Cenozoic Fossil Mollusks From Western Pacific Islands; Gastropods (Eulimidae and Volutidae Through Terebridae)

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1171

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By HARRY S. LADD

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Descriptions or citations of 271 representatives of gastropod families from seven island groups

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CENOZOIC FOSSIL MOLLUSKS FROM WESTERN PACIFIC ISLANDS; GASTROPODS (EULIMIDAE AND VOLUTIDAE THROUGH TEREBRIDAE)

By HARRY S. LADD

ABSTRACT

Descriptions and citations of Cenozoic fossil mollusks from seven island groups in the western Pacific, started in Professional Papers 531, 532, and 533, are continued in the present report, which deals with 271 forms. These forms include representatives of the Eulimidae and seven other gastropod families—Volutidae through Terebridae—as well as many additions to families previously covered. One new genus is named in the Turridae, and 52 new species and subspecies are described.

The fossils, like those treated in the earlier reports, are clearly Indo-Pacific in general aspect, but an increasing number of fossils appear to be closely related to living and fossil species from North and South America and the Caribbean area. These new fossils come mostly from rich off-reef deposits in the New Hebrides and Fiji.

INTRODUCTION

The present report is the fourth in a series (*see* Ladd, 1966, 1972, 1977) that attempts to describe or cite all fossil mollusks collected from seven island groups in the western Pacific. These groups extend from the Marianas and Palau in the northwest through the Marshall, Ellice [1], and New Hebrides groups to Fiji and Tonga in the southeast—the "island area" of the text, which is enclosed by a solid line on figure 1. The preceding reports in the series covered the chitons, archaeogastropods, mesogastropods, and part of the neogastropods. The present report treats many of the remaining neogastropods.

In this report, 271 species and subspecies of gastropods are described or recorded, including additions to families previously covered and representatives of eight families (Acmaeidae, Cocculinidae, Cyclostrematidae, Seguenziidae, Eulimidae, Fossaridae, Colubrariidae, and Volutomitridae) not previously covered. The fossils discussed in the present paper range in age from early Miocene to Holocene.

The following references, containing identifications of fossil mollusks, supplement those cited on pages 3–5 of Ladd (1966), page 1 of Ladd (1972), and page 1 of Ladd (1977).

1975 Mallick, D. I. J., and Greenbaum, David, The Navaka fossiliferous sands and the Kere shell bed: New Hebrides Condominium, Geol. Survey Ann. Rept. 1973, p. 8–12. Includes identifications and photographs of eight species of gastropods and refers to others. Paleoecological interpretations based on the mollusks and on other types of fossils are given.

1975 Ladd, H. S., Two Pleistocene volutes from the New Hebrides (Mollusca; Gastropoda): Veliger, v. 18, no. 2, p. 134–138.

1976 Ladd, H. S., New Pleistocene Neogastropoda from the New Hebrides: Nautilus, v. 90, no. 4, p. 127–138. One new genus and 11 new species from the Navaka Sands are described and figured, along with a highly decorated cone, possibly identical with a living species. Paleoecology and age are briefly discussed.

1976 Hindle, W. H., Geology of west-central Vanua Levu: Fiji Mineral Resources Div. Bull. 1, 176 p., geol. maps. Includes lists of fossil mollusks (p. 10, 37–38, 40, 41, 42) identified by H. S. Ladd.

1977 Mallick, D. I. J., and Greenbaum, David, Geology of southern Santo: New Hebrides Condominium, Geol. Survey, Regional Rept., 84 p. Includes (p. 52–54, 56) names of fossil mollusks identified by H. S. Ladd.

ACKNOWLEDGMENTS

As in earlier units in this series, I am deeply indebted to field geologists and their assistants on the Geological Surveys of Fiji [2] and New Hebrides for extensive collections of fossils that were transmitted to me for identification. From Fiji, I received such material from Peter Rodda, F. E. I. Coulson, and William Hindle. From the New Hebrides, Dr. D. I. J. Mallick and Dr. David Greenbaum sent extensive collections of fossils from Pleistocene beds on Santo. Dr. Thomas Waller of the Smithsonian Institution and Warren Blow, then of the U.S. Geological Survey, visited the island in 1974 and collected bulk samples.

[1] In 1976, the name Ellice was officially changed to Tuvalu.

[2] In 1972, the Geological Survey Department of Fiji was amalgamated with the Mines Section of the Department of Lands, Mines and Mineral Resources to form the Mineral Resources Division of a new Ministry of Lands and Mineral Resources.

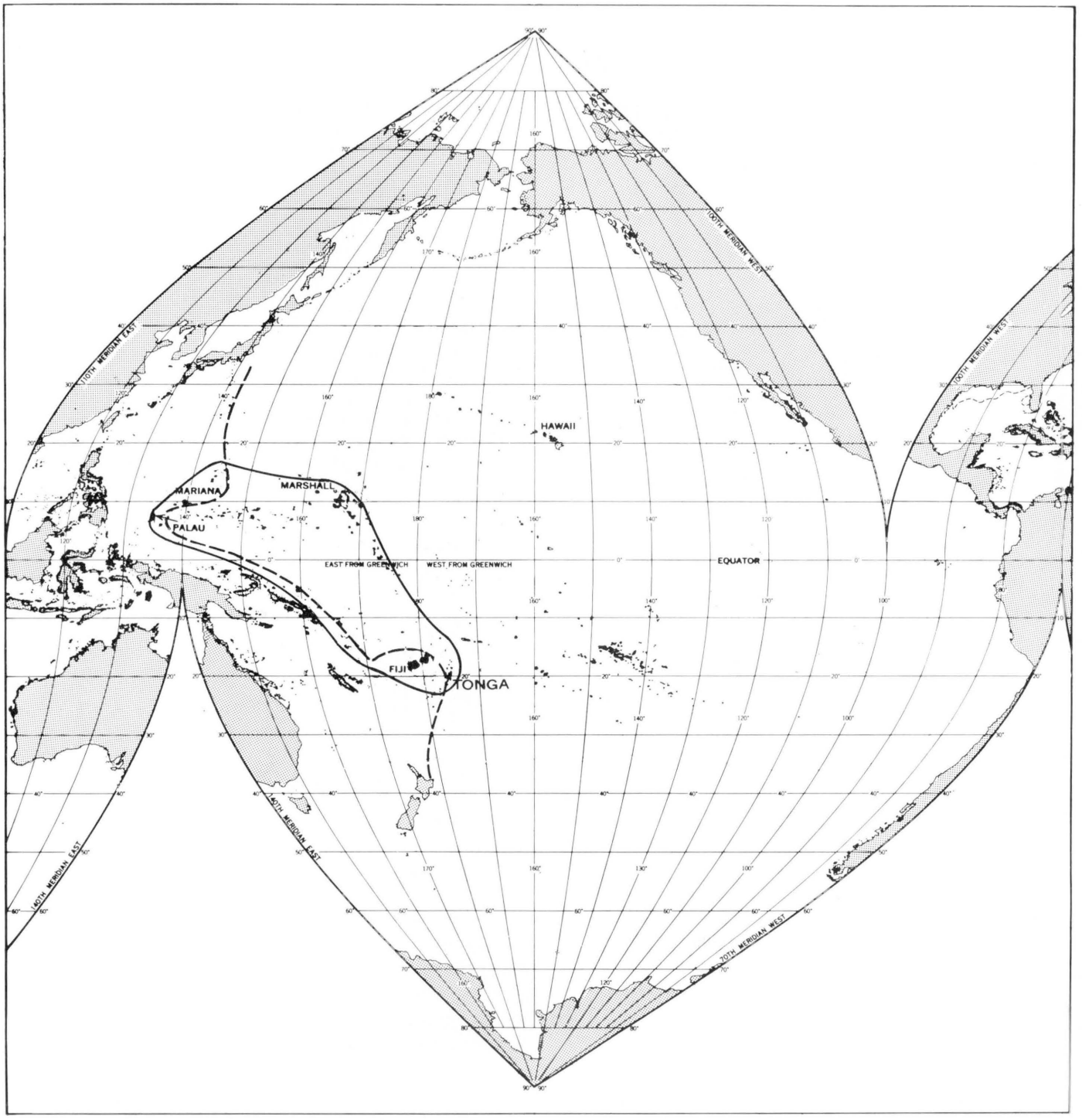

FIGURE 1.—Location of island groups (solid line) from which fossil mollusks have been obtained. Dashed line marks structural boundary of Pacific basin (andesite line). Islands shown include the surrounding reefs.

Dr. C. P. Nuttall of the British Museum (Natural History) loaned Fijian fossils from their collections. Dr. Alan J. Kohn of the University of Washington reviewed the many fossil species of *Conus* from the islands, and Dr. W. F. Ponder of the Australian Museum checked some of my identifications of fossils, as did Richard Petit of Myrtle Beach, S.C. As in earlier reports, I am indebted to my colleagues in Washington—Drs. H. A. Rehder and J. P. E. Morrison, Richard S. Houbrick, and Druid Wilson, all of the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.—

for discussions involving the identification of certain fossils. All photographs, except for SEM views, were taken by Robert H. McKinney of the U.S. Geological Survey.

The manuscript has benefited from technical reviews by Dr. R. Tucker Abbott of Greenfield, Del., and Dr. Harald A. Rehder of the U.S. National Museum of Natural History, Washington, D.C.

GEOLOGY

STRATIGRAPHY AND CORRELATION

In recent years, geological work in the island area outlined in the Introduction has been largely confined to Fiji and the New Hebrides. Most of the islands in those two groups have now been mapped geologically. The stratigraphic units shown in table 1 differ but little from those given by Ladd in 1977.

In Tonga, according to press reports, there are plans for additional drilling in search of oil. A report by Wells (1976) on Eocene corals from deposits on Eua was accompanied by a supplementary report by John E. Fitch on fossil otoliths from the same deposit.

Two other developments are worthy of special note. One deals with the ages of Tertiary units, the other with Quaternary beds.

In 1975, W. S. Cole and Darwin Kadar, in separate articles, published the results of their detailed studies of a remarkable sample from the Miocene of Java that contained both larger and smaller Foraminifera. After reviewing the findings of the Java sample and similar occurrences from other parts of the southwest Pacific, Cole proposed a reasonable correlation that would tie the widely used letter classification (based on larger Foraminifera) with the N scale (based on planktonic Foraminifera). The suggested correlation appears in table 2.

The second development is not tied to the work of a single individual or to work in a particular locality. During the past 10 years or so, radiometric methods of determining exact ages have been improved and have been applied to many beds in or near the island area (Rodda, and others, 1967). Detailed studies at Eniwetok and Bikini in the Marshall Islands have located and dated stratigraphic intervals of reef growth and associated lagoonal sedimentation during the Quaternary (Tracey and Ladd, 1974; Henny and others, 1974).

PALEONTOLOGY

GEOGRAPHIC AND GEOLOGIC DISTRIBUTION OF SPECIES

[See tables 3 and 4.]

On the island of Santo in the New Hebrides, a thin series of richly fossiliferous beds crops out on the south-flowing Navaka and Kere Rivers. Locations of these beds are shown on a sketch map (fig. 2[3]), and some of the actual outcrops are shown in figures 3 and 4. The exposures were discovered by Mallick and Greenbaum (1975, p. 8, 9) of the New Hebrides Survey while they were mapping on Santo. They named the beds the Navaka Sands and the Kere Shell bed and identified the Navaka Sands with the Tasiriki foundation beds found by Mawson in 1905 on the southwest coast of Santo. The first fossils sent by Mallick and Greenbaum to the U.S. National Museum for identification proved of such interest that Thomas Waller of the Smithsonian Institution and Warren Blow, then of the U.S. Geological Survey, visited the island in 1974 to collect bulk samples. These samples proved very rich in fossil mollusks—perhaps the most diversified and certainly the best preserved fauna of fossil mollusks yet discovered in the islands of the Pacific. Age of the mollusks has been determined as Pleistocene (Ladd, 1976, p. 128).

Early in 1973, William Hindle, geologist with the Fiji Survey, visited Rotuma for a period of 2 weeks. This volcanic island, which lies 220 miles (352 km) north-northwest of Fiji, appeared very young to him, perhaps no more than a few thousand years old. The tuff cones at some places contained considerable coral and some shell debris. On the north coast (Station KR32, at a point 600 yards (546 m) northwest of the village of Maftoa), Hindle (oral commun., 1973) collected shallow-water shells from the tuff—a cerithid, a cypraeid, an immature *Nassarius* (*Arcularia*), a worn muricid, and a fragment of a large spondylid. The only specifically identifiable forms were a shell of *Cypraea helvola* Linnaeus and one of *Strombus* (*Lentigo*) *pipus* (Röding). The latter is figured on plate 4 of the present report. Prior to Hindle's visit, no fossils had been collected from Rotuma.

In July 1973, in company with William Hindle, Peter Rodda, and Howard Colley of the Fiji Survey, I revisted parts of the northwest coast of Vanua Levu, made brief examinations of Thikombia-i-Ra (Fiji's most northerly island), Yanutha, and Lauthala, and made brief visits to some small lime-

[3] In figure 2 only two SM stations are shown. One is on the Navaka River (SM43); the other is on the Kere River (SM242). The many USGS localities cited in the text on these rivers are close to the SM stations.

TABLE 1.—*Correlation chart of Cenozoic units in the island area*

PERIOD	EPOCH		LETTER CLASSIFICATION	MARSHALL		ELLICE (TUVALU)	PALAU	MARIANA		
				ENIWETOK	BIKINI	FUNAFUTI		SAIPAN	TINIAN	GUAM
QUATERNARY	Holocene			Reef complex, chiefly lagoonal and forereef	Reef limestone, chiefly lagoonal beds	Reef limestone	Beach deposits	Raised beaches	Raised-beach sand and gravel	Beach deposits
	Pleistocene						Peleliu Limestone	Tanapag Limestone		
TERTIARY NEOGENE	Pliocene		*h*					Mariana Limestone	Mariana Limestone	Mariana Limestone
	Miocene	Late	*g*			?	Palau Limestone	Terrace deposits?		? Alifan Limestone
								?		Janum Formation
							Airal clay and lignite			Barrigada Limestone
		Early	*f*							Bonya Limestone
			e					Fina-sisu Formation	Tagpochau Limestone	Umatac Formation
PALEOGENE	Oligocene	Late	*d*	?	?		? ? Ngeremiengui Formation	Tagpochau Limestone		?
			c		?					Alutom Limestone
	Eocene	Early	*b*	Reef complex	?		? ? Aimelik Formation	Matansa Limestone / Densinyama Formation / Hagman Formation	Pyroclastic rocks	
			a		Globigerina ooze[1]		? Babelthuap Formation ?			

[1]Occurrence on Sylvania Guyot adjoining Bikini (Hamilton and Rex, 1959).
[2]Robinson (1969).
[3]Reported as Burdigalian-lower Pliocene.
[4]Mitchell (1971).
[5]This is a generalized section from Rodda's map of 1967. In this and other reports (Fiji Geol. Survey Dept. 1965, 1966, Rodda and Band, 1967, Band, 1968) the Fiji Survey recognizes volcanic groups, sedimentary groups, and undifferentiated units that cannot, at present, be accurately integrated.
[6]Generalized section based on Ibbetson (1969), Rickard (1970) and Coulson (1971).
[7]List of formations given in Hindle (1976).

TABLE 1.—Continued.

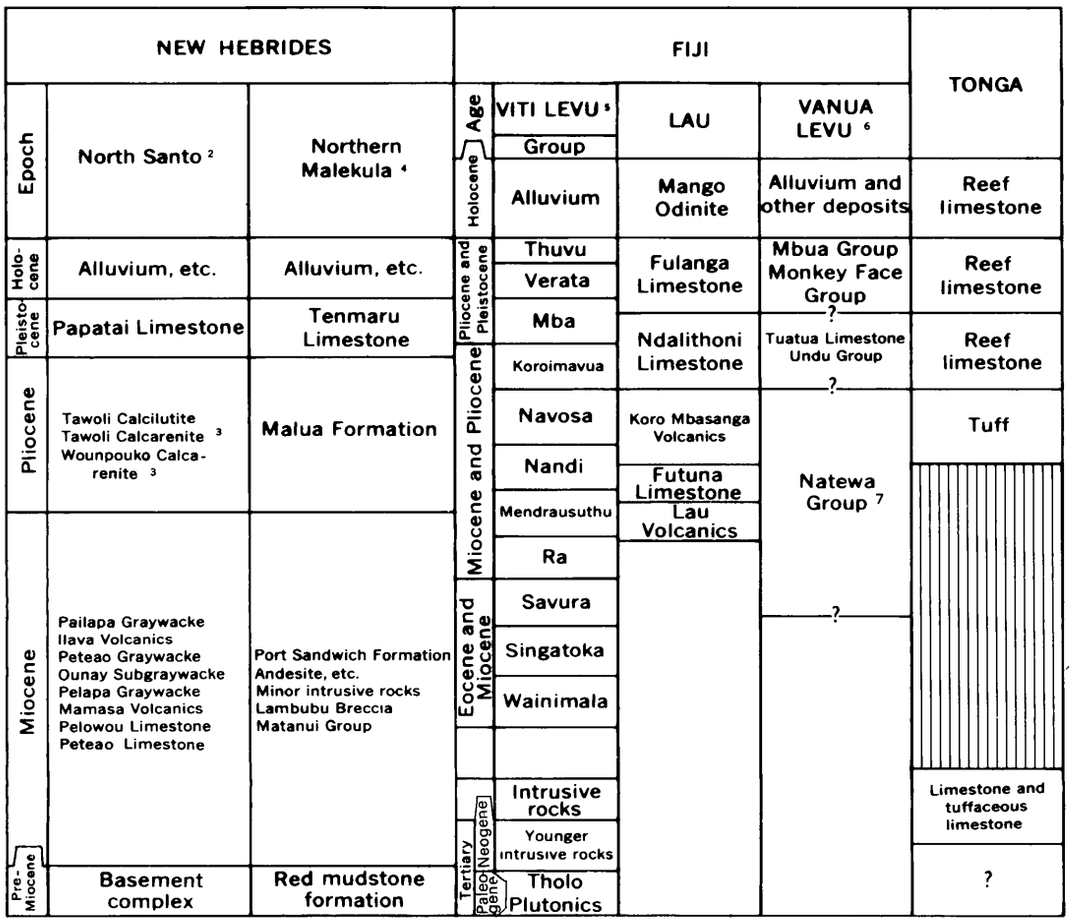

TABLE 2.—*Suggested relationship between planktonic foraminiferal zones and letter stages based on larger Foraminifera.*

Zones by Blow (1969) and Kadar (1975)	Epochs	Sub-epochs (informal)	Letter stages Southwest Pacific by Cole (1975)[1]
N23	Holocene and Pleistocene		Not applied
N22			
N21			
N20	Pliocene		T*h*
N19			
N18			
N17		late	T*g*
N16			
N15			
N14			
N13			
N12			
N11	Miocene		T*f*
N10			
N9			
N8			
N7		early	T*e*
N6			
N5			
N4			
N3			
N2		late	T*d*
N1			
P20	Oligocene		
P19		early	T*c*
P18			
P17			
P16			
P15	Eocene	late	T*b*
P14			

[1] In a paper published the same year, Haak and Postuma (1975) suggested a very similar correlation between the planktonic zones and those of the letter scale.

stone islands on nearby reefs, including Nggele Levu and Vatauba. A stop was also made on Thombia, a tuff crater. Fossil mollusks were collected at several places, but only a few were gastropods, and most of these were poorly preserved. We visited Ronald Bartholomew's fossil locality near Naweni on Vanua Levu. The roadcut there, from which a *Thatcheria* and other mollusks had been collected by others many years earlier, was found to be heavily overgrown, and our efforts at collecting yielded little of interest.

The many petrologic and geophysical data that have been accumulated seem to indicate that some form of crustal (plate) movement has been involved in the formation of the existing islands of Lau and Tonga. Exact interpretations still vary, but there is every reason to believe that in the near future movements and dates will be generally agreed upon.

In 1967, Dickinson published a comprehensive review of available data on the tectonic history of Fiji.

In 1970, Milsom published a map of the Fiji area in the southwest Pacific, using bathymetry by Menard and others (1969). He suggested that the Lau Ridge might be an example of a "dead" island arc, its activity transferred to the Tonga-Kermadec region after a post-Miocene change in sea-floor spreading.

In 1971, regional relations in the New Hebrides Islands were summarized by Mitchell and Warden, who showed that eastern and western belts of islands containing Neogene rocks are bisected by a central chain of active and recently extinct volcanoes. Massive reef limestones were laid down in all three belts during Pliocene and Quaternary time. Also in 1971, Chase published a tectonic history of the Fiji Plateau based on all available geological and geophysical data.

In 1973, Green and Cullen published an updated summary of Fijian geology and included an account of probable tectonic evolution.

In 1975, Lingen summarized the deep-sea-sediment drilling in the southwest Pacific. In 1974, Hawkins had described the Lau Basin (between Fiji and Tonga) as being underlain by young sea-floor tholeiitic basalt. He noted that the basin has a very thin sedimentary cover, except near the bordering ridges on the east and west.

In 1976, Gill compared the volcanic rocks of Lau with those of Tonga. He concluded that available data favored Karig's (1970) interpretation that the Lau and Tonga ridges were united as an island arc from Eocene to Miocene time before being separated in the Pliocene. The rifting formed the Lau Basin, an area characterized by shallow depths (2,300 m) and little sediment (0–100 m, generally; 700 m maximum, close to the bordering ridges).

In two earlier reports in the present series (Ladd, 1966, 1972), some of the difficulties of distinguishing Pleistocene and Holocene fossils obtained from drill holes and from outcrops were briefly discussed. Also mentioned was the difficulty of drawing a boundary between the Quaternary beds and the underlying sediments of the Pliocene.

In 1969, Berggren published a summary of Cenozoic chronostratigraphy, planktonic foraminiferal zonation, and the radiometric time scale. This report was followed by a broad review of climatic events during the past 15 million years ("Late Neogene") by Berggren and van Couvering (1974). Opinions still differ on the exact limits of the Pleistocene, but as the number of radiometric age determinations grow, there seems to be a widespread feeling that

TABLE 3.—*Geographic distribution of Cenozoic fossil mollusk species in the island area*

Species	Palau	Guam	Saipan	Eniwetok	Bikini	Funafuti	New Hebrides	Fiji	Tonga
Additions to families covered in Ladd (1966, 1972, 1977), plus Acmaeidae, Cocculinidae, Cyclostrematidae, Seguenziidae, Eulimidae, Fossaridae, and Colubrariidae not previously covered									
Scissurellidae:									
Anatoma japonica A. Adams	--	--	--	--	--	--	×	--	--
Sinezona carinata (A. Adams)	--	--	--	--	--	--	×	--	--
cingulata (O. G. Costa)	--	--	--	--	--	--	×	--	--
Fissurellidae:									
Emarginula sp. C	--	--	--	--	--	--	--	--	--
(*Emarginella*) *eximia* A. Adams	--	--	--	--	--	--	×	--	--
Puncturella (*Puncturella*) *agger* Watson	--	--	--	--	--	--	×	--	--
(*Cranopsis*) *pileolus* A. Adams	--	--	--	--	--	--	×	--	--
Zeidora calceolina A. Adams	--	--	--	--	--	--	×	--	--
Rimula sp. A	--	--	--	--	--	--	--	×	--
Acmaeidae:									
Chiazacmea cf. *C. pygmaea* Kuroda and Habe	--	--	--	--	--	--	×	--	--
Patelloida cf. *P. latistrigata* (Angas)	--	--	--	--	--	--	×	--	--
Cocculinidae:									
Cocculina nipponica Kuroda and Habe	--	--	--	--	--	--	×	--	--
Trochidae:									
Calliotropis rewaensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
? sp. A	--	--	--	--	--	--	×	--	--
Turcica (*Perrinea*) *fijiensis* Ladd, n. sp	--	--	--	--	--	--	--	×	--
(*Perrinea*) *waiwailevensis* Ladd, n. sp	--	--	--	--	--	--	--	×	--
Turcicula sp. A	--	--	--	--	--	--	--	×	--
Calliotrochus navakaensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
Enida warreni Ladd, n. sp	--	--	--	--	--	--	×	--	--
Solariella (*Ethaliopsis*) *vitilevensis* Ladd, n. sp	--	--	--	--	--	--	--	×	--
Microgaza (*Microgaza*) *navakaensis* Ladd, n. sp	--	--	--	--	--	--	×	--	--
? sp. A	--	--	--	--	--	--	--	×	--
Turbinidae:									
Astraea (*Bolma*) *girgyllus* (Reeve)	--	--	--	--	--	--	×	--	--
Arene (*Arene*) sp. B	--	--	--	--	--	--	×	--	--
Dentarene navakaense Ladd, n. sp	--	--	--	--	--	--	×	--	--
depressa Ladd, n. sp	--	--	--	--	--	--	×	--	--
Turbo (*Turbo*) *petholatus* Linnaeus	--	--	--	--	--	--	×	--	--
Homalopoma (*Cantrainea*) *whipplei* Ladd, n. sp	--	--	--	--	--	--	--	×	--
(*Cantrainea*?) *druidi* Ladd, n. sp	--	--	--	--	--	--	--	×	--
Cyclostrematidae:									
Cyclostrema somidi Ladd, n. sp	--	--	--	--	--	--	--	×	--
cf. *C. somidi* Ladd	--	--	--	--	--	--	×	--	--
Neritidae:									
Neritina zigzag Lamarck	--	--	--	--	--	--	×	--	--
Smaragdia (*Smaragdia*) cf. *S. viridis* (Linnaeus)	--	--	--	--	--	--	--	×	--
Rissoidae:									
Zebina (*Cibdezebina*) *metaltilana* Ladd	--	--	--	--	--	--	×	--	--
(*Moerchiella*) *supracostata* (Garrett)	--	--	--	--	--	--	×	--	--
sp. A	--	--	--	--	--	--	×	--	--
Architectonicidae:									
Mangonuia navakaensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
kerensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
sp. A	--	--	--	--	--	--	×	--	--
sp	--	--	--	--	--	--	×	--	--
Pseudomalaxis (*Pseudomalaxis*?) *roddai* Ladd, n. sp	--	--	--	--	--	--	--	×	--
Architectonica maxima (Philippi)	--	--	--	--	--	--	×	--	--
(*Pseudotorinia*) aff. *A.* (*P.*) *euprepes* Woodring	--	--	--	--	--	--	×	--	--
Turritellidae:									
Siliquaria cumingii (Mörch)	--	--	--	--	--	--	×	--	--
aff. *S. armata* Kuroda, Habe, and Kozuge	--	--	--	--	--	--	×	--	--
Thiaridae:									
Thiara (*Plotia*) *scabra* (Müller)	--	--	--	--	--	--	×	--	--
Cerithiidae:									
Clypeomorus coralium (Kiener)	--	--	--	--	--	--	×	--	--
Seguenziidae:									
Seguenzia donaldi Ladd, n. sp	--	--	--	--	--	--	×	--	--
Epitoniidae:									
Epitonium cf. *E. replicata* (Sowerby)	--	--	--	--	--	--	×	--	--
(*Cycloscala*) cf. *E. revolutum* (Hedley)	--	--	--	--	--	--	--	×	--
Eulimidae:									
Eulima santoensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
sp. A	×	--	--	×	--	--	--	--	--
Balcis martinii (A. Adams)	--	--	--	--	--	--	×	--	--
aff. *B. kanaka* (Pilsbry)	--	--	--	--	×	--	--	--	--
aff. *B. vitrea* (A. Adams)	--	--	--	--	--	--	--	×	--

TABLE 3.—*Geographic distribution of Cenozoic fossil mollusk species in the island area*—Continued

Species	Palau	Guam	Saipan	Eniwetok	Bikini	Funafuti	New Hebrides	Fiji	Tonga
Strombidae:									
Varicospira cf. *V. cancellata* (Lamarck)	--	--	--	--	--	--	×	--	--
cancellata spinifera (Martin)	--	--	--	--	--	--	--	×	--
Tibia powisii (Petit)	--	--	--	--	--	--	×	--	--
Strombus (*Canarium*) *labiatus* (Röding)	--	--	--	--	--	--	--	×	--
(*Canarium*) *microurceus* (Kira)	--	--	--	--	--	--	--	×	--
(*Dolomena*) *minimus* Linnaeus	--	--	--	--	--	--	--	×	--
plicatus columba Lamarck	--	--	--	--	--	--	×	--	--
(*Lentigo*) *pipus* (Röding)	--	--	--	--	--	--	--	×	--
(*Euprotomus*) *bulla* (Röding)	--	--	--	--	--	--	×	--	--
Fossaridae:									
Couthouyia kerensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
Capulidae:									
Capulus japonicus A. Adams	--	--	--	--	--	--	×	--	--
Calyptryraeidae:									
Crepidula sp. A	--	--	--	--	--	--	×	--	--
Eratoidae:									
Trivirostra (*Dolichupis*) *producta* (Gaskoin)	--	--	--	--	--	--	×	--	--
Cypraeidae:									
Cypraea (*Erronea*) *gracilis* Gaskoin	--	--	--	--	--	--	×	--	--
(*Erronea*) *pulchella* Swainson	--	--	--	--	--	--	×	--	--
cf. *C. pyriformis* Gray	--	--	--	--	--	--	×	--	--
(*Notadusta*) *punctata* Linnaeus	--	--	--	--	--	--	×	--	--
Ovulidae (Amphiperatidae):									
Pedicularia navakaensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
Crenavolva (*Serratovolva*) *imitablis* Cate	--	--	--	--	--	--	×	--	--
Dentiovula masaoi Cate	--	--	--	--	--	--	×	--	--
tadashigei Cate	--	--	--	--	--	--	×	--	--
Ovula ishibashii (Kuroda)	--	--	--	--	--	--	×	--	--
Phenacovolva longirostrata (Sowerby)	--	--	--	--	--	--	×	--	--
Volva (*Volva*) *volva* Linnaeus	--	--	--	--	--	--	×	--	--
Naticidae:									
Natica (*Natica*) *areolata* Récluz	--	--	--	--	--	--	×	--	--
(*Natica*) *vitellus* (Linnaeus)	--	--	--	--	--	--	×	--	--
(*Tectonatica*) aff. *N. violacea* Sowerby	--	--	--	--	--	--	×	--	--
Neverita albumen (Linnaeus)	--	--	--	--	--	--	×	--	--
Eunaticina sp	--	--	--	--	--	--	--	×	--
Sinum undulatum (Lischke)	--	--	--	--	--	--	×	--	--
Cassidae:									
Morum (*Cancellomorum*) *cancellata* (Sowerby)	--	--	--	--	--	--	×	--	--
Phalium areola (Linnaeus)	--	--	--	--	--	--	×	--	--
Casmaria ponderosa (Gmelin)	--	--	--	--	--	--	×	--	--
Cymatiidae:									
Gyrinium cf. *G. reticulare robusta* (Fulton)	--	--	--	--	--	--	×	--	--
Cymatium (*Ranularia*) *sinensis* (Reeve)	--	--	--	--	--	--	×	--	--
(*Ranularia*) *gutturnium* (Röding)	--	--	--	--	--	--	×	--	--
Charonia tritonis (Linnaeus)	--	--	--	--	--	--	×	--	--
Bursidae:									
Bursa bufonia dunkeri Kira	--	--	--	--	--	--	×	--	--
rubeta (Linnaeus)	--	--	--	--	--	--	×	--	--
Tonnidae:									
Tonna cerevisina Hedley	--	--	--	--	--	--	×	--	--
allium (Dillwyn)	--	--	--	--	--	--	×	--	--
Ficidae:									
Ficus ficoides (Lamarck)	--	--	--	--	--	--	×	--	--
Muricidae:									
Chicoreus axicornis (Lamarck)	--	--	--	--	--	--	×	--	--
cf. *C. superbus* (Sowerby)	--	--	--	--	--	--	×	--	--
Murex (*Murex*) *pecten* (Lightfoot)	--	--	--	--	--	--	×	--	--
(*Murex*) *tribulus* Linnaeus	--	--	--	--	--	--	×	--	--
rectirostris Sowerby	--	--	--	--	--	--	×	--	--
aff. *M. aduncospinosus* Beck	--	--	--	--	--	--	--	×	--
Pterynotus (*Naquetia*) *barclayi* (Reeve)	--	--	--	--	--	--	×	--	--
Typhis cf. *T. japonicus* (A. Adams)	--	--	--	--	--	--	×	--	--
Thaididae:									
Drupa (*Morula*) *concatenata* (Lamarck)	--	--	--	×	--	--	--	--	--
Drupella cornus (Röding)	--	--	--	--	--	--	×	--	--
Mancinella aff. *M. bufo* (Lamarck)	--	--	--	--	--	--	×	--	--
Magilidae (Coralliophilidae):									
Coralliophila mallicki Ladd	--	--	--	--	--	--	×	--	--
Latiaxis roddai Ladd, n. sp	--	--	--	--	--	--	--	×	--
(*Tolema*) *deburghiae* (Reeve)	--	--	--	--	--	--	×	×	--
cf. *L. winckworthi* Fulton	--	--	--	--	--	--	×	--	--
blowi Ladd	--	--	--	--	--	--	×	--	--

TABLE 3.—*Geographic distribution of Cenozoic fossil mollusk species in the island area*—Continued

Species	Palau	Guam	Saipan	Eniwetok	Bikini	Funafuti	New Hebrides	Fiji	Tonga
Columbellidae:									
Anachis (Costoanachis) mawsoni Ladd, n. sp	--	--	--	--	--	--	×	--	--
(Costoanachis) sp. A	--	--	--	--	--	--	--	×	--
Buccinidae:									
Hindsia sinensis (Sowerby)	--	--	--	--	--	--	×	--	--
rewaensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
Siphonofusus walleri (Ladd)	--	--	--	--	--	--	×	--	--
Phos bakeri Ladd	--	--	--	--	--	--	×	--	--
Euthria rewaensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
Metula kerensis Ladd	--	--	--	--	--	--	×	--	--
santoensis Ladd	--	--	--	--	--	--	×	--	--
cf. *M. mitrella* (Adams and Reeve)	--	--	--	--	--	--	×	--	--
Colubrariidae:									
Colubraria maculosa (Gmelin)	--	--	--	--	--	--	×	--	--
obscura (Reeve)	--	--	--	--	--	--	×	--	--
tortuosa (Reeve)	--	--	--	--	--	--	×	--	--
rehderi Ladd, n. sp	--	--	--	--	--	--	×	--	--
Nassariidae:									
Nassarius (Plicarcularia) globosus (Quoy and Gaimard)	--	--	--	--	--	--	×	--	--
(Plicarcularia) cf. *N. bimaculatus* (A. Adams)	--	--	--	--	--	--	×	--	--
(Niotha) albescens (Dunker)	--	--	--	--	--	--	×	--	--
nodiferus (Powys)	--	--	--	--	--	--	×	--	--
variegatus (A. Adams)	--	--	--	--	--	--	×	--	--
(Zeuxis) dorsatus (Röding)	--	--	--	--	--	--	×	--	--
margaritiferus (Dunker)	--	--	--	--	--	--	×	--	--
(Alectrion) barsdelli Ladd	--	--	--	--	--	--	×	--	--
glans (Linnaeus)	--	--	--	--	--	--	×	--	--
Bathynassa bolangoi Ladd	--	--	--	--	--	--	×	--	--
Fasciolariidae:									
Latirus craticulatus (Linnaeus)	--	--	--	--	--	--	×	--	--
paetelianus (Küster)	--	--	--	--	--	--	×	--	--
polygonus (Gmelin)	--	--	--	--	--	--	×	--	--
cf. *L. formosior* Melvill	--	--	--	--	--	--	×	--	--
Dolicholatirus cf. *D. lancea* (Gmelin)	--	--	--	--	--	--	--	×	--
Fusinus colus (Linnaeus)	--	--	--	--	--	--	×	--	--
Olividae:									
Oliva ispida (Röding)	--	--	--	--	--	--	×	--	--
Mitridae:									
Mitra (Nebularia) contracta Swainson	--	--	--	--	--	--	×	--	--
Cancilla (Cancilla) isabella (Swainson)	--	--	--	--	--	--	×	--	--
Vexillum (Vexillum) coccineum (Reeve)	--	--	--	--	--	--	×	--	--
(Vexillum) vulpecula (Linnaeus)	--	--	--	--	--	--	×	--	--
subdivisum (Gmelin)	--	--	--	--	--	--	×	--	--
(Costellaria) polygonum (Gmelin)	--	--	--	--	--	--	×	--	--
cf. *V. bellum* (Pease)	--	--	--	--	--	--	×	--	--
(Pusia) millecostatum (Broderip)	--	--	--	--	--	--	×	--	--
Families covered in this report									
Volutidae:									
Lyria mallicki Ladd	--	--	--	--	--	--	×	--	--
santoensis Ladd	--	--	--	--	--	--	×	--	--
Volutomitridae:									
Volutomitra? vitilevensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
Cancellariidae:									
Cancellaria tholoensis Ladd	--	--	--	--	--	--	--	×	--
(Merica) asperella Lamarck	--	--	--	--	--	--	×	--	--
petiti Ladd, n. sp	--	--	--	--	--	--	--	×	--
Trigonostoma (Scalptia) crenifera (Sowerby)	--	--	--	--	--	--	×	--	--
Neadmete nausorensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
Marginellidae:									
Marginella cf. *M. (Granula) iota* Hedley	--	--	--	--	--	×	--	--	--
(Eratoidea) ringicula Sowerby	×	--	--	×	×	--	--	--	--
Volvarina cf. *V. avena* (Kiener)	--	--	--	×	--	--	--	--	--
Turridae:									
Gemmula speciosa (Reeve)	--	--	--	--	--	--	×	×	--
kieneri (Doumet)	--	--	--	--	--	--	×	--	--
woodwardi (Martin)	--	--	--	--	--	--	--	×	--
congener (E. A. Smith)	--	--	--	--	--	--	--	×	--
monilifera (Pease)	--	--	--	--	--	--	--	×	--
aff. *G. clifdenensis* Powell	--	--	--	--	--	--	--	×	--
sp. A	--	--	--	--	--	--	--	×	--
Nasavusavuia nuttalli Ladd, n. g. et n. sp	--	--	--	--	--	--	--	×	--
Ptychosyrinx aff. *P. timorensis teschi* Powell	--	--	--	--	--	--	--	×	--
Cryptogemma richmondi Ladd, n. sp	--	--	--	--	--	--	--	×	--

TABLE 3.—*Geographic distribution of Cenozoic fossil mollusk species in the island area*—Continued

Species	Palau	Guam	Saipan	Eniwetok	Bikini	Funafuti	New Hebrides	Fiji	Tonga
Families covered in this report—Continued									
Turridae—Continued									
Epidrona greenbaumi Ladd	--	--	--	--	--	--	×	--	--
Lophiotoma (Lophiotoma) acuta (Perry)	--	×	--	--	--	--	--	×	--
(*Lophiotoma*) *eniwetokensis* Ladd, n. sp	--	--	--	×	--	--	--	--	--
cf. *L. leucotropis* (Adams and Reeve)	--	--	--	--	--	--	--	×	--
(*Lophioturris*) *indica* Röding	--	--	--	--	--	--	×	×	--
Turris crispa crispa (Lamarck)	--	--	--	--	--	--	×	--	--
Comitas aff. *C. kamakurana* (Pilsbry)	--	--	--	--	--	--	×	--	--
nausorensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
waluensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
sp. A	--	--	--	--	--	--	--	×	--
Leucosyrinx fijiensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
rabbidgei Ladd, n. sp	--	--	--	--	--	--	--	×	--
Clavosurcula? briggsi Ladd, n. sp	--	--	--	--	--	--	--	×	--
Clathrodrillia kerensis Ladd, n. sp	--	--	--	--	--	--	×	--	--
Crassispira macneili Ladd, n. sp	--	--	--	--	--	--	--	×	--
Inquisitor walleri Ladd, n. sp	--	--	--	--	--	--	×	--	--
Agathotoma vanualevensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
Guraleus vitilevensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
fijiensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
formosus Ladd, n. sp	--	--	--	--	--	--	×	--	--
Ithycythara lata Ladd, n. sp	--	--	--	--	--	--	×	--	--
Euclathurella santoensis Ladd	--	--	--	--	--	--	×	--	--
? sp. A	--	--	--	--	--	--	--	×	--
Eucithara stromboides (Reeve)	--	--	--	--	--	--	×	--	--
sawitrae (Beets)	×	--	--	--	--	--	--	--	--
marshallensis Ladd, n. sp	--	--	--	×	×	--	--	--	--
Etrema palauensis Ladd, n. sp	×	--	--	--	--	--	--	--	--
sp. A	--	--	--	--	--	--	--	×	--
Eubela woodrowi Ladd. n. sp	--	--	--	--	--	--	--	×	--
Thatcheria vitiensis Charig	--	--	--	--	--	--	--	×	--
Clinura? fijiensis Ladd, n. sp	--	--	--	--	--	--	--	×	--
? sp. A	--	--	--	--	--	--	--	×	--
? sp. B	--	--	--	--	--	--	--	×	--
Conidae:									
Conus acueliformis Reeve	--	--	--	--	--	--	×	--	--
acueliformis mckinneyi Ladd, n. subsp	--	--	--	--	--	--	--	×	--
acutangulus Lamarck	--	--	--	--	--	--	×	--	--
ammiralis Linnaeus	--	--	--	--	--	--	×	--	--
cf. *C. aristophanes* Sowerby	--	--	--	--	--	--	--	×	--
cf. *C. bonus* Nomura	--	--	--	--	--	--	--	×	--
cf. *C. catus* Hwass	--	--	--	--	--	--	×	--	--
charigi Ladd, n. sp	--	--	--	--	--	--	--	×	--
cf. *C. coelinae* Crosse	--	--	--	--	--	--	×	--	--
corrugatus Sowerby	--	--	--	--	--	--	--	×	--
eburneus Hwass	--	--	--	×	--	--	--	--	--
cf. *C. emaciatus* Reeve	--	--	--	--	--	--	×	--	--
cf. *C. eugrammatus* Bartsch and Rehder	--	--	--	--	--	--	×	--	--
excelsus Sowerby	--	--	--	--	--	--	×	--	--
figulinus Linnaeus	--	--	--	--	--	--	×	--	--
cf. *C. gembacanus* Martin	--	--	--	--	--	--	×	--	--
geographus Linnaeus	--	--	--	--	--	--	×	--	--
glans Hwass	--	--	--	--	--	--	--	--	×
gloriamaris Chemnitz	--	--	--	--	--	--	×	--	--
gracilis Sowerby	--	--	--	--	--	--	×	--	--
vouensis Ladd	--	--	--	--	--	--	--	×	--
grangeri Sowerby	--	--	--	--	--	--	×	--	--
gubernator Hwass	--	--	--	--	--	--	×	--	--
insculptus Kiener	×	--	--	--	--	--	--	--	--
kimioi (Habe)	--	--	--	--	--	--	×	--	--
cf. *C. litteratus* Linnaeus	--	×	--	--	--	--	--	×	--
macarae Bernardi	--	--	--	--	--	--	×	--	--
miliaris Hwass	--	--	--	--	--	--	×	--	--
mucronatus Reeve	--	--	--	--	--	--	×	--	--
nussatella Linnaeus	--	--	--	--	--	--	×	--	--
ochroleucus Gmelin	--	--	--	--	--	--	×	--	--
orbignyi Audouin	--	--	--	--	--	--	×	--	--
cf. *C. vertusus* Hwass	--	--	--	--	--	--	×	--	--
praecellens A. Adams	--	--	--	--	--	--	×	--	--
quercinus Hwass	--	--	--	--	--	--	×	--	--
recluzianus Bernardi	--	--	--	--	--	--	×	--	--
aff. *C. saecularis* Melvill	--	--	--	--	--	--	×	--	--
aff. *C. socialis* Martin	--	--	--	--	--	--	--	×	--

TABLE 3.—*Geographic distribution of Cenozoic fossil mollusk species in the island area*—Continued

Species	Palau	Guam	Saipan	Eniwetok	Bikini	Funafuti	New Hebrides	Fiji	Tonga
Families covered in this report—Continued									
Conidae—Continued									
Conus striatus Linnaeus	--	--	--	--	--	--	×	×	×
sulcatus Hwass	--	--	--	--	--	--	×	×	--
undulatus Sowerby	--	--	--	--	--	--	×	--	--
terebra Born	--	--	--	--	--	--	×	--	--
cf. *C. tessulatus* Born	--	--	--	--	--	--	--	×	--
vimineus Reeve	--	--	--	--	--	--	×	--	--
yanuyanuensis Ladd	--	--	--	--	--	--	--	×	--
sp. A	--	--	--	--	--	--	--	×	--
sp	--	--	--	--	--	--	--	--	×
Kenyonia cf. *K. chiangi* (Azuma)	--	--	--	--	--	--	×	--	--
Terebridae:									
Hastula sp	--	--	--	--	--	--	--	--	×
Terebra (*Terebra*) *subulata* (Linnaeus)	--	--	--	--	--	--	×	--	--
(*Strioterebrum*) *torquata* Adams and Reeve	--	--	--	--	--	--	×	--	--
nebulosa Sowerby	--	--	--	--	--	--	×	--	--
sp. A	--	--	--	×	--	--	--	--	--
sp.	--	--	--	--	--	--	--	×	--
(*Decorihastula*) *affinis* Gray	--	--	×	×	--	--	--	--	--
(*Microtrypetes*) *vanualevensis* Ladd, n. sp.	--	--	--	--	--	--	--	×	--
kerensis Ladd	--	--	--	--	--	--	×	--	--
(*Oxymeris*) *maculata* (Linnaeus)	--	--	×	--	--	--	--	--	--
interlineata (*Deshayes*)	--	--	--	--	--	--	×	--	--
cf. *T. felina* (Dillwyn)	--	--	--	--	--	--	--	×	--
argus (Hinds)	--	--	×	--	--	--	--	--	--
sp. B	--	--	--	×	--	--	--	--	--
(*Myurella*) *myuros* Lamarck	--	--	--	--	--	--	×	--	--
pretiosa Reeve	--	--	--	--	--	--	×	--	--
alveolata Hinds	--	--	--	--	--	--	×	--	--
(*Triplostephanus*) *triseriata* Gray	--	--	--	--	--	--	×	--	--
Total of 271 species									

TABLE 4.—*Geologic distribution of Cenozoic mollusk species in the island area*

[Queries following occurrences show uncertainty as to the exact age of the beds from which the fossils were obtained. The Alifan Limestone of Guam may be Miocene or Pliocene (Tertiary *g* or *h*); the Mariana Limestone of the same island may be Pliocene or Pleistocene]

Species	Tertiary					Quaternary		
	Late Eocene b	Early Miocene e	Miocene f	Late Miocene g	Pliocene h	Pleistocene	Holocene	Living
Additions to families covered in Ladd (1966, 1972, 1977), plus Acmaeidae, Cocculinidae, Cyclostrematidae, Seguenziidae, Eulimidae, Fossaridae, and Colubrariidae not previously covered								
Scissurellidae:								
Anatoma japonica A. Adams	--	--	--	--	--	×	--	×
Sinezona carinata (A. Adams)	--	--	--	--	--	×	--	×
cingulata (O. G. Costa)	--	--	--	--	--	×	--	×
Fissurellidae:								
Emarginula sp. C	--	--	--	--	--	×	--	--
(*Emarginella*) *eximia* A. Adams	--	--	--	--	--	×	--	×
Puncturella (*Puncturella*) *agger* Watson	--	--	--	--	--	×	--	×
(*Cranopsis*) *pileolus* A. Adams	--	--	--	--	--	×	--	×
Zeidora calceolina A. Adams	--	--	--	--	--	×	--	×
Rimula sp. A	--	--	--	--	×	--	--	--
Acmaeidae:								
Chiazacmea cf. *C. pygmaea* Kuroda and Habe	--	--	--	--	--	×	--	×
Patelloida cf. *P. latistrigata* (Angas)	--	--	--	--	--	×	--	--
Cocculinidae:								
Cocculina nipponica Kuroda and Habe	--	--	--	--	--	×	--	×
Trochidae:								
Calliotropis rewaensis Ladd, n. sp	--	--	--	--	×	--	--	--
? sp. A	--	--	--	--	--	×	--	--
Turcica (*Perrinea*) *fijiensis* Ladd, n. sp	--	--	--	--	×	--	--	--
(*Perrinea*) *waiwailevensis* Ladd n. sp	--	--	--	--	×	--	--	--
Turcicula sp. A	--	--	--	--	×	--	--	--
Calliotrochus navakaensis Ladd, n. sp	--	--	--	--	--	×	--	--
Enida warreni Ladd, n. sp	--	--	--	--	--	×	--	--
Solariella (*Ethaliopsis*) *vitilevensis* Ladd, n. sp	--	--	--	--	×	--	--	--
Microgaza (*Microgaza*) *navakaensis* Ladd, n. sp	--	--	--	--	--	×	--	--
? sp. A	--	--	--	--	×	--	--	--
Turbinidae:								
Astraea (*Bolma*) *girgyllus* (Reeve)	--	--	--	--	--	×	--	×
Arene (*Arene*) sp. B	--	--	--	--	--	×	--	--
Dentarene navakaense Ladd, n. sp	--	--	--	--	--	×	--	--
depressa Ladd, n. sp	--	--	--	--	--	×	--	--
Turbo (*Turbo*) *petholatus* Linnaeus	--	--	--	--	--	×	--	×
Homalopoma (*Cantrainea*) *whipplei* Ladd, n. sp	--	--	--	--	×	--	--	--
(*Cantrainea*?) *druidi* Ladd, n. sp	--	--	--	--	×	--	--	--
Cyclostrematidae:								
Cyclostrema somidi Ladd, n. sp	--	--	--	--	×	--	--	--
cf. *C. somidi* Ladd	--	--	--	--	--	×	--	--
Neritidae:								
Neritina zigzag Lamarck	--	--	--	--	--	×	--	×
Smaragdia (*Smaragdia*) cf. *S. viridis* (Linnaeus)	--	--	--	--	×	--	--	--
Rissoidae:								
Zebina (*Cibdezebina*) *metaltilana* Ladd	--	--	--	--	--	×	--	×
(*Moerchiella*) *supracostata* (Garrett)	--	--	--	--	--	×	--	×
sp. A	--	--	--	--	--	×	--	--
Architectonicidae:								
Mangonuia navakaensis Ladd, n. sp	--	--	--	--	--	×	--	--
kerensis Ladd, n. sp	--	--	--	--	--	×	--	--
sp. A	--	--	--	--	--	×	--	--
sp	--	--	--	--	--	×	--	--
Pseudomalaxis (*Pseudomalaxis*?) *roddai* Ladd, n. sp	--	--	--	--	×	--	--	--
Architectonica maxima (Philippi)	--	--	--	--	--	×	--	×
(*Pseudotorinia*) aff. *A.* (*P.*) *euprepes* Woodring	--	--	--	--	--	×	--	--
Turritellidae:								
Siliquaria cumingii (Mörch)	--	--	--	--	--	×	--	×
aff. *S. armata* Kuroda, Habe, and Kozuge	--	--	--	--	--	×	--	--
Thiaridae:								
Thiara (*Plotia*) *scabra* (Müller)	--	--	--	--	--	×	--	×
Cerithiidae:								
Clypeomorus coralium (Kiener)	--	--	--	--	--	×	--	×
Seguenziidae:								
Seguenzia donaldi Ladd, n. sp	--	--	--	--	--	×	--	--
Epitoniidae:								
Epitonium cf. *E. replicata* (Sowerby)	--	--	--	--	--	×	--	--
(*Cycloscala*) cf. *E. revolutum* (Hedley)	--	--	--	--	×	--	--	--
Eulimidae:								
Eulima santoensis Ladd, n. sp	--	--	--	--	--	×	--	--
sp. A	×	--	--	--	--	--	--	--

TABLE 4.—*Geologic distribution of Cenozoic mollusk species in the island area*—Continued

	Tertiary					Quaternary		
	Late Eocene b	Early Miocene e	Miocene f	Late Miocene g	Pliocene h	Pleistocene	Holocene	Living
Eulimidae—Continued								
Balcis martinii (A. Adams)	--	--	--	--	--	×	--	×
aff. *B. kanaka* (Pilsbry)	--	--	--	--	×	--	--	--
aff. *B. vitrea* (A. Adams)	--	--	--	--	×	--	--	--
Strombidae:								
Varicospira cf. *V. cancellata* (Lamarck)	--	--	--	--	--	×	--	--
cancellata spinifera (Martin)	--	--	×	×	--	--	--	--
Tibia powisii (Petit)	--	--	--	--	--	×	--	×
Strombus (*Canarium*) *labiatus* (Röding)	--	--	--	--	×	--	--	×
(*Canarium*) *microurceus* (Kira)	--	--	--	--	×	--	--	×
(*Dolomena*) *minimus* Linnaeus	--	--	--	--	--	×	--	×
plicatus columba Lamarck	--	--	--	--	--	×	--	×
(*Lentigo*) *pipus* (Röding)	--	--	--	--	--	--	×	×
(*Euprotomus*) *bulla* (Röding)	--	--	--	--	--	×	--	×
Fossaridae:								
Couthouyia kerensis Ladd, n. sp	--	--	--	--	--	×	--	--
Capulidae:								
Capulus japonicus A. Adams	--	--	--	--	--	×	--	×
Calyptyraeidae:								
Crepidula sp. A	--	--	--	--	--	×	--	--
Eratoidae:								
Trivirostra (*Dolichupis*) *producta* (Gaskoin)	--	--	--	--	--	×	--	×
Cypraeidae:								
Cypraea (*Erronea*) *gracilis* Gaskoin	--	--	--	--	--	×	--	×
(*Erronea*) *pulchella* Swainson	--	--	--	--	--	×	--	×
cf. *C. pyriformis* Gray	--	--	--	--	--	×	--	--
(*Notadusta*) *punctata* Linneaus	--	--	--	--	--	×	--	×
Ovulidae (Amphiperatidae):								
Pedicularia navakaensis Ladd, n. sp	--	--	--	--	--	×	--	--
Crenavolva (*Serratovolva*) *imitablis* Cate	--	--	--	--	--	×	--	×
Dentiovula masaoi Cate	--	--	--	--	--	×	--	×
tadashigei Cate	--	--	--	--	--	×	--	×
Ovula ishibashii (Kuroda)	--	--	--	--	--	×	--	×
Phenacovolva longirostrata (Sowerby)	--	--	--	--	--	×	--	×
Volva (*Volva*) *volva* Linnaeus	--	--	--	--	--	×	--	×
Naticidae:								
Natica (*Natica*) *areolata* Récluz	--	--	--	--	--	×	--	×
(*Natica*) *vitellus* (Linnaeus)	--	--	--	--	--	×	--	×
(*Tectonatica*) aff. *N. violacea* Sowerby	--	--	--	--	--	×	--	--
Neverita albumen (Linnaeus)	--	--	--	--	--	×	--	×
Eunaticina sp	--	--	--	--	×	--	--	--
Sinum undulatum (Lischke)	--	--	--	--	--	×	--	×
Cassidae:								
Morum (*Cancellomorum*) *cancellata* (Sowerby)	--	--	--	--	--	×	--	×
Phalium areola (Linnaeus)	--	--	--	--	--	×	--	×
Casmaria ponderosa (Gmelin)	--	--	--	--	--	×	--	×
Cymatiidae:								
Gyrinium cf. *G. reticulare robusta* (Fulton)	--	--	--	--	--	×	--	×
Cymatium (*Ranularia*) *sinensis* (Reeve)	--	--	--	--	--	×	--	×
(*Ranularia*) *gutturnium* (Röding)	--	--	--	--	--	×	--	×
Charonia tritonis (Linnaeus)	--	--	--	--	--	×	--	×
Bursidae:								
Bursa bufonia dunkeri Kira	--	--	--	--	--	×	--	×
rubeta (Linnaeus)								
Tonnidae:								
Tonna cerevisina Hedley	--	--	--	--	--	×	--	×
allium (Dillwyn)	--	--	--	--	--	×	--	×
Ficidae:								
Ficus ficoides (Lamarck)	--	--	--	--	--	×	--	×
Muricidae:								
Chicoreus axicornis (Lamarck)	--	--	--	--	--	×	--	×
cf. *C. superbus* (Sowerby)	--	--	--	--	--	×	--	--
Murex (*Murex*) *pecten* (Lightfoot)	--	--	--	--	--	×	--	×
(*Murex*) *tribulus* Linnaeus	--	--	--	--	--	×	--	×
rectirostris Sowerby	--	--	--	--	--	×	--	×
aff. *M. aduncospinosus* Beck	--	--	--	?	×	--	--	--
Pterynotus (*Naquetia*) *barclayi* (Reeve)	--	--	--	--	--	×	--	×
Typhis cf. *T. japonicus* (A. Adams)	--	--	--	--	--	×	--	--
Thaididae:								
Drupa (*Morula*) *concatenata* (Lamarck)	--	--	--	--	--	--	×	×
Drupella cornus (Röding)	--	--	--	--	--	×	--	×
Mancinella aff. *M. bufo* (Lamarck)	--	--	--	--	--	×	--	--

TABLE 4.—*Geologic distribution of Cenozoic mollusk species in the island area*—Continued

Species	Tertiary					Quaternary		
	Late Eocene b	Early Miocene e	Miocene f	Late Miocene g	Pliocene h	Pleistocene	Holocene	Living
Magilidae (Coralliophilidae):								
Coralliophila mallicki Ladd	--	--	--	--	--	×	--	--
Latiaxis roddai Ladd, n. sp	--	--	--	--	×	--	--	--
(*Tolema*) *deburghiae* (Reeve)	--	--	--	--	×	--	--	×
cf. *L. winckworthi* Fulton	--	--	--	--	--	×	--	--
blowi Ladd	--	--	--	--	--	×	--	--
Columbellidae:								
Anachis (*Costoanachis*) *mawsoni* Ladd, n. sp	--	--	--	--	--	×	--	--
(*Costoanachis*) sp. A	--	--	--	--	×	--	--	--
Buccinidae:								
Hindsia sinensis (Sowerby)	--	--	--	--	--	×	--	×
rewaensis Ladd, n. sp	--	--	--	--	×	--	--	--
Siphonofusus walleri (Ladd)	--	--	--	--	--	×	--	×
Phos bakeri Ladd	--	--	--	--	--	×	--	--
Euthria rewaensis Ladd, n. sp	--	--	--	--	×	--	--	--
Metula kerensis Ladd	--	--	--	--	--	×	--	--
santoensis Ladd	--	--	--	--	--	×	--	--
cf. *M. mitrella* (Adams and Reeve)	--	--	--	--	--	×	--	--
Colubrariidae:								
Colubraria maculosa (Gmelin)	--	--	--	--	--	×	--	×
obscura (Reeve)	--	--	--	--	--	×	--	×
tortuosa (Reeve)	--	--	--	--	--	×	--	×
rehderi Ladd, n. sp	--	--	--	--	--	×	--	×
Nassariidae:								
Nassarius (*Plicarcularia*) *globosus* (Quoy and Gaimard)	--	--	--	--	--	×	--	×
(*Plicarcularia*) cf. *N. bimaculatus* (A. Adams)	--	--	--	--	--	×	--	×
(*Niotha*) *albescens* (Dunker)	--	--	--	--	--	×	--	×
nodiferus (Powys)	--	--	--	--	--	×	--	×
variegatus (A. Adams)	--	--	--	--	--	×	--	×
(*Zeuxis*) *dorsatus* (Röding)	--	--	--	--	--	×	--	×
margaritiferus (Dunker)	--	--	--	--	--	×	--	×
(*Alectrion*) *barsdelli* Ladd	--	--	--	--	--	×	--	--
glans (Linnaeus)	--	--	--	--	--	×	--	×
Bathynassa bolangoi Ladd	--	--	--	--	--	×	--	--
Fasciolariidae:								
Latirus craticulatus (Linnaeus)	--	--	--	--	--	×	--	×
paetelianus (Küster)	--	--	--	--	--	×	--	×
polygonus (Gmelin)	--	--	--	--	--	×	--	×
cf. *L. formosior* Melvill	--	--	--	--	--	×	--	--
Dolicholatirus cf. *D. lancea* (Gmelin)	--	--	×	--	--	--	--	--
Fusinus colus (Linnaeus)	--	--	--	--	--	×	--	×
Olividae:								
Oliva ispida (Röding)	--	--	--	--	--	×	--	×
Mitridae:								
Mitra (*Nebularia*) *contracta* Swainson	--	--	--	--	--	×	--	×
Cancilla (*Cancilla*) *isabella* (Swainson)	--	--	--	--	--	×	--	×
Vexillum (*Vexillum*) *coccineum* (Reeve)	--	--	--	--	--	×	--	×
(*Vexillum*) *vulpecula* (Linnaeus)	--	--	--	--	--	×	--	×
subdivisum (Gmelin)	--	--	--	--	--	×	--	×
(*Costellaria*) *polygonum* (Gmelin)	--	--	--	--	--	×	--	×
cf. *V. bellum* (Pease)	--	--	--	--	--	×	--	--
(*Pusia*) *millecostatum* (Broderip)	--	--	--	--	--	×	--	×
Families covered in this report								
Volutidae:								
Lyria mallicki Ladd	--	--	--	--	--	×	--	--
santoensis Ladd	--	--	--	--	--	×	--	--
Volutomitridae:								
Volutomitra? vitilevensis Ladd, n. sp	--	--	--	--	×	--	--	--
Cancellariidae:								
Cancellaria tholoensis Ladd	--	--	--	×	--	--	--	--
(*Merica*) *asperella* Lamarck	--	--	--	--	--	×	--	×
petiti Ladd, n. sp	--	--	--	--	×	--	--	--
Trigonostoma (*Scalptia*) *crenifera* (Sowerby)	--	--	--	--	×	×	--	×
Neadmete nausorensis Ladd, n. sp	--	--	--	--	×	--	--	--
Marginellidae:								
Marginella cf. *M.* (*Granula*) *iota* Hedley	--	--	--	--	--	--	×	--
(*Eratoidea*) *ringicula* Sowerby	--	×	×	×	--	--	--	×
Volvarina cf. *V. avena* (Kiener)	--	--	×	×	--	--	--	×

TABLE 4.—*Geologic distribution of Cenozoic mollusk species in the island area*—Continued

Species	Tertiary					Quaternary		
	Late Eocene b	Early e	Miocene f	Late Miocene g	Pliocene h	Pleistocene	Holocene	Living
Turridae:								
Gemmula speciosa (Reeve)	--	--	--	--	×	×	--	×
kieneri (Doumet)	--	--	--	--	--	×	--	×
woodwardi (Martin)	--	--	--	--	×	--	--	--
congener (E. A. Smith)	--	--	--	--	×	--	--	×
monilifera (Pease)	--	--	--	--	×	--	--	×
aff. *G. clifdenensis* Powell	--	--	×	--	--	--	--	--
sp. A	--	--	--	--	×	--	--	--
Nasavusavuia nuttalli Ladd, n. g. et n. sp	--	--	--	--	×	--	--	--
Ptychosyrinx aff. *P. timorensis teschi* Powell	--	--	--	--	×	--	--	--
Cryptogemma richmondi Ladd, n. sp	--	--	×	--	--	--	--	--
Epidrona greenbaumi Ladd	--	--	--	--	--	×	--	--
Lophiotoma (*Lophiotoma*) *acuta* (Perry)	--	--	--	?	×	--	--	×
(*Lophiotoma*) *eniwetokensis* Ladd, n. sp	--	--	×	--	--	--	--	--
cf. *L. leucotropis* (Adams and Reeve)	--	--	--	--	×	--	--	--
(*Lophioturris*) *indica* Röding	--	--	--	--	×	×	--	×
Turris crispa crispa (Lamarck)	--	--	--	--	--	×	--	×
Comitas aff. *C. kamakurana* (Pilsbry)	--	--	--	--	--	×	--	--
nausorensis Ladd, n. sp	--	--	--	--	×	--	--	--
waluensis Ladd, n. sp	--	--	×	--	--	--	--	--
sp. A	--	--	×	--	--	--	--	--
Leucosyrinx fijiensis Ladd, n. sp	--	--	×	--	--	--	--	--
rabbidgei Ladd, n. sp	--	--	×	--	--	--	--	--
Clavosurcula? *briggsi* Ladd, n. sp	--	--	×	--	--	--	--	--
Clathrodrillia kerensis Ladd, n. sp	--	--	--	--	--	×	--	--
Crassispira macneili Ladd, n. sp	--	--	--	--	×	--	--	--
Inquisitor walleri Ladd, n. sp	--	--	--	--	--	×	--	--
Agathotoma vanualevensis Ladd, n. sp	--	--	--	--	×	--	--	--
Guraleus vitilevensis Ladd, n. sp	--	--	--	--	×	--	--	--
fijiensis Ladd, n. sp	--	--	--	--	×	--	--	--
formosus Ladd, n. sp	--	--	--	--	--	×	--	--
Ithycythara lata Ladd, n. sp	--	--	--	--	--	×	--	--
Euclathurella santoensis Ladd	--	--	--	--	--	×	--	--
? sp. A	--	--	--	--	×	--	--	--
Eucithara stromboides (Reeve)	--	--	--	--	--	×	--	×
sawitrae (Beets)	--	--	--	×	--	--	--	--
marshallensis Ladd, n. sp	--	--	×	×	--	--	--	--
Etrema palauensis Ladd, n. sp	--	--	--	×	--	--	--	--
sp. A	--	--	--	--	×	--	--	--
Enbela woodrowi Ladd, n. sp	--	--	--	--	×	--	--	--
Thatcheria vitiensis Charig	--	--	--	--	×	--	--	--
Clinura? *fijensis* Ladd, n. sp	--	--	×	--	--	--	--	--
? sp. A	--	--	×	--	--	--	--	--
? sp. B	--	--	×	--	--	--	--	--
Conidae:								
Conus aculeiformis Reeve	--	--	--	--	--	×	--	×
aculeiformis mckinneyi Ladd, n. subsp	--	--	--	--	×	--	--	--
acutangulus Lamarck	--	--	--	--	--	×	--	×
ammiralis Linnaeus	--	--	--	--	--	×	--	×
cf. *C. aristophanes* Sowerby	--	--	×	--	--	--	--	--
cf. *C. bonus* Nomura	--	--	--	--	×	--	--	--
cf. *C. catus* Hwass	--	--	--	--	--	×	--	--
charigi Ladd, n. sp	--	--	×	--	×	--	--	--
cf. *C. coelinae* Crosse	--	--	--	--	--	×	--	--
corrugatus Sowerby	--	--	--	--	--	×	--	×
eburneus Hwass	--	--	×	--	--	--	--	×
cf. *C. emaciatus* Reeve	--	--	--	--	--	×	--	×
cf. *C. eugrammatus* Bartsch and Rehder	--	--	--	--	--	×	--	×
excelsus Sowerby	--	--	--	--	--	×	--	×
figulinus Linnaeus	--	--	--	--	--	×	--	×
cf. *C. gembacanus* Martin	--	--	--	--	--	×	--	--
geographus Linnaeus	--	--	--	--	--	×	--	×
glans Hwass	--	--	--	--	--	--	×	×
gloriamaris Chemnitz	--	--	--	--	--	×	--	×
gracilis Sowerby	--	--	--	--	--	×	--	×
vouensis Ladd	--	--	×	--	--	--	--	--
grangeri Sowerby	--	--	--	--	--	×	--	×
gubernator Hwass	--	--	--	--	--	×	--	×
insculptus Kiener	--	--	--	×	--	--	--	×
kimioi (Habe)	--	--	--	--	--	×	--	×
cf. *C. litteratus* Linnaeus	--	--	×	--	--	×	--	--
macarae Bernardi	--	--	--	--	--	×	--	×

TABLE 4.—*Geologic distribution of Cenozoic mollusk species in the island area*—Continued

Species	Tertiary					Quaternary		
	Late Eocene b	Early e	Miocene f	Late Miocene g	Pliocene h	Pleistocene	Holocene	Living
Conidae—Continued								
Conus miliaris Hwass	--	--	--	--	--	×	--	×
mucronatus Reeve	--	--	--	--	--	×	--	×
nussatella Linnaeus	--	--	--	--	--	×	--	×
ochroleucus Gmelin	--	--	--	--	--	×	--	×
orbignyi Audouin	--	--	--	--	--	×	--	×
cf. *C. pertusus* Hwass	--	--	--	--	--	×	--	--
praecellens A. Adams	--	--	--	--	--	×	--	×
quercinus Hwass	--	--	--	--	--	×	--	×
recluzianus Bernardi	--	--	--	--	--	×	--	×
aff. *C. saecularis* Melvill	--	--	--	--	--	×	--	--
aff. *C. socialis* Martin	--	--	--	--	×	--	--	--
striatus Linnaeus	--	--	--	--	×	--	--	×
sulcatus Hwass	--	--	--	--	×	--	--	×
undulatus Sowerby	--	--	--	--	--	×	--	×
terebra Born	--	--	--	--	--	×	--	×
cf. *C. tessulatus* Born	--	--	--	--	×	×	--	×
vimineus Reeve	--	--	--	--	--	×	--	×
yanuyanuensis Ladd	--	--	--	--	×	--	--	--
sp. A	--	--	--	--	×	--	--	--
sp	×	--	--	--	--	--	--	--
Kenyonia cf. *K. chiangi* (Azuma)	--	--	--	--	--	×	--	--
Terebridae:								
Hastula sp	×	--	--	--	--	--	--	--
Terebra (*Terebra*) *subulata* (Linnaeus)	--	--	--	--	--	×	--	×
(*Strioterebrum*) *torquata* Adams and Reeve	--	--	--	--	--	×	--	×
nebulosa Sowerby	--	--	--	--	--	×	--	×
sp. A	--	--	--	×	--	--	--	--
sp	--	--	--	×	--	--	--	--
(*Decorihastula*) *affinis* Gray	--	--	--	--	--	×	--	×
(*Microtrypetes*) *vanualevensis* Ladd, n. sp	--	--	--	--	×	--	--	--
kerensis Ladd	--	--	--	--	--	×	--	--
(*Oxymeris*) *maculata* (Linnaeus)	--	--	--	--	--	×	--	×
interlineata (Deshayes)	--	--	--	--	--	×	--	×
cf. *T. felina* (Dillwyn)	--	--	--	×	--	--	--	--
argus (Hinds)	--	--	--	--	--	×	--	×
sp. B	--	--	--	×	--	--	--	--
(*Myurella*) *myuros* Lamarck	--	--	--	--	--	×	--	×
pretiosa Reeve	--	--	--	--	--	×	--	×
alveolata Hinds	--	--	--	--	--	×	--	×
(*Triplostephanus*) *triseriata* Gray	--	--	--	--	--	×	--	×
Total of 271 species								

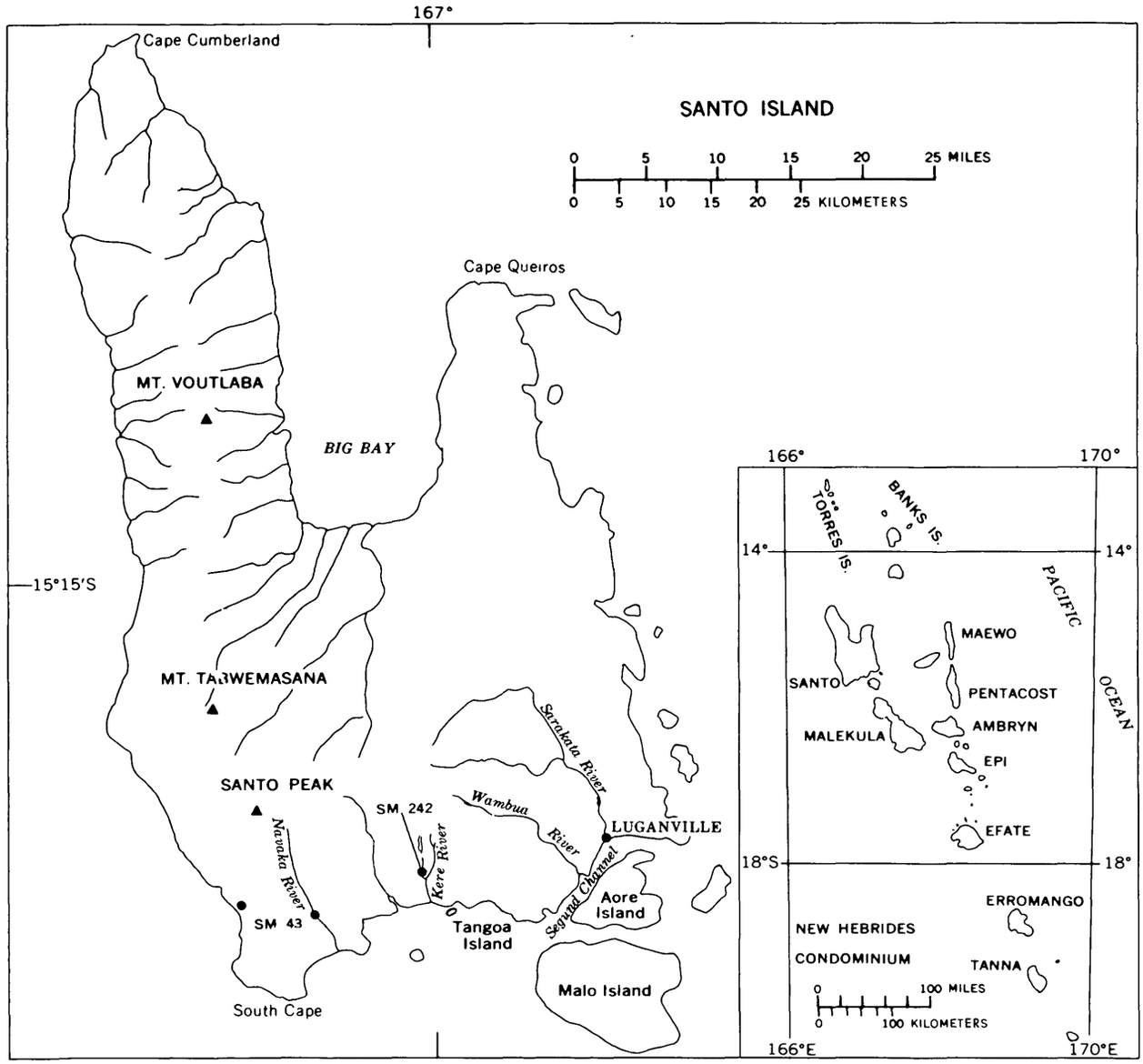

FIGURE 2.—Sketch map of Santo, New Hebrides, showing major SM fossil stations on the Navaka and Kere Rivers.

the Pleistocene began nearly 2 million years ago and lasted until about 7,000 years B.P. (before the present). Morrison (1969, p. 370) concluded that the time-stratigraphic interval from 12,000 to 10,000 years B.P. was the most likely boundary between the Pleistocene and the Holocene. Frye and others (1968) and Willman and Frye (1970, p. 37, 61, 126) cited sequences of tills and soil profiles to place the end of the Pleistocene above the Valderan Substage —about 7,000 years B.P.

