent.

7,8. **Codakia (Jagonia) umbonicostata** Weisbord, n. sp. 236
Holotype (I519a). 26664 PRI. Exterior and interior of right valve. Height 10 mm.; width 10.5 mm.; thickness 3.2 mm. Lower Mare formation.

9,10. **Bornia tacaguana** Weisbord, n. sp. 251
Holotype (T548a). 26665 PRI. Exterior and interior of right valve. Width 3.4 mm.; height 3.1 mm.; thickness 0.5 mm. Upper Mare formation.

11-14. **Chama congregata** Conrad 238
Specimen A436a1-2. 26666 PRI. Paired valves. Figs. 11, 12 (A436a1), exterior and interior of left valve. Length 20 mm.; width 15 mm. Figs. 13, 14 (A436a2), exterior and interior of right valve. Length 15 mm.; width 13.7 mm.; thickness of attached valves 12 mm. Recent.


1
5
6
2
8
7
3
9
11
4
10
13
12
14


1
3
5
2
4
6
9
7
8
12
10
11
13

Explanation of Plate 32

Figure — Page

1-9. **Chama congregata** Conrad 238

Figs. 1, 2, specimen H436b. 26667 PRI. Exterior and interior of right valve. Length 15.2 mm.; width 14.9 mm.; thickness 4 mm. Mare formation. Figs. 3, 4, specimen I436a. 26668 PRI. Exterior and interior of right valve. Length 20.1 mm.; width 17.1 mm.; thickness 5 mm. Lower Mare formation. Figs. 5, 6, specimen J436b. 26669 PRI. Exterior and interior of right valve. Length 17.7 mm.; width 14.6 mm.; thickness 3.5 mm. Lower Mare formation. Fig. 7, specimen J436a. 26670 PRI. External view of left valve, showing flattened area of attachment. Length 28 mm.; width 24.8 mm.; thickness 15.2 mm. Lower Mare formation. Figs. 8, 9, specimen H436a. 26671 PRI. Exterior and interior of left valve. Length 25 mm.; width 20.4 mm.; thickness 11.5 mm. Identification uncertain. Mare formation.

10-13. **Chama sinuosa bermudensis** Heilprin 245

Figs. 10, 11, specimen C438a. 26672 Exterior and interior of left valve. Height 61 mm,; width 52 mm.; thickness 23 mm. Guaiguaza clay. Figs. 12, 13, specimen C438b. 26673 PRI. Exterior and interior of right valve. Height 40 mm.; width 41 mm.; thickness 9 mm. Guaiguaza clay.

Explanation of Plate 33

Figure — Page

1,2. **Chama macerophylla** Gmelin 241
Specimen A436b. 26674 PRI. Exterior and interior of right valve. Length 18.9 mm.; width 18 mm.; thickness 6.6. mm. Recent.

3,4. **Chama florida** Lamarck 244
Specimen A661a. 26675 PRI. Exterior and interior of right valve. Length 15 mm.; width 13 mm.; thickness 5.3 mm. Recent.

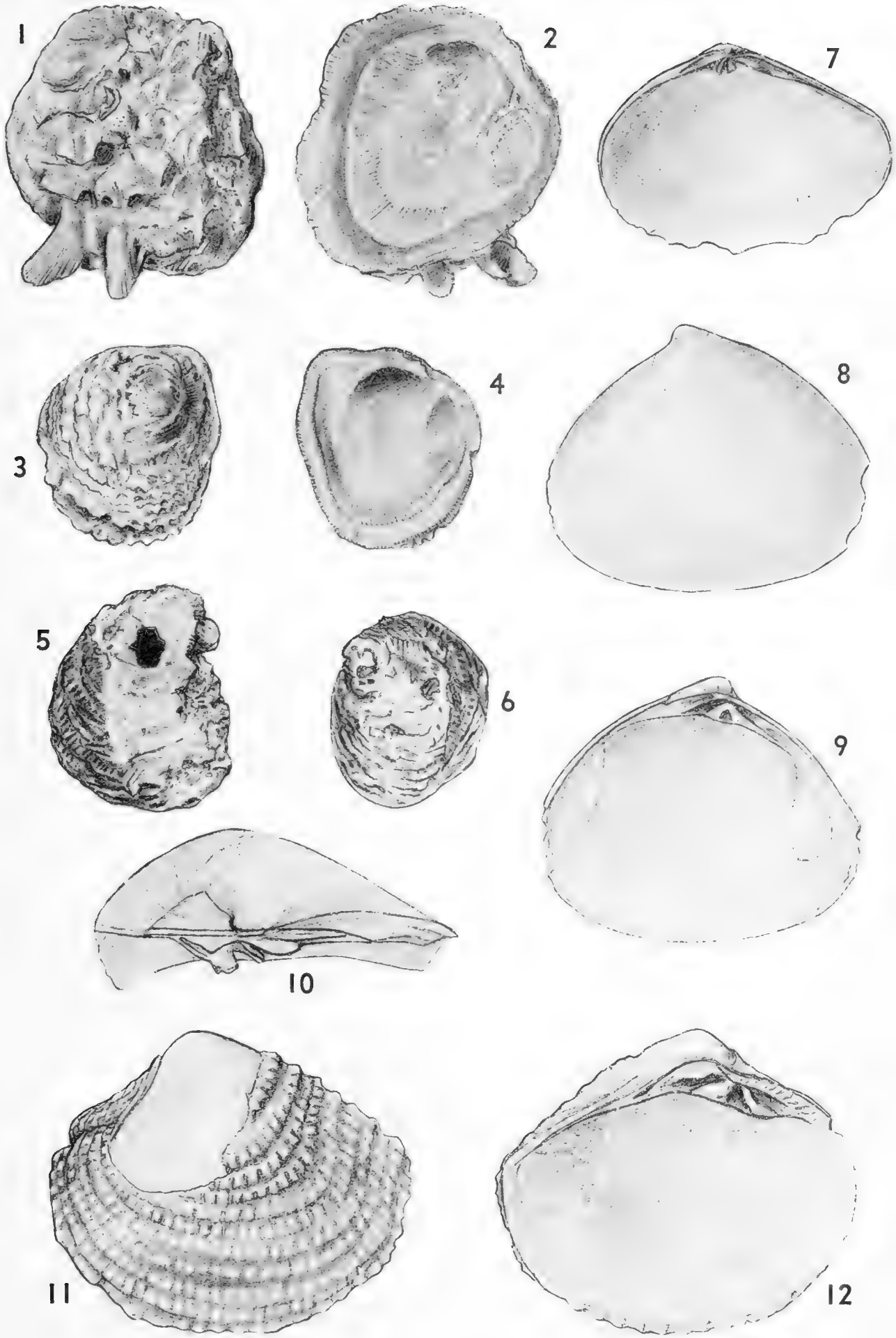
5,6. **Pseudochama radians** (Lamarck) 246
Specimen A662a1-2. 26676 PRI. Paired valves. Fig. 5. External view of right valve of pair. Height 31.5 mm.; width 27.3 mm.; thickness, 17.1 mm. Fig. 6, external view of left valve of pair. Height 23.6 mm.; width 27.5 mm.; thickness 5 mm. Recent.

7. **Tivela (Planitivela) venezuelana** Weisbord, n. sp. 281
Paratype (T451a). 26677 PRI. Internal view of left valve. Height 3.9 mm.; length, 4.8 mm.; thickness 1.2 mm. Upper Mare formation.

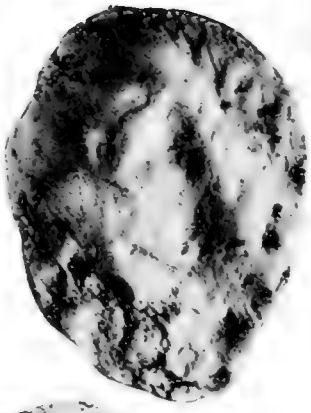
8,9. **Pitar (Pitar ?) antillensis** Weisbord, n. sp. 296
Holotype (T666a). 26678 PRI. Exterior and interior of left valve. Length 2.7 mm.; height 2.2 mm. Upper Mare formation.

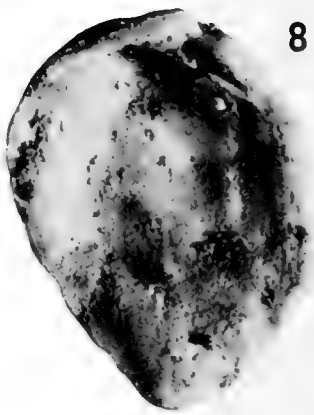
10. **Pitar (Pitarella ?) scutellaris** Weisbord, n. sp. 298
Holotype (G416a). 26679 PRI. View of umbo and hinge of right valve. Length of fragment 4.7 mm.; thickness at umbo 1.3 mm. Mare formation.

11,12. **Chione (Chione ?) mamoensis** Weisbord, n. sp. 315
Paratype (S401b). 26680 PRI. Exterior and interior of left valve. Length 11.2 mm.; height 9.7 mm.; thickness 3.3 mm. Playa Grande formation (Maiquetía member).


1
2
7
3
4
8
5
6
9
10
11
12

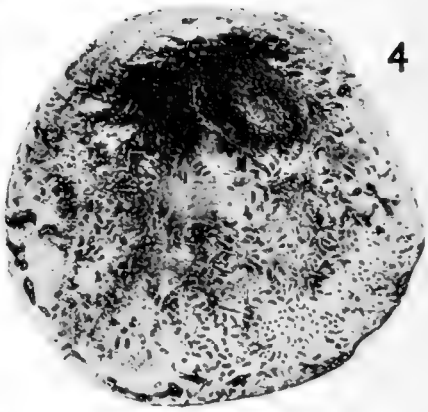

1

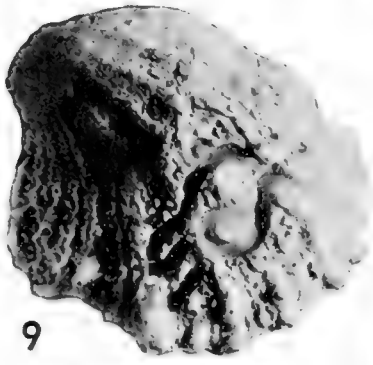

7


8

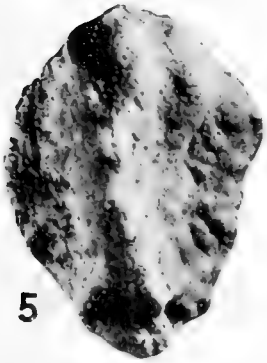

3

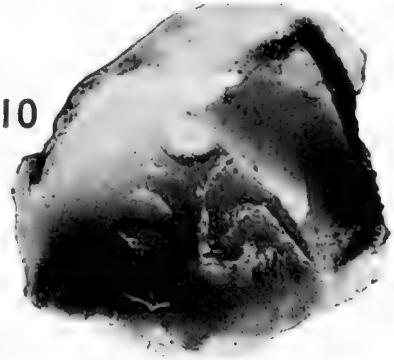

2

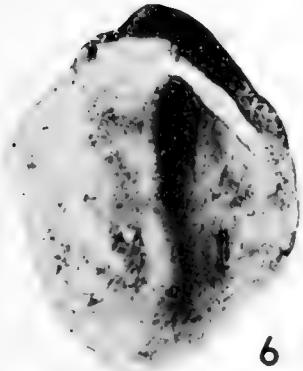

4

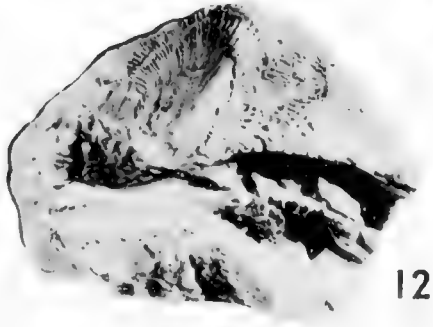

9

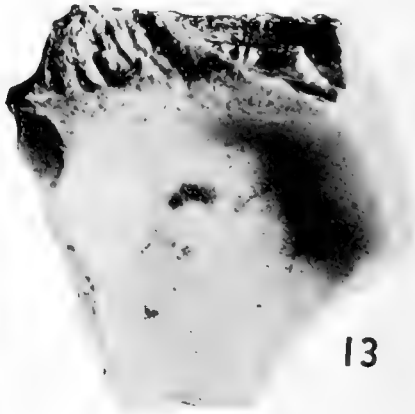

11


5


10


6


12


13

Explanation of Plate 34

Figure — Page

1-6. **Pseudochama radians** Lamarck 246
Figs. 1, 2, specimen D439a. 26681 PRI. Exterior and interior of right valve. Height 50 mm.; width 39.5 mm.; thickness 33 mm. Abisinia formation. Figs. 3, 4, specimen D439b. 26682 PRI. Exterior and interior of left valve. Height 33 mm.; width 33 mm.; thickness 10 mm. Abisinia formation. Figs. 5, 6, specimen D440a. 26683 PRI. Exterior and interior of young right valve. Height 12.6 mm.; width 10 mm.; thickness 7.1 mm. Identification uncertain. Abisinia formation.

7,8. **Pseudochama** ? species 249
Specimen D508a. 26684 PRI. Exterior and interior of immature left valve. Height 8 mm.; width 6 mm.; thickness 0.8 mm. Abisinia formation.

9,10. **Arcinella** species "a" 249
Specimen T442a. 26685 PRI. Exterior and interior of broken left valve. Height 16 mm.; width 12 mm. Upper Mare formation.

11-13. **Arcinella** species "b" 250
Specimen G435a. 26686 PRI. Figs. 11, 12, exterior and interior of apical area of right valve. Length 14.2 mm.; width 15 mm.; thickness at umbo 10.3 mm. Fig. 13, view looking down on beak. Mare formation.

Explanation of Plate 35

Figure — Page

1-8. **Trachycardium (Dallocardia) muricatum** (Linnaeus) 252

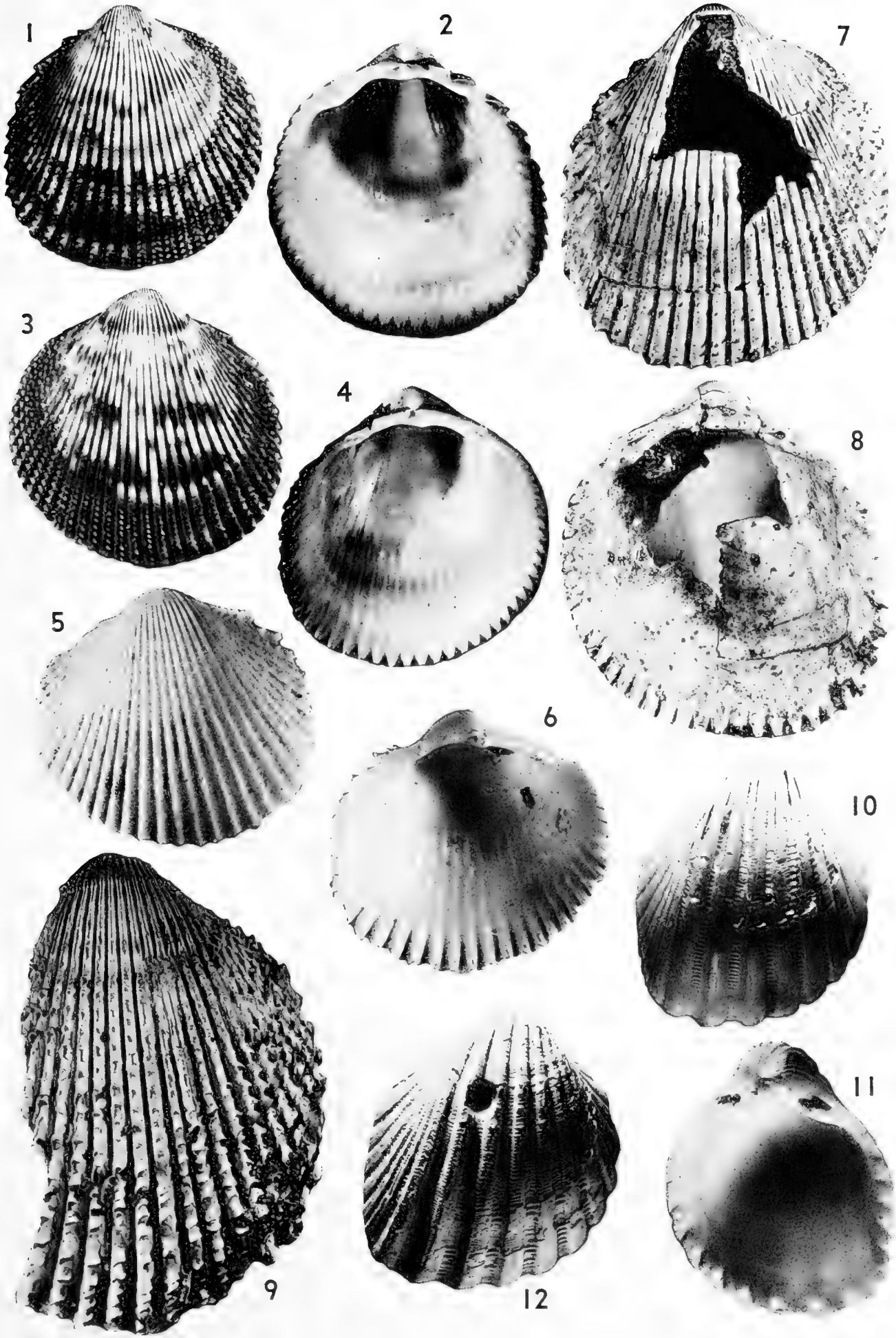
Figs. 1, 2, specimen A498a. 26687 PRI. Exterior and interior of right valve. Height 30 mm.; width 29 mm.; thickness 11.2 mm. Recent. Figs. 3, 4, specimen A498b. 26688 PRI. Exterior and interior of left valve. Height 28.8 mm.; width 27.9 mm.; thickness 11 mm. Recent. Figs. 5, 6, specimen I498a. 26689 PRI. Exterior and interior of juvenile left valve. Height 4.7 mm.; width 5 mm.; thickness 1.5 mm. Lower Mare formation. Figs. 7, 8, specimen H498a. 26690 PRI. Exterior and interior of right valve. Height 48 mm.; width 44 mm.; thickness 15 mm. Mare formation.

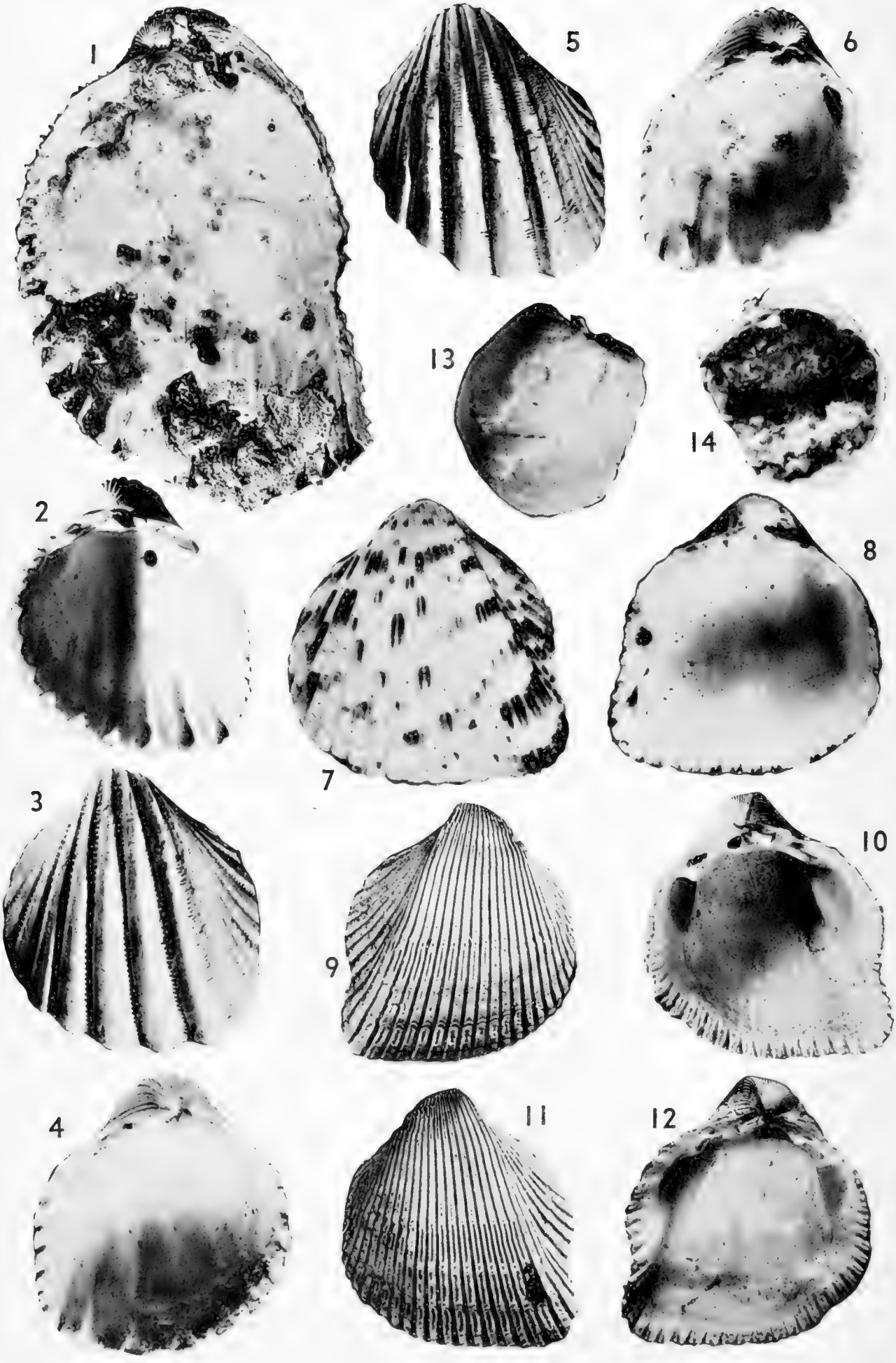
9. **Trachycardium (Trachycardium)** cf. **isocardia** (Linnaeus) 256

Specimen S500a. 26691 PRI. External view of anterior half of right valve. Height 66 mm.; thickness 24 mm. Playa Grande formation (Maiquetía member).