PALEOECOLOGY

There are no significant additions to the generalized paleoecological statements given in earlier reports of the present series (Ladd, 1966, p. 11, 13–15; 1972, p. 3, 11; 1977, p. 6).

In special articles dealing with mollusks from the highly fossiliferous Pleistocene beds of Santo in the New Hebrides, available paleoecological data have been summarized by the author (1975, p. 134–136; 1976, p. 128). The fossiliferous beds crop out on two south-flowing streams, the Navaka on the west (fig. 1) and the Kere on the east (fig. 2). The beds on the Navaka contain a higher proportion of open-sea planktonic mollusks along with numerous shells of *Pedicularia* that lived on octocorals at moderate depths. The beds on the Navaka also contained a few intermediate valves of chitons. The beds on the

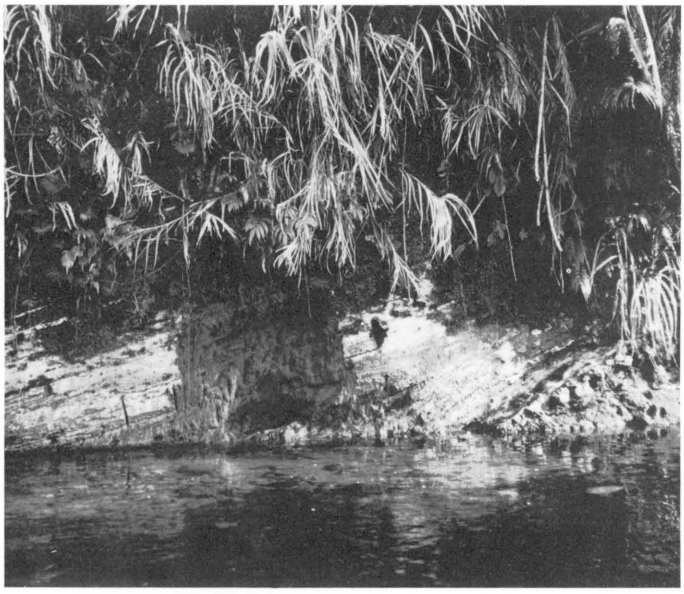

FIGURE 3.—Pleistocene beds cropping out on the Navaka River, Santo, New Hebrides. Thomas Waller and Warren Blow collected bulk samples from these beds in 1974. Photograph by Waller.

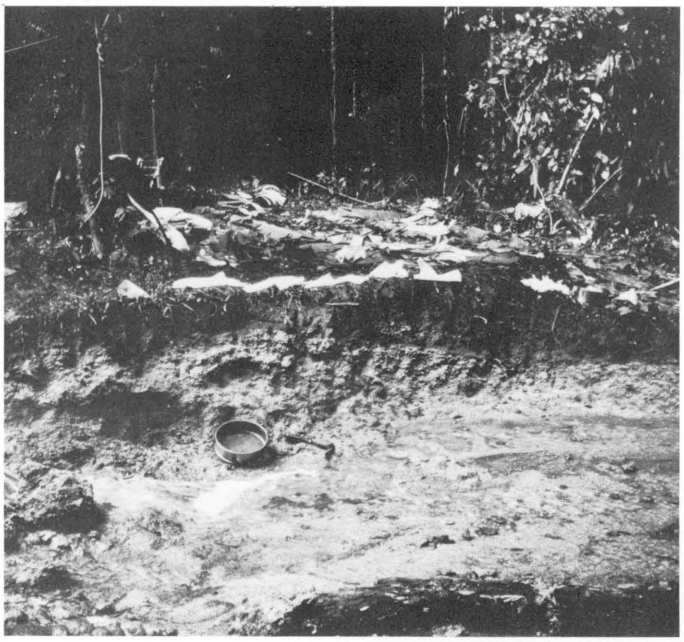

FIGURE 4.—Flat-lying Pleistocene beds on the Kere River, Santo, New Hebrides. These beds were among the first studied by D. I. J. Mallick (SM242), and from them, Thomas Waller and Warren Blow collected bulk samples. Photograph by Blow.

Kere contained no pedicularias but did yield great numbers of large, shallow-water mollusks, the fruits of a lowland tree (*Garcinia*) (Fosberg, 1978), and a single fossil chiton plate (a worn tail valve of a species of *Lucilina*). All the Santo beds were probably deposited in an offreef environment, but the beds on the Navaka probably accumulated in somewhat deeper water than did those on the Kere.

Practically all the elevated limestones found in the island area are reef associated and are believed to have accumulated in very shallow water in lagoons or at intertidal levels in high-energy environments. Of the thousands of limestone-outcrop and drill-hole samples that have been examined during the present study, only one yielded an identifiable pteropod, which was in cuttings from a drill hole on Eniwetok[4] at a depth of 35–40 feet (11–12 m). The species, *Cavolinia tridentata occidentalis* Dall, was the same one that F. S. MacNeil (unpub. data, 1950) collected on the inner edge of the beach at Taka Atoll (USNM 614457), also in the Marshall Islands. In general, pteropods seem to be too fragile to survive in reef-associated deposits. When, however, the clays and marls of offreef sediments are examined, pteropods and similar planktonic mollusks (notably *Atlantis*) are found in great abundance. Notable examples are the upper Tertiary marls of Fiji and the Pleistocene beds of Santo in the New Hebrides. Such occurrences demonstrate two things: (1) free access of waters of the open sea and (2) deposition in quiet water. In such deposits, the only suggestion of water movement is the tendency of tubular forms, like styliolids, to be grouped in parallel position, as though rolled by bottom currents.

Questions about the interisland dispersal of small mollusks, especially land shells, have been briefly discussed earlier (Ladd, 1958, 1960) and more recently and more fully discussed by Solem (1976). The dispersal problems are by no means limited to mollusks. Ostracodes seem to have their own means of interisland transport. In the island area in 1951, for example, Fosberg (1955, p. 33) found freshwater ostracodes living in rain-filled cavities and irregularities in the bases of *Pisonia* trees on little known Bikar in the Marshall Islands, where there is no other fresh water. Such occurrences, though widely recognized, are little understood.

Station I1010 on the south coast of Vanua Levu, Fiji, yielded a presumed deep-water mollusk, *Eubela*. Age of the sample, based primarily on smaller Foraminifera (Ruth Todd, written commun., 1974), was thought to be possibly Pliocene (Tertiary *h*). David Bukry of the U.S. Geological Survey (written commun., 1977) found a diverse assem-

[4] In 1974, the Board on Geographic Names recognized a new spelling, Eniwetak, and that spelling is being widely adopted. To avoid confusion in the present series of reports, the old spelling, Eniwetok, is continued.

blage of nannoplankton that contained relatively few discoasters. This assemblage suggested a deep environment of deposition. The maximum depth could only be estimated on the basis of known dissolution sequences. Bukry also found *Syracosphaera histrica* Kamptner, which dissolves below about 3,800 m (Roth and Berger, 1975, p. 104).

Bukry also examined three samples from the Navaka Sands for nannoplankton. Two of these consisted of sediment obtained from inside the shells of fossil mollusks. One was from the Kere River (USGS locality 25715), the other from the Navaka River (USGS locality 25731). The third sample was from an outcrop at the north end of the Navaka River exposures (USGS locality 25736). Nannoplankton were found to be common to abundant in all three samples. The samples also contained ascidian spicules, suggesting a fully marine offreef depositional environment. Older Tertiary coccoliths such as *Cyclicargolithus, Discoaster* and *Sphenolithus* had been reworked into the samples. The indigenous coccoliths were a low-diversity, normal-salinity assemblage. Characteristic inshore taxa such as *Braarudosphaera* were missing. Bukry believed that nearshore related turbidity could account for the low diversity of the nannoplankton, primarily an open-ocean group. Depth of deposition was estimated to be less than 500 m on the basis of the ascidian spicule distribution (Hekel, 1973, p. 10; David Bukry, written commun., 1977).

The bulk samples collected on the Kere and Navaka Rivers on Santo, New Hebrides, by Thomas Waller and Warren Blow contained most of the species collected earlier by Mallick and Greenbaum of the New Hebrides Survey, as well as others not previously collected. Many of the Santo species belong to families previously covered (in Ladd, 1966, 1972, and 1977), hence the length, in the present paper, of the section devoted to "Additional species."

All the material making up the bulk samples collected by Waller and Blow in 1974 has not yet been fully processed, and additional species, particularly those having small shells, will doubtless continue to appear. It is already apparent, however, that the Pleistocene sediments of Santo contain the richest, most diversified, and best preserved faunas of fossil mollusks yet discovered in the islands of the Pacific —probably in the whole Indo-Pacific region (Ladd, 1976). In my 1976 paper, I described new species of mollusks from the Navaka Sands of Santo and suggested (p. 128) that the high percentage of new species from the Pleistocene beds might reflect present lack of knowledge of the existing fauna. One of the species described in the 1976 paper, *Fasciolaria walleri*[5] has now been recovered from deep water off Mactan Island in the Philippines. On December 20, 1977, two shells of this species were shown to me by Mary Young, a dealer, who had obtained them from Dr. B. M. Olivera of the University of Utah. I feel confident that other representatives of the numerous fossil species will be obtained from the existing seas.

FAUNAL RELATIONS

As noted in earlier reports in the present series (Ladd, 1966, 1972, 1977), the fossil molluscan faunas obtained from the island area are clearly Indo-Pacific in general aspect. Exceptional cases have been recorded relating island-area fossils to American genera (*Haplocochlias, Arene*) (Ladd, 1966). Recently, studies of the rich Pleistocene deposits from the island of Santo in the New Hebrides and beds in the Pliocene of Fiji have made apparent additional ties between the east (America and the Caribbean) and the west (island area).

A trochid, recently found in the Pleistocene beds of Santo, appears to be related to Caribbean and North American forms. It is a species of *Microgaza*, a genus known only from the Caribbean. (A second species, provisionally referred to *Microgaza*, was found in the Pliocene of Fiji.)

Two turbinids, both from the Pliocene of Fiji, are referred to *Cantrainea*, subgenus of *Homalopoma*. *Cantrainea* includes a group known only from Europe, except for one species, *H.* (*C.*) *panamensis* (Dall), a form that lives at depths of 350–1,150 m off parts of the west coast of America (Keen, 1971, p. 350).

An architectonicid from the Pleistocene beds of southern Santo that appears closely related to a Tertiary Caribbean species is cited as *Architectonica* (*Pseudotorinia*) aff. *A. euprepes* Woodring. The two species differ chiefly in minor sculptural features.

In commenting upon the "Caribbean connection" seemingly shown by some muricid shells from the island area, Emily Vokes (written commun., 1978) noted that a form described as *Murex bantamensis coulsoni* (Ladd, 1977, p. 38, pl. 13, figs. 12–15; pl. 14, figs. 1, 2) was much like an undescribed form from the upper Miocene of the Dominican Republic.

Two eastern genera of turrids appear to have had representatives in the New Hebrides area during the Pleistocene: A species from the Kere River beds

[5] This species is now recognized as belonging to the buccinid genus *Siphonofusus*.

was provisionally assigned to *Euclathurella* (Ladd, 1976, p. 134), and in the present paper, a species is assigned to *Ithycythara*.

The above statements all deal with gastropods. In 1973, Thomas Waller (written commun.) of the Smithsonian Institution examined some small pecten shells recovered from a sample collected on the Navaka River in southern Santo. He placed the shells in the genus *Pectinella*. Studies of the microstructure of the shells suggested that the Pleistocene New Hebrides examples were nearly identical with the typical Atlantic form known only from Holocene shells collected in Cuban waters. This remarkable discovery was primarily responsible for the collecting trip to the New Hebrides taken by Waller and Warren Blow in 1974.

SYSTEMATIC PALEONTOLOGY

The arrangement of families in the Gastropoda is essentially that of Taylor and Sohl (1962). The Eulimidae were not treated in Ladd, 1972. The Taylor-Sohl order is followed in the text, but there are irregularities in the arrangement of the plates. The preparation of the present report extended over a period of years that covered also periods of extensive fossil collecting, particularly in the New Hebrides. Late additions to the collection under study appeared with unexpected frequency and, when identified, were photographed and added to supplementary plates.

In the present report, one new subgenus, *Nasavusavuia*, a turrid from the Pliocene of Fiji, is proposed. (Recently, *Bathynassa* was described as a new genus in the Nassariidae from the Pleistocene of the New Hebrides (Ladd, 1976, p. 131)).

ADDITIONAL SPECIES IN FAMILIES COVERED IN LADD (1966, 1972, 1977)

Family SCISSURELLIDAE

Genus SCISSURELLA Orbigny

Orbigny, 1824, Soc. Histoire Nat. Paris Mém. 1, p. 341.

Type (by subsequent designation, Gray, 1847, Zool. Soc. London Proc., pt. 15, p. 146).—*Scissurella laevigata* Orbigny. Holocene, Mediterranean Sea.

Subgenus ANATOMA Woodward

Woodward, 1859, Zool. Soc. London Proc. p. 204.

Type (by original designation).—*Scissurella crispata* Fleming. Holocene, North Sea.

Scissurella (Anatoma) japonica A. Adams

Plate 1, figures 1, 2

Anatomus japonicus A. Adams, 1862, Annals and Mag. Nat. History, p. 2 of reprint.

Anatoma japonica (A. Adams), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 2, pl. 1, fig. 9.

As pointed out by Adams, this species closely resembles the type of the subgenus, *A. crispata*, in sculpture. Represented in the fossil collections by four shells from the Pleistocene beds at station SM43 on the Navaka River, Santo, New Hebrides. The figured specimen, USNM 214325, measures: height 1.5 mm, diameter 2.4 mm.

The species lives today in Japanese waters.

Genus SINEZONA Finlay

Finlay, 1926, New Zealand Inst. Trans., v. 57, p. 341.

Type (by original designation).—*Scissurella brevis* Hedley. Holocene, New Zealand.

Sinezona carinata (A. Adams)

Plate 1, figures 3, 4

Scissurella carinata A. Adams, 1862, Annals and Mag. Nat. History, v. 10, p. 346.

Woodwardia carinata (A. Adams), Habe, 1951, Illust. catalogue Japanese shells, no. 11, p. 68, pl. 2, figs. 5, 6.

A single incomplete shell of this strongly keeled species was collected at USGS locality 25718 on the Kere River, Santo, New Hebrides. The last whorl of the shell is broken, so that the foramen appears as a fissure.

Measurements of the specimen, USNM 214324: height 1.3 mm, diameter 2.1 mm.

S. carinata lives today in Japanese waters from intertidal levels to 70 fathoms. In the Marshall Islands, small shells were found in the drift on Rongelap. The New Hebrides shell seems to be the first reported as a fossil.

Sinezona cingulata (O. G. Costa)

Plate 40, figures 1–3

Scissurella cingulata Costa, 1861, Microdoride Mediterranean, p. 61, pl. 12, figs. 9a, b; Pilsbry, 1890, Manual Conchology, ser. 1, v. 12, p. 61, pl. 57, figs. 1–7.

Schismope cingulata (Costa), Warmke and Abbott, 1961. Caribbean seashells, p. 35, text-fig. 10.

Scissurella (Scissurella) cingulata (Costa), Abbott, 1974, American seashells 2d ed., p. 17.

Measurements of the figured specimen, USNM 250154: height 2.6 mm, diameter 2.8 mm.

Occurrence.—One shell from USGS locality 25715, Kere River, Santo, New Hebrides; age, Pleistocene. The species was originally described from Holocene shells from the Mediterranean and was later recognized from Bermuda and the Caribbean. The New Hebrides fossil appears to be specifically identical with slightly smaller Holocene shells found in drift on Rongerik Atoll in the Marshalls (USNM

594639). According to Abbott, the species is common today in algae on mangrove roots.

Family FISSURELLIDAE

Genus EMARGINULA Lamarck

Lamarck, 1801, Systéme animaux sans vertebres, p. 69.

Type (by monotypy).—*Emarginula conica* Lamarck. Holocene, European Seas.

Emarginula sp. C

Plate 1, figures 7, 8

A shell of an *Emarginula* recovered from the Pleistocene beds on the Navaka River (USGS locality 25655), Santo, New Hebrides, differs from other species of the genus. It may represent an undescribed form, but the single shell is incomplete, and a name is withheld.

The shell is small, thin, and moderately convex; the apex lies close to the posterior edge and is strongly incurved. The most striking features are the strong, obscurely noded radial ribs, six on one side, seven on the other. The ribs are overridden by close-set concentric threads that are best seen under magnification; slit narrow and open for more than one-third of its length. The shell, USNM 214277, measures: length 3.6 mm, width 2.4 mm.

Subgenus EMARGINELLA Pilsbry

Pilsbry, 1891, Manual Conchology, ser. 1, v. 12, p. 269.

Type (by original designation).—*Emarginula cuvieri* Audouin. Holocene, Red Sea.

Emarginula (Emarginella) eximia A. Adams

Plate 1, figures 5, 6

Emarginula eximia A. Adams, 1851, Zool. Soc. London Proc., pt. 19, p. 86; 1863, Thesaurus Conchyliorum, Fissurellidae, p. 212, pl. 246, fig. 63; Pilsbry, 1891, Manual Conchology, ser. 1, v. 12, p. 267, pl. 28, fig. 26.

Emarginula (*Emarginella*) *eximia* (A. Adams), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 3, fig. 10.

A small, oval, flattened shell with strong scaly radiating ribs cancellated by concentric ridges; apex posterior, curved backwards.

Measurements of the figured specimen, USNM 214305: length 9.9 mm, width 6.1 mm, height 2.5 mm.

Occurrence.—Three shells from the Kere River outcrops (USGS localities 25715 and 25718), Santo, New Hebrides; age, Pleistocene. The species lives today in the Amami Islands and southward.

Genus PUNCTURELLA Lowe

Lowe, 1827, Zool. Jour. v. 3, no. 9, p. 77.

Subgenus PUNCTURELLA ss.

Type (by monotypy).—*Patella noachina* Linnaeus. Holocene, northern seas.

Puncturella (Puncturella) agger Watson

Plate 1, figures 12, 13

Puncturella agger Watson, 1884, Linnean Soc. London Jour., v. 17, p. 32; 1886, Challenger Report, p. 40, pl. 4, fig. 6; Pilsbry, 1891, Manual Conchology, ser. 1, v. 12, p. 233, pl. 26, figs. 32–35.

A single specimen, USNM 214322, collected from the Pleistocene beds at station SM43 on the Navaka River, Santo, New Hebrides, measures: length 2.5 mm, width 1.7 mm, convexity 1.8 mm. Watson described the Holocene shell from the West Indies at a depth of 390 fathoms (710 m); a shell in the USNM collection (No. 276623) was dredged in the Philippines at 171 fathoms (313 m).

Subgenus CRANOPSIS A. Adams

Adams, A., 1860, Annals and Mag. Nat. History ser. 3, v. 5, p. 302.

Type (by monotypy).—*Cranopsis pelex* A. Adams. Holocene, western Pacific.

Puncturella (Cranopsis) pileolus A. Adams

Plate 1, figures 9–11

Cranopsis pileolus A. Adams, 1860, Annals and Mag. Nat. History ser. 3, v. 6, p. 120; Sowerby, 1862, Thesaurus Conchyliorum, Fissurellidae, p. 209, pl. 10, *Cranopsis*, figs. 1, 2.

Puncturella (*Cranopsis*) *pileolus* A. Adams, Pilsbry, 1890, Manual Conchology, ser. 1, v. 12, p. 241, pl. 28, fig. 9; Habe, 1964, Shells of the western Pacific in color, v. 2, p. 4.

Shell small, elliptical in outline, highly convex, laterally compressed; apex strongly recurved, projecting beyond the posterior margin. Sculpture consisting of strong radiating ribs that are cancelled by weaker concentric lirae. Margin sharply crenulated; interior with a narrow marginal platform projecting from the posterior half of the shell; posterior end of slit lies under an arched platform.

Measurements of the single fossil, USNM 214315: length 3.2 mm, width 2.2 mm, convexity 1.7 mm.

Occurrence.—Pleistocene beds cropping out at station SM43 on the Navaka River, Santo, New Hebrides. The species lives today in Japanese waters.

Genus ZEIDORA A. Adams

Adams, A. 1860, Annals and Mag. Nat. History, ser. 3, v. 5, p. 301–302.

Type (by monotypy).—*Zeidora calceolina* A. Adams. Holocene, Japan.

Zeidora calceolina A. Adams

Plate 1, figures 14–16

Zeidora calceolina A. Adams, 1860 Annals and Mag. Nat. History ser. 3, v. 5, p. 302; Sowerby, 1862, Thesaurus Conchyliorum, v. 3, p. 209, pl. 10, fig. 3; Kuroda, Habe, and Oyama, 1971, Seashells of the Sagami Bay, Tokyo, Maruzen Co., p. 7, pl. 106, figs. 4–6.

Six shells of this wide-septum species were recovered from the Pleistocene marls on the Navaka River, Santo, New Hebrides.

Measurements of the figured specimen, USNM 214304, from USGS locality 25734: length 3.1 mm, width 3.1 mm, convexity 1.4 mm.

I have not seen Holocene examples, but the New Hebrides fossils agree in all respects with the excellent illustrations published by Kuroda, Habe, and Oyama (1971), who reported the species living in Japanese waters at depths of 50 to 200 m. They also cited a Pleistocene fossil from Kyushu.

Rimula sp. A

Small, oval in outline with a crenulated margin; highly convex with apex strongly recurved over the posterior margin; perforation narrow, located anteriorly between two elevated ribs. Sculpture consisting of about a dozen ribs, exclusive of those bounding the slit; in the grooves between ribs are closeset lirae.

Measurement of the single specimen, USNM 214378: length 2.0 mm.

The Fijian fossil appears to be conspecific with a lot of Holocene shells in the National Museum (no. 292376) collected off Tablas Island in the Philippines at a depth of 73 fathoms (134 m).

Occurrence.—Single shell from Station C2026, near Nausori, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Family ACMAEIDAE

Genus CHIAZACMEA

Oliver, 1926 New Zealand Inst. Trans., v. 56, p. 558.

Type (by original designation).—*Patelloida flammea* Quoy and Gaimard. Holocene, southwest Pacific.

Chiazacmea cf. C. pygmaea sygnatoides Kuroda and Habe

Plate 33, figures 1, 2

A single small shell from the Pleistocene beds on the Kere River (USGS locality 25718), Santo, New Hebrides, may represent this Holocene species. As shown in the illustrations, the shell is a low cone with an elliptical base, its apex anterior to the midpoint. There are low radial ribs but because of erosion, they are clearly visible only near the margin of the shell. The eroded surface retains traces of brown radial rays.

Measurements of the specimen, USNM 214361: length 3.2 mm, width 2.6 mm, convexity 1.5 mm.

C. pygmaea sygnatoides Kuroda and Habe (Kuroda and others, 1971, p. 17, pl. 8, fig. 11), with which the fossil is compared, lives in Japanese waters and off Okinawa from the intertidal zone to a depth of 20 m.

Genus PATELLOIDA Quoy and Gaimard

Quoy and Gaimard, 1834, Voyage Astrolabe, Zoologie, v. 3, pt. 1, p. 349.

Type (by subsequent designation, Gray, 1847, Zool. Soc. London Proc. pt 15, p. 158).—*Patelloida rugosa* Quoy and Gaimard. Holocene, Indonesia.

Patelloida cf. P. latistrigata (Angas)

Plate 1, figures 17–19

A single small shell from the Pleistocene beds on the Kere River (USGS locality 25717), Santo, New Hebrides, may represent this Holocene South Australian species (Angas, 1865, p. 154; Macpherson and Gabriel, 1962, p. 48, fig. 64), although I have seen no specimens for detailed comparison. The fossil is strongly ribbed and much depressed. The apex lies about one-third of the length from the slightly narrowed anterior end. Sculpture consists of a dozen broad, rounded radial ribs that crenulate the margin of the shell.

Measurements, USNM 214350: length 11.5 mm, width 9.0 mm, convexity 2.8 mm.

In Australia, the species lives on rock surfaces at intertidal levels.

Family COCCULINIDAE

Genus COCCULINA

Dall, 1882 U.S. Natl. Mus. Proc., v. 4 (for 1881), p. 402.

Type (by subsequent designation, Suter, 1913, Man. New Zealand Mollusca, p. 173).—*Cocculina rathbuni* Dall. Holocene, Atlantic coast of North America.

Cocculina nipponica Kuroda and Habe

Plate 33, figures 3, 4

Cocculina nipponica Kuroda and Habe, 1949 Venus, v. 15, nos. 5–8, p. 59, 62, pl. 3, fig. 1; Habe, 1964, Shells of the western Pacific in color, v. 2, p. 24, pl. 8, fig. 21; Kuroda, Habe, and Oyama, 1971, Seashells of Sagami Bay, p. 56, pl. 106, fig. 25.

Three shells from the Pleistocene beds on the Navaka River (USGS localities 25652, 25734, and station SM43) seem to represent this species, though I have not seen specimens. The figured shell,

USNM 214360, from USGS locality 25652, measures: length 2.4 mm, width 1.6 mm, convexity 1.1 mm. All three fossils are smaller than the Japanese examples described by Kuroda and Habe. As pointed out by Habe, this species may be a form of *C. subcompressa* described by Schepman (1908, p. 21, pl. 1, fig. 9) from Indonesia.

Occurrence.—Navaka River outcrops, Santo, New Hebrides. In Japan, the species has been reported from depths of 50–930 m. Schepman reported his species from 216 m.

Family TROCHIDAE

Genus CALLIOTROPIS Seguenza

Seguenza, 1903, Soc. Geol. Italiana, Boll., v. 21, p. 462.

Type (by original designation).—*Trochus ottoi* Phillipi. Pliocene and Pleistocene, Italy.

Calliotropis rewaensis Ladd, n. sp.

Plate 39, figures 5–8

Shell small, trochiform, height and diameter approximately equal. Protoconch of about three smooth convex whorls, followed by about three sculptured whorls. Sculpture consisting of four strong spiral keels, the upper two, which are close to the deeply excavated suture, are strongly beaded, the beads extended as retracted axials. The lower pair of spiral keels form the periphery and are nearly smooth. Base gently convex with four spiral ribs. The rib that encircles the wide and deep umbilicus and the rib next to it are beaded; the other two basal ribs are smooth. Aperture subcircular, nacreous within, outer lip thin, scalloped by the spiral keels; edge of inner lip reflected over umbilicus.

Measurements of the holotype, USNM 250126: height 3.2 mm, diameter 3.0 mm.

C. rewaensis seems related to a Holocene species from Indonesia described by Schepman (1908, p. 49, pl. 3, fig. 7) as *Solariella mutabilis*. The Fijian fossils are smaller than the Holocene shells, have an additional major keel, but lack the secondary spirals of the Holocene shells. Also, on the Holocene shells all major spiral keels are beaded; on the fossils, the peripheral keels are smooth.

Occurrence.—Two shells from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Calliotropis? sp. A

Plate 39, figures 9–12

A single shell, which may be immature, is provisionally assigned to *Calliotropis*. The small shell is conical in outline with a deeply excavated suture. A protoconch of one or more smooth convex whorls is followed by 5½ whorls that make up the teleoconch. Sculpture consisting of three strong spiral ribs that are deeply beaded by axials; periphery of body whorl angular; base flattened with half a dozen low, slightly beaded spirals. Aperture nearly circular; outer lip thin; callus of inner lip slightly extended over edge of a narrow umbilicus.

Measurements of the figured specimen, USNM 214421: height 5.0 mm, diameter 4.6 mm.

I have not been able to identify the fossil with a living species. In major features, it resembles a shell dredged off Celebes (Sulawesi) (USNM 239196) at a depth of 647 fathoms (1,183 m), but the fossil is smaller, has more subdued sculpture on the base, and coarser and more numerous spirals on the teleoconch.

Occurrence.—USGS locality 25731, Navaka River, Santo, New Hebrides; age, Pleistocene.

Genus TURCICA A. Adams

A. Adams, 1854, Zool. Soc. London Proc. p. 37.

Type (by monotype).—*Turcica monilifera* A. Adams. Holocene, Morton Bay, Australia.

Subgenus PERRINIA H. and A. Adams

Adams, H. and A., 1854, Genera of Recent Mollusca. v. 1, p. 419.

Type (by subsequent designation. Pilsbry, 1889, Manual Conchology, ser. 1, v. 11, p. 15).—*Monodonta angulifera* Adams. Holocene, Philippine Islands.

Turcica (Perrinia) fijiensis Ladd, n. sp.

Plate 39, figures 1–4

Shell small, trochoid, nacreous within. Protoconch incomplete; teleoconch flat-sided, composed of about 4½ whorls covered by strong spiral ribs that are beaded by close-set axials; suture deeply excavated; periphery of body whorl angulate, formed by a strong spiral rib; base convex with sculpture like that of remainder of teleoconch; imperforate; aperture subcircular, inner lip callused, its edge free; columella with two well-developed teeth; outer lip thin, its edge crenulate, lirate within.

Measurements of the holotype, USNM 250128: height 3.6 mm, diameter 3.3 mm.

T. fijiensis closely resembles *T. angulifera*, the type of *Perrinia*, but is smaller and more finely sculptured and has two prominent columellar teeth, rather than one as in the Holocene shell.

Occurrence.—A single shell from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Turcica (Perrinea) waiwailevensis Ladd, n. sp.

Plate 24, figures 10–13

Small, trochoid; protoconch of about one smooth

whorl, followed by 4½ sculptured whorls covered by strong ribs that are beaded by close-set axials; spirals that cover the base are smaller than those on the spire; imperforate; aperture subcircular; columella with a single large tooth near its base; outer lip with a thin edge, lirate within.

Measurements of the holotype, USNM 250142: height 4.4 mm, diameter 3.3 mm.

T. (P.) waiwailevensis closely resembles *T. (P.) fijiensis* that occurs with it at station C2026 on Viti Levu, but *T. (P.) waiwailevensis* has only a single columellar tooth, and the lower part of its body whorl is evenly rounded with no trace of an angulation or enlarged peripheral rib.

Occurrence.—Holotype and an immature shell from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus TURCICULA Dall

Dall, 1881, Harvard Coll., Mus. Comp. Zoology Bull., v. 9, p. 42.

Type (by monotypy).—*Margarita (Turcicula) imperialis* Dall. Holocene, Cuba.

Turcicula sp. A

Plate 2, figures 1–3

Shell small, conical, thin, composed of five or more whorls. Sides of spire flattened; base slightly convex; Columella short, aperture subrectangular. Sculpture consisting of two primary noded spirals that form the periphery. The beadlike nodes of the spirals are joined between the spirals by low axial ribs that are continued faintly across the flattened part of the whorl above the peripheral spirals; on the base are three spirals, the inner two beaded, and fine axial lines of growth.

Measurements of the only shell, USNM 214271; height (apex incomplete) 3.6 mm, diameter 3.4 mm.

Turcicula sp. A resembles *T. imperialis*, type of the genus, in many features, but on the Holocene type, a larger shell, the lower of the two major spirals forms the periphery; on the fossil, both spirals combine to form the periphery. The fossil has shorter columella and stronger spirals on the base than does the Holocene shell. The fossil probably represents an undescribed species, but the small incomplete shell seems inadequate as a type.

A much larger Holocene species was described by Dall (1889, p. 377; 1890b, p. 346, pl. 7, fig. 3) as *T. bairdii*. Small shells of this species have sculptural features suggesting *Turcicula* sp. A, particularly strong basal sculpture, but the two are clearly distinct.

Occurrence.—Station C2019, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*). The related type, *T. imperialis*, was dredged off Cuba in 200 fathoms of water.

Genus CALLIOTROCHUS Fischer

Fischer, 1879, *in* Kiener (*fide* Keen, 1960, Treatise Invert. Paleontology, pt. I, Mollusca 1, p. I256).

Type (by monotypy).—*Turbo phasianellus* Deshayes. Holocene, Indo-Pacific.

Calliotrochus navakaensis Ladd, n. sp.

Plate 34, figures 9–11

Shell minute, conical, composed of about five smooth whorls, suture impressed, aperture nearly circular, nacreous within, outer lip beveled, inner lip callused, umbilicus a faint linear groove. Color pattern consisting of subparallel narrow lines of reddish brown. On the base, the colorlines parallel the angular periphery; above the periphery, the color bands descend from dark subsutural blobs, to cross the whorl from right to left.

Measurements of the holotype (only specimen), USNM 214405: height 4.2 mm, diameter 3.2 mm.

C. navakaensis bears a close resemblance to the genotype, *C. phasianellus*, though I have not seen specimens. The chief difference seems to lie in the mottled color pattern of the Holocene shell.

Occurrence.—A single specimen from station SM43 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Genus ENIDA A. Adams

A. Adams, 1860, Annals and Mag. Nat. History, ser. 3, v. 5, p. 408.

Type (by subsequent designation, Kobelt, 1879 (*fide* Keen, 1960, Treatise on invertebrate paleontology, Pt. I, Mollusca 1, p. I256)).—*Gibbula japonica* A. Adams, Holocene, Japan.

Enida warreni Ladd, n. sp.

Plate 2, figures 4–14

Small, depressed-conical, deeply umbilicate; whorls about five, flattened, separated by a deeply excavated suture; base flattened, umbilicus wide; aperture subquadrate, rim slightly flaring. Sculpture consisting of spiral ribs that are beaded by close-set oblique axials; periphery of body whorl composed of two strong spirals with crenulated edges; base slightly convex with a half dozen spiral ribs, the one encircling the umbilicus being much stronger than the others.

Both type specimens retain radiating bands of

reddish-brown that widen toward the periphery (pl. 2, especially figs. 4, 6, 13).

Measurements of the holotype, USNM 214354: height 1.7 mm, diameter 3.4 mm; paratype, USNM 214355: height 2.5 mm, diameter 3.1 mm.

E. warreni is smaller than *E. japonica*, type of the genus, but there are more important differences. On *E. japonica*, the periphery is formed by a single sharp carina; this species has a smoother base and less definitely outlined color areas than *E. warreni*.

The strongly marked color pattern of *E. warreni* differentiates it from described species of the deep-water genus *Basilissa*, which the fossils resemble in other respects.

This species is named for Warren Blow, who, as a member of the U.S. Geological Survey, collected the types on the Kere and Navaka Rivers.

Occurrence.—Holotype from USGS locality 25718 on the Kere River; paratype from USGS locality 25734 on the Navaka River, Santo, New Hebrides. A single shell was also collected at station SM43 on the Navaka. An incomplete shell was collected from SM242 on the Kere; this shell retains no trace of color pattern. Age of all fossils is Pleistocene.

The related species *Enida japonica* has been recovered from depths of 50–200 m off Japan (taken alive from 69–80 m) and has also been reported from Indonesia (Kuroda and others, 1971, p. 20).

Genus SOLARIELLA Wood

Wood, S. V., 1842, Annals and Mag. Nat. History v. 9, p. 531.

Type (by monotypy).—*Solariella maculata* Wood. Pliocene, England.

Subgenus ETHALIOPSIS Schepman

Schepman, 1908, Prosobranchia of the Siboga Exped., pt. 1, p. 51.

Type (by monotypy).—*Solariella* (*Ethailiopsis*) *callomphala* Schepman. Holocene, Indo-Pacific.

Solariella (Ethaliopsis) vitilevensis Ladd, n. sp.

Plate 41, figures 1–3

Small, trochoid spire of medium height composed of about six rounded whorls; nacreous within. Aperture subquadrate, umbilicus wide and deep, its margin crenulated radially; umbilicus partly concealed by an extension of the inner lip. Sculpture consisting of faint retracted axials and fine close-set spiral cords that on the base, are slightly more prominent near the umbilicus than elsewhere. Traces of dark zigzag axial lines are preserved on the dorsal surface of the holotype.

Measurements of the holotype, USNM 214407: height 3.6 mm, diameter 4.8 mm.

S. (*E.*) *vitilevensis* is much smaller than *Ethaliopsis katoi* Kuroda and Habe (Habe, 1964, (*in* Kira and Habe, 1965, v. 2, p. 17, pl. 6, fig. 16), is more strongly sculptured than that species and has a different color pattern.

Occurrence.—Two specimens from station C1764; age, probably Pliocene. This seems to be the first fossil occurrence of *Ethaliopsis*.

Genus MICROGAZA Dall

Dall, 1881, Harvard Coll., Mus. Comp. Zoology Bull., v. 9, p. 50.

Type (by monotypy).—*Microgaza rotella* Dall. Holocene, West Indies.

Subgenus MICROGAZA s. s.

Microgaza (Microgaza) navakaensis Ladd, n. sp.

Plate 34, figures 1–5

Shell small, lenticular with a low spire and a rounded periphery. Protoconch a smooth inflated whorl, followed by about two whorls marked with spiral threads; on later whorls there is a beaded spiral immediately below the suture; faint spirals are present above the periphery. Aperture broadly triangular, nacreous within; umbilicus wide and deep, its side vertical for each whorl. Umbilicus bordered, except close to aperture, by a band of axial wrinkles that extends one-third to one-half way across the base; belt of wrinkles spirals down the umbilicus. Upper part of whorls marked with brown zigzag lines; on base, the bands are more widely spaced and less sharply marked.

Measurements of the holotype, USNM 214398: height 4.7 mm, diameter 7.7 mm. The holotype is the largest and most complete of the five fossil shells.

Shells of the Holocene genotype, *M. rotella* Dall, in the USNM collections contain examples from off Barbados, Cuba, and Florida from depths of 73–150 fathoms. Woodring (1928, p. 435, pl. 37, figs. 1–3) described a subspecies of *M. rotella* as *M. r. vetula* from the Miocene of Jamaica. Though strikingly similar to both of these Caribbean forms, *M. navakaensis* differs in the presence of spiral threads on the early postnuclear whorls and in its strong color pattern. In describing the Bowden subspecies, Woodring noted that some of the fossils showed traces of narrow color bands diverging spirally from the suture. These bands can hardly be compared with the pattern shown by the New Hebrides fossils, though the resemblance may have been closer when the Bowden shells were alive.

Occurrence.—Represented by five shells, all from the Navaka River Pleistocene outcrops. The holotype is from USGS locality 25731.

Microgaza? sp. A

Plate 34, figures 6–8

Small, with a low spire and an angular periphery. Protoconch consisting of about one smooth inflated whorl, followed by four or more flattened sculptured whorls; there is a beaded spiral immediately below the suture and three smaller unbeaded spirals—one at the periphery, one a short distance above, the other below. Base rounded, showing traces of lesser spirals. Aperture broadly triangular, nacreous within. Umbilicus wide, deep, and steep-sided, as in typical *Microgaza,* but the axials that radiate from it are strongly beaded by spirals. Weaker spirals are visible on the steep sides of the umbilicus.

Measurements of the single incomplete specimen, USNM 214400: height 4.5 mm, diameter 3.6 mm.

The incomplete Fijian fossil is provisionally assigned to *Microgaza.* It may represent a different group. *M. oblita* Jung from the Pliocene of Trinidad (Jung, 1969, p. 422, pl. 42, figs. 4–9) has an angular periphery, as does the Fijian shell, but it has a lower spire and lacks many of the sculptural features described above.

Occurrence.—A single incomplete shell from station C2024, Viti Levu, Fiji; age Pliocene (Tertiary *h*).

Family TURBINIDAE

Genus ASTRAEA Roding

Subgenus BOLMA Risso

Risso, 1826, Histoire nat. principales productions Europe méridionale * * * p. 117.

Type (by monotypy).—*Turbo rugosus* Linnaeus. Holocene, Mediterranean Sea and eastern Atlantic.

Astraea (Bolma) girgyllus (Reeve)

Plate 2, figure 15; plate 3, figure 1

Trochus girgyllus Reeve, 1871, Conchologica Iconica, v. 14, *Trochus,* pl. 10, no. 53.

Turbo (Bolma) girgyllus (Reeve), Sowerby, 1884, Thesaurus Conchyliorum, *Turbo,* no. 57, p. 208, pl. 7, fig. 23.

Two incomplete shells from the Pleistocene beds on the Kere River, Santo, New Hebrides (station SM242). One shell measures: height 41.0 mm, diameter 31.6 mm; the other: height 42 mm, diameter 40 mm. The species was described from a Holocene shell found in Chinese waters. Not previously reported as a fossil.

Genus ARENE

Arene (Arene) sp. B

Plate 37, figures 17–20

Shell minute with a low turreted spire whose early whorls are flattened. Sculpture of body whorl consisting of two strong spirals, the upper larger one forming the periphery and bearing a dozen triangular scales opening forward; the lower smaller spiral is inconspicuously scaly and borders the flattened base. Axial sculpture relatively subdued on the spire but strongly developed on the base near the open umbilicus.

Measurements of the figured specimen, USNM 250143: height 2.2 mm, diameter 2.8 mm.

The New Hebrides fossil closely resembles *Bathyliotina,* a genus created by Habe (1964, *in* Kira and Habe, 1965, v. 2, p. 19, pl. 7, fig. 1) with type *Liotia armata* A. Adams. The species lives in the western Pacific, but I have not seen specimens. *Arene* sp. B superficially resembles *Liotia (Arene) venusta* described by Woodring (1928, p. 423, pl. 35, figs. 4–6) from Bowden, Jamaica, but there are many differences. Like the New Hebrides fossil, the one from Jamaica is represented by a single shell; both probably are immature.

Occurrence.—Station SM43, Navaka River, Santo, New Hebrides; age, Pleistocene.

Genus DENTARENE Iredale

Iredale, 1929, Queensland Mus. Mem. 9, p. 274.

Type (by original designation).—*Dentarene sarcina* Iredale, new name for *Delphinula crenata* Kiener. Holocene, Philippines.

Collections made from the Pleistocene beds cropping out on the Navaka River, Santo, New Hebrides, contained two small rare species of liotids, as described below. One proved a fairly typical *Dentarene, D. navakaense;* the other, characterized by a flattened spire, is given the name *D. depressa.*

Dentarene navakaense Ladd, n. sp.

Plate 40, figures 4–6

Shell small, spire moderately high, composed of about four whorls whose upper surfaces are gently convex; periphery of shell made up of a dozen triangular spines, opening forward spines curved upward; space between periphery and suture covered by a series of poorly defined spiral cords, the cord next to the suture larger than the others and beaded. Below the scaled periphery is a flattened strip bordered by a scaly spiral less prominent than the peripheral spiral above. On the base are two secondary spirals of axially oriented beads and a more

prominent beaded spiral that encircles a deep umbilicus. This spiral tied to inner lip of the subcircular aperture.

Measurements of the holotype, USNM 250163: diameter 3.5 mm, height 2.5 mm.

Occurrence.—Holotype and two other shells from USGS locality 25734, Navaka River, Santo, New Hebrides; age, Pleistocene.

Dentarene depressa Ladd, n. sp.

Plate 40, figures 7–11

Shell small, spire depressed below the level of the body whorl; spire composed of about four whorls, the upper surfaces gently convex. Periphery formed of about a dozen elongated triangular spines, opening forward and curved upward. Upper surfaces of whorls mostly smooth but showing traces of axial lines of growth near outer margins. Lower surface mostly smooth except for a row of spines similar to those forming the periphery above but slightly smaller; this row of spines spirals down the deep umbilicus. Aperture circular except for angles made by the two rows of spines.

Measurements of the holotype, USNM 250161: diameter 3.5 mm, height (upper spines omitted) 1.5 mm; the paratype, USNM 250162: diameter 3.6 mm, height (upper spines omitted) 1.6 mm.

The species bears a resemblance to *Pterarene* described by Sakurai and Habe (1977) from Japanese waters but, as the author noted, that genus has only a single stellate peripheral keel.

Occurrence.—Holotype and paratype from the Pleistocene beds the Navaka River, Santo, New Hebrides (station SM43 and USGS locality 25731).

Genus TURBO Linnaeus

Linnaeus, 1758, Systema naturae, 10th ed., p. 761.

Subgenus TURBO s. s.

Type (by subsequent designation, Montfort, 1810, Conchyliologie systématique, v. 2, p. 203).—*Turbo petholatus* Linnaeus. Holocene, Indo-Pacific. Also reported as a Cenozoic fossil on various islands in the Southwest Pacific (Ladd, 1966, p. 47).

Turbo (Turbo) petholatus Linnaeus

Plate 2, figures 16, 17

Turbo petholatus Linnaeus, 1758, Systema naturae, 10th ed., p. 762.

A large and well-colored shell of the type species of *Turbo* was collected from the Pleistocene beds at USGS locality 25715 on the Kere River, Santo, New Hebrides. Because of the excellence of its color preservation, the shell (USNM 214366) is shown on plate 2. It measures 50 mm in height, 40 mm in diameter.

Genus HOMALOPOMA Carpenter

Carpenter, 1846, British Assoc. Adv. Sci. Rept. for 1863, p. 537.

Type (by monotypy).—*Turbo sanguinea* Linnaeus. Holocene, Mediterranean Sea.

Subgenus CANTRAINEA Jeffreys

Jeffreys, 1883, Zool. Soc. London Proc., p. 109.

Type (by original designation).—*Turbo peloritanus* Contraine. Holocene, Mediterranean Sea.

Homalopoma (Cantrainea) whipplei Ladd, n. sp.

Plate 36, figures 1–4

Shell small with a turbinate spire. Protoconch of about one smooth convex whorl followed by 3½ whorls that make up the teleoconch. Sculpture on body whorl consisting of four strong, widely spaced spiral keels, one close to the suture, the others nearer the base where they form a projecting peripheral band; base smooth except for growth lines. Secondary spirals discernible only under magnification. Axial sculpture poor, consisting of growth lines and, on the whorls of the spire, obscure subsutural beads. Aperture subcircular, nacreous within; outer lip thin, crenulated by the spiral keels; inner lip thickened by a toothlike callus at about the midpoint. Umbilicus concealed by columellar callus.

Measurements of the holotype, USNM 214419: height 5.0 mm, diameter 5.6 mm.

The Fiji fossil seems most closely related to *Homalopoma* (*Cantrainea*) *panamensis* (Dall) (cited by Keen, 1971, p. 350). Other species of *Cantrainea* are confined to the Tertiary and Holocene of Europe. *H.* (*C.*) *whipplei* is smaller than *H.* (*C.*) *panamensis* and has a lower spire and a more prominent subsutural keel.

This species is named for G. Leslie Whipple who did much to establish a geologic chronology for Viti Levu.

Occurrence.—A single specimen from station C2026, Viti Levu, Fiji; age Pliocene (Tertiary *h*). Dall's related Panamic species has been reported from 380 to 1,150 m.

Homalopoma (Cantrainea?) druidi Ladd, n. sp.

Plate 36, figures 5–8

Shell small, turbinate. Protoconch of about one smooth convex whorl, followed by about 3½ strongly sculptured whorls. On the body whorl are six primary spiral ribs, the lowest three larger than the others; secondary spirals present over the entire

shell, including the base where the riblet bordering the umbilicus is larger than the others. Aperture subcircular; columella with a heavy callus with two rounded projections anteriorly, the callus projecting over part of the umbilicus; outer lip thin, beveled within.

Measurements of the holotype, USNM 250139, only specimen: height 5.2 mm, diameter 5.7 mm.

This species superficially resembles *H.* (*C.*) *whipplei* described above but has more numerous primary spirals, much stronger secondary spirals, a dual columellar callus, and a more open umbilicus. The reference of *H. druidi* to the subgenus *Cantrainea* is questioned because of its umbilical features.

This species is named for Druid Wilson, formerly of the Geological Survey, now with the Smithsonian, who has aided me greatly during my study of western Pacific fossil mollusks.

Occurrence.—Station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Family CYCLOSTREMATIDAE

Genus CYCLOSTREMA Marryat

Marryat, 1818, Linnean Soc. London Trans., v. 12, p. 338.

Type (by monotypy).—*Cyclostrema cancellata* Marryat. Holocene, West Indies.

Cyclostrema somidi Ladd, n. sp.

Plate 3, figures 15–17

Minute, apex sunken; later whorls forming slow spire, upper surface of whorls flat and smooth; periphery with prominent triangular spines, 11 on body whorl, that curve upward and are open forward. A second spiral keel below the periphery has smaller, more numerous spines. Aperture circular; umbilicus apparently deep, bordered by a coarsely puckered rib.

Measurements of the holotype, USNM 214416: height 1.5 mm, diameter 2.3 mm.

I have not found a close relative of *C. somidi*. Its prominent peripheral spines are comparable with those found on some species of *Liotina* (*Dentarene*) and *Astraea* (*Bellastraea*), but those forms lack the second spiral keel that seems to characterize this *Cyclostrema*. The specific name is Fijian for very small, minute.

Occurrence.—Two shells from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Cyclostrema cf. C. somidi Ladd

Plate 37, figures 21–25

Shell small, planorboid, spire depressed below the level of the flattened body whorl. Periphery of the shell formed by two strong spiral ridges. The upper of the two spirals is the larger and is extended into a series of regularly spaced, upturned triangular projections that give the shell a starlike appearance when viewed from above; nine such projections are present on the body whorl of the single complete specimen, an immature shell. Base flattened, widely umbilicate, the steep-sided umbilicus bordered by a noded rib.

Measurements of the complete specimen, USNM 250141: height 1.6 mm, diameter 0.7 mm.

A second shell, USNM 250140 (diameter 3.2), represents a larger individual but is incomplete. It may represent a distinct species, as it has a secondary spiral on its upper surface that is not found on the complete shell and the base is less flattened (pl. 37, fig. 25) but shows strong axial ribs.

The New Hebrides shells appear to be closely related to *C. somidi* Ladd from the Pliocene of Fiji.

Occurrence.—Two shells from station SM43 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Family NERITIDAE

Genus NERITINA Lamarck

Lamarck, 1816, Encyclopédie méthodique. Histoire nat. vers, v. 3, p. 455; liste p. 11.

Type (by subsequent designation, Children, 1823, Lamarck's genera of shells, p. 111).—*Nerita pulligera* Linneaus. Holocene, rivers of India and Melanesia.

Neritina zigzag Lamarck

Plate 3, figures 2, 3

Neritina zigzag Lamarck, 1822, Histoire nat. animaux sans vertèbres, v. 6, no. 2, p. 185.

Neritina ziczac Lamarck, Sowerby, 1849, Thesaurus Conchyliorum, v. 2, Abt. 10, *Neritina* p. 540; Martens, 1879, Conchylien Cabinet, v. 2, Abt. 10, p. 101, pl. 2, figs. 6, 7; pl. 10, figs. 20–22.

Represented by three somewhat worn shells from the Kere River outcrops, Santo, New Hebrides. The largest and most complete of these, USNM 308095, is figured. It measures: height 23.0 mm, diameter 22.8 mm. These Pleistocene shells are the first fossil occurrence. According to published reports, the species lives today in the Philippines and Tahiti.

Genus SMARAGDIA Issel

Issel, 1860, Malacologia del Mare Rosso, p. 212.

Subgenus SMARAGDIA s. s.

Type (by subsequent designation, Kobelt, *in* Martini and Chemnitz, 1879, Systematische Conchylien–Cabinet v. 2, p. 246).—*Nerita viridis* Linnaeus. Holocene, Mediterranean Sea.

Smaragdia (Smaragdia) cf. S. viridis (Linnaeus)

Plate 3, figures 4, 5

Small shells of the *S. viridis* type were recovered from shallow horizons in three diamond drill holes in western Viti Levu. Many of the shells are worn, but all retain traces of their original color pattern—a series of thin zigzag lines that, as Olsson and Harbison (1953, p. 341) pointed out, characterize shells from the Mediterranean. The Fijian fossils may represent more than one species, but shells of this group vary widely, and no probable division seems possible. The figured specimen, USNM 214246 from station C1766, measures: height 4.6 mm, diameter 5.0 mm.

Occurrence.—More than 40 shells from three drill holes in western Viti Levu at depths of 9–62 m (stations C1763, C1764, C1766, C1769, C1872, C2055). Most of the shells are very small, but two are larger than the others; one of these is figured. Age, probably Pliocene.

Family RISSOIDAE

Genus ZEBINA H. and A. Adams

Adams, H. and A., 1854, Genera of Recent Mollusca, v. 1, p. 328.

Type (by subsequent designation, G. Nevill, 1885, Hand list Mollusca Indian Museum, pt. 2, p. 93).—*Rissoina coronata* Récluz. Holocene, Mauritius.

Subgenus CIBDEZEBINA Woodring

Woodring, 1928, Carnegie Inst. Washington Pub. 385, p. 369.

Type (by original designation).—*Rissoina browniana* d'Orbigny. Holocene, West Indies.

Zebina (Cibdezebina) metaltilana Ladd

Plate 31, figures 1, 2

Zebina (Cibdezebina) metaltilana Ladd, 1966, U.S. Geol. Survey, Prof. Paper 531, p. 64, pl. 12, fig. 10.

About a dozen specimens believed to represent this species were collected from the Pleistocene beds at station SM43 on the Navaka River, Santo, New Hebrides. The species was described originally from the Miocene and younger beds drilled in the Marshall Islands; it was also recovered from the Miocene of Fiji and was found living in Bikini's lagoon.

Measurements of the figured specimen from the Pleistocene of the New Hebrides, USNM 250159: height 4.0 mm, diameter 1.7 mm.

This specimen shows the posterior denticle, but most of the shells are immature and show no denticles at all.

Subgenus MOERCHIELLA G. Nevill

Nevill, 1885, Hand list Mollusca Indian Museum, pt. 2, p. 88.

Type (by original designation).—*Rissoina gigantea* Deshayes. Holocene, Philippine Islands.

Zebina (Moerchiella) supracostata (Garrett)

Plate 33, figures 5, 6

Rissoina supracostata Garrett, 1873, Acad. Nat. Sci. Philadelphia Proc., pt. 2, p. 209, pl. 2, fig. 1.

A single shell, USNM 214377, was found in the Pleistocene beds at USGS locality 25715 on the Kere River, Santo, New Hebrides. It measures: height 5.7 mm, diameter 2.0 mm.

Garrett described *Rissoina supracostata* from Holocene shells collected in Fiji. I have not seen shells from the type area, but the New Hebrides fossil is conspecific with shells in a lot in the Hirase collection (USNM 342187) collected from Osumi at the northern end of the Ryukyu Islands. The lot consists of 10 shells that show considerable variation in the strength and extent of the axials on the early whorls of the teleoconch.

Zebina (Moerchiella) sp. A

Plate 33, figures 7, 8

Medium in size, elongate, with a high flat-sided spire. Teleoconch of about eight slightly convex whorls. All whorls covered by fine close-set oblique axial ribs that are slightly stronger near the apex, becoming nearly obsolete on the body whorl; all whorls with microscopic spirals that are most prominent on the body whorl; suture lightly impressed; aperture oblique, broadly lenticular; outer lip thickened behind; inner lip callused.

Measurements of the figured specimen, USNM 214371: height 10.1 mm, diameter 4.0 mm.

The single shell may represent an undescribed species, but it is incomplete. It is characterized particularly by the uniformity of the axials on the whorls of the teleoconch; there is no marked break between ribbed and unribbed whorls.

Occurrence.—USGS locality 25731 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Family ARCHITECTONICIDAE

Genus MANGONUIA Mestayer

Mestayer, 1930, New Zealand Inst. Trans., v. 61, p. 144–145.

Type (by monotypy).—*Mangonuia bollonsi* Mestayer. Holocene, off North Cape, New Zealand.

Mangonuia navakaensis Ladd, n. sp.

Plate 31, figures 3–5

Small with spire flattened. Adult sculpture of both the upper and the lower surfaces starting from a prominent varix. On the upper surface are two beaded peripheral cords, the lower one the larger; a

smaller beaded cord is also present next to the suture. The lower surface is widely umbilicate with a peripheral beaded cord comparable with the peripheral cords of the upper surface. Between the primary cords of the upper and lower surfaces is a gently concave beveled area carrying two fine secondary spirals. On the upper surface, the gently convex areas are covered with fine curved axial lines. Aperture made subquadrate by the peripheral cords.

Measurements of the holotype, USNM 250150: diameter 3.5 mm, height 0.9 mm.

M. navakaensis seems closely related to *M. bollonsi,* Holocene type of the genus from New Zealand, but the fossil shells, through smaller, have a more prominent varix initiating the adult sculpture. The fossils are also less depressed apically and have stronger spirals around the umbilicus, weaker axial sculpture both above and below. The secondary spirals on the beveled margin area are stronger on the Holocene shell. The holotype and two other fossil shells assigned to *M. navakaensis* may be immature.

M. meridionalis (Hedley, 1903) has weaker spirals below and three secondary spirals in the beveled area.

Occurrence.—Holotype and two other shells from station SM43 on the Navaka River. Age of fossils, Pleistocene.

Mangonuia kerensis Ladd, n. sp.

Plate 31, figures 6–8

Small, spire gently convex. Adult sculpture above starting from a fairly prominent varix and consisting of two primary peripheral beaded spirals; the lower one is the larger and forms the sharply crenulated periphery. Inside the primary peripheral spirals on the upper surface are five secondary spirals, the one next to the suture slightly larger than the others; secondary spirals weakly beaded by curved axials. Shell widely umbilicate below, the entire surface covered by beaded spirals. The spiral bounding a beveled zone below the periphery is slightly larger than the others. The beveled zone has three beaded spirals and a trace of a fourth above (beneath the prominent peripheral spiral). Aperture subcircular.

Measurements of the holotype, USNM 250151: diameter 4.3 mm, height 1.1 mm.

One of the four shells from the type locality, though incomplete, is larger than the others and carried remnants of still another whorl, now broken away. A complete adult shell of *M. kerensis* would probably be considerably larger than the figured holotype.

M. kerensis is closely related to *M. navakaensis,* described above, but is less flattened apically, has a less conspicuous peripheral spiral below, and has stronger spirals in the so-called beveled area. *M. kerensis* has stronger axials on the upper surface than does *M. navakaensis.*

The Kere River species also resembles the Holocene species described by Hedley (1903, p. 351) from Australia, as *Omalaxis meridionalis.* That species, however has a more strongly developed peripheral axial below and weaker, unbeaded spirals in the beveled area.

Occurrence.—Four shells from USGS locality 25715, Kere River, Santo, New Hebrides; age, Pleistocene.

Mangonuia sp. A

Plate 31, figures 9–11

A minute shell collected on the Navaka River with shells of *M. navakaensis* may represent a distinct species. Adult sculpture starts with a varix both above and below. The peripheral margin is not angularly beveled between the upper and lower surfaces as in *M. navakaensis;* its upper surface is margined by only a single beaded cord, and its lower surface lacks the secondary spirals of *M. navakaensis.* The single shell, USNM 250160, may be immature. It measures: diameter 2.5 mm, height 0.8 mm.

Occurrence.—Station SM43, Navaka River, Santo, New Hebrides; age, Pleistocene.

Mangonuia sp.

Plate 32, figures 1–9

Three small, incomplete, and probably immature shells may represent one or more unusual species of *Mangonuia.* They are flattened above, each shell consisting of a large, convex smooth nuclear whorl separated from several highly sculptured whorls by a varix. Upper surface covered by four or five strongly beaded spiral ribs, of which the peripheral rib next to the suture is stronger. The lower surface covered by beaded spirals, the largest spiraling into the wide umbilicus. One or two beaded spirals form the periphery; if two are present, they are subequal in strength; if one only is present, it is located centrally. Aperture subcircular or made slightly irregular by spirals.

Measurements of the two shells from the Kere River: USNM 250164, diameter 3.4 mm, height 1.4 mm; USNM 250165, diameter 3.1 mm, height 1.2 mm. A single shell from the Navaka River, USNM 250166 measures: diameter 3.3 mm, height 1.1 mm.

Differences in the peripheral sculpture suggest that more than one species may be represented. Additional material, particularly adult shells, are needed to settle this question.

Occurrence.—Two shells from USGS locality 25715 on the Kere River, one shell from station SM43 on the Navaka River, both on Santo, New Hebrides. All specimens Pleistocene.

Genus PSEUDOMALAXIS Fischer

Fischer, 1885, Manuel Conchyliologie, p. 714.

Subgenus PSEUDOMALAXIS s. s.

Type (by monotypy).—*Bifrontia? zanclaea* Philippi. Pliocene, Sicily.

Pseudomalaxis (Pseudomalaxis?) roddai Ladd, n. sp

Plate 32, figures 10–12

Shell small, flattened above, widely concave below; whorls about three; (adult sculpture above and below starting from a varix and consisting of two prominent subequal beaded peripheral cords and a smaller beaded spiral cord at the suture. The peripheral cords make the last whorl quadrate in section; the flattened upper surface shows obscure traces of axials. Both upper and lower surfaces depressed at the suture, but the whorls are in contact.

Measurements of the holotype, the only specimen, USNM 250149: diameter 2.6 mm, height 0.8 mm.

I have not found a close relative of *P. roddai*, living or fossil. The reference to *Pseudomalaxis* s.s. is questioned because the shell shows no trace of spiral sculpture other than the beaded cords.

This species is named for Peter Rodda, Senior Geologist with the Mineral Resources Division in Fiji, who has collected many fossils on Viti Levu, including the one here described.

Occurrence.—Station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus ARCHITECTONICA Roding

Architectonica maxima (Philippi)

Plate 3, figures 6–8

Solarium maximum Philippi, 1848, Zeitschr. Malakologie, v. 5, p. 170.

Architectonica maxima (Philippi), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 25, pl. 13, fig. 7; Kuroda, Habe, and Oyama, 1971, Sea shells of Sagami Bay, p. 261, pl. 61, fig. 28; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 194, pl. 3. fig. 7.

One large shell (figured) and two smaller ones from USGS locality 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Measurements of the figured specimen, USNM 175078: height 35.4 mm, diameter 62.0 mm.

The species lives today in many parts of the western Pacific and has been in parts of Indonesia since late Tertiary time (Vlerk, 1931, p. 256).

Subgenus PSEUDOTORINIA Sacco

Sacco, 1892, Molluschi dei terzianii de Piemonte e della Liguria, pt. 12, p. 66.

Type (by original designation).—*Solarium obtusum* Bronn. Miocene and Pliocene of Italy.

Architectonica (Pseudotorinia) aff. A. (P.) euprepes Woodring

Plate 35, figures 1–3.

Three shells from the Pleistocene beds of Santo, New Hebrides, appear to very closely related to the Tertiary species described by Woodring (1928, p. 357, pl. 27, figs. 15–17) from Jamaica. The figured shell from the New Hebrides is an adult; one of the others is immature. All three have elaborate sculpture similar to that of the Jamaican species. The New Hebrides shells have a wider umbilicus than the Jamaican species, and their marginal cusps are sharper. The 30 shells from the Aldrich collection assigned to *A. euprepes* by Woodring are mostly immature and resemble the smaller of the two Navaka River shells.

Measurements of the figured specimen, USNM 214406: height 3.3 mm, diameter 7.8 mm.

Occurrence.—Figured specimen from the Pleistocene beds on the Kere River (USGS locality 25718); a second adult shell and an immature shell from Station SM43 on the Navaka River, Santo, New Hebrides.

Family TURRITELLIDAE

Additional slit worm shells were found in the Pleistocene beds exposed on Santo.

Genus SILIQUARIA Bruguiere

Bruguière, 1789, Encyclopédie methodique. Histoire nat. vers, v. 1, p. 15.