10-12. **Trigoniocardia (Trigoniocardia) caboblanquensis** Weisbord, n. sp. 259

Figs. 10, 11, holotype (G496d). 26692 PRI. Exterior and interior of right valve. Height 10.2 mm.; width 8.2 mm.; thickness 4.9 mm. Mare formation. Fig. 12, paratype (G496c). 26693 PRI. External view of right valve. Height 11.3 mm.; width 10.1 mm.; thickness 4.8 mm. Mare formation.


1
2
7
3
4
8
5
6
10
9
12
11


1
5
6
13
14
2
7
8
3
9
10
4
11
12

Explanation of Plate 36

Figure — Page

1. **Trachycardium (Trachycardium) cf. isocardia** (Linnaeus) 256
Specimen S500a. 26691 PRI. Interior of same specimen illustrated on Pl. 35, fig. 9. Playa Grande formation (Maiquetía member).

2-6. **Trigoniocardia (Trigoniocardia) caboblanquensis** Weisbord, n. sp. 259
Fig. 2, paratype (G496c). 26693 PRI. Interior of same specimen illustrated on Pl. 35, fig. 12. Mare formation. Figs. 3, 4, paratype (G496a). 26696 PRI. Exterior and interior of left valve. Height 9.1 mm.; width 8.5 mm.; thickness 3.2 mm. Mare formation. Figs. 5, 6, paratype (G496b). 26697 PRI. Exterior and interior of left valve. Height 10.9 mm.; width 9.2 mm.; thickness 5.3 mm. Mare formation.

7-12. **Trigoniocardia (Americardia) media** (Linnaeus) 264
Figs. 7. 8, specimen A497a. 26698 PRI. Exterior and interior of left valve. Height 17.9 mm.; length 16.1 mm.; thickness 6.4 mm. Recent. Figs. 9-12, specimen S497a1-2. 26699 PRI. Paired valves. Figs. 9, 10 (S497a1). Exterior and interior of right valve. Figs. 11, 12 (497a2). Exterior and interior of left valve. Height 29.3 mm.; length 26.1 mm.; thickness of paired valves 24.1 mm. Playa Grande formation (Maiquetía member).

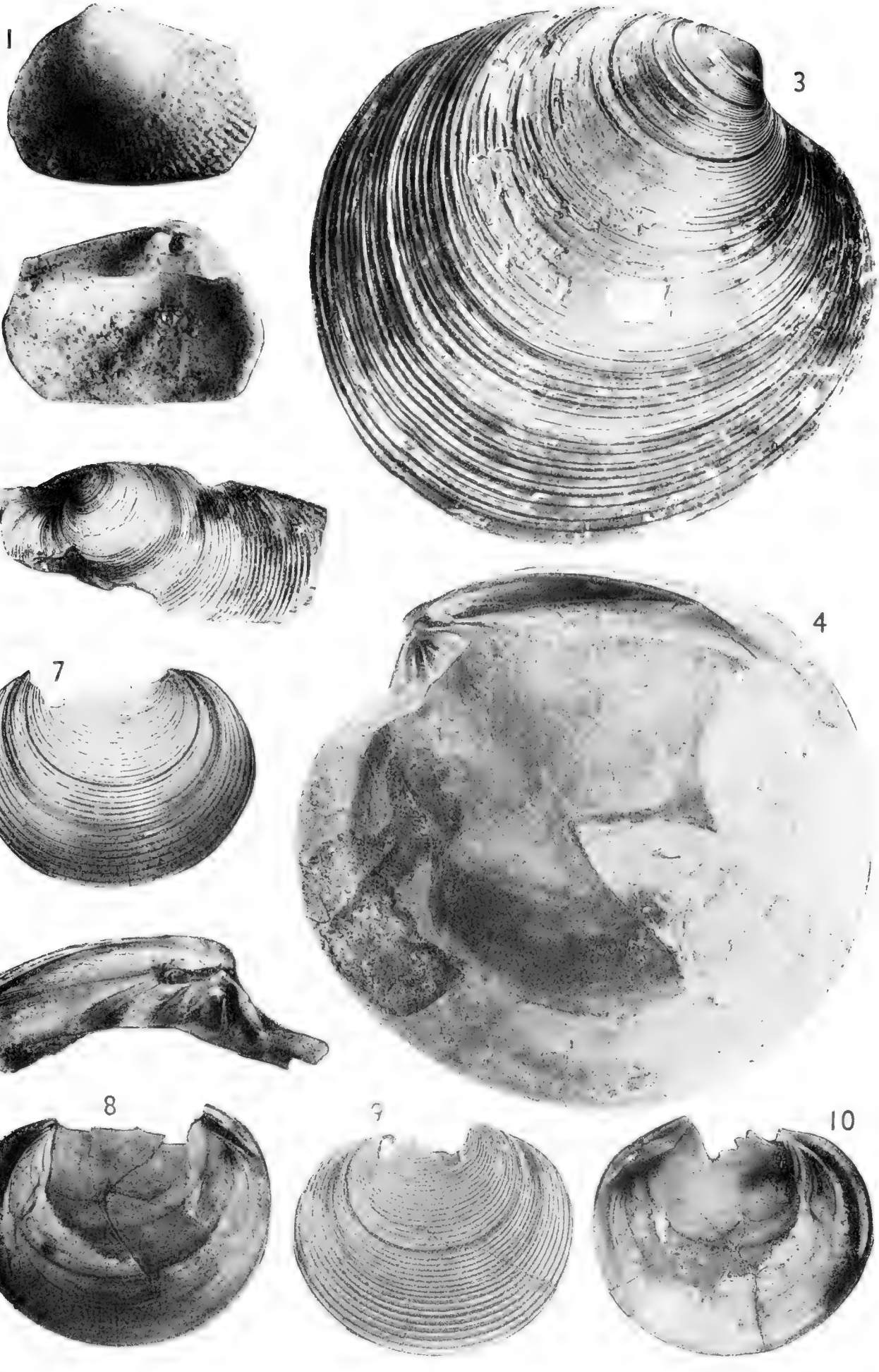
13,14. **Laevicardium** ? species 268
Specimen H550a. 26700 PRI. Exterior and interior of incomplete and juvenile right valve. Height 1.7 mm.; length 1.5 mm.; thickness 0.9 mm. Mare formation.

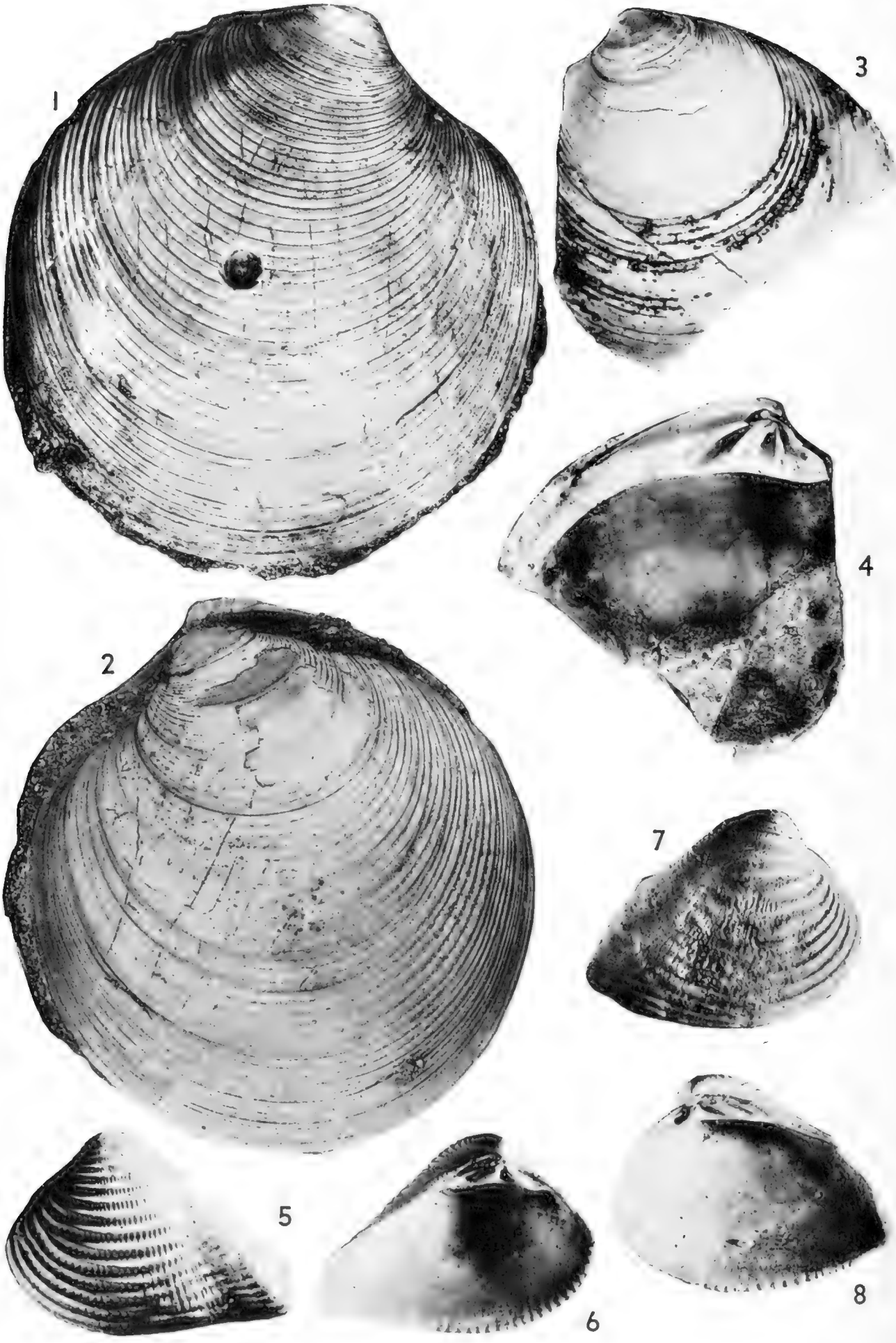
Explanation of Plate 37

Figure — Page

1,2. **Papyridea** aff. **soleniformis** (Bruguière) 268
Specimen I512a. 26701 PRI. Exterior and interior of broken left valve. Length 4.7 mm.; height 3.5 mm.; thickness 1.2 mm. Lower Mare formation.

3-10. **Dosinia (Dosinidia) concentrica prosapia** Weisbord, n. subsp. 270
Figs. 3, 4, holotype (T418a). 26702 PRI. Exterior and interior of right valve. Length 75.5 mm.; height 75 mm.; thickness 14.5 mm. Upper Mare formation. Figs. 5, 6, paratype (I418a). 26703 PRI. Hinge area of left valve. Length of fragment 52 mm. Lower Mare formation. Figs. 7-10, paratype (G420a1-2). 26704 PRI. Young valves of pair. Length 36 mm.; thickness of doublet 14.5 mm. Figs. 7, 8 (G420a1). Exterior and interior of right valve of pair; figs. 9, 10 (G420a2). Exterior and interior of left valve of pair. Mare formation.


1
2
3
5
4
7
6
8
9
10


1
3
4
2
7
5
6
8

Explanation of Plate 38

Figure — Page

1-4. **Dosinia (Dosinidia) concentrica prosapia** Weisbord, n. subsp. 270
Figs. 1, 2, paratype (R419a1-2). 26705 PRI. Paired valves. Length 67 mm.; height 70.5 mm. Fig. 1, exterior of right valve. Fig. 2, exterior of left valve. Playa Grande formation (Maiquetía member). Figs. 3, 4, paratype (R419b). 26706 PRI. Hinge area of left valve. Height of fragment 47 mm. Playa Grande formation (Maiquetía member).

5-8. **Anomalocardia brasiliana** (Gmelin) 274
Figs. 5, 6, specimen C539a. 26868 PRI. Exterior and interior of left valve. Length 12.7 mm.; height 8.9 mm.; thickness 3.3 mm. Guaiguaza clay. Figs. 7, 8, specimen C539b. 26869 PRI. Exterior and interior of right valve. Length 10.8 mm.; height 8.8 mm.; thickness 3 mm. Guaiguaza clay.

Explanation of Plate 39

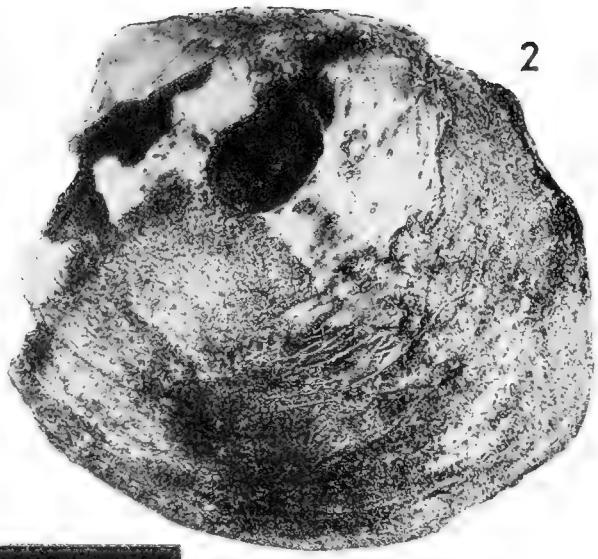
Figure — Page

1,2. **Dosinia (Dosinidia) concentrica prosapia** Weisbord, n. subsp. 270
Paratype (K414a). 26709 PRI. Paired valves. Length 71.5 mm.; height 74 mm.; thickness of pair 28 mm. Fig. 1, exterior of right valve; fig. 2, exterior of left valve. Playa Grande formation (Catia member).

3-6. **Anomalocardia venezuelana** Weisbord, n. sp. 276
Figs. 3, 4, holotype (C399a). 26710 PRI. Exterior and interior of right valve. Length 2.5 mm.; height 2.1 mm.; thickness 0.8 mm. Guaiguaza clay. Figs. 5, 6, paratype (C399b). 26711 PRI. Exterior and interior of right valve. Length 2 mm.; height 1.75 mm.; thickness 0.7 mm. Guaiguaza clay.

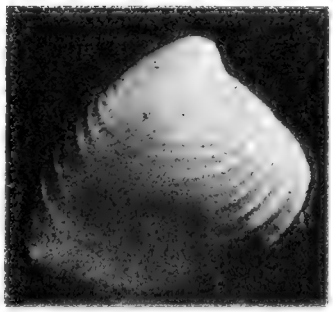
7-13. **Tivela (Tivela) mactroides** (Born) 278
Figs. 7-10, specimen B543a1-2. 26712 PRI. Paired valves. Figs. 5, 8 (B543a1), exterior and interior of right valve of pair. Height 37 mm.; length 42.5 mm.; thickness 12.8 mm. Figs. 9, 10 (B543a2), exterior and interior of left valve of pair. Height 37.2 mm.; length 43 mm.; thickness 12.5 mm. Recent. Fig. 11, specimen B543b. 26713 PRI. Dorsal view of attached valves. Height 41 mm.; length 48 mm.; thickness 29 mm. Recent. Figs. 12, 13, specimen D546a. 26714 PRI. Exterior and interior of left valve. Height 8 mm.; length 9.9 mm.; thickness 3.3 mm. Abisinia formation.

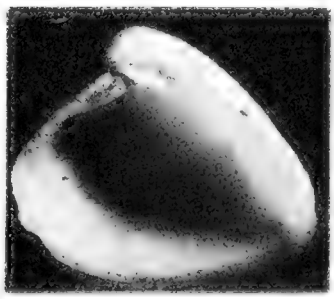

1

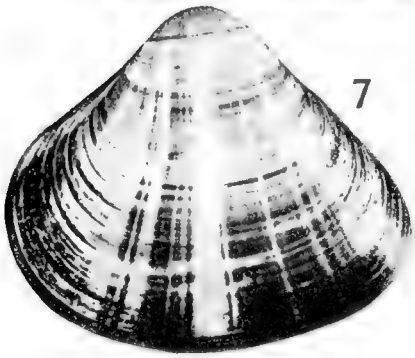

2

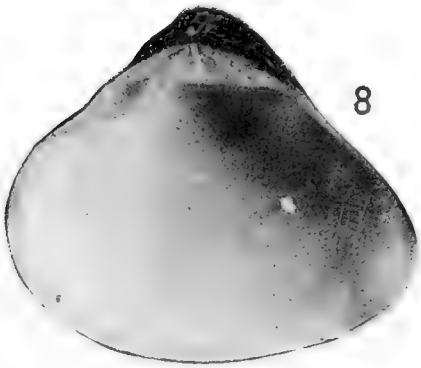

3

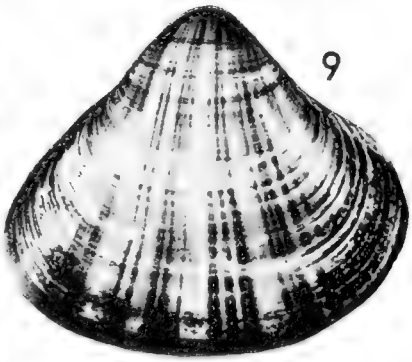

4


5


6

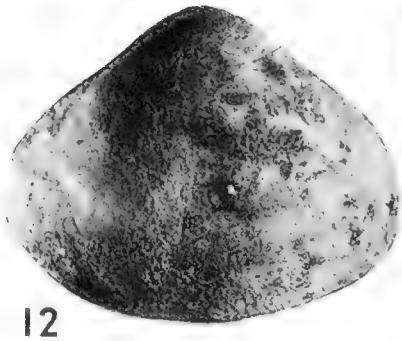

7

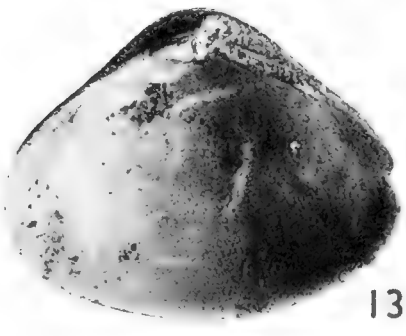

8

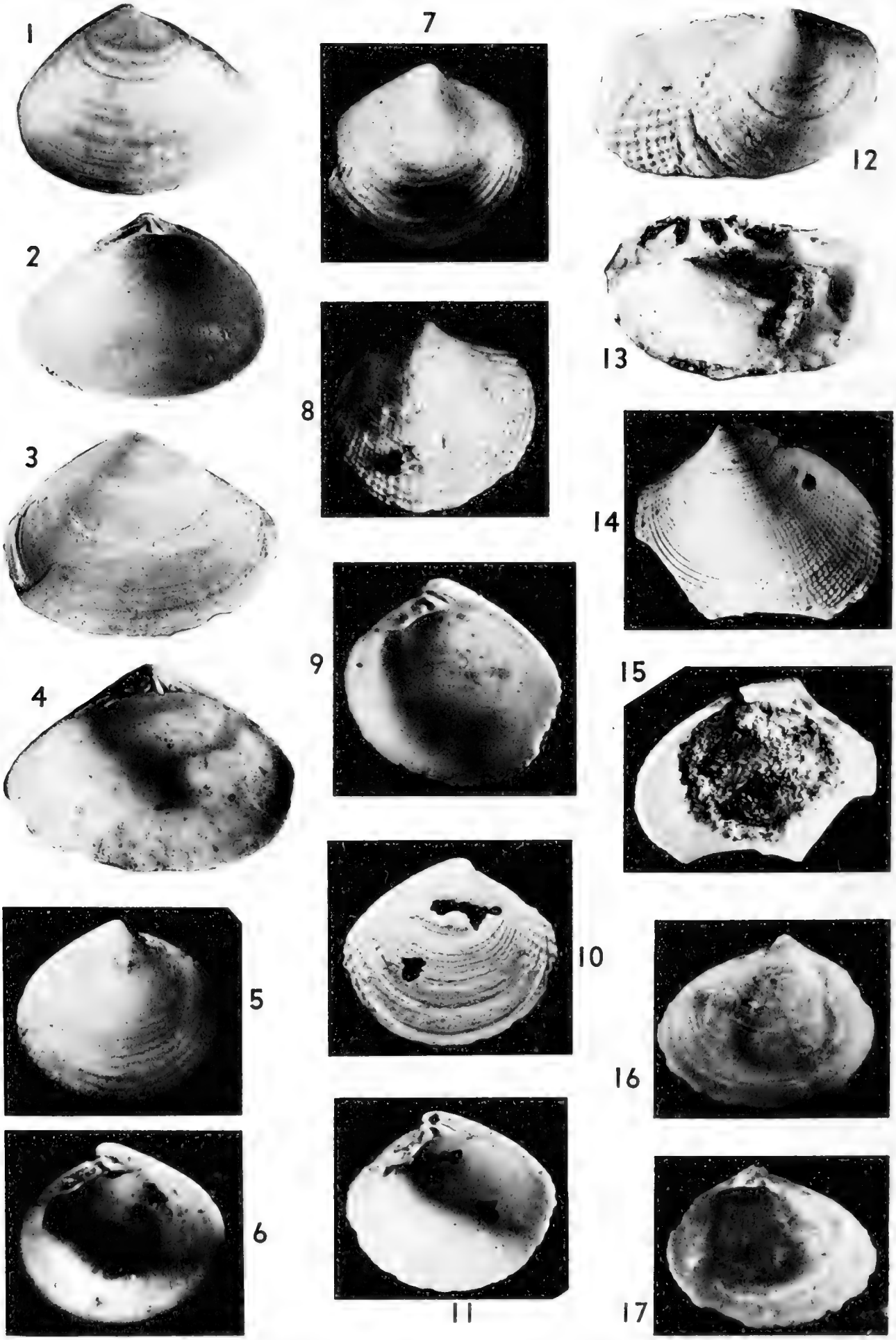

9


10


11


12


13


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Explanation of Plate 40

Figure — Page

1-4. **Tivela (Planitivela) venezuelana** Weisbord, n. sp. 281
Figs. 1, 2, holotype (J451a). 26715 PRI. Exterior and interior of right valve. Height 4.1 mm.; length 5 mm.; thickness 1.3 mm. Lower Mare formation Figs. 3, 4, paratype (I457a). 26716 PRI. Exterior and interior of right valve. Height 6 mm.; length 8 mm.; thickness 1.8 mm. Lower Mare formation.

5-15. **Gouldia venezuelana** Weisbord, n. sp. 282
Figs. 5, 6, holotype (S533b). 26717 PRI. Exterior and interior of right valve. Length 1.6 mm.; width 1.4 mm. Playa Grande formation (Maiquetía member). Fig. 7, paratype (S533a). 26718 PRI. External view of right valve. Length 1.7 mm.; height 1.5 mm. Playa Grande formation (Maiquetía member). Figs. 8, 9, paratype (S532a). 26719 PRI. Exterior and interior of right valve. Length 2.1 mm.; height 1.9 mm. Playa Grande formation (Maiquetía member). Figs. 10, 11, paratype (S522a). 26720 PRI. Exterior and interior of right valve. Length 3.2 mm.; height 2.8 mm. Playa Grande formation (Maiquetía member). Figs. 12, 13, paratype (H527a). 26721 PRI. Hinge area of left valve. Length 4.7 mm. Mare formation. Figs. 14, 15, paratype (H421a). 26722 PRI. Exterior and interior of broken left valve. Length 5 mm. Mare formation.

16,17. **Gouldia ? diffidentia** Weisbord. n. sp. 284
Holotype (I510a). 26723 PRI. Exterior and interior of juvenile left valve. Length 1.7 mm.; height 1.2 mm. Lower Mare formation.

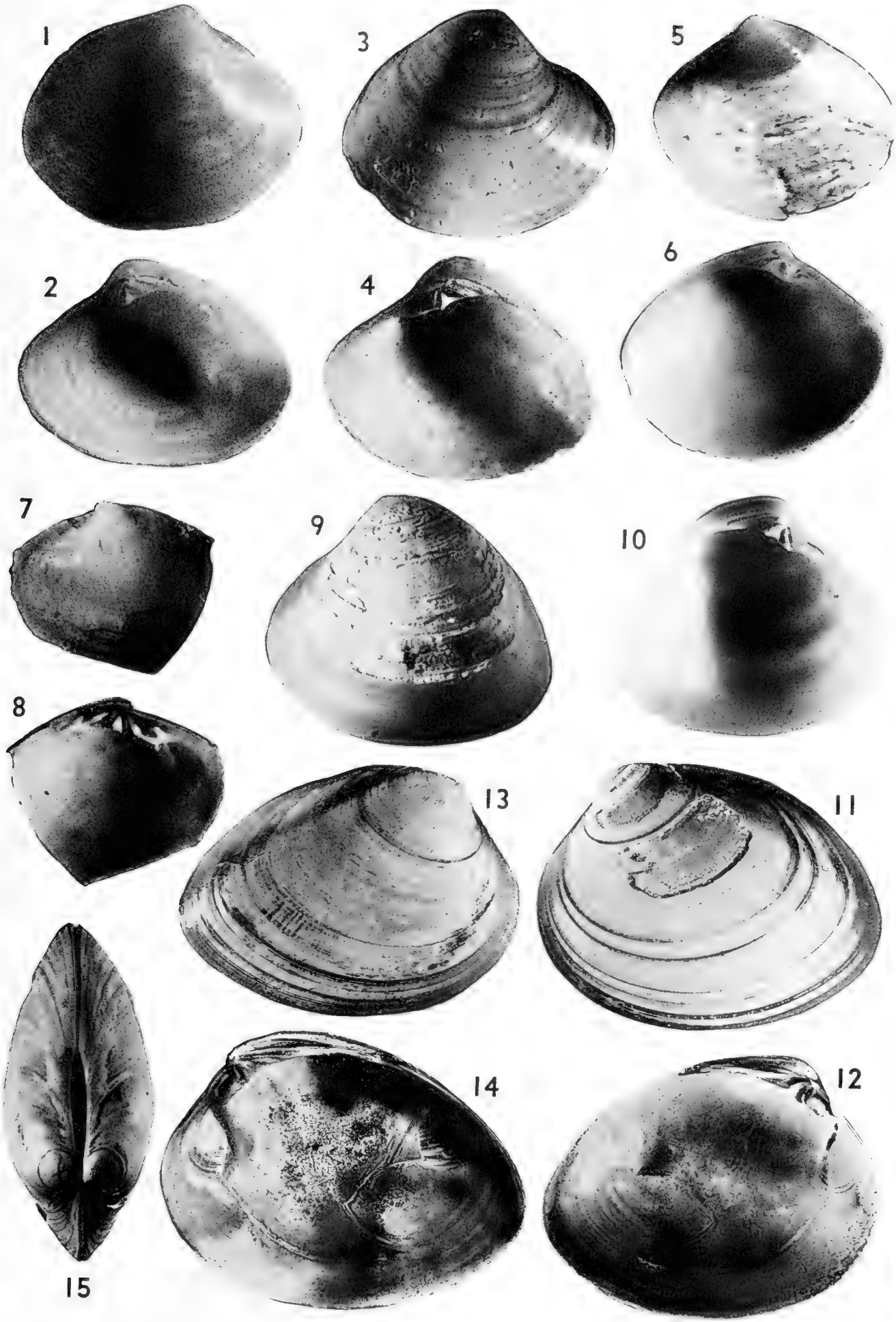
Explanation of Plate 41

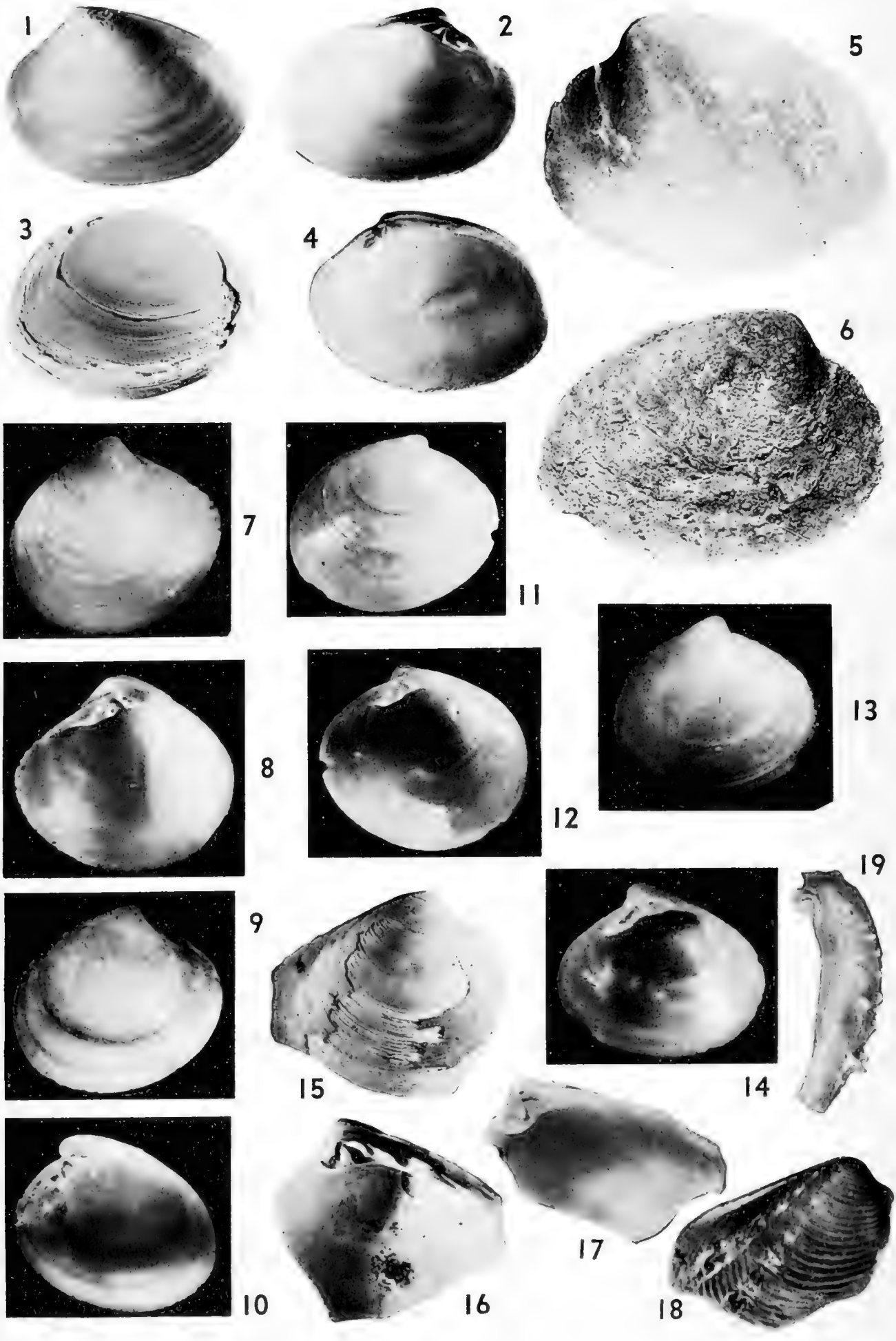
Figure — Page

1-8. **Transennella caboblanquensis** Weisbord, n. sp. 285
Figs. 1, 2, holotype (I516c). 26724 PRI. Exterior and interior of right valve. Length 4.5 mm.; height 3.6 mm.; thickness 1.8 mm. Lower Mare formation. Figs. 3, 4, paratype (I516b). 26725 PRI. Exterior and interior of right valve. Length 5.5 mm.; height 4.8 mm.; thickness 2 mm. Lower Mare formation. Figs. 5, 6, paratype (I516a). 26726 PRI. Exterior and interior of left valve. Length 3 mm.; height 2.5 mm.; thickness 1 mm. Lower Mare formation. Figs. 7, 8, paratype (T517a). 26727 PRI. Exterior and interior of broken left valve. Length 1.9 mm. Upper Mare formation.

9,10. **Transennela venezuelana** Weisbord, n. sp. 287
Holotype (S552a). 26728 PRI. Exterior and interior of left valve. Length 6.2 mm.; height 5.5 mm.; thickness 1.7 mm. Playa Grande formation (Maiquetía member).

11-15. **Macrocallista maculata** (Linnaeus) 288
Figs. 11, 12, specimen G295a. 26729 PRI. Exterior and interior of left valve. Length 64 mm.; height 50 mm.; thickness 14 mm. Upper Mare formation. Figs. 13, 14, specimen G295b. 26730 PRI. Exterior and interior of right valve. Length 72.5 mm.; height 54 mm.; thickness 12 mm. Upper Mare formation. Fig. 15, specimen E295a. 26731 PRI. Dorsal view of attached valves. Length 71 mm.; height 54 mm.; thickness of doublet 31.5 mm. Upper Mare formation.


1
3
5
2
4
6
7
9
10
8
13
11
14
12
15


1
2
5
3
4
6
7
11
8
12
13
9
15
14
19
10
16
17
18

Explanation of Plate 42

Figure — Page

1-6. **Macrocallista maculata** (Linnaeus) 288
Figs. 1, 2, specimen G295e. 26732 PRI. Exterior and interior of young left valve. Length 13.9 mm.; height 10.1 mm.; thickness 2.8 mm. Upper Mare formation. Figs. 3, 4, specimen G295f. 26733 PRI. Exterior and interior of young right valve. Length 14.6 mm.; height 11.4 mm.; thickness 3.3 mm. Upper Mare formation. Figs. 5, 6, specimen M295a. 26734 PRI. Internal mold of paired valves. Length 65 mm.; height 48 mm.; thickness of pair 26 mm. Fig. 5, left valve; fig. 6, right valve. Playa Grande formation (Catia member).

7,8. **Pitar (Pitar) albida** (Gmelin) 293
Specimen C407a. 26735 PRI. Exterior and interior of juvenile right valve. Length 1.9 mm.; height 1.7 mm. Guaiguaza clay.

9,10. **Pitar (Pitar) maiquetiensis** Weisbord, n. sp. 295
Holotype (T515a). 26736 PRI. Exterior and interior of juvenile right valve. Length 1.9 mm.; height 1.7 mm. Upper Mare formation.

11-14. **Pitar (Nanopitar) marensis** Weisbord, n. sp. 297
Figs. 11, 12, holotype (I515b). 26737 PRI. Exterior and interior of right valve. Length 1.8 mm.; height 1.5 mm. Lower Mare formation. Figs. 13, 14, paratype (I515a). 26738 PRI. Exterior and interior of right valve. Length 1.3 mm.; height 1.5 mm. Lower Mare formation.

15,16. **Pitar (Pitarella ?) scutellaris** Weisbord, n. sp. 298
Holotype (G416a). Exterior and interior of incomplete right valve. Length of fragment 4.7 mm.; thickness (at umbo) 1.3 mm. Mare formation.

17-19. **Pitar (Hysteroconcha) dione** (Linnaeus) 300
Specimen J397a. 26740 PRI. Internal, external, and posterodorsal views of incomplete right valve. Height of fragment 18.5 mm.; thickness 6 mm. Lower Mare formation.

Explanation of Plate 43

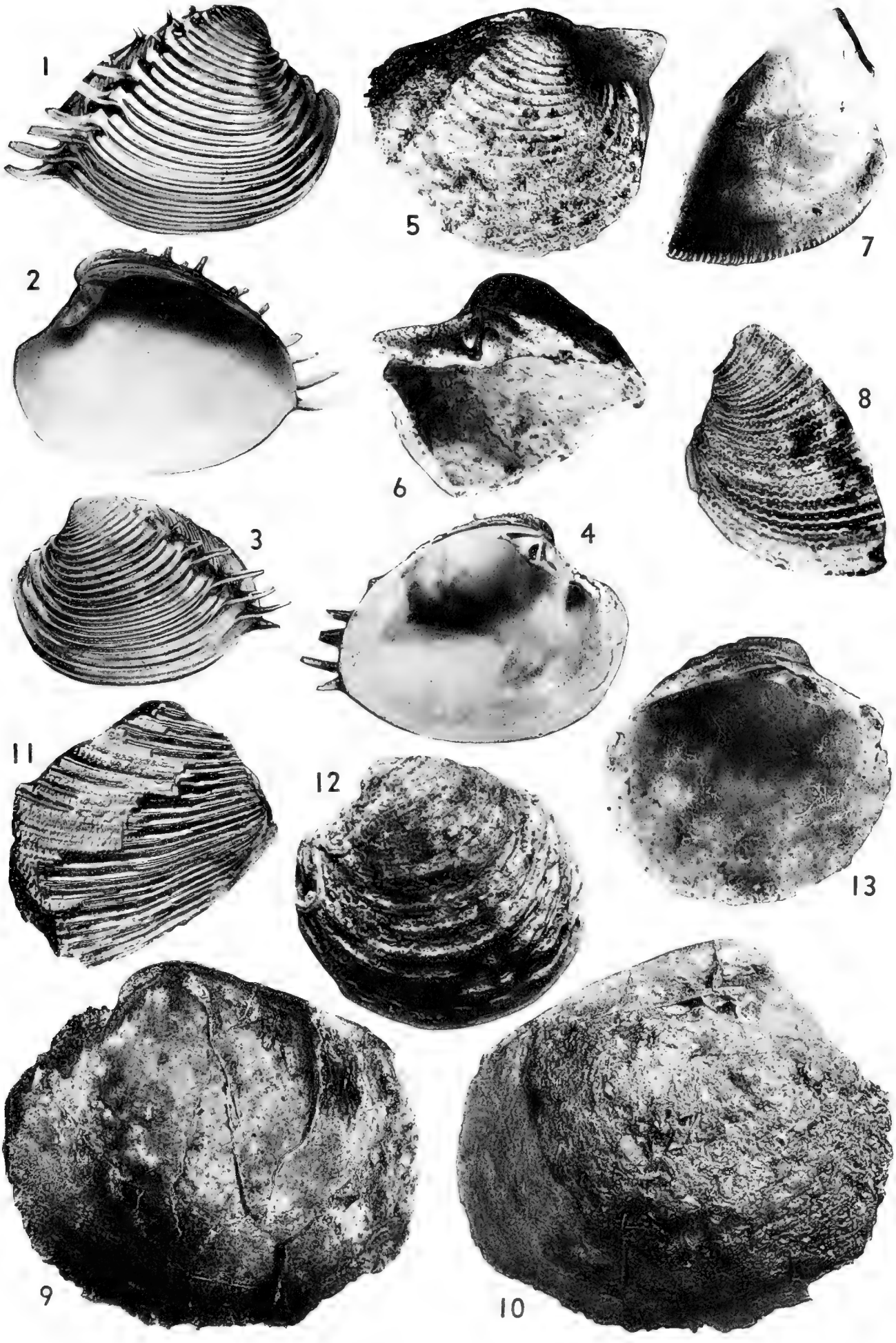
Figure — Page

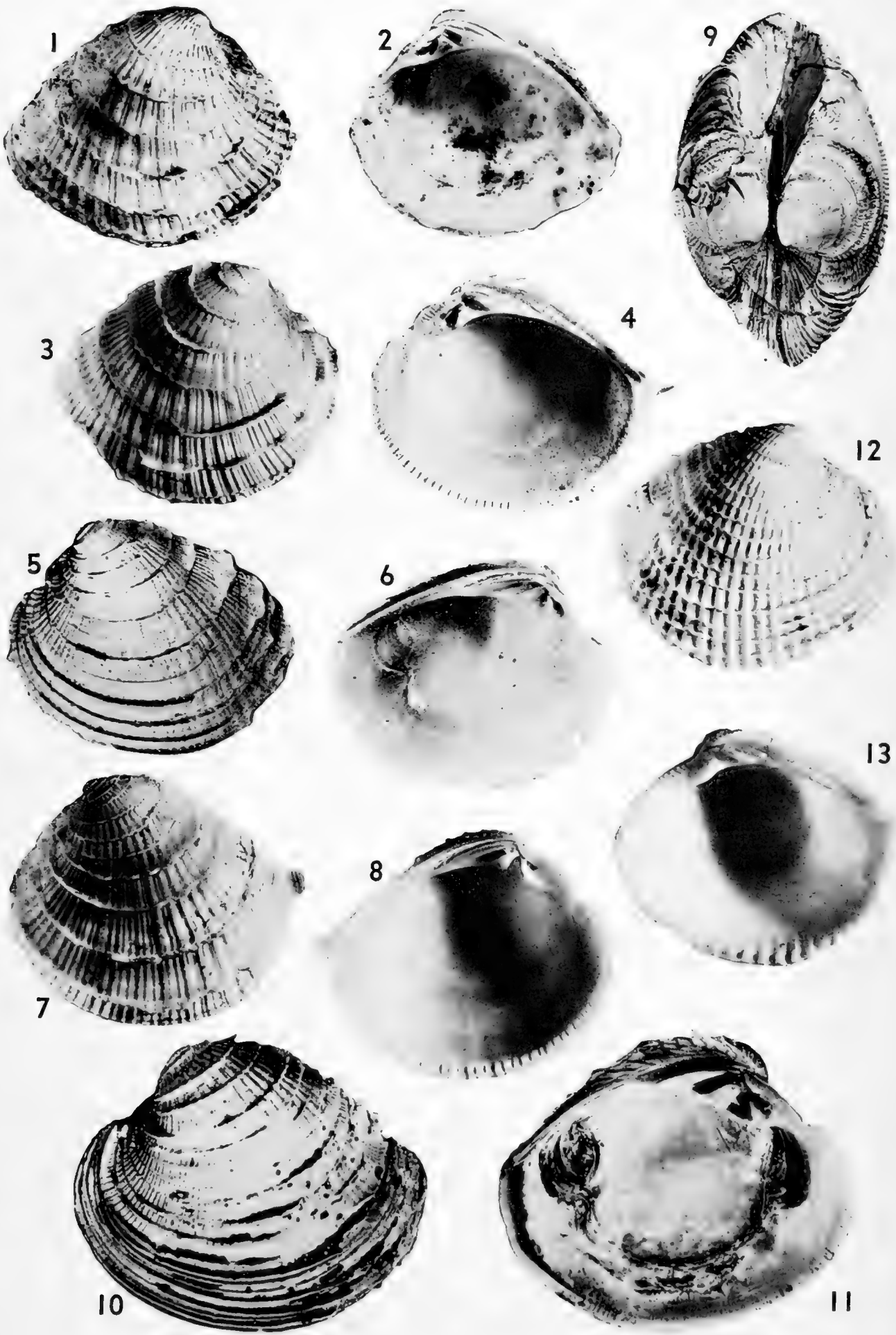
1-6. **Ptiar (Hysteroconcha) dione** (Linnaeus) 300
Figs. 1, 2, specimen B397a. 26741 PRI. Exterior and interior of right valve. Length 31.2 mm.; height 25 mm.; thickness 7.6 mm. Recent. Figs. 3, 4, specimen B397b. 26742 PRI. Exterior and interior of left valve. Length 36 mm.; height 28.1 mm.; thickness 7.5 mm. Recent. Figs. 5, 6, specimen D403a. 26743 PRI. Exterior and interior of broken right valve. Length of fragment 18.4 mm.; thickness 7.3 mm. Identification uncertain. Abisinia formation

7,8. **Periglypta** aff. **listeri** (Gray) 302
Specimen I410a. 26744 PRI. Interior and exterior of anterior end of left valve. Height of fragment 27.5 mm. Lower Mare formation.