Type (by subsequent designation, Herrmannsen, 1847, Indicis generum malacozoorum, v. 2, p. 455).—*Serpula anguina* Linnaeus. Holocene, Indo-Pacific.

Siliquaria cumingii (Morch)

Plate 35, figures 4, 5

Tenagodus (*Siliquaria*) *cumingii* Mörch, 1860, Zool. Soc. London Proc., v. 28, p. 403.

Siliquaria (*Agathirses*) *cumingi* Mörch, Kira, 1962, Shells of the western Pacific in color, v. 1, p. 25, pl. 13, fig. 8.

Siliquaria cumingi Mörch, Matsura, 1977, Kanazawa Univ. Sci. Rept., v. 22, p. 144, pl. 6, figs. 16, 17.

The figured specimen, USNM 214414, from the Kere River, USGS locality 27518, Santo, New Hebrides, and several smaller shells from the Navaka

River outcrops appear to represent this Holocene species, which is widespread in the western Pacific today. The incomplete figured shell measures: height 37.6 mm, breadth 19.1 mm. The fossils are Pleistocene in age, as are those from Japan cited by Matsura.

Siliquaria aff. S. armata Kuroda, Habe and Kozuge

Plate 35, figures 6–8

The figured specimen, USNM 214415, is larger than the shell described by Kuroda, Habe, and Kozuge (*in* Kuroda and others, 1971, p. 64), and it has more numerous spiral cords (eight as against five or six). The incomplete fossil measures: height 8.6 mm, breadth 18.8 mm. As the authors of *S. armata* point out, their species closely resembles the type of the genus, *S. anguina* (Linnaeus).

Occurrence.—Figured specimen from USGS locality 25718 on the Kere River, Santo, New Hebrides; a smaller shell was found at station SM43 on the Navaka River; age of both shells, Pleistocene.

Family THIARIDAE

Genus THIARA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 109.

Type (*fide* Wenz, 1938, Handbuch der Paläzoologie, Gastropoda, p. 712).— *Helix amarula* Linnaeus. Holocene, Réunion.

Subgenus PLOTIA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 95.

Type (*fide* Thiele, 1931, Handbuch der Systematischen weichtierkunde, p. 200).—*Buccinum scabrum* Müller. Holocene, Indo-Pacific

Thiara (Plotia) scabra (Muller)

Plate 3, figure 9

Buccinum scabrum Müller, 1774, Vermium terrestrium et fluviatilium, v. 2, p. 136.

Thiara scabra (Müller), Benthem Jutting, 1956, Treubia, v. 23, pt. 2, p. 393, figs. 72, 78 (see for additional references).

A single bleached shell that clearly represents this variable Holocene freshwater species was collected by Harold Stearns from a gravel bar in the Sarakata River near the south coast of Santo, New Hebrides (USGS locality 21031). Though fragile, the shell is nearly complete. The body whorl is unfilled, but the presence of cemented material along part of the suture and in the broken apex indicate that the specimen is a fossil, not the shell of a living example that was washed into the river. The shell, USNM 214319, measures: height 12.8 mm, diameter (incomplete) 5.7 mm. The shell is probably Pleistocene in age.

Family CERITHIIDAE

As recorded in Ladd, 1972, members of the family Cerithiidae were found in variety and abundance in the reef-associated deposits of the island area. This was to be expected, as cerithids flourish today in shallow (intertidal) waters. They were not abundant in the richly fossiliferous Tertiary offshore marls of Fiji and, for the same reason, were found to be rare in the Pleistocene beds of Santo. Among thousands of shells collected from Santo, less than two dozen were cerithids and, of these, nearly half were from outcrops on the Wambu River. Only three species were identified. One of these, *Clypeomorphus coralium* (Kiener), is illustrated; the other two are treated in Ladd, 1972, as *Rhinoclavis* (*Proclava*) *sordidula* (Gould) and *Bittium* (*Ischnocerithium*) *rostrata* (Sowerby).

Genus CLYPEOMORUS Jousseaume

Jousseaume, 1888, Soc. Zool. France Mém. 1, p. 171–173.

Type (by original designation).—*Clypeomorus clypeomorus* Jousseaume. Holocene, Red Sea area.

Clypeomorus coralium (Kiener)

Plate 37, figures 6–8

Cerithium coralium Kiener, 1841, Coquilles vivantes, Cerithium, p. 32, pl. 8, fig. 3.

Cerithium corallium Kiener, Sowerby, 1855, Thesaurus Conchyliorum, *Cerithium*, p. 863, pl. 129, fig. 63.

Clypeomorus coralium (Kiener), Kira, 1962, Shells of western Pacific in color, p. 27, pl. 13, fig. 20.

This Holocene Philippine species is represented in the extensive Santo Pleistocene collections by 14 shells from half a dozen localities. The figured specimen, USNM 250167 from station SM308, on the Wambu River, measures: height 16.4 mm, diameter 6.0 mm.

Family SEGUENZIIDAE

Genus SEGUENZIA Jeffreys

Jeffreys, 1876, Royal Soc. London Proc., v. 25. p. 187, 202.

Type (by subsequent designation, Harris, 1897, Catalogue Tertiary Mollusca, British Mus., pt. 1, Australasian, p. 266).—*Seguenzia formosa* Jeffreys. Holocene, Atlantic.

Seguenzia donaldi Ladd, n. sp.

Plate 35, figures 9–15

Shell minute, iridescent; protoconch inconspicuous, consisting of about one whorl; teleoconch of about five whorls that form a turreted trochoid spire. Aperture irregular in outline; outer lip indented by a deep sinus at the suture (on some shells, this sinus widens posteriorly) and shallower sinuses at the periphery and near the base. The

columella borders a narrow deep umbilicus and terminates near its base in a toothlike projection. Body whorl has two prominent spiral carinae, one close to the suture, the other at the periphery; immediately below the peripheral carina is a smaller carina, and there are several less prominent spirals on the gently convex base. Axial sculpture, fine threads visible only under high magnification.

Measurements of the types: Holotype, USNM 214409, height 2.2 mm, diameter 2.1 mm; paratype, USNM 214411, height 2.1 mm, diameter 2.1 mm.

The New Hebrides fossils are much smaller than numerous Holocene species with which they have been compared. In size, the New Hebrides shells are comparable with the Miocene species from Bowden, Jamaica, described by Woodring (1928, p. 327, pl. 24, figs. 6, 7) as *S. hapala*, but they have a better developed umbilicus and more subdued axial sculpture than does that species. The New Hebrides fossils more closely resemble Holocene shells dredged in the Philippine area from a depth of 226 fathoms (413 m) (USNM 285266). The larger Holocene shells have a less well developed umbilicus and stronger axial sculpture.

This deep-water species is named for Dr. Donald I. J. Mallick, who made the first extensive collections from the Navaka River outcrops that yielded this species in some abundance.

Occurrence.—Many shells from station SM43 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Family EPITONIIDAE

Genus EPITONIUM Roding

Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 91.

Type (by subsequent designation, Suter, 1913, Manual New Zealand Mollusca, p. 319.—*Turbo scalaris* Linnaeus. Holocene, western Pacific.

Epitonium cf. E. replicata (Sowerby)

Plate 3, figures 10–12

Fossil shells from the Pleistocene of the New Hebrides are probably identical with the Holocene shell described by Sowerby (1844, p. 84, pl. 32, figs. 23, 24), but most Pleistocene shells show more numerous axial ribs (9–10 on body whorl) than do Holocene shells.

Measurements of the figured specimen, USNM 214303: height 12.3 mm, diameter 7.2 mm.

Occurrence.—Fifteen complete shells from USGS locality 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene. *E. replicata* lives today in Japan and many parts of the southwest Pacific.

Subgenus CYCLOSCALA Dall

Dall, 1889, Harvard Coll., Mus. Comp. Zoology Bull., v. 18, p. 316.

Type (by subsequent designation, de Boury, 1909, Jour. Conchyliologie, v. 57, p. 258).—*Scala dunkeriana* Dall (=*Scalaria echinaticosta* d'Orbigny). Holocene, West Indies.

Epitonium (Cycloscala) cf. E. revolutum (Hedley)

Plate 3, figure 13

A single incomplete shell from Pliocene beds, station C1766, Viti Levu, Fiji, may represent this species that was described by Hedley from the sands of a lagoon beach at Funafuti, Ellice Islands. The Fiji fossil has a wider and more closely coiled shell and more numerous axial lamellae than do the two shells described from the upper Miocene beds of Palau (Ladd, 1972, p. 51, pl. 13, fig. 4). The Fiji shell, USNM 214326, measures: height 2.3 mm, diameter 1.4 mm.

Family STROMBIDAE

Genus VARICOSPIRA Eames

Eames, F. E., 1952, Royal Soc. London Philos. Trans, ser., B, v. 236, no. 631, p. 70.

Type (by original designation).—*Strombus cancellatus* Lamarck, Holocene, Philippines.

Varicospira cf. V. cancellata (Lamarck)

Plate 34, figures 12–14

Two incomplete shells that probably represent this genotype were recovered from Station MWC 40, on Maewo, New Hebrides; age, probably Pleistocene. The figured specimen, USNM 214402, measures: length 30.5 mm, diameter (incomplete) 10.0 mm.

Varicospira cancellata spinifera (Martin)

Plate 4, figures 7, 8

Rostellaria (*Rimella*) *spinifera* Martin, 1899, Geol. Reichs-Mus. Leiden Samml., v. 1, p. 192, pl. 30, figs. 447, 448.
Rimella (*Dientomochilus*) *cancellata spinifera* (Martin), Altena, 1941, Leidsche geol. Mededeel. v. 12, p. 42; Cox, 1948, Schweizerische Paleont. Abh., v. 66, p. 31, pl. 2, figs. 6a–c.

Two small shells from station C2026, Fiji, appear to represent this species. One is incomplete anteriorly, but the other, the figured specimen, USNM 214289, retains its smooth labrum with a short spine near its base, features that distinguish Martin's form from *V. cancellata* (Lamarck). The figured fossil measures: length (incomplete) 17.3 mm, diameter 8.5 mm.

Occurrence.—The Fijian shells from station C2026, Viti Levu, are from the upper Tertiary

(stage *f* or *g*). Described from the Pliocene of Indonesia (Java, Sumatra, Obi).

Genus TIBIA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 123.

Subgenus TIBIA s. s.

Type (by subsequent designation, Dall, 1906, Jour. Conchology (Leeds), v. 11, p. 295).—*Murex fusus* Linnaeus, Holocene, western Pacific.

Tibia powisii (Petit)

Plate 4, figures 3–6

Rostellaria powisii Petit, 1840, Rev. Zoologie v. 3, p. 326; 1842, Mag. Zoologie, pl. 53; Tesch, 1920, Paläontologie von Timor, pt. 14, Jungtertiäre und Quartäre Mollusken, p. 51, pl. 130, fig. 170.

Tibia powisi Kira, 1962, Shells of the western Pacific in color, v. 1, p. 35, pl. 16, fig. 10.

This is one of the most abundant shells in the Pleistocene marls on the Kere River, Santo, New Hebrides. Some of the shells have strong spiral ridges, particularly on the later whorls; on other shells, the whorls of the spire are nearly smooth. Some shells are intermediate between the two.

Measurements of a strongly sculptured example, USNM 214285: length 45.4 mm, diameter 17.0 mm; a smooth shell, USNM 214286: length 45.9 mm, diameter 17.3 mm.

The species lives today in the Philippines, Indonesia, and Japan and has been recognized in the Pliocene of Timor. A smaller form, *T. powisii modesta,* was described by Martin from the Pliocene of Java and has been widely recognized in the Pliocene of Fiji (Ladd, 1972, p. 56, pl. 15, figs. 2, 3).

Genus STROMBUS Linnaeus

Linnaeus, 1758, Systema naturae 10*th* ed. p. 742.

Type (by subsequent designation, Montfort, 1810, Conchyliologie systematique, v. 2, p. 515).—*Strombus pugilis* Linnaeus. Holocene, Caribbean and Florida.

Subgenus CANARIUM Schumacher

Schumacher, 1817, Essai d'un nouveau système des habitations des vers testacés, Copenhagen, p. 219.

Type (by monotypy).—*Canarium ustulatum* Schumacher (= *Strombus urceus* Linnaeus). Holocene, southwest Pacific.

Strombus (Canarium) labiatus (Roding)

Plate 4, figures 9, 10

Lambis labiatus Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 63, no. 806.

Strombus (Canarium) labiatus (Röding), Abbott, 1960, Indo-Pacific Mollusca v. 1, no. 2, p. 67–69, pl. 20, figs. 22, 23; pl. 44; pl. 45, figs. 1–6 (see for additional references).

A single well-preserved shell of the strongly sculptured form of this variable species was found at station C2026 on Viti Levu, Fiji. The specimen, USNM 214235, measures: length 33.4 mm, diameter 17.4 mm. *S. labiatus* lives today in the western Pacific from Japan to northern Australia and from Fiji westward into the Indian Ocean (Abbott, 1960, pl. 46). It is found in some abundance on the reefs off Viti Levu today. The fossil, Pliocene (Tertiary *h*), cannot be distinguished from Holocene shells from the same area.

Strombus (Canarium) microurceus (Kira)

Plate 33, figures 11, 12

Canarium microurceus Kira, 1955, Kuroda Ms., Colored illust. shells Japan, ed. 1, pl. 15, fig. 5 (nomen nudum); 1959, ed. 2, p. 35, pl. 15, fig. 5.

Strombus (Canarium) microurceus (Kira), Abbott, 1960, Indo-Pacific Mollusca, v. 1, no. 2, p. 71, pl. 20, figs. 24, 25.

Strombus microurceus (Kira), Cernohorsky, 1965, Records Fiji Mus., v. 1, no. 1, p. 3, pl. 4, fig. 20.

Two incomplete and slightly worn shells from a drill hole in the Nandi area, Viti Levu, Fiji (station C2173) seem to represent this Holocene species that is known from the western Pacific—from northern Australia to Japan and eastward to Fiji and Samoa. The shells from C2173 are probably Pliocene in age and are the first recorded fossil occurrence. The figured specimen, USNM 214380, measures: length 24.8 mm, diameter 11.6 mm.

Subgenus DOLOMENA Iredale

Iredale, 1931, Australian Mus. Records, v. 18, no. 4, p. 212.

Type (by monotypy).—*Strombus pulchellus* Reeve (= *Strombus plicatus pulchellus* Reeve), Holocene, Red Sea.

Strombus (Dolomena) minimus Linnaeus

Strombus minimus Linnaeus, 1771, Mantissa plantarum, appendix, p. 549; Abbott, 1960, Indo-Pacific Mollusca, v. 1, no. 2, p. 105, pl. 18, figs. 4, 5; pl. 74, fig. 3; Cernohorsky, 1965, Fiji Mus. Recs., v. 1, no. 1, p. 8, pl. 2, fig. 11.

A single incomplete shell from station C1763, Viti Levu, Fiji; age, probably Pleistocene. The shell, USNM 214313, measures: length (incomplete) 17.5 mm, diameter 16.5 mm. The species lives today throughout the southwest Pacific—from Fiji to Indonesia and north to the Ryukyu Islands. Martin (1899, p. 182, pl. 29, figs. 421) reported it from the Pliocene of Java.

Strombus (Dolomena) plicatus columba Lamarck

Plate 4, figures 11, 12

Strombus columba Lamarck, 1822, Histoire nat. animaux sans vertèbres, v. 7, p. 208.

Strombus (Dolomena) plicatus columba Lamarck, Abbott, 1960, Indo-Pacific Mollusca, v. 1, no. 2, p. 90–91, pl. 18, figs. 1, 2; pl. 63, fig. 1 (see for additional synonymy).

Two typical specimens from river debris (station SG79) on the Sarakata River, Santo, New Hebrides, are probably Pleistocene in age. The figured shell measures: length 44.8 mm, diameter 25.3 mm.

As Abbott pointed out, this species is characteristic of the western Indian Ocean area. Shells in the National Museum collection, however (No. 609962), are from New Caledonia. Abbott (1960) questioned the Vredenberg report of an occurrence in the Gaj beds (upper Miocene) in West Pakistan.

Subgenus LENTIGO Jousseaume

Jousseaume, 1886, Le Naturaliste, Paris, 1st ser., v. 3, no. 28, p. 220.

Type (by monotypy): *Strombus lentiginosus* Linnaeus. Holocene, Indo-Pacific.

Strombus (Lentigo) pipus (Roding)

Plate 4, figures 13, 14

Lambis pipa Röding. 1798, Mus. Boltenianum, Hamburg, v. 2, p. 63.

Strombus pipus (Röding), Abbott, 1960, Indo-Pacific Mollusca, v. 1, no. 2, p. 119, pl. 17, figs. 9, 10; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 81, pl. 17, fig. 9.

Cernohorsky reported the species to be rare in most Pacific localities; it is interesting, therefore, to find it one of the first two identifiable fossil mollusks recovered from a tuff cone on the island of Rotuma. The shell, USNM 214284, measures: length (spire incomplete) 40.8 mm, diameter 32.1 mm.

Occurrence.—Single shell from beds forming a tuff cone on the north coast of Rotuma. Collected by William Hindle; age, Holocene. The species lives today in the western Pacific from the Society Islands to Indonesia and in western Indian Ocean. According to Abbott, it lives at depths of 8–39 fathoms.

Subgenus EUPROTOMUS Gill

Gill, T., 1870, Am. Jour. Conchology, v. 5, p. 131.

Type (by monotypy).—*Strombus aurisdianae* Linnaeus. Holocene, Indo-Pacific .

Strombus (Euprotomus) bulla (Roding)

Plate 4, figures 15–17

Lambis bulla Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 64.

Strombus bulla (Röding), Abbott, 1960, Indo-Pacific Mollusca, v. 1, no. 2, p. 128, pl. 14, figs. 5, 6, pl. 101, fig. 5 (see for additional citations).

This species with its curved posterior projection of the outer lip and its strongly recurved siphonal canal has been recently reviewed by Abbott. The figured specimen, USNM 214234, a small shell, measures: length 43.1 mm, width 24.8 mm.

Occurrence.—A single specimen from U.S. Geological Survey station 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene. Cox (1930, p. 137) reported the species (as *S. auris dianae* Linnaeus) from the Pleistocene of Kenya. It lives today in the western Pacific from the Ryukyu Islands to Samoa (Abbott, 1960, pl. 106).

Family FOSSARIDAE

Genus COUTHOUYIA A. Adams

Adams, A., 1860, Annals and Mag. Nat. History, v. 5, p. 410.

Type (by monotypy).—*Couthouyia decussata* A. Adams, Holocene, Japan.

Couthouyia kerensis Ladd, n. sp.

Plate 33, figures 9, 10

Shell small, globose, thin; composed of four whorls, those of the spire small, the body whorl enormous. Aperture and lower part of body whorl separated from the rest of the shell by a wide umbilicus; aperture semicircular in outline, columella straight, outer lip thin. Sculpture consisting of fine, close-set spirals that are stronger over the middle part of the body whorl than elsewhere; spirals beaded by equally close-set axials.

Measurements of the holotype, USNM 214367: height 3.6 mm, diameter 3.0 mm.

The closest living relative of *C. kerensis* is *C. gracilis* (Brazier), a small and equally fragile species found in Sydney Harbor (Henn and Brazier, 1894, p. 169, pl. 14, fig. 4; Hedley, 1900, p. 506, pl. 26, fig. 13), but there are striking differences: *C. kerensis* is shorter, has a much wider umbilicus, and its whorls are more strongly sculptured. *C. exilis* (Murdock) from the Pliocene of New Zealand (Murdock, 1899, p. 220, pl. 20, fig. 6) likewise has a narrower umbilicus than does *C. kerensis* and is less strongly sculptured.

Occurrence.—Holotype, only specimen, from USGS locality 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Family CAPULIDAE

Genus CAPULUS Montfort

Montfort, 1810, Conchyliologie systématique, v. 2, p. 54.

Type (by original designation).—*Patella ungarica* Linnaeus. Holocene, West Indies.

Capulus japonicus A. Adams

Plate 3, figure 14

Capulus japonicus A. Adams, 1861, Annals and Mag. Nat. History, p. 11 (reprint); Kuroda and Habe, 1954,

Venus, v. 18, no. 1, p. 6, 13, pl. 1. fig. 20a, 20b; Kuroda, Habe, and Oyama, 1971, Sea shells of Sagami Bay, p. 88, pl. 23, fig. 11.

Thin shells that probably represent this variable species were recovered from the Pleistocene beds at USGS localities 25731 and 25739 and station SM43 on the Navaka River, Santo, New Hebrides. The figured specimen, USNM 214359, measures: length 4.2 mm, width 2.7 mm, convexity 3.7 mm. The species has been collected alive off Japan at depths of 69–85 m (Kuroda and others, 1971).

Family CALYPTRAEIDAE

Genus CREPIDULA Lamarck

Lamarck, 1799, Soc. Histoire Nat., Paris. Mém. p. 78.

Type (by monotypy).—*Patella fornicata* Linnaeus. Holocene, Atlantic.

Crepidula sp. A

Plate 4, figures 1, 2

Shell minute, flattened with a coiled apex near its posterior end; marked exteriorly by concentric lines; interiorly there is a shelly platform across the posterior part of the concave shell.

Measurements of the figured specimen, USNM 214410: length 2.8 mm, width 2.7 mm.

This little species is identical with juvenile shells of a Holocene species dredged off Borneo from depths of 292 fathoms (534 m) (USNM 289673).

Occurrence.—Three shells from Station SM43, Navaka River, Santo, New Hebrides; age, Pleistocene.

Family ERATOIDAE

Genus TRIVIROSTRA Jousseaume

Jousseaume, 1884, Soc. Zool. France, Bull. 9, p. 100.

Type (by subsequent designation, Roberts, 1885, *in* Tryon, Manual Conchology, v. 7, p. 161).—*Trivia scabriuscula* Gray (= *Cypraea oryza* Lamarck). Holocene, Indo-Pacific.

Subgenus DOLICHUPIS Iredale

Iredale, 1930, Queensland Mus. Mem., v. 10, p. 83.

Type (by original designation).—*Cypraea producta* Gaskoin. Holocene, western Pacific.

Trivirostra (Dolichupis) producta (Gaskoin)

Plate 5, figures 1–3

Cypraea producta Gaskoin, 1836, Zool. Soc. London Proc. for 1835, p. 200.

Pusula producta (Gaskoin), Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 112, pl. 22, fig. 135.

Trivirostra (Dolichupis) producta (Gaskoin), Cernohorsky, 1968, Veliger, v. 10, no. 4, p. 370, pl. 52, figs. 20, 20a.

Two small shells from the Pleistocene beds on the Kere River, Santo, New Hebrides, represent this species that reportedly lives today from Indonesia to the Tuamotu Islands. The figured specimen, USNM 214334, from USGS locality 25715, measures: length 7.1 mm, lateral diameter 5.3 mm, dorsoventral diameter 4.1 mm. The species has not previously been reported as a fossil.

Family CYPRAEIDAE

Genus CYPRAEA Linnaeus

Linnaeus, 1758, Systema naturae, 10th ed., p. 718.

Subgenus ERRONEA Troschel

Troschel, 1863, Das Gebiss der Schnecken zur Begründung einer natürl. Klass., v. 1, p. 205, 210.

Type (by subsequent designation, following virtual tautonymy, Schilder, 1924, Archiv. für Naturgeschichte, Abt. A, no. 4, p. 202).—*Cypraea errones* Linnaeus, Holocene, Indo-Pacific.

Cypraea (Erronea) gracilis Gaskoin

Plate 5, figure 4

Cypraea gracilis Gaskoin, 1849, Zool. Soc. London Proc. for 1848, pt. 16, p. 93–94; Burgess, 1970, The living cowries, p. 140, pl. 9a, figs. A–D.

Several small shells from the Pleistocene beds on the Kere River (SM242) probably represent this species that lives today in many parts of the western Pacific and widely in the Indian Ocean. All the fossils show scattered brown spots on the ventral surface but retain no traces of other coloration. The figured specimen USNM 175132, measures: length 14.4 mm, lateral diameter 8.1 mm, dorsoventral diameter 6.9 mm.

Cypraea (Erronea) pulchella Swainson

Plate 5, figures 5, 6

Cypraea pulchella Swainson, 1823, Philos. Mag., v. 61, p. 376; Burgess, 1970, The living cowries, p. 70, pl. 5, figs. A, B.

Holocene shells of this species are characterized particularly by their dark brown teeth that are extended on the columellar side. On the numerous fossils from the Kere River outcrops, the color of the teeth in most specimens is restricted to the columellar side, but on some shells, patches of brown color are also retained on the dorsal side.

Measurements of the figured specimen, USNM 214279 (SM242): length 31.4 mm, lateral diameter 17.9 mm, dorsoventral diameter 9.6 mm.

Occurrence.—Abundant in the Pleistocene beds on the Kere River, Santo, New Hebrides. The species lives today in many parts of the western Pacific, from New Britain to the China coast.

Cypraea (Erronea) cf. C. pyriformis Gray

Plate 5, figures 7, 8

Two small thin shells from the Pleistocene marls at USGS locality 25715 on the Kere River, Santo, New Hebrides, may represent this common western Pacific Holocene species. The columellar teeth retain a trace of brown stain, and other brown stains appear scattered over the dorsal surface, near the base and above the edge of the outer lip.

Measurements of the figured specimen, USNM 214292: length 27.2 mm, lateral diameter 17.0 mm, dorsoventral diameter 14.1 mm.

Subgenus NOTADUSTA Schilder

Schilder, 1935, Malacolog. Soc. London Proc., v. 21, p. 350.

Type (by original designation).—*Notadusta victoriana* Schilder, late Miocene, Australia.

Cypraea (Notadusta) punctata Linnaeus

Plate 5, figures 9–11

Cypraea punctata Linnaeus, 1771, Mantissa plantarum, appendix, p. 548; Cernohorsky 1964, Veliger, v. 6, p. 193. pl. 25, fig. 45; Burgess, 1970, The living cowries, p. 104, pl. 7A, figs. D, E, F.

Notadusta punctata (Linnaeus), Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 91, pl. 16, fig. 87.

The single fossil retains traces of the widely spaced dark spots on the dorsal side.

Measurements: length 11.2 mm, lateral diameter 5.6 mm, dorsoventral diameter 5.0 mm.

Occurrence.—Pleistocene beds on the Kere River, Santo, New Hebrides (SM242). The species lives today from the west coast of Africa to Polynesia (Burgess, 1970, distribution map, p. 104).

Family OVULIDAE (AMPHIPERATIDAE)

Genus PEDICULARIA Swainson

Swainson, 1840, Treatise on malacology, p. 245, 357.

Type (by monotypy).—*Pedicularia sicula* Sowerby. Holocene Mediterranean Sea.

Shells of *Pedicularia* are present in some abundance in the Pleistocene beds on the Navaka River, Santo, New Hebrides, at USGS locality 25734 and 25731 (SM43). The shells are small and are exceedingly variable in form and in sculpture. Many of them probably represent the living species *P. pacifica* (Pease), known from many parts of the area, including Japan. This same species was recognized from a Holocene sediment in a drill hole on Eniwetok in the Marshall Islands (Ladd, 1977, p. 25).

Pedicularia navakaensis Ladd, n. sp.

Plate 17, figures 1–5

Shell small, stout; exposed conical spire is eroded but apparently consisted of about three whorls. On the lowest whorl, two spirals are crossed by regularly spaced axials that are more prominent where they cross the spirals than on the intervening low areas. Body whorl greatly expanded, covered by rounded spirals that are more widely spaced above and below. The spirals are crossed by less well developed axials and by several conspicuous varixlike axial elevations. Aperture semiovate; constricted anteriorly; columella elevated and slightly sinuous, outer lip thickened.

Measurements of the holotype and only specimen, USNM 214385: length 5.7 mm, diameter 4.4 mm.

The shell is small but does not appear to be a juvenile. I have not been able to locate a close relative in Holocene faunas.

Occurrence.—A single specimen from USGS locality 25734 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Genus CRENAVOLVA Cate

Cate, 1973, Veliger, v. 15, Supp., p. 49.

Type (by original designation).—*Ovulum striatulum* Sowerby. Holocene, East Indies.

Subgenus SERRATOVOLVA Cate

Cate, 1973, Veliger, v. 15, Supp., p. 53.

Type (by original designation).—*Primovula (Diminiovula) dondani* Cate. Holocene, Philippines.

Crenavolva (Serratovolva) imitablis Cate

Plate 5, figures 15, 16

Crenavolva (Serratovolva) imitablis Cate, 1973, Veliger, v. 15, Supp., p. 54, fig. 112.

A single shell from the Pleistocene beds on the Kere River, USNM 308098, Santo, New Hebrides. The fossil is larger than the Holocene type from Japan described by Cate. The fossil measures: length 17.9 mm, width 10.5 mm, dorsoventral diameter 9.0 mm. This is the first fossil occurrence. As noted by Cate, the species is very closely related to the type species of *Serratovolva, C. (S.) dondani* Cate.

Genus DENTIOVULA Habe

Habe, 1961, Colored illustrations of the shells of Japan, II, p. 41, pl. 19, fig. 9.

Type (by monotypy).—*Ovulum dorsuosum* Hinds. Holocene, Japan.

Dentiovula masaoi Cate

Plate 5, figures 12–14

Dentiovula masaoi Cate, 1973, Veliger, v. 15, Supp., p. 15, figs. 23, 23a.

Small shells that clearly represent this unusual species were found at USGS locality 25734 and

25731 on the Navaka River, Santo, New Hebrides; age, Pleistocene. The figured shell, USNM 214358, measures: length 6.0 mm, lateral diameter 3.0 mm, dorsoventral diameter 2.7 mm. Cate described the species from the Holocene of Japan but noted an occurrence in the Philippines.

Dentiovula tadashigei Cate

Plate 33, figures 13, 14

Dentiovula tadashigei Cate, 1973, Veliger. v. 15, Supp., p. 14, fig. 22.

Represented by a single shell from the Pleistocene beds exposed at USGS locality 25718 on the Kere River, Santo, New Hebrides. The specimen, USNM 214381, measures: height 9.8 mm, diameter 5.1 mm. Cate's type was collected in Sagami Bay, Japan.

Genus OVULA Bruguiere

Bruguière, 1789, Encylopedie méthodique Histoire nat. vers, v. 1, p. 15.

Type (by subsequent designation, Lamarck, 1801, Système animaux sans vertèbres, p. 72).—*Ovula oviformis* (= *Bulla ovum* Linnaeus). Holocene, Indo-Pacific.

Ovula ishibashii (Kuroda)

Plate 6, figures 3, 4

Amphiperas isibasii Kuroda, 1928, Venus, v. 1, pl. 1, figs. 3, 4.
Pseudosimnia (Margovula) ishibashii (Kuroda), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 45, pl. 19, fig. 8.
Ovula ishibashii (Kuroda), Cate, 1973, Veliger, v. 15, Supp., p. 65, fig. 145.

Shell large, inflated, smooth. Outer lip thickened with strong teeth on the inner side; posteriorly, the outer lip forms a rounded loop that unites with a short low fold on the inner lip, the structure supported dorsally by an elevated spirally ridged callus that covers the apex of the shell.

Measurements of the figured specimen, USNM 214231: length 31.5 mm, lateral diameter 19.5 mm, dorsoventral diameter 16.9 mm.

The species is similar to *Margovula pyriformis* (Sowerby) and *M. tinctilis* Cate, but I have not seen specimens (discussed by Cate, 1973, p. 16, 19, 66).

Occurrence.—Three specimens from the outcrops of Pleistocene marls on the Kere River, Santo, New Hebrides. Figured specimen from USGS locality 25715, a smaller shell from USGS locality 25718, and one from station SM242. The species lives today in Japanese waters. Not previously reported as a fossil.

Genus PHENACOVOLVA Iredale

Iredale, 1930, Queensland Mus. Mem., v. 10, pt. 1, p. 85.

Type (by original designation).—*Phenacovolva nectarea* Iredale. Holocene, Australia.

Phenacovolva longirostrata (Sowerby)

Plate 6, figure 2

Ovulum longirostratum Sowerby, 1828, Zool. Jour. London, v. 4, p. 160; Reeve, 1865, Conchologica Iconica, v. 15, *Ovulum*, pl. 9, figs. 40a–c.
Volva (Phenacovolva) longirostrata (Sowerby), Cernohorsky, 1971, Auckland Inst. and Mus. Recs., v. 8, p. 126.

Half a dozen narrow shells with thin, acuminate, recurved ends were recovered from the Pleistocene marls on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214258, from USGS locality 25715, measures: height 51.5 mm, diameter 8.5 mm. The species lives today off Japan and New Zealand at depths from about 50 m to nearly 150 m (Cate, 1973, p. 107).

Genus VOLVA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 21–22.

Subgenus VOLVA s.s.

Type (by tautonymy).—*Volva textoria* Roding (= *Bulla volva* Linnaeus). Holocene, Indo-Pacific.

Volva (Volva) volva (Linnaeus)

Plate 6, figure 1

Bulla volva Linnaeus, 1758, Systema naturae, 10th ed., p. 725.
Volva volva (Linnaeus), Cernohorsky, 1967, Marine shells of of the Pacific, v. 1, p. 108, fig. 127; Cate, 1973, A systematic revision of the Recent cypraeid family Ovulidae, Veliger, v. 15, Supp., p. 109, fig. 245.

Two shells of this widespread and fairly common Holocene Pacific species were collected from the Pleistocene marls on the Kere River, Santo, New Hebrides. The figured specimen, USNM 308099, measures: height (incomplete) 54.6 mm, diameter 19.1 mm.

Family NATICIDAE

Genus NATICA Scopoli

Scopoli, 1777, Introductio historiam naturalem, p. 392.

Subgenus NATICA s. s.

Type (by subsequent designation, Harris, 1897, Cat. Tertiary Mollusca * * * British Mus., pt. 1, p. 255).—*Nerita vitellus* Linnaeus. Holocene western Pacific.

Natica (Natica) areolata Recluz

Plate 6, figures 5, 6

Natica areolata Récluz, 1844, Zool. Soc. London Proc., pt. 11, p. 206; Tryon, 1886, Manual Conchology, v. 8, p. 25, pl. 6, fig. 23.
Natica (Natica) areolata Récluz, Cernohorsky, 1971, Auckland Inst. and Mus. Recs., v. 8, p. 182, figs. 26, 28–30.

The figured specimen, USNM 214247, and one other shell from station SM242 on the Kere River, Santo, New Hebrides, retain identifiable traces of the brownish axial color bands that characterize the species. Many other shells from the same station do not retain color and cannot be identified with certainty. The figured specimen measures: height 20.9 mm, diameter 23.1 mm. Age of all specimens, Pleistocene. The species lives today in the Philippines and Fiji; it has not previously been reported as a fossil.

Natica (Natica) vitellus (Linnaeus)

Plate 6, figure 7

Nerita vitellus Linnaeus, 1758, Systema naturae, 10th ed., p. 776.

Natica vitellus (Linnaeus), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 42, pl. 18, fig. 17.

Natica (Natica) vitellus (Linnaeus), Cernohorsky, 1971, Auckland Inst. and Mus. Recs., v. 8, p. 173, figs. 2–5 (see for additional synonymy).

Four shells from the Pleistocene beds on the Kere River, Santo, New Hebrides. The figured shell from station SM242, measures: height 36.3 mm., diameter 37.8 mm. The body whorl retains clear traces of the brown zones that characterize Holocene shells. The species lives today in the western Pacific and into the Indian Ocean. According to Vlerk (1931, p. 259), it has been recorded from the upper Tertiary in several parts of what is now Indonesia.

Subgenus TECTONATICA Sacco

Sacco, 1890, Torino Univ., Mus. Zool. Anat. Boll. 33.

Type (by monotypy).—*Natica tectula* Bovs. Late Tertiary, Italy.

Natica (Tectonatica) aff. N. violacea Sowerby

Plate 6, figures 8–10

Eight shells from the Kere River outcrops, Santo, New Hebrides (SM242 and USGS locality 25715), retain traces of spiral rows of brown spots that strongly suggest the color pattern of *N. violacea* Sowerby, but none of the three has a parietal callus as extensive as that shown by all Holocene examples (see Cernohorsky, 1971, p. 189).

Measurements of the figured specimen: height 18.5 mm, diameter 19.8 mm.

Occurrence.—Stations on Kere River, Santo, New Hebridges; age, Pleistocene.

Genus NEVERITA Risso

Risso, 1826, Histoire naturelle principales productions Europe méridionale, v. 4, p. 149.

Type (by monotypy).—*Neverita joshephina* Risso. Holocene, Mediterranean Sea.

Neverita albumen (Linnaeus)

Plate 6, figures 11, 12

Nerita albumen Linnaeus, 1758, Systema naturae, 10th ed., p. 776.

Polinices (Neverita) albumen (Linnaeus), Cernohorsky, 1971, Auckland Inst. and Mus. Recs., v. 8, p. 195, figs. 57, 58 (see for additional references).

Two small specimens of this somewhat variable species were collected from the Pleistocene marls on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214245 from USGS locality 25715, measures: height 13.3 mm, diameter 17.4 mm. The species lives today in many parts of the western Pacific and into the Indian Ocean. MacNeil (1960, p. 53) compared Miocene shells from Okinawa with this species.

Genus EUNATICINA Fischer

Fischer, 1885, Manuel Conchyliologie, p. 768 (= *Naticina* Gray, 1847, Zool. Soc. London Proc., pt. 15, p. 150).

Type (by original designation.)—*Natica papilla* Gmelin. Holocene, western Pacific.

Eunaticina sp.

Plate 36, figures 12–14

Shell small with a low spire; protoconch not preserved, body whorl greatly inflated; aperture broadly ovate; columella curved, inner lip callused, the callus curved over the edge of the wide umbilicus; outer lip imperfect on the single specimen but apparently thin. Sculpture consisting of fine, close-set, slightly wavy spiral grooves that cover the entire shell.

Measurements of the figured specimen, USNM 250138: height 8.3 mm, diameter 10.2 mm.

The Fijian fossil is closely related to, possibly identical with, *E. papilla* (Gmelin), type of the genus. That species lives around Viti Levu today, though it is said to be uncommon (Cernohorsky, 1971, p. 202). The fossil is smaller than most Holocene shells, but this may be due to immaturity.

Occurrence.—Station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus SINUM Roding

Röding, 1789, Mus. Boltenianum, Hamburg, v. 2, p. 14.

Type (by subsequent designation, Dall, 1915, U.S. Natl. Mus. Bull. 90, p. 109): *Helix haliotoidea* Linnaeus (= *Sinum haliotoideum* Röding). Holocene, western Pacific.

Sinum undulatum (Lischke)

Plate 6, figs. 13, 14

Sigaretus undulatus Lischke, 1872, Malacolog. Blätter, v. 19, p. 103.

Sinum (Ectosinum) undulatus (Récluz), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 61, pl. 18, fig. 12.
Sinum undulatum (Lischke), Kuroda and others, 1971, Sea shells of Sagami Bay, p. 123, pl. 109, figs. 8, 9.

A small but otherwise typical shell measures: height 4.5 mm, diameter 9.1 mm. It was recovered from the shell-bearing beds at station SM259, Santo, New Hebrides; age, probably Pleistocene. The species lives today in waters off Japan and Okinawa at depths of 5–50 m (Kuroda and others, 1971).

Family CASSIDAE

Genus MORUM Roding

Röding, 1798, Mus. Boltenianum, Hamburg, p. 53.

Type (by monotypy).—*Morum purpureum* Röding (= *Strombus oniscus* Linnaeus). Holocene, Florida to Brazil.

Subgenus CANCELLOMORUM Emerson and Old

Emerson, W. K., and Old, W. E., 1963, Am. Mus. Novitates, no. 2153, p. 18.

Type (by original designation).—*Oniscia grande* A. Adams. Holocene, Japan.

Morum (Cancellomorum) cancellata (Sowerby)

Plate 11, figures 17, 18

Oniscidia cancellata Sowerby, 1824, Genera of recent and fossil shells, pl. 233, figs. 1–3.
Morum (Onimusiro) cancellatum (Sowerby), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 68, pl. 20, fig. 6.

A small, strongly sculptured shell whose broadly triangular body whorl is topped by a turreted, sharply pointed spire. On the body whorl widely spaced axial ribs are crossed by strong spiral ribs, forming axially flattened spines at the crossings; on the shoulder of all whorls the spines are thin and sharp. The wide callus on the inner lip is pustulose, its margin detached; outer lip thickened and strongly toothed. The edge of the outer lip shows traces of a discontinuous line of brown spots, and one shell retains faint spiral bands of brown like those on Holocene shells.

Measurements of the figured specimen, USNM 214225: length 38.0 mm, diameter 24.2 mm.

Occurrence.—A dozen specimens from USGS locality 25715 on the Kere River, Santo, New Hebrides; one specimen in the SM242 collection. The species lives today in the China Seas. Not previously reported as a fossil.

Genus PHALIUM Link

Link, 1807, Rostock Univ., Beschreibung Naturalien-Sammlung, pt. 3, p. 112.

Type (by subsequent designation, Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 62).—*Buccinum glaucum* Linnaeus. Holocene, Indo-Pacific.

Phalium areola (Linnaeus)

Plate 7, figures 1, 2

Buccinum areola Linnaeus, 1758, Systema naturae, 10th ed., p. 736.
Phalium areola (Linnaeus), Abbott, 1968, Indo-Pacific Mollusca, v. 2, no. 9, p. 86, pl. 7, figs. 5–7, pl. 61, 63 (see for complete synonymy); Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 104, pl. 1, fig. 2.

The figured specimen, USNM 308103, measures: height 34.7 mm, diameter 19.6 mm. The sculpture is well preserved, but there is no trace of original color pattern.

Occurrence.—Station SM242, Kere River, Santo, New Hebrides; age, Pleistocene. The species lives today from the east coast of Africa to western Polynesia but, as noted by Cernohorsky, is rare in the islands of the western Pacific.

Genus CASMARIA H. and A. Adams

Adams. H. and A., 1853, Genera of Recent Mollusca, v. 1, p. 216.

Type (by subsequent designation, G. F. Harris, 1897, Catalogue of Tertiary Mollusca * * * British Mus., p. 200).—*Buccinum vibex* Linnaeus = *Buccinum erinaceus* Linnaeus. Holocene, Indo-Pacific.

Casmaria ponderosa (Gmelin)

Plate 7, figures 3, 4

Buccinum ponderosum Gmelin, 1791, Systema naturae, 13th ed., p. 3477.
Casmaria ponderosa (Gmelin), Abbott, 1968, Indo-Pacific Mollusca. v. 2, no. 9, p. 195–198, pl. 14, figs. 1–4; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 106, pl. 29, figs. 3, 3a.

Represented in the Pleistocene marls of the Kere River, Santo, New Hebrides (station SM242), by a single shell. It measures: length 30.5 mm, diameter 17.9 mm. Other Pleistocene occurrences cited by Abbott are Lanai, Hawaii, and the northern Ryukyu Islands. The species lives today throughout the Indo-Pacific region.

Family CYMATIIDAE

Genus GYRINEUM Link

Link, 1807, Rostock Univ., Beschreibung Naturalien-Sammlung, pt. 3, p. 123.

Type (by subsequent designation following virtual tautonymy, Dall, 1904. Smithsonian Misc. Colln. v. 47, p. 131).—*Murex gyrinus* Linnaeus, Holocene, southwest Pacific.

Gyrineum cf. G. reticulare robusta (Fulton)

Plate 7, figures 5, 6

Shell small to medium in size, slightly compressed laterally, varices aligned on opposite sides. Aperture widely ovate, extended anteriorly as a slightly curved tube; outer lip denticulate, columellar callus plicate. Sculpture consisting of well-developed axial ribs, six to seven on body whorl, overridden by coarse and fine spiral threads. Crests of varices and of axial ribs retain a reddish-brown color.

Measurements of the figured specimen, USNM 214253: height 34.9 mm, diameter 21.7 mm.

The New Hebrides fossils may represent the heavily granulated variety of *G. nator* (Röding) (= *G. reticulare* (Linnaeus)) described by Fulton (1936, p. 10, pl. 2, fig. 4) from Hong Kong. It is identical with a Holocene shell collected from beach rubble in Thailand (USNM 661596).

Occurrence.—A dozen specimens from USGS locality 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene. Holocene shells from Hong Kong, Japan, and Thailand.

Genus CYMATIUM Roding

Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 129.

Type (by subsequent designation, Dall, 1904, Smithsonian Misc. Colln. v. 47, p. 133).—*Murex femorale* Linnaeus. Holocene, West Indies.

Subgenus RANULARIA Schumacher

Schumacher, 1817, Essai d'un nouveau système des habitations des vers testaces, Copenhagen, p. 253.

Type (by subsequent designation, Herrmannsen, 1847, Indicis generum malacozoorum, v. 2, p. 388).—*Triton clavator* Chemnitz (= *Triton clavator* Lamarck). Holocene, western Pacific.

Cymatium (Ranularia) sinensis (Reeve)

Plate 7, figures 7, 8

Triton sinensis Reeve, 1844, Conchologica Iconica, v. 2, Triton, pl. 6, no. 18.

Ranularia sinensis (Reeve). Habe, 1964, Shells of the western Pacific in color, v. 2, p. 72, pl. 22, fig. 14.

Medium in size and strongly sculptured with an acutely pointed spire and inflated body whorl; aperture lenticular extended anteriorly into a long and slightly twisted canal; outer lip with strong nodular teeth, columellar callus with a detached edge bearing numerous linear teeth that are best developed anteriorly. Sculpture consisting of widely spaced varices with intervening axial ribs that are made nodulose by overriding double spiral ribs; one or two secondary spirals occur in the areas between the double primary spirals, and fine axial threads are found over the entire shell.

Measurements of the figured specimen from SM242: Length 76.5 mm, diameter 32.5 mm.

Occurrence.—Five specimens from the Pleistocene marls cropping out on the Kere River, Santo, New Hebrides. The species lives today in Chinese and Japanese waters; in the latter area, Habe has reported it at depths of 50–100 m.

Cymatium (Ranularia) gutturnium (Roding)

Plate 7, figures 9, 10

Tudicla gutturnium Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 145.

Cymatium (Ranularia) gutturnium (Röding), Cernohorsky, 1962, Marine shells of the Pacific, v. 2, p. 115, pl. 33. fig. 6.

A single shell with a short canal was collected at SM309, Santo, New Hebrides. It measures: height 28.2, diameter 17.5 mm. Age, Pleistocene.

Genus CHARONIA Gistel

Gistel, 1848, Naturgeschichte des Thierreichs, p. 170.

Type (by monotypy).—*Murex tritonis* Linnaeus. Holocene, Indo-Pacific.

Charonia tritonis (Linnaeus)

Plate 7, figures 11, 12

Murex tritonis Linnaeus, 1758, Systema naturae, 10th ed., p. 754.

Charonia tritonis (Linnaeus), Cernohorsky, 1967, Veliger, v. 9. no. 3, p. 326, pl. 46, fig. 27.

A small but typically formed shell was collected by John Bolango on the Navaka River (USGS locality 25742), Santo, New Hebrides. The specimen, USNM 214342, measures: height 119 mm, diameter 42 mm; age, Pleistocene. The shell retains traces of light-brown color in irregular axial bands, and the interstices between plicae on the inner lip are dark brown. The species lives today from the east coast of Africa to Hawaii, on the east coast of North America and in the Caribbean, but I have not found any other record as a fossil.

Family BURSIDAE

Genus BURSA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, p. 128.

Type (by subsequent designation, Jousseaume, 1881, Soc. Zool. France Bull. v. 6, p. 174).—*Bursa monitata* Röding (= *Murex bufonius* Gmelin). Holocene, western Pacific.

Bursa bufonia dunkeri Kira

Plate 8, figures 6, 7; plate 33, figures 15, 16

Murex bufonius Gmelin, 1793, Systema naturae, 13th ed., p. 3534.

Bursa monitata Röding, 1798, Mus. Boltenianum, Hamburg, p. 129.
Bursa dunkeri Kira, 1959. Colored illust. shells Japan, v. 1, p. 54. pl. 31, fig. 18; 1962, Shells of the western Pacific in color, v. 1, p. 57, pl. 22, fig. 18.
Bursa bufonia dunkeri Kira, *in* Kuroda, Habe and Oyama, 1971, Sea shells of Sagami Bay, p. 133, pl. 33, fig. 2.

A large, robust example of this form (pl. 33, figs. 15, 16) was recovered from USGS locality 25718 on the Kere River, Santo, New Hebrides. The aperture, particularly the outer lip, is strongly colored yellow. A smaller specimen from the same area (USGS locality 25715), USNM 214267, is shown on plate 8, figures 6, 7. The larger shell, USNM 214388, measures: height 87 mm, diameter 57 mm. Age of both specimens, Pleistocene (first reported occurrence as a fossil). The specific name *dunkeri* was applied by Kira to yellow-mouthed Japanese shells found from intertidal levels to a depth of 20 m.

Bursa rubeta (Linnaeus)

Plate 8, figures 4, 5

Murex rana rubeta Linnaeus, 1758. Systema naturae, 10th ed., p. 748.
Bursa rubeta (Linnaeus), Hedley, 1926, Jour. Conchology, v. 15, no. 2, p. 41–42; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 118, pl. 1, fig. 5.

This tropical Pacific species is represented by three shells from the Pleistocene marls on the Kere River, Santo, New Hebrides. The largest and most complete of the three, USNM 308107, is figured. It measures: height 73.8 mm, diameter 46.5 mm.

Family TONNIDAE

Genus TONNA Brunnich

Brünnich, 1772, Zoologiae fundamenta. p. 248.

Type (by subsequent designation, Suter, 1913, Manual New Zealand Mollusca, p. 314).—*Buccinum galea* Linnaeus. Holocene, Mediterranean Sea.

Tonna allium (Dillwyn)

Plate 8, figure 8

Buccinum dolium allium Dillwyn, 1817, Descriptive catalogue recent shells, v. 2, p. 585.
Tonna allium (Dillwyn), Kuroda, Habe, and Oyama, 1971, Sea shells of Sagami Bay, p. 137, pl. 38, fig. 4; Cernohorsky, 1972, Marine shells of the Pacific. v. 2, p. 110, pl. 31, figs. 5, 5a.

A single small incomplete shell from the Pleistocene marls on the Kere River Santo, New Hebrides, probably represents this species. The specimen, USNM 214263 from USGS locality 25715, measures: height 43.5 mm, diameter 34.6 mm. As noted by Cernohorsky, this species ranges today from Fiji into the Indian Ocean.

Family FICIDAE

Genus FICUS Roding

Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 148.

Type (by tautonymy and subsequent designation, Winckworth, 1945, Malacolog. Soc. London Proc. v. 26, p. 140).—*Ficus variegatus* Röding (= *Bulla ficus* Gmelin = *Murex ficus* Linnaeus). Holocene, western Pacific.

Ficus ficoides (Lamarck)

Plate 8, figure 9

Pyrula ficoides Lamarck, 1822, Histoire nat. animaux sans vertebres, v. 7, p. 142.
Ficula reticulata Reeve, 1847, Conchologica Iconica, v. 4. *Ficula*, No. 1.
Ficus ficoides (Lamarck), Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 113, pl. 33, fig. 2.

Similar to *F. variegata;* shell thinner with two sets of fine spiral threads replacing the flat-topped ribs of that species. The figured fossil retains traces of the brown spots that characterize the body whorl.

Measurements, USNM 214230: height 65.4 mm, diameter 36.9 mm.

Occurrence.—USGS locality 25718 and 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene. According to MacNeil (1960, p. 62), the species has also been reported from upper Tertiary horizons in Java, Okinawa, and the Philippines; from the Pliocene of India and Formosa; the Pleistocene of Java, the Philippines, and Japan. The species lives today in various parts of the western Pacific and in the Indian Ocean.

Family MURICIDAE

Genus CHICOREUS Montfort

Montfort, 1810, Conchyliologie systématique, v. 2, p. 611.

Type (by original designation).—*Murex ramosus* Linnaeus. Holocene, Indo-Pacific.

Chicoreus axicornis (Lamarck)

Plate 8, figures 10, 11

Murex axicornis Lamarck. 1822, Histoire nat. animaux sans vertebres, v. 7, p. 163; Kiener, 1842, Coquilles vivantes, v. 7, pl. 52. fig. 2.
Euphyllon axicornia (Lamarck), Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 124, pl. 26, fig. 154.

Five shells of this highly ornamented species were recovered from the Pleistocene marls at USGS station 25715 on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214256, measures: height 30.7 mm, diameter 22.1 mm. The species lives today in many parts of the western Pacific and in the Indian Ocean but has not previously been reported as a fossil.

Chicoreus cf. C. superbus (Sowerby)

Plate 8, figures 12, 13

A single small shell from USGS locality 25715 on the Kere River, Santo, New Hebrides, may represent this species that lives today in Japan. The numerous spiral cords and threads on the fossil are minutely scaly, and only a single large node is present between varices on each whorl.

Measurements of the specimen, USNM 214280: height 39.3 mm, diameter 24.1 mm. The fossil is Pleistocene in age.

Genus MUREX Linnaeus

Linnaeus, 1758, Systema naturae, 10th ed., p. 746.

Subgenus MUREX s. s.

Type (by subsequent designation, Montfort, 1810, Conchyliologie systématique, v. 2, p. 619).—*Murex pecten* (Lightfoot) (= *M. tribulus* Linnaeus var.) Holocene, western Pacific.

Murex (Murex) pecten (Lightfoot)

Plate 9, figures 3, 4

Murex tribulus pecten Lightfoot, 1786, Cat. Portland Mus., p. 188.

Murex pecten (Lightfoot), Vokes, 1971, Bulls. Am. Paleontology, v. 61, p. 79.

A small but well-preserved example of the type of *Murex* s.s. was collected from the Pleistocene marls at station SM242 on the Kere River, Santo, New Hebrides. It measures: length 48.2 mm, diameter (spines omitted) 20 mm.

Murex (Murex) tribulus Linnaeus

Plate 9, figure 7

Murex tribulus Linnaeus, 1758, Systema naturae, 10th ed., p. 746; Cernohorsky. 1967, Marine shells of the Pacific, v. 1, p. 117, pl. 23, fig. 139.

One complete shell and two fragmentary anterior canals from the Pleistocene marls on Santo, New Hebrides.

Measurements of the complete figured specimen, USNM 308109: length 97.0 mm, diameter 48.9 mm.

The species lives today throughout the tropical Indo-Pacific area.

Murex (Murex) rectirostris Sowerby

Plate 9, figures 5, 6

Murex rectirostris Sowerby, 1841, Conchological illustrations, *Murex*, pl. 197, fig. 111; 1841, Zool. Soc. London Proc., pt. 8, p. 138; Habe, 1964, Shells of the western Pacific in color, v. 2, p. 78, pl. 25, fig. 3.

Represented by numerous shells from the Pleistocene Kere River outcrops, Santo, New Hebrides. The figured specimen, USNM 214236 from USGS locality 25715, measures: length 41.4 mm, diameter (spines excluded) 19.3 mm. The fossil shells retain traces of narrow spiral bands of yellowish-brown. The species lives today in Chinese waters. It seems not to have been reported previously as a fossil, but MacNeil (1960, p. 63) described a related species, *M. saplisi*, from the upper Tertiary of Okinawa.

Murex (Murex) aff. M. aduncospinosus Beck

Plate 9, figures 8, 9

A single small shell with curved spines recovered from a drill hole in western Viti Levu, Fiji (station C2055), may represent this Holocene Indo-Pacific species. The specimen, USNM 214268, is 17.3 mm in length. Age, possibly Pliocene.

Genus PTERYNOTUS Swainson

Swainson, 1833, Zool. illustrations, ser. 2, v. 3, expl. to pl. 100.

Type (by subsequent designation, Swainson, 1833, Zool. illustrations, ser. 2, v. 3, pl. 122).—*Murex pinnatus* Swainson (= *Purpura alata* Röding). Holocene, Pacific.

Subgenus NAQUETIA Jousseaume

Jousseaume, 1880, Le Naturaliste, Année, v. 2, no. 42, p. 335.

Type (by original designation).—*Murex triqueter* Born. Holocene, Indo-Pacific.

Pterynotus (Naquetia) barclayi (Reeve)

Plate 9, figures 1, 2

Murex barclayi Reeve, 1857, Zool. Soc. London Proc., pt. 25, p. 209, pl. 38, fig. 2; Tryon, 1880. Manual conchology, v. 2, p. 85, pl. 41, fig. 535.

Pterynotus (Naquetia) barclayi Reeve, Vokes, 1971, Bulls. Am. Paleontology, v. 61, no. 268, p. 22.

This large species with its wide anterior flanges, known only from the Holocene fauna of Mauritius, is represented by six specimens (five complete) collected from the Pleistocene marls on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214244 from USGS locality 25715, measures: length 95.6 mm, diameter 41.5 mm.

Genus TYPHIS Montfort

Montfort, 1810, Conchyliologie systématique, v. 2, p. 614.

Type (by original designation).—*Murex tubifer* Bruguière. Middle Eocene, Paris Basin.

Typhis cf. T. japonicus (A. Adams)

Plate 35, figures 16, 17

One small shell from the Pleistocene beds at USGS locality 25734 on the Navaka River, Santo, New Hebrides, probably represents this widespread Holocene species. The specimen, USNM 214395, measures: height 3.9 mm, diameter 1.8 mm. MacNeil

(1960, p. 63) reported on a similar shell from the Pliocene of Okinawa.

Family THAIDIDAE

Genus DRUPA Roding

Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 55.

Type (by subsequent designation, Rovereto, 1899, Primi ricerche sinonimiche sui generi dei gasteropodi, Soc. Ligustica, Atti, v. 10, p. 105).—*Drupa morum* Röding. Holocene, Indo-Pacific.

Subgenus MORULA Schumacher

Schumacher, 1817, Essai d'un nouveau système des habitations des vers testacés, Copenhagen, p. 227.

Type (by monotypy).—*Ricinula papillosa* Schumacher (= *R. morus* Lamarck = *R. uva* Röding). Holocene, western Pacific.

Drupa (Morula) concatenata (Lamarck)

Plate 11, figures 12, 13

Murex concatenatus Lamarck, 1822, Histoire nat. animaux sans vertebres, v. 7, p. 176; Tryon, 1880. Manual conchology, v. 2, p. 189. pl. 59, fig. 269.

Morula concatenata (Lamarck), Demond, 1957, Pacific Sci., v. 11, p. 311.

A single fossil from Eniwetok is immature but retains the conspicuous orange-tipped knobs that occur in five spiral rows on the body whorl of today's shells in the same area.

Measurements of the specimen, USNM 214229: height 15.7 mm, diameter 8.2 mm.

Occurrence.—The fossil was recovered from drill hole E–1 on Eniwetok at a depth of 50–60 feet (15–18 m) age, Holocene. According to Vlerk (1931, p. 238) the species has been reported from the upper Miocene of Nias, the Pliocene of Timor, and the Quaternary of Celebes. *D. concatenata* lives today in the Indo-Pacific from Mauritius to Hawaii.

Genus DRUPELLA Thiele

Thiele, 1925, Gastropoden Deutschen Tiefsee-Exped., v. 2, p. 137.

Type (by original designation).—*Purpura elata* Blainville (= *Purpura cornus* Röding). Holocene, Indo-Pacific.

Drupella cornus (Roding)

Plate 10, figure 1

Drupa cornus Röding, 1798. Mus. Boltenianum, Hamburg, v. 2, p. 56.

Drupella cornus (Röding), Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 125, pl. 35, fig. 8.

A single worn specimen of this widespread Pacific Holocene species was recovered from the Pleistocene marls at USGS locality 25715 on the Kere River, Santo, New Hebrides. The specimen, USNM 214272, measures: height 31.3 mm, diameter 18.1 mm.

Genus MANCINELLA Link

Link, 1807, Rostock Univ., Beschreibung Naturalien Sammlung, p. 115.

Type (by absolute tautonymy).—*Murex mancinella* Linnaeus. Holocene, Indo-Pacific.

Mancinella aff. M. bufo (Lamarck)

Plate 10, figures 2–4

Medium in size, heavy, solid; spire flattened, consisting of about five whorls; body whorl large, flattened above periphery, convex below. Sculpture consisting of a spiral row of pointed nodes on the periphery with indistinct traces of a second row below the periphery on the posterior half of the whorl; all whorls covered by fine, close-set flattened spirals that are overridden by slightly retracted axial striae. Aperture large, lenticular; outer lip with a denticulate margin crenulate within; columella smooth, callused; anal canal not developed; siphonal canal deep.

Measurements of the figured specimen USNM 308110: height 45.2 mm, diameter 30.5 mm.

Holocene examples of *M. bufo* show great variation in the strength and number of the spirally arranged nodules. The single fossil differs from most of the Holocene shells with which it has been compared in lacking a well-developed anal canal and in being crenulate within the aperture. On some Holocene shells, the denticles of the outer lip are continued within, but none has the strong liration shown by the fossil.

Occurrence.—Pleistocene marl on the Kere River, Santo, New Hebrides. Holocene shells most closely comparable with the fossil are found in northern Australia and the Philippines.

Family MAGILIDAE (CORALLIOPHILIDAE)

Genus CORALLIOPHILA H. and A. Adams

Adams, H. and A., 1853, Genera of recent Mollusca, v. 1, p. 135.

Type (by subsequent designation, Iredale, 1912, Malacolog. Soc. London Proc., v. 10, p. 221).—*Murex neritoideus* Chemnitz = *Purpura violacea* Kiener. Holocene, Pacific.

Coralliophila mallicki Ladd

Plate 16, figures 1–3

Coralliophila mallicki Ladd, 1976, Nautilus, v. 90, no. 4, p. 128, figs. 5–7.

The holotype and only specimen, USNM 214348, may be immature. It measures: height 11.9 mm, diameter 10.0 mm. Collected from the Pleistocene beds at station SM242 on the Kere River, Santo, New Hebrides.

Genus LATIAXIS Swainson

Swainson, 1840, Treatise on malacology, p. 306.

Type (by subsequent designation, Gray, 1847, Zool. Soc. London Proc., v. 15, p. 135).—*Pyrula mawae* Gray. Holocene, Indo-Pacific.

Latiaxis roddai Ladd, n. sp.

Plate 11, figures 4–7

Shell medium in size with pagodiform spire that is shorter than the remainder of the shell; whorls of spire about six, each with a prominent primary keel whose thin crest is formed by two strong spiral cords; above the keel, the whorl is flattened, below it, the whorl is concave. Whorls of spire covered by close-set spiral cords that are coarser below the keel than above it; obscure arcuate lines of growth present. Spiral cords cover the body whorl, and a secondary spiral keel is developed at the level of the top of the aperture; crest of secondary keel formed by a coarse spiral cord. Aperture ovate, constricted and extended anteriorly; columella smooth, bordered below by a wide umbilical pit.

Measurements of the holotype, USNM 214254: height 27.8 mm, diameter 16.7 mm; paratype, USNM 214255: height 23.5 mm, diameter 10.0 mm.

L. roddai is closely related to an unnamed species dredged off the island of Celebes at depths of nearly 500 fathoms (900 m) (USNM 230901, 239474). The Holocene shells lack the well-developed lower keel present on the body whorl of the fossils, and on the Holocene shells the surface of the whorl above the keel is flat or concave, rather than inclined at an angle of 45° as on the fossils.

This species is named for Peter Rodda of the Fiji Geological Survey; with a Survey party, he collected the types and many other fossils from the Veisari Sandstone near Suva.

Occurrence.—Three shells collected at station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Subgenus TOLEMA Iredale

Iredale, 1929, Australian Mus. Recs., v. 17, no. 4, p. 186, pl. 41, figs. 3, 4.

Type (by original deysignation: *Purpura sertata* Iredale, non Hedley (= *Tolema australis* Laseron). Holocene, Australia.

Latiaxis (Tolema) deburghiae (Reeve)

Plate 10, figures 5–9

Pyrula (Rhizochelus) deburghiae Reeve, 1857, Zool. Soc. London Proc., pt. 25, p. 208. pl. 38, figs. 3a, b.

Latiaxis deburghiae purpuratus Chenu, Kira, 1962, Shells of the western Pacific in color, v. 1, p. 70, pl. 26, fig. 18.

Latiaxis (Tolema) deburghiae (Reeve), Kuroda, Habe, and Oyama, 1971, The sea shells of Sagami Bay, p. 155, pl. 43, figs. 1, 7, Tokoyo.

Two specimens are figured: USNM 214248, from USGS station 25715, Santo, New Hebrides, measures: height 33.7 mm, diameter 32.7 mm; USNM 214249, from station C2026, Pliocene of Viti Levu, Fiji, measures: height 36.3 mm, diameter 28.5 mm. These figured specimens are larger than typical living examples, but Holocene shells even larger than the fossils have been collected in Japan.

Occurrence.—A single shell from C2026, Viti Levu, Fiji, is probably Pliocene (Tertiary *h*); three shells from station 25715 on the Kere River, Santo, New Hebrides, are Pleistocene. The species occurs today in western Pacific waters—Japan, Okinawa, and the South China Sea.

Latiaxis (Tolema) cf. L. winckworthi Fulton

Plate 10, figures 10–12

A single shell from SM242 on Santo, New Hebrides. USNM 308111, agrees in all features with *L. winckworthi,* except that the whorls are less sharply angled at the shoulder than on Holocene shells. The fossil measures: height 33.7 mm, diameter 21.4 mm. *L. winckworthi* was described by Fulton (1930) from a shell from Kii, Japan. Kira (*in* Kira and Habe, 1965, p. 69, pl. 26, fig. 15) noted Japanese occurrences off central Honshu and farther south in 5–10 fathoms of water. The fossil was collected from the Pleistocene marls on the Kere River, Santo, New Hebrides.

Latiaxis (Tolema) blowi Ladd

Plate 11, figures 1–3

Latiaxis blowi Ladd, 1976, Nautilus, v. 90, no. 4, p. 130, figs. 2–4.

The holotype is the only specimen. It, USNM 214250, measures: height 28.0 mm, diameter 18.3 mm. From the Pleistocene beds cropping out on the Kere River (USGS locality 25715), Santo, New Hebrides.

Family COLUMBELLIDAE

Genus ANACHIS H. and A. Adams

Adams, H. and A., 1853, The genera of recent Mollusca, v. 1, p. 184.

Type (by subsequent designation, Tate, 1868, Appendix to second ed. Woodward's Manual of the Mollusca, p. 13).—*Columbella scalarina* Sowerby. Holocene, west coast of Mexico to Panama.

Subgenus COSTOANACHIS Sacco

Sacco, 1890, I. Molluschi dei terreni terziarii del Piemonte e della Liguria, pt. 6, p. 384.

Type (by subsequent designation, Pace, 1902, Malacolog. Soc. London Proc., v. 5, p. 43).—*Columbella* (*Anachis*) *turrita* Sacco, Miocene, Italy.

Anachis (Costoanachis) mawsoni Ladd, n. sp.

Plate 35, figures 18–20; plate 37, figures 1–5

Shell small, biconic but strongly constricted at base of body whorl; spire exceeding half the height of shell. Protoconch consisting of three convex glassy whorls, followed by about six flattened whorls that make up the teleoconch. On the holotype and on most other shells, all whorls except the body whorl bear broad, rounded, slightly inclined axial ribs; on a paratype (pl. 37, figs. 1–3), the axials are restricted to the first two whorls of the teleoconch; body whorl smooth, its base sharply constricted; base with strong spiral ribs; on the side of the shell opposite the aperture the spirals continue a short distance on the body whorl. Aperture narrow; inner lip callused, its edge detached, denticulate within; outer lip thin but backed by a heavy varix, denticulate within; anterior canal short, slightly curved.

Measurements of the types: holotype, USNM 214396; height 7.7 mm, diameter 3.3 mm; paratype, USNM 214397: height 7.0 mm, diameter 2.6 mm.

Two juvenile shells that unquestionably represent this species were recovered from the Navaka River outcrops. One of them, USNM 214422, is figured (pl. 37, figs. 4, 5); it measures: height 4.5 mm, diameter 2.4 mm.

A. mawsoni is very closely related to *A. leroyi* MacNeil (1960, p. 67, pl. 13, fig. 11) from the Pliocene of Okinawa but is more constricted anteriorly and has a longer anterior canal.

This species is named for Douglas Mawson who collected fossils from Santo more than 70 years ago.

Occurrence.—Represented by 20 adult shells from USGS localities 25715 and 25717 and station SM242 on the Kere River and four shells from station SM43 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Anachis (Costoanachis) sp. A

Plate 36, figures 9–11

A juvenile shell of a species that may be closely related to *A.* (*C.*) *mawsoni* described above was recovered from Pliocene beds at station C2026, Viti Levu, Fiji.

The Fijian juvenile is small, biconic; its aperture and spire are about equal in height. The protoconch consists of 2½ convex glassy whorls and part of a whorl with strong close-set axials, followed by about four sculptured whorls that make up a flat-sided, slightly concave, spire; whorls of the spire with strong rounded axial ribs, about a dozen on the penultimate whorl. On the lowest whorl, the axials occur above a sharply angular periphery and are subdued near the aperture. Axials on adjacent whorls are aligned. Base of the lowest whorl is flat and smooth, showing only slight traces of the axials that lie above. Aperture irregular in outline; inner lip with columellar plaits that decrease in size anteriorly where the smaller members of the series make up the siphonal fasciole; outer lip thin; anterior canal deep and rounded.