9-11. **Antigona (Ventricolaria)** aff. **rigida** (Dillwyn) 304
Figs. 9, 10, specimen M411a. 26745 PRI. Internal mold of paired valves. Length 79 mm.; height 75 mm.; thickness of doublet 53 mm. Fig. 9, left valve; fig. 10, right valve. Playa Grande formation (Catia member). Fig. 11, specimen H412a. 26746 PRI. Height of fragment 27.4 mm. Identification uncertain. Mare formation.

12,13. **Antigona (Ventricolaria) rugatina** (Heilprin) 306
Specimen A402a. 26747 PRI. Exterior and interior of left valve. Length 19.7 mm.; height 18.3 mm.; thickness 6 mm. Recent.


1
5
7
2
6
8
3
4
11
12
13
9
10


1
2
9
3
4
12
5
6
13
8
7
10
11

Explanation of Plate 44

Figure — Page

1-8. **Chione (Chione) cancellata** (Linnaeus) 308
Figs. 1, 2, specimen C400a. 26748 PRI. Exterior and interior of right valve. Length 21 mm.; height 18.1 mm.; thickness 5.6 mm. Guaiguaza clay. Fig. 3, specimen J400a. 26749 PRI. External view of right valve. Length 18.2 mm.; height 15.4 mm.; thickness 3.7 mm. Lower Mare formation. Fig. 4, specimen T400a. 26750 PRI. Internal view of right valve. Length 23.2 mm.; height 19.4 mm.; thickness 4.6 mm. Upper Mare formation. Figs. 5, 6, specimen T400b. 26751 PRI. Exterior and interior of left valve. Length 32.1 mm.; height 26 mm.; thickness 8 mm. Upper Mare formation. Figs. 7, 8, specimen I400b. 26752 PRI. Exterior and interior of left valve. Length 17.8 mm.; height 15.9 mm.; thickness 4 mm. Lower Mare formation.

9-11. **Chione (Chione) pailasana** Weisbord, n. sp. 313
Fig. 9, holotype (P401a). 26753 PRI. Attached valves. Length 47 mm.; height 43 mm.; thickness of pair 27.5 mm. Playa Grande formation (Maiquetía member). Figs. 10, 11, paratype (R401a). 26754 PRI. Exterior and interior of left valve. Length 43.8 mm.; height 39 mm.; thickness 13.2 mm. Playa Grande formation (Maiquetía member).

12,13. **Chione (Chione ?) mamoensis** Weisbord, n. sp. 315
Holotype (S401a). 26755 PRI. Exterior and interior of right valve. Length 13 mm.; height 11.2 mm.; thickness 4 mm. Playa Grande formation (Maiquetía member).

Explanation of Plate 45

Figure — Page

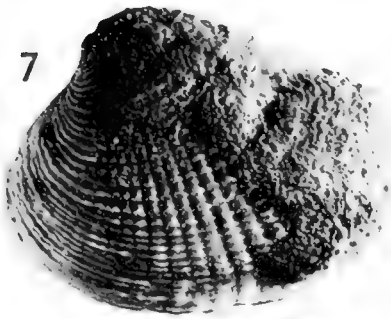
1,2. **Chione (Chione ?) mamoensis** Weisbord, n. sp. 315
Paratype (D401a). 26870 PRI. Exterior and interior of right valve. Length 10 mm.; height 9 mm.; thickness 3.7 mm. Abisinia formation.

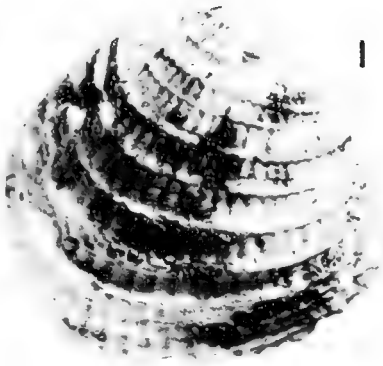
3-6. **Chione (Chione ?) laciniosa** Weisbord, n. sp. 317
Figs. 3, 4, holotype (I401a) 26757 PRI. Exterior and interior of immature right valve. Length 2.4 mm.; height 2.3 mm.; thickness 0.7 mm. Lower Mare formation. Figs. 5, 6, paratype (I405a). 26758 PRI. Exterior and interior of broken right valve. Length of fragment 3.7 mm.; thickness 1.1 mm. Lower Mare formation.

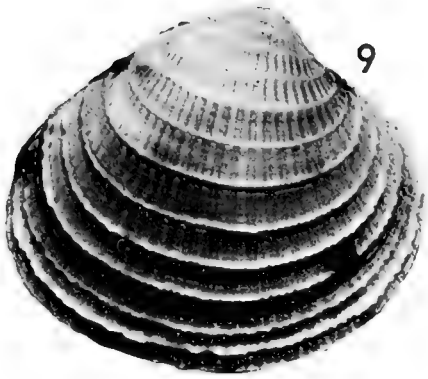
7,8. **Chione (Timoclea) tacaguana** Weisbord, n. sp. 320
Holotype (S401c). 26759 PRI. Exterior and interior of left valve. Length 13 mm.; height 11 mm.; thickness 4.2 mm. Playa Grande formation (Maiquetía member).

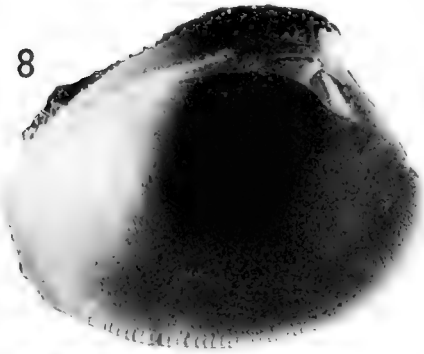
9-14. **Chione (Chionopsis) subrostrata** (Lamarck) 322
Figs. 9, 10, specimen B400a. 26760 PRI. Exterior and interior of right valve. Length 21.3 mm.; height 19 mm.; thickness 5.1 mm. Recent. Figs. 11, 12, specimen B400b. 26761 PRI. Exterior and interior of left valve. Length 20 mm.; height 17 mm.; thickness 6 mm. Recent. Figs. 13, 14, specimen A404a. 26762 PRI. Exterior and interior of worn right valve. Length 15 mm.; height 13 mm.; thickness 5 mm. Recent.

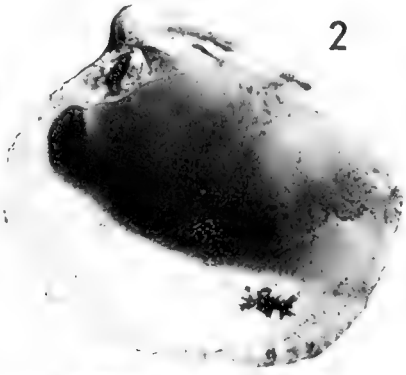
15,16. **Chione (Lirophora) riomaturensis** Maury 325
Specimen H398a. 26763 PRI. Exterior and interior of right valve. Length 34.7 mm.; height 28.2 mm.; thickness (excluding height of ribs) 7 mm. Mare formation.

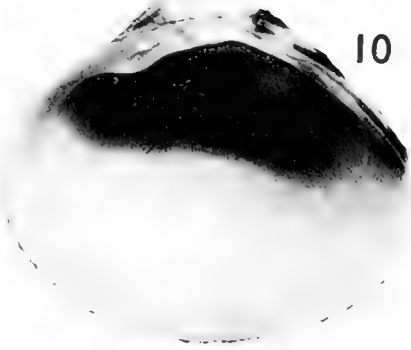

7

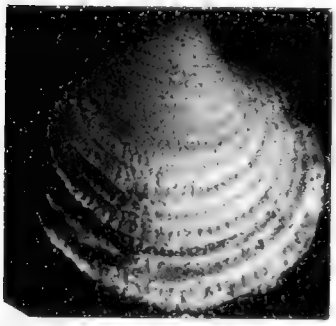

1

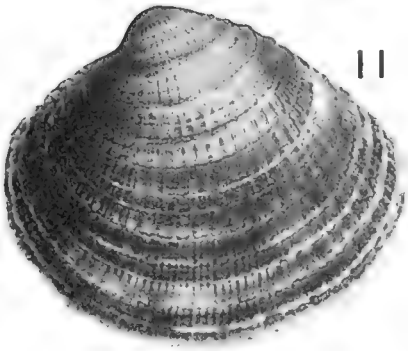

9

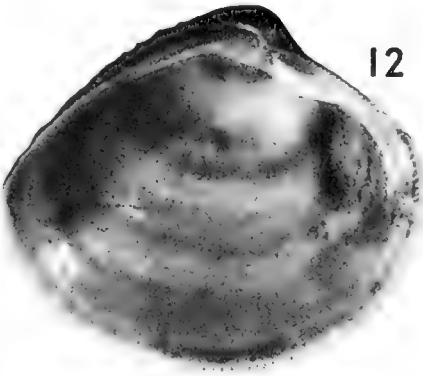

8

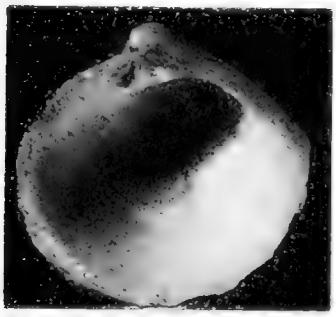

2

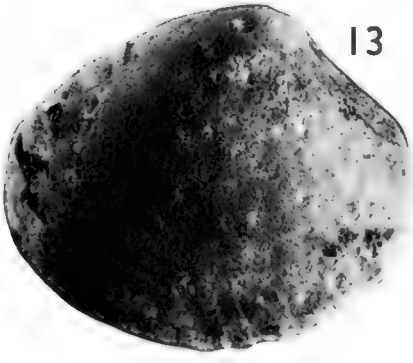

10

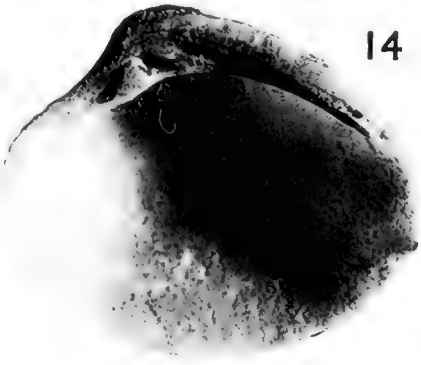

3

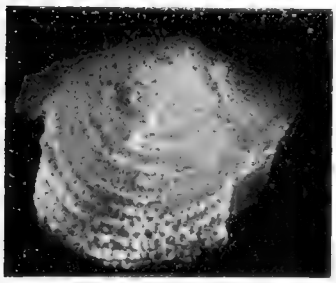

11

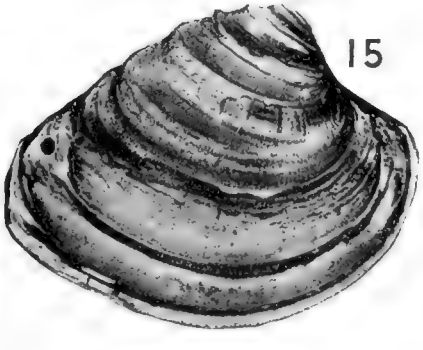

12

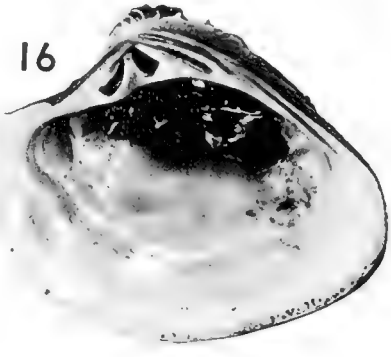

4

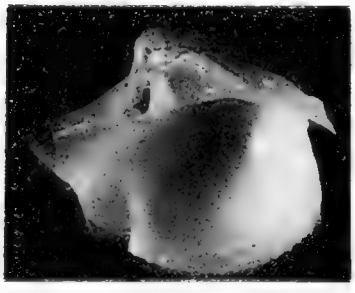

13

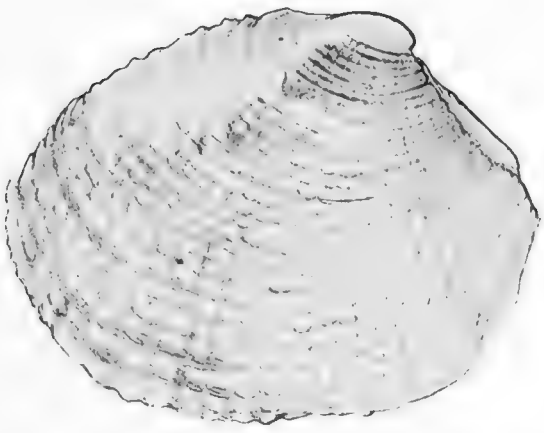

14


5

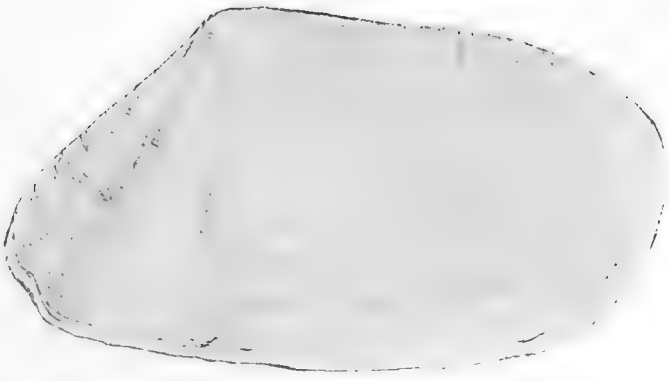

15


16

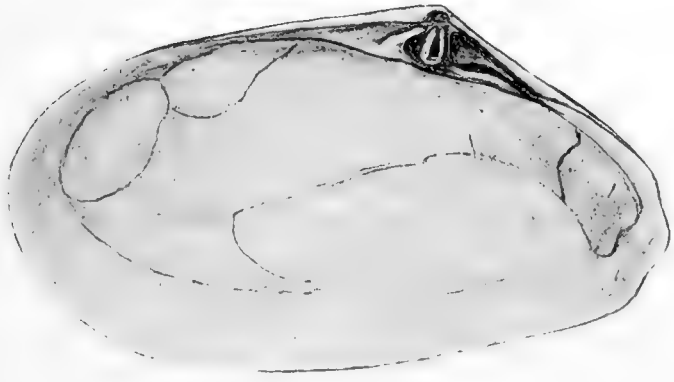

6

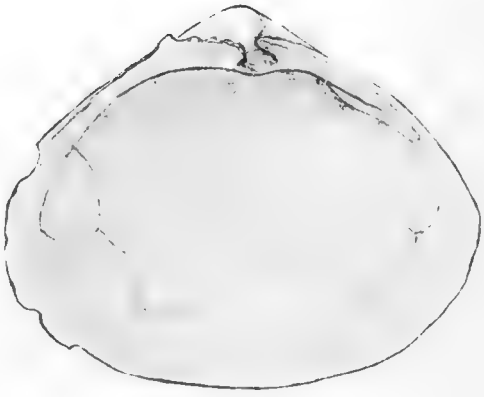

1


2


3


5


4


6

Explanation of Plate 46

Figure — Page

1,2. **Chione (Timoclea) tacaguana** Weisbord, n. sp. 320
Paratype (S401d). 26764 PRI. Exterior and interior of right valve. Length 11.8 mm.; height 10.4 mm.; thickness 3.9 mm. Playa Grande formation (Maiquetía member).

3,4. **Macoma (Psammacoma) hybrida** Weisbord, n. sp. 354
Holotype (I665a). 26765 PRI. Exterior and interior of right valve. Length 36.2 mm.; height 21 mm.; thickness 4.1 mm. Lower Mare formation.

5,6. **Corbula (Notocorbula) bruscasensis** Weisbord, n. sp. 400
Holotype (R667a). 26766 PRI. Exterior and interior of left valve. Length 3 mm.; height 2.5 mm. Playa Grande formation (Maiquetía member).

Explanation of Plate 47

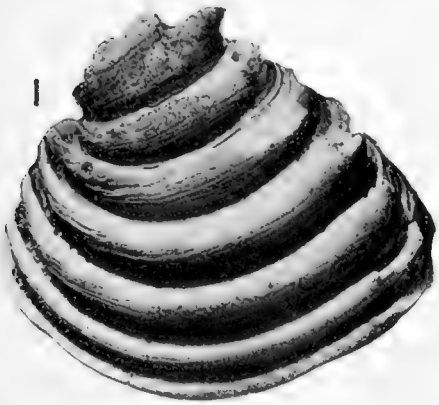
Figure — Page

1-6. **Chione (Lirophora) riomaturensis** Maury 325
Figs. 1, 2, specimen I398a. 26767 PRI. Exterior and interior of left valve. Length 36.6 mm.; height 32.1 mm.; thickness (excluding ribs) 10 mm. Lower Mare formation. Figs. 3, 4, specimen J398a. 26768 PRI. Exterior and interior of right valve. Length 14.6 mm.; height 12 mm.; thickness (excluding ribs) 3.1 mm. Lower Mare formation. Figs. 5, 6, specimen J398b. 26769 PRI. Exterior and interior of left valve. Length 14.3 mm.; height 12.3 mm.; thickness (excluding ribs) 4 mm. Lower Mare formation.

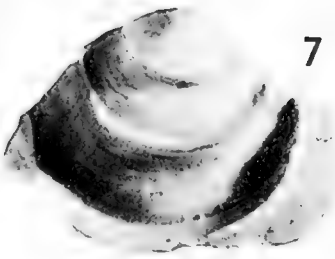
7-12. **Chione (Lirophora) cultellata** Weisbord, n. sp. 328
Figs. 7, 8, holotype (G409a). 26770 Exterior and interior of incomplete right valve. Length 4.3 mm. Upper Mare formation. Figs. 9, 10, paratype (G408a). 26771 Exterior and interior of left valve. Length 4.7 mm.; height 3.9 mm. Upper Mare formation. Figs. 11, 12, paratype (I406a). 26772 Exterior and interior of left valve. Length 4 mm.; height 3.7 mm.; thickness (excluding ribs) 1 mm. Lower Mare formation.

13,14. **Petricola (Naranio) lapicida** (Gmelin) 329
Specimen S549a. 26773 PRI. Exterior and interior of left valve. Length 12.0 mm.; height 11.2 mm.; thickness 3.9 mm. Playa Grande formation (Maiquetía member).

15. **Petricola (Rupellaria) typica** (Jonas) 331
Specimen A506a. 26774 PRI. Dorsal view of paired valves. Length 11 mm.; height 9 mm.; thickness of doublet 8.3 mm. Recent.

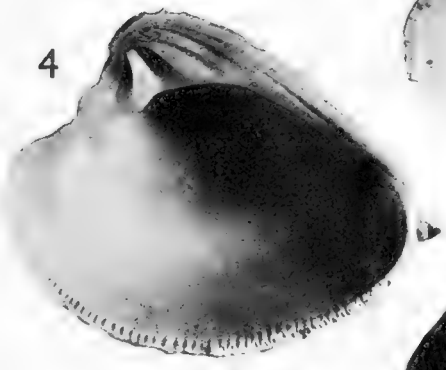

1

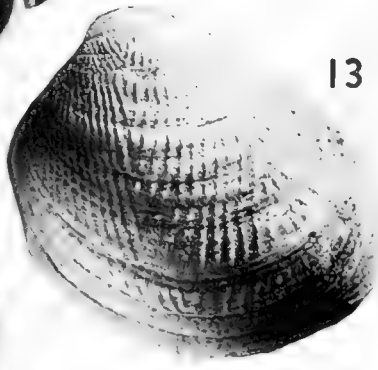

2

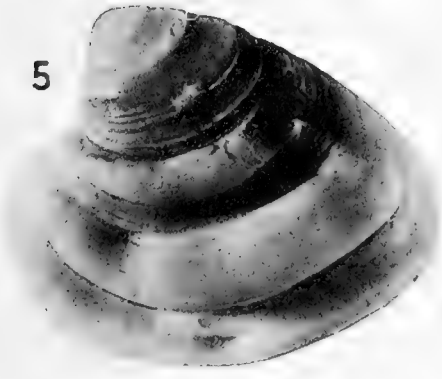

7

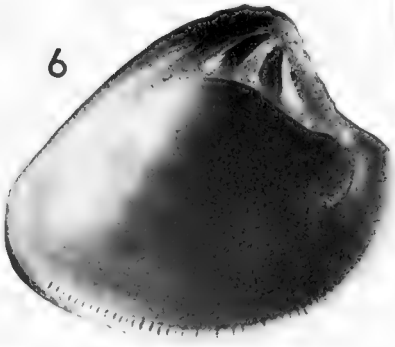

8

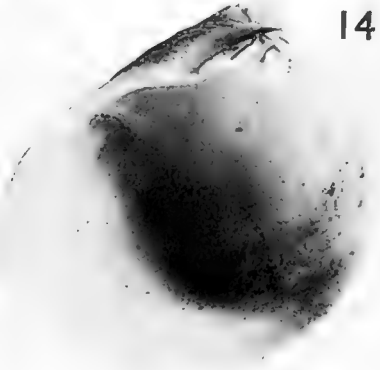

3


4


13

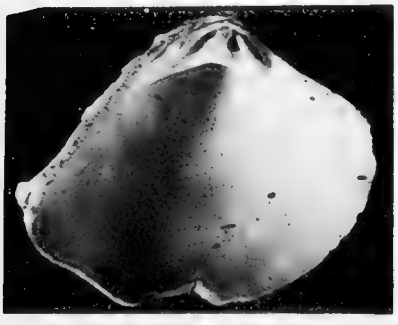

5


6

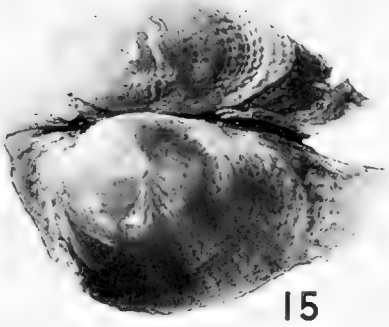

14

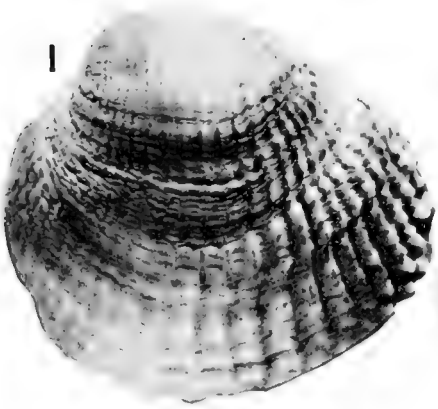
9

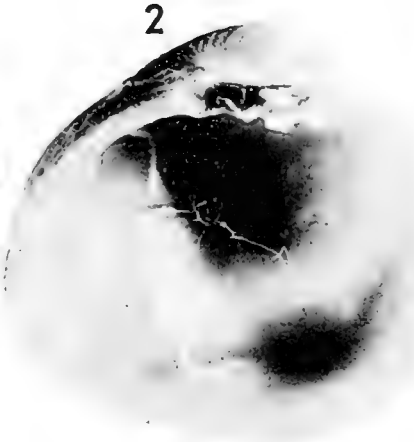

11

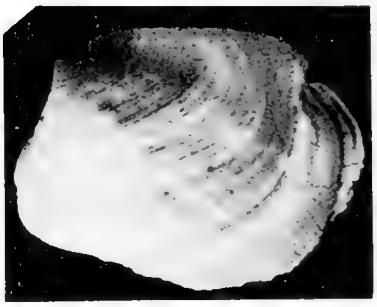

10


12

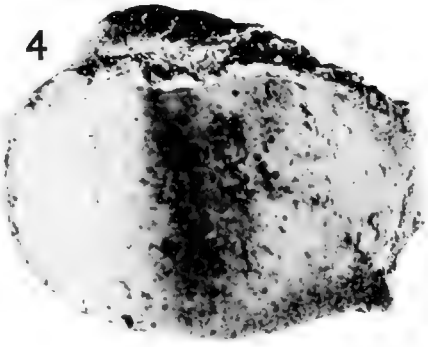

15

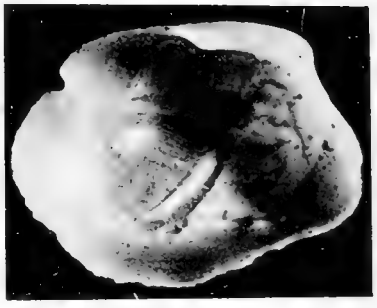

1

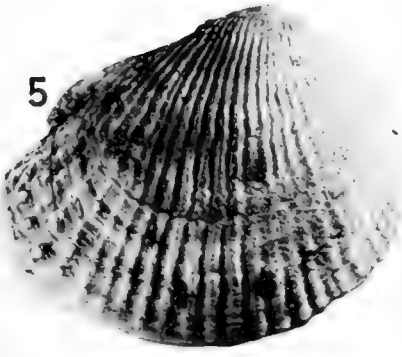

2


9

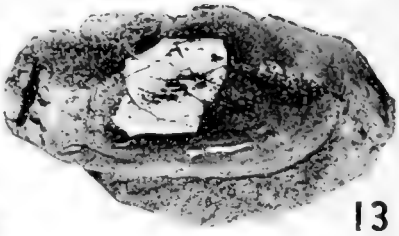

3


4

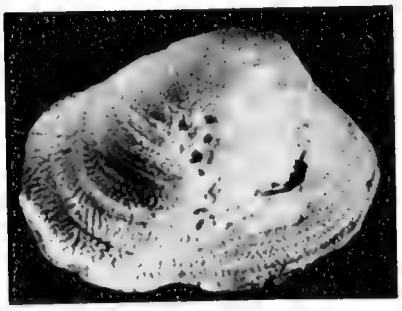

10

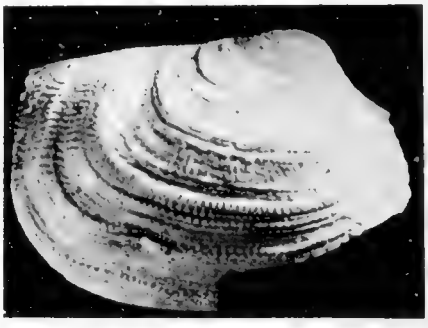

5

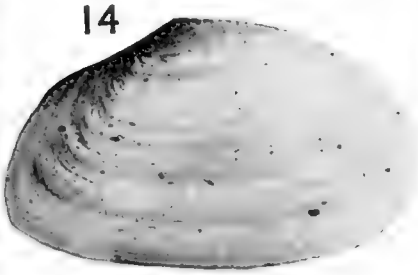

6


13

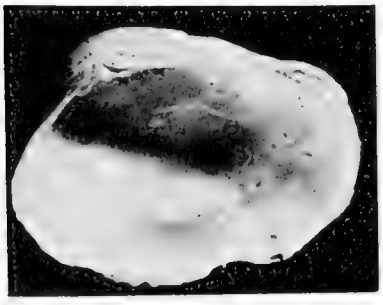
7

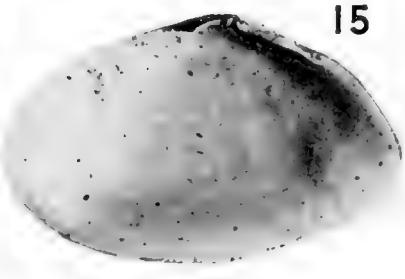



11

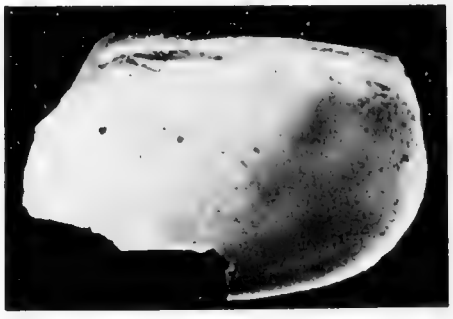

14

8




15

12



Explanation of Plate 48

Figure — Page

1-6. **Petricola (Rupellaria) typica** (Jonas) 331
Figs. 1, 2, specimen A506b. 26775 PRI. Exterior and interior of left valve. Length 13.8 mm.; height 13 mm.; thickness 5.1 mm. Recent. Figs. 3, 4, specimen A506c. 26776 PRI. Exterior and interior of right valve Length 16 mm.; height 13.5 mm.; thickness 4.6 mm. Recent. Figs. 5, 6, specimen D506a. 26777 PRI. Exterior and interior of right valve. Length 13.3 mm.; height 11 mm.; thickness 5 mm. Abisinia formation.

7-12. **Pleiorytis venezuelensis** Weisbord, n. sp. 334
Figs. 7, 8, holotype (I507a). 26778 PRI. Exterior and interior of right valve. Length 4 mm.; height 3 mm.; thickness 1.5 mm. Lower Mare formation. Figs. 9, 10, paratype (I507b). 26779 PRI. Exterior and interior of left valve. Length 3.7 mm.; height 3.3 mm.; thickness 1.4 mm. Lower Mare formation. Figs. 11, 12, paratype (T507a). 26780 PRI. Exterior and interior of broken right valve. Length 4.5 mm. Upper Mare formation.

13. **Tellina (Tellina** ?) species indeterminate 337
Specimen Q446a. 26781 PRI. External view of right valve. Length 43 mm.; height 26 mm. Playa Grande formation (Maiquetía member).

14-15. **Tellina (Eurytellina) punicea** Born 337
Specimen J448a. 26782 PRI. Exterior and interior of young right valve. Length 11 mm.; height 7 mm.; thickness 1.1 mm. Lower Mare formation.

Explanation of Plate 49

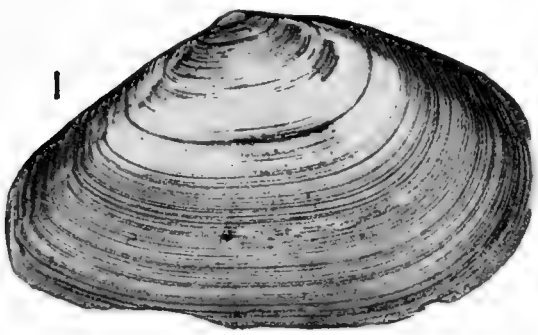
Figure — Page

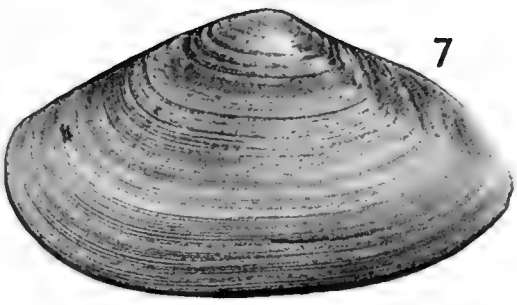
1,2. **Tellina (Eurytellina) punicea** Born 337
Specimen I448a. 26783 PRI. Exterior and interior of right valve. Length 44 mm.; height 28 mm.; thickness 4.6 mm. Lower Mare formation.

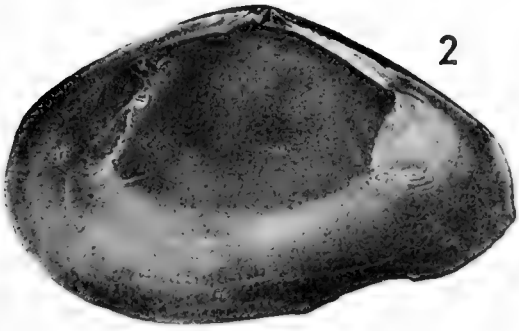
3-10. **Tellina (Eurytellina) nitens** C. B. Adams 341
Figs. 3, 4, specimen G448a. 26784 PRI. Exterior and interior of right valve. Length 21.8 mm.; height 12 mm.; thickness 2.2 mm. Mare formation. Figs. 5, 6, specimen G448b. 26785 PRI. Exterior and interior of immature right valve. Length 8.1 mm.; height 4.8 mm.; thickness 0.9 mm. Mare formation. Figs. 7, 8, specimen G448c. 26786 PRI. Exterior and interior of left valve. Length 29 mm.; height 16 mm.; thickness 2.3 mm. Mare formation. Figs. 9, 10, specimen G448d. 26787 PRI. Exterior and interior of immature left valve. Length 10.2 mm.; height 5.6 mm.; thickness 1 mm. Mare formation.

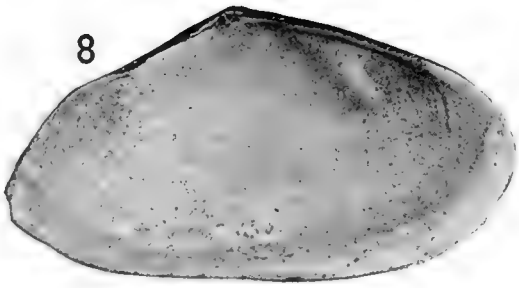
11-12. **Tellina (Eurytellina) alternata** ? Say 344
Specimen R447a. 26788 PRI. Exterior and interior of broken left valve. Length of fragment 34 mm.; height 21 mm. Playa Grande formation (Maiquetía member).

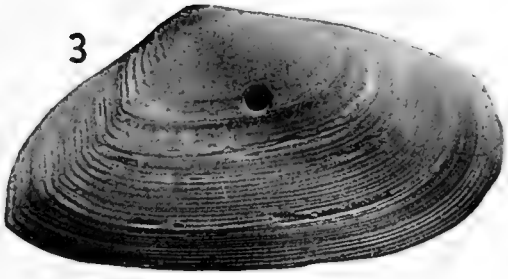
13,14. **Tellina (Merisca) cristallina** Spengler 345
Specimen J455a. 26789 PRI. Exterior and interior of broken left valve. Length 17.4 mm.; height 13.1 mm.; thickness 3.2 mm. Lower Mare formation.

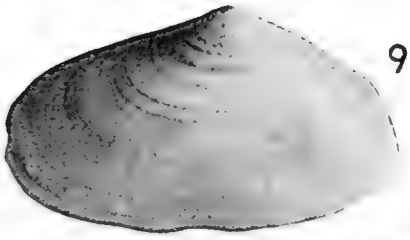

1

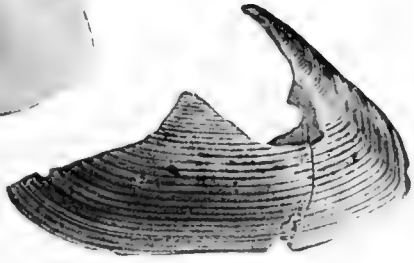

7

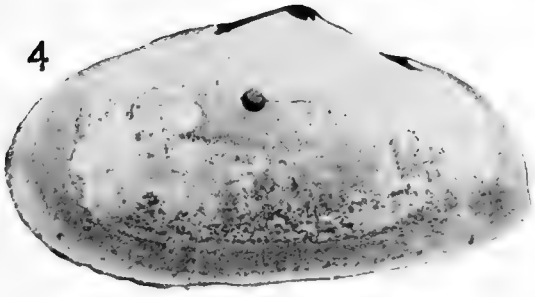

2

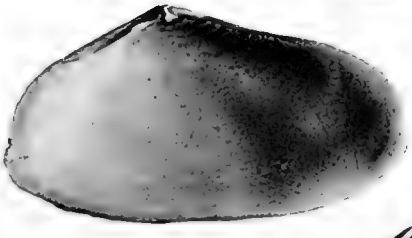

8


3

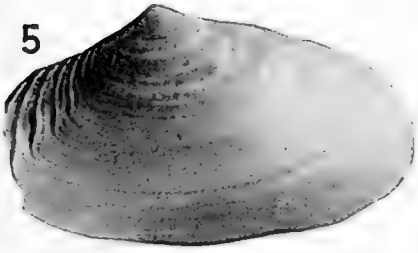

9


11

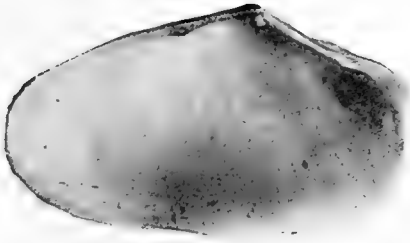

4

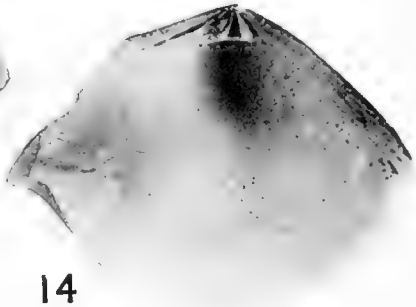

10

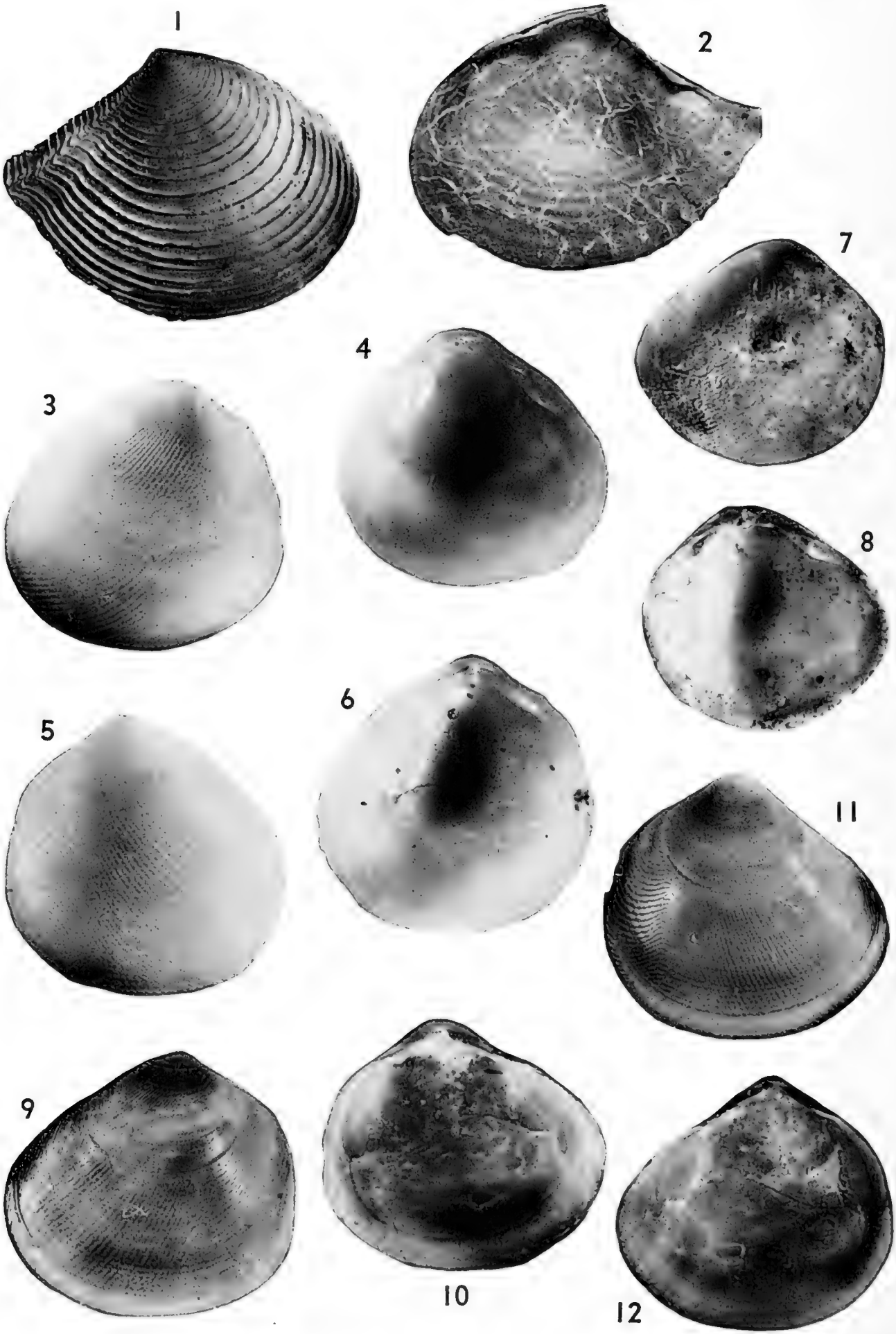

12


5


13


6


14


1
2
7
4
3
8
6
5
11
9
10
12

Explanation of Plate 50

Figure — Page

1,2. **Tellina (Merisca) cristallina** Spengler 345
Specimen T454a. 26790 PRI. Exterior and interior of right valve. Length 27 mm.; height 20.3 mm.; thickness 2.4 mm. Upper Mare formation.