Measurements of the specimen, USNM 214417: height 4.3 mm, diameter 2.5 mm.

The Fijian juvenile differs but little from juveniles of *A.* (*C.*) *mawsoni.* The Fiji shell has one less glassy whorl in the protoconch, the ribbed whorl that follows the glassy whorls is sharply set off from them, and the axials of the lowest sculptured whorl are subdued near the aperture.

No adult shell of an *Anachis* (*Costoanachis*) was recovered from the highly fossiliferous beds at station C2026 or from nearby stations.

I had some difficulty in placing the above-described juvenile and two others recovered from Pleistocene outcrops on the Navaka River, Santo, New Hebrides. Druid Wilson suggested that the shells were columbellids. The late George Radwin, after examining photographs and one shell, confirmed this suggestion and convinced me that the shells were juveniles. From this position, it was easy to link the New Hebrides juveniles to *A.* (*C.*) *mawsoni.*

Family BUCCINIDAE

When the preceding report in the present series, Professional Paper 533, appeared in 1977, it was reviewed informally by W. O. Cernohorsky. He submitted suggestions on a number of identifications to me. He noted correctly that the species described as *Cymatium rickardi* was a buccinid, *Hindsia.* The misidentification was a regrettable error on my part.

Genus HINDSIA A. Adams

Adams, A., 1853, Zool. Soc. London Proc. for 1853, p. 182, Moll., pl. 10;

Type (by subsequent designation, Dell, 1967, Dominion Mus. Recs., v. 5, no. 25, p. 310).—*Hindsia nivea* Pfeiffer (=*Buccinum niveum* Gmelin). Holocene, India.

Hindsia sinensis (Sowerby)

Plate 11, figures 8, 9

Nassaria sinensis Sowerby, 1859, Thesaurus Conchyliorum, *Nassaria*, p. 86, pl. 220, figs. 8, 9.

Hindsia sinensis (Sowerby), Habe, 1964, Shells of the western Pacific in color, v. 2. p. 96, pl. 34, fig. 6.

This species occurs in abundance in the Pleistocene marls of the Kere River, Santo, New Hebrides. The figured specimen, USNM 214270, from USGS locality 25715, measures: height 31.9 mm, diameter 17.5 mm. It lives today in Chinese and Formosan waters.

Hindsia rewaensis Ladd, n. sp.

Plate 11, figures 10, 11

Medium in size, whorls inflated, spire slightly longer than aperture. Protoconch incomplete but apparently consisting of one to two smooth whorls; spire of five whorls. Aperture broadly ovate, columella with three strong folds, the posterior one the largest; edge of outer lip incomplete; inside outer lip is a series of low, barely discernible lirae below a varixlike terminal axial. Sculpture consisting of spiral lirations, three on penultimate whorl, that override broad retracted axials; 11 axials on penultimate whorl; between each two primary spirals is a median thread. Suture appressed, subsutural slope narrow and slightly concave.

Measurements of the holotype (only specimen), USNM 214335: height 16.5 mm, diameter 10.1 mm.

The Fijian fossil bears a general resemblance to *H. nivea* (Gmelin), the type of the genus, but that species has a channeled suture, weaker columellar folds, and coarser sculpture. The Fiji shell also resembles two species from the upper Tertiary of Okinawa assigned by MacNeil (1960, p. 71) to the subgenus *Nihonophos*. One of these, *H.* (*N.*) *whitmorei*, has a wide slightly concave subsutural slope and only two weak columellar folds. The other Okinawan form, a subspecies named *H.* (*N.*) *magnifica okinavia*, by MacNeil, is a more slender form, but it also has a wide subtural slope and only two columellar folds.

Occurence.—Station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus SIPHONOFUSUS Kuroda and Habe

Kuroda and Habe, 1952, Check list and bibliography of recent marine Mollusca of Japan, p. 86; Venus, v. 18, no. 2, p. 89, 96.

Type (by original designation).—*Siphonalia lubrica* Dall. Holocene, Japan.

Siphonofusus walleri (Ladd)

Plate 16, figures 12–14

Fasciolaria (Pleuroploca) walleri Ladd, 1976, Nautilus, v. 90, no. 4, p. 193, figs. 16–20.

This species was originally assigned to *Fasciolaria* (*Pleuroploca*) though it lacked the three columellar plates that characterize that group. It now appears that the New Hebrides fossils are much more closely related to *Siphonofusus*, a buccinid, and are therefore transferred to that genus. The relationship to *Siphonofusus lubricus* (Dall) was suggested to me by Tadashige Habe (written commun., Feb. 17, 1977). Dall (1918, p. 230) described the species as *Siphonalia lubrica* from Japanese waters at depths of 100–200 m. *S. walleri* is larger, has more whorls on protoconch and teleoconch, and has fewer axial ribs. The color patterns of the two species are similar; those of the fossils, strangely enough, are appreciably stronger.

The New Hebrides fossils bear a superficial resemblance to *Granulifusus* Kuroda and Habe (type, by original designation, *Fusus niponicus* E. A. Smith), but there are many differences in aperture and canal.

Occurrence.—Four shells from the Pleistocene beds on the Kere River (USGS locality 25715 and station SM242), Santo, New Hebrides.

The species still lives. On December 20, 1977, Mary Young, a shell dealer in Washington, allowed me to examine several shells recovered from a gill net off Mactan Island in the Philippines.

Genus PHOS Montfort

Montfort, 1810, Conchyliologie systématique. p. 494.

Type (by original designation).— *Murex senticosus* Linnaeus. Holocene, southwest Pacific.

Phos bakeri Ladd

Plate 16, figures 4, 5

Phos bakeri Ladd, 1976, Nautilus, v. 90, no. 4, p. 130, figs. 8, 9.

The holotype, USNM 214307, measures: height 18.4 mm, diameter 9.0 mm. From the Pleistocene beds cropping out on the Kere River (USGS locality 25715), Santo, New Hebrides.

As Cernohorsky pointed out (written commun., 1978), *Phos bakeri* bears a close resemblance to *Phos naucratoris* described by Watson from the sea off the Admiralty Islands at 150 fathoms (275 m) (Watson, 1886, p. 218–219, pl. 13, fig. 11). On shells of that species, however, one or more axial ribs on each whorl is varixlike. Shells in the National Museum (USNM 778359) were collected off Cape Morton, Queensland, Australia, at a depth of 64–70 fathoms (117–128 m).

Genus EUTHRIA J. E. Gray

Gray, J. E., 1850, *in* M. E. Gray, Figures of molluscous animals, v. 4, p. 67.

Type (by monotypy).—*Fusus lignarius* Lamarck (= *Murex corneus* Linnaus). Holocene, Mediterranean Sea.

Euthria rewaensis Ladd, n. sp.

Plate 11, figure 14

Shell large, heavy, fusiform; spire high, whorls moderately convex, suture distinct; aperture lenticular, longer than spire, constricted anteriorly; inner lip smooth, concave, callused, umbilicus bounded by a thick fasciole; outer lip with a thin margin, lirate within. Sculpture consisting of low flattened spirals, arranged in pairs, crossed by inconspicuous axials. The protoconch on the only specimen is incomplete but apparently composed of at least two smooth convex whorls.

Measurements of the holotype, USNM 214333: height 44.5 mm, diameter 20.7 mm.

This species bears a superficial resemblance to the well-known and widely distributed living thaidid *Nassa sertum* (Bruguière), but has more inflated whorls, lacks a ridge on the posterior end of the inner lip, and has lirae inside the outer lip.

The fossil lacks the peripheral nodes and the subsutural depression of the type of the genus *Euthria*. It has no close living relatives but closely resembles *E. jogjacartensis* described by Martin (1914, p. 142, pl. 3, fig. 85) from the upper Eocene of Java. The Java fossil has flatter whorls, a more heavily callused inner lip, and a less conspicuous siphonal fasciole.

Occurrence.—Holotype (only specimen) from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus METULA H. and A. Adams

Adams, H. and A.. 1853, Genera of recent Mollusca, v. 1, p. 84.

Type (by hidden tautonymy).— *Buccinum hindsii* H. and A. Adams (= *Buccinum metula* Hinds). Holocene, Pacific coast of Panama.

Metula kerensis Ladd

Plate 16, figure 6

Metula kerensis Ladd, 1976, Nautilus, v. 90, no. 4. p. 130, fig. 10.

The holotype of this weakly sculptured species, USNM 214288, measures: height 24.3 mm, diameter 7.3 mm. A total of eight shells from USGS localities 25715 and 25718 and station SM242 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Metula santoensis Ladd

Plate 16, figure 7

Metula santoensis Ladd, 1976, Nautilus, v. 90, no. 4, p. 131, fig. 11.

The holotype, British Museum (Nat. History) no. GG19763, measures: height 30 mm, diameter 9.8 mm. The type was collected from the Pleistocene beds outcropping on the Kere River (station SM242), Santo New Hebrides, and a second shell was found in river debris on the nearby Sarakata River.

Metula cf. M. mitrella (Adams and Reeve)

Plate 11, figures 15, 16

Five specimens from the Pleistocene marls on the Kere River, Santo, New Hebrides, may represent this species briefly described by Adams and Reeve (1850, p. 32, pl. 11, fig. 13) from China Sea waters. On the fossil shells the close-set axial riblets are a little stronger than the spiral cords, the intersections slightly beaded. Some of the fossil shells retain obscure traces of broad brown spiral bands.

Measurements of the figured specimen, USNM 214282 from USGS locality 25715: height 33.2 mm, diameter 9.2 mm.

Family COLUBRARIIDAE

Genus COLUBRARIA Schumacher

Schumacher, 1817, Essai d"un nouveau système des habitations des vers testacés, Copenhagen, p. 251.

Type (by monotypy).—*Colubraria granulata* Schumacher (= *Murex maculosa* Gmelin): Holocene, Indo-Pacific.

Colubraria maculosa (Gmelin)

Plate 8, figure 1

Murex maculosa Gmelin, 1790. Systema Naturae, 13th ed., p. 3548.

Colubraria maculosa (Gmelin), Kira, 1962, Shells of the western Pacific, in color, v. 1, p. 206, pl. 70, fig. 14; Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 59, fig. 27.

A single incomplete, but identifiable, shell from USGS locality 25715 in the Pleistocene marls on the

Kere River, Santo, New Hebrides. The specimen, USNM 214287, measures: height (incomplete) 38.7 mm, diameter 25.8 mm. The species lives today from the Red Sea to Hawaii.

Colubraria obscura (Reeve)

Plate 41, figures 4–6

Triton obscurus Reeve, 1844, Conchologica Iconica, v. 2. *Triton*, pl. 16, fig. 63.

Colubraria obscura (Reeve), Rehder and Ladd, 1973, Tohoku Univ., Sci. Repts., 2d Ser. (Geology), Spec. v. no. 6, p. 41 (identification only).

This strongly sculptured species is characterized by a heavily callused inner lip. Two small shells from the station SM242 on the Kere River, Santo, are assigned here, and one of them, USNM 214394, is figured; it measures: height 22.6 mm, diameter 7.5 mm. Both of the New Hebrides shells are slender. Similarly small and slender shells were dredged off the lee reef of Kure Island in Hawaii (USNM 709316). The New Hebrides fossils are more sharply sculptured than the Hawaiian shells.

Occurrence.—Station SM242 on the Kere River, Santo, New Hebrides; age, Pleistocene. Reeve described the Holocene shell from the East Indies; the species has been reported from other parts of the western Pacific and from several parts of Hawaii.

Colubraria tortuosa (Reeve)

Plate 41, figures 7–9

Triton tortuosa Reeve, 1844, Conchologica Iconica, v. 2, *Triton*. pl. 17, figs. 74a, b.

Colubraria tortuosa (Reeve), Cernohorsky, 1967, Veliger, v. 9, no. 3, p. 327, fig. 29.

Five shells of this widely distributed Holocene species were collected from the beds cropping out on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214393 from USGS locality 25715, measures: height 27.3 mm, diameter 10.9 mm. Some of the fossils retain trace of original brown color.

Occurrence.—USGS locality 25715 and station SM242 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Colubraria rehderi Ladd, n. sp.

Plate 8, figures 2, 3

Medium in size, fusiform, robust; protoconch of about 1½ smooth convex whorls followed by nine sculptured whorls. Sculpture consisting of varices, about two per whorl, and coarse, close-set axial ribs that are crossed and beaded by weaker spirals. Aperture elongate; outer lip thin, backed by a varix, crenulate within; inner lip heavily callused, edge of callus detached; columella concave, finely plicate anteriorly.

Measurements of the holotype, USNM 214293: height 35.2 mm, diameter 9.8 mm.

C. rehderi closely resembles *C. nitidula* (Sowerby), a widely distributed Holocene species in the Indo-Pacific but is much more coarsely sculptured than that species.

The species is named for Dr. Harald Rehder of the U.S. National Museum of Natural History who has studied living mollusks in many parts of the Pacific.

Occurrence.—Four shells from USGS locality 25715 and two from 25718; Pleistocene beds on the Kere River, Santo, New Hebrides. In the National Museum collections (USNM 281817), Holocene shells were collected from the central Philipines at a depth of 135 fathoms (247 m). The larger specimens in this lot of five are certainly conspecific with the New Hebrides fossils.

Family NASSARIIDAE

Genus NASSARIUS Dumeril

Duméril, 1806, Zoologie analytique, p. 107 (genus without species).

Type (by monotypy).—Froriep, 1806, C. Duméril's analytique zoologie, p. 167 (*fide* Iredale, 1916, Malacolog. Soc. London Proc., v. 12, p. 83).—*Buccinum arcularia* Linnaeus. Holocene, western Pacific.

Subgenus PLICARCULARIA Thiele

Thiele, 1929, Handbuch der systematischen Weichtierkunde, v. 1, p. 324.

Type (by monotypy).—*Nassa thersites* Bruguière = *Buccinum pullus* Linnaeus. Holocene, Indo Pacific.

Nassarius (Plicarcularia) globosus (Quoy and Gaimard)

Plate 12, figures 1–3

Buccinum globosum Quoy and Gaimard, 1833, Voyage l'Astrolabe, v. 2, p. 448, pl. 32, figs. 25–27.

Nassarius (Plicarcularia) globosus (Quoy and Gaimard), Cernohorsky, 1972, Auckland Inst. and Mus. Recs., v. 9, p. 136, figs. 16–18.

A half dozen typical shells were recovered from the Pleistocene beds at Station SM239 on the Navaka River, Santo, New Hebrides. One is figured; it measures: height 11.7 mm, diameter 9.3 mm. The species lives today in the New Hebrides and many other island groups in the western Pacific. According to Vlerk (1931, p. 233), the species has also been reported from the Pliocene of Timor.

Nassarius (Plicarcularia) cf. N. bimaculatus (A. Adams)

Plate 12, figures 4, 5

Nassa bimaculosa A. Adams, 1852, Zool. Soc. London Proc., pt. 19, p. 102.

Nassarius (Plicarcularia) bimaculosus (A. Adams), Cernohorsky, 1972, Auckland Inst. and Mus. Recs., v. 9, p. 133, fig. 13.

A single worn shell from the Pleistocene beds on the Wenui River (station SM329), Santo, New Hebrides, may represent this Holocene western Pacific species. It measures: height (incomplete) 11.8 mm, diameter 9.0 mm. Three small shells from the same beds are probably immature. They lack any indication of a dorsal swelling.

Measurements of the figured specimen, USNM 214339: height 6.1 mm, diameter 3.6 mm.

Subgenus NIOTHA H. and A. Adams

Adams, H. and A., 1853, Genera of recent Mollusca, v. 1, p. 117.

Type (by subsequent designation, Cossmann, 1901, Essais de paléoconchologie comparée, pt. 4, p. 203).—*Nassa cumingi* Adams. Holocene, western Pacific.

Nassarius (Niotha) albescens (Dunker)

Plate 12, figures 6, 7

Buccinum albescens Dunker, 1846. Zeitschr. Malakozoologie, v. 3, p. 170; Philippi, 1849, Abbildungen und Beschreibungen * * * Conchylien, v. 3, p. 68, pl. 2. fig. 15.

Nassarius (Niotha) albescens albescens (Dunker), Cernohorsky, 1972, Auckland Inst. and Mus. Recs.. v. 9, p. 144, figs. 43, 44, 59.

A single shell of this western Pacific Holocene species was recovered from the Pleistocene marls on the Sarakata River (SG82), Santo, New Hebrides. It measures: height 17.3 mm, diameter 10.0 mm.

Nassarius (Niotha) nodiferus (Powys)

Plate 12, figures 8, 9

Nassa nodifera Powys. 1835, Zool. Soc. London Proc., p. 95; Reeve, 1853, Conchologica Iconica, v. 8, *Nassa*, pl. 4, no. 23.

Nassarius (Niotha) nodiferus (Powys), Cernohorsky, 1972, Auckland Inst and Mus. Recs., v. 9, p. 153. figs. 69, 70.

Fossils from the Pleistocene of New Hebrides represent the slender form of this species recognized by Cernohorsky. The striking features are the axially ribbed convex whorls, the ribs becoming subnodose at the suture.

Measurements of the figured specimen, USNM 214252 from USGS locality 25715; height 31.9 mm, diameter 17.3 mm. A second specimen, USNM 214413, from the same area measures: height 26.5 mm, diameter 13.9 mm.

Occurrence.—Two specimens from the Kere River marls, Santo, New Hebrides; age, Pleistocene. The species lives today in the Philippines, Indonesia, and parts of the Indian Ocean. Originally, and apparently erroneously, reported from the Galapagos and Panama.

Nassarius (Niotha) variegatus (A. Adams)

Plate 12, figures 10, 11

Nassa variegata A. Adams, 1851, Zool. Soc. London Proc., pt. 19, p. 97; Reeve, 1853, Conchologica Iconica, v. 8, pl. 11, no. 70.

Nassa gemmulata Lamarck, Reeve, 1853, Conchologica Iconica, v. 8, pl. 5, no. 29.

Nassarius (Niotha) gemmulatus (Lamarck) (Deshayes), MacNeil, 1960, U.S. Geol. Survey Prof. Paper 339, p. 79, pl. 13, fig. 29.

Niotha clathrata (Lamarck), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 81, pl. 29, fig. 19.

Nassarius (Niotha) variegatus (A. Adams), Cernohorsky, 1972. Auckland Inst. and Mus. Recs., v. 9, p. 140, figs. 35–37 (see for more complete synonymy).

A variable but coarsely granulated species that is characterized by its deeply excavated suture, inflated body whorl, and thin but widely expanded columellar callus. The figured specimen, USNM 214251 from USGS locality 25715, Santo, New Hebrides, measures: height 23.2 mm, diameter 16.4 mm.

Occurrence.—More than a dozen specimens from Pleistocene beds on the Kere and Wambu Rivers, Santo, New Hebrides. Holocene shells were described originally from the Philippines; now known from Japanese and Chinese waters, from Indonesia and the Indian Ocean. The New Hebrides fossils are smaller than the average Holocene shells.

MacNeil (above) referred a specimen from the Pliocene of Okinawa to this species and a closely related, if not identical, form was identified by Martin (1895, p. 106, pl. 17, fig. 237) from the Pliocene of Java.

Subgenus ZEUXIS H. and A. Adams

Adams, H. and A.. 1853, Genera of recent Mollusca, v. 1, p. 119.

Type (by subsequent designation, Cossmann, 1901, Essais de paléoconchologie comparée, pt. 4, p. 207).—*Buccinum taenia* Gmelin. Holocene, Indo-Pacific.

Nassarius (Zeuxis) dorsatus (Roding)

Plate 12, figures 12, 13

Buccinum dorsatum Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 111.

Nassarius (Zeuxis) dorsatus (Röding), Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 150, pl. 43, fig. 8.

Represented by five shells from the Kere River marls and by one from the Sarakata River marls (SG78), Santo, New Hebrides.

Measurements of the figured specimen from USGS locality 25715, Kere River, USNM 214281: height 26.9 mm, diameter 17.8 mm.

Occurrence.—Pleistocene beds on the Kere and Sarakata Rivers, Santo, New Hebrides. The species lives today off northern Australia and the Philippines and in Indonesian waters.

Nassarius (Zeuxis) margaritiferus (Dunker)

Plate 12, figures 14, 15

Buccinum margaritiferus Dunker, 1847, Zeitschr. Malakozoologie, v. 4, p. 60.

Nassarius (Zeuxis) margaritiferus (Dunker), Cernohorsky, 1972, Auckland Inst. and Mus. Recs., v. 9, p. 170, figs. 122, 141.

Seven shells were collected from the Pleistocene beds along the Kere River, Santo, New Hebrides, but only one of them is fully adult. It is a much inflated, highly sculptured shell from station SM242, measuring: height 27.6 mm, diameter 14.5 mm. The species lives today in the New Hebrides and in the Indian Ocean.

Subgenus ALECTRION Montfort

Montfort, 1810, Conchyliologie, systématique, v. 2, p. 566.

Type (by original designation).—*Buccinum papillosum* Linnaeus. Holocene, Indo-Pacific.

Nassarius (Alectrion) barsdelli Ladd

Plate 16, figures 8–11

Nassarius (Alectrion) barsdelli Ladd, 1976, Nautilus, v. 90, no. 4, p. 131, figs. 12–15.

Holotype, USNM 214274, measures: height 23.8 mm, diameter 14.0 mm; paratype, USNM 214278: height 23.8, diameter 15.0 mm. Present in abundance in the Pleistocene beds outcropping on the Kere River (USGS locality 25715), Santo, New Hebrides.

Nassarius (Alectrion) glans (Linnaeus)

Plate 19, figure 16

Buccinum glans Linnaeus, 1758, Systema Naturae, 10th ed., p. 737.

Nassarius (Alectrion) glans glans (Linnaeus), Cernohorsky, 1972, Auckland Inst. and Mus. Recs., v. 9, p. 180, figs. 135, 136, 146 (see for additional references).

Incomplete but typically banded shells that clearly represent this Holocene Pacific species were recovered from USGS localities 25715, 25717, and 25718 on the Kere River, Santo, New Hebrides; age, Pleistocene. The figured specimen, USNM 214408, from USGS locality 25718 measures 43.6 mm in height.

Genus BATHYNASSA Ladd

Ladd, 1976, Nautilus, v. 90, no. 4, p. 131.

Type (by original designation): *Bathynassa bolangoi* Ladd. Pleistocene, New Hebrides.

Bathynassa bolangoi Ladd

Plate 38, figures 1–7

Bathynassa bolangoi Ladd, Nautilus, v. 90, no. 4, p. 132, figs. 34–40.

The holotype, USNM 214343, measures: length 13.9 mm, diameter 5.2 mm. The holotype is one of seven shells collected from the Pleistocene beds on Navaka River (USGS localities 25736 and 25742 at the northern end of the outcrop area), Santo, New Hebrides.

Habe pointed out (written commun., 1977) that *B. bolangoi* "somewhat relates to *Zeuxis hirasei* Kuroda and Habe" (see Habe, *in* Kira and Habe, 1965, p. 101, pl. 32, fig. 26), a species living at 200–300 m in Japanese waters. *Z. hirasei* is much larger than *B. bolangoi*, and though it has a canaliculated suture, it is not deeply furrowed as is the fossil shell.

Walter Cernohorsky questioned the validity of *Bathynassa* (written commun., 1978). He suggested that *B. bolangoi* might be identified with *Nassarius siquijorensis* (A. Adams) from Philippine waters. Adams' species does have a flatly channeled suture, but when the fossil is compared with various lots of the widely distributed living species, a number of differences appear. The fossil is more slender and more strongly turreted because of its more deeply excavated suture; it has a smoother columella, and its outer lip is less strongly dentate.

Family FASCIOLARIIDAE

Genus LATIRUS Montfort

Montfort, 1810, Conchyliologie systématique, v. 2, p. 531.

Type (by original designation).—*Latirus aurantiacus* Montfort (= *Murex gibbulus* Gmelin). Holocene, Australia.

Latirus craticulatus (Linnaeus)

Plate 13, figures 1, 2

Linnaeus, 1758, Systema Naturae, 10th ed., p. 755; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 156, pl. 46, fig. 5.

Six shells from the Pleistocene marls on the Kere River, Santo, New Hebrides. The figured specimen, USNM 308114, measures: height 44.4 mm, diameter 19.2 mm. The species lives today throughout the tropical Pacific and in the Indian Ocean. MacNeil (1960, p. 83, pl. 17, figs. 11, 17, pl. 19, fig. 22) found

comparable forms in the Pliocene and Pleistocene of Okinawa. According to Vlerk (1931, p. 229), Schepman reported it from post-Tertiary beds on Celebes (Sulawesi).

Latirus paetelianus (Kuster)

Plate 13, figures 3, 4

Turbinella paeteliana Küster, 1844, *in* Martini and Chemnitz, Systematisches Conchylien-Cabinet, v. 3, abt. A, p. 71, pl. 18, figs. 2, 3.

Medium in size, fusiform, stout. Protoconch of two convex smooth whorls followed by about eight strongly sculptured whorls. Sculpture consisting of strong axial folds, seven on body whorl, that are overridden by regularly spaced spiral cords; inconspicuous axial threads cover all whorls. Suture appressed; aperture elongate-ovate, extended anteriorly as a long and recurved canal. Columella with three elongate plaits across its midsection; outer lip lirate within.

Measurement of the figured specimen, USNM 214269: height 46.5 mm, aperture and canal combined 26.8 mm, diameter 16.1 mm.

Hedley (1912, p. 149, pl. 43, fig. 34) described a variety that he dredged at 10 fathoms in the Gulf of Carpentaria (*L. paeteliana carpentariensis*). It seems very close to Küster's species, possibly identical with it.

MacNeil's (1960, p. 86, pl. 4, fig. 10) subspecies (*Streptochetus paeteliana riukiuana*) from the Miocene of Okinawa has fewer axials than the Holocene and Pleistocene form here described.

Occurrence.—Thirteen specimens from station 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene. Küster's specimen, a Holocene shell, was collected—questionably—from China. A Holocene shell in the USNM collections (No. 230905) was found off Cebu in the Philippines.

Latirus polygonus (Gmelin)

Plate 13, figures 5, 6

Murex polygonus Gmelin, 1790, Systemae naturae, 13th ed., p. 3555.

Latirus polygonus (Gremlin) Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 154, pl. 45, figs. 7, 7a.

A heavy, strongly sculptured shell whose massive nodes are elongated axially, each overriden by three to four conspicuously elevated spiral cords; elsewhere spiral cords are weakly developed; axial lines visible everywhere under low magnification. Aperture elongate-oval, lirate within; outer lip incomplete, but the part preserved shows remnants of the small spiny denticles that characterize Holocene shells; lower part of columella obscurely plicate. Traces of red-brown are found on the nodes in the interstices between spirals, and broken spiral bands of brown are present on the base. The figured specimen, USNM 308116, measures: height 66.9 m, diameter 27.3 mm.

Occurrence.—Two shells from the Pleistocene marls on the Kere River, Santo, New Hebrides. The species lives in many parts of the tropical Pacific but seems not to have been previously reported as a fossil.

Latirus cf. L. formosior Melvill

Plate 13, figures 7, 8

Medium in size, slender, fusiform. Protoconch consisting of about two smooth convex whorls, followed by eight highly convex sculptured whorls; suture deeply impressed. Whorls bearing strong axial folds, seven on body whorl, overridden by spiral cords that alternate with spiral threads; axial lines of growth inconspicuous. Aperture lenticular, extended anteriorly into a long straight canal; outer lip crenulate within, inner lip callused with an inconspicuous parietal dentical and four plaits. Axial folds retain traces of brown.

Measurements of the figured specimen, USNM 214297: height 29.9 mm, diameter 10.3 mm.

The New Hebrides fossil closely resembles the rare Holocene shell described by Melvill (1891, p. 394, pl. 2, fig. 16), but I have not seen a specimen. Shells of *Latirus paetelianus* (Küster) that occur in the Kere River marls with the shell described above are larger, proportionately wider, and have a curved anterior canal.

Occurrence.—A single specimen from the Pleistocene marls on the Kere River at USGS locality 25715, Santo, New Hebrides. The locality of the Melvill type of *L. formosior* is not known.

Genus DOLICHOLATIRUS Bellardi

Bellardi, 1884, I Molluschi * * * del Piemonte e della Liguria, pt. 4, p. 39, pl. 2, figs. 13, 14.

Type (by subsequent designation, Cossmann, 1901, Essais de Paléoconchologie comparée, v. 4, p. 23).—*Turbinella bronni* Michelotti. Miocene, Italy.

Dolicholatirus cf. D. lancea (Gmelin)

Plate 13, figures 9, 10

A single incomplete fossil has a proportionately shorter siphonal canal and stronger axial threads than Holocene shells but may represent the same species.

Measurements of the specimen, USNM 214294: height (spire incomplete) 17.8 mm, diameter 7.8 mm.

Occurrence.—Station 160, Walu Bay, Viti Levu, Fiji; age, early Miocene (Tertiary *f*). *D. lancea* lives in Fiji today and in Pacific areas to the west (Cernohorsky, 1972, p. 161–162).

Fusinus colus (Linnaeus)

Plate 13, figure 11

Murex colus Linnaeus, 1758, Systema naturae, 10th ed., p. 753.

Fusinus colus (Linnaeus), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 88, pl. 31, fig. 7; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 162, pl. 48, figs. 1, 1a.

More than a dozen nearly complete shells and several fragments of this western Pacific and Indian Ocean form were recovered from the Pleistocene outcrops on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214257, from USGS station 25715 measures: height 92 mm, diameter 24.2 mm. The fossils, like Holocene shells, vary considerably in the size, shape, and number of the axial nodes on the body whorl.

Family OLIVIDAE

Genus OLIVA Bruguiere

Bruguière, 1789, Encylopedie méthodique. Histoire nat. vers, v. 1, p. xv (genus without species).

Type (by monotypy and tautonomy, Lamarck, 1799, Soc. Hist. Nat. Paris, Mém., p. 70).—*Voluta oliva* Linnaeus. Holocene, western Pacific.

Oliva ispida (Roding)

Plate 13, figures 12, 13

Porphrua ispida Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 35.

Voluta ispidula Linnaeus = *Oliva ispida* (Röding), Dodge, 1955, Am. Mus. Nat. History Bull., v. 107, art. 1, p. 74–78; Habe, 1964, Shells of the western Pacific in color, v. 2, p. 104, pl. 33, fig. 19.

A total of nine small to medium sized-shells of *Oliva,* collected from the Pleistocene beds of Santo are referred to this species. All but one were found on the Kere River; the other, from SM259. One of the larger Kere River shells (USGS locality 25715), USNM 214331, is figured. It measures: length 33.8 mm, diameter 15.3 mm. All the shells are well preserved and agree in major features—shape, height of spire, presence of channeled sutural groove—but they differ in color patterns. Two of the larger shells are orange with traces of irregular bands of a darker shade; the third large shell has an irregular pattern of fine discontinuous spiral dashes; two of the small shells show traces of zigzag brown lines.

O. ispida lives today in many parts of the western Pacific and the Indian Ocean.

Family MITRIDAE

Genus MITRA Lamarck

Lamarck, 1798, Tableau encyclopédique, pl. 369.

Type (by tautonomy).—*Voluta mitra* Linnaeus. Holocene, Indo-Pacific.

Subgenus NEBULARIA Swainson

Swainson, 1840, Treatise on malacology: London, Longman, Orme, Brown, Green, and Longmans, p. 319.

Type (by subsequent designation, Herrmannsen, 1847, Indicis generum malacozoorum, v. 2, p. 110).—*Mitra contracta* Swainson, Holocene, Indo-Pacific.

Mitra (Nebularia) contracta Swainson

Plate 13, figures 14, 15

Mitra contracta Swainson, 1821, Zool. illustrations, ser. 1, pl. 18; Cernohorsky, 1965, Veliger, v. 8, no. 2, p. 84, pl. 13, fig. 9; Cernohorsky, 1970, Auckland Inst. and Mus. Bull. 8, p. 36.

A single shell from the Pleistocene marl beds on the Kere River (USGS locality 25715), Santo, New Hebrides. The shell, USNM 214301, measures: height 28.7 mm, diameter 10.6 mm. Traces of original color remain in the form of axially oriented streaks of reddish brown. The species lives today throughout the Indo-Pacific region.

Genus CANCILLA Swainson

Swainson, 1840, Treatise on malacology, p. 130, 320.

Subgenus CANCILLA sensu stricto

Type (by subsequent designation, Herrmannsen, 1846, Indicis generum malacozoorum primordia, v. 1, p. 168).—*Tiara isabella* Swainson. Holocene, Indo-Pacific.

Cancilla (Cancilla) isabella (Swainson)

Plate 13, figure 16

Tiara isabella Swainson; 1831, Zool. illustrations, v. 2, pl. 50, fig. 1; 1840, Treatise on malacology, p. 320, fig. 84b.

Mitra isabella (Swainson), Reeve, 1844, Conchologica Iconica., v. 2, *Mitra,* pl. 6, fig. 42.

Cancilla isabella (Swainson), Cernohorsky, 1970, Auckland Inst. and Mus. Bull. 8, p. 47.

Shell large, covered with sharply elevated spiral ribs; depressed areas between ribs crossed by close-set axial threads; columella with five oblique plaits. The unworn and nearly complete figured specimen, USNM 214233 measures: height 49.6 mm, diameter 15.3 mm. However, two other shells (SM 242) have heights of 88 and 90 mm.

Occurrence.—Figured specimen from USGS locality 25715 on the Kere River, Santo, New Hebrides; two other shells from SM242 on the same river; age of all specimens, Pleistocene. The species

lives today in Chinese and Japanese waters but is rare. The New Hebrides shells make up the first fossil record.

Genus VEXILLUM Roding

Röding, 1798, Mus. Boltenianum, Hamburg, pt. 2, p. 138.

Subgenus VEXILLUM sensu stricto

Type (by subsequent designation, Woodring, 1928, Carnegie Inst. Washington Pub. 385, p. 244).—*Vexillum plicatum* Röding (= *Voluta plicaria* (Linnaeus). Holocene, Indo-Pacific.

Vexillum (Vexillum) coccineum (Reeve)

Plate 13, figures 17, 18

Mitra coccinea Reeve, 1844, Conchologica Iconica, v. 2, *Mitra*, pl. 7, fig. 49.

Vexillum (Vexillum) coccineum (Reeve), Cernohorsky, 1970, Auckland Inst. and Mus. Bull. 8, p. 53.

Two small shells that preserve the original color banding were recovered at USGS locality 25715 on the Kere River, Santo, New Hebrides. The figured shell, USNM 214264, measures: height 35.3 mm, diameter 11.7 mm.

Occurrence.—The Pleistocene marls on the Kere River, Santo, New Hebrides. The species is common today in the western Pacific from the Ryukyus to the Philippines.

Vexillum (Vexillum) vulpecula (Linnaeus)

Plate 14, figures 1, 2

Voluta vulpecula Linnaeus, 1758, Systema Naturae, 10th ed., p. 732.

Vexillum vulpecula (Linnaeus), Cernohorsky, 1965, Veliger, v. 8, no. 2, p. 140, pl. 20, fig. 89; 1970, Auckland Inst. and Mus. Bull. 8, p. 53.

A single shell that is worn but that retains traces of brown spiral bands was collected from the Pleistocene marls on the Sarakata River (station SG79), Santo, New Hebrides. It measures: height 40.0 mm, diameter 15.9 mm. The species lives today throughout the Indo-Pacific region but, apparently, has not previously been reported as a fossil.

Vexillum (Vexillum) subdivision (Gmelin)

Plate 41, figures 10, 11

Voluta subdivisa Gmelin, 1791. Systema naturae. 13th ed., p. 3453.

Vexillum subdivisum (Gmelin), Cernohorsky, 1965, Veliger, v. 6, no. 2, p. 136, pl. 20, fig. 92.

A single shell from station MWC40 on Maewo, New Hebrides, appears to represent this widespread Indo-Pacific Holocene species. The shell, USNM 214401, measures: height (apex incomplete) 53.4 mm, diameter 17.0 mm. The shell is stouter than Holocene examples in the USNM collections, and its outer lip is more strongly lirate within. Traces of the original brown color bands are preserved on the fossil.

Occurrence.—Station MWC40, Maewo, New Hebrides; age, probably Pleistocene. Not previously reported as a fossil.

Subgenus COSTELLARIA Swainson

Swainson, 1840, Treatise on malacology: London, Longman, Orme, Brown, Green, and Longmans, p. 320.

Type (by monotypy).—*Mitra rigida* Swainson (= *Mitra semifasciata* Lamarck). Holocene, Indo-Pacific.

Vexillum (Costellaria) polygonum (Gmelin)

Plate 14, figures 3, 4

Murex polygonum Gmelin, 1791, Systema naturae, 13th ed., p. 3555.

Mitra angulosa Küster, 1841 *in* Martini and Chemnitz, Systematisches Conchylien-Cabinet, v. 5, abt. 2, p. 65, pl. 12, figs. 8, 9; Sowerby, 1874, Thesaurus Conchyliorum, *Mitra*, no. 430, p. 32, pl. 34, figs. 531, 534, 535.

Vexillum (Costellaria) polygonum (Gmelin), Cernohorsky, 1970, Auckland Inst. and Mus. Bull. 8, p. 55.

Two shells of this coarsely sculptured *Vexillum* were collected on the Kere River, Santo, New Hebrides. The figured specimen, USNM 214290 from USGS locality 25715 measures: height 53.5 mm, diameter 16.0 mm. The smaller of the two fossil shells retains traces of narrow axial bands of reddish brown. The species lives in the Philippines today. The New Hebrides Pleistocene shells are the first fossils recorded.

Vexillum (Costellaria) cf. V. bellum (Pease)

Plate 14, figure 5

Three shells from the Pleistocene marls on the Kere River (USGS locality 25715), Santo, New Hebrides, may be identical with *V. bellum* (Pease) (1960a, p. 145), a Holocene species that is widespread in Hawaii. The New Hebrides fossils are larger than most Hawaiian shells, and individual whorls and the spire as a whole are flatter. In all other features, including the color pattern, shells from the two areas appear conspecific.

Measurements of the figured specimen, USNM 214266: height 30.0 mm, diameter 9.3 mm.

The U.S. National Museum collection contains 22 lots of shells of *V. bellum* from Hawaii and one (No. 88545) from Samoa.

Subgenus PUSIA Swainson

Vexillum (Pusia) millecostatum (Broderip)

Plate 14, figures 6, 7

Tiara millecostata Broderip, 1836, Zool. Soc. London Proc., pt. 3 (36), Ap. p. 195.

Mitra millecostata (Broderip), Reeve, Conchologica Iconica, v. 2, *Mitra*, pl. 36, fig. 301.
Vexillum (*Pusia*) *millecostatum* (Broderip), Cernohorsky, 1970, Auckland Inst. and Mus. Bull. 8, p. 56.

A single somewhat worn shell of this stout, biconic, highly inflated Holocene Pacific species was collected at USGS locality 25715, Pleistocene marls on the Kere River, Santo, New Hebrides. The shell, USNM 214300, measures: height 23.8 mm, diameter 12.3 mm. The fossil retains traces of original color in the form of irregular, axially elongated blotches of brown.

FAMILIES COVERED IN THE PRESENT PAPER

Family EULIMIDAE (MELANELLIDAE)

The Eulimidae of the Mesogastropoda were not treated ahead of the Strombidae in Professional Paper 532 (Ladd, 1972). They are given the proper place in table 3 of the present paper, but species are here identified for the first time.

Minute eulimids were found in Tertiary sediments in several parts of Fiji, but the shells are rare, and only once has a relationship with a described species been indicated. Eulimids were also found in the drill holes on Eniwetok to depths greater than 2,000 ft (606 m) (lower Miocene) but never in abundance.

A few shells of minute eulimids were found in sands from the deep hole drilled on Funafuti at depths of 65–90 ft (19–27 m), but these could not be identified with either of the two species reported by Hedley (1899, p. 410–411) from the lagoon and lagoon beach of Funafuti.

Genus EULIMA Risso

Risso, 1826, Histoire Nat. Europe Méridionale, v. 4, p. 123.

Type (by subsequent designation, Herrmannsen, 1846, Indicis generum malacoozorum, v. 1, p. 431). —*Turbo sublatus* Donovan (= *Strombiformis glaber* da Costa). Holocene, eastern Atlantic.

Very small slender high-spired shells; in many shells, the apex is curved to one side; aperture pointed above.

Eulima santoensis Ladd, n. sp.

Plate 41, figures 12, 13

Shell small, slender, straight-sided, composed of about 12 polished whorls. Body whorl marked with three spiral bands of brown, one band appearing faintly near the suture on earlier whorls. Aperture elongate-oval, pointed above, outer lip thin, its upper part deeply recessed; inner lip gently curved, columella slightly thickened.

Measurements of the holotype, USNM 250158: height 9.5 mm, diameter 2.2 mm.

The color bands of the fossil shells suggest the pattern described by Kuroda and Habe for *E. lacca*, a species living in Sagami Bay (*in* Kuroda and others, 1971, p. 79), but the fossils do not show an overall brown color, they have more whorls than the Japanese shells, and the outer lip of the fossil shells is not thickened.

Occurrence.—Holotype and one other nearly complete shell from USGS locality 25715 on the Kere River, Santo, New Hebrides; an incomplete shell was found at station SM43 on the Navaka River. All three Santo shells are Pleistocene.

Eulima sp. A.

Plate 41, figures 14, 15

Shells of a minute species of *Eulima* occur in several parts of the upper Miocene marls at the base of the Palau Limestone on the Goikul Peninsula, Babelthuap, Palau. A figured specimen (pl. 41, fig. 14), USNM 250155, is from USGS locality 21304, where the shells were found in large numbers. It measures: height 2.7 mm, diameter 0.7 mm. A shell that seems identical was recovered from lower Miocene (Tertiary *f*) beds drilled in E–1, 970-980 ft (293–296 m) on Eniwetok. It, USNM 250156, is also figured (pl. 41, fig. 15). It measures: height 2.1 mm, diameter 0.6 mm.

Genus BALCIS Leach

Leach, 1847, Annals and Mag. Nat. History, v. 20, p. 271.

Type (by subsequent designation, Winckworth, 1934, Jour. Conchology, v. 20, p. 13).—*Balcis montagui* Leach (= *Eulima alba* da Costa).

Balcis martinii (A. Adams)

Plate 37, figures 9, 10

Eulima martinii A. Adams, 1854, *in* Sowerby, Thesaurus Conchyliorum, *Eulima*, p. 795, pl. 169, fig. 6; Reeve, 1866, Conchologica Iconica, *Eulima*, sp. 6.

A single shell of this giant eulimid was obtained from the Pleistocene beds on the Kere River (USGS locality 25718), Santo, New Hebrides. The specimen, USNM 214365, measures: height 33.6 mm, diameter 12.3 mm. The species lives today in the China Sea, in Japanese waters, and in the Philippines. According to Vlerk (1931, p. 260), Fischer reported the species from the Pliocene of the Moluccan Islands.

Balcis aff. B. kanaka (Pilsbry)

Plate 41, figure 17

Shell small, robust, flat-sided, apex not acicular; spire of about eight whorls curved to right. A series of impressed varices is initiated above and to the

right of the aperture. Aperture elongate-ovate, not sharply pointed above; inner lip gently curved, thickened anteriorly; outer lip thin, strongly arched forward.

Measurements of the figured specimen, USNM 250157: height 4.0 mm, diameter 1.4 mm.

The single Bikini fossil is very similar to Holocene shells of *B. kanaka* (Pilsbry) present in the Thanuum Collection (USNM 333340) from near Hilo on the island of Hawaii, but the fossil is larger and more robust. Pilsbry (1917, p. 310, fig. 3) described *Melanella kanaka* from Kailua on Oahu.

Occurrence.—Drill hole 2B, Bikini, at depth 1,629–1,640 ft (493–496 m); age, early Miocene (Tertiary *e*).

Balcis aff. B. vitrea (A. Adams)

Plate 41, figure 16

A single incomplete shell from the Pliocene beds at station C2026, Viti Levu, Fiji, may represent this Holocene species described by Adams (1851, p. 277) from shells taken from the stomach of a holothurian collected in Fiji. The fossil, USNM 214386, measures: height (incomplete) 4.9 mm, diameter 1.4 mm. It shows a slight bend to the right.

Family VOLUTIDAE

Genus LYRIA Gray

Gray, 1847. Zool. Soc. London Proc., pt. 15, p. 141.,

Type (by original designation).—*Voluta nucleus* Lamarck. Holocene, Southwest Pacific.

The two fossil volutes recorded below—both from the Pleistocene beds of Santo—are the only representatives of the family that have been found in the New Hebrides. Both species were described in 1975 in *Veliger;* the descriptions are not repeated here, though the original figures are reproduced and their measurements given.

Lyria mallicki Ladd

Plate 15, figures 1–8

Lyria mallicki Ladd, 1975, Veliger, v. 18, p. 137, fig. 29.

The holotype, USNM 175096, measures: height 48.0 mm, diameter 19.2 mm; paratype A, USNM 214226, height 45.7 mm, diameter 17.8 mm; paratype B, British Museum (Nat. History) No. GG 19760, height 33.0 mm, diameter 15.5 mm.

Lyria santoensis Ladd

Plate 15, figures 9–14

Lyria santoensis Ladd, 1975, Veliger, v. 18, p. 137, figs. 10–15.

The holotype, USNM 175138, measures: length, 87.7 mm, diameter 29.6 mm, length of aperture 48.2 mm; the paratype, USNM 175139: length 78.6 mm, diameter 28.9 mm, length of aperture 45.6 mm.

In 1975, Habe rescribed *Lyria* (*Lyria*) *kawamurai* from specimens dredged off Formosa. This species is similar in shape to *L. santoensis* but is smaller, has more inflated whorls, and lacks the wide brown bands found on the New Hebrides fossils.

Family VOLUTOMITRIDAE

Genus VOLUTOMITRA H. and A. Adams

Adams, H. and A., 1853, Genera Recent Molluca, v. 1, p. 172.

Type (by subsequent designation, Fischer, 1884, Manuel conchyliologie, p. 610).—*Mitra groenlandica* Beck. Holocene, Arctic Sea.

Volutomitra? vitilevensis Ladd, n. sp.

Plate 14, figures 8, 9

Shell medium in size, fusiform. Protoconch incomplete but composed of at least two smooth convex whorls, followed by eight whorls with strong, straight axial ribs (15 on penultimate whorl) that become almost completely obsolete on the body whorl. Whorls covered by fine rounded spiral threads; in the series of spirals, one lying about one-fourth the width of the whorl below the suture is more prominent than the others but does not form a shoulder. Aperture narrowly lenticular, about same length as spire, outer lip broken, inner lip callused, columella with three sharply elevated plaits, the posterior one the largest.

Measurements of the holotype, USNM 214332: length 35.0 mm, diameter 11.7 mm.

V. vitilevensis appears to be closely related to Dall's *Mitra bairdii* (Dall, 1889b, p. 161) that Cernohorsky (1970, p. 140–141) tentatively assigned to the Volutomitridae. In doing so, Cernohorsky noted it to be unusually slender, a feature not shared by *V. vitilevensis*. The prominent spiral thread present on *V. vitilevensis* does not occur on *V. bairdii*, but a narrow color band replaces it on shells assigned to *Pusia ebenus* Lamarck, a Holocene mitrid known from Europe and the eastern Atlantic and also reported from the Pliocene of Europe and England (Cernohorsky, 1970, p. 56). I hope that the collection of additional examples of the Fijian fossil may clarify family and generic relations which, at present, are somewhat obscure.

Occurrence.—A single specimen from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Family CANCELLARIIDAE

Genus CANCELLARIA Lamarck

Lamarck, 1799, Soc. Histoire Nat. Paris Mém, p. 71.

Type (by monotypy).—*Voluta reticulata* Linnaeus. Holocene, western Atlantic and Caribbean.

Cancellaria tholoensis Ladd

Plate 14, figures 10, 11

Cancellaria tholoensis Ladd, 1934, Bernice P. Bishop Mus. Bull 119, p. 230, pl. 41, fig. 2.

No additional material collected, but a correction should be made in connection with the holotype (B. P. Bishop Mus., Geol. no. 1213) previously described and figured. The outer lip shown in the figure was improperly combined with a nearly complete shell; it actually represents a second specimen of the same species. The holotype number is here restricted to the nearly complete shell, and it is refigured. Its measurements are: length 27.2 mm, diameter 14.6 mm.

Occurrence.—Station 59, Viti Levu, Fiji; age, late Miocene (Tertiary *g*).

Subgenus MERICA H. and A. Adams

Adams, H. and A., 1854, Genera of recent Mollusca, v. 1, p. 277.

Type (by subsequent designation, Cossmann, 1889, Petit, 1974, Venus, v. 33, no. 3, p. 112).—*Cancellaria melanostoma* Sowerby. Holocene, Pacific.

Cancellaria (Merica) asperella Lamarck

Plate 14, figures 14, 15

Cancellaria asperella Lamarck, 1822, Histoire Nat. animaux sans vertebres, v. 7, p. 112; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 179, pl. 50, fig. 3.

Two shells from the Pleistocene marls exposed at station SM242 on the Kere River, Santo, New Hebrides, represent this somewhat variable Holocene species that lives in Japanese waters. One of the fossils, USNM 308118, is figured. It measures: length 25.0 mm, diameter 15.5 mm.

Cancellaria (Merica) petiti Ladd, n. sp.

Plate 14, figures 16–18

Shell small, slender, biconic; protoconch consisting of about two smooth slightly convex whorls, followed by 4½ sculptured whorls that are weakly shouldered in front of a deep suture. Aperture lenticular; outer lip with a thin beveled edge behind which there is a broad axial bulge; outer lip strongly lirate within; inner lip callused; columella with three strong folds and obscure short secondary folds between. Sculpture consisting of numerous spiral ribs that tend to alternate in size and are slightly beaded where they cross close-set axials to give a reticulate pattern. There are about 20 axials on the body whorl.

Measurements of the holotype, a single fossil, USNM 214320: height 15.7 mm, diameter 6.9 mm.

C. (*M.*) *petiti* is closely related to *M. oblonga* (Sowerby), a well-known Holocene, Indo-Pacific species, but is more slender and much more strongly and sharply sculptured.

The species is named for Richard E. Petit of South Carolina, authority on the Cancellariidae, who recognized the affinities of the Fijian fossil.

Occurrence.—Station 817, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus TRIGONOSTOMA Blainville

Blainville, 1825, Manuel de malacologie et conchyliologie, p. 652.

Type (by monotypy).—*Delphinula trigonostoma* Lamarck. Holocene, Indo-Pacific.

Subgenus SCALPTIA Jousseaume

Jousseaume, 1887. Naturaliste v. 2, p. 213.

Type (by subsequent designation, Cossmann, 1899, Essais de paleóconchologie comparée, v. 3, p. 15).—*Cancellaria obliquata* Lamarck. Holocene, Philippines.

Trigonostoma (Scalptia) crenifera (Sowerby)

Plate 14, figures 12, 13

Cancellaria crenifera Sowerby, 1855, Thesaurus Conchyliorum, v. 2, p. 453, pl. 46, figs. 84–86; Reeve, 1856, Conchologica Iconica, v. 10, *Cancellaria*, pl. 6, no. 24.
Scalptia crenifera (Sowerby), Habe, 1961, Venus, v. 21, p. 436, pl. 23, fig. 7, pl. 24, fig. 4: 1964, Shells of the western Pacific in color, v. 2, p. 113, pl. 36, fig. 5; Kuroda, Habe, and Oyama, 1971, Sea shells of Sagami Bay, Tokyo, Maruzen, Ltd., p. 203, pl. 54, fig. 4.

The fossil from Viti Levu, Fiji, station C1264, USNM 175124, measures 12.5 mm in height and 7.3 in diameter. Age, Pliocene (Tertiary *h*). It is smaller than described Holocene shells but seems identical in all other respects. A single shell was also recovered from Pleistocene beds at station SG97, Santo, New Hebrides.

Occurrence.—Station C1264, Viti Levu, Fiji; age, Pliocene (Tertiary *h*) and Pleistocene (station SG97), Santo, New Hebrides. Not previously reported as a fossil, though a closely related species, *T. crispata* (Sowerby), has been reported from the Pliocene of Java (Martin, 1895, p. 51, pl. 7, fig. 117). *T. crenifera* lives today in the Philippines and Japan.

Genus NEADMETE Habe

Habe, 1961, Colored illustrations of the shells of Japan, app. p. 28.

Type (by original designation): *Cancellaria ja-*

ponica E. A. Smith (replaced by *Neadmete okutani* Petit, 1974, Venus, v. 44, no. 3, p. 1100).

Neadmete nausorensis Ladd, n. sp.

Plate 14, figures 19–22

Shell small, stout, biconic; protoconch not preserved. Spire of about six convex, weakly shouldered whorls. Aperture broadly lenticular, edge of outer lip not preserved, but there are well-developed lirae within; inner lip thinly callused; columella with three strong folds, the posterior one the largest; anterior canal wide, short, straight. Sculpture consisting of sharp-crested spiral ribs (four on the penultimate) that are distinctly beaded where they override rounded axial ribs; there are a dozen axials on the body whorl. Weak secondary spirals and axials are discernible on some shells under magnification.

Measurements of the holotype, USNM 214349: length 17.8 mm, diameter 10.2 mm; a paratype, USNM 214351, measures: length 19.0, diameter 10.0 mm.

N. nausorensis resembles the type of the genus, *N. okutani* Petit, a Holocene Japanese species, but is stouter and has stronger axials and weaker secondary sculpture than that species. The Fiji fossil also resembles the larger incomplete shell figured by Martin as *Cancellaria neglecta* from an unknown horizon in Java (Martin, 1895, p. 47, pl. 7, fig. 112). The Java shell has better developed secondary spirals.

Occurrence.—Four nearly complete shells from station C2026, near Nausori, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Family MARGINELLIDAE

Many of the margin shells are coral sand dwellers, yet they are not uniformly distributed in the reef-associated deposits of the island area. Many shells were recovered from the lagoonal beds drilled on Eniwetok and Bikini in the Marshall Islands and a few from similar beds drilled on Funafuti in the Ellice Islands (Tuvalu). Shells were found in abundance in the shallow-water marls of the Goikul Peninsula in Palau, but none were collected on Guam or Saipan. They were rare in Fiji and the New Hebrides in marls that probably accumulated in somewhat deeper water.

Genus MARGINELLA Lamarck

Lamarck, 1799, Soc. Histoire Nat. Paris Mém., p. 70.

Type (by monotypy).—*Voluta glabella* Linnaeus. Holocene, West Africa.

Subgenus GRANULA Jousseaume

Jousseaume, 1875, Coquilles de la famille des Marginelles, Rev. de Zoologie, v. 3, p. 83.

Type (first species named, p. 83).—*Marginella bensoni* Reeve. Holocene, South Africa.

Marginella cf. M. (Granula) iota Hedley

Plate 37, figure 26

Four specimens recovered from drill cuttings from a depth of 65 feet (20 m) in the deep drill hole on Funafuti, Ellis Islands. One of these from a sample borrowed from the Harvard University Museum of Comparative Zoology, is figured; it measures: length 1.1 mm, diameter 0.8 mm. Hedley's (1899, p. 469) three shells from the sand of the lagoon beach of Funafuti were slightly larger.

Subgenus ERATOIDEA Weinkauff

Weinkauff, 1879, in Martini and Chemnitz, Systematisches Conchylien-Cabinet, v. 5, pt. 4, p. 140.

Type (by subsequent designation, Cossmann, 1899, Essais paléoconchologie comparée, pt. 3, p. 87).—*Marginella margarita* Kiener. Holocene, West Indies.

Marginella (Eratoidea) ringicula Sowerby

Plate 37, figures 13–16

Marginella ringicula Sowerby, 1900 Malacolog. Soc. London Proc., v. 4, p. 126, pl. 11, fig. 3.

Marginella (Eratoidea) ringicula Sowerby, Beets, 1941, Geol.-Mijnb. Genoot. Nederland en Kolonien Verh. Geol. Ser., v. 13, pt. 1, p. 124, pl. 7, figs. 264–266.

Shell small, heavy, biconic; apex of spire smoothly rounded. Aperture elongate, columella with four strong folds; outer lip thickened, bearing within a series of denticles, the posterior one larger than the others; beyond the denticles, the outer lip is thinner and is depressed to form a shallow sinus.

Measurements of the figured specimen from Palau, USNM 175094: height 4.0 mm, diameter 2.0 mm. A figured specimen from Eniwetok, USNM 175095 measures: height 3.2 mm, diameter 1.5 mm.

Occurrence.—Present in large numbers at three stations (USGS 21301, 21304, and 21308) in the upper Miocene (Tertiary *g*) marls at the base of the Palau Limestone on Goikul Peninula, Babelthuap, Palau. Three deep drill holes on Eniwetok yielded more than 50 specimens from depths ranging from 650 to 1,245 ft (197 to 377 m): age, Miocene (Tertiary *g–e*). From two drill holes on Bikini, 13 specimens were recovered from depths of 893–1,199 ft (271–363 m): age, Miocene (Tertiary *g–e*). The species was described by Sowerby from Holocene shells from the Philippines. Beets (1941) described shells from the upper Miocene of East Borneo.

Genus VOLVARINA Hinds

Hinds, 1844, Zool. Soc. London Proc., pt. 12, p. 75.

Type (by subsequent designation, Redfield, 1870, Am. Jour. Conchology, v. 6, p. 221).—*Marginella nitida* Hinds. Holocene, locality unknown.

Volvarina cf. V. avena (Kiener)

Plate 37, figures 11, 12

After comparing the figured fossil and two other Miocene shells from Eniwetok with many lots of Holocene shells from the Caribbean and Atlantic west coast, I am unable to recognize any essential differences. Such differences as exist between the fossils and the average Holocene shell fall well within the range of variation shown by the Holocene specimens. The fossils retain no trace of original color pattern.

Measurements of the figured specimen, USNM 175101: length 8.6 mm, diameter 3.8 mm. One of the other two fossils, an incomplete shell, measures 11.2 mm in length.

The Marshall Island fossils bear a general resemblance to *Volvarina*(?) sp. B described and figured by Jung (1969, p. 536, pl. 57, fig. 16) from the Pliocene of Trinidad, but that form is proportionately much wider. *Marginella* (*Volvarina*?) *berauensis* Beets (1941, p. 123, pl. 6, figs. 248–250) from the upper Miocene of Palau is more tapered anteriorly than are the Marshall Island shells.

Occurrence.—Three specimens from two deep drill holes on Eniwetok at depths of 790–930 feet (239–282 m); age, Miocene (Tertiary *g* and *f*). The species lives today in many parts of the West Indies, along the east coast of North America from North Carolina to Key West, Fla., and ranges as far as Brazil and Bermuda (Abbott, 1974, p. 257, color pl. 11, fig. 2757).

Family TURRIDAE

The Turridae constitute the largest and in many ways the most complex family of existing marine Gastropoda. In my study of fossil shells from the island area, I have followed the systematic arrangement used by Powell (1964–1969) in "Indo-Pacific Mollusca," supplemented by the full coverage published in New Zealand (Powell, 1966). Many of the turrid species recognized as fossils are from Fiji and the New Hebrides, where highly fossiliferous offreef deposits occur.

Genus GEMMULA Weinkauff

Weinkauff, 1875, Deutsche Malakozool. Gesell. Jahrb., v. 2, p. 287.

Type (by subsequent designation, Cossmann, 1896, Essai paléoconchologie comparée, pt. 2, p. 62).—*Pleurotoma gemmata* Hinds (= *Gemmula hindsiana* Berry). Holocene, eastern Pacific.

As Powell pointed out (1964, p. 243), the genus *Gemmula* has a more extended geographic range than any other of the Turrinae, and the genus can be traced back to the beginning of the Tertiary. The greatest concentration today is in the Indo-West Pacific. Powell recognized half a dozen gemmate genera, only one of which, *Gemmula*, is represented in the fossils of the Island Area.

Gemmate shells are abundant in the upper Tertiary marls of Fiji, but most of them are incomplete, and specific identifications are difficult. More complete and better preserved shells are found in the Pleistocene beds on Santo in the New Hebrides. Some of these shells retain diagnostic color patterns.

Gemmula speciosa (Reeve)

Plate 18, figures 1, 2

Pleurotoma speciosa Reeve, 1843, Conchologica Iconica, v. 1, *Pleurotoma*, pl. 2, fig. 9.

Gemmula speciosa (Reeve), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 245, pl. 186, fig. 1 (see for full synonymy).

The peripheral, sharply elevated squared keel bears regularly spaced gemmules that are axially oriented. As pointed out by Powell, this species is closely related to *G. kieneri* (Doumet). The most striking difference—discernible on fossil shells as well as those from the existing seas—is the peripheral keel. The keel of *G. speciosa* is much more strongly projecting than that of *G. kieneri* and fossil shells of *G. speciosa* average smaller than Holocene shells of *G. kieneri*.

Measurements of a figured specimen from Fiji, USNM 214310: height 28.0 mm, diameter 9.4 mm.

Occurrence.—Several specimens from the Pliocene marls on Fiji (stations C2021, C2024, C2026). As noted by Powell (1964, p. 246), Tesch recorded the species (as *Pleurotoma carinata* Gray) from the upper Tertiary of Timor. The species lives today in many parts of the southwest Pacific and the Indian Ocean.

Gemmula kieneri (Doumet)

Plate 18, figures 3–6

Pleurotoma kieneri Doumet, 1840, Magasin Zoologie, v. 2, p. 2, pl. 1.

Gemmula kieneri (Doumet), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 246, pl. 186, figs. 2, 3 (see for complete synonymy).

Some of the fossils from the New Hebrides retain brown spots between the gemmules and traces of the same color on the primary spirals.

A Pleistocene shell from the New Hebrides, (USGS locality 25715), USNM 214368, measures: height 39.9 mm, diameter 12.8 mm.

Occurrence.—Numerous shells from the Pleistocene beds on the Kere River, Santo, New Hebrides. The sepcies lives today in Japan and the Philippines. As noted by Powell (1964, p. 247), Tesch recorded the species (as *Pleurotoma carinata* Gray) from the upper Tertiary of Timor.

Gemmula kieneri woodwardi (Martin)

Plate 18, figures 7, 8

Pleurotoma woodwardi Martin, 1884, Geol. Reichs-Mus. Leiden Samml., ser. 1, v. 3, p. 56, pl. 4, fig. 57.

Turris (Gemmula) granosa woodwardi (Martin), Oostingh, 1938, Ingenieur in Nederlansch-Indie, Gastropoda, pt. 1, p. 27.

Gemmula kieneri woodwardi (Martin), Powell, 1964, Indo-Pacific Mollusca v. 1, no. 5, *Gemmula* p. 247, pl. 188, fig. 2.

The numerous Pliocene fossils from Fiji are smaller than the Pleistocene and Holocene shells of *G. kieneri,* and the secondary spirals on the Fiji shells are finer and sharper.

Measurements of the figured specimen from station C2021 on Viti Levu, USNM 214295: height 24.5 mm, diameter 8.5 mm. The Fijian shells are identical with a late Tertiary shell from Java.

Occurrence.—Abundant in the marls at station 817 on Vanua Levu, Fiji; also occurring at station K700 on the same island. On Viti Levu, found at stations RB44, C2021, and C1133. Age of all shells probably Pliocene (Tertiary *h*). Martin and Oostingh described shells from the Pliocene of Java.

Gemmula congener (E. A. Smith)

Plate 18, figures 9, 10

Pleurotoma congener E. A. Smith, 1894, Annals and Mag. Nat. History, ser. 6, v. 14, p. 160, pl. 3, figs. 4, 5.

Pleurotoma (Gemmula) congener Smith, Schepman, Siboga Exped., pt. 5, 49e, p. 403.

Gemmula congener congener (Smith), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 251, figs. 1–4.

Fossils from Fiji are incomplete but very clearly represent this unusual species. The subsutural fold, composed of two coarse spiral ridges, is strongly developed, extending outward beyond the gemmule-bearing double peripheral keel. Four of the spirals near the top of the base are coarser than those intervening or those found lower on the base.

Measurements of the figured specimen, USNM 214369: height (incomplete) 18.7 mm, diameter 7.4 mm.

Occurrence.—Station B107 (= 817), Vanua Levu and C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*). The species lives today in the Philippines and Indonesia and through the Indian Ocean.

Gemmula monilifera (Pease)

Plate 18, figures 11, 12

Turris monilifera Pease, 1860, Zool. Soc. London Proc., p. 398; Kay, 1965, Marine Molluscs in the Cuming Collection, British Mus. (Nat. History) described by William Harper Pease, British Mus. Bull., Supp. 1, p. 39, pl. 5, figs. 17, 18; pl. 8, fig. 7.

Gemmula monilifera (Pease), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 249, pl. 189, figs. 3, 4.

Incomplete fossils from the Pliocene of Vanua Levu (station 817) and station C2026 on Viti Levu, Fiji, represent this species that lives today in Hawaii and Fiji. The figured specimen, USNM 214372, measures: height 18.6 mm, diameter 8.2 mm. The fossils are slightly less slender than Holocene shells but agree in all other respects. The species has not previously been reported as a fossil.

Gemmula aff. G. clifdenensis Powell

Plate 18, figures 13, 14

Small, fusiform, with a tall spire; peripheral keel with numerous tubercles that bear three narrow spiral cords. Below the suture is a smooth spiral and below that, six or more spirals of varying size may be seen under magnification. On the body whorl below the keel are three prominent spirals, the highest one weaker than the other two; below, these fine spirals cover the neck.

Measurements of the figured specimen, USNM 214370: height 25.7 mm, diameter 10.0 mm.

G. clifdenensis was described by Powell in 1942 (p. 49, pl. 13, fig. 14) and was refigured in 1964 (p. 205, fig. 1). I have not seen the type in the Auckland Museum, but the resemblance to the Fiji fossils is striking. On the Fiji shells, the spiral cords are below the midpoint of the keel.

Occurrence.—The figured specimen and a less complete shell from station FB13, Viti Levu, Fiji; age, early Miocene (Tertiary *f*). Powell described the species from the lower Miocene on New Zealand.

Gemmula sp. A

Plate 18, figures 15, 16

A single incomplete specimen of *Gemmula* with a pattern of beading that distinguishes it from the species described above and from species described elsewhere was found in the Pliocene marls of station C2021, Viti Levu, Fiji. The whorls of the spire have one beaded carina on the periphery, but on the last whorl are three beaded peripheral spirals, the middle one slightly weaker than the other two. Apex and aperture not preserved. The shell, USNM 214328, measures 14.1 mm. in length.

Genus NASAVUSAVUIA Ladd, n. gen.

Type.—*Nasavusavuia nuttalli* Ladd, n. sp.

Medium in size with a double spiral ridge immediately below the suture and a more rounded ridge near the middle of the whorl; the subsutural ridge is excavated above and below; both major spirals gemmulate; beaded secondary spirals lie between the primary spirals; suture deep.

The prominence of the gemmulate major spirals differentiates *Nasavusavuia* from other gemmulate genera.

Nasavusavuia nuttalli Ladd, n. gen. et n. sp.

Plate 19, figures 8, 9

Medium in size; spire long and slender, made up of about nine whorls. A double spiral ridge with undercut sides rises abruptly next to the deep suture; a more rounded but equally conspicuous spiral ridge is located near the middle of the whorl; both of these major features carry coarse, axially oriented gemmules. On later whorls, four beaded secondary spirals lie below the median ridge, and these alternate in size; two similar beaded spirals are found above the median ridge. On the upper part of each whorl, axial lines are directed downward and posteriorly, their direction being reversed below the median ridge. The aperture of the single specimen is incomplete but apparently narrow; columella twisted. The base is covered by beaded spirals.

Measurements of the holotype, British Museum No. GG1841: length 21.1 mm, diameter 7.0 mm.

The species described by Martin (1879, p. 61, pl. 11, fig. 2) as *Pleurotoma coronifera* from the Miocene of Java has strong spirals, but they do no more than suggest those of the Fijian shell. Powell (1967, p. 436), who renamed Martin's species noted that on the double submargins of the sutre, the top spiral was the smaller. No such discrepancy in size is seen in the double subsutural collar of the Fiji shell, whose major sculptural features are all coarser and more sharply elevated than are those on *Gemmula miocoronifera.*

The species is named for Dr. C. P. Nuttall of the British Museum, long a student of Cenozoic fossil mollusks from the southwest Pacific.

Occurrence.—Single specimen from station VI–5, 5 miles (8 km) east of Na Savusavu, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus PTYCHOSYRINX Thiele

Thiele, 1925, Deutsche Tiefsee-Exped., v. 17, no. 2, p. 210.

Type (by original designation, *fide* Powell, 1942, Auckland Inst. and Mus. Bull. 2, p. 20).—*Pleurotoma bisinuata* Martens. Holocene, Indonesia.