3-8. **Strigilla pisiformis** (Linnaeus) 348
Figs. 3, 4, specimen B466a. 26791 PRI. Exterior and interior of right valve. Length 7.8 mm.; height 7.5 mm.; thickness 2.6 mm. Recent. Figs. 5, 6, specimen B468a. 26792 PRI. Exterior and interior of left valve. Length 7.9 mm.; height 8 mm.; thickness 2.3 mm. Recent. Figs. 7, 8, specimen D467a. 26793 PRI. Exterior and interior of right valve. Length 5.1 mm.; height 4.6 mm.; thickness 1.2 mm. Abisinia formation.

9-12. **Strigilla carnaria** (Linnaeus) 351
Specimen A464a1-2. 26794 PRI. Paired valves. Length 15.8 mm.; height 14.7 mm.; thickness of attached valves 7 mm. Figs. 9, 10, (A464a1), exterior and interior of right valve; figs. 11, 12 (464a2), exterior and interior of left valve. Recent.

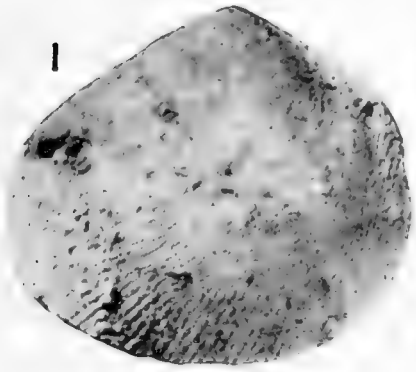
Explanation of Plate 51

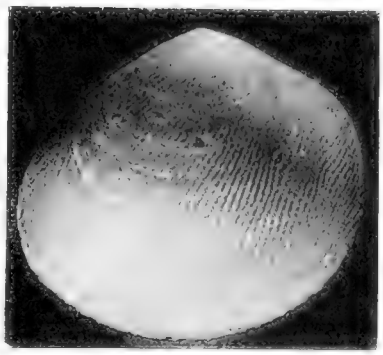
Figure — Page

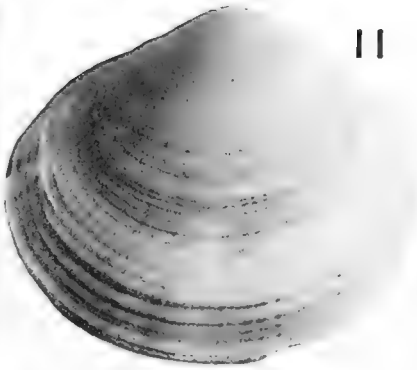
1-6. **Strigilla carnaria** (Linnaeus) 351
Figs. 1, 2, specimen D464a 26795 PRI. Exterior and interior of right valve. Length 6.8 mm.; height 6 mm.; thickness 1.2 mm. Abisinia formation. Figs. 3, 4, specimen I465a. 26796 PRI. Exterior and interior of young right valve. Length 4.8 mm.; height 4.2 mm.; thickness 1.4 mm. Lower Mare formation. Figs. 5, 6, specimen I465b. 26797 PRI. Exterior and interior of young left valve. Length 4.9 mm.; height 4.05 mm.; thickness 1.2 mm. Lower Mare formation.

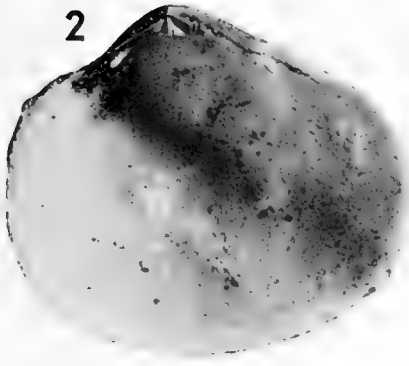
7,8. **Semele purpurascens** (Gmelin) 355
Specimen A456a. 26798 PRI. Exterior and interior of left valve. Length 16.7 mm.; height 13 mm.; thickness 3 mm. Recent.

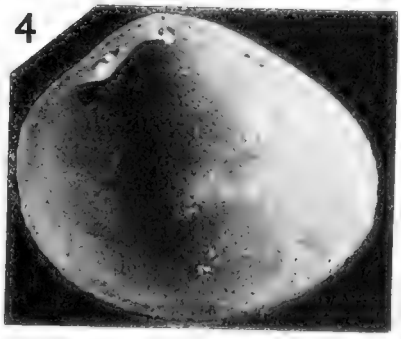
9-14. **Semele proficua** (Pultney) 358
Figs. 9, 10, specimen B470a. 26807 PRI. Exterior and interior of right valve. Length 23.1 mm.; height 21.6 mm.; thickness 4.2 mm. Recent. Figs. 11, 12, specimen A424b. 26800 PRI. Exterior and interior of left valve. Length 16 mm.; height 14 mm.; thickness 2.2 mm. Recent. Figs. 13, 14, specimen J425a. 26801 PRI. Exterior and interior of left valve. Length 19.7 mm.; height 17.3 mm.; thickness 3.5 mm. Lower Mare formation.

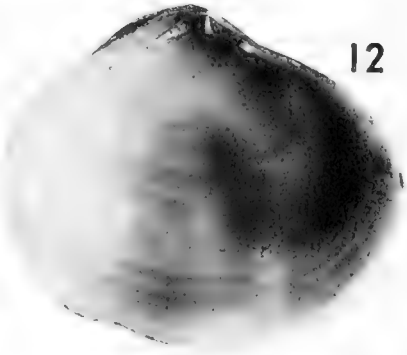

1

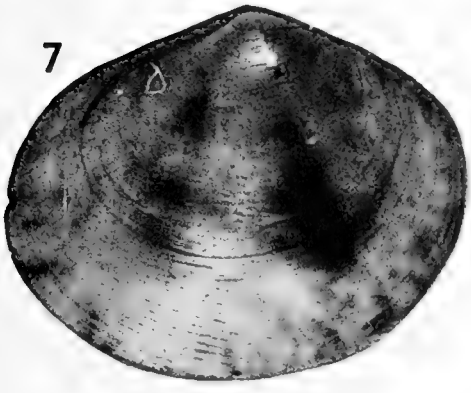

3

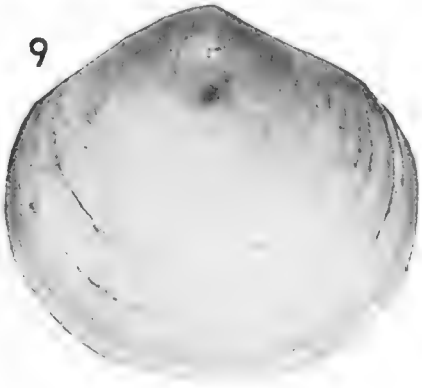

11

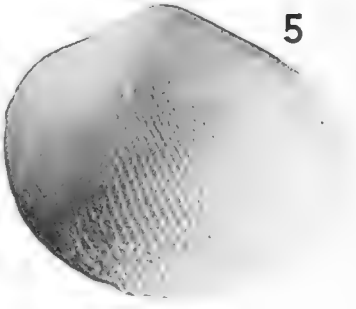

2

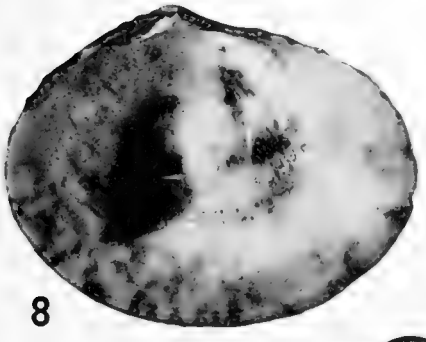

4

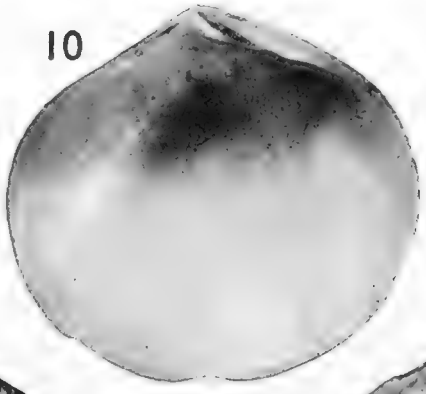

12

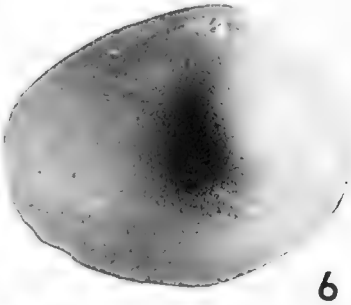

7

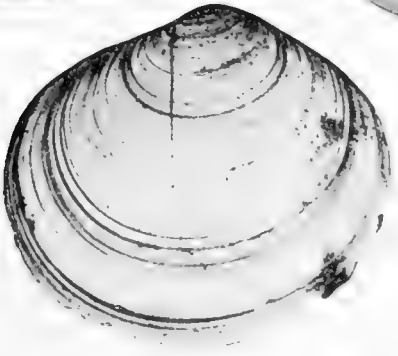

9

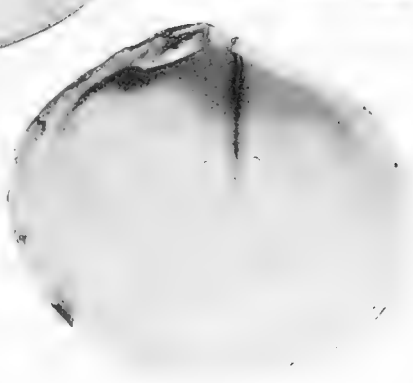

5


8

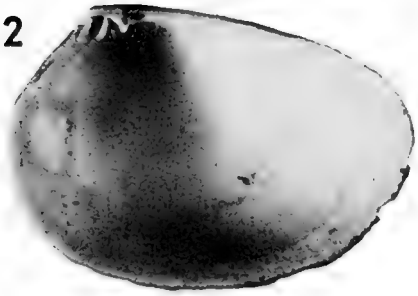

10

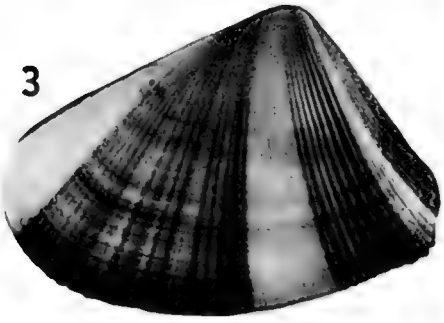

6

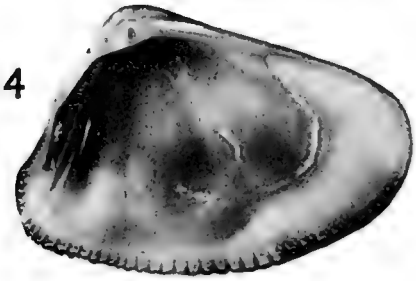

13

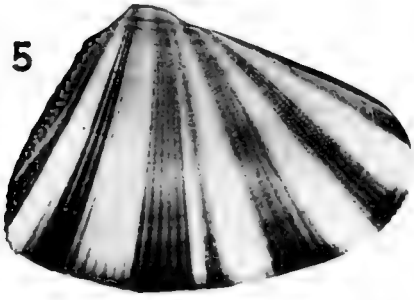

14

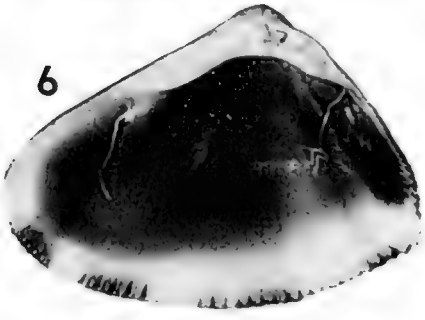

1


2


3

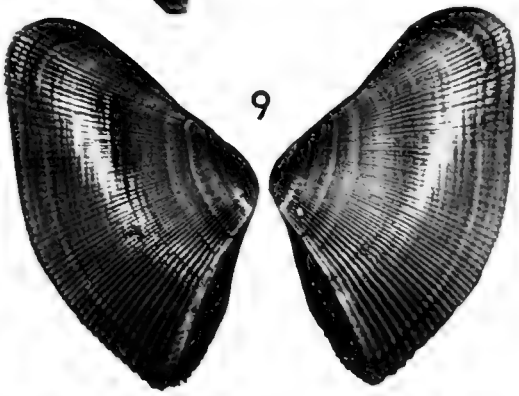

4

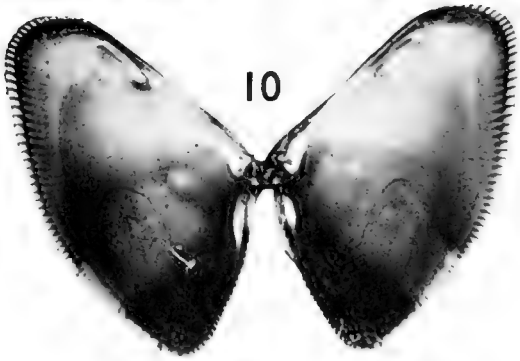

5


6

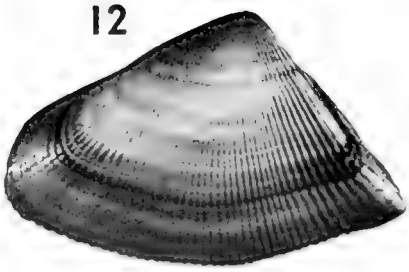

7

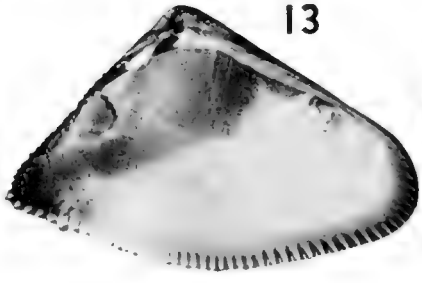

8

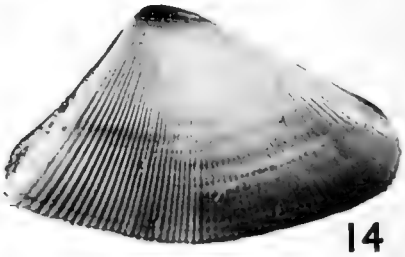

9

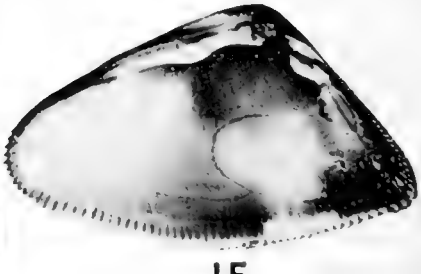

10


11


12


13


14


15


16


17

Explanation of Plate 52

Figure — Page

1,2. **Semelina nuculoides** (Conrad) 361
Specimen S458. 26802 PRI. Exterior and interior of left valve. Length 4.3 mm.; height 2.9 mm.; thickness 1.1 mm. Playa Grande formation (Maiquetía member).

3-8. **Donax denticulatus** Linnaeus 363
Figs. 3, 4, specimen B469a. 26803 PRI. Exterior and interior of left valve. Length 29.3 mm.; height 20.5 mm.; thickness 6.9 mm. Recent. Figs. 5, 6, specimen B469b. 26804 PRI. Exterior and interior of right valve. Length 20.8 mm.; height 15 mm.; thickness 5 mm. Recent. Fig. 7, specimen B469c. 26805 PRI. Posterior end of left valve. Length 25.4 mm.; height 18.7 mm.; thickness 6 mm. Recent. Fig. 8, specimen B469d. 26806 PRI. Posterior end of right valve. Length 27.3 mm.; height 20.3 mm.; thickness 6.8 mm. Recent.

9-17. **Donax striatus** Linnaeus 365
Figs. 9, 10, specimen B470a. 26807 PRI. Exterior and interior of paired valves, open. Length 26.3 mm.; height 16.4 mm; thickness of pair, closed 11.5 mm. Recent. Fig. 11, specimen B470b. 26808 PRI. Dorsal view of paired valves, closed. Length 12.3 mm.; height 7.9 mm.; thickness of pair 5.2 mm. Recent. Figs. 12, 13, specimen B470c. 26809 PRI. Exterior and interior of left valve. Length 25.9 mm.; height 17 mm.; thickness 5 mm. Recent. Figs. 14, 15, specimen B470d. 26810 PRI. Exterior and interior of right valve. Length 23.3 mm.; height 14.1 mm.; thickness 4.6 mm. Recent. Figs. 16, 17, specimen B470e1-2. 26811 PRI. Paired valves, detached. Length 28.1 mm.; height 18.2 mm.; thickness of attached valves 12.2 mm. Fig. 16, posterior end of left valve; fig. 17, posterior end of right valve. Recent.