Ptychosyrinx aff. P. timorensis teschi Powell

Plate 18, figures 17, 18

A single shell from the Pliocene marls at station C2026, Viti Levu, Fiji, is incomplete but obviously closely related to the Holocene shell described by Powell from Indonesia (Powell, 1964, p. 291, pl. 223, figs. 5, 6). In comparing the Fiji fossil with the holotype of Powell's subspecies (USNM 239068), minor differences in spiral sculpture are recognizable. Above the peripheral carina, on the fossil, the subsutural cord is dual on early whorls but not conspicuously so on the body whorl. On the Fiji shell, the spirals below the peripheral carina are comparatively weak, and there are more numerous threads overriding the peripheral gemmules than on the Holocene shell. On the fossil, the spirals on the base and the neck are more sharply elevated than on the Holocene shell. Additional fossils are needed to determine the significance of these differences. The incomplete fossil, USNM 214312, measures: height 28.4 mm, diameter 12.3 mm.

Powell noted (1964, p. 291) that *P. timorensis teschi* was found in waters off Celebes, Moluccas, and Borneo at depths of 347–559 fathoms (625–1,020 m).

Genus CRYPTOGEMMA Dall

Dall, 1918, U. S. Natl. Mus. Proc., v. 54, no. 2288, p. 325.

Type (by monotypy).—*Gemmula benthina* Dall. Holocene, Gulf of Panama.

Cryptogemma richmondi Ladd, n. sp.

Plate 19, figures 10–15

Medium in size, biconic; height of spire exceeding that of aperture; protoconch and first apical whorls not preserved; teleoconch composed of more than six whorls, strongly turreted by a noded peripheral keel that lies close above the suture. Aperture elongate-ovate; anterior canal moderately long and re-

curved. Sinus at the periphery is a wide V-shaped structure. Weak spirals occur on the flattened area above the peripheral keel, and a spiral of this sort is found on the keel immediately below the tips of the nodes; three prominent spirals occur on the base, the middle one the largest; less prominent spirals cover the balance of the base.

Measurements of the types: holotype, USNM 214403: height (incomplete) 24.1 mm, diameter 13.2 mm; paratype, USNM 214404: height 23.0 mm, diameter 12.4 mm.

C. richmondi has the size and proportions of the genotype, *C. benthina* (Dall, 1919, p. 32, pl. 9, fig. 9), but its detailed sculpture is closer to that of *C. quentinensis* Dall. The fossil has a longer anterior canal than either of the Holocene species and shows no trace of subsutural nodes or wrinkles.

This species is named for Ronald Richmond, Director of the Department of Natural Resources, Fiji, under whose general direction many fossils, including the ones here described, were collected.

Occurrence.—Ten shells from station C497, near Suva, Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Genus EPIDRONA Iredale

Iredale, 1931, Australian Mus. Recs., v. 18, no. 4, p. 225.

Type (by original designation): *Epidrona hedleyi* Iredale. Holocene, Australia.

Epidrona greenbaumi Ladd

Plate 18, figures 19–22

Epidrona greenbaumi Ladd, 1976, Nautilus, v. 90, no. 4, p. 134, figs. 23–26.

Measurements of the holotype, USNM 214306: length 20.8 mm, diameter 8.3 mm; paratype, British Museum (Nat. History) GG19762: length 20.0 mm, diameter 8.1 mm.

This species is represented by two shells from USGS locality 25715 and three from station SM242 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Genus LOPHIOTOMA Casey

Casey, 1904, Acad. Sci. St. Louis Trans., v. 14, no. 5, p. 130.

Subgenus LOPHIOTOMA

Type (by subsequent designation, Woodring, 1928, Carnegie Inst. Washington, Pub. 385, p. 146).—*Pleurotoma tigrina* Lamarck (= *P. acuta* Perry). Holocene, Indo-Pacific.

Lophiotoma (Lophiotoma) acuta (Perry)

Plate 18, figures 23, 24; plate 19, figure 1

Pleurotoma acuta Perry, 1811, Conchology, London, pl. 54, fig. 5.

Pleurotoma tigrina Lamarck, 1822, Histoire nat. animaux sans vertebres, v. 7, p. 95.

Lophiotoma acuta (Perry), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5. p. 303–307 (see for additional references); Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 183, pl. 53, figs. 5, 5a.

This species, the type of the genus, is a common shell in existing seas and is said to be the most widespread of the turrids. It has a double-corded peripheral keel; but other sculptural features are quite variable. A coarsely sculptured form lives in Fiji today, occurs in the late Tertiary there and in somewhat younger rocks in Guam and the New Hebrides.

Measurements of the figured specimens: Pl. 18, figs. 23, 24, an unusually large coarsely sculptured variety from the New Hebrides, USNM 308120, length 80.0 mm, diameter 23.2 mm; pl. 19, fig. 1, a latex cast of a mold from Fiji, USNM 175097, length 49 mm, diameter 17 mm.

Occurrence.—In the late Tertiary of Viti Levu, Fiji (station X75). Incomplete molds from the Pliocene and Pleistocene Mariana Limestone of Guam (station 20608 and 20611) probably represent this species. Other fossil occurrences, according to Powell (1964, p. 306), Vlerk (1931, p. 219), and Abrard (1946, p. 87), include the late(?) Miocene, the Pliocene and Quaternary of Indonesia, and the Pliocene of Malekula in the New Hebrides. The species lives today from the Red Sea to Polynesia.

Lophiotoma (Lophiotoma) eniwetokensis Ladd, n. sp.

Plate 19, figures 2, 3

Shell small, slender, biconic. Protoconch incomplete but apparently consisting of smooth convex whorls. Spire flat-sided, nine whorls, its height exceeding that of the aperture and canal combined. Sculpture consists of a double sinus rib with a slightly scalloped crest; double rib lies below the middle of the whorl; a prominent spiral cords lies immediately below the suture, and there are fine spiral threads above, below, and between the larger spirals; on the base and neck are a dozen spiral cords and included secondary threads.

Measurements of the holotype, USNM 214309: height 24.6 mm, diameter 8.1 mm.

L. eniwetokensis bears a general resemblance to *L. polytropa* (Helbling) (see Powell, 1964, p. 313, pl. 244), a much larger Holocene species from the southwest Pacific (Philippines, Moluccas, New Hebrides) but is more slender and has a flatter spire, and the double sinus rib of the fossil has a scalloped profile, not seen on today's shells.

Occurrence.—Holotype and only specimen from

drill hole F–1, Eniwetok, at depth of 890–900 feet (270–273 m); age, early Miocene (Tertiary *f*).

Lophiotoma (Lophiotoma) cf. L leucotropis (Adams and Reeve)

Plate 19, figures 4, 5

Lophiotoma cf. *L. leucotropis* (Adams and Reeve), MacNeil, 1960, U.S. Geol. Survey, Prof. Paper 339, p. 100, pl. 5, figs. 8, 9.

A single incomplete shell from the Pliocene marls at station C2026, Viti Levu, Fiji, is probably conspecific with the shell figured by MacNeil from the Miocene Yonabaru Clay on Okinawa. The narrow double peripheral keel of the Fijian shell shows more evidence of gemmulation on the earlier whorls than does the shell from Okinawa, and on its base the primary spirals are more uniformly spaced.

Measurements of the figured specimen, USNM 214308: height (incomplete) 20.6 mm, diameter 9.1 mm.

Subgenus LOPHIOTURRIS Powell

Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 311.

Type (by original designation).—*Turris indica* Röding.

Lophiotoma (Lophioturris) indica (Roding)

Plate 18, figures 25, 26

Turris indica Röding, 1798, Mus. Boltenianum, v. 2, p. 124.
Pleurotoma marmorata Lamarck, 1822, Histoire nat. animaux sans vertebres, v. 7, p. 95.
Lophiotoma marmorata (Lamarck), MacNeil, 1960, U.S. Geol. Survey Prof. Paper 339, p. 101, pl. 14, figs. 17–18.
Lophiotoma indica (Röding), Powell, 1964, Indo-Pacific Mollusca, v. 1, no. 5, p. 311, pl. 75, figs. 2, 3, 9, 16; pl. 242 (see for additional references); Cernohorsky, 1972. Marine shells of the Pacific, v. 2, p. 184, pl. 53, fig. 4.

L. indica, type of the subgenus *Lophioturris*, has a paucispiral, smooth, rounded protoconch, and the whorls of the spire have a conspicuous angular keel near or below the midpoint.

Measurements of the figured specimen from the New Hebrides: length 43.9 mm, diameter 13.3 mm. A specimen from Fiji, USNM 175098, measures: length 41.0 mm, diameter 12.6 mm.

Occurrence.—One specimen from station 817, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*). This species is the most abundant turrid in the Pleistocene marls on the Kere River, Santo, New Hebrides. Powell cited fossil occurrences from Miocene and later sediments from several areas in Indonesia and the Neogene of the Philippine Islands, but he expressed the feeling that the specimens so reported should be reexamined. The species lives today from Ceylon eastward to Fiji and northward to Japan.

Genus TURRIS Roding

Röding, 1798, Mus. Boltenianum, Hamburg, v. 2, p. 123.

Type (by subsequent designation, Dall, 1909, U.S. Geol. Survey, Prof. Paper 59, p. 24).—*Murex babylonius* Linnaeus. Holocene, Indo-Pacific.

Turris crispa crispa (Lamarck)

Plate 19, figures 6, 7

Pleurotoma crispa Lamarck, 1816, Encyclopédique et Méthodique, pl. 459, fig. 4, Le liste p. 8.
Turris crispa crispa (Lamarck), Powell, 1964, Indo-Pacific Mollusca v. 1, no. 5, p. 330, pl. 181, figs. 9–12; Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 182, pl. 53, fig. 2.

A large shell with high spire and long, nearly straight siphonal canal. Whorls covered with growth lines that are particularly scabrous below the primary cords that form the peripheral keel.

Measurements of the figured specimen, USNM 175100: length 77.5 mm, diameter 17.8 mm.

Occurrence.—Seven specimens from the Pleistocene marls of Santo (station SM242), New Hebrides. The specimen lives today in many parts of the western Pacific, from Fiji to the China coast, and in the Indian Ocean as far west as Madagascar. Cossmann (1900, p. 28) recorded *Pleurotoma* cf. *crispa* from the Pliocene of southern India, but, as Powell pointed out, this may be a distinct subspecies.

Genus COMITAS Finlay

Finlay, 1926, New Zealand Inst. Trans., v. 56, p. 251.

Type (by original designation).—*Surcula oamaruica* Suter. Miocene, New Zealand.

Comitas aff. C. kamakurana (Pilsbry)

Plate 20, figures 1, 2

Numerous fossil shells of a species of *Comitas* from the Pleistocene of the New Hebrides appear to be closely related to *C. kamakurana* (Pilsbry), a Holocene species in Japanese waters (Pilsbry, 1895, p. 16, pl. 2, figs. 15, 16). The fossils have a proportionately shorter aperture and lack clear traces of the color pattern of the living shells (dull brown with a lighter peripheral band). The figured specimen, USNM 214273, measures: height 52.7 mm, length of aperture 22.0 mm, diameter 15.3 mm.

Occurrence.—More than a dozen specimens from the Pleistocene marls at USGS locality 25715 and station SM242 on the Kere River, Santo, New Hebrides. *C. kamakurana*, to which the fossils seem to be affiliated, lives today off Japan in depths of 10–100 m (Kuroda and others, 1971, p. 219).

Comitas nausorensis Ladd, n. sp.

Plate 20, figs. 3–6; plate 21, figs. 1, 2

Medium in size, fusiform, slender. Protoconch consisting of 2½ smooth convex whorls, followed by nine sculptured whorls. Spire about equal to aperture and canal combined; aperture narrow, anterior canal only slightly recurved. Sculpture consisting of a row of small, elongate, and slightly curved subsutural nodes and, close to the base of each whorl, a row of larger, more widely spaced peripheral nodes. Peripheral nodes overridden by three to five strong spiral ribs. Base covered by close-set spirals, which are coarser above, where they may alternate with finer spirals; on the neck, the spirals are beaded. Peripheral nodes become obsolete on the body whorls of larger shells. On the smooth area between the two rows of nodes, fine lines indicate a broad arcuate sinus; sinus sharply rounded below the suture, thence sweeping forward in a broad curve over the remainder of the whorl.

Measurements of the types (holotype and paratypes A and B are figured): holotype, USNM 214314: height 28.9 mm, aperture and canal 14.9 mm, diameter 9.9 mm; paratype A, USNM 214275: height (incomplete) 37.5 mm, diameter 14.7 mm; paratype B, USNM 214276: height (incomplete) 31.3 mm., diameter 15.4 mm; paratype C, USNM 214316: height 30.4 mm, aperture and canal 14.8 mm, diameter 10.1 mm.

C. nausorensis seems most closely related to *C. erica* (Thiele), a Holocene species living off Sumatra at a depth of 350 m, but that species (Powell, 1969, p. 284, pl. 266, fig. 2) is much smaller, and on the whorls of its spire, the spirals that appear on the peripheral nodes are not recognizable in the depressions between the nodes.

C. nausorensis is also related to the shell described by MacNeil (1960, p. 106, pl. 9, fig. 17) as *Paracomitas rodgersi* from the upper Tertiary of Okinawa, but that species (possibly not a *Paracomitas*, according to Powell, 1969, p. 296, pl. 233, fig. 2), is less slender, has weaker spiral sculpture on the base, and has subsutural nodes only on the juvenile whorls.

Occurrence.—Five shells from station C2026, near Nausori, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Comitas waluensis Ladd, n. sp.

Plate 20, figures 7–9

Medium in size, slender, pagodiform with a strongly noded carina low on the whorl. Protoconch not preserved; spire consisting of about eight whorls. Sinus rounded below suture, sweeping forward in a broad curve below. Sculpture consisting of strong nodes on a peripheral carina, about a dozen on the body whorl, and spirals that are weak above the periphery; strong over the noded periphery and the area below; on the body whorl, the strong spirals cover the entire base. Aperture elongate-oval, extended as a narrow anterior canal.

Measurements of the types: holotype, USNM 214262: height 33.7 mm, diameter 15.9 mm; paratype, USNM 214265: height 30.8 mm, diameter 16.8 mm.

The unique feature of *C. waluensis* is the belt of strong spiral ribs that override the prominent nodes of the carina. It closely resembles *C. nausorensis*, described above, but lacks the subsutural nodes that characterize that species. The absence of subsutural nodes also differentiates it from *Paracomitas rodgersi* MacNeil (1960, p. 106, pl. 9, fig. 17) from the late Tertiary of Okinawa.

Occurrence.—Six shells from station C497, Walu Bay, Suva, Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Comitas sp. A.

Plate 20, figures 12, 13

A single incomplete shell from station C497, Viti Levu, Fiji, resembles other turrids from the area but is probably a distinct species. A specific name is withheld pending the recovery of a more complete shell. The incomplete specimen, USNM 214336, measures: height 18.7 mm, diameter 10.0 mm.

Comitas sp. A differs from *C. waluensis* (described above) that occurs with it in having a row of small but regularly spaced subsutural nodes. *Comitas nausorensis* n. sp. that occurs in somewhat younger beds in the same area has subsutural nodes, but they are axially elongated, and the shell is more slender than that of *Comitas* sp. A.

Occurrence.—Station C497, Walu Bay, Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Genus LEUCOSYRINX Dall

Dall, 1889, Harvard Coll. Mus. Comparative Zoology Bull., v. 18, no. 29, pt. 2, p. 75.

Type (by original designation).—*Pleurotoma verrilli* Dall. Holocene, Caribbean.

Leucosyrinx fijiensis Ladd, n. sp.

Plate 20, figures 14, 15

Medium in size, slender, fusiform. Protoconch not preserved; whorls of spire with a strong median keel-like projection composed of rounded nodes that are inclined to the right; nine nodes on penultimate whorl, nodes becoming inconspicuous on the body

whorl. Above the peripheral nodes, the surface is smooth except for faint spiral cords and strongly curved lines marking the anal sinus; below the nodular periphery are four or five spiral cords; on body whorl, such cords extend over the entire base. Aperture lenticular, extended anteriorly as a short canal.

Measurements of the holotype, USNM 214299: height 24.4 mm, diameter 8.0 mm.

L. fijiensis is very closely related to *L. iwaensis* described by MacNeil (1960, p. 109, pl. 9, fig. 24) from the upper Tertiary of Okinawa but is less slender and has fewer peripheral nodes than that species; on *L. iwaensis,* the nodes are completely obsolete on the body whorl.

Occurrence.—Represented by three specimens, the holotype and one other from the Carlton Brewery outcrop (FB–13 and USGS locality 25142) and one from a nearby outcrop (C2048), Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Leucosyrinx rabbidgei Ladd, n. sp.

Plate 20, figures 10, 11

Small, very slender, with a strongly noded carina lying slightly above the midpoint of each whorl; protoconch not known; spire consisting of about seven whorls. Sinus rounded at periphery, sweeping forward in a broad curve below before reversing. Sculpture consisting of strong peripheral nodes, more than a dozen on the body whorl, that are loosely tied to a row of smaller but well-developed subsutural nodes; surface of entire shell covered by close-set rounded spiral ribs that override the peripheral nodes. Aperture elongate, extended anteriorly as a narrow canal; inner lip callused, edge of callus discrete.

Measurements of the holotype, USNM 214373: height 22.1 mm, diameter 5.6 mm.

L. rabbidgei occurs with the larger species, *Comitas waluensis,* described above, but *C. waluensis* is less slender and lacks subsutural nodes.

L. rabbidgei resembles the type of the genus, *L. verrilli* Dall, in having the entire shell covered by fine spirals, but the fossils of *L. rabbidgei* are much more slender.

This species is named for Gordon Rabbidge of Suva, owner of the artificial cut in the marls (locality C497 = FB13) on the Queen's Road across from Walu Bay. The marl bank yielded this species and many other fossil mollusks.

Occurrence.—Represented by nine shells from station C497 (= FB13) near Suva, Fiji; age, early Miocene (Tertiary *f*).

Genus CLAVOSURCULA Schepman

Schepman, 1913, Siboga-Expeditie Mon. 49e, pt. 5, p. 429.

Type (by monotypy).—*Clavosurcula sibogae* Schepman. Holocene, Indonesia.

Clavosurcula? briggsi Ladd, n. sp.

Plate 20, figures 16, 17

Shell small, biconic; spire gently convex, made up of about eight whorls; suture lightly impressed; aperture lenticular, longer than spire, extended anteriorly as a short canal; outer lip thin, inner lip callused. Sculpture consisting of a prominent subsutural groove and coarse spiral striae on the lower half of the body whorl; close-set axial growth lines show a deep sinus below the suture and are then reversed in a broad curve.

Measurements of the holotype, USNM 214232: height 14.7 mm, diameter 7.3 mm.

The Fijian fossils resemble the Holocene *C. sibogae* Schepman in some features, but the fossils are smaller, have a much shorter anterior canal, and lack a keel and the spiral striae that are present on the upper part of the whorl on that specimen.

The species is named for Dr. William M. Briggs, Jr., who collected the holotype and many other fossils in Fiji in 1962.

Occurrence.—Holotype from station FB–7 on the south side of Walu Bay, Viti Levu, Fiji; three other specimens from C497 across Walu Bay; age of all specimens, early Miocene (Tertiary *f*). The only other member of the genus *Clavosurcula* is the genotype, a single shell dredged in Indonesia at a depth of 794 m (2,600 ft) (Schepman 1913, p. 429).

Genus CLATHRODRILLIA Dall

Dall, 1918, U.S. Natl. Mus. Proc., v. 54, no. 2238, p. 317.

Type (by original designation).—*Pleurotoma gibbosa* Reeve. Holocene, West Indies.

Clathrodrillia kerensis Ladd, n. sp.

Plate 21, figures 3, 4

Medium in size, fusiform, with a high turreted spire. Protoconch not preserved; sculpture consisting of numerous slightly sigmoid axial folds (15 on penultimate whorl) that extend from suture to suture and are crossed by close-set axial threads; surface of whorl concave between suture and shoulder; on the body whorl, behind the aperture, a large rounded varix is extended at an angle to the axis of the spire; aperture lenticular, outer lip thin and flaring; inner lip heavily callused. Anterior canal short, truncated; posterior sinus deep, extending to the edge of the varix.

The single shell retains blotches of yellowish brown that are most conspicuous on the low areas between ribs near the suture and on the varix.

Measurements of the holotype, USNM 308122: length 32.0 mm, diameter 13.6 mm.

C. kerensis resembles *C. flavidula* (Lamarck), a species living off Japan and the Philippines, but that species is larger, proportionately longer, and has a less conspicuous hump on the body whorl.

Occurrence.—Pleistocene outcrop on the Kere River (SM242), Santo, New Hebrides.

Genus CRASSISPIRA Swainson

Swainson, 1840, Treatise on malacology, p. 152, 313.

Type (by subsequent designation, Herrmannsen, 1847, Indicis generum malacozoorum, v. 1, p. 318). —*Pleurotoma bottae* Valenciennes (Kiener). Holocene, Gulf of California.

Crassispira macneili Ladd, n. sp.

Plate 21, figures 5, 6

Medium in size, slender, fusiform; protoconch not preserved; spire consisting of 10 convex whorls; suture appressed; subsutural collar fairly well developed; below are nodular subequal axial ribs inclined to the right; 9 or 10 on penultimate whorl. Aperture lenticular, extended anteriorly as a short canal. Anal sinus sharply angled, moderately deep. Faint spiral threads that can be distinguished only under magnification over most of the shell become clearly visible on the lower part of the body whorl.

Measurements of the holotype, USNM 214296: height 30.3 mm, diameter 9.5 mm.

C. macneili is most closely related to *C. hataii* described from the Miocene of Okinawa (MacNeil, 1960, p. 112, pl. 5, fig. 30, pl. 6, fig. 1), but that species has more sharply elevated spirals and a more distinctly marked subsutural collar. *C. macneili* also resembles *C. rufovaricosa* Kuroda and Oyama (Kuroda and others, 1971, p. 217, pl. 56, fig. 13, pl. 110, fig. 12), a Holocene species from Japanese waters, but *C. rufovaricosa* has recognizable varices and more numerous axial ribs.

This species is named for F. Stearns MacNeil, who reported on the varied assemblage of turrids in the Cenozoic rocks of Okinawa.

Occurrence.—Holotype and 16 other shells from station C2026 and one shell from station C2021, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus INQUISITOR Hedley

Hedley, 1918, Royal Soc. New South Wales Jour., v. 51, p. M79.

Type (by original designation).—*Pleurotoma sterrha* Watson. Holocene, Australia.

Inquisitor walleri Ladd, n. sp.

Plate 21, figures 7–10

Medium in size with a high spire composed of eight convex whorls, the early ones slightly shouldered. Protoconch consisting of about three convex whorls, the last with close-set oblique axials, discernible only under high magnification. Adult sculpture of strong, slightly oblique axials that are overridden by spiral cords. Suture deep, the subsutural area flattened or slightly concave and finely threaded; aperture elongate, outer lip thin, sinus shallow, inner lip thinly callused; anterior canal short, wide, and abruptly truncated.

Measurements of the types: holotype from USGS locality 25715, USNM 214362: length 23.1 mm, diameter 7.4 mm; paratype, station SM242, USNM 308123: length 18.3 mm, diameter 6.4 mm.

I have not been able to find a close relative of *I. walleri,* though it bears a general resemblance to many living and fossil forms.

The species is named for Dr. Thomas Waller of the Smithsonian Institution, who, in 1974, organized a collecting trip to the New Hebrides.

Occurrence.—Two specimens from the Kere River Pleistocene beds.

Genus AGATHOTOMA Cossmann

Cossmann, 1899, Revue critique de paléozoologie, v. 3, no. 1, p. 45, nom. nov. pro, *Ditoma,* Bellardi, 1877, Mem. Royal Accad. Sci. Torino, ser. 2, v. 29, p. 295.

Type (by monotypy).—*Mangelia angusta* (Jan), Bellardi. Pliocene, Italy.

Agathotoma vanualevensis Ladd, n. sp.

Plate 21, figures 11–15

Medium in size, ovate-fusiform. Protoconch consisting of 2½ smooth, gently convex whorls followed by eight shouldered whorls. Sculpture consisting of strong twisted axials (13 on penultimate whorl); axials extend from suture to suture and are roughly aligned from whorl to whorl; axials become obsolete only near the anterior end of the shell; axials overridden by closely spaced spiral threads; traces of secondary threads can be seen under magnification, and the primary threads are distinctly finer over the upper third of each whorl. Outer lip with a prominent varix, inner lip heavily callused, margin of callus elevated. Subsutural sinus deep and broadly U-shaped. Holotype, USNM 216317: height 25.2 mm, diameter 10.4 mm; paratype, USNM 216318 (smaller shell with protoconch preserved): height 17.3 mm, diameter 6.5 mm.

A. vanualevensis is most closely related to *A. aethra* (Dall), a small Holocene species dredged off Lower California in 26½ fathoms of water (Dall, 1919, p. 57, pl. 18, fig. 6), but that species has fewer and straighter axials and coarser spiral sculpture. The sculpture of the fossil superficially resembles that of another Lower California Holocene species described by Dall (1919, p. 13, pl. 1, fig. 3), *Elaeocyma aerope,* but that species has fewer and less twisted axials and has no varix.

Occurrence.—Represented by 11 specimens from the richly fossiliferous Pliocene marls exposed in the roadcut at station 817, Vanua Levu, Fiji.

Genus GURALEUS Hedley

Hedley, 1918. Royal Soc. New South Wales Jour., v. 51, p. M79.

Type (by original designation).—*Mangelia picta* Adams and Angas. Holocene, Australia.

Guraleus vitilevensis Ladd, n. sp.

Plate 21, figures 16, 17

Shell small, thin, fusiform, with a strong peripheral keel that lies below the midpoint. Protoconch consisting of two convex whorls followed by a third whorl, likewise convex, that bears close-set oblique axials. Teleoconch has about five whorls with strong axial ribs (10 on penultimate), that extend from suture to suture and are aligned from whorl to whorl. Length of body whorl less than that of remainder of shell. Peripheral keel beaded where crossed by axial ribs; fine spirals are present on the body whorl. Aperture elongate, constricted anteriorly to a spoutlike canal; margin of outer lip not preserved. Sinus broad and shallow, occuping most of the slope above the peripheral keel.

Measurements of the holotype, USNM 214341: length 7.0 mm, diameter 3.1 mm.

G. vitilevensis does not seem to be closely related to other fossil species that have been described from Australia (Powell, 1944). The Fiji shell appears to be most closely related to *G. formosus* from the Pleistocene of the New Hebrides, described in the present paper.

Occurrence.—One nearly complete shell from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Guraleus fijiensis Ladd, n. sp.

Plate 21, figures 18, 19

Shell small, fusiform with a strong peripheral keel that lies above the midpoint of the whorl. Protoconch consisting of two smooth convex whorls followed by a third convex whorl that bears close-set oblique axials. Teleoconch made up of about 6 whorls with strong axial ribs, 10 on penultimate, that extend from suture to suture and are aligned from whorl to whorl. Axial ribs sharply elevated from the base of the whorl to the periphery, there dropping sharply in elevation as they cross a narrow flattened area to the suture. Length of body whorl exceeding that of the remainder of the shell. Fine spiral striae cover areas below the periphery and are coarsest on the base. Aperture elongate, constricted anteriorly; inner lip lightly callused.

Measurements of the holotype, USNM 214352: height 10.5 mm, diameter 3.7 mm.

G. fijiensis is larger than *G. vitilevensis* that occurs with it; it has more numerous whorls, more sharply elevated axial ribs, and a proportionately longer body whorl.

Occurrence.—Holotype and only specimen from station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Guraleus formosus Ladd, n. sp.

Plate 21, figures 20–22

Small, thin fusiform, length of body whorl exceeding that of remainder of shell. Protoconch made up of about 2½ smooth, slightly convex whorls followed by a more strongly convex whorl with oblique axial ribs. Spire of 5½ whorls with oblique axial ribs (about a dozen on the penultimate) that extend from suture to suture and are aligned from whorl to whorl. A weak peripheral keel lies above the midpoint of each whorl and a slight beading effect is developed where it crosses the axials; elsewhere spiral sculpture is absent except for a few weak riblets on the base. Aperture long and slightly sinuous, margin of outer lip thin and bladelike, anterior canal short, straight. Sinus deep, lying above the peripheral keel.

Measurements of the holotype, USNM 214353 (USGS locality 25715). length 12.4 mm, diameter 4.5 mm.

Superficially resembles *G. vitilevensis* and *G. fijiensis* already described, but there are many differences: *G. formosus* has a proportionately longer body whorl, a weaker peripheral keel, more oblique axial ribs, a deeper sinus.

Occurrence.—More than a dozen specimens from the Pleistocene beds cropping out on the Kere River, Santo, New Hebrides.

Genus ITHYCYTHARA Woodring

Woodring, 1928, Carnegie Inst. Washington Pub. 385, p. 168.

Type (by original designation).—*Mangilia psila* Busch. Holocene, southeast coast of the United States.

Ithycythara lata Ladd, n. sp.

Plate 22, figures 1–3

Shell small, biconic, robust. Protoconch poorly preserved but apparently consisting of two to three whorls, followed by five strongly ribbed whorls that make up the teleoconch; each whorl with five strong axial ribs that are aligned from whorl to whorl and bear a median projection, best defined on the body whorl and the penultimate; spiral sculpture limited to a few weak cords on the base. Aperture elongate-rectangular, anal canal long and narrow, ending in a bulbous enlargement; outer lip varicose.

Measurements of the two types (only specimens): holotype, USNM 308124: height 7.9 mm, diameter 4.3 mm; paratype, USNM 214356: height 5.0 mm, diameter 2.5 mm.

I. lata is characterized particularly by its wide apical angle and a body whorl that is slightly flattened in the plane of the aperture.

The New Hebrides occurrence extends the geographic range of *Ithycythara*. The genus has previously been known in the Pacific only by a single species, *I. penelope* (Dall), off the coast of Lower California (Dall, 1919, p. 80, pl. 24, fig. 19). Woodring (1970, p. 391) has summarized the occurrence of the genus in eastern America and the Caribbean.

Occurrence.—Holotype from station SM242 on the Kere River; paratype from USGS station 25731 on the Navaka River, Santo, New Hebrides; age, Pleistocene.

Genus EUCLATHURELLA Woodring

Woodring, 1928, Carnegie Inst. Washington Pub. 385, p. 187.

Type (by original designation).—*Clathurella vendryesianus* Dall. Miocene, Jamaica.

Euclathurella santoensis Ladd

Plate 22, figures 4–7

Euclathurella santoensis Ladd, 1976, Nautilus, v. 90, no. 4, p. 134, figs. 27–30.

This species is placed provisionally in the genus *Euclathurella*. The holotype, USNM 214337, measures: height 14.0 mm, diameter 4.9 mm. It is one of four shells collected from the Pleistocene beds on the Kere River (USGS locality 25718), Santo, New Hebrides.

Euclathurella? sp. A.

Plate 22, figures 8–10

Small and slender; the protoconch is missing from the only specimen, and the generic reference is questioned. Sculpture consisting of broad axial ribs overridden by fine rounded spirals that are weaker in the subsutural band. Outer lip with a thin edge backed by a stout varix and callused within both anteriorly and posteriorly. Anal sinus moderately deep and callused.

Measurements of the figured specimen, USNM 214338: height 12.3 mm, diameter 4.3 mm.

The shell resembles *E. fimbria* described by MacNeil (1960, p. 117, pl. 15, fig. 2) from the Pliocene of Okinawa, but the smaller Fijian fossil has stronger axials and a proportionately shorter aperture.

Occurrence.—Single incomplete shell from the fossiliferous marls of station 817, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus EUCITHARA Fischer

Fischer, 1883, Manuel Conchyliologie, p. 593.

Type (by monotypy).—*Mangelia stromboides* Reeve. Holocene, Indo-Pacific.

Eucithara stromboides (Reeve)

Plate 22, figure 11

Mangelia stromboides Reeve, 1846, Zool. Soc. London Proc., p. 63.

Eucithara stromboides (Reeve), Cernohorsky, 1972, Marine shells of the Pacific, v. 2, p. 186, pl. 54, fig. 1.

A single example of the type species of *Eucithara* was collected from the island of Maewo in the New Hebrides. The shell, USNM 214357, measures: height 14.8 mm, diameter 5.8 mm.; age, probably Pleistocene. The species lives today throughout much of the Indo-Pacific—from Fiji to the Red Sea.

Eucithara sawitrae (Beets)

Plate 22, figures 12–14

Cythara (Cythara) sawitrae Beets, 1941, Geol.-Mijnb. Genoot Nederland en Kolonien Verh, Geol. Ser., v. 13, pt. 1, p. 130, pl. 7, figs. 282, 283.

Two shells from Palau probably represent Beets' species from East Borneo, though the Palau shells are smaller and are less strongly turreted. The figured specimen, USNM 214376, measures: length 3.9 mm, diameter 1.6 mm.

Occurrence.—USGS locality 21304, in the marls at the base of the Palau Limestone on Goikul Peninsula, Babelthuap, Palau; age, late Miocene (Tertiary *g*). Beets described the species from a comparable horizon in East Borneo.

Eucithara marshallensis Ladd, n. sp.

Plate 22, figures 15–19

Shell small, robust, biconic; protoconch of about three whorls, the first two smooth, the last with close-set arcuate axials. Sculpture consisting of

heavy axial folds (7–10 on body whorl) overridden by regularly spaced spiral cords. Aperture narrowly rectangular, its length equaling that of the spire; anterior canal short, subsutural sinus deep and rounded; inner and outer lips denticulate; outer lip with a prominent varix.

Measurements of the types: Holotype, USNM 214382, F–1, Eniwetok, 690–700 ft (209–212 m), height 6.4 mm, diameter 2.9 mm; paratype A, USNM 214383, F–1, Eniwetok, 790–800 ft (239–242 m), height 5.1 mm, diameter 2.1 mm; and paratype B, USNM 214384, 2A, Bikini, 852–857 ft (258–259 m), height 6.4 mm, diameter 2.5 mm.

E. marshallensis seems most closely related to *E. sawitrae* (Beets) from the upper Miocene of East Borneo, but that species has narrower and more numerous axial folds.

Occurrence.—Many specimens from deep drill holes on Eniwetok and Bikini in the Marshall Islands from Miocene beds (Tertiary *f* and *g*).

Genus ETREMA Hedley

Hedley, 1918, Royal Soc. New South Wales Jour., v. 51, p. M79.

Type (by orginal designation).—*Glyphostoma aliciae* Melvill and Standen Holocene, Australia.

Etrema palauensis Ladd, n. sp.

Plate 23, figures 1–3

Small, biconic, body whorl longer than remainder of shell. Protoconch of two convex whorls, teleoconch of 4½ evenly convex whorls. Sculpture consisting of strong axials that extend from suture to suture and over the base. Axials overridden by erect spirals, four on penultimate whorl; suture deep. Aperture elongate; inner lip thinly callused, and on some shells, the spirals show through as rounded denticles; outer lip denticulate within, variced, recessed above by the deep U-shaped anal sinus that is heavily callused; balance of outer lip extended to a thin margin. Anterior canal short, obliquely truncated.

Measurements of the holotype, USNM 214374: height 3.6 mm, diameter 1.5 mm.

E. palauensis is one of the smallest of the numerous species assigned to *Etrema*. It strongly resembles *E. royi* (Sowerby) (1913, p. 235, pl. 3, fig. 6), a Holocene species from Japan, but is less strongly shouldered and is more delicately sculptured.

Occurrence.—Abundant in the marls that underlie the Palau Limestone on the Goikul Peninsula of Babelthuap, Palau; age, late Miocene (Tertiary *g*).

Etrema sp. A

Plate 23, figures 4–6

Medium in size, biconic, body whorl longer than remainder of shell. Protoconch incomplete, its last whorl smooth and gently convex; teleoconch of 5½ convex whorls. Sculpture consisting of strong, widely spaced axials that are aligned from whorl to whorl; axials overridden by fine spirals, four on penultimate, that alternate with still finer threads; sutural area wide and shallow. Aperture lenticular; inner lip callused, outer lip backed by a varix but extended to a thin edge. Anal sinus deep, U-shaped, and heavily callused; anterior canal short, obliquely truncated.

Measurements of the figured specimen, USNM 214375: height 6.9 mm, diameter 3.0 mm.

This Pliocene fossil resembles the much smaller Miocene species, *E. palauensis*, described above, but sculptural differences and apertural features indicate that the two are distinct. *Etrema* sp. A is represented only by a single incomplete shell, and a name is withheld.

Occurrence.—Station MR20, Viti Levu, Fiji; age, Pliocene (Tertiary *h*).

Genus EUBELA Dall

Dall, 1899, Harvard Coll., Mus. Comp. Zoology Bull., v. 18, p. 102.

Type (by original designation).—*Pleurotoma (Bela) limacina* Dall, Holocene, western Atlantic.

The genus includes widely scattered deep-water species characterized particularly by a subsutural row of strong rounded beads.

Eubela woodrowi Ladd, n. sp.

Plate 23, figures 7, 8

Shell small, smooth, glossy, biconic. Protoconch consisting of three slightly convex whorls, the upper half of each whorl with arcuate axials, the lower half sharply reticulated. The four postnuclear whorls nearly flat with a distinct shoulder, accentuated by a row of regularly spaced rounded subsutural tubercles; aperture incomplete; outer lip thin.

Measurements of the holotype, USNM 175093; height 4.8 mm, diameter 2.4 mm.

The species is represented by six incomplete specimens. The holotype may be immature, but preservation is excellent, and the species appears to be distinct from others assigned to this unusual genus. In general shape and proportion and the sculpture of the protoconch, *E. woodrowi* resembles *E. limacina* Dall, type of the genus, that lives in the deep

waters of the western Atlantic, but the fossil has a stronger shoulder and a somewhat wider apical angle than the living species. *E. hormophora* (Watson) (1886, p. 351, pl. 21, fig. 9) from 450 fathoms (823 m) in the West Indies has a protoconch similar to that of the Fijian shells, but the shoulder and the subsutural tubercles are weaker than those in the fossils.

As noted by Powell (1942, p. 165), Thiele (1925, p. 253–254, pl. 29) described several abyssal species of *Eubela* from East and South African localities, but Thiele's figures show that all lack the strong shoulder of the Fijian shell.

E. woodrowi from Fiji seems closely related to *E. monile* described by Marwick (1931, p. 146, pl. 16, figs. 310, 311) from the Hutchinsonian (lower Miocene) of New Zealand. Their sculptured protoconchs appear identical, but on the New Zealand fossil, the subsutural tubercles are set on a beveled surface and the shoulder is weaker than it is on the Fijian species.

One of the shells from station C 2026, Viti Levu, has a lower apical angle than all others. It may represent a distinct species but is incomplete.

This species is named for Peter Woodrow of the Fiji Geological Survey, who collected the type and many other fossils along the Hibiscus Highway, southeast Vanua Levu, Fiji.

Occurrence.—Holotype from station I1010, Vanua Levu, Fiji; other specimens from station C 2021 and C 2026 in Nausori area, Viti Levu; age of all shells, Pliocene (Tertiary *h*).

Genus THATCHERIA Angas

Angas, 1877, Zool. Soc. London Proc., p. 529.

Type (by monotypy).—*Thatcheria mirabilis* Angas. Holocene, Japan.

Thatcheria vitiensis Charig

Thatcheria vitiensis Charig, 1963, British Mus. (Nat. Hist.) Bull., Geology, v. 7, no. 9, p. 292, pl. 47, figs. 4–6.

This species, represented solely by the holotype in the British Museum, was fully described and illustrated by Charig, and his account is not repeated here. The unique shell was collected by R. W. Bartholomew in 1957; several subsequent attempts to find additional specimens by the writer and Fiji Survey geologists have proved unsuccessful. The locality on Vanua Levu, Fiji, north of Naweni (station VL–1–5 = H3 = C2019) is a roadcut in marls of Pliocene age (Tertiary *h*). The cut is now heavily overgrown.

Genus CLINURA A. Bellardi

Bellardi, A., 1875, Soc. Malacol. Italiana Boll., Pisa, v. 1, p. 20.

Type (by subsequent designation, Bellardi, L., 1877, R. Accad. Sci. Torino Mem. ser. 2, v. 29, p. 204).—*Murex calliope* Brocchi. Late Miocene and early Pliocene, Italy and France.

Clinura? fijiensis Ladd, n. sp.

Plate 23, figures 9–12

Medium in size, slender, fusiform; protoconch unknown; teleoconch pagodiform, made up of about six whorls, each with a submedian carina bearing prominent knobs; below the carina are two strong spiral ribs, the upper one reflecting the knobs of the carina; spiral ribs continued over the base; above the carina, the surface is smooth, except for growth lines; and slightly concave. Aperture narrowly lenticular, extended anteriorly as a moderately long canal; inner lip thinly callused. Sinus rounded below the suture, curving forward below.

Measurements of the holotype, USNM 214387: length 27.0 mm, diameter 11.0 mm.

The reference to *Clinura* is questioned, as the protoconch is not preserved on the single specimen available. The Fijian shell is more slender than *C. calliope* (Brocchi), later Tertiary type of the genus in Europe and has a longer anterior canal; the carina is lower on the whorl than on the genotype.

The two strong spirals below the carina are not found on pogadiform species of *Comitas*, such as *Comitas waluensis*, already described.

Occurrence.—Station C497, Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Clinura? sp. A

Plate 24, figures 4–9

Medium in size, biconic, strongly turreted; protoconch unknown; teleoconch of five or more whorls; periphery made up of sharply elevated axials, 16 on penultimate whorl; areas below the periphery and on the base covered by fine spiral ribs that tend to alternate in size and are made slightly wavy in crossing the axials; areas above the periphery are comparatively smooth, but close to the periphery the axials cause undulations; on early whorls the axials form inconspicuous subsutural nodes; growth lines above the periphery are convex posteriorly, sweeping forward in a broad curve to the periphery below. Aperture elongate oval; anterior canal short, straight; outer lip thin, inner lip with a veneer of callus.

Measurements of the two incomplete shells: USNM 214389: length 25.5 mm, diameter 13.3 mm;

USNM 214390: length 24.0 mm, diameter 12.0 mm. The shells do not have a sharply delineated keel like that found in the type species, *C. calliope* (Brocchi) or in *C. fijiensis*, described above. The reference to the genus *Clinura* is questioned because of the lack of knowledge of the protoconch.

Occurrence.—Two shells from station C497 (= FB13), Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Clinura? sp. B

Plate 23, figures 13–15; plate 24, figures 1–3

Medium in size, biconic, apical angle 65°. Protoconch unknown; teleoconch pagodiform, consisting of about six whorls, each with a median carina bearing prominent rounded nodules; below the carina are several spirals that are larger than similar spirals on the flattened area above the carina. On the body whorl, below the periphery, is a second noded carina and below this, on the base, the spirals more prominent. Aperture broadly ovate, leading below to an extended and slightly recurved canal; inner lip lightly callused; outer lip not preserved.

Measurements of the figured specimens: USNM 214391: length 20.7 mm, diameter 11.2 mm; USNM 214392: length 20.7 mm, diameter 11.3 mm.

C.? sp. B differs from *C.? fijiensis* and *C.?* sp. A that occur with it in having a much wider apical angle, in the presence of low spiral ribs on the flattened area above the periphery, and in the presence of a second noded spiral rib on the body whorl below the periphery.

Occurrence.—Two incomplete shells from station C497, Viti Levu, Fiji; age, early Miocene (Tertiary *f*).

Family CONIDAE

Most of the fossil cones that I had identified from the islands were reviewed by Dr. Alan Kohn. His knowledge of rare species of *Conus* covers some that are known only from types in foreign museums. I am very grateful to Dr. Kohn for his assistance with many of the species that follow.

Conus aculeiformis Reeve

Plate 25, figures 1, 2

Conus aculeiformis Reeve, 1843, Zool. Soc. London Proc., p. 176; 1844, Conchologica Iconica v. 1, *Conus*, pl. 44, no. 240.

A small, slender, moderately high-spired shell covered with low flattened spiral ribs separated by finely cancellated grooves; whorls of concave spire showing four spiral ribs, the lowest one larger than the others.

Measurements of the figured fossil: length 19.5 mm, diameter 6.6 mm.

Occurrence.—Four specimens from SM242, Santo, New Hebrides; age, Pleistocene. The species lives today in the Philippines. MacNeil (1960, p. 121, pl. 6, fig. 29) compared a Miocene form from Okinawa with this species and discussed closely related species from the Pliocene of Indonesia. MacNeil's figured specimen appears to be identical with a Pliocene form from Fiji described below as a new subspecies of *C. aculeiformis*.

Conus aculeiformis mckinneyi Ladd, n. subsp.

Plate 24, figures 14–19

Conus cf. *C. aculeiformis* Reeve, MacNeil, 1960, U.S. Geol. Survey Prof. Paper 339, p. 121, pl. 6, fig. 29.

Shell medium to large in size with an elevated spire. Sculpture consisting of regularly spaced punctate spiral grooves separated by wide flat interspaces; each whorl of the flattened spire with four to six spiral ribs, of which the lowest is much larger than the others.

Measurements of the types: holotype, USNM 250136, length 39.7 mm, diameter 16.3 mm; paratype, USNM 250137, length 30.0 mm, diameter 11.8 mm.

The new subspecies is larger and stouter than Holocene and Pleistocene examples of *C. aculeiformis* Reeve, and on shells of the new subspecies, the lowest spiral on the whorls of the spire appears to be proportionately larger than on younger shells. *C. aculeiformis mckinneyi* appears to be identical with the Miocene shell from Okinawa figured by MacNeil.

The new subspecies is named for Robert H. McKinney of the Geological Survey who made all the photographs of fossils in the present report except the SEM views.

Occurrence.—Numerous shells from station 817 (= 2B107 = R70) on Vanua Levu, Fiji; age, Pliocene (Tertiary *h*).

Conus acutangulus Lamarck

Plate 25, figures 3–6

Conus acutangulus Lamarck, 1810, Mus. Histoire Nat. Paris, Ann., v. 15, p. 286; Kohn, 1959, Pacific Sci., v. 13, p. 371, pl. 2, fig. 37; Kohn and Weaver, 1962, Pacific Sci., v. 16, p. 349, fig. 1 a–b; Cernohorsky, 1964, Veliger, v. 7, no. 2, p. 66, pl. 17, fig. 54.

A single specimen from the Pleistocene marls of Santo, New Hebrides (station SM242), is referred to *C. acutangulus*. The fossil is larger than the aver-

age Holocene shells but shows well-developed nodes along the shoulder of the whorls. The figured specimen from the New Hebrides (pl. 25, figs. 5, 6) measures: length 29.7 mm, diameter 14.5 mm. A shell was also identified from the Miocene of Fiji (pl. 25, figs. 3, 4). It (USNM 214321) measures 15.5 mm in length. *C. acutangulus* lives in abundance today in the Philippines and has been collected in Hawaii and in the Society Islands. According to Vlerk (1931, p. 213), it has been reported from the upper Miocene and Pliocene in several parts of Indonesia.

Conus ammiralis Linnaeus

Plate 25, figures 7, 8

Conus ammiralis Linnaeus, 1791, Systema naturae, 13th ed., p. 3378; Reeve, 1843, Conchologica Iconica, v. 1, *Conus*, pl. 3, no. 11; Tryon, 1884, Manual conchology, v. 6, p. 29, pl. 8, figs. 44, 46.

Leptoconus ammiralis (Linnaeus), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 117. pl. 37, fig. 13.

Two Pleistocene specimens from the New Hebrides show identifiable traces of the color pattern of bands and triangles that characterizes this widespread Holocene species.

Measurements of the smaller figured specimen, USNM 250144: height 22.2 mm, diameter 11.5 mm; the incomplete larger shell is catalogued USNM 175092.

Occurrence.—Two shells from SM242 on Santo, New Hebrides; age, Pleistocene. The species ranges today from the Marshall and Society Islands westward to Japan and southwestward through the Philippines and Indonesia to the Indian Ocean. The species has not previously been reported as a fossil.

Conus cf. C. aristophanes Sowerby

Plate 25, figures 9–11

Conus pulicarius? Hwass, Ladd, 1934, B. P. Bishop Mus. Bull. 119, p. 231, pl. 41, fig. 4.

Conus cf. *C. aristophanes* Sowerby, Cernohorsky, 1964, Veliger, v. 7, no. 2, p. 92.

No additional material collected. I agree with Cernohorsky that the Fijian fossil more closely resembles *C. aristophanes* Sowerby (1857, no. 63, pl. 4, figs. 81, 82; Cernohorsky, 1964, p. 67, pl. 18, fig. 67) than *C. pulicarius* Hwass. The fossil (Bishop Mus. Geol. no. 1167) measures 26.9 by 17.4 mm; it was collected from station 160 on Viti Levu; age, early Miocene (Tertiary *f*). *C. aristophanes* is widely distributed today in the Indo-Pacific, exclusive of Hawaii.

Conus cf. C. bonus Nomura

Plate 25, figures 12, 13

A shell from the Pliocene beds at station 817 on Vanua Levu, Fiji, is closely related to, possibly identical with, *C. bonus* described by Nomura (1935, p. 110, pl. 7, figs. 7a, 7b) from the Pliocene (Boritzu) beds of Taiwan. The specimen, USNM 175123, measures: length 38.6 mm, diameter 18.5 mm.

The shell resembles *C. djarianensis* Martin from the Miocene of Java (1895, p. 20, pl. 3, figs. 45–50) and a shell affiliated with it by MacNeil (1960, p. 121, pl. 6, figs. 17, 22) from the Miocene of Okinawa, but it is more slender and there are differences of sculpture. On the Miocene shells, the spiral sculpture is limited to the lower part of the body whorl, but on the Pliocene shells, fine spirals extend over the entire body whorl. The single Fiji shell is worn, but the spirals are clearly marked on the inner lip and under magnification can be seen elsewhere.

Conus cf. C. catus Hwass

Plate 25, figures 14, 15

A single somewhat worn shell from the Pleistocene beds at USGS locality 25715 on the Kere River, Santo, New Hebrides, has the proportions and sculpture of *C. catus*, and traces of original color on the spire are similar to patterns of *C. catus*. On the body whorl, however, are spiral lines of reddish-brown dashes, a pattern not found on any of the shells in the large USNM collections—collections that, however, do not include any shells from the New Hebrides. Cernohorsky (1964, p. 70) reported such a pattern in his discussion of this variable species. The figured fossil, USNM 214311, measures: length 25.6 mm, diameter 16.3 mm.

Conus charigi Ladd, n. sp.

Plate 25, figures 16–21

Shell small, stout, with a strongly coronated spire of medium height; body whorl with strongly tubercled, rather widely spaced spiral ribs; tubercles of each spiral are imperfectly aligned with those above and below over much of the shell.

Measurements of the holotype, British Museum (Natural History) No. GG. 9145: length 30.6 mm, diameter 14.0 mm; a paratype, USNM 250168: length 16.7 mm, diameter 9.8 mm.

In general form and size, *C. charigi* suggests the granulated form of *C. boeticus* Reeve, a species living in Indonesia and the Moluccas (Coomans, 1973, p. 322–323), but the fossil is more strongly coronated and the spiral lines of tubercles on the body whorl are larger and more widely spaced.

C. charigi resembles strongly coronated shells of the variable living species, *C. sulcatus* Hwass, but the fossil has much better developed tubercles on the body whorl and the spirals are more widely spaced and are in a single series. *C. deburghiae* Sowerby (1887, p. 2, pl. 1, fig. 7), a living species from Indonesia and the Moluccas, has a granulated form, but it is larger and more slender than *C. charigi*.

The species is named for Dr. Alan Jack Charig of the British Museum (Natural History), who first examined the fossil collected by Ronald Bartholomew, recognizing it as a coarsely tubercled undescribed form.

Occurrence.—Holotype from station RB44, Viti Levu, Fiji; age, probably Pliocene (Tertiary *h*). Figured paratype and two other shells from station 160 on Viti Levu; age, early Miocene (Tertiary *f*). The figured paratype and one of the two shells with it are small; the other is as large as the holotype but is incomplete.

Conus cf. C. coelinae Crosse

Plate 26, figures 1, 2

Shell large, slender, and flat spired, characterized particularly by fine spiral threads that cover the entire body whorl except for a narrow band at the shoulder.

Measurements of the figured specimen: length 58.2 mm, diameter 29.0 mm.

The fossils may actually represent *C. coelinae* Crosse (1858, p. 117, pl. 2, fig. 1) but are narrower and have a lower spire.

Occurrence.—Two specimens from Pleistocene marls of station SM242 on Santo, New Hebrides. *C. coelinae* has been described from New Caledonia.

Conus corrugatus Sowerby

Plate 26, figures 3, 4

Conus corrugatus Sowerby, 1870, Zool. Soc. London Proc., p. 257, pl. 22, fig. 7; Tryon, 1884, Manual conchology, v. 6, p. 78, pl. 24, fig. 19.

Shell small with a moderately high flat-sided spire and sharp apex; whorls of the spire with a rounded basal rib and weak spiral threads above, all crossed by close-set, retracted lines of growth; body whorl narrowed anteriorly, covered by flattened spiral ribs; outer lip sharp; color pattern consisting of irregular reddish-brown axial stripes over the entire shell.

Measurements of the figured sepcimen: length 30.8 mm, diameter 15.6 mm.

Identification of this species was made by Dr. Alan Kohn, who had examined and photographed the type in the British Museum.

Occurrence.—Five specimens from the Pleistocene marls of station SM242, Santo, New Hebrides. The exact locality of the holotype is unknown, but Tryon received a specimen from Sowerby collected in Chinese waters.

Conus eburneus Hwass

Plate 26, figure 5

Conus eburneus Hwass, 1972, *in* Bruguière, Encyclopedie Méthodique. Histoire Nat. vers, v. 1, p. 640; Reeve, 1843, Conchologica Iconica, v. 1, *Conus*, pl. 49, no. 106; Demond, 1957, Pacific Sci., v. 11, no. 3, p. 327; Kohn, 1968, Linnean Soc. Jour. (Zoology), v. 47, p. 455, pl. 14, fig. 40.

A small shell recovered from a depth of more than 800 feet in a drill hole on Eniwetok seems to represent this widely distributed living species. The incomplete shell consists of the low spire and the posterior half of the body whorl; both show faded but distinct spots in the pattern that characterizes the living shells. The whorls of the spire do not show the two light grooves that are found on most Holocene shells, but such grooves are not consistent on many shells collected in the Marshall Islands. The spire of the fossil cannot be distinguished from those of Holocene shells.

Measurements of the figured specimen, USNM 175131: length (incomplete) 15 mm, diameter 16.2 mm.

Occurrence.—Drill hole F–1, Eniwetok, at depth 860–870 feet (260–263 m); age, early Miocene (Tertiary *f*). According to Vlerk (1913, p. 213), Martin reported it from the Pliocene of Timor. MacNeil (1960, p. 123, pl. 15, figs. 13, 16) figured a questionable shell from the Pliocene of Okinawa, noting that the species also occurred in the Pleistocene of Okinawa. *Conus eburneus* lives today from the western part of the Indian Ocean eastward into many Pacific island groups but is not found in Hawaii.

Conus cf. C. emaciatus Reeve

Plate 26, figures 6, 7

A shell from the outcrops on the Kere River on Santo, USNM 308129, seems closely related to Reeve's Holocene species from the Philippines. It measures: length 78.7 mm, diameter 37.1 mm.

Occurrence.—Station SM242, Kere River, Santo, New Hebrides; age, Pleistocene. *C. emaciatus* lives today in many island groups in the western Pacific.

Conus cf. C. eugrammatus Bartsch and Rehder

Plate 26, figures 8, 9

Two shells from the Pleistocene marls of station SM242 on Santo, New Hebrides, agree with *C.*

eugrammatus (Bartsch and Rehder, 1943, p. 85) in all important features. Both specimens, however, are smaller than most available shells, including the type, and the color pattern is not clearly shown (one of the fossils retains no color, the other only faint traces on the spire).

Measurements of the figured specimen: length 18.3 mm, diameter 9.3 mm.

C. eugrammatus has been collected at several stations in Hawaii. Kohn and Weaver (1962, p. 352) reported one live specimen on a mud-sand bottom 1 mile (1.6 km) south-southwest of Pearl Harbor, Oahu.

Conus excelsus Sowerby

Plate 26, figures 10, 11

Conus excelsus Sowerby, 1908, Annals and Mag. Nat. History ser. 8, v. 1, p. 465–466; Cernohorsky, 1974, Auckland Inst. and Mus. Recs., v. 11, p. 133, figs. 27, 28.

Shell large, biconic; spire acute, consisting of 18 whorls; each whorl of the spire broadly convex below, concave above with two narrow and one broad spiral ribs; the convex area below is made irregular by swollen retracted axials; remaining areas of spire covered by fine growth lines. Body whorl, except near the shoulder, covered by low beaded spiral ribs and numerous axial lines of growth; posterior end of aperture deeply notched.

Five specimens were collected: USNM 175129, collected at USGS locality 25715 on the Kere River, Santo, New Hebrides, is figured. It measures: length 83.2 mm, diameter 30.0 mm; USNM 308131 from SM242 measures: height 80.7 mm, diameter 31.5 mm.

Identification of this rare species was made by Dr. Alan Kohn who had examined and photographed the type in the British Museum. Tomlin (1937, p. 246) believed that *C. excelsus* was identical with *C. pulcherrimus*, a species named and briefly described by Brazier (1895, p. 187). As Tomlin noted, however (1937, p. 298), the name *pulcherrimus* was applied by Heilprin in 1879 to an Eocene cone from Alabama. In any event, Brazier's type speciemn is not available. An interesting aspect of the case is that the specimen was found on the beach of the island of Tanna in the New Hebrides, having reportedly been thrown up with other shells after a submarine volcanic eruption in 1878.

Occurrence.—Five specimens from the Pleistocene marls at station SM242, Santo, New Hebrides. The Holocene type of the species is reported to have come from New Caledonia. Occurs in Phillipines.

Conus figulinus Linnaeus

Plate 26, figure 12

Conus figulinus Linnaeus, 1758, Systema naturae, 10th ed. p. 715; Cernohorsky, 1964, Veliger, v. 7, no. 2, p. 74, pl. 12, fig. 14.

A large heavy shell with a low spire; apex acuminate, shoulder broadly rounded; body whorl with close-set narrow spiral lines of brown. Represented in the fossil collections by a single incomplete shell 52.2 mm in diameter from station SM242 on Santo, New Hebrides; age, Pleistocene. The species lives today in the western tropical Pacific and in parts of the Indian Ocean. Not previously reported as a fossil.

Conus cf. C. gembacanus Martin

Plate 26, figures 13–15

A small shell with a high turreted spire; body whorl covered by about 20 strongly beaded axial ribs; the row of beads at the periphery more prominent than others.

Measurements of the figured specimen, USNM 214347: length 8.2 mm, diameter 4.1 mm.

This strongly sculptured cone is smaller than the shell described by Martin (1883–87, p. 49, pl. 4, fig. 49); it has more numerous beaded spirals and a more strongly turreted spire than does that species.

Occurrence.—A single specimen from USGS locality 25731 on the Navaka River, Santo, New Hebrides; age, Pleistocene. Martin described *C. gembacanus* from the Miocene of Java.

Conus geographus Linnaeus

Conus geographus Linnaeus, 1758, Systema Naturae 10th ed., p. 718; Cernohorsky, 1964, Veliger, v. 7, p. 75, pl. 15, fig. 37.

A fragment of a large thin shell nearly 50 mm in diameter (USNM 175136) bears the unmistakable color pattern of *C. geographus*. It was collected from the Pleistocene beds on the Kere River (USGS locality 25715), Santo, New Hebrides. As Cernohorsky has pointed out, this species occurs widely in the Indo-West Pacific area but is rare and is characteristic of deeper waters.

Conus glans Hwass

Plate 26, figures 16, 17

Conus glaus Hwass, 1792, *in* Bruguière, Encyclopedie méthodique. Histoire nat. vers, v. 1, p. 735; Reeve, 1843, Conchologica Iconica, v. 1, *Conus*, pl. 26, no. 145; Ostergaard, 1935, B. P. Bishop Mus. Bull. 131, p. 23; Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 222, pl. 56, fig. 421; Kohn, 1968, Linnaean Soc. Jour. (Zoology), v. 47, p. 458, pl. 5, fig. 49.

A medium-sized cone with a rounded shoulder. Each whorl of the spire bears three fine spiral ribs,

and the body whorl is covered by close-set, weakly beaded lirations.

Represented in the fossil collections by a single shell collected from the cliff at Houma on Tongatapu, Tonga, about 35 feet (10.6 m) above sea level. The specimen, B. P. Bishop Mus. no. 202938, measures: length 31.4 mm, diameter 12.9 mm. The species lives today throughout the tropical Indo-Pacific. According to Vlerk (1931, p. 213), the species has also been reported from post-Tertiary beds in Celebes (Sulawesi).

Conus gloriamaris Chemnitz

Plate 26, figure 18

Conus gloriamaris Chemnitz, 1777, Besch. Gesell. Naturf. Freunde, Berlin, v. 3, p. 321–331; Kohn, 1964, Linnean Soc. Jour. (Zoology), v. 45, no. 304, p. 152–153, pl. 1, figs. 1, 2; Abbott, 1967, Acad. Nat. Sci. Philadelphia Notulae Naturae, no. 400, 8 p., 3 figs; Zilch, 1970, Archiv. Molluskenkunde, v. 100, p. 159–163, 1 fig., 1 pl.; Mallick and Greenbaum, 1975, New Hebrides Condominium, Geol. Survey Ann. Rept. 1973, p. 11, pl. 1. fig. 3; Cernohorsky, 1968, Hawaiian Shell News, v. 16, no. 3, p. 4.

This species has been regarded as one of the rarest and most beautiful of all living shelled mollusks and has been the subject of many special papers over the past 50 years. It was first described from a shell collected in the Philippines, but its range has been extended to Indonesia, New Guinea, and nearby islands, including the Bismarck and Solomon Islands [6] and Yap in the Carolines (Abbott, 1967, fig. 2). Until now, its expanding range has not been extended to the New Hebrides; it is, therefore, doubly interesting to record the first fossil examples from uplifted Pleistocene marls in that group. In 1973, D. I. J. Mallick and David Greenbaum of the New Hebrides Geological Survey collected and identified one complete and three incomplete shells from station SM242 on the Kere River on the island of Santo about 40 m (130 ft) above sea level. All specimens retain the original color pattern; two of them retain the characteristic high spire. The complete shell was figured by Mallick and Greenbaum (1975); it measures: 75 mm in height.

Conus gracilis Sowerby

Plate 26, figures 19, 20

Conus gracilis Sowerby, 1823, Genera Recent and fossil shells, pt. 16, pl. 267, fig. 4. (= *Conus australis* Lamarck (*ex* Chemnitz), 1810, Mus. Histoire Nat. Annales, Paris, v. 15, p. 439).

Asprella australis (Holten), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 109, pl. 39, fig. 6.

[6] A particularly rich find in the Solomons was recorded by Cross and Fair (1970).

A medium-sized high-spired species with conspicuous close-set spiral furrows. Fossils from the Pleistocene marls of Santo (station SM242) retain clear traces of the scattered discontinuous lines and patches of brown that are present on Holocene shells.

Measurements of the figured specimen: length 63.2 mm, diameter 25.5 mm.

The species lives today in the western Pacific from Australia to Japan.

Conus gracilis vouensis Ladd

Plate 27, figures 1, 2

Conus australis vouensis Ladd, 1945, B. P. Bishop Mus. Bull. 181, p. 369, pl. 53, figs. D, E.

No additional material collected. The recrystallized holotype (only specimen), USNM 252899, measures: length (incomplete) 54.7 mm, diameter 27.3 mm.

Occurrence.—Futuna Limestone, station L389, Lakemba, Fiji, age, early Miocene (Tertiary *f*).

Conus grangeri Sowerby

Plate 27, figures 3, 4

Conus grangeri Sowerby, 1900 Annals and Mag. Nat. History, ser. 7, v. 5, p. 441, fig. 5.

A large stout shell with a moderately high spire. Sculpture on the body whorl consists of strong beaded spiral ribs that alternate with weaker unbeaded spirals except near the rounded shoulder where the spirals are somewhat flattened; the shoulder itself bears broad low nodes; shoulder nodes are prominent on the whorls of the concave spire, and above the line of nodes are several secondary spirals; axial lines, present over the entire shell, are particularly conspicuous anteriorly.

Measurements of the figured specimen, USNM 175099: length 50.2 mm, diameter 31.8 mm.

C. grangeri bears a strong resemblance to *C. planiratus batheon,* a Holocene shell described by Sturany (1903, p. 227, pl. 4, figs. 6a–c, 7a–b) from the Red Sea, but the spirals on the spire and the body whorl of that species do not appear to be as strongly noded or beaded as on *C. grangeri.*

Occurrence.—One complete shell and the anterior half of another from station SM242 (USGS locality 25715), Santo, New Hebrides; age, Pleistocene. The locality of the type specimen described by Sowerby is not known, but Holocene shells have been dredged in the Philippines off Luzon at depths of 83 and 106 fathoms (USNM collections). Not previously reported as a fossil.

Conus gubernator Hwass

Plate 27, figures 5, 6

Conus gubernator Hwass, 1792, *in* Bruguière, Encyclopedie méthodique. Histoire Nat. Vers, v. 1, p. 727; Kohn, 1968, Linnean Soc. Jour. (Zoology), v. 47, p. 459, pl. 5, fig. 51.

Shell large, elongate, solid, spire moderately high, apex sharp; sides straight, shoulder distinctly angulate, its raised rim prominent on earlier whorls; inside shoulder ridge are several spiral riblets that may be locally obscured by close-set lines of growth; posterior notch of aperture deep, outer lip sharp. Surface of shell smooth except for fine spirals and equally fine lines of growth; basal ridges prominent with a sharply bounded fasciole below.

Measurements of the figured specimen: length 87.1 mm, diameter 35.7 mm.

Occurrence.—Six specimens from station SM242 on the island of Santo, New Hebrides; age, Pleistocene. Reported by Hedley (*in* Mawson, 1905, p. 478) from "passage beds" described by Mawson (1905, p. 413–414) on Epi in the New Hebrides, lying between the marine fossiliferous cinder beds and solid coralliferous limestone; the age may be late Miocene. The species lives today in New Caledonia, the Philippines, and the Indian Ocean.

Conus insculptus Kiener

Plate 27, figures 8, 9

Conus insculptus Kiener, 1850. Iconographie des coquilles vivantes, *Conus*, p. 309, pl. 49, fig. 2; Martin, 1891, Die Fossilien von Java, Bd. 1, Gastropoda, p. 14, pl. 1, fig. 18; Cernohorsky, 1964, Veliger, v. 7, no. 2, p. 76, pl. 17, figs. 55, 55a.

A small slender shell with a high, slightly concave spire; the attenuated body whorl is slightly recurved anteriorly; shoulder of all whorls with an inconspicuous carination, above which are several weak spiral ribs. Surface of body whorl with shallow cancellated grooves. On the figured specimen, the spiral grooves are present almost to the shoulder, but on most fossils from Palau, they become obsolete over the upper two-thirds of the whorl. On fossils from Java, the grooves persist almost to the shoulder, as in the figured Palauan fossil.

Measurements of the figured specimen, USNM 175125: length 19.7 mm, diameter 8.1 mm.

C. insculptus is closely related to *C. aculeiformis* Reeve, but that species is not recurved anteriorly, has stronger spirals above the shoulder, and is grooved over the entire body whorl.

Occurrence.—Abundant in marls at the base of the Palau Limestone (stations 21301, 21304, 21308) on the Goikul Peninsula, Babelthaup, Palau; age, late Miocene (Tertiary *g*). Martin reported it from the upper Miocene of Java. The species was described originally from the China Sea and is now known to live also in the Philippines and Fiji.

Conus kimioi (Habe)

Plate 27, figure 7

Rhizoconus kimioi Habe, 1965, Venus, v. 24, no. 1, p. 48, pl. 4, figs. 1–2.

Shell small, thin, spire almost flat; protoconch of two convex glassy whorls, followed by five sculptured whorls, each with several spiral cords, the peripheral cord forming a narrow keel. Body whorl flat-sided with several fine spiral grooves immediately below the periphery and about ten larger grooves on the base; lines of growth are discernible over the entire shell. Regularly spaced reddish-brown dots are present on the spire and on the body whorl immediately below the periphery; body whorl with a series of narrow spiral brown lines, some of which mark the boundaries of three light-brown spiral bands.

Measurements of the figured specimen, USNM 175091; height 12.6 mm, diameter 5.8 mm.

The fossil shells are smaller than the Holocene shells described from Japan. Dr. Alan Kohn, who has examined the shells here referred to *C. kimioi*, thinks that some of them, at least, may represent juvenile examples of *Conus macarae*, described long ago by Bernardi (1857, p. 56, pl. 2, fig. 2).

Occurrence.—Thirteen specimens from station SM242 on Santo, New Hebrides; age, Pleistocene. The species lives today in Japanese waters at depths of about 100 ms. Not previously reported as a fossil.

Conus cf. C. litteratus Linnaeus

Plate 27, figures 10, 11

A single specimen of a large cone was collected from a cascajo pit near Agat on Guam (station 20997); age, Quaternary. The specimen, USNM 175080, is 100 mm high and has a diameter of about 60 mm. The shell is recrystallized, its aperture incomplete anteriorly. It probably represents the widespread living species, *C. litteratus* Linnaeus, but it could be *C. leopardus* (Röding), an equally large form that also lives in the Marianas. According to Vlerk (1931, p. 214), *C. litteratus* has been reported from the Pliocene of Timor.

The flattened spire of a large cone was recovered from the Miocene conglomerate at station 160 on Viti Levu, Fiji. The margin of the last whorl is incomplete, but it measures 48.9 mm in diameter. This fossil also may represent *C. litteratus* Linnaeus.

Conus macarae Bernardi

Plate 27, figures 12–15

Conus macarae Bernardi, 1857, Jour. Conchyliologie, v. 6, p. 56, pl. 2, fig. 2; 1861, Mon. Genre *Conus*, p. 19, pl. 1, fig. 1; Tryon, 1884, Manual Conchology, v. 6, p. 34, pl. 9, fig. 72.

Two shells from station SM242 on Santo, New Hebrides, are tentatively referred to this species at the suggestion of Dr. Alan Kohn. Both have lower spires than published figures of the species, but they retain clear traces of the white bands shown on published figures—shoulder and middle of the body whorl have dark marks at the top of the median band—as well as fine close-set spiral lines of color.

Measurements of the larger specimen, 51.2 mm by 25.0 mm; smaller specimen, 36.0 by 17.7 mm.

The locality of the Holocene shell described by Bernardi is not known; Tryon cites Mauritius. The Pleistocene shells from the New Hebrides are the first fossil occurrence.

Conus miliaris Hwass

Plate 27, figure 16

Conus miliaris Hwass, 1792, *in* Bruguière, Encyclopedie méthodique. Histoire nat. vers. v. 1, p. 629; Demond, 1957, Pacific Sci., v. 11, p. 330, fig. 39; Cernohorsky, 1964, Veliger, v. 7, p. 80, pl. 18, fig. 72; Kohn, 1968, Linnean Soc. Jour. (Zoology), v. 47, p. 468, pl. 6, fig. 70.

Shell small, solid, spire moderately high; body whorl with low granular ridges that are best developed on the anterior half of the shell; shoulder angulate and coronate; whorls of spire with several low spiral riblets above the coronate border.

Measurements of the figured specimen, USNM 175128: length 29.4 mm, diameter 18.7 mm.

C. miliaris is very similar to *C. aristophanes* Sowerby but is proportionately wider and its spiral ribs are granular.

Occurrence.—A single shell from recrystallized limestone at USGS station 21028, Santo, New Hebrides; age, Pleistocene. The species is abundant today throughout the Indo-Pacific except in Hawaii and Australia. Not previously reported as a fossil.

Conus mucronatus Reeve

Plate 27, figures 17, 18

Conus mucronatus Reeve, 1843, Conchologica Iconica, v. 1, *Conus*, pl. 37, no. 104.

Medium in size with a moderately high concave spire that has a sharp apex; each flattened whorl of the spire has four spiral riblets, the lowest one larger than the others; body whorl slightly convex, covered by low flattened spiral ribs that alternate with spiral threads; in the grooves between spiral ribs are close-set axial threads that may cause beading of the spirals; all sculpture on the body whorl becomes more prominent anteriorly. Brown bands cross the whorls of the spire and are continued irrregularly on the body whorl.

Measurements of the figured specimen, USNM 175132: length 33.9 mm, diameter 17.3 mm.

Occurrence.—Numerous specimens from the Pleistocene marls of station SM242 on Santo, New Hebrides. The species lives today in the Philippines but has not previously been reported as a fossil.

Conus nussatella Linnaeus

Plate 28, figure 1

Conus nussatella Linnaeus, 1758, Systema naturae, 10th ed., p. 716; Kohn, 1959, Pacific Sci., v. 13, p. 385, pl. 1, fig. 19.

The anterior part of a large shell of this species was collected from a pit in Pleistocene limestone at an altitude of 240 feet (75 m) on Santo in the New Hebrides (U.S. Geol. Survey station 21028). The shell is bleached but retains traces of the spiral lines of small brownish dots that are on the close-set, slightly granulose ribs. The specimen, USNM 175126, measures: length 31.7 mm, diameter 20.6 mm. *C. nussatella* lives today throughout the Indo-Pacific region, but in some areas it appears rare. Ostergaard (1928, p. 5) reported it as a Pleistocene fossil on Oahu in Hawaii, and Kohn confirmed the occurrence there.

Conus ochroleucus Gmelin

Plate 28, figure 2

Conus ochroleucus Gmelin, 1791, Systema naturae, 13th ed., p. 3391; Tryon, 1884, Manual conchology v. 6, p. 60, pl. 18, fig. 75; Marsh and Rippingale, 1964, Cone shells of the world, p. 75, pl. 10, fig. 19.

The anterior part of a large cone, USNM 308140, recovered from the Pleistocene marls of station SM242 on Santo, New Hebrides, represents *C. ochroleucus*. The shell is yellowish brown, fading to tan at the anterior extremity; it bears widely spaced, sharply incised spiral grooves and microscopic lines of growth. Measurements: length 64.4 mm, diameter 30.0 mm.

The figured specimen, a smaller uncolored shell, is nearly complete; measurements: length 58.5 mm, diameter 24.1 mm. It probably represents *C. ochroleucus*, but it shows shallow and widely spaced spiral grooves over the entire body whorl, and the lower whorls of the spire are almost smooth.

C. ochroleucus lives today in the southwest Pacific from the Philippines to New Guinea and Fiji.

Conus orbignyi Audouin

Plate 28, figures 3, 4

Conus orbignyi Audouin, 1831, Magasin de Zoologie, Paris, Moll. 1, pl. 20; Reeve, 1843, Conchologica Iconica, v. 1, pl. 4, no. 17.

A single shell from the Pleistocene marls at station SM242, Santo, New Hebrides, is assigned to this species. Though worn, it shows characteristic features: the spire is high, acute, coronated, and the body whorl is covered by flat-topped spirals separated by shallow punctate grooves. Measurements: length 35.2 mm, diameter 13.1 mm. Reportedly lives in China, Japan, and the Philippines.

Conus cf. C. pertusus Hwass

Plate 28, figure 5

Small to medium in size with a low convex spire and pointed apex; whorls of spire obscurely ribbed, suture impressed; shoulder smoothly rounded; sides of body whorl straight, marked by distant shallow spirals and microscopic lines of growth; spirals stronger near base.

Measurements of the figured specimen: length 48.0 mm, diameter 25.0 mm.

Two fossils from Pleistocene beds on the Kere River (station SM242), Santo, New Hebrides. They appear closely related to Holocene shells but retain no traces of color pattern. The species lives today from Hawaii to the Indian Ocean but is rare in all areas.

Conus praecellens A. Adams

Plate 28, figure 6

Conus praecellens A. Adams, 1853, Zool. Soc. London Proc., p. 119.

Conasprella praecella (A. Adams), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 114, pl. 36, fig. 10.

Small to medium in size, biconic; shoulder formed of a rounded cord that appears as a strong spiral on the whorls of the concave spire; above the shoulder spiral are about six smaller spirals. Surface of body whorl covered by spiral ribs that may show a tendency to alternate in size. Traces of rows of brownish dots are preserved on the ribs and on two shells; wider bands are visible on the body whorl; traces of axial bands of similar color are present on the spire.

Measurements of the figured specimen: length 37.7 mm, diameter 14.9 mm.

Occurrence.—Numerous specimens from Pleistocene marls of Santo, New Hebrides (station SM242). The species occurs today in the Philippines and Japan. Apparently not previously reported as a fossil.

Conus quercinus Hwass

Plate 28, figures 7, 8

Conus quercinus Hwass, 1792, in Bruguière, Encyclopedie méthodique. Histoire nat. vers, v. 1, p. 681; Reeve, 1843, Conchologica Iconica, v. 1, *Conus*, pl. 26, no. 148; Kira, 1962, Shells, of the western Pacific in color, v. 1, p. 106, pl. 38, fig. 7; Kohn, 1968, Linnean Soc. London Jour. (Zoology), v. 47, p. 480, pl. 8, fig. 100.

A stout, acutely tapered shell; shoulder rounded but with a narrow elevated rim; spire low, surmounted by a sharp apex; surface of body whorl smooth except for a few spiral grooves on the base; faint, narrow, yellow close-set wavy spiral lines are retained on the fossil.

Measurements of the figured specimen from New Hebrides: length 42.1 mm, diameter 27.5.

Occurrence.—Station SM259, Santo, New Hebrides; age, Pleistocene. A single incomplete shell from USGS station 20626 on Guam, Mariana Islands; age, Pliocene and Pleistocene. According to Vlerk (1931, p. 214), the species has been reported from the upper Miocene of Java and the Quaternary of Celebes. The species is found today throughout the Indo-Pacific region, except in Australia.

Conus recluzianus Bernardi

Plate 28, figures 9, 10

Conus recluzianus Bernardi, 1853, Jour. Conchyliologie, v. 4, p. 148, pl. 6, fig. 6; 1861, Mon. genre Conus, p. 20, pl. 1, fig. 5.

Leptoconus recluzianus (Bernardi), Garrard, 1966, Malacolog. Soc. Australia Jour., no. 10, p. 11, pl. 1, fig. 4.

A dozen specimens from the Pleistocene marls of station SM242, Santo, New Hebrides, are referred to this flat-sided, low-spired species. The figured specimen measures 46.3 mm by 24.0 mm. It has the shoulder nodes shown by Bernardi's type. It is slightly larger than the type and has a lower spire but, according to Alan Kohn who has examined that specimen, is almost identical with it.

Occurrence.—Type from the "China Seas," reported living also off the Queensland coast in 60–75 fathoms of water. The New Hebrides shells are the first fossil occurrence. Indeed, the fossils may outnumber the Holocene shells.

Conus aff. C. saecularis Melvill

Plate 28, figure 11

A small shell with a moderately high concave spire culminating in a sharp apex; the whorls of the spire have a basal spiral rib with several smaller spirals above. Body whorl cancellated by wide low flat spiral ribs and slightly retracted axial lines.

Traces of irregular brown spots are present on most shells.

Measurements of the figured specimen, USNM 175137: length 26.9 mm, diameter 13.6 mm.

The New Hebrides fossils are smaller on the average and are less slender than the Holocene shell figured by Melvill (1898, pl. 1, fig. 23) from the Persian Gulf. The fossils also resemble *C. sagittatus,* a Holocene shell described by Sowerby (1865, p. 518, pl. 32, figs. 8, 9) but are more attenuated anteriorly than is that species.

Occurrence.—Represented by 15 specimens from the Pleistocene marls of station SM242, Santo, New Hebrides.

Conus aff. C. socialis Martin

Plate 28, figures 12–15; plate 29, figures 1, 2

Small to medium in size, with a moderately high flattened spire; spire has about nine whorls, each with six or seven fine spiral ribs, the lowest in the series larger than the others. Body whorl has close-set flattened spiral ribs that may alternate with fine threads on the upper part of the whorl; axial lines numerous over the entire shell, being most conspicuous on the body whorl in the grooves between spiral ribs.

Measurements of the figured specimens: USNM 214227, length 36.8 mm, diameter 17.7 mm; USNM 214228, length 37.3 mm, diameter 18.3 mm.

When compared with fossils from the Sondé beds of Java, type locality of *C. socialis,* the Fijian fossils are seen to be larger and to have a slightly higher and more flattened spire. They may represent a distinct species.

Occurrence.—Seven specimens from station 817 (= B107) on Vanua Levu, Fiji; 1 questionable shell from station C1264 on Viti Levu, Fiji; age, Pliocene (Tertiary *h*). Martin (1895, p. 17, pl. 2, figs. 27–33) described *C. socialis* from the upper Tertiary Sondé-beds of Java. The species was also reported by Martin (1928, p. 13) from the upper Tertiary of Sumatra; Tesch (1915, p. 19, pl. 74, figs. 15–18) cited it from the upper Tertiary and lower Quaternary of Timor.

Conus striatus Linnaeus

Plate 29, figures 3, 4

Conus striatus Linnaeus, 1758, Systema naturae, 10th ed., p. 716; Ostergaard, 1935, B. P. Bishop Mus. Bull. 131, p. 25; Demond, 1957, Pacific Sci., v. 11, p. 332; Kohn, 1959, Pacific Sci., v. 13, p. 391, pl. 1, fig. 5.

A large low-spired cone that is strongly shouldered, but the area of maximum width lies about one-fifth of the distance from shoulder to base. The New Hebrides shell from USGS locality 21028, USNM 214412, measures: length 73.0 mm, diameter 35.3 mm. The figured fossil specimen from Fiji (British Museum specimen from station RB44, Viti, Levu) is smaller than fossils from Tonga and the New Hebrides and most Holocene shells; it measures: length 49.7 mm, diameter 23.8 mm.

Occurrence.—Station RB44, Viti Levu, Fiji; age, Pliocene (Tertiary *h*). Fossils have also been collected from elevated limestones on Santo, New Hebrides (USGS locality 21028), and similar rock in quarries on Tongatapu, Tonga, (Ostergaard, 1935, p. 25). These occurrences as well as others on Oahu in Hawaii (Kohn, 1959, p. 392) are probably Pleistocene. The species lives today in the Indo-Pacific from Africa to Hawaii.

Conus sulcatus Hwass

Plate 29, figures 5–9

Conus sulcatus Hwass, 1792, *in* Bruguière, Encyclopedie méthodique. Histoire Nat. vers. v. 1, p. 618; Reeve, 1843; Conchologica Iconica, v. 1, *Conus*, pl. 18, no. 99; Tryon, 1884, Manual conchology, v. 6, p. 73, pl. 23, figs. 79a, 81; Kohn, 1968, Linnean Soc. Jour. (Zoology), v. 47, p. 484.

A stout, turbinate shell with strong spiral ridges that may be in two sizes and are mostly flat-topped but may be rounded; on the upper part of the body whorl the spirals are weakly developed on some shells, are missing on others; axial lines are numerous; on many shells, they are discernible only in the grooves between spirals; on others, they override the spirals, beading them in the process. Spire moderately high, slightly concave, with a sharp apex; whorls of spire spirally corded. Shoulder has incipient or well-developed tubercles.

Measurements of the figured specimens: (pl. 29, figs. 5, 6) from SM242, Santo, New Hebrides, length 59.4 mm, diameter 35.2 mm; (pl. 29, figs. 7–9), from station C1133, Viti Levu, Fiji, USNM 175121, length 49.2 mm, diameter 25.3 mm.

Occurrence.—More than a dozen specimens from many stations in Fiji 32b, 32c, 44q—British Museum C1133, R50, F238, 817, all probably in Pliocene (Tertiary *h*) beds. Three shells from the Pleistocene marls on Santo, New Hebrides. Martin (1895, p. 12, pl. 1, figs. 11, 12) reported the species from the upper Tertiary of Java; Beets (1941, p. 139) found it in the late Miocene of East Borneo; Tesch (1915, p. 19), in the Pliocene of Timor. The species lives today in the Philippines and the South China Sea.

Conus sulcatus undulatus Sowerby

Plate 29, figures 10, 11

Conus undulatus Sowerby, 1857, Thesaurus Conchyliorum, *Conus* no. 294, pl. 4, fig. 63.

Conus sulcatus undulatus Sowerby, Tryon, 1884, Manual conchology, v. 6, p. 74, pl. 23, fig. 80.

Characterized by unusual sculpture on the body whorl; the lower three-quarters of the whorl bear widely spaced shallow spiral grooves; remainder of whorl smooth; shoulder nodes prominent.

Measurements of the figured specimen: length 48.6 mm, diameter 24.3 mm.

A single shell from station SM242, Santo, New Hebrides; age, Pleistocene.

Conus terebra Born

Plate 29, figure 12

Conus terebra Born, 1780, Testacea Mus. Caesarei, p. 162; Tryon, 1884, Manual conchology, v. 6, p. 80, pl. 25, figs. 31–33; Marsh and Rippingale, 1964, Cone shells of the world, p. 124, pl. 18, figs. 8, 9.

Shell large and heavy with a spire of medium height that is gently convex above a rounded shoulder; whorls of the spire slightly inflated and smooth, suture shallow, apex rounded. Body whorl nearly flat, with many sharp spiral threads that are more widely spaced anteriorly; between the threads are numerous microscopic lines.

Measurements of the incomplete specimen, USNM 175127; length 45.6 mm, diameter 28.5 mm.

Occurrence.—A single specimen from limestone at USGS station 21028, Santo, New Hebrides; age, probably Pleistocene. The species lives today throughout the tropical western Pacific, including Queensland, Australia, and in the Indian Ocean.

Conus cf. C. tessulatus Born

Plate 29, figure 13

Conus (*Lithoconus*) *tessulatus* Born, Ladd, 1945, B. P. Bishop Mus. Bull. 181, p. 370, pl. 53, fig. G.

The single Fijian fossil found at station 103 on Vanua Mbalavu is probably Pliocene and many represent the widespread Indo-Pacific Holocene species, but no clear traces of the pattern of square orange spots that give the species its name are visible. In the absence of color, it is very difficult to make a positive identification of this species because it varies in apical angle, roundness of shoulder, and other shell characters.

Measurements of the figured specimen (Univ. Rochester, Mus. Nat. History no. 13073 = USNM 252900) : length 25.6 m, diameter 14.3 mm.

Fossils from the upper Tertiary Alifan Limestone of Guam (U.S. Geol. Survey station 20730) may represent the species, but they retain no color. In 1900, Newton (p. 545) reported the species from Pleistocene elevated beach deposits in the Red Sea area.

Conus vimineus Reeve

Plate 29, figure 14

Conus vimineus Reeve, 1849, Conchologica, Iconica, v. 1, Conus Supp. pl. 7, no. 269; Marsh and Rippingale, 1964, Cone shells of the world, p. 138, pl. 19, fig. 20.

A slender, biconic shell with a sharp apex; both spire and body whorl are cancellated by flattened spiral ribs and fine axial lines.

Measurements of the figured specimen, a small shell; length 25.6 mm, diameter 8.3 mm.

Occurrence.—A single shell from the Pleistocene marls of station SM242, Santo, New Hebrides. Marsh and Rippingale (1964) stated that the species seemed endemic to the Philippines, but empty shells have been dredged in Indonesia, off Celebes, and Sumatra. The New Hebrides shell is the first fossil occurrence.

Conus yanuyanuensis Ladd

Plate 29, figure 15

Conus yanuyanuensis Ladd, 1945, B. P. Bishop Mus. Bull. 181, p. 369, pl. 53, fig. F.

No additional material collected. I have not been able to find a described species, fossil or living, having the unique combination of characters shown by the single Fijian fossil. It is a slender form with a high and slightly convex spire whose whorls have a well-developed shoulder keel; the body whorl is smooth except for weak spirals anteriorly. A feature not mentioned in the original description is the presence of beads on the peripheral keel of early whorls.

Measurements of the holotype, now USNM 175130: length 19.0 mm, diameter 7.4 mm, height of spire 5.2 mm.

Occurrence.—A single specimen from station 110C, Vanua Mbalavu, Fiji, Ndalithoni Limestone, age, Pliocene (Tertiary *h*).

Conus sp. A

Plate 29, figures 16, 17

Medium in size, spire depressed, apex pointed; whorls of spire flattened with several spiral ribs that are obscured by strong, close-set, curved axial lines of growth; suture impressed. Sides of body whorl concave, greatly narrowed toward the base; flattened spiral ribs present on the lowest third of the shell.

Measurements of the figured specimen, USNM 175133: length 44.8 mm, diameter 24.1 mm.

The Fijian fossil seems most closely related to *C. ngavianus* described by Martin (1895, p. 23, pl. 4, figs. 57–61) from the upper Tertiary of Java but has a lower spire and is more constricted anteriorly.

Conus sp. A resembles *C. monile* Hwass, a Holocene species from the tropical Indian and western Pacific Oceans but has a more angular shoulder, is more constricted anteriorly, and has more strongly developed basal ribs. It also resembles *C. fosteri* Clench and Arguay (Clench, 1942, p. 34, pl. 12, fig. 5), a species living in the western Atlantic, but has a lower spire and a more strongly concave profile. If additional specimens are collected, the Fijian fossil may prove to be an unnamed species.

Occurrence.—A single specimen from station K700 on Vanua Levu, Fiji; age, probably Pliocene (Tertiary *h*).

Conus sp.

Conus sp. Ladd, 1970, U. S. Geological Survey Prof. Paper 640–C, p. C8, pl. 5, fig. 2, late Eocene (Tertiary *b*); Eua, Tonga.

Genus KENYONIA Brazier

Brazier, 1896, Linnean Soc. New South Wales Proc., v. 21, p. 346.

Type (by monotypy).—*Kenyonia pulcherrimum* Brazier. Holocene. New Hebrides.

Kenyonia cf. K. chiangi (Azuma)

Plate 19, figures 17–19

Kenyonia cf. *K. chiangi* (Azuma), Ladd, 1976, Nautilus, v. 70, no. 4, p. 135, figs. 21, 22.

A single example of a highly decorated cone was collected at USGS locality 25731 on the Navaka River, Santo, New Hebrides. The shell measures: length 10.4 mm, diameter 5.9 mm, USNM 214291. It may be closely related to the Holocene shell described by Brazier in 1896 as probably from New Hebrides, but that shell, unfortunately, has been lost. The fossil from Santo may be conspecific with *Taranteconus chiangi* described by Azuma (1972, p. 59, figs. 5, 6) and later figured by Okutani (1975, pl. 10, fig. 27), but the fossil is more slender anteriorly and may have stronger spiral sculpture. Azuma's type of *T. chiangi* was collected in the South China Sea at a depth of 200 fathoms (365 m). Okutani found living specimens fairly common on banks at depths of 150–190 m in Japanese waters.

Family TEREBRIDAE

Genus HASTULA H. and A. Adams

Adams, H. and A., 1853, Genera of Recent mollusks, v. 1, p. 225.

Type (by subsequent designation, Cossmann, 1896, Essais de paléoconchologie comparée, pt. 2, p. 53).—*Buccinum strigilatum* Linnaeus. Holocene, Indo-Pacific.

Hastula sp.

Hastula sp. Ladd, 1970, U.S. Geological Survey, Prof. Paper 640–C, p. C–8, pl. 5, fig. 3. Late Eocene (Tertiary *b*); Eua, Tonga.

Genus TEREBRA Bruguiere

Bruguière, 1789, Encyclopedie méthodique. Histoire nat. vers, v. 1, p. 15 (genus without species).

Subgenus TEREBRA sensu stricto

Type (by monotypy) Lamarck, 1799, Soc. Histoire Nat., Paris, Mém, p. 79).—*Buccinum subulatum* Linnaeus. Holocene, western Pacific.

Terebra (Terebra) subulata (Linnaeus)

Plate 30, figure 15

Buccinum subulatum Linnaeus, 1767, Systema naturae, 12th ed., p. 1205.

Terebra subulata (Linnaeus), Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 6, no. 22; Tryon, 1885, Manual conchology, v. 7, p. 10, pl. 1, fig. 3; Demond, 1957, Pacific Sci., v. 11, no. 3, p. 334; Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 205, pl. 52, fig. 385.

A single fossil from the New Hebrides, though worn and incomplete, shows traces of the subsutural groove on the early whorls and the double row of squarish brown spots that are unique.

Measurements: height 82.5 mm, diameter 15.9 mm.

Occurrence.—Station SM242, Santo, New Hebrides; age, Pleistocene. The species lives today throughout the Indo-Pacific region. Not previously reported as a fossil.

Subgenus STRIOTEREBRUM Sacco

Sacco, 1891, I. molluschi dei terreni terziarii del Piemonte e della Liguria, pt. 10, p. 33.

Type (by original designation).—*Terebra basteroti* Nyst. Miocene, Mediterranean.

Terebra (Strioterebrum) torquata Adams and Reeve

Plate 30, figure 1

Terebra torquata Adams and Reeve, 1850, Zoology of the voyage of H.M.S. *Samarang*, p. 30, pl. 10, fig. 13; MacNeil, 1960, U.S. Geol. Survey Prof. Paper 339, p. 125, pl. 15, figs. 18, 19.

Cinguloterebra torquata (Adams and Reeve), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 128, pl. 40, fig. 19.

Each whorl bears two strong, beaded, subsutural ridges, the ridge next to the suture being the stronger; below the major spirals are four secondary spirals and faint traces of tertiary spirals.

Measurements of the figured specimen: height (incomplete) 35.7 mm, diameter 8.3 mm.

Occurrence.—One incomplete shell from station SM242, Santo, New Hebrides; age, Pleistocene. The species lives today in Japan and other parts of the western Pacific; MacNeil reported it from the Pliocene of Okinawa.

Terebra (Strioterebrum) nebulosa Sowerby

Plate 30, figure 2

Terebra nebulosa Sowerby, 1825, Tankerville catalogue. Appendix, p. 25; Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 1, fig. 1; Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 204, pl. 51, fig. 380.

A medium-sized species with a swollen subsutural band that bears fine spirals and is bounded anteriorly by an open punctate groove; remainder of shell reticulated by coarser spirals and strong curved axial ribs.

Measurements of the figured specimen: height (apex incomplete) 50.9 mm, diameter 11.4 mm.

Occurrence.—A single specimen from the Pleistocene marls on Santo (station SM242), New Hebrides. The species lives today in parts of the tropical Indo-Pacific. Not previously reported as a fossil.

Terebra (Strioterebrum) sp. A

Plate 30, figure 3

Shell large, sides nearly straight. Sculpture consisting of a wide coarsely noded subsutural band that occupies more than one-third of each whorl and spiral cords. The nodes are regularly spaced, each one pinched to a sharp ridge that parallels the axis of the shell; nodes overridden by fine spiral cords, traces of secondary cords intervening. Remainder of whorl has three or four spiral cords that are coarser than those of the subsutural band but, like them, have traces of finer cords between. Suture inconspicuous; columella has a heavy double fold; anterior canal extended and reflexed; outer lip not preserved.

Measurements of the single specimen, USNM 175084; height (incomplete) 33.3 mm, diameter 12.8 mm.

The major sculptural features—the strongly noded subsutural band and the well-developed spiral cords—suggest *Terebra nelsoni* Hanna and Israelsky, an early Miocene species from Peru described by Nelson (1870, p. 10, reprint) and by Spieker (1922, p. 36, pl. 1, fig. 2), but the nodes and spirals of the Eniwetok fossil are much sharper than are those of *T. nelsoni*. The Eniwetok shell probably represents an undescribed form, but the single example is incomplete and a name is withheld.

Occurrence.—A single specimen from drill hole F–1, Eniwetok, at a depth of 680–690 feet (210 m); age, late Miocene (Tertiary *g*).

Terebra (Strioterebrum?) sp.

Terebra (Strioterebrum) species Ladd, 1934, B. P. Bishop Mus. Bull. 119, p. 233, pl. 41, fig. 9.

No additional shells collected. The species is unusual in that it shows no trace of spiral scupture other than the groove marking the base of the subsutural band. As noted by Cernohorsky (1966, p. 65), it does not resemble any of the living Fijian Terebridae.

Measurements of the incomplete figured specimen, B. P. Bishop Mus., Geol. No. 1223: height 26.6 mm, diameter 5.8 mm.

Occurrence.—Station 59, Viti Levu, Fiji; age, late Miocene (Tertiary *g*).

Subgenus DECORIHASTULA Oyama

Oyama, 1961, Venus, v. 21, no. 2, p. 185.

Type (by original designation).—*Terebra affinis* Gray. Holocene, Indo-Pacific.

Terebra (Decorihastula) affinis Gray

Plate 30, figures 4, 5

Terebra affinis Gray, 1834, Zool. Soc. London Proc., pt. 2, p. 60.

Decorihastula affinis (Gray), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 208, pl. 71, fig. 2; Cernohorsky, 1966, Veliger, v. 9, no. 1, p. 45, pl. 5, fig. 26.

Fossil representatives are small and incomplete, but they show major sculptural features, including the punctate grooves, that characterize this species.

Measurements of the figured specimen from Saipan, USNM 175081: height 23.3 mm, diameter 6.1 mm.

Occurrence.—Figured specimen from the Tanapag Limestone of Saipan (USGS loc. 17891); age, Pleistocene and Holocene. A second specimen from drill hole F–1, Eniwetok, at depth of 130–140 feet (40 m); age, Quaternary. The species is common today throughout most of the tropical Indo-Pacific. Not previously reported as a fossil.

Subgenus MICROTRYPETES Pilsbry and Lowe

Pilsbry and Lowe, 1932, Acad. Nat. Sci. Philadelphia Proc., v. 84, p. 43.

Type (by original designation).—*Terebra iola* Pilsbry and Lowe. Holocene, west coast of Mexico.

The subgenus includes slender forms with unbroken ribs that lack a distinct subsutural groove.

Terebra (Microtrypetes) vanualevensis Ladd, n. sp.

Plate 30, figures 6, 7

Shell small, slender, made up of 10 or more gently convex whorls; apex not preserved. Sculpture con-

sisting of strong, narrow-crested, curved axial ribs; 11 present on body whorl; concave area between ribs scored by spiral grooves of variable size; uppermost two or three are faint, the next one more prominent, suggesting the boundary of a subsutural band. Suture impressed; anterior canal extended; columella with a single narrow fold.

Measurements of the holotype, USNM 175085; height (incomplete) 15.6 mm, diameter 3.3 mm; paratype, USNM 175086: height 14.9 mm, diameter 4.0 mm.

One small nearly complete specimen and two incomplete larger shells from Viti Levu closely resemble the Vanua Levu form, but their whorls are less convex, their sutures shallower, and they have a more discernible subsutural band. The nearly complete Viti Levu shell is from station C742 and probably is Pliocene (Tertiary *h*); the two fragments of larger shells from station 165 are probably older—late Miocene (Tertiary *g*). Final decision as to the identity of the Viti Levu shells must await the collection of better material.

T. vanualevensis appears to be most closely related to *T. iola* Pilsbry and Lowe, the type of *Microtrypetes,* but has fewer axial ribs than does that species, a Holocene shell obtained from 20 fathoms off Mazatlan. The Fijian species is larger and more slender than is *T.* (*M.*) *mariato* Pilsbry and Lowe, another Holocene species occurring off the Pacific coast of Panama, and it has stronger spirals but fewer axials than does that species.

T. (*M.*) *spei* Brown and Pilsbry (1913, p. 497), a Pleistocene species from the Isthmus of Panama, has a more prominent subsutural groove and more axial ribs than does the Fijian species.

Occurrence.—Three incomplete specimens from station 817, Vanua Levu, Fiji; age, Pliocene (Tertiary *h*).

Terebra (Microtrypetes) kerensis Ladd

Plate 24, figures 20, 21

Terebra (*Microtrypetes*) *kerensis* Ladd, 1976, Nautilus, v. 90, no. 4, p. 137, figs. 31–33.

Holotype, USNM 214340, measures: height 10.0 mm, diameter 2.0 mm. Many shells collected from USGS locality 25715 on the Kere River, Santo, New Hebrides; age, Pleistocene.

Subgenus OXYMERIS Dall

Dall, 1903, U.S. Natl. Mus. Proc., v. 26, p. 951. New name for *Acus* Gray.

Type (Gray, 1847, Zool. Soc. London Proc., p. 139).—*Buccinum maculatum* Linnaeus. Holocene, Indo-Pacific.

Terebra (Oxymeris) maculata (Linnaeus)

Plate 30, figure 8

Buccinum maculatum Linnaeus, 1758, Systema Naturae, 10th ed., p. 741.

Terebra maculata (Linnaeus), Demond, 1957, Pacific Sci., v. 11, 334; Cernohorsky, 1967, Marine shells of the Pacific, p. 204, pl. 51, fig. 376.

A single example of this widely distributed living Indo-Pacific species was collected from the Pleistocene and Holocene Tanapag Limestone of Saipan (USGS locality 17891). The shell, USNM 175079, measures: height 165 mm, diameter 45 mm. The early whorls of the shell retain traces of the original spiral lines of brown spots. Martin (1890, p. 280) reported the species from the Quaternary of Timor.

Terebra (Oxymeris) interlineata Deshayes

Plate 30, figure 9

Terebra interlineata Deshayes, 1859, Zool. Soc. London Proc., p. 277; Reeve, 1860, Conchologica Iconica, v. 12 *Terebra* pl. 12, no. 51.

Terebra (*Oxymeris*) *crenulata* (Linnaeus) variant, Cernohorsky and Jennings, 1966, Veliger, v. 9, no. 1, p. 41–42.

Recognized by many authors as a synonym or as a variant of the widespread living Indo-Pacific species *Terebra crenulata* (Linnaeus), characterized particularly by numerous axial wrinkles that persist over the entire shell. Such wrinkled shells have heretofore been found only in Hawaii. The New Hebrides Pleistocene shell from station SM242 on Santo is the first fossil occurrence. It preserves traces of reddish-brown markings on the subsutural band but none of the brown dots that mark the whorls below the band.

Measurements: height 56.0 mm, diameter 13.6 mm.

Terebra (Oxymeris) cf. T. felina (Dillwyn)

Plate 30, figures 10–12

An unusually large, nearly complete shell (pl. 30, fig. 10) was recovered from the Pleistocene marls of Santo in the New Hebrides (station SM242). The specimen measures: height (apex missing) 110 mm, diameter 25 mm. *T. felina* lives today in many parts of the tropical Pacific but rarely exceeds 80 mm in height. The fossil shell, when complete, probably exceeded 150 mm in height. Its suture and subsutural groove are more prominent than on Holocene shells, as are lines of growth on later whorls.

Two incomplete shells (pl. 30, figs. 11, 12) from station 165 on Viti Levu, Fiji, are comparable in size with Holocene shells of *T. felina,* but their sculpture, like that of the younger New Hebrides fossil, is coarser than on Holocene shells. The Fijian

fossils are late Miocene (Tertiary *g*) in age. Both are figured. The larger, USNM 175087, measures: height (incomplete) 35.6 mm, diameter 15.2 mm. The smaller fragmentary fossil, USNM 175088, has the coarse axials of the early whorls; it measures: height 15.8 mm, diameter 10.1 mm. *T. felina* (Dillwyn) lives today throughout the tropical Indo-Pacfic (Cernohorsky, 1967, p. 199).

Terebra (Oxymeris) argus (Hinds)

Plate 30, figure 13

Terebra argus Hinds, 1843, Zool. Soc. London Proc., p. 160; Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 6, fig. 21; Tryon, 1885, Manual conchology, v. 7, p. 11, pl. 2, fig. 24; Cernohorsky, 1967, Marine shells Pacific, v. 1, p. 196, pl. 49, fig. 354.

Subula argus (Hinds), Kira, 1962, Shells of western Pacific in color, v. 1, p. 209, pl. 71, fig. 15.

A small, nearly complete fossil shell from Saipan represents this living species. The fossil lacks the pale color pattern found on fresh shells. The whorls are smooth except for traces of axials on early whorls and a punctate subsutural groove.

Measurements of the figured specimen, USNM 175083; height (apex incomplete) 32.5 mm, diameter 6.8 mm.

Occurrence.—USGS locality 17891 on Saipan in the Pleistocene and Holocene Tanapag Limestone. The species lives today in many parts of the western Pacific, including the Marianas.

Terebra (Oxymeris) sp. B

Plate 30, figure 14

A juvenile shell consisting of 10 strongly plicate, flat-sided whorls form a sharp spire with an apical angle of 26°. Both suture and subsutural groove are well impressed; the columella has a single narrow fold.

Measurements of the specimen, USNM 175089: height 34.4 mm, diameter 11.5 mm.

The fossil resembles the abundant and widespread Holocene Indo-Pacific species, *T. maculata* (Linnaeus) but has a slightly greater apical angle and is much more strongly plicate. It may represent an undescribed form, but, as noted, the only specimen is juvenile.

Occurrence.—Drill hole F–1, Eniwetok, at depth of 800–810 feet (245 m); age, late Miocene (Tertiary *g*).

Subgenus MYURELLA Hinds

Hinds, 1844, *in* Sowerby, Thesaurus Conchyliorum, *Terebra*, p. 171.

Type (by subsequent designation, Dall, 1908 Nautilus, v. 21, p. 125).—*Terebra myuros* Lamarck. Holocene, Indo-Pacific.

Terebra (Myurella) myuros Lamarck

Plate 30, figure 16

Terebra myuros Lamarck, 1822, Systèms animaux sans vertebres, v. 7, p. 289; Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 8, 31.

Spire slender and flat-sided. Subsutural band made up of two nearly flat but slightly beaded spirals, the one next to the suture wider than the other; below the subsutural band are several beaded secondary spirals.

Measurements of the incomplete figured specimen: height 56.1 mm, diameter 11.0 mm.

Occurrence.—Station SM242 on Santo, New Hebrides; age, Pleistocene. The species lives today in several parts of Indonesia, and a variety was reported by Martin (1883, p. 217) from the upper Miocene of Java.

Terebra (Myurella) pretiosa Reeve

Plate 30, figures 17, 18

Terebra pretiosa Reeve, 1842, Zool. Soc. London Proc., p. 200; Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 8, fig. 30; Tryon, 1885, Manual conchology, v. 7, p. 27, pl. 8, fig. 33; MacNeil, 1960, U.S. Geol. Survey Prof. Paper 339, p. 125, pl. 10, fig. 18.

Myurella pretiosus (Reeve), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 110, pl. 39, fig. 8.

Shell large with many gently convex and slightly turreted whorls. Sculpture consisting of a distinct light-colored subsutural band and close-set curved axial ridges. Below the subsutural band, fine spirals, some of which override the axials, give rise to a latticed appearance. Reddish-brown axial bands cover much of the area below the subsutural band on one shell; on the other shell, discontinuous patches of brown occur along axial lines.

Measurements of the figured specimen: height 116 mm, diameter 15 mm.

Occurrence.—Two specimens from station SM242, Santo, New Hebrides; age, Pleistocene. MacNeil (1960) reported on shells from the upper Tertiary of Okinawa. Described originally from Chinese waters; found also near Japan at depths of 50–80 fathoms.

Terebra (Myurella) alveolata Hinds

Plate 30, figures 19, 20

Terebra alveolata Hinds, 1843, Zool. Soc. London Proc., p. 151; Reeve, 1860, Conchologica Iconica, v. 12, *Terebra*, pl. 19, fig. 89; Tryon, 1885, Manual Conchology, v. 7, p. 23, pl. 5, fig. 87.

Haustulopsis alveolata (Hinds), Habe, 1964, Shells of the western Pacific in color, v. 2, p. 128, pl. 41, fig. 19.

Small, whorls nearly flat, slightly turreted to produce an impressed suture. A moderately deep

groove on the upper part of each whorl sets off a subsutural band, and there are two or more inconspicuous spiral grooves below; whorls covered by close-set, curved, rounded axial ribs. The sutural band carries a series of regularly spaced brown spots, and a second series is present on the body whorl near the base. The fossil shells retain clear traces of this unusual color pattern.

Measurements of the figured specimen, USNM 175082 from station SM242 on the Kere River, Santo, New Hebrides: height 52.5 mm, diameter 9.0 mm.

Occurrence.—Nine specimens from Pleistocene beds on the Kere River, Santo, New Hebrides. The species lives today in Indonesia and Japan.

Subgenus TRIPLOSTEPHANUS Dall

Dall, 1908, Nautilus, v. 21, p. 125–125.

Type (by original designation).—*Terebra triseriata* Gray. Holocene, Pacific.

Terebra (Triplostephanus) triseriata Gray

Plate 30, figure 21

Terebra triseriata Gray, 1834, Zool. Soc. London Proc., p. 62; Cernohorsky, 1967, Marine shells of the Pacific, v. 1, p. 206, pl. 52, fig. 389.

Triplostephanus triseriata (Gray), Kira, 1962, Shells of the western Pacific in color, v. 1, p. 110, pl. 39, fig. 9.

Terebra (Triplostephanus) triseriata (Gray), Cernohorsky, 1966, Veliger, v. 9, p. 57, pl. 4, fig. 14.

Shell long and very narrow, composed of many whorls (20 on the incomplete fossil segment). Sculptured uniformly, each whorl having three conspicuously beaded spiral cords; cord immediately below the suture is the largest, the cord immediately below it is next in size, and the one immediately above the suture is the smallest; the low area occupying the middle of each whorl bears four beaded secondary spiral cords, the lowest slightly larger than the other three. Apex and aperture not preserved.

Measurements of the figured specimen: height (incomplete) 34.3 mm, diameter 4.1 mm.

An examination of Holocene shells shows that the spiral cords vary considerably in number and relative size. Two other fossils from SM242 exceed the variability shown by most Holocene shells. They are less slender than the typical specimen already described but are assigned to *T. triseriata*. One is nearly complete, consisting of a protoconch of about five glassy whorls followed by 24 sculptured whorls that have a large subsutural cord, comparatively small cords above and below, plus two or three still smaller cords in the center of each whorl. The third specimen, not figured, is likewise dominated by a single subsutural cord.

Occurrence.—Station SM242 on Santo, New Hebrides; age, Pleistocene. Living examples have been collected widely in the tropical Pacific.

LOCALITIES

Some of the fossils described or cited in the present report were collected from localities (see fig. 2) not listed or shown on maps in the previous reports Ladd 1966, 1972, 1977). A few fossils were obtained from Rotuma and islands not previously reported upon. The locality data given below supplement those given previously by Ladd (1966, p. 81–89; 1972, p. 63–69; 1977, p. 68–73). Outline maps of most of the islands were provided in the reports just cited.

Island	*U.S. Geological Survey Cenozoic locality or Station*	*Locality and collector*
	Mariana Islands	
Guam	20608	About 2 miles (3 km) NNW of Fadian Point, waist of island. Pacific Island Engineers.
Do	20997	Cascajo pit near Agat, close to west coast of island. H. T. Stearns.
	New Hebrides	
Santo	SM298	Lat 15°33.81′ S., long 166°56.77′ E., altitude 80 m (260 ft). D. I. J. Mallick.
Do	SM307	Middle Pakalolo River, a tributary to the Wambu. D. I. J. Mallick.
Do	SM308	Upper Wambu River near SM309. D. I. J. Mallick.
Do	SM309	South bank of Wambu River and as much as 50 m (165 ft) downstream from mouth of Pakalolo. a tributary. D. I. J. Mallick.
Do	SM310	Upper Wambu River near SM309. D. I. J. Mallick.
Do	SG78	Lat 15°26′30″ S., long 167°05′48″ E., altitude 55 m (180 ft).
Do	SG79	Sarakata River debris.
Do	SG82	Lat 15°26′40″ S., long 167°5′10″ E., altitude 55 m (180 ft).
Do	SG94	Lat 15°25′30″ S., long 166°56′ E., altitude 360 m (1,180 ft) David Greenbaum.

Island	U.S. Geological Survey Cenozoic locality or Station	Locality and collector
New Hebrides—Continued		
Do	SG97	Lat 15°22′28″ S., long 167°01′28″ E., altitude 275 m (900 ft). David Greenbaum.
Do	25731	Navaka River about lat 15°36′08″ S., long 166°51′04″ E., altitude 70–80 m (231–264 ft). T. R. Waller, John Bolango, and W. C. Blow, June 1974.
Do	25739	Left bank of Navaka River about 4 km N. 8° W. of village of Ipayato; from large transported block. W. C. Blow. June 1974.
Maewo	MWC40	Float about 2 miles (3 km) inland (west) from Lavwovwage Bay; altitude 100 m (330 ft). J. N. Carnay. 1977.
		Fiji
Viti Levu	C1133	Near base of Mba Group near Lautoka, lat 17°39.5′ S., long 177°26.8′ E. Peter Rodda.
Do	C1264	Thuvu area in southwest part of island, lat 18°07.2′ S., long 177°24.8′ E. Peter Rodda.
Do	C1763	DDH 13/7, beside the bank of Vunatongotongo Creek at Meigunyah near Nandi, lat 17°47.3′ S., 177°27.1′ E.; depth about 46 m to 52.83 m (150 to 174 ft).
Do	C1764	Same as C1763; depth 52.83–54.86 m (174–181 ft).
Do	C1765	Same as C1763; depth 54.86–57.91 m (181–191 ft).
Do	C1766	Same as C1763; depth 57.91–59.44 m (191–196 ft).
Do	C1769	Same as C1763; depth 61.14–61.55 m (201–203 ft).
Do	C1770	Same as C1763; depth 61.55–65.53 m (203–216 ft).
Do	C1872	Drill hole W 1/73; immediately southeast of Sana trigonometrical station in Nandi area, lat 17°44.4′ S., long 177°27.7′ E.
Do	C2021	West of pumping station, Nausori, lat 18°02.0′ S., long 178°31.4′ E. Peter Rodda, E. Tupua, A. Manu. Penjueli, and J. Komai. collectors.
Do	C2024	Roadcut west of C2021, lat 18°02.0′ S., long 178°31.2′ E. Same collectors as C2021.
Do	C2026	From bulldozed surface thought to be close to dip slope between C2021 and C2024; lat 18°02.0′ S., long 178°31.3′ E.
Fiji—Continued		
		W. H. Hindle, Peter Woodrow, Peter Rodda, and others.
Do	C2048	Near the top of old hospital hill, behind brewery and flour mill, lat 18°07.7′ S., long 178°26.1′ E. Peter Rodda.
Do	C2055	Drill hole 2/72, Waimalika near Thuvu, lat 17°44.4′ S., long 177°27.7′ E.; depth 9.1–10 m (30–33 ft).
Do	C2062	Nggalinggali Creek downstream from Nandrau-Koro track, lat 17°42.4′ S., long 177°56.6′ E. Peter Rodda.
Do	C2073	Drill hole U9, Nanduri, lat 18°04.9′ S., long 177°33.7′ E. Depth in hole, 30.5 m (101 ft); collar of hole 7.0 m (23 ft) above sea level.
Do	C2173	CDH (W) 76/1, near Nandi Airport; depth 47±3 m (155±10 ft).
Do	MR81	Nggaliembuto Creek. 600 yards (545 m) northwest of Mbatinatoka trigonometric station (near Tambungguto) in Mbalevuto area, northwest part of island.
Do	MR111	Navala on the Mba River. 5.25 miles (8.4 km) southeast of Tonge. Collected by M. J. Rickard.
Do	RB217	Nausori Highlands near Korondranandole, 11 miles (17.6 km) east of Nandi. R. W. Bartholomew, 1959.
Do	X75	Takahi Pt., 5 miles (8 km) east of Navua, R. B. Band, 1966.
Do	25710	Mbalevuto area, approx. lat 17°35′ S., long 177°41′ E. H. S. Ladd and Peter Ibbotson, 1964.
Do	FB–7	Quarry, south side of Walu Bay Suva, Viti Levu. Fiji; on Edinburgh Road, immediately behind Mobilgas depot; in vicinity Ladd station 160. W. M. Briggs, June 7, 1962.
Do	300	Along trail 1/8th mile (200 m) east of Vunindumba; altitude 200 feet (61 m) Viti Levu, Fiji. H. S. Ladd, 1926.
Waya	C1444	Immediately south of Wayalevu village on track to Natawa, lat 17°16.9′ S.. long 177°8.9′ E.

Island	U.S. Geological Survey Cenozoic locality or Station	Locality and collector
Fiji—Continued		
Vanua		
Mbalavu	103	Floater; creek bed just east of Ndalithoni.
Vanua Levu	I1010	Hibiscus Highway, 300 m (990 ft) northeast of Mataniwa River, lat 16°44.4′ S.. long 179°38.1′ E. Collected by Peter Woodrow.
Do	C2019 (=B395, near H3)	Cut in main road about ¾ mile (1.2 km) north of Naweni. R. W. Bartholomew, William Hindle, and others.
Do	818 (=B140)	Roadcut 200 yards (182 m) east of Vunisea Creek bridge, ¼ mile (400 m) east of Nasarowangga River. Peter Ibbotson and H. S. Ladd.
Do	K671	Drill hole at Naiselesele Falls, Sheet 4; lat 16°38.28′ S., long 178°45.64′ E.; depth 367–369 ft (111.2–111.8 m). William Hindle.
Do	K755	Kilaka River, 200 yards (182 m) below junction with Mbengga Creek, lat 16°48.8′ S., long 178°59.75′ E. William Hindle.
Rotuma[7]		Solroroa on the north coast 600 yards (545 m) northwest of village of Naftoa. William Hindle.
Tonga		
Tongatapu	Bishop Mus. Cat. No. 202938.	Station 3, sea cliff southwest of Houma; altitude 35 ft (10.6 m). J. M. Ostergaard.

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[7] A small island 300 miles (480 km) north of the Yasawa Islands, which extend northeast from the west side of Viti Levu.

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PLATES 1-41

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PLATE 1

FIGURES 1, 2. *Scissurella* (*Anatoma*) *japonica* A. Adams (p. 20).
Diameter 2.4 mm (× 20). SM43 on the Navaka River, Santo, New Hebrides. Pleistocene. USNM 214325.

3, 4. *Sinezona carinata* (A. Adams) (p. 20).
Diameter 2.1 mm (× 20). USGS locality 25718 on the Kere River, Santo, New Hebrides. Pleistocene. USNM 214324.

5, 6. *Emarginula* (*Emarginella*) *eximia* A. Adams (p. 21).
Length 9.9 mm (× 6). USGS locality 25715 on the Kere River, Santo, New Hebrides. Pleistocene. USNM 214305.

7, 8. *Emarginula* sp. C (p. 21).
Length 3.6 mm (× 12). USGS locality 25655 on the Navaka River, Santo, New Hebrides. Pleistocene, USNM 214277.

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14–16. *Zeidora calceolina* A. Adams (p. 22).
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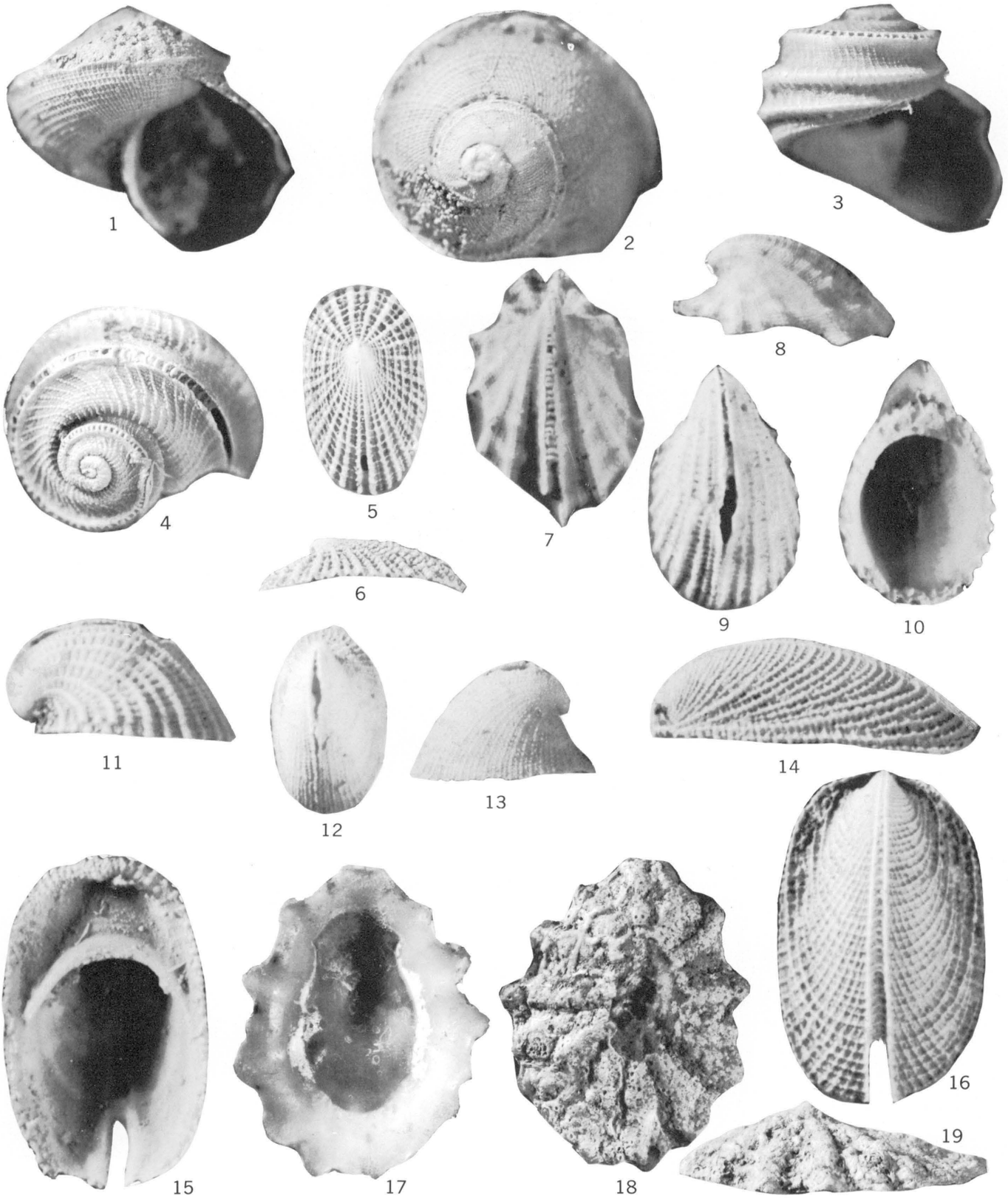
17–19. *Patelloida cf. P. latistrigata* (Angas) (p. 22).
Length 11.5 mm (× 5). USGS locality 25717 on the Kere River. Santo, New Hebrides. Pleistocene. USNM 214350.



SCISSURELLIDAE, FISSURELLIDAE, ACMAEIDAE

PLATE 2

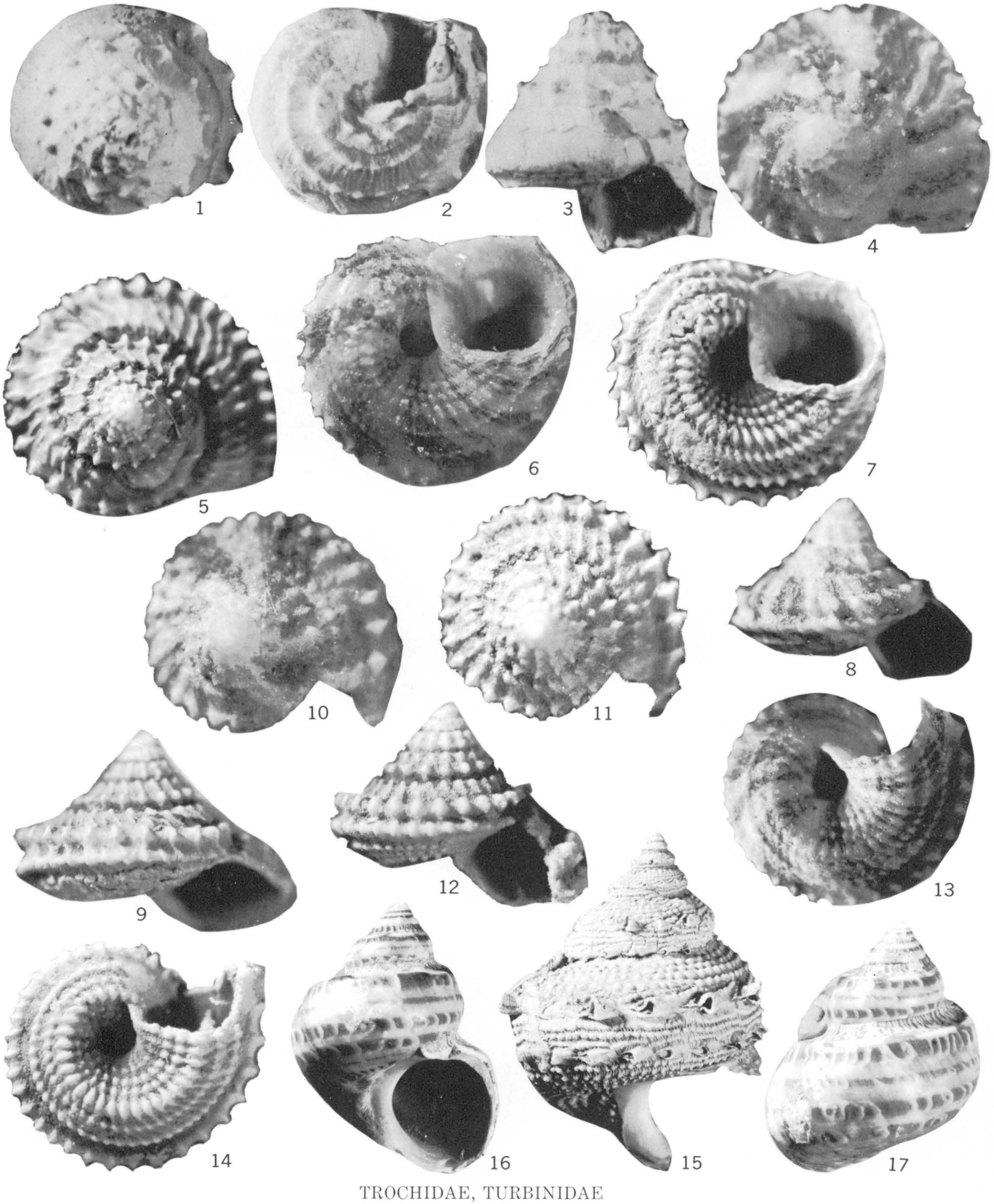
[Figures 4, 6, 8, 10, 12, 13, 16, 17 are uncoated and show original color pattern.]

FIGURES 1–3. *Turcicula* sp. A. (p. 24).
Diameter 3.4 mm (× 12). Station C2019, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214271.

4–14. *Enida warreni Ladd*, n. sp. (p. 24).
4–9. Holotype, diameter 3.4 mm (× 15). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214354.
10–14. Paratype, diameter 3.1 mm (× 15). USGS locality 25734, Navaka River, Santo, New Hebrides. Pleistocene USNM 214355.

15. *Astraea* (*Bolma*) *girgyllus* (Reeve) (p. 26).
Height 41.0 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308093.

16, 17. *Turbo* (*Turbo*) *petholatus* Linnaeus (p. 27).
Height 50 mm (× 1). USGS locality 25715, Kere River, Santo. New Hebrides. Pleistocene. USNM 214366.



TROCHIDAE, TURBINIDAE

PLATE 3

FIGURE

1. *Astraea* (*Bolma*) *girgyllus* (Reeve) (p. 26).
   Diameter 40 mm (× 1½) Station SM242 on the Kere River, Santo, New Hebrides. Pleistocene. USNM 308094.

2, 3. *Neritina zigzag* Lamarck (p. 28).
   Diameter 22.8 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308095.

4, 5. *Smaragdia* (*Smaragdia*) cf. *S. viridis* (Linnaeus) (p. 29).
   Diameter 5.0 mm (× 5). Station C1766, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214246.

6–8. *Architectonica maxima* (Philippi) (p. 31).
   Diameter 62.0 mm (× 1). USGS locality 25715, Kere River, Santo. New Hebrides. Pliestocene. USNM 175078.

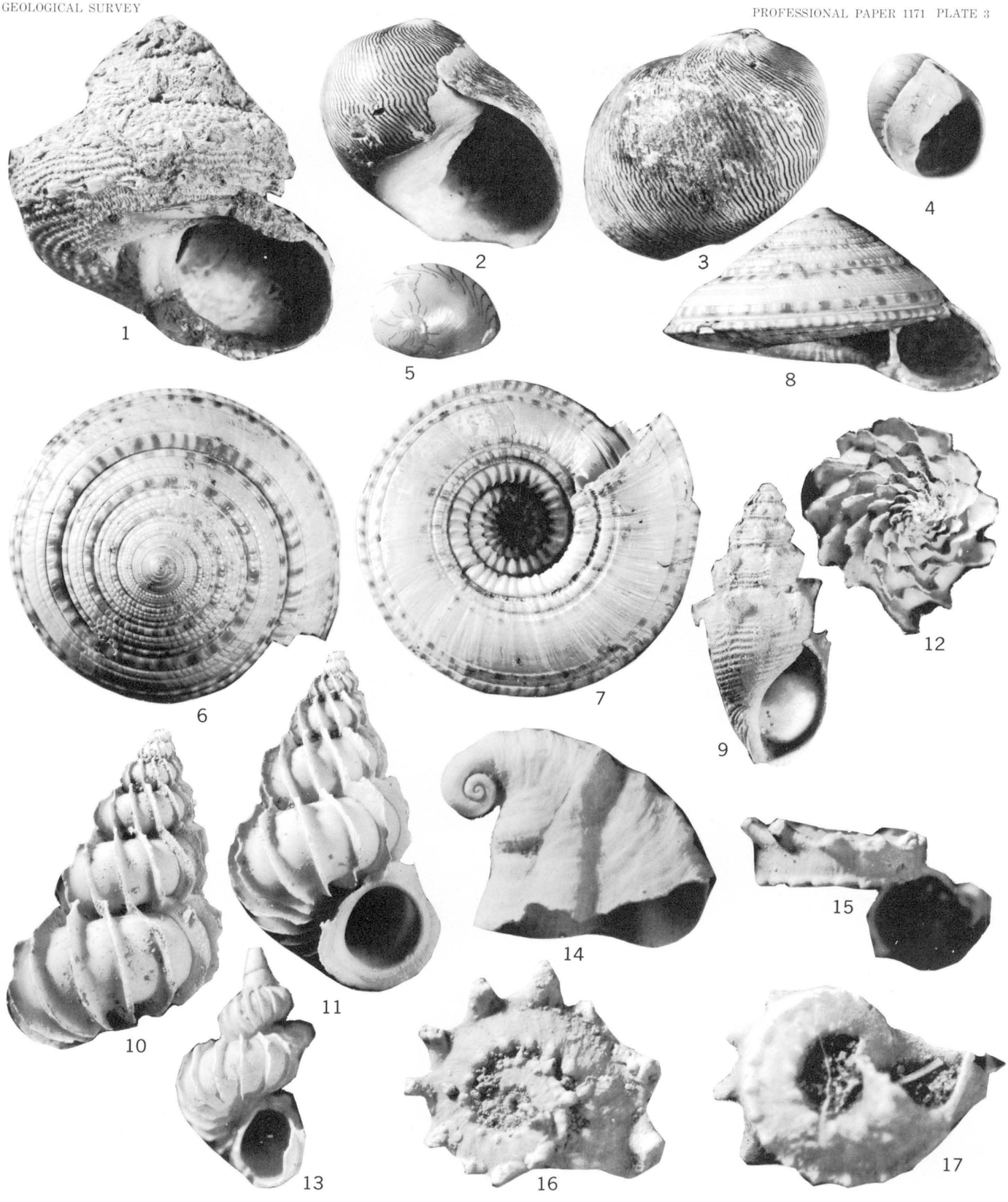
9. *Thiara* (*Plotia*) *scabra* (Müller) (p. 32).
   Height 12.8 mm (× 4). USGS locality 21031, float in Sarakata River, Santo, New Hebrides. Probably Pleistocene. USNM 214319.

10–12. *Epitonium* cf. *E. replicata* (Sowerby) (p. 33).
   Height 12.3 mm (× 5). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214303.

13. *Epitonium* (*Cycloscala*) cf. *E. revolutum* (Hedley) (p. 33).
   Height 2.3 mm (× 20). Station C1766. Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214326.

14. *Capulus japonicus* A. Adams (p. 35).
   Length 4.2 mm (× 10). USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214359.

15–17. *Cyclostrema somidi* Ladd, n. sp. (p. 28).
   Holotype. Diameter 2.3 mm (× 20). Station C2023, Viti Levu, Fiji. Late Tertiary. USNM 214416.



TURBINIDAE, NERITIDAE, ARCHITECTONICIDAE, THIARIDAE, EPITONIIDAE, CAPULIDAE, CYCLOSTREMATIDAE

PLATE 4

FIGURES 1, 2. *Crepidula* sp. A (p. 36).
Length 2.8 mm (× 15). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214410.

3–6. *Tibia powisii* (Petit) (p. 34).
3, 4. A strongly sculptured shell; length 45.4 mm (× 1½).
5, 6. A comparatively smooth shell; length 45.9 mm (× 1½).
Both shells from USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM nos. 214285 and 214286.

7, 8. *Varicospira cancellata spinifera* (Martin) (p. 33).
Length (incomplete) 17.3 mm (× 3). Station C2026, Vitu Levu, Fiji. Late Tertiary (Tertiary *f* or *g*). USNM 214289.

9, 10. *Strombus* (*Canarium*) *labiatus* (Röding) (p. 34).
Length 33.4 mm (× 2). Station C2026. Viti Levu, Fiji. Probably Pliocene (Tertiary *h*). USNM 214235.

11, 12. *Strombus* (*Dolomena*) *plicatus columba* Lamarck (p. 34).
Length 44.8 mm (× 1½). Station SG79 (river debris), Santo, New Hebrides. Probably Pleistocene. USNM 308096.

13, 14. *Strombus* (*Lentigo*) *pipus* (Röding) (p. 35)
Length 40.8 mm (× 1½). Tuff zone on north coast of Rotuma. Holocene. USNM 214284.

15–17. *Strombus* (*Euprotomus*) *bulla* (Röding) (p. 35)
Length 43.1 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214234.

CALYPTRAEIDAE, STROMBIDAE

PLATE 5

FIGURES 1–3. *Trivirostra* (*Dolichupis*) *producta* (Gaskoin) (p. 36).
Length 7.1 mm (× 8). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214334.

4. *Cypraea* (*Erronea*) *gracilis* Gaskoin (p. 36).
Length 14.4 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175132.

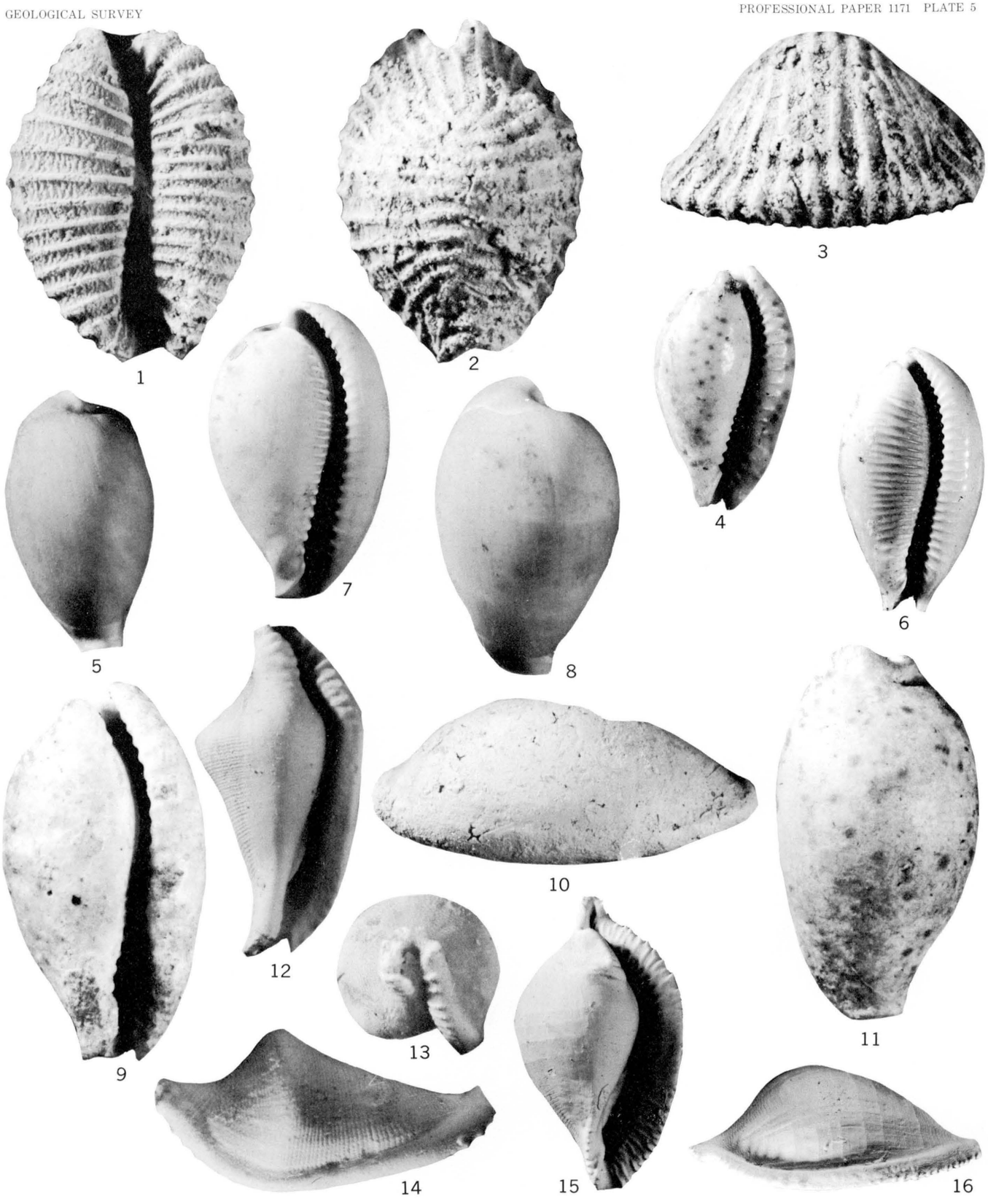
5, 6. *Cypraea* (*Erronea*) *pulchella* Swainson (p. 36).
Length 31.4 mm (× 1½). Station SM242. Kere River, Santo, New Hebrides. Pleistocene. USNM 214279.