Explanation of Plate 53

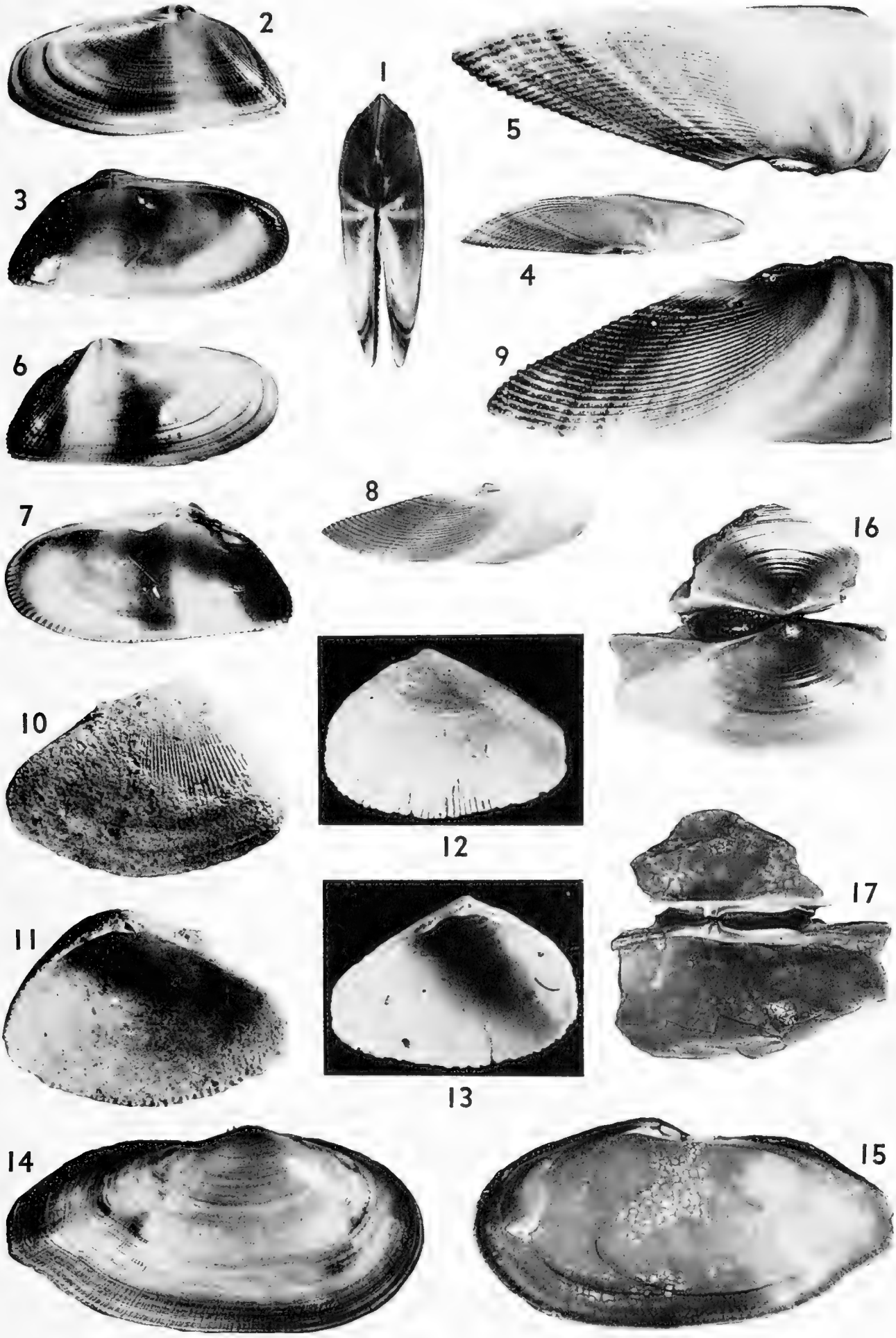
Figure — Page

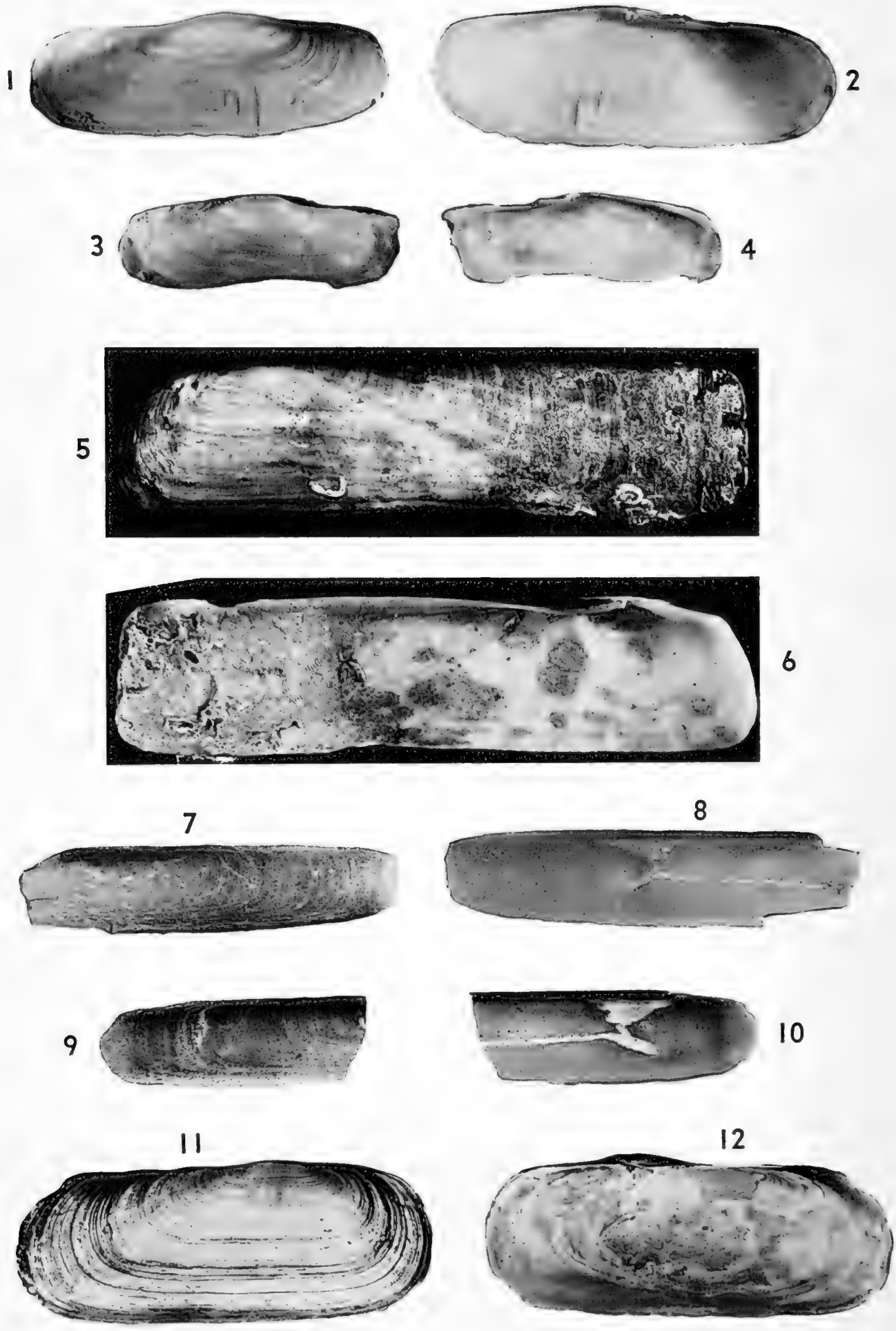
1-9. **Donax higuerotensis** Weisbord, n. sp. 368
Fig. 1, holotype (B471a). 26812 PRI. Dorsal view of paired valves. Length 25 mm.; height 12.2 mm.; thickness 7.5 mm. Recent. Figs. 2-5, paratype (B471b). 26813 PRI. Left valve. Length 23 mm.; height 10.7 mm.; thickness 4 mm. Figs. 2, 3, exterior and interior; fig. 4, dorsal view; fig. 5, enlarged view of posterior end. Recent. Figs. 6-9, paratype (B471c). 26814 PRI. Right valve. Length 22 mm.; height 10.9 mm.; thickness 4 mm. Figs. 6, 7, exterior and interior; fig. 8, dorsal view; fig. 9, enlarged view of posterior end. Recent.

10,11. **Donax vagus** Weisbord, n. sp. 370
Holotype (I542a). 26815 PRI. Exterior and interior of left valve. Length 5.1 mm.; height 3.6 mm.; thickness 1.4 mm. Lower Mare formation.

12,13. **Donax marensis** Weisbord, n. sp. 371
Holotype (T472a). 26816 PRI. Exterior and interior of right valve. Length 2.7 mm.; height 2 mm. Upper Mare formation.

14-17. **Sanguinolaria (Psammotella) operculata** (Gmelin) 372
Figs. 14, 15, specimen B445a. 26817 PRI. Exterior and interior of right valve. Length 65.5 mm.; height 34 mm.; thickness 10.2 mm. Recent. Figs. 16, 17, specimen B445b. 26818 PRI. Exterior and interior of hinged pair. Length of larger fragment (right valve) 34 mm. Recent.


2
1
5
3
4
6
9
8
7
16
10
12
17
11
13
14
15


1
2
3
4
5
6
7
8
9
10
11
12

Explanation of Plate 54

Figure — Page

1-4. **Tagelus plebeius** (Solander) 375
Figs. 1, 2, specimen B492a. 26819 PRI. Exterior and interior of right valve. Length 51.5 mm.; height 18.7 mm.; thickness 5.2 mm. Recent. Figs. 3, 4, specimen B492b. 26820 PRI. Exterior and interior of incomplete left valve. Length of specimen 37.7 mm.; thickness 4 mm. Recent.

5,6. **Solen (Solena) obliquus** Spengler 378
Specimen B489a. 26821 PRI. Exterior and interior of left valve. Length 90 mm.; height 23 mm.; thickness 5 mm. Recent.

7-10. **Solen** species 380
Figs. 7, 8, specimen I490a. 26822 PRI. Exterior and interior of posterior portion of incomplete left valve. Length of fragment 55 mm.; height 14.3 mm.; thickness 6 mm. Lower Mare formation. Figs. 9, 10, specimen T490a. 26823 PRI. Exterior and interior of posterior portion of incomplete right valve. Length of fragment 42 mm.; height 14.3 mm.; thickness 6 mm. Upper Mare formation.

11,12. **Solecurtus cumingianus** (Dunker) 381
Specimen I491a. 26824 PRI. Exterior and interior of right valve. Length 61 mm.; height 24.7 mm.; thickness 8.1 mm. Lower Mare formation.

Explanation of Plate 55

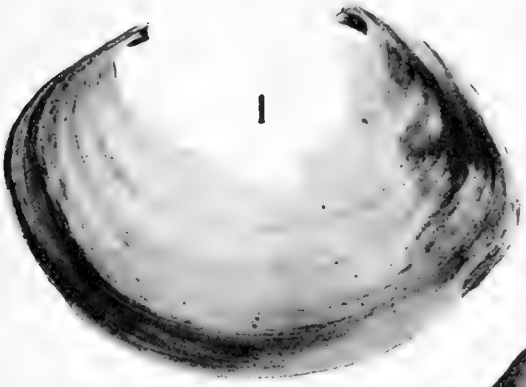
Figure — Page

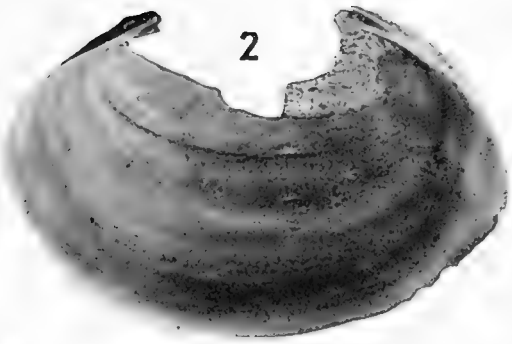
1,2. **Mactra (Mactrellona ?) iheringi** (Dall) 383
Specimen B554a. 26825 PRI. Exterior and interior of broken left valve. Length 52 mm.; thickness 21 mm. Recent.

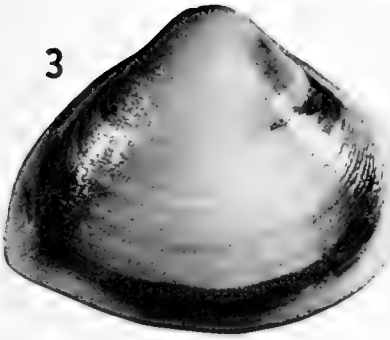
3-6. **Mulinia cleryana** (d'Orbigny) 384
Figs. 3, 4, specimen B545a. 26826 PRI. Exterior and interior of right valve. Length 23 mm.; height 18.3 mm.; thickness 5.2 mm. Recent. Figs. 5, 6, specimen B545b. 26827 PRI. Exterior and interior of left valve. Length 24.2 mm.; height 21 mm.; thickness 6.9 mm. Recent.

7,8. **Labiosa (Raeta)** aff. **plicatella** (Conrad) 387
Specimen Q463a. 26828 PRI. Paired valves, incomplete. Height 26 mm.; thickness of pair 18 mm. Fig. 7, external view of left valve of pair; fig. 8, external view of right valve of pair. Playa Grande formation (Maiquetía member).

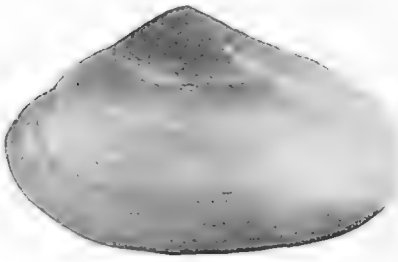
9-14. **Ervilia nitens venezuelana** Weisbord, n. subsp. 389
Figs. 9, 10, holotype (J449a). 26829 PRI. Exterior and interior of right valve. Length 7.3 mm.; height 5.3 mm.; thickness 1.3 mm. Lower Mare formation. Figs. 11, 12, paratype (J449b). 26830 PRI. Exterior and interior of left valve. Length 9 mm.; height 5.6 mm.; thickness 1.3 mm. Lower Mare formation. Figs. 13, 14, paratype (T449a). 26831 PRI. Exterior and interior of juvenile right valve. Length 3.8 mm.; height 2.5 mm.; thickness 0.9 mm. Upper Mare formation.


1

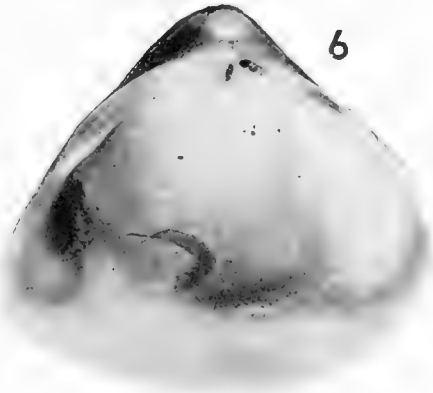

2


3

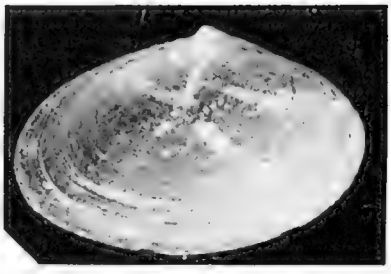

5


11


4

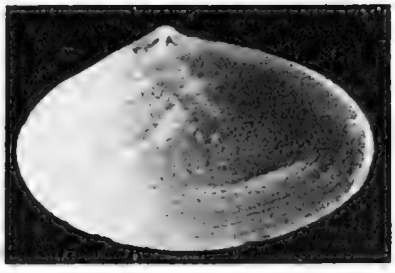

6

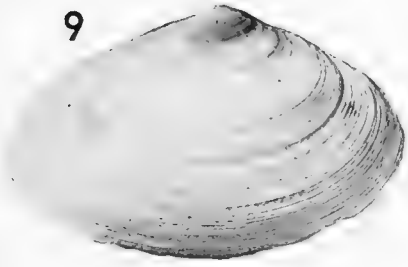

12

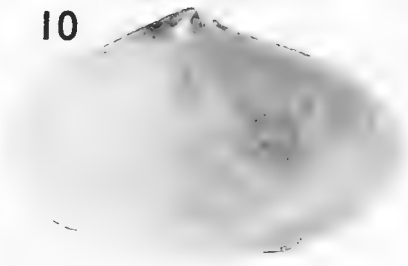

13

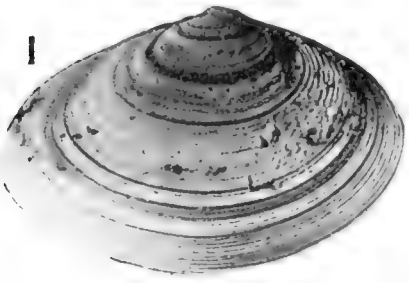

7


8

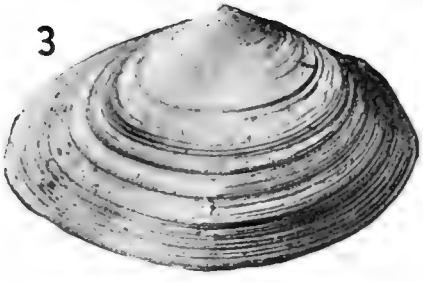

14

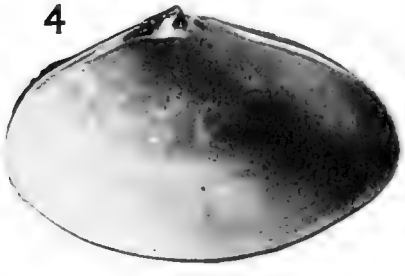

9

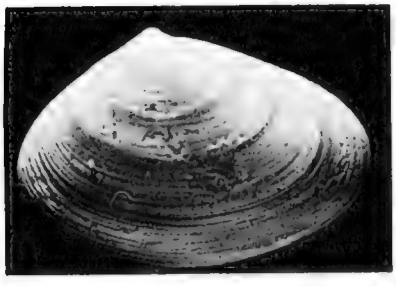

10

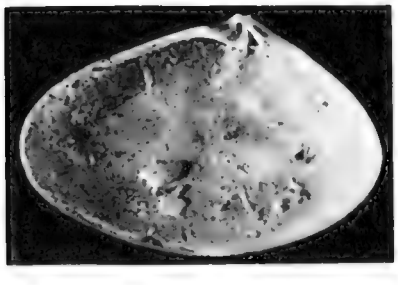

1

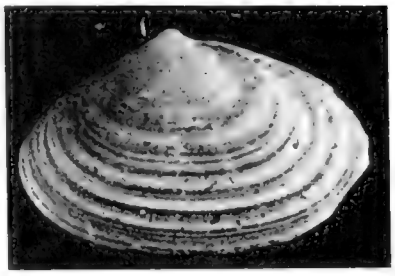

2

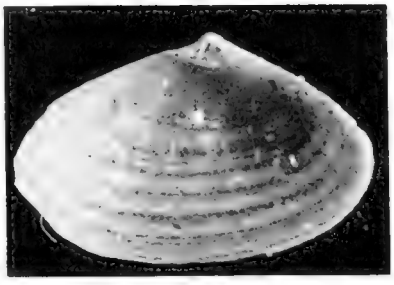

3

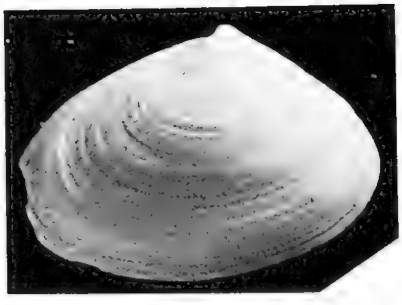

4

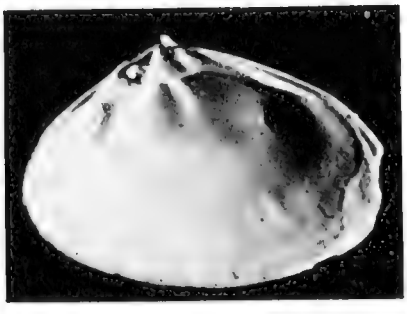

5

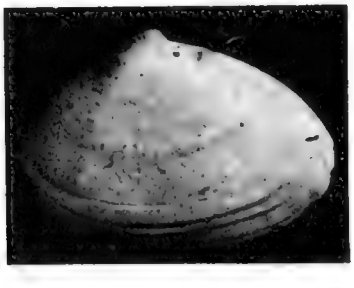

6

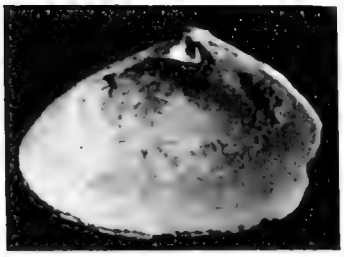

7

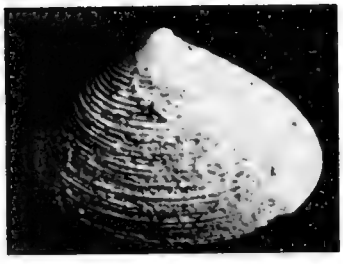

8

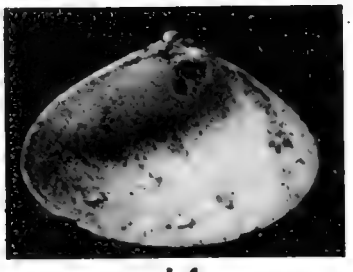

9

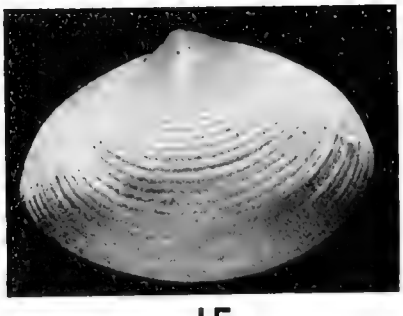

10

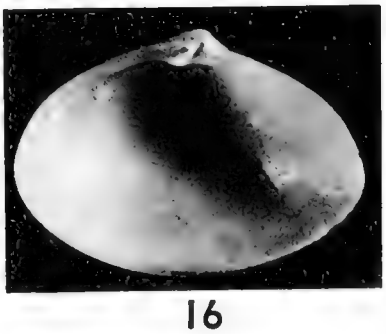

11


12


13


14


15


16

Explanation of Plate 56

Figure — Page

1-8. **Ervilia nitens venezuelana** Weisbord, n. subsp. 389
Figs. 1, 2, paratype (G449a). 26832 PRI. Exterior and interior of right valve. Length 7.8 mm.; height 5.3 mm.; thickness 1.2 mm. Upper Mare formation. Figs. 3, 4, paratype (I449a). 26833 PRI. Exterior and interior of right valve. Length 6.7 mm.; height 4.4 thickness 1 mm. Lower Mare formation. Figs. 5, 6, paratype (G449b). 26834 PRI. Exterior and interior of young left valve. Length 4.1 mm.; height 2.8 mm.; thickness 0.9 mm. Upper Mare formation. Figs. 7, 8, paratype (T453a). 26835 PRI. Exterior and interior of juvenile left valve. Length 3.3 mm.; height 2.2 mm.; thickness 0.8 mm. Upper Mare formation.