7, 8. *Cypraea* (*Erronea*) cf. *C. pyriformis* Gray (p. 37).
Length 27.2 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214292.

9–11. *Cypraea* (*Notadusta*) *punctata* Linnaeus (p. 37).
Length 11.2 mm (× 6). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308097.

12–14. *Dentiovula masaoi* Cate (p. 37).
Length 6.0 mm (× 10). USGS locality 25734 on the Navaka River, Santo, New Hebrides. Pleistocene. USNM 214358.

15, 16. *Crenavolva* (*Serratovolva*) *imitablis* Cate (p. 37).
Length 17.9 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308098.



ERATOIDAE, CYPRAEIDAE, OVULIDAE

PLATE 6

FIGURE

1. *Volva* (*Volva*) *volva* (Linnaeus) (p. 38).
   Height (incomplete) 54.6 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308099.
2. *Phenacovolva longirostrata* (Sowerby) (p. 38).
   Height 51.5 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214258.

3, 4. *Ovula ishibashii* (Kuroda) (p. 38).
   Length 31.5 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214231.

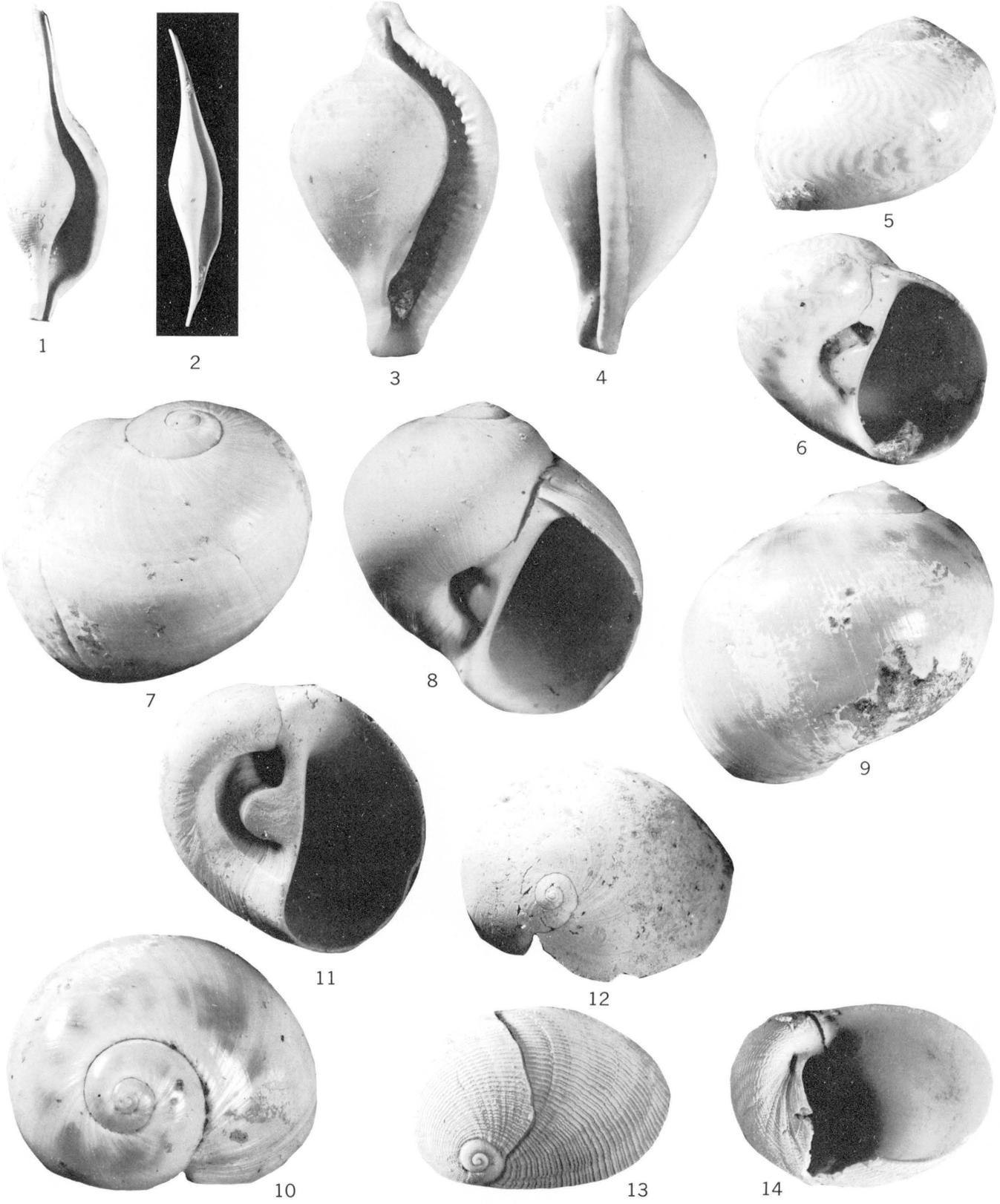
5, 6. *Natica* (*Natica*) *areolata* Récluz (p. 38).
   Height 20.9 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 214247.

7. *Natica* (*Natica*) *vitellus* (Linnaeus) (p. 39).
   Height 36.3 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308100.

8–10. *Natica* (*Tectonatica*) aff. *N. violacea* Sowerby (p. 39).
   Height 18.5 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308101.

11, 12. *Neverita albumen* (Linnaeus) (p. 39).
   Height 13.3 mm (× 3). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214245.

13, 14. *Sinum undulatum* (Lischke) (p. 39).
   Height 4.5 mm (× 5). Station SM259, Santo, New Hebrides. Pleistocene. USNM 308102.



OVULIDAE, NATICIDAE

PLATE 7

FIGURES 1, 2. *Phalium areola* (Linnaeus) (p. 40).
Height 34.7 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308103.

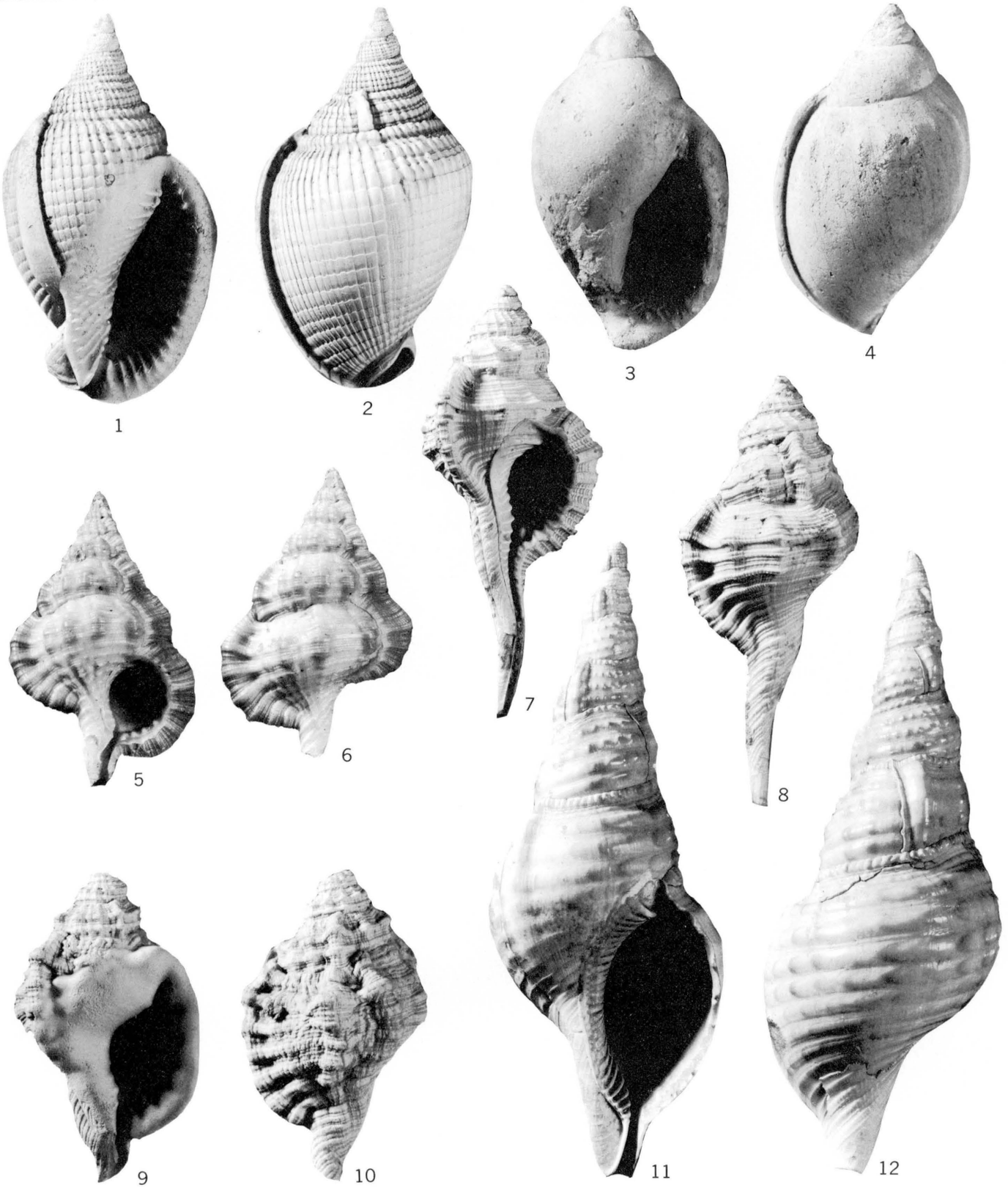
3, 4. *Casmaria ponderosa* (Gmelin) (p. 40).
Length 30.5 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308104.

5, 6. *Gyrineum* cf. *G. reticulare robusta* (Fulton) (p. 41).
Height 34.9 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214253.

7, 8. *Cymatium* (*Ranularia*) *sinensis* (Reeve) (p. 41).
Length 76.5 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308105.

9, 10. *Cymatium* (*Ranularia*) *gutturnium* (Röding) (p. 41).
Height 28.2 mm (× 2). Station SM309, Santo, New Hebrides, Pleistocene. USNM 308106.

11, 12. *Charonia tritonis* (Linnaeus) (p. 41).
Height 119 mm (× 1). USGS locality 25742, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214342.



CASSIDAE, CYMATIIDAE

PLATE 8

FIGURE

1. *Colubraria maculosa* (Gmelin) (p. 48).
   Height (incomplete) 38.7 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214287.

2, 3. *Colubraria rehderi* Ladd, n. sp. (p. 49).
   Holotype. Height 35.2 mm (× 2). USGS locality 25718, Kere River, Santo, New Hebrides, Pleistocene. USNM 214293.

4, 5. *Bursa rubeta* (Linnaeus) (p. 42).
   Height 73.8 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308107.

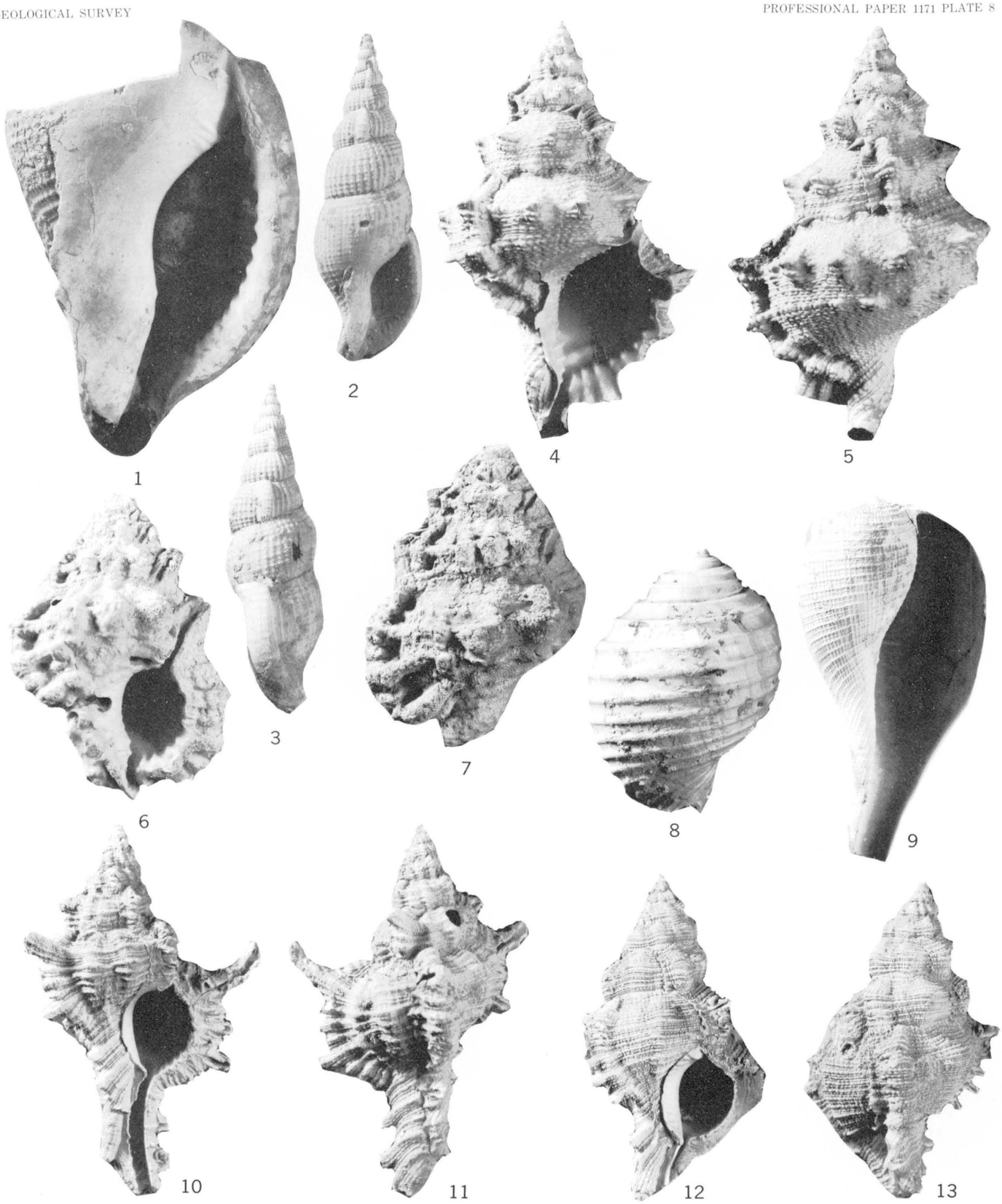
6, 7. *Bursa bufonia dunkeri* Kira (p. 41)
   Height 36.7 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214267.

8. *Tonna allium* (Dillwyn) (p. 42).
   Height 43.5 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214263.

9. *Ficus ficoides* (Lamarck) (p. 42).
   Height 65.4 mm (× 1). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214230.

10, 11. *Chicoreus axicornis* (Lamarck) (p. 42).
   Height 30.7 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214256.

12, 13. *Chicoreus* cf. *C. superbus* (Sowerby) (p. 43).
   Height 39.3 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214280.



COLUBRARIIDAE, BURSIDAE, TONNIDAE, FICIDAE, MURICIDAE

PLATE 9

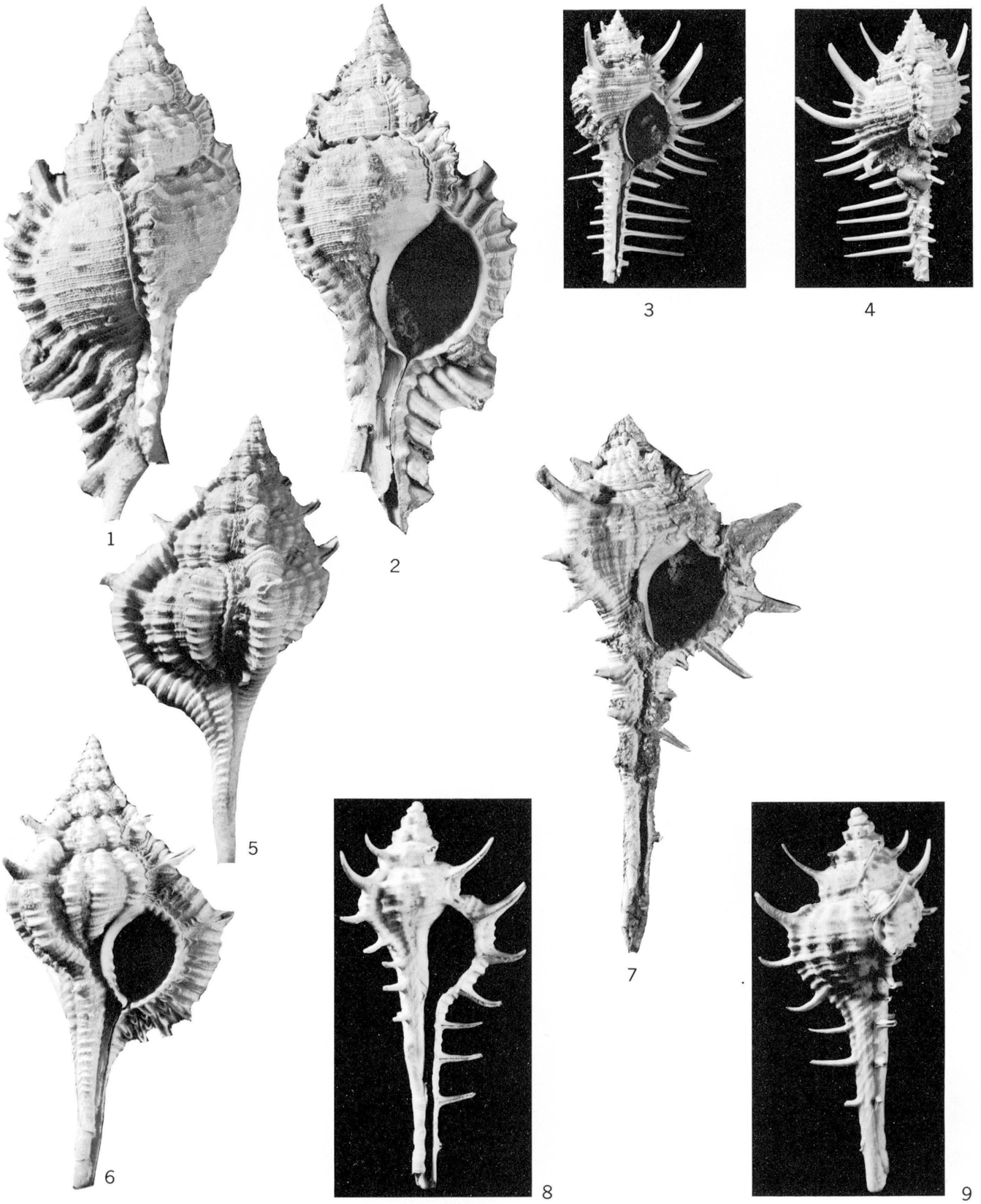
FIGURES 1, 2. *Pterynotus* (*Naquetia*) *barclayi* (Reeve) (p. 43).
Length 95.6 mm (× 1). USGS locality 25715 on the Kere River, Santo, New Hebrides. Pleistocene. USNM 214244.

3, 4. *Murex* (*Murex*) *pecten* (Lightfoot) (p. 43).
Length 48.2 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308108.

5, 6. *Murex* (*Murex*) *rectirostris* Sowerby (p. 43).
Length 41.4 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214236.

7. *Murex* (*Murex*) *tribulus* Linnaeus (p. 43).
Length 97.0 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308109.

8, 9. *Murex* (*Murex*) aff. *M. aduncospinosus* Beck (p. 43).
Length 17.3 mm (× 4). Station C2055, Viti Levu Fiji. Possibly Pliocene (Tertiary *h*). USNM 214268.



1 2 3 4 5 6 7 8 9

MURICIDAE

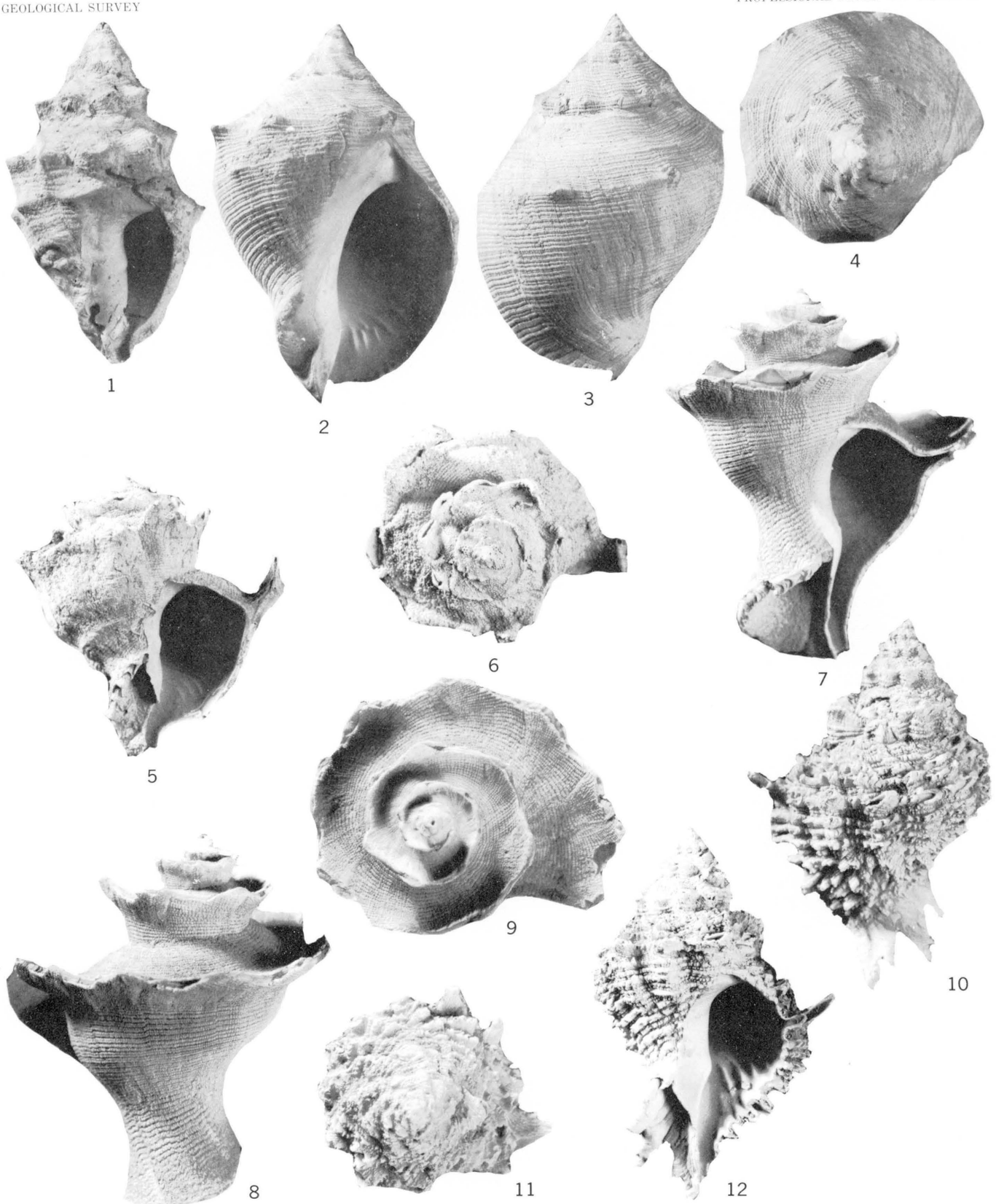
PLATE 10

FIGURE 1. *Drupella cornus* (Röding) (p. 44).
Height 31.3 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214272.

2–4. *Mancinella* aff. *M. bufo* (Lamarck) (p. 44).
Height 45.2 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308110.

5–9. *Latiaxis* (*Tolema*) *deburghiae* (Reeve) (p. 45).
5, 6. Height 33.7 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214248.
7–9. Height 36.3 mm (× 2). Station C2026, Viti Levu, Fiji. Probably Pliocene (Tertiary *h*). USNM 214249.

10–12. *Latiaxis* (*Tolema*) cf. *L. winckworthi* Fulton (p. 45).
Height 33.7 mm (× 2). Station SM242, Kere River,, Santo, New Hebrides. Pleistocene. USNM 308111.



THAIDIDAE, MAGILIDAE

PLATE 11

FIGURES 1–3. *Latiaxis* (*Tolema*) *blowi* Ladd (p. 45).
Holotype. Height 28.0 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214250.

4–7. *Latiaxis roddai* Ladd, n. sp. (p. 45)
4, 5. Holotype. USNM 214254. Height 27.8 mm (× 2).
6, 7. Paratype. USNM 214255. Height 23.5 mm (× 2).
Both specimens from station C2026, Viti Levu, Fiji. Age, Pliocene (Tertiary *h*).

8, 9. *Hindsia sinensis* (Sowerby) (p. 47)
Height 31.9 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214270

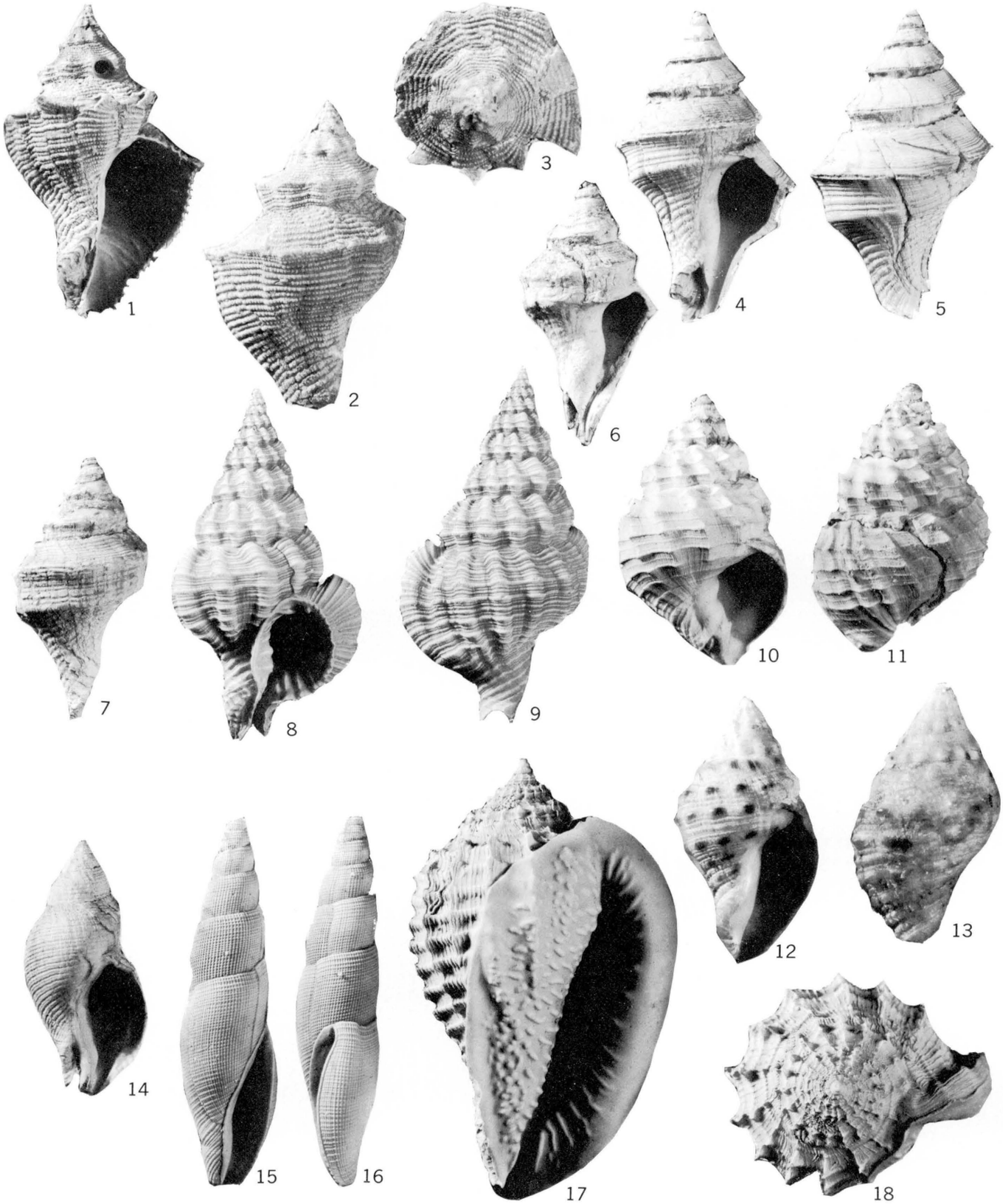
10, 11. *Hindsia rewaensis* Ladd, n. sp. (p. 47)
Holotype. Height 16.5 mm. (× 3). Station C2026 Viti Levu, Fiji; age, Pliocene (Tertiary *h*). USNM 214335.

12, 13. *Drupa* (*Morula*) *concatenata* (Lamarck) (p. 44).
Height 15.7 mm (× 3). Drill hole E–1, Eniwetok, depth 40–50 ft (12–15 m) age, Holocene. USNM 214229.

14. *Euthria rewaensis* Ladd, n. sp. (p. 48)
Holotype. Height 44.5 mm (× 1). Station C2026, Viti Levu, Fiji; age, Pliocene (Tertiary *h*). USNM 214333.

15, 16. *Metula* cf. *M. mitrella* (Adams and Reeve) (p. 48)
Height 33.2 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides, Pleistocene. USNM 214282.

17, 18. *Morum* (*Cancellomorum*) *cancellata* (Sowerby) (p. 40)
Length 38.0 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214225.



MAGILIDAE, BUCCINIDAE, THAIDIDAE, CASSIDAE

PLATE 12

FIGURES 1–3. *Nassarius* (*Plicarcularia*) *globosus* (Quoy and Gaimard) (p. 49).
Height 11.7 mm (× 5). Station SM239, Navaka River, Santo, New Hebrides. Pleistocene. USNM 308112.

4, 5. *Nassarius* (*Plicarcularia*) cf. *N. bimaculatus* (A. Adams) (p. 50).
Height 6.1 mm (× 6). Station SM329, Wenui River, Santo, New Hebrides. Pleistocene. USNM 214339.

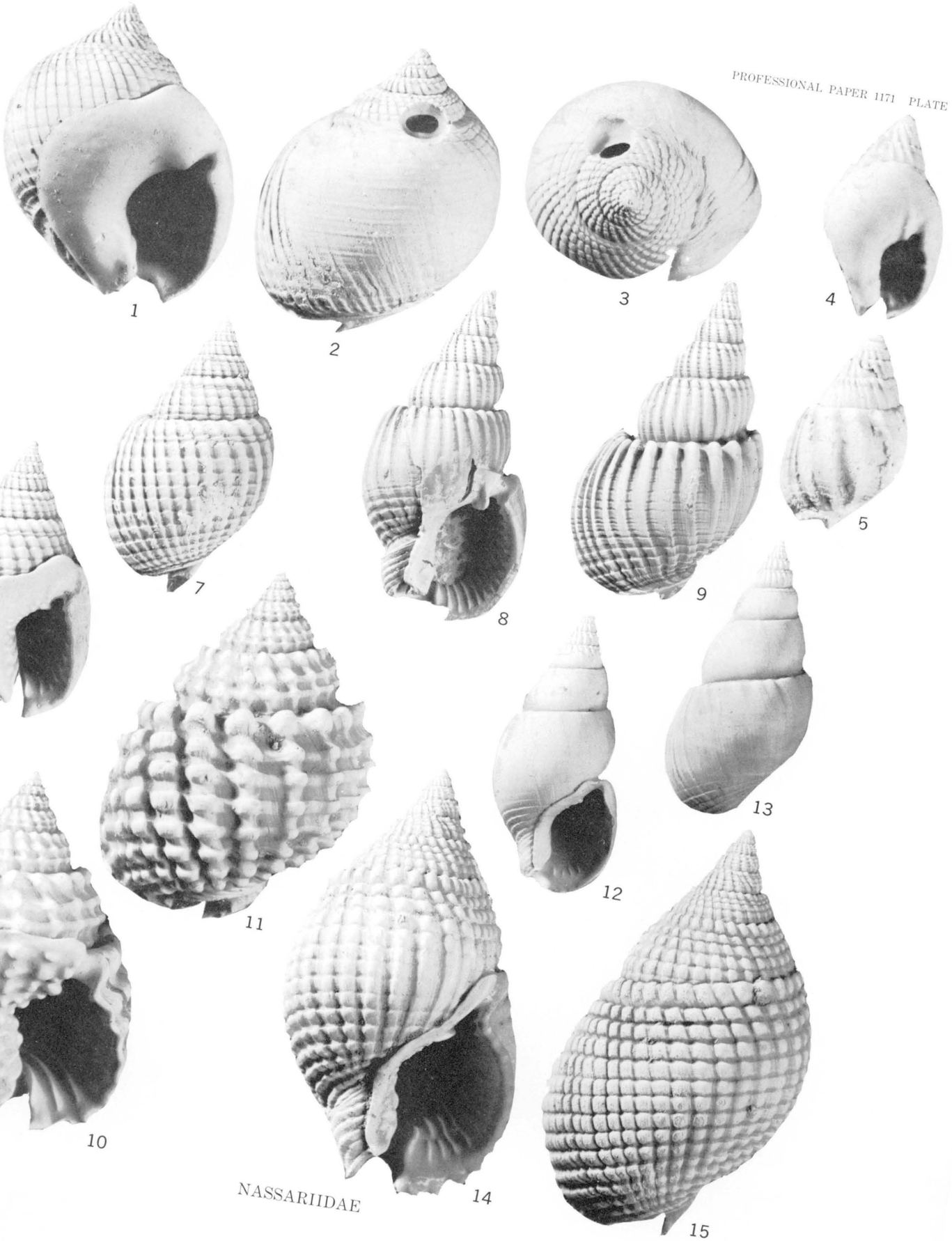
6, 7. *Nassarius* (*Niotha*) *albescens* (Dunker) (p. 50).
Height 17.3 mm (× 3). Station SG82, Sarakata River, Santo, New Hebrides. Pleistocene. USNM 308113.

8, 9. *Nassarius* (*Niotha*) *nodiferus* (Powys) (p. 50).
Height 31.9 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214252.

10, 11. *Nassarius* (*Niotha*) *variegatus* (A. Adams) (p. 50).
Height 23.2 mm (× 3). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214251.

12, 13. *Nassarius* (*Zeuxis*) *dorsatus* (Röding) (p. 50).
Height 26.9 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214281.

14, 15. *Nassarius* (*Zeuxis*) *margaritiferus* (Dunker) (p. 51).
Height 27.6 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308114.



NASSARIIDAE

PLATE 13

FIGURES 1, 2. *Latirus craticulatus* (Linnaeus) (p. 51)
Height 44.4 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308115.

3, 4. *Latirus paetelianus* (Küster) (p. 52).
Height 46.5 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214269.

5, 6. *Latirus polygonus* (Gmelin) (p. 52).
Height 66.9 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308116.

7, 8. *Latirus* cf. *L. formosior* Melvill (p. 52).
Height 29.9 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214297.

9, 10. *Dolicholatirus* cf. *D. lancea* (Gmelin) (p. 52)
Height (incomplete) 17.8 mm (× 3). Station 160, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214294.

11. *Fusinus colus* (Linnaeus) (p. 53).
Height 92 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214257.

12, 13. *Oliva ispida* (Röding) (p. 53).
Length 33.8 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214331.

14, 15. *Mitra* (*Nebularia*) *contracta* Swainson (p. 53).
Height 28.7 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214301.

16. *Cancilla* (*Cancilla*) *isabella* (Swainson) (p. 53).
Height 49.6 mm (× 1½) USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214233.

17, 18. *Vexillum* (*Vexillum*) *coccineum* (Reeve) (p. 54).
Height 35.3 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214264. (Shell uncoated to show color banding).

FASCIOLARIIDAE, OLIVIDAE, MITRIDAE

PLATE 14

FIGURES 1, 2. *Vexillum* (*Vexillum*) *vulpecula* (Linnaeus) (p. 54)
Height 40.0 mm (× 1½). Station SG79, Sarakata River, Santo, New Hebrides. Pleistocene. Shell uncoated to show traces of original color bands. USNM 308117.

3, 4. *Vexillum* (*Costellaria*) *polygonum* (Gmelin) (p. 54)
Height 53.5 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214290.

5. *Vexillum* (*Costellaria*) cf. *V. bellum* (Pease) (p. 54)
Height 30.0 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214266.

6, 7. *Vexillum* (*Pusia*) *millecostatum* (Broderip) (p. 54)
Height 23.8 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214300.

8, 9. *Volutomitra*? *vitilevensis* Ladd, n. sp. (p. 56)
Holotype, length 35.0 mm (× 2). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214332.

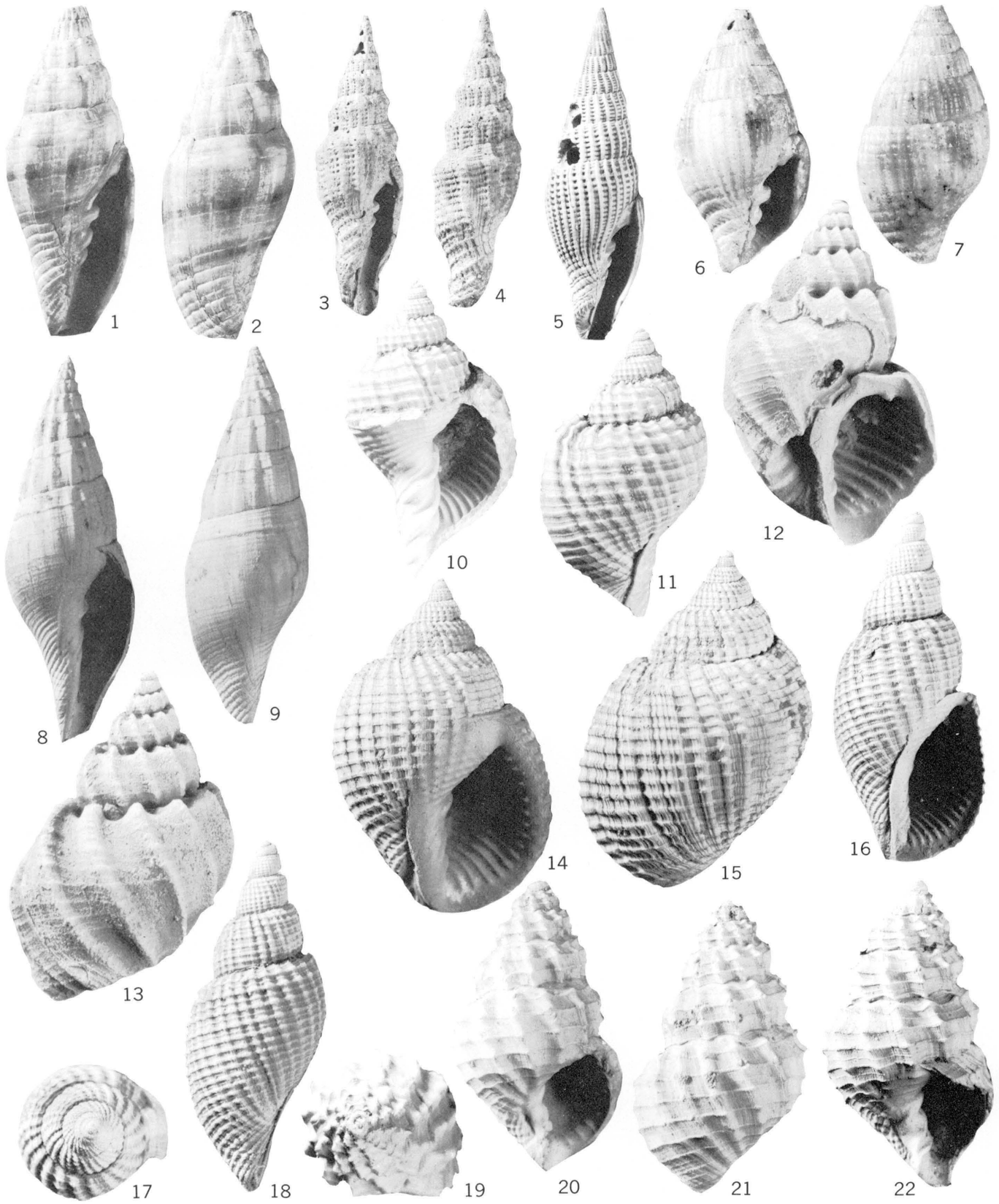
10, 11. *Cancellaria tholoensis* Ladd (p. 57).
Holotype, length 27.2 mm (× 2). Station 59, Viti Levu, Fiji. Late Miocene (Tertiary *g*). B. P. Bishop Museum, Geol. no. 1213.

12, 13. *Trigonostoma* (*Scalptia*) *crenifera* (Sowerby) (p. 57).
Height 12.5 mm (× 5). Station C1264, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 175124.

14, 15. *Cancellaria* (*Merica*) *asperella* Lamarck (p. 57).
Length 25.0 mm (× 2½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308118.

16–18. *Cancellaria* (*Merica*) *petiti* Ladd, n. sp. (p. 57).
Holotype, height 15.7 mm (× 4). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214320.

19–22. *Neadmete nausorensis* Ladd, n. sp. (p. 58).
19–21. Holotype, length 17.8 mm (× 3). USNM 214249.
22. Paratype, length 19.0 mm (× 3). USNM 214351. Both specimens from station C2026, Vitu Levu, Fiji. Pliocene (Tertiary *h*).



MITRIDAE, VOLUTOMITRIDAE, CANCELLARIIDAE

PLATE 15

[Figures 10 and 14 uncoated; show traces of color pattern]

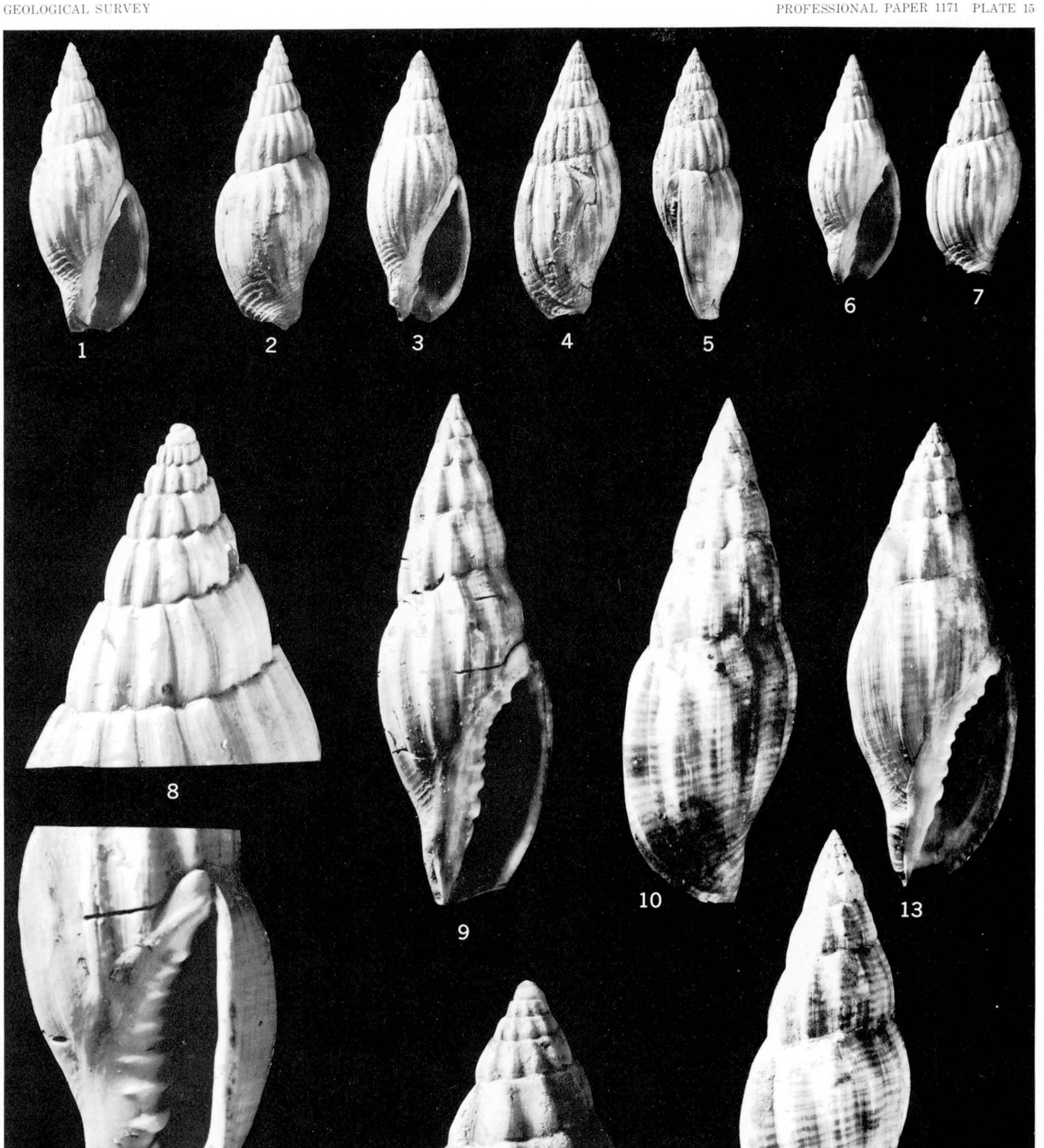
FIGURES 1, 2. *Lyria mallicki* Ladd (p. 56).
Holotype, height 48.0 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175096.

3–5. *Lyria mallicki* Ladd (p. 56).
Paratype A, height 45.7 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214226.

6–8. *Lyria mallicki* Ladd (p. 56).
Paratype B. Height 33.0 mm (fig. 6, 7, × 1; fig. 8, × 5). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. British Museum (Nat. History) No. GG 19760.

9–12. *Lyria santoensis* Ladd (p. 56).
Holotype, height 87.7 mm (figs. 9, 10, × 1; fig. 11, × 1½; figure 12 × 5). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175138.

13, 14. *Lyria santoensis* Ladd (p. 56).
Paratype, height 78.6 mm (× 1). USGS locality 25742, Navaka River, Santo, New Hebrides. Pleistocene. USNM 175139.



VOLUTIDAE

PLATE 16

FIGURES 1–3. *Coralliophila mallicki* Ladd (p. 44).
Holotype, height 11.9 mm (× 6). Station SM242, Kere River, Santo, New Hebrides. Pleistocene USNM 214348.

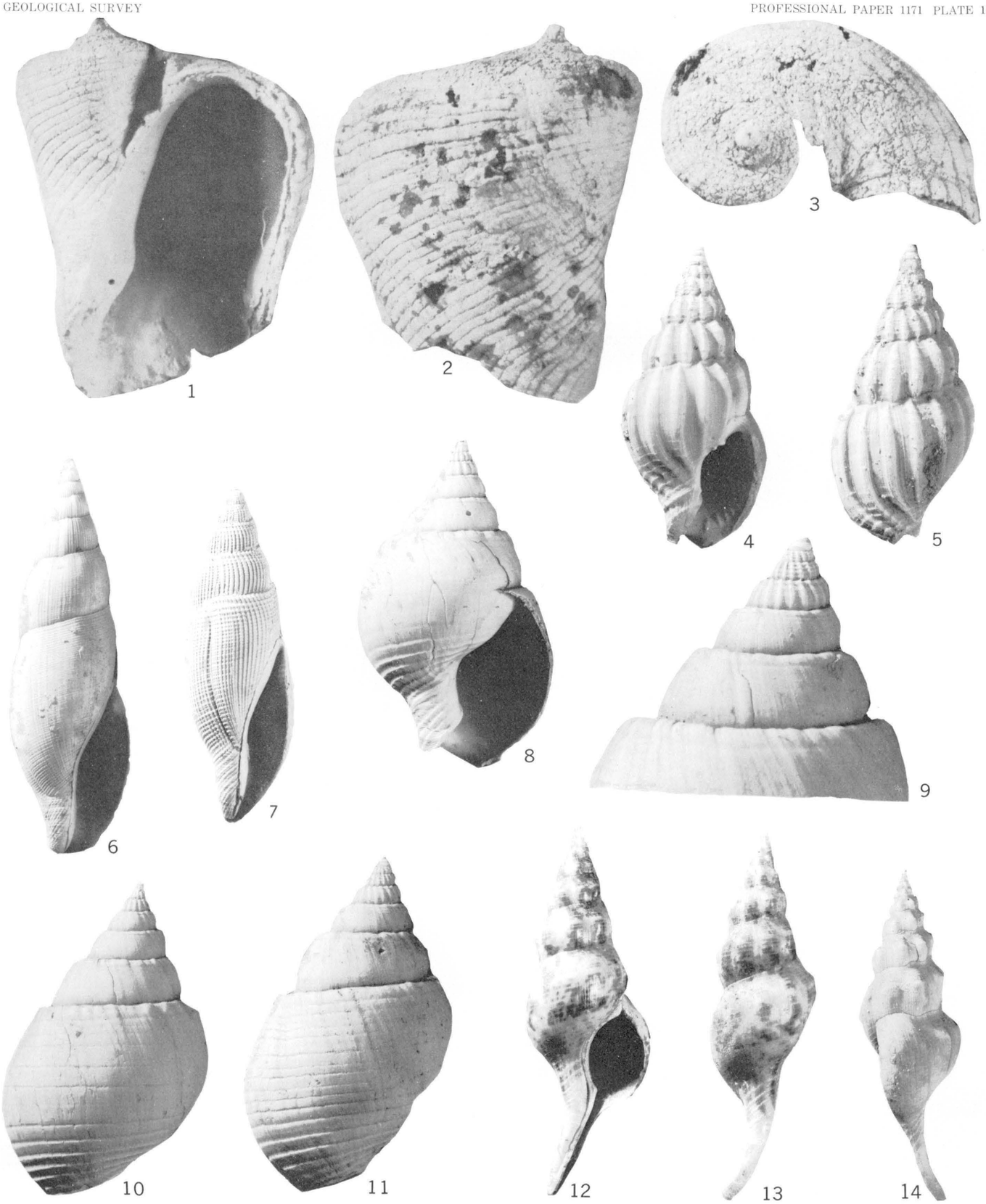
4, 5. *Phos bakeri* Ladd (p. 47).
Holotype, height 18.4 mm (× 3). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214307.

6. *Metula kerensis* Ladd (p. 48).
Holotype, height 24.3 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 214288.

7. *Metula santoensis* Ladd (p. 48).
Holotype, height 30 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. BM (Nat. Hist.) GG19763.

8–11. *Nassarius* (*Alectrion*) *barsdelli* Ladd (p. 51).
8–10. Holotype, height 23.8 mm Apertural and rear views (× 2.5); tip (× 5). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214274.
11. Paratype, height 23.8 mm (× 2½). USNM 214278.

12–14. *Siphonofusus walleri* (Ladd) (p. 47).
12, 13. Holotype, length 66.6 mm (× 1). USNM 214260.
14. Paratype, length 58.7 mm (× 1). USNM 214261. Both types from USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene.



MAGILIDAE, BUCCINIDAE, NASSARIIDAE

PLATE 17

Pedicularia navakaensis Ladd, n. sp. (p. 37).

Scanning electron microscope photographs of holotype and only specimen. Length 5.7 mm. USNM 214385, USGS locality 25734, Navaka River, Santo, New Hebrides. Pleistocene.

FIGURE
1. × 18
2. × 12
3. × 20
4. × 18
5. × 88

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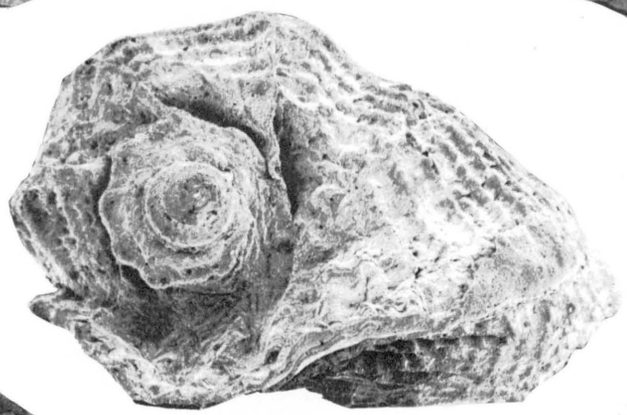

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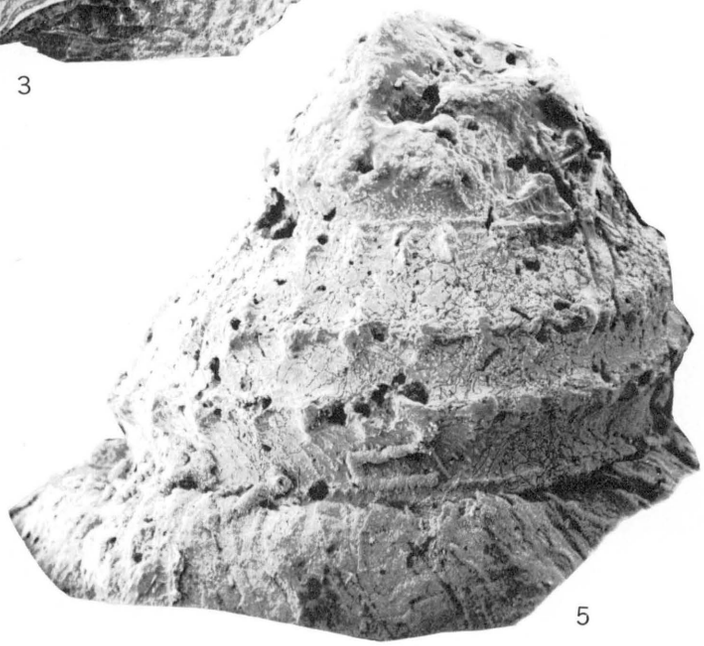

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OVULIDAE

PLATE 18

FIGURES 1, 2. *Gemmula speciosa* (Reeve) (p. 59).
Height 28.0 mm (× 1½). Station C2024, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214310.

3–6. *Gemmula kieneri* (Doumet) (p. 60).
3, 4. Height 44.0 mm (× 1½). Station SM242–57A, Kere River, Santo, New Hebrides. Pleistocene. USNM 308119.
5, 6. Height 39.9 mm (× 1½). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214368.

7, 8. *Gemmula kieneri woodwardi* (Martin) (p. 60).
Height 24.5 mm (× 2). Station C2021, Vitu Levu, Fiji. Probably Pliocene (Tertiary *h*). USNM 214295.

9, 10. *Gemmula congener* (E. A. Smith) (p. 60).
Height (incomplete) 18.7 mm (× 2½). Station B107, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214369.

11, 12. *Gemmula monilifera* (Pease) (p. 60).
Height 18.6 mm (× 3). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214372.

13, 14. *Gemmula* aff. *G. clifdenensis* Powell (p. 60).
Height 25.7 mm (× 2½). Station FB13, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214370.

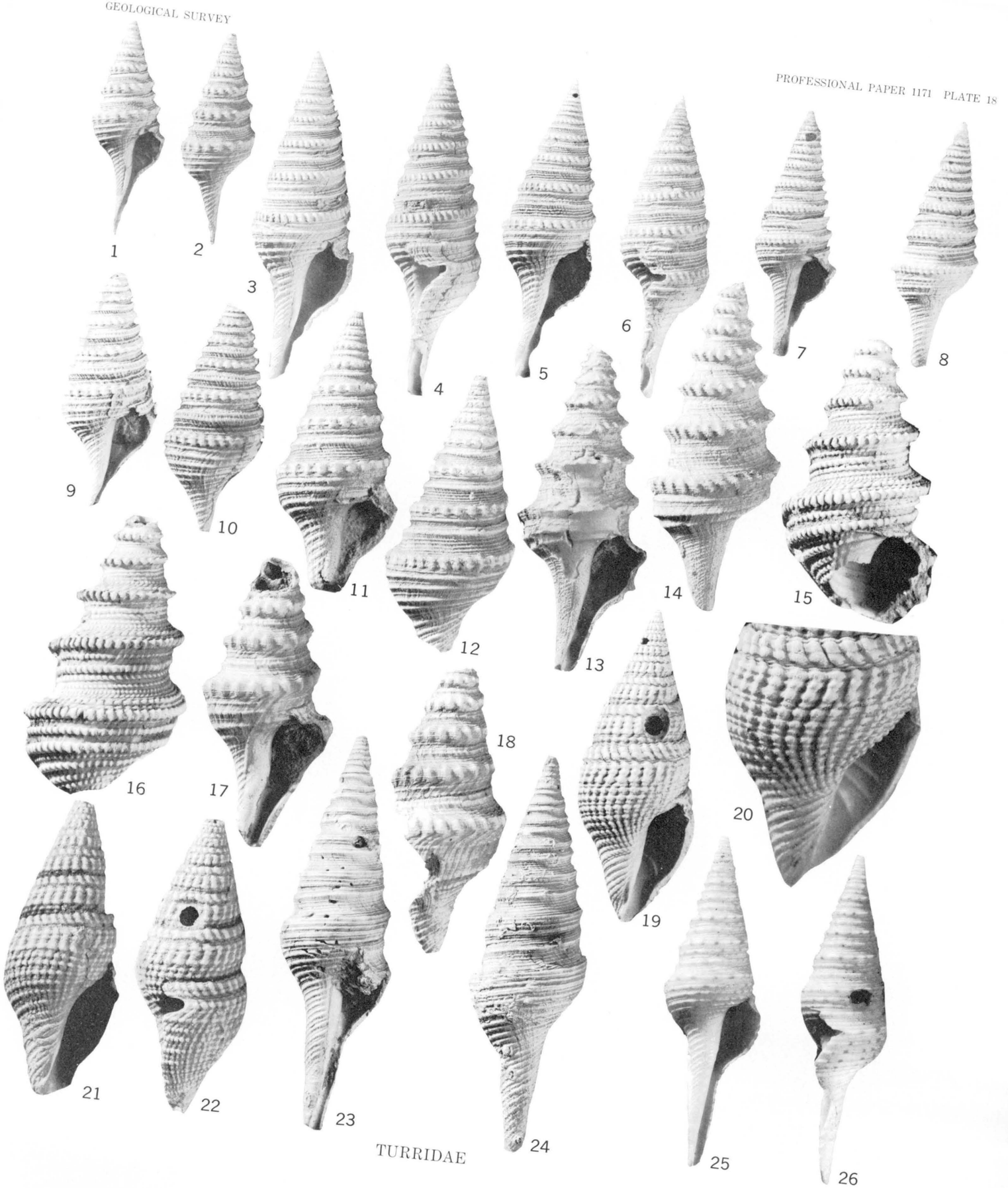
15, 16. *Gemmula* sp. A (p. 61).
Height (incomplete) 14.1 mm (× 4). Station C2021, Viti Levu, Fiji. Pliocene. (Tertiary *h*). USNM 214328.

17, 18. *Ptychosyrinx* aff. *P. timorensis teschi* Powell (p. 61).
Height (incomplete) 28.4 mm (× 2). Station C2026, Viti Levu, Fiji. Late Tertiary. USNM 214312.

19–22. *Epidrona greenbaumi* Ladd (p. 62).
19, 20. Holotype length 20.8 mm, 19, apertural view (× 3); 20, base (× 5) USGS locality 25715, USNM 214306.
21, 22. Paratype length 20.0 mm (× 3). Station SM242 BM(NH)GG19762.
Both shells from outcrops on Kere River, Santo, New Hebrides. Pleistocene.

23, 24. *Lophiotoma* (*Lophiotoma*) *acuta* (Perry) (p. 62).
Length 80.0 mm (× 1). Station SM242, Kere River, Santo, New Hebrides, Pleistocene. USNM 308120.

25, 26. *Lophiotoma* (*Lophioturris*) *indica* (Röding) (p. 63).
Length 43.9 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308121.



TURRIDAE

PLATE 19

FIGURE 1. *Lophiotoma* (*Lophiotoma*) *acuta* (Perry) (p. 62).
Latex cast of mold from station (× 75), Viti Levu, Fiji. Length 49 mm (× 1). Age, late Tertiary. USNM 175097.

2, 3. *Lophiotoma* (*Lophiotoma*) *eniwetokensis* Ladd, n. sp. (p. 62).
Holotype, height 24.6 mm (× 2). Drill hole F–1, Eniwetok, depth 890–900 feet. Early Miocene (Tertiary *f*). USNM 214309.

4, 5. *Lophiotoma* (*Lophiotoma*) cf. *L. leucotropis* (Adams and Reeve) (p. 63).
Height (incomplete) 20.6 mm (× 2½). Station C2026, Viti Levu, Fiji. Late Tertiary. USNM 214308.

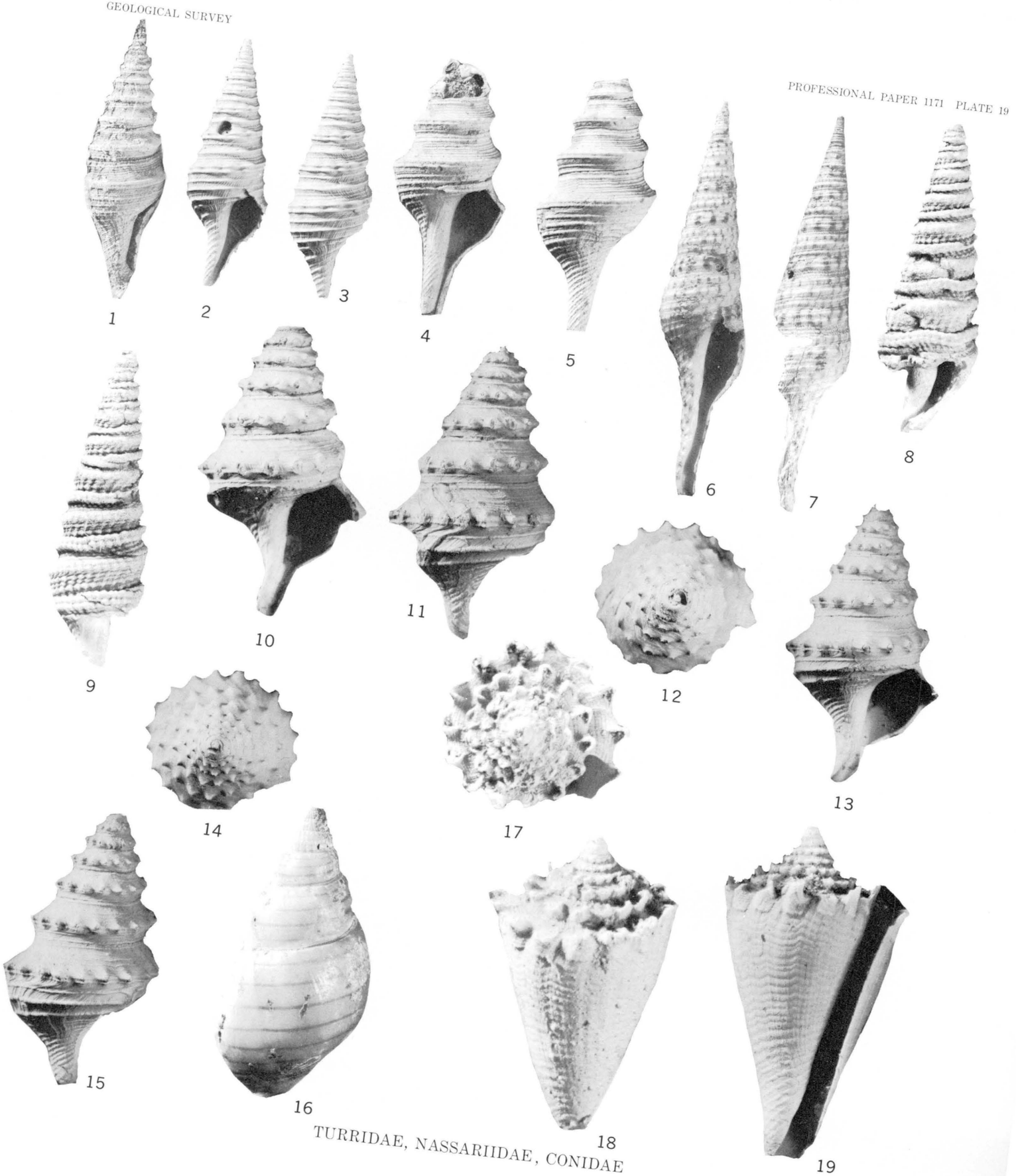
6, 7. *Turris crispa crispa* (Lamarck) (p. 63).
Length 77.5 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175100.

8, 9. *Nasavusavuia nuttalli* Ladd, n. gen. et n. sp. (p. 61).
Holotype, length 21.1 mm (× 3). Station VI–5, Vanua Levu, Fiji British Museum (Nat. Hist.) GG1841.

10–15. *Cryptogemma richmondi* Ladd, n. sp. (p. 61).
10–12. Holotype (incomplete) height 24.1 mm (× 2½).
13–15. Paratype height 23.0 mm (× 2½).
Both specimens, USNM 214403 and 214404, from station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*).

16. *Nassarius* (*Alectrion*) *glans* (Linnaeus) (p. 51).
Height 43.6 mm (× 1½). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214408.

17–19. *Kenyonia* cf. *K. chiangi* (Azuma) (p. 81).
Length 10.4 mm (× 6). USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214291.



TURRIDAE, NASSARIIDAE, CONIDAE

PLATE 20

FIGURES 1, 2. *Comitas* aff. *C. kamakurana* (Pilsbry) (p. 63).
Height 52.7 mm (× 1). USGS locality 25715, Santo, New Hebrides. Pleistocene. USNM 214273.

3–6. *Comitas nausorensis* Ladd, n. sp. (p. 64).
3, 4. Paratype B. Height 31.3 mm (× 2). USNM 214276.
5, 6. Paratype A. Height 37.5 mm (× 2). USNM 214275.
Both specimens from station C2026, Viti Levu, Fiji Pliocene (Tertiary *h*).

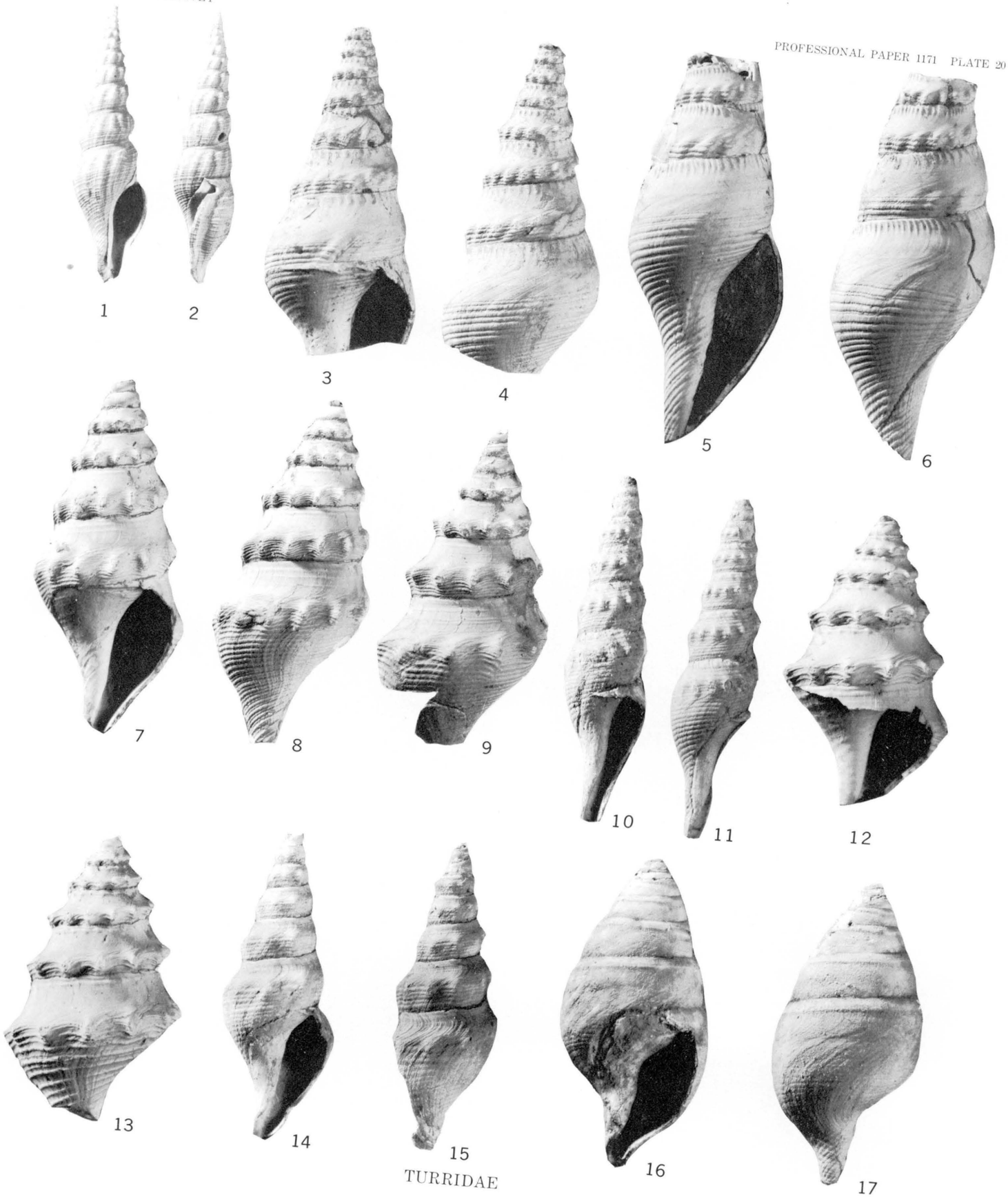
7–9. *Comitas waluensis* Ladd, n. sp. (p. 64).
7, 8. Holotype. Height 33.7 mm (× 2). USNM 214262.
9. Paratype. Height 30.8 mm (× 2). USNM 214265.
Both specimens from station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*).