9-12. **Ervilia antilleana** Weisbord, n. sp. 391
Figs. 9, 10, holotype (G450a). 26836 PRI. Exterior and interior of right valve. Length 3.4 mm.; height 2.3 mm.; thickness 0.8 mm. Mare formation. Figs. 11, 12, paratype (G450b). 26837 PRI. Exterior and interior of left valve. Length 2.2 mm.; height 1.5 mm.; thickness 0.7 mm. Mare formation.

13,14. **Ervilia caribbeana** Weisbord, n. sp. 393
Holotype (S459a). 26838 PRI. Exterior and interior of young left valve. Length 2.6 mm.; height 1.8 mm.; thickness 0.8 mm. Playa Grande formation (Maiquetía member).

15,16. **Ervilia mareana** Weisbord, n. sp. 394
Holotype (I452a). 26839 PRI. Exterior and interior of right valve. Length 2.85 mm.; height 2.1 mm.; thickness 1.1 mm. Lower Mare formation.

Explanation of Plate 57

Figure — Page

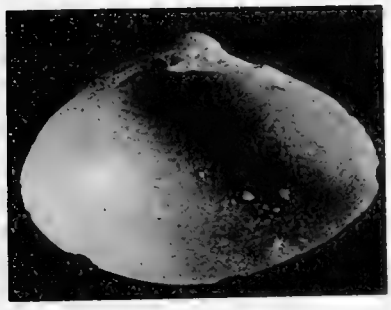
1,2. **Ervilia mareana** Weisbord, n. sp. 394
Paratype (J452a). 26840 PRI. Exterior and interior of right valve. Length 3.8 mm.; height 2.7 mm.; thickness 1.1 mm. Lower Mare formation.

3-6. **Corbula (Juliacorbula) aequivalvis** Philippi 394
Figs. 3, 4, specimen C535a. 26841 PRI. Exterior and interior of right valve. Length 12.3 mm.; height 8 mm.; thickness 3.6 mm. Guaiguaza clay. Figs. 5, 6, specimen C535b. 26842 PRI. Exterior and interior of left valve. Length 10.2 mm.; height 7 mm.; thickness 2.8 mm. Guaiguaza clay.

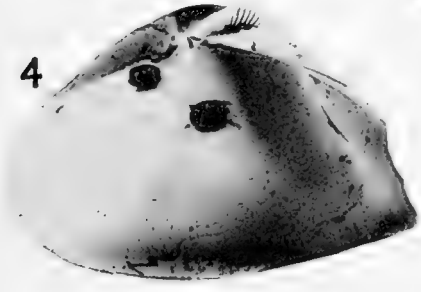
7-14. **Corbula (Caryocorbula) cf. lavalleana** d'Orbigny 397
Figs. 7, 8, specimen C536a. 26843 PRI. Exterior and interior of right valve. Length 9.8 mm.; height 7 mm.; thickness 4 mm. Guaiguaza clay. Figs. 9, 10, specimen C536b. 26844 PRI. Exterior and interior of left valve. Length 10.2 mm.; height 6.1 mm.; thickness 3.9 mm. Guaiguaza clay. Figs. 11, 12, specimen T536a. 26845 PRI. Exterior and interior of young right valve. Length 5.5 mm.; height 3.8 mm.; thickness 1.7 mm. Upper Mare formation. Figs. 13, 14, specimen I537a. 26846 PRI. Exterior and interior of young left valve. Length 5.9 mm.; height 3.8 mm.; thickness 1.9 mm. Lower Mare formation.

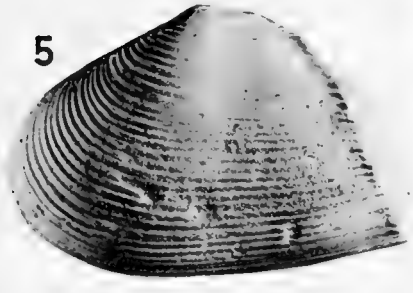
15-16. **Corbula (Notocorbula) puntagordensis** Weisbord, n. sp. 402
Holotype (H551a). 26847 PRI. Exterior and interior of left valve. Length 2.9 mm.; height 2.6 mm.; thickness 1.3 mm. Mare formation.

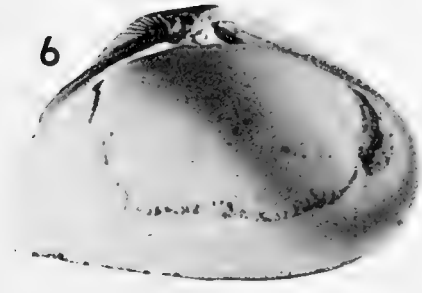

1

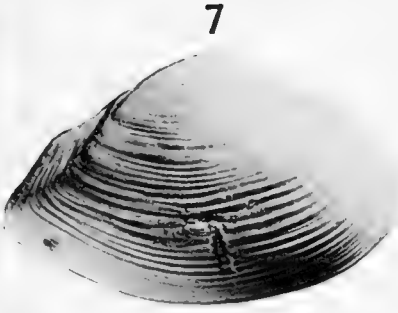

2

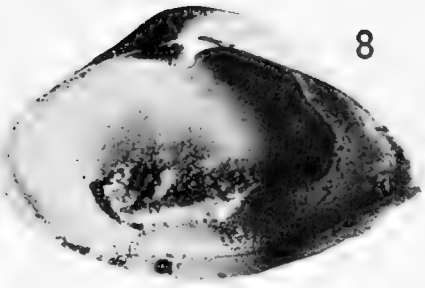

3


4

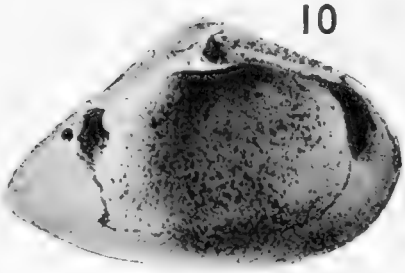

5

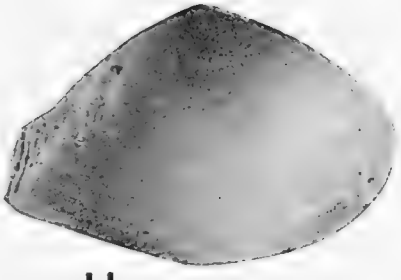

6

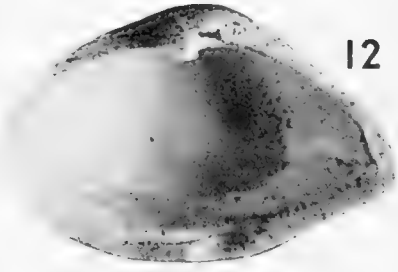

7

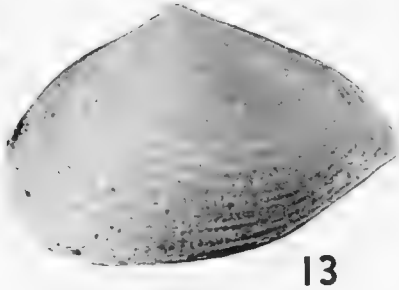

8

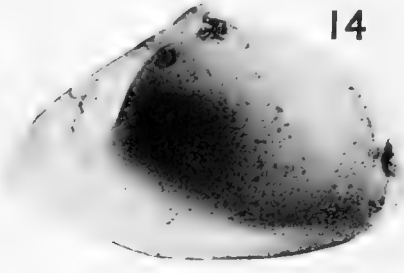

9

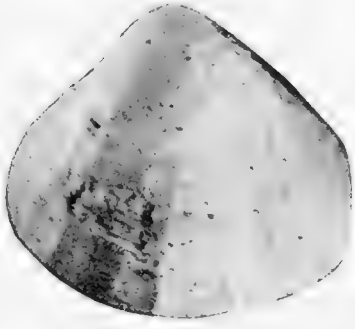

10

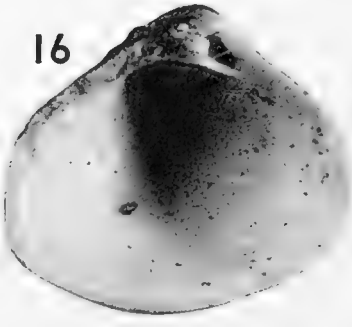

11

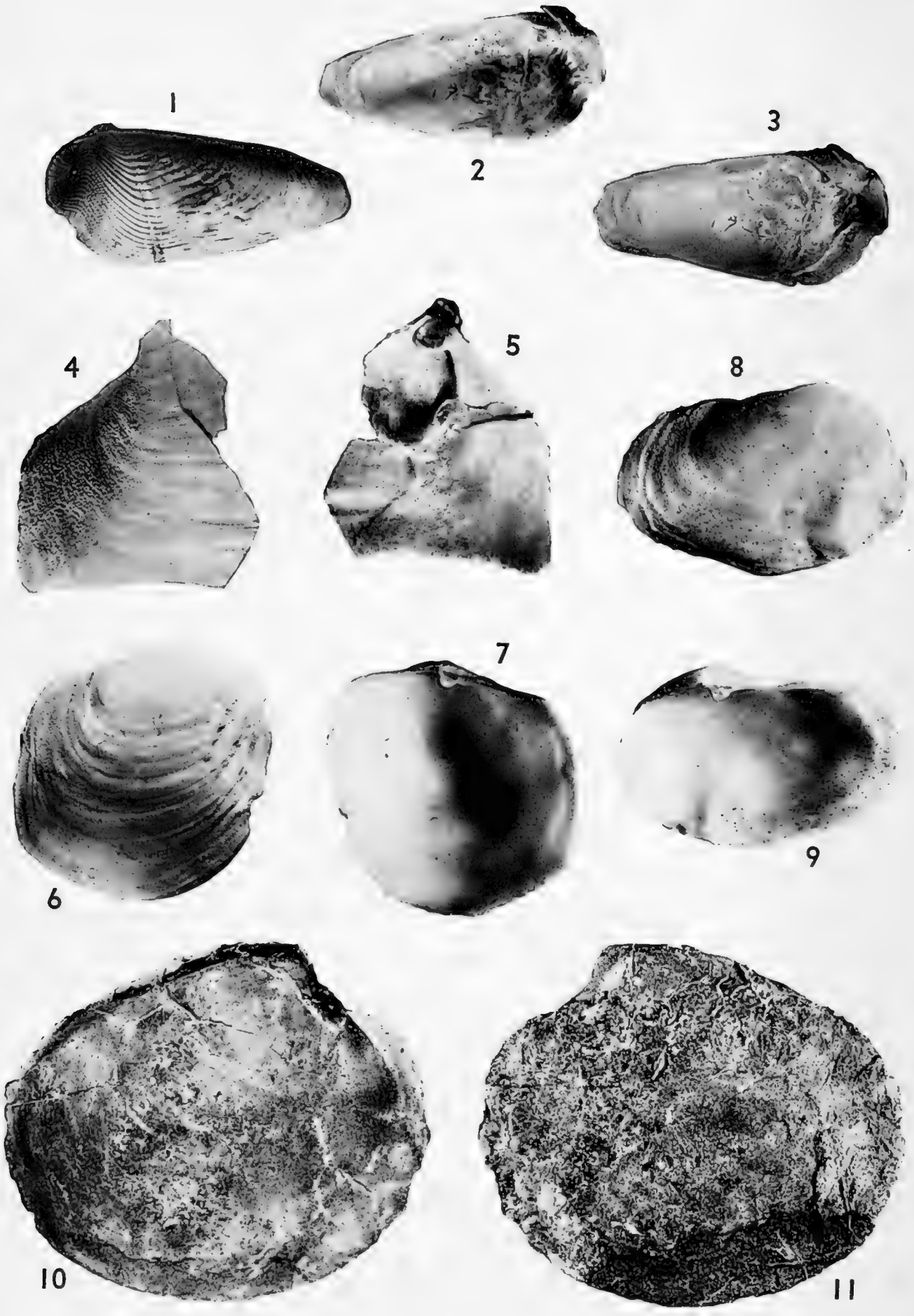

12


13


14


15


16


1
2
3
4
5
8
6
7
9
10
11

Explanation of Plate 58

Figure — Page

1-3. **Martesia striata** (Linnaeus) 405
Specimen B505a. 26848 PRI. Exterior, and two interior views. Length 24 mm.; height 11.6 mm.; thickness 6 mm. Recent.

4-9. **Periploma margaritacea** (Lamarck) 408
Figs. 4, 5, specimen I509a. 26849 PRI. Exterior and interior of broken right valve. Height of fragment 9 mm. Lower Mare formation. Figs. 6, 7, specimen A534a. 26850 PRI. Exterior and interior of laterally foreshortened right valve. Height 15.1 mm.; length 14.3 mm.; thickness 2.5 mm. Recent. Figs. 8, 9, specimen A558a1. 26851 PRI. Exterior and interior of right valve of pair. Length 13.3 mm.; height 8.4 mm.; thickness of attached pair 5.5 mm. Recent.

10,11. **Dosinia (Dosinidia) concentrica prosapia** Weisbord, n. subsp. 270
Paratype (M415a). 26852 PRI. Internal mold of pair. Length 98.3 mm.; height 89 mm.; thickness of pair 33 mm. Fig. 10, right valve; fig. 11, left valve. Playa Grande formation (Catia member).

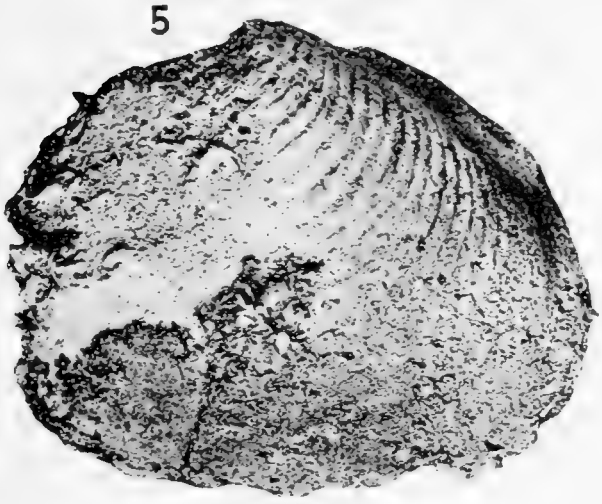
Explanation of Plate 59

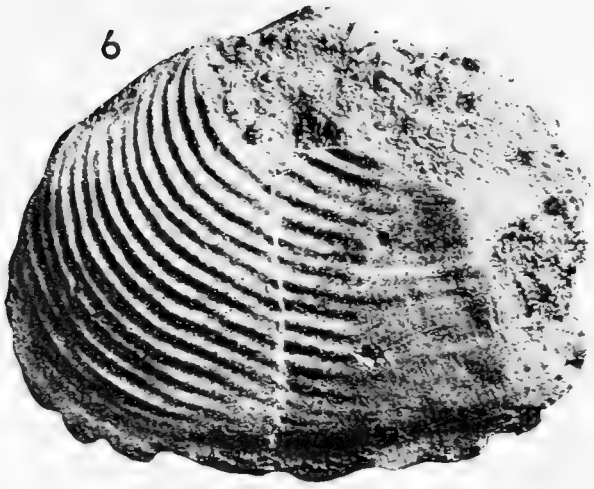
Figure — Page

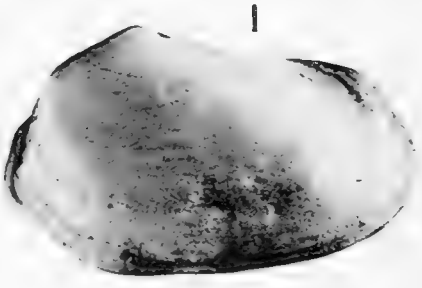
1,2. **Periploma margaritacea** (Lamarck) 408
Specimen A558a2. 26853 PRI. Exterior and interior of left valve of pair. Length 13.9 mm.; height 8.1 mm.; thickness of pair 5.5 mm. Recent.

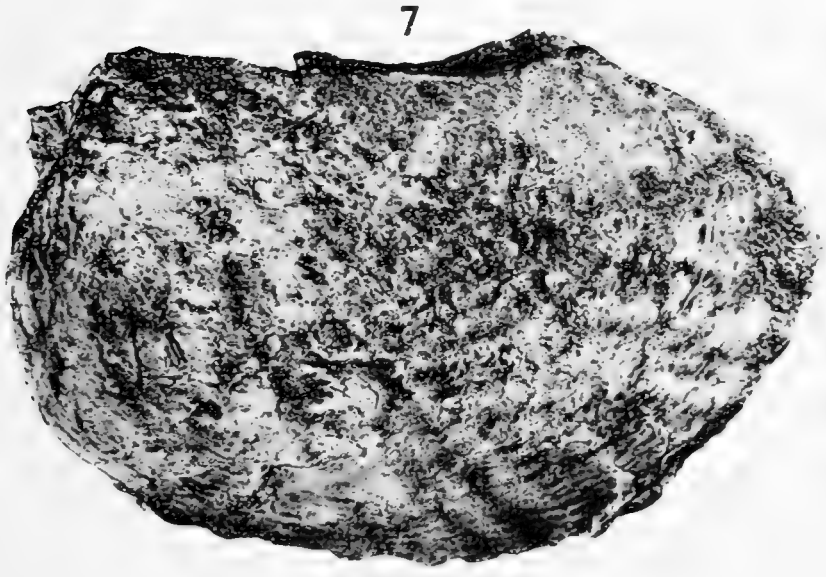
3-6. **Cyathodonta** cf. **tristani** Olsson 410
Figs. 3, 4, specimen L460a. 26854 PRI. Internal mold of pair. Length 34 mm.; thickness of pair 10 mm. Fig. 3, right valve; fig. 4, left valve. Playa Grande formation (Catia member). Figs. 5, 6, specimen M462a. 26855 PRI. Internal mold of paired valves. Length 62 mm.; height 50 mm.; thickness of pair 24 mm. Fig. 5, right valve; fig. 6, left valve. Playa Grande formation (Catia member).

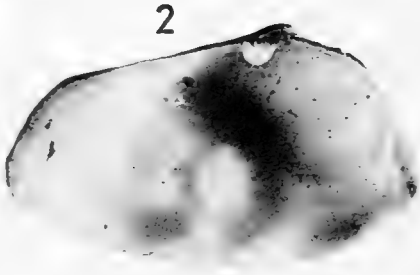
7,8. **Pholadomya** cf. **candida** Sowerby 412
Specimen M357a. 26856 PRI. Internal mold of paired valves. Length 104 mm.; height 72 mm.; thickness of pair 61 mm. Fig. 7, left valve; fig. 8, right valve. Playa Grande formation (Catia member).

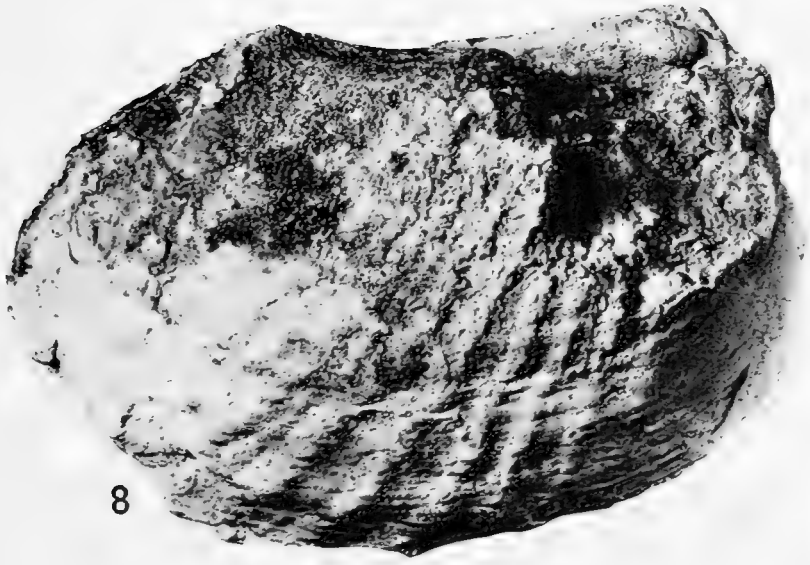

5

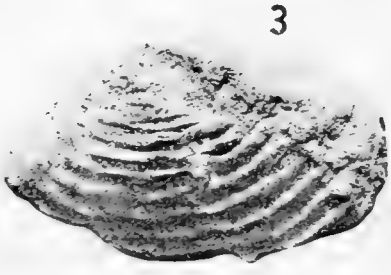

6


1


7


2


8


3


4

INDEX TO VOLUME XLV

Note: Light face figures refer to pages. Heavy face figures refer to plates.

D

E

S

T