10, 11. *Leucosyrinx rabbidgei* Ladd, n. sp. (p. 65).
Holotype. Height 22.1 mm (× 3). Station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214373.

12, 13. *Comitas* sp. A (p. 64).
Height (incomplete) 18.7 mm (× 3). Station C497, Viti Levu, Fiji Early Miocene (Tertiary *f*). USNM 214336.

14, 15. *Leucosyrinx fijiensis* Ladd, n. sp. (p. 64).
Holotype. Height 24.4 mm (× 2½). Station FB–13, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214299.

16, 17. *Clavosurcula*? *briggsi* Ladd, n. sp. (p. 65).
Holotype. Height 14.7 mm (× 4). FB–7, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214232.



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TURRIDAE

PLATE 21

FIGURES 1, 2. *Comitas nausorensis* Ladd, n. sp. (p. 64).
Holotype. Height 28.9 mm (× 2). Station C2026, Viti Levu, Fiji. Late Tertiary. USNM 214314.

3, 4. *Clathrodrillia kerensis* Ladd, n. sp. (p. 65).
Holotype. Height 32.0 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308122.

5, 6. *Crassispira macneili* Ladd, n. sp. (p. 66).
Holotype. Height 30.3 mm (× 2). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214296.

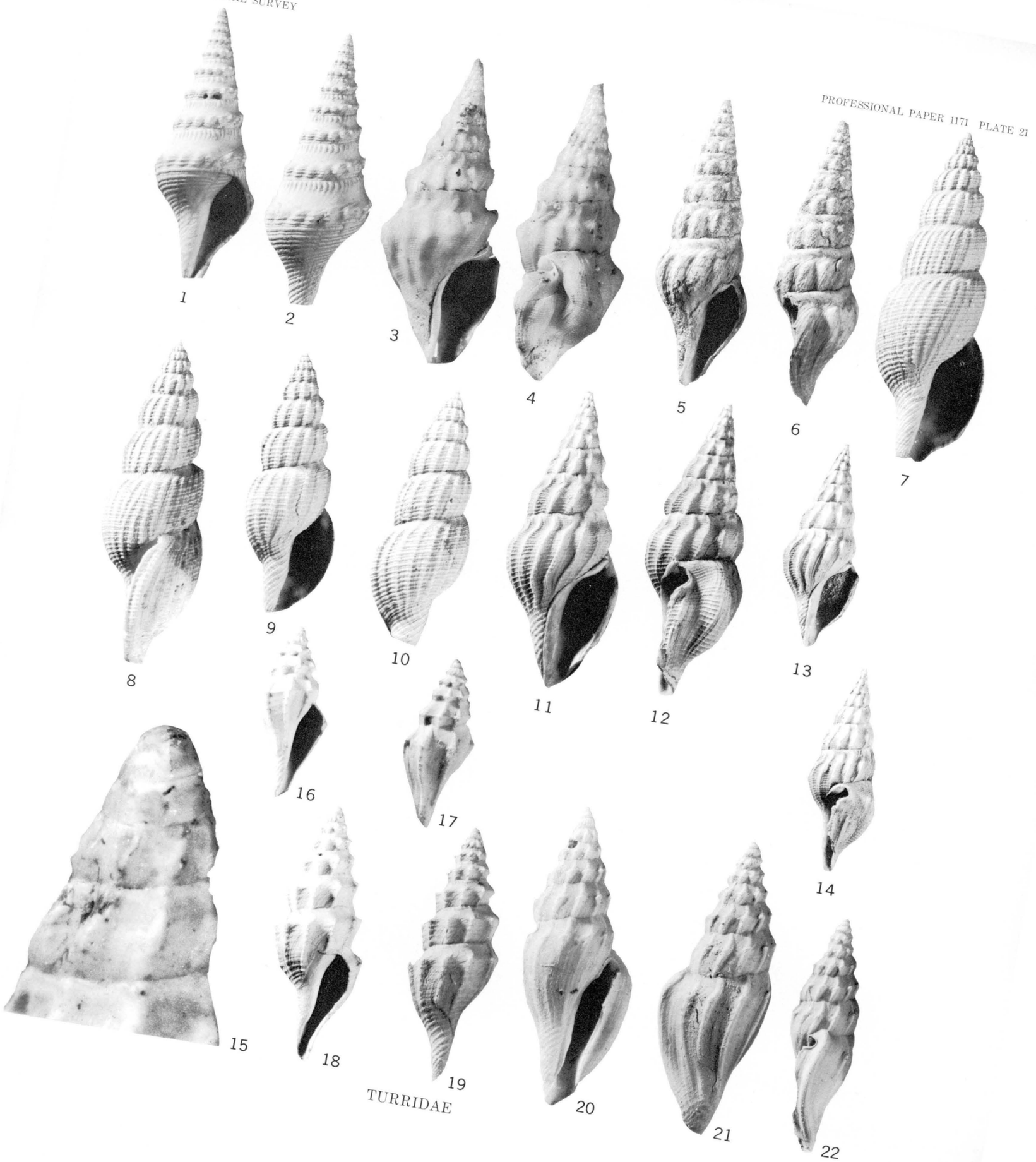
7–10. *Inquisitor walleri* Ladd, n. sp. (p. 66).
7, 8. Holotype. Height 23.1 mm (× 3). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214362.
9, 10. Paratype. Height 18.3 mm (× 3). Same locality as holotype. USNM 308123.

11–15. *Agathotoma vanualevensis* Ladd, n. sp. (p. 66).
11, 12. Holotype, Height 25.2 mm (× 2½). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 216317.
13–15. Paratype. Height 17.3 mm (figs. 13, 14, × 2½; fig. 15, × 30). Locality same as holotype. USNM 216318.

16, 17. *Guraleus vitilevensis* Ladd, n. sp. (p. 67).
Holotype. Height 7.0 mm (× 5). USNM 214341. Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*).

18, 19. *Guraleus fijiensis* Ladd, n. sp. (p. 67).
Holotype. Height 10.5 mm (× 5). USNM 214352. Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*).

20–22. *Guraleus formosus* Ladd, n. sp. (p. 67).
Holotype. Height 12.4 mm (figs. 20, 21, × 5; fig. 22, × 4). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214353.



TURRIDAE

PLATE 22

FIGURES 1–3. *Ithycythara lata* Ladd, n. sp. (p. 68).
Holotype. Height 7.9 mm (× 5). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308124.

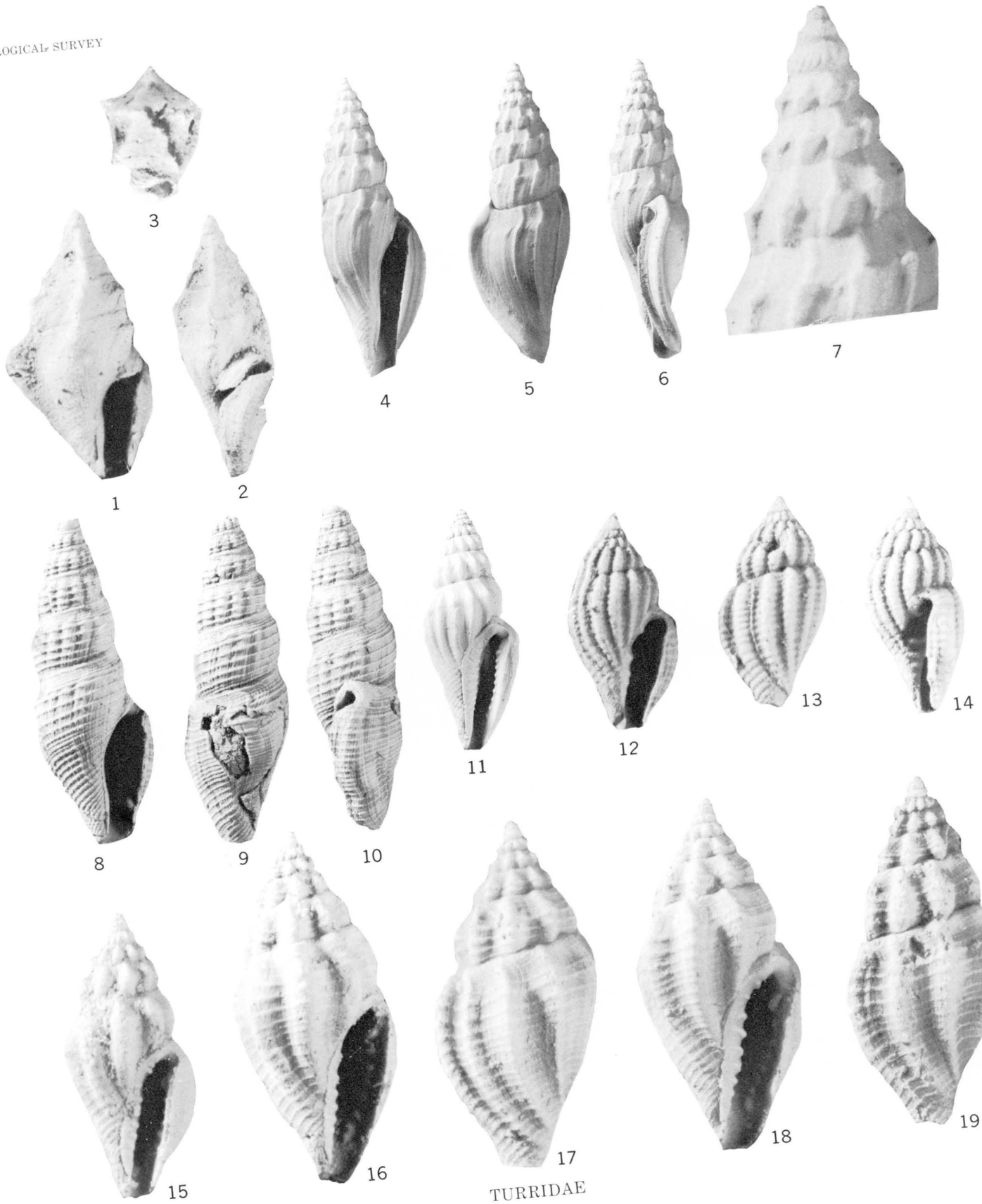
4–7. *Euclathurella santoensis* Ladd, (p. 68).
Holotype. Height 14.0 mm (figs. 4–6, × 4; fig. 7, × 14). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214337.

8–10. *Euclathurella*? sp. A (p. 68).
Height 12.3 mm (× 5). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214338.

11. *Eucithara stromboides* (Reeve) (p. 68).
Height 14.8 mm (× 3). Island of Maewo, New Hebrides. Probably Pleistocene. USNM 214357.

12–14. *Eucithara sawitrae* (Beets) (p. 68).
Length 3.9 mm (× 10). USGS locality 21304, Goikul Peninsula, Babelthuap, Palau. Late Miocene (Tertiary *g*). USNM 214376.

15–19. *Eucithara marshallensis* Ladd, n. sp. (p. 68).
15. Paratype A. Height 5.1 mm (× 10). F–1, Eniwetok, depth 790–800 ft (239–242 m). Late Miocene (Tertiary *g*). USNM 214383.
16, 19. Paratype B. Height 6.4 mm (× 10). 2A, Bikini, depth 852–857 ft (258–259 m). Late Miocene (Tertiary *g*). USNM 214384.
17, 18. Holotype. Height 6.4 mm (× 10). F–1, Eniwetok, depth 690–700 ft (209–212 m). Late Miocene (Tertiary *g*). USNM 214382.



TURRIDAE

PLATE 23

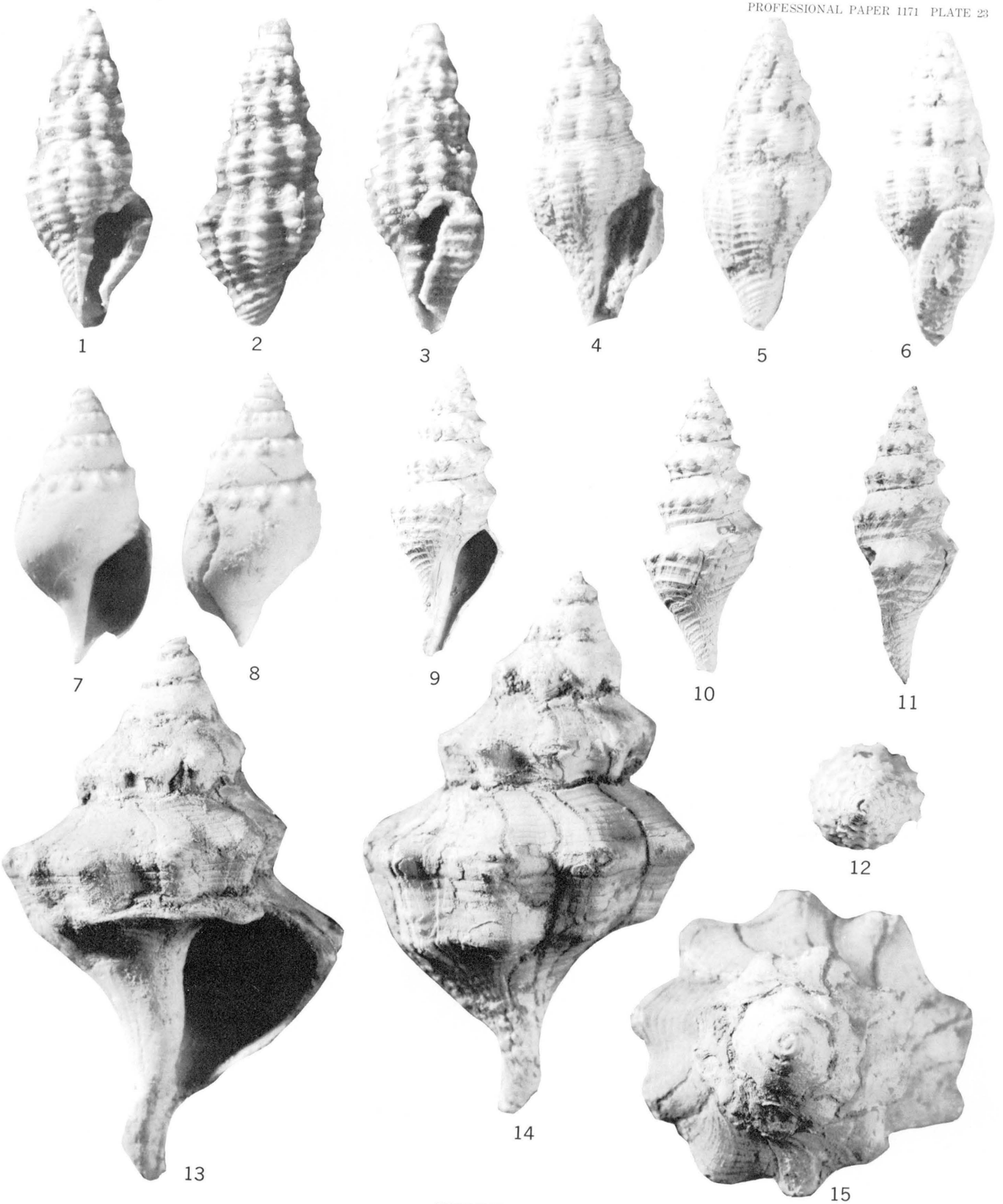
FIGURES 1–3. *Etrema palauensis* Ladd, n. sp. (p. 69).
Holotype. Height 3.6 mm (× 15). USGS locality 21304. Late Miocene (Tertiary *g*). USNM 214374.

4–6. *Etrema* sp. A (p. 69).
Height 6.9 mm (× 8). Station MR20, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214375.

7, 8. *Eubela woodrowi* Ladd, n. sp. (p. 69).
Holotype. Height 4.8 mm (× 10). Station I1010, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 175093.

9–12. *Clinura*? *fijiensis* Ladd, n. sp. (p. 70).
Holotype. Length 27.0 mm (× 2). Station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214387.

13–15. *Clinura*? sp. B. (p. 71).
Length 20.7 mm (× 5). Station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214391.



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TURRIDAE

PLATE 24

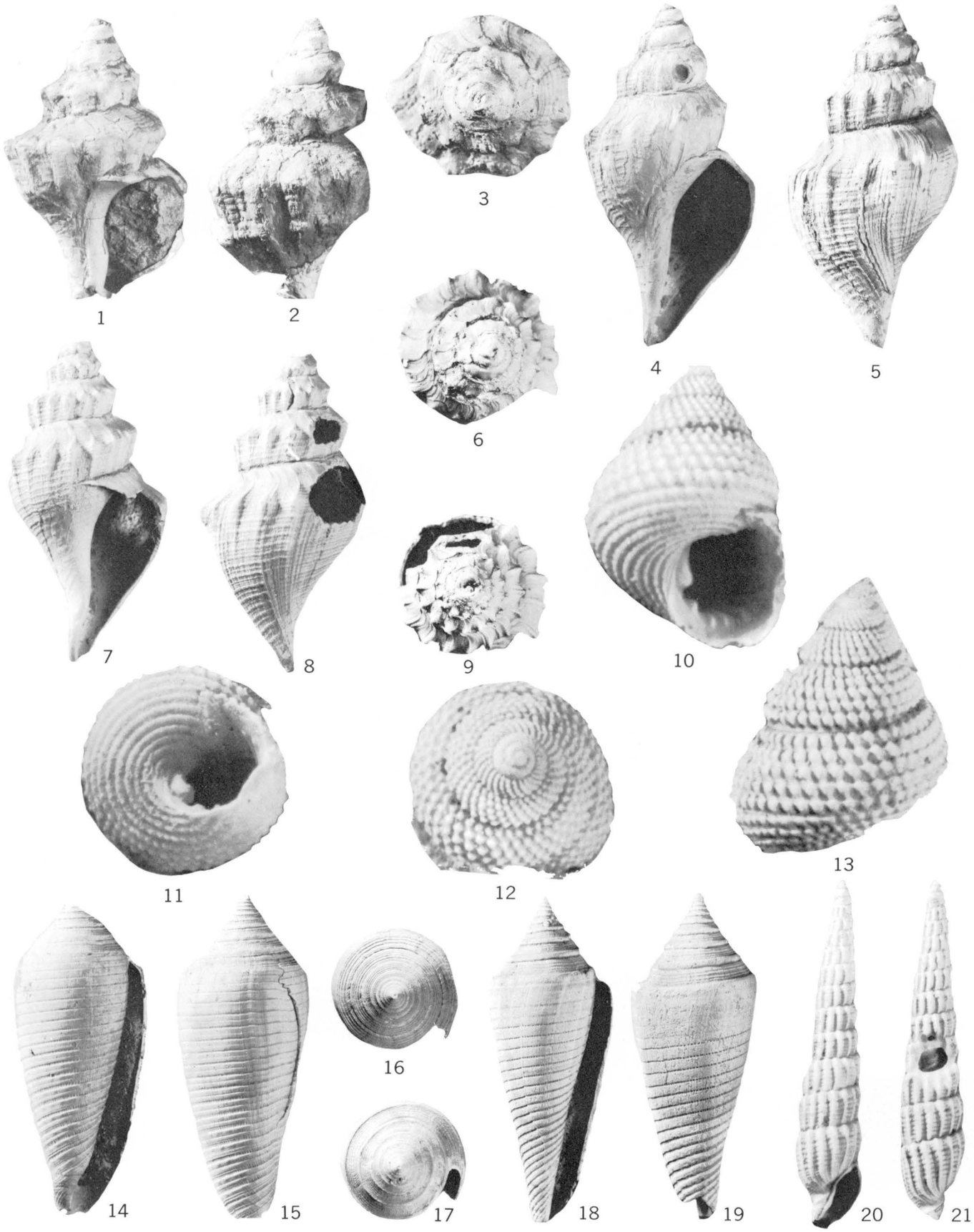
FIGURES 1–3. *Clinura?* sp. B (p. 71).
Length 20.7 mm (× 2½). Station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 214392.

4–9. *Clinura?* sp. A (p. 70).
4–6. USNM 214389. Length 25.5 mm (× 2½).
7–9. USNM 214390. Length 24.0 mm (× 2½).
Both shells from station C497, Viti Levu, Fiji. Early Miocene (Tertiary *f*).

10–13. *Turcica* (*Perrinea*) *waiwailevensis* Ladd, n. sp. (p. 23).
Holotype. Height 4.4 mm (× 12). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 250142.

14–19. *Conus aculeiformis mckinneyi* Ladd, n. subsp. (p. 71).
14–16. Holotype. Length 39.7 mm (× 1½). USNM 250136.
17–19. Paratype. Length 30.0 mm (× 2). USNM 250137.
Both shells station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*).

20, 21. *Terebra* (*Microtrypetes*) *kerensis* Ladd (p. 83).
Holotype. Height 10.0 mm (× 6). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214340.



TURRIDAE, TROCHIDAE, CONIDAE, TEREBRIDAE

PLATE 25

FIGURES 1, 2. *Conus aculeiformis* Reeve (p. 71).
Length 19.5 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308125.

3–6. *Conus acutangulus* Lamarck (p. 71).
3, 4. Shell from Miocene of Fiji, station F238, length 15.5 mm (× 4). USNM 214321.
5, 6. Shell from Pleistocene of New Hebrides, station SM242, Kere River, Santo, length 29.7 mm (× 2). USNM 308126.

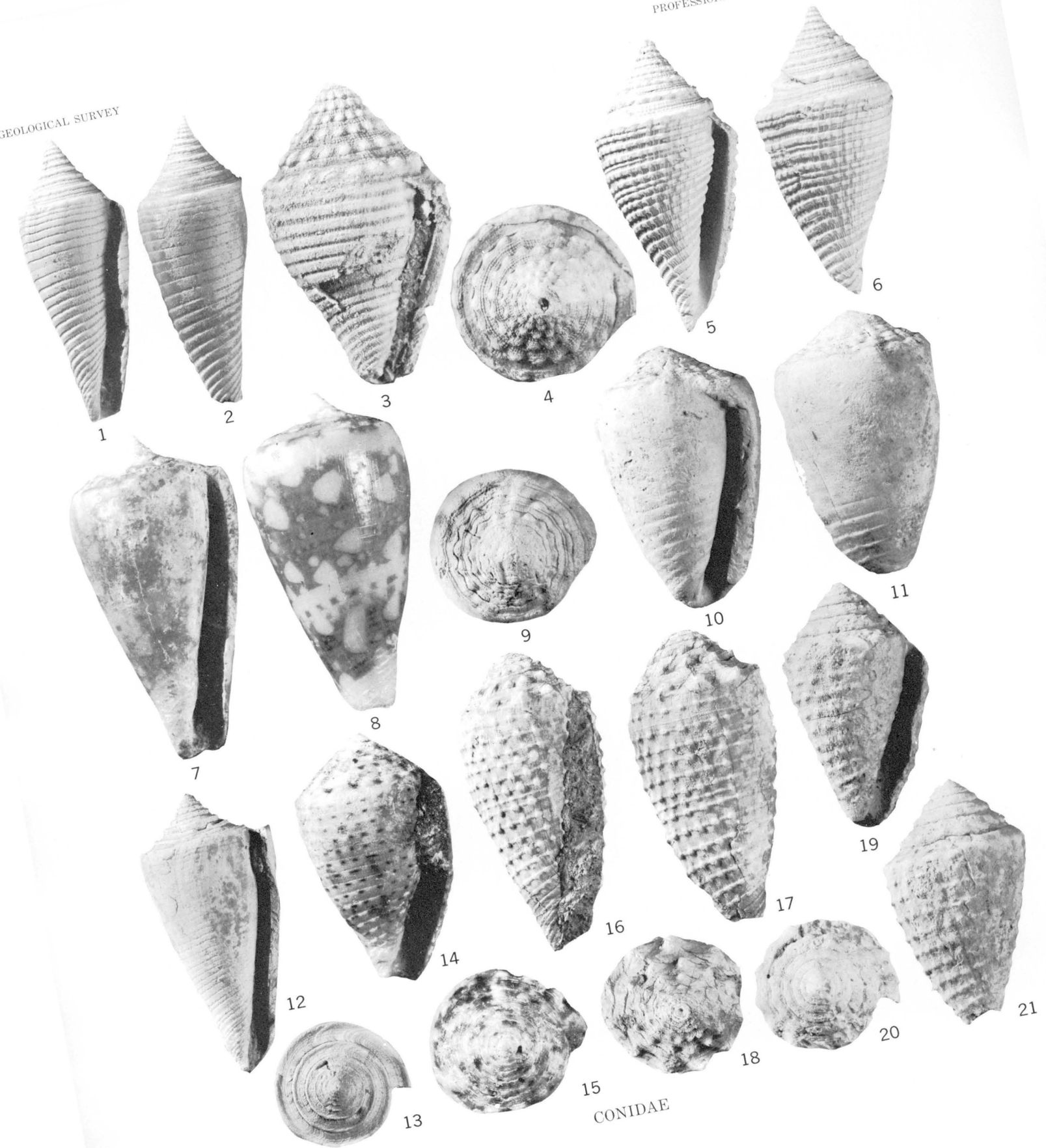
7, 8. *Conus ammiralis* Linnaeus (p. 72).
Height 22.2 mm (× 3). Station SM242, Kere River, Santo New Hebrides. Pleistocene. USNM 250144.

9–11. *Conus* cf. *C. aristophanes* Sowerby (p. 72).
Length 26.9 mm (× 2). Bishop Mus., Geol. no. 1167, station 160, Viti Levu, Fiji. Early Miocene (Tertiary *f*).

12, 13. *Conus* cf. *C. bonus* Nomura (p. 72).
Length 38.6 mm (× 1½). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 175123.

14, 15. *Conus* cf. *C. catus* Hwass (p. 72).
Length 25.6 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214311.

16–21. *Conus charigi* Ladd, n. sp. (p. 72).
16–18. Holotype, length 30.6 mm (× 2). Station RB44, Viti Levu, Fiji. Probably Pliocene (Tertiary *h*). British Mus. (N.H.) no. GG9145.
19–21. Paratype. Length 16.7 mm (× 3). Station 160, Viti Levu, Fiji. Early Miocene (Tertiary *f*). USNM 250168.



CONIDAE

PLATE 26

FIGURES 1, 2. *Conus* cf. *C. coelinae* Crosse (p. 73).
Length 58.2 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308127.

3, 4. *Conus corrugatus* Sowerby (p. 73).
Length 30.8 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308128.

5. *Conus eburneus* Hwass (p. 73).
Diameter 16.2 mm (× 2). Drill hole F–1, Eniwetok, 860–870 feet (260–263 m). Early Miocene (Tertiary *f*). USNM 175131.

6, 7. *Conus* cf. *C. emaciatus* Reeve (p. 73).
Length 78.7 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308129.

8, 9. *Conus* cf. *C. eugrammatus* Bartsch and Rehder (p. 73).
Length 18.3 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308130.

10, 11. *Conus excelsus* Sowerby (p. 74).
Length 83.2 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 175129.

12. *Conus figulinus* Linnaeus (p. 74).
Diameter 52.2 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308132.

13–15. *Conus* cf. *C. gembacanus* Martin (p. 74).
Length 8.2 mm (× 6). USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214347.

16, 17. *Conus glans* Hwass (p. 74).
Length 31.4 mm (× 1½). Houma, Tonga. Age, Quaternary. B. P. Bishop Mus. no. 202938.

18. *Conus gloriamaris* Chemnitz (p. 75).
Length (incomplete) 38 mm. (× 1). Station SM242, Santo, New Hebrides. USNM 308133.

19, 20. *Conus gracilis* Sowerby (p. 75).
Length 63.2 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308134.

CONIDAE

PLATE 27

FIGURES 1, 2. *Conus gracilis vouensis* Ladd (p. 75).
Length (incomplete) 54.7 mm (× 1). Station L389, Lakemba, Fiji. Early Miocene (Tertiary *f*). USNM 252899.

3, 4. *Conus grangeri* Sowerby (p. 75).
Length 50.2 mm (× 1). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 175099.

5, 6. *Conus gubernator* Hwass (p. 76).
Length 87.1 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308135.

7. *Conus kimioi* (Habe) (p. 76).
Height 12.6 mm (× 5). Uncoated specimen showing original color pattern. Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175091.

8, 9. *Conus insculptus* Kiener (p. 76).
Length 19.7 mm (× 3). USGS locality 21301, Babelthuap, Palau. Late Miocene (Tertiary *g*). USNM 175125.

10, 11. *Conus* cf. *C. litteratus* Linnaeus (p. 76).
10. Recrystallized shell from Guam (station 20997); length 100.0 mm (× 1). Quaternary. USNM 175080.
11. Spire of Miocene shell from station 160, Viti Leve, Fiji; diameter 48.9 mm (× 1). USNM 308136.

12–15. *Conus macarae* Bernardi (p. 77).
12, 13. Smaller specimen: length 36.0 mm (× 1). USNM 308137.
14, 15. Larger specimen: length 51.2 mm (× 1½). USNM 308138.
Both shells from station SM242, Kere River, Santo, New Hebrides. Pleistocene.

16. *Conus miliaris* Hwass (p. 77).
Length 29.4 mm (× 2). USGS station 21028, Santo, New Hebrides. Pleistocene. USNM 175128.

17, 18. *Conus mucronatus* Reeve (p. 77).
Length 33.9 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175132.

CONIDAE

PLATE 28

FIGURE

1. *Conus nussatella* Linnaeus (p. 77).
   Length 31.7 mm (× 2). USGS Station 21028, Santo, New Hebrides. Pleistocene. USNM 175126.
2. *Conus ochroleucus* Gmelin (p. 77).
   Length 58.5 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308139.

3, 4. *Conus orbignyi* Audouin (p. 78).
   Length 35.2 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308141.

5. *Conus* cf. *C. pertusus* Hwass (p. 78).
   Length 48.0 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308142.
6. *Conus praecellens* A. Adams (p. 78).
   Length 37.7 mm (× 1½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308143.

7, 8. *Conus quercinus* Hwass (p. 78).
   Length 42.1 mm (× 1½). Station SM259, Santo, New Hebrides. Pleistocene. USNM 308144.

9, 10. *Conus recluzianus* Bernardi (p. 78).
   Length 46.3 mm (× 1½). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308145.

11. *Conus* aff. *C. saecularis* Melvill (p. 78).
   Length 26.9 mm (× 2). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 175137.

12–15. *Conus* aff. *C. socialis* Martin (p. 79).
   12–14. Length 36.8 mm (× 2). Station B107, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214227.
   15. Length 37.3 mm (× 2). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214228.

CONIDAE

PLATE 29

FIGURES 1, 2. *Conus* aff. *C. socialis* Martin (p. 79).
Length 37.3 mm (× 2). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 214228.

3, 4. *Conus striatus* Linnaeus (p. 79).
3. Length 73.0 mm (× 1). USGS locality 21028. Probably Pleistocene. USNM 214412.
4. Length 49.7 mm (× 1). British Mus. specimen from station RB44, Viti Levu, Fiji. Pliocene (Tertiary *h*).

5–9. *Conus sulcatus* Hwass (p. 79).
5, 6. Length 59.4 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308146.
7–9. Length 49.2 mm (× 1½). Station C1133, Viti Levu, Fiji. Pilocene (Tertiary *h*). USNM 175121.

10, 11. *Conus sulcatus undulatus* Sowerby (p. 80).
Length 48.6 mm (× 1). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308147.

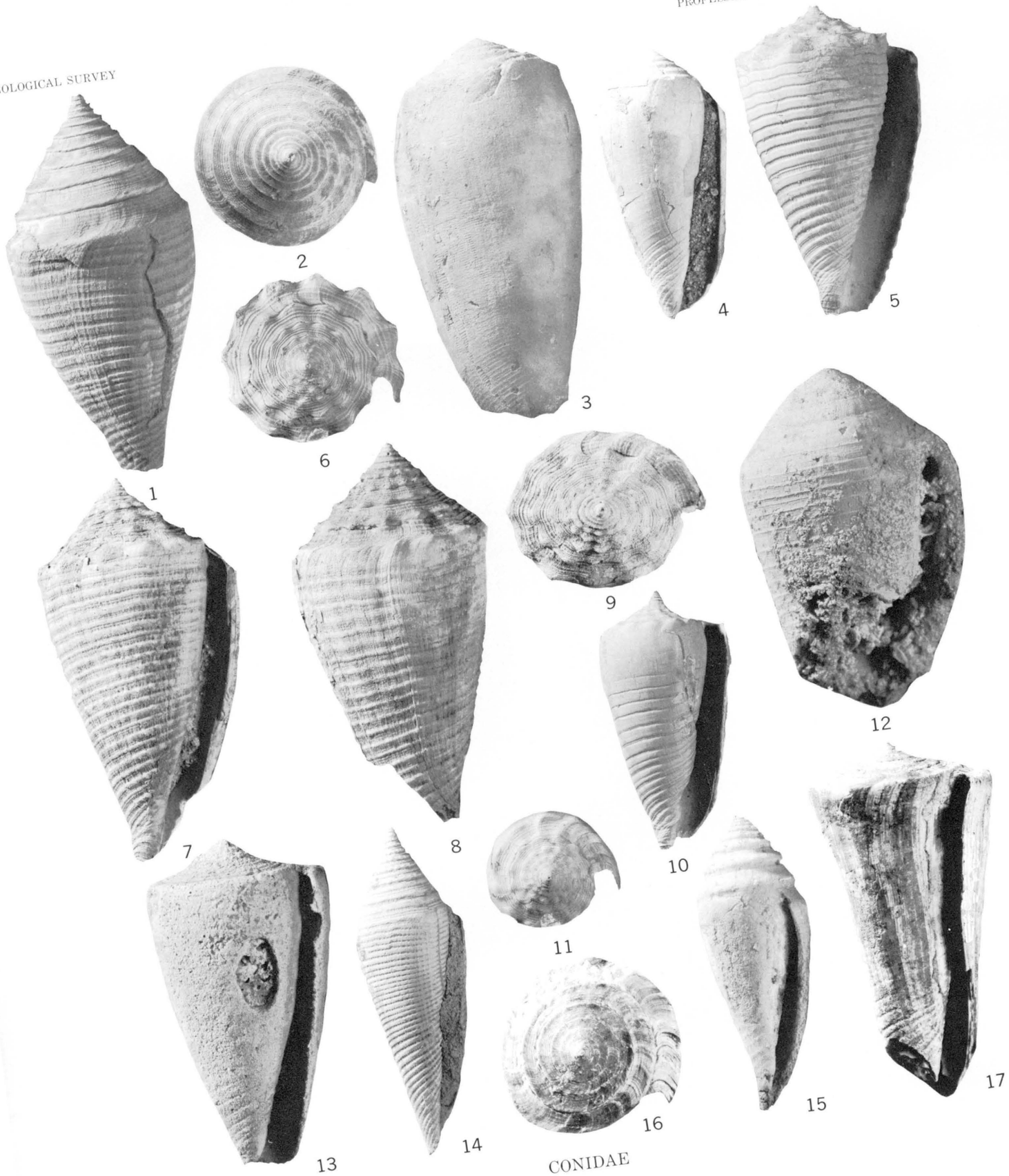
12. *Conus terebra* Born (p. 80).
Length 45.6 mm (× 1½). USGS locality 21028, Santo, New Hebrides. Probably Pleistocene. USNM 175127.

13. *Conus* cf. *C. tessulatus* Born (p. 80).
Length 25.6 mm (× 2½). Station 103, Vanua Mbalavu, Fiji. Probably Pliocene. Univ. Rochester, Mus. Nat. History, no. 13073 = USNM 252900.

14. *Conus vimineus* Reeve (p. 80).
Length 25.6 mm (× 2½). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 308148.

15. *Conus yanuyanuensis* Ladd (p. 80).
Holotype, length 19.0 mm (× 3). Station 110C, Vanua Mbalavu, Fiji. Pliocene (Tertiary *h*). USNM 175130.

16, 17. *Conus* sp. A (p. 80).
Length 44.8 mm (× 1½). Station K700, Vanua Levu, Fiji. Probably Pliocene (Tertiary *h*). USNM 175133.



CONIDAE

PLATE 30

FIGURE

1. *Terebra* (*Strioterebrum*) *torquata* Adams and Reeve (p. 81).
   Height (incomplete) 35.7 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308150.
2. *Terebra* (*Strioterebrum*) *nebulosa* Sowerby (p. 82).
   Height (apex incomplete) 50.9 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308151.
3. *Terebra* (*Strioterebrum*) sp. A (p. 82).
   Height (incomplete) 33.3 mm (× 2). Drill hole F–1, Eniwetok, depth 680–690 ft (210 m). Late Miocene (Tertiary *g*). USNM 175084.

4, 5. *Terebra* (*Decorihastula*) *affinis* Gray (p. 82).
   Height 23.3 mm (× 3). USGS locality 17891, Saipan. Tanapag Limestone, Pleistocene and Holocene. USNM 175081.

6, 7. *Terebra* (*Microtrypetes*) *vanualevensis* Ladd, n. sp. (p. 82).
   6. Holotype. Height (incomplete) 15.6 mm (× 2½). Station 817, Vanua Levu, Fiji. Pliocene (Tertiary *h*). USNM 175085.
   7. Paratype. Height 14.9 mm. (× 2½). Same locality as holotype. USNM 175086.

8. *Terebra* (*Oxymeris*) *maculata* (Linnaeus) (p. 83).
   Height 165 mm (× 1). USGS locality 17891, Saipan. Tanapag Limestone, Pleistocene and Holocene. USNM 175079.
9. *Terebra* (*Oxymeris*) *interlineata* Deshayes (p. 83).
   Height 56.0 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308152.

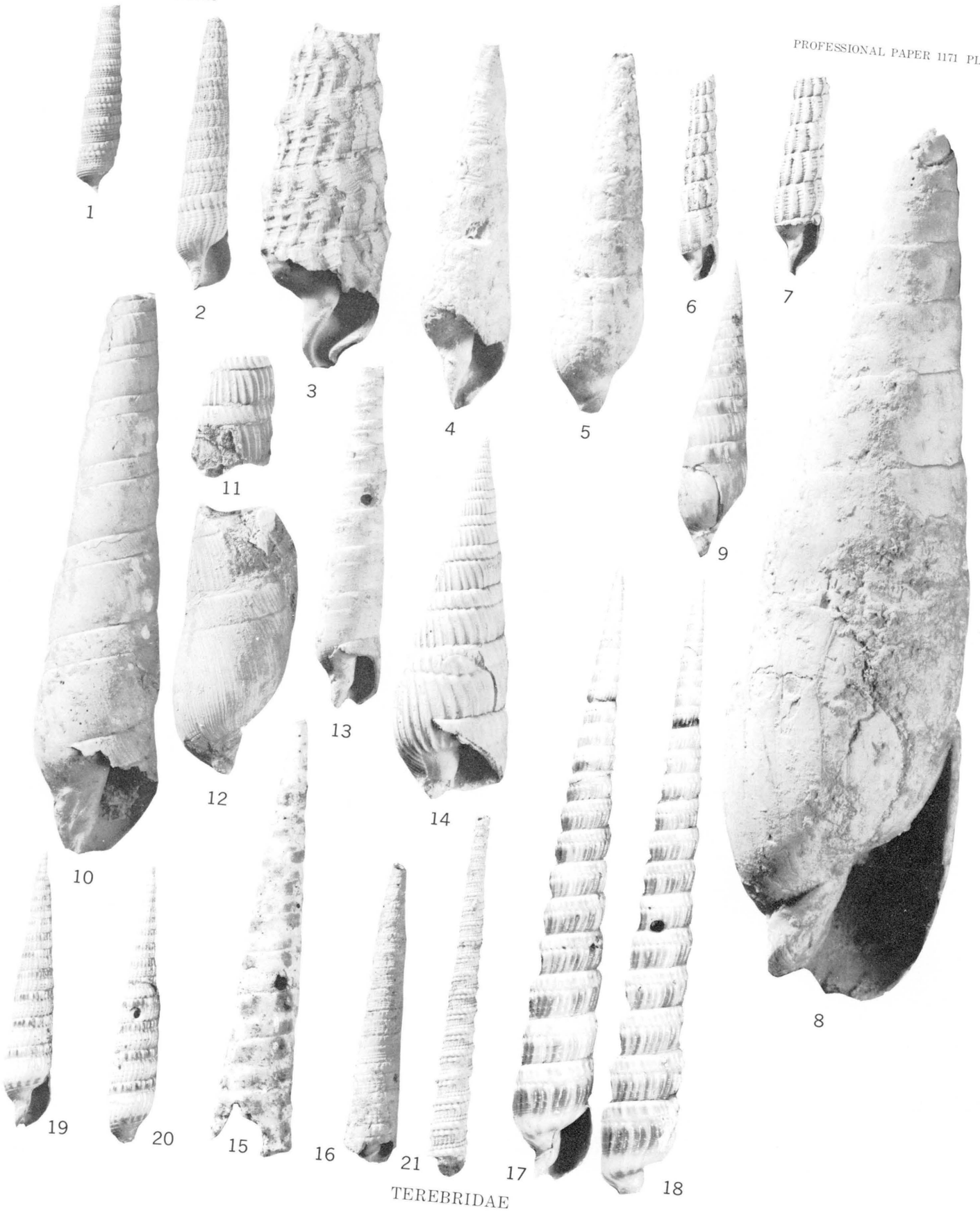
10–12. *Terebra* (*Oxymeris*) cf. *T. felina* (Dillwyn) (p. 83).
   10. Height (incomplete) 110 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308153.
   11, 12. Two fragmentary fossils from the late Miocene of Viti Levu, Fiji (station 165); larger is 35.6 mm in height, smaller 15.8 mm (both × 1½, USNM 175087 and 175088).

13. *Terebra* (*Oxymeris*) *argus* (Hinds) (p. 84).
   Height (apex incomplete) 32.5 mm (× 2). USGS locality 17891, Saipan. Tanapag Limestone, Pleistocene and Holocene. USNM 175083.
14. *Terebra* (*Oxymeris*) sp. B (p. 84).
   Height 34.4 mm (× 2). Drill hole F–1, Eniwetok, depth 800–810 ft (245 m). Late Miocene (Tertiary *g*). USNM 175089.
15. *Terebra* (*Terebra*) *subulata* (Linnaeus) (p. 81).
   Height 82.5 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308149.
16. *Terebra* (*Myurella*) *myuros* Lamarck (p. 84).
   Height 56.1 mm. (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 308154.

17, 18. *Terebra* (*Myurella*) *pretiosa* Reeve (p. 84).
   Height 116 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 309740.

19, 20. *Terebra* (*Myurella*) *alveolata* Hinds (p. 84).
   Height 52.5 mm (× 1). Station SM242, Santo, New Hebrides. Pleistocene. USNM 175082.

21. *Terebra* (*Triplostephanus*) *triseriata* Gray (p. 85).
   Height (incomplete) 34.3 mm (× 2). Station SM242, Santo, New Hebrides. Pleistocene. USNM 309741.



TEREBRIDAE

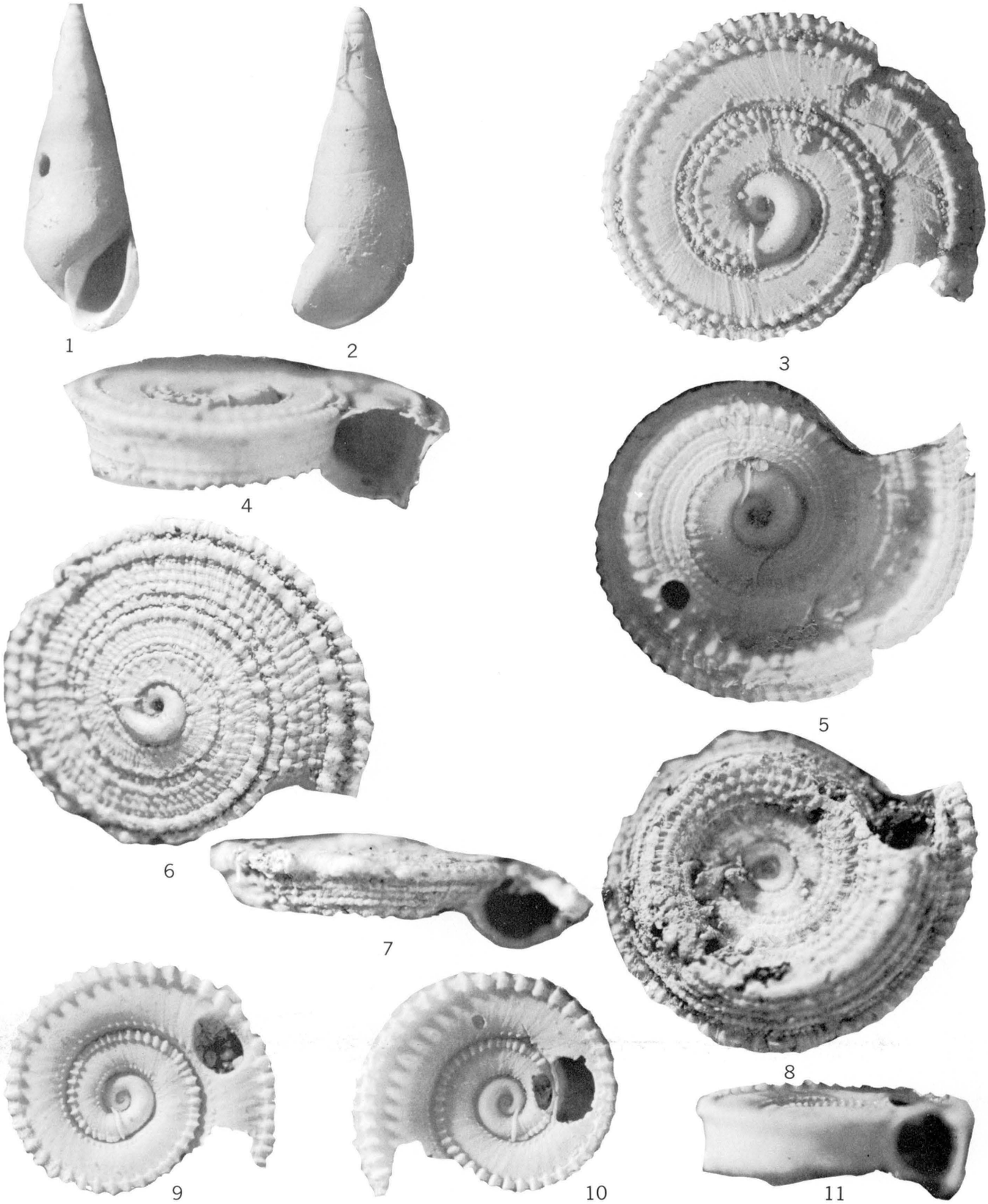
PLATE 31

FIGURES 1, 2. *Zebina (Cibdezebina) metaltilana* Ladd (p. 29).
Height 4.0 mm (× 15). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250159.

3–5. *Mangonuia navakaensis* Ladd, n. sp. (p. 29).
Holotype. Diameter 3.5 mm (× 20). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250150.

6–8. *Mangonuia kerensis* Ladd, n. sp. (p. 30).
Holotype. Diameter 4.3 mm (× 15). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 250151.

9–11. *Mangonuia* sp. A (p. 30).
Diameter 2.5 mm (× 20). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250160.



RISSOIDAE, ARCHITECTONICIDAE

PLATE 32

FIGURES 1–9. *Mangonuia* sp. (p. 30).

Three small, incomplete, and probably immature shells that may represent one or more unusual species of *Mangonuia*; all three from the Pleistocene beds of southern Santo, New Hebrides.

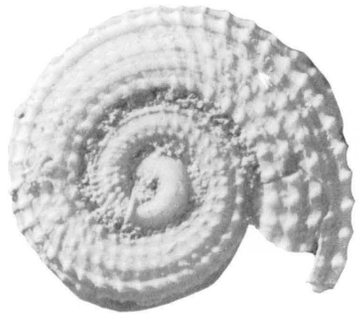
Figures 1–3 are views of a shell from station SM43 on the Navaka River. It measures 3.3 mm in diameter (× 15). USNM 250166.

Figures 4–6 are views of a shell from USGS locality 25715 on the Kere River. It measures 3.1 mm in diameter (× 15). USNM 250165.

Figures 7–9 show another shell from the same locality on the Kere River. It measures 3.4 mm in diameter (× 15). USNM 250164.

10–12. *Pseudomalaxis* (*Pseudomalaxis*?) *roddai* Ladd, n. sp. (p. 31).

Holotype. Diameter 2.6 mm (× 20). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 250149.



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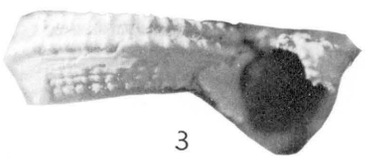

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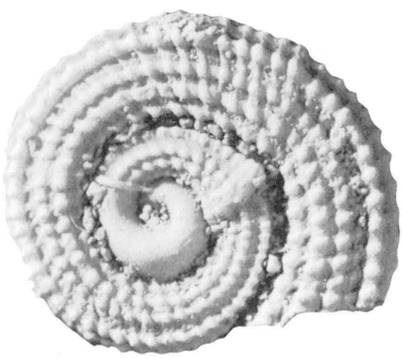

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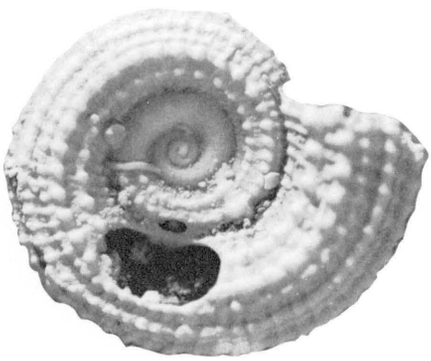

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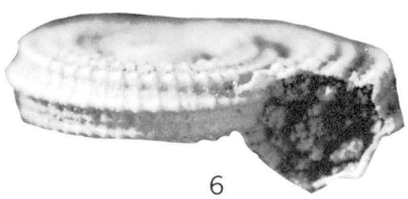

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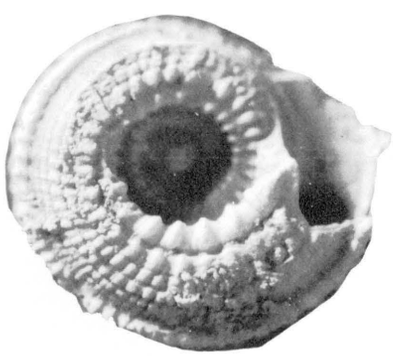

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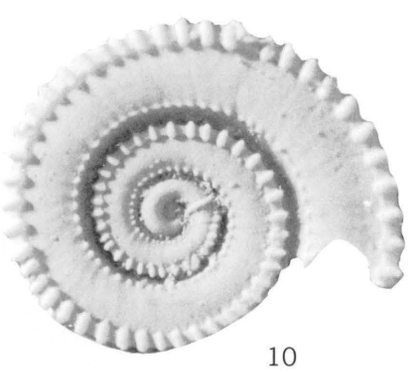

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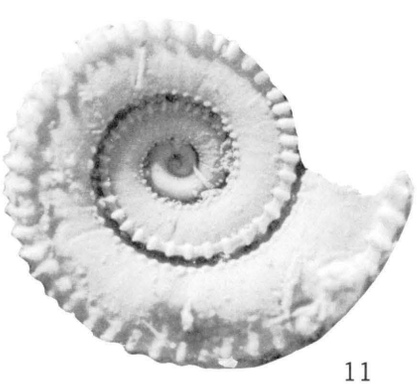

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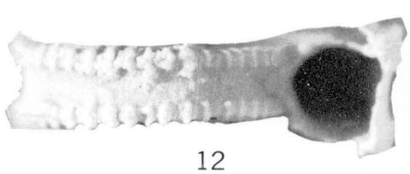


12

ARCHITECTONICIDAE

PLATE 33

FIGURES 1, 2. *Chiazacmea* cf. *C. pygmaea sygnatoides* Kuroda and Habe (p. 22).
Length 3.2 mm (× 15). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214361.

3, 4. *Cocculina nipponica* Kuroda and Habe (p. 22).
Length 2.4 mm (× 15). USGS locality 25652, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214360.

5, 6. *Zebina* (*Moerchiella*) *supracostata* (Garrett) (p. 29).
Height 5.7 mm (× 10). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214377.

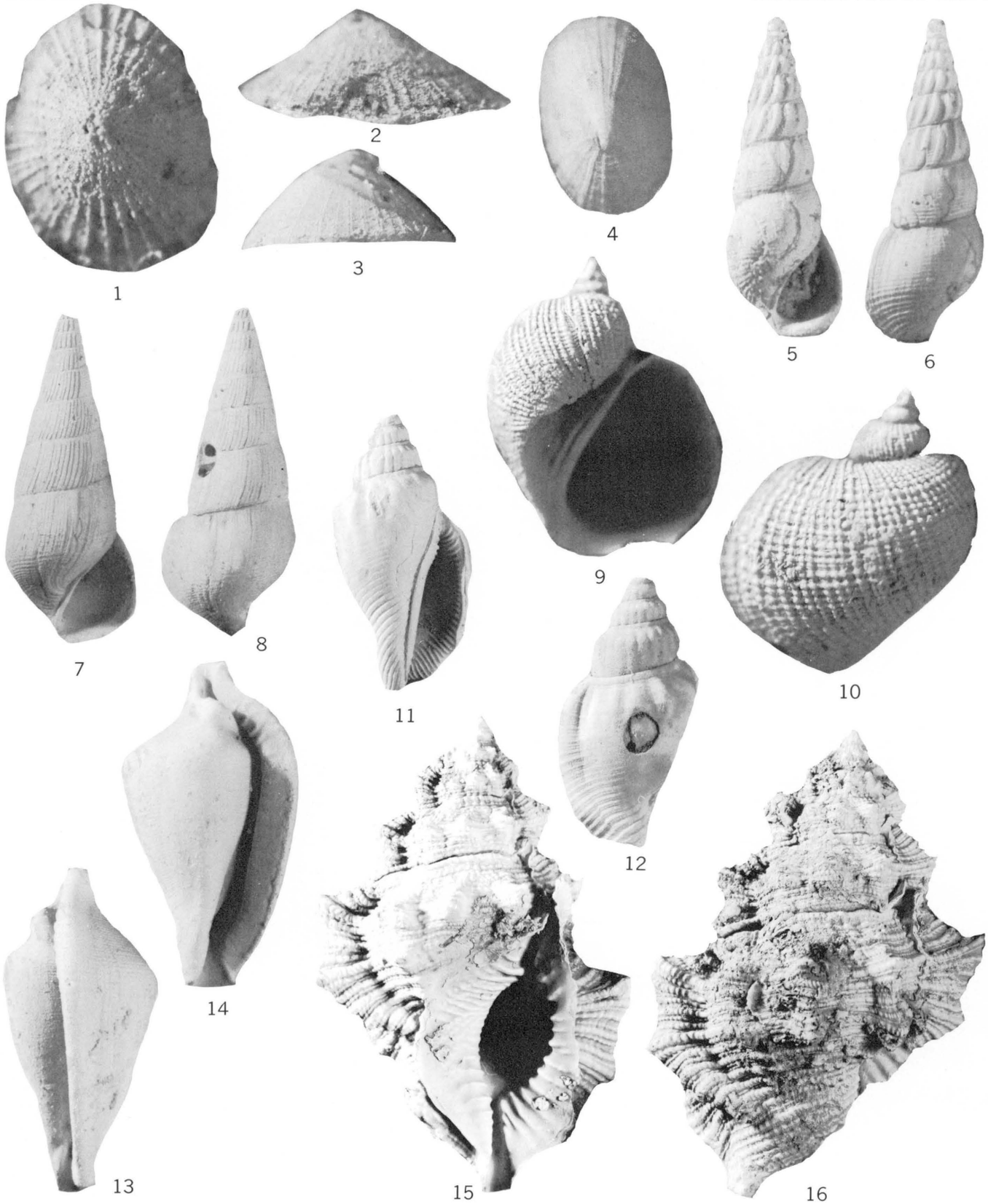
7, 8. *Zebina* (*Moerchiella*) sp. A (p. 29).
Height 10.1 mm (× 6). USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214371.

9, 10. *Couthouyia kerensis* Ladd, n. sp. (p. 35).
Holotype, height 3.6 mm (× 15). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214367.

11, 12. *Strombus* (*Canarium*) *microurceus* (Kira) **(p. 34)**.
Length 24.8 mm (× 2). Station C2173, drill hole in Nandi area, Viti Levu, Fiji. Probably Pliocene. USNM 214380.

13, 14. *Dentiovula tadashigei* Cate (p. 38).
Height 9.8 mm (× 6). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214381.

15, 16. *Bursa bufonia dunkeri* Kira (p. 41).
Height 87 mm (× 1). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214388.



ACMAEIDAE, COCCULINIDAE, RISSOIDAE, FOSSARIDAE, STROMBIDAE, OVULIDAE, BURSIDAE

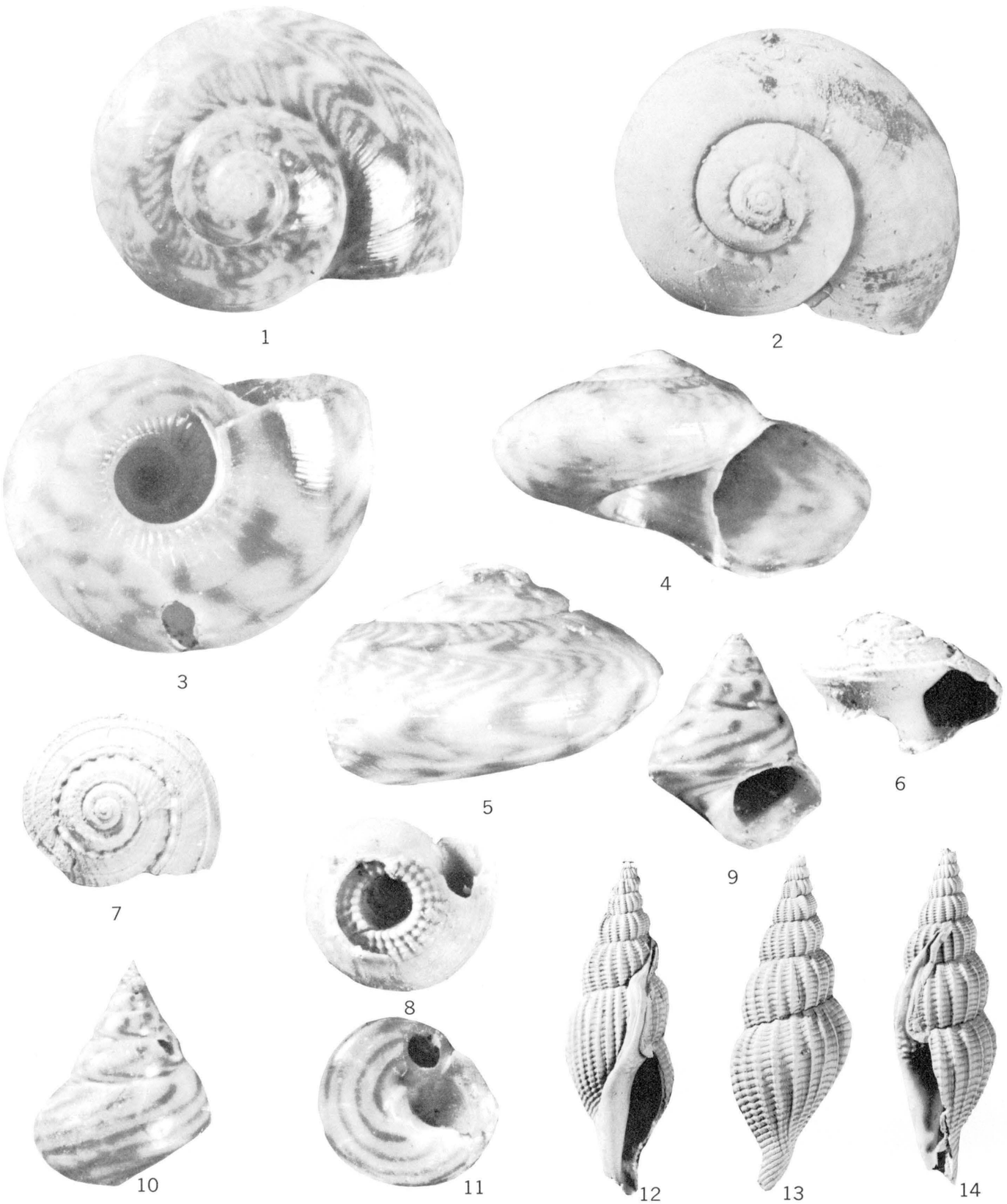
PLATE 34

FIGURES 1–5. *Microgaza* (*Microgaza*) *navakaensis* Ladd, n. sp. (p. 25).
Holotype. Height 4.7 mm (× 9). Figures 1, 3–5 not coated, revealing original color pattern. USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214398.

6–8. *Microgaza*? sp. A (p. 26).
Height 4.5 mm (× 9). Station C2024. Viti Levu, Fiji. Probably Pliocene (Tertiary *h*). USNM 214400.

9–11. *Calliotrochus navakaensis* Ladd, n. sp. (p. 24).
Holotype. Height 4.2 mm (× 10). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214405.

12–14. *Varicospira* cf. *V. cancellata* (Lamarck) (p. 33).
Length 30.5 mm (× 2). Station MWC 40, Maewo, New Hebrides. Probably Pleistocene. USNM 214402.



TROCHIDAE, STROMBIDAE

PLATE 35

FIGURES 1–3. *Architectonica* (*Pseudotorinia*) aff. *A.* (*P.*) *euprepes* Woodring (p. 31).
Diameter 7.8 mm (× 4). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214406.

4, 5. *Siliquaria cumingii* (Mörch) (p. 31).
Height 37.6 mm (× 2). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214414.

6–8. *Siliquaria* aff. *S. armata* Kuroda, Habe and Kozuge (p. 32).
Height 8.6 mm (× 3). USGS locality 25718, Kere River, Santo, New Hebrides. Pleistocene. USNM 214415.

9–15. *Seguenzia donaldi* Ladd, n. sp. (p. 32).
9–12. Holotype, height 2.2 mm (× 20). USNM 214409.
13–15. Paratype, height 2.1 mm (× 20). USNM 214411.
Both shells from station SM43, Navaka River, Santo, New Hebrides. Pleistocene.

16, 17. *Typhis* cf. *T. japonicus* (A. Adams) (p. 43).
Height 3.9 mm (× 10). USGS locality 25734, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214395.

18–20. *Anachis* (*Costoanachis*) *mawsoni* Ladd, n. sp. (p. 46).
Holotype. Height 7.7 mm (× 8). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214396.

ARCHITECTONICIDAE, TURRITELLIDAE, SEGUENZIDAE, MURICIDAE, COLUMBELLIDAE

PLATE 36

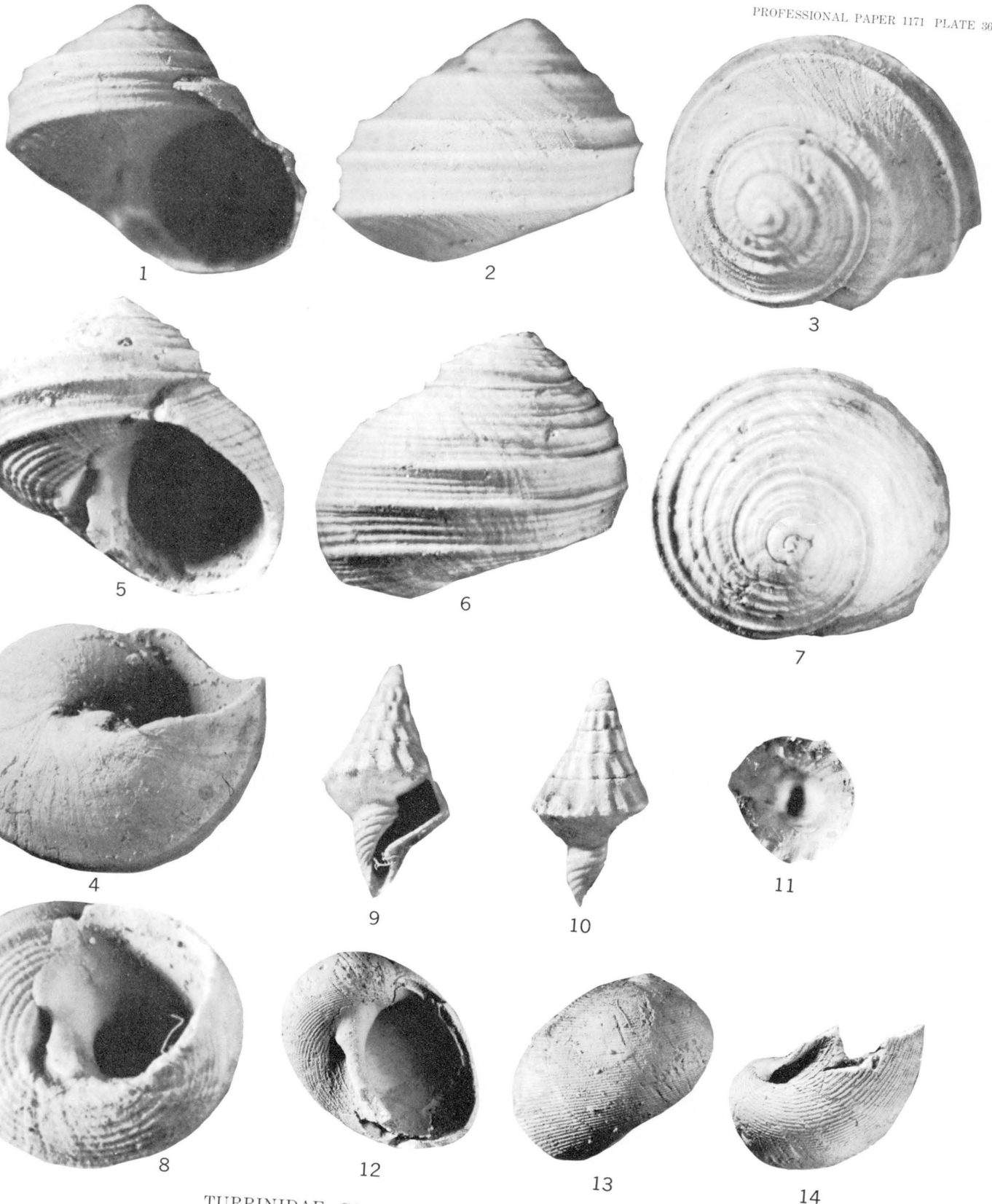
[All fossils shown on this plate were collected from Station C2026, Viti Levu, Fiji, and are Pliocene (Tertiary *h*) in age.]

FIGURES 1–4. *Homalopoma* (*Cantrainea*) *whipplei* Ladd, n. sp. (p. 27).
Holotype. Height 5.0 mm (× 10). USNM 214419.

5–8. *Homalopoma* (*Cantrainea*?) *druidi* Ladd, n. sp. (p. 27).
Holotype. Height 5.2 mm (× 10). USNM 250139.

9–11. *Anachis* (*Costoanachis*) sp. A (p. 46).
Juvenile shell. Height 4.3 mm (× 10). USNM 214417.

12–14. *Eunaticina* sp. (p. 39).
Immature shell. Height 8.3 mm (× 4). USNM 250138.



TURBINIDAE, COLUMBELLIDAE, NATICIDAE

PLATE 37

FIGURES 1–5. *Anachis* (*Costoanachis*) *mawsoni* Ladd, n. sp. (p. 46).
1–3. Paratype. Height 7.0 mm (× 8). USGS locality 25715, Kere River, Santo, USNM 214397.
4, 5. Juvenile shell. Height 4.5 mm (× 10). USGS locality 25739, Navaka River, Santo, USNM 214422.
Both shells Pleistocene.

6–8. *Clypeomorus coralium* (Kiener)(p. 32).
Height 16.4 mm (× 3). Station SM308, Wambu River, Santo. Pleistocene. USNM 250167.

9, 10. *Balcis martinii* (A. Adams) (p. 55).
Height 33.6 mm (× 2). USGS locality 25718, Kere River, New Hebrides; age, Pleistocene. USNM 214365.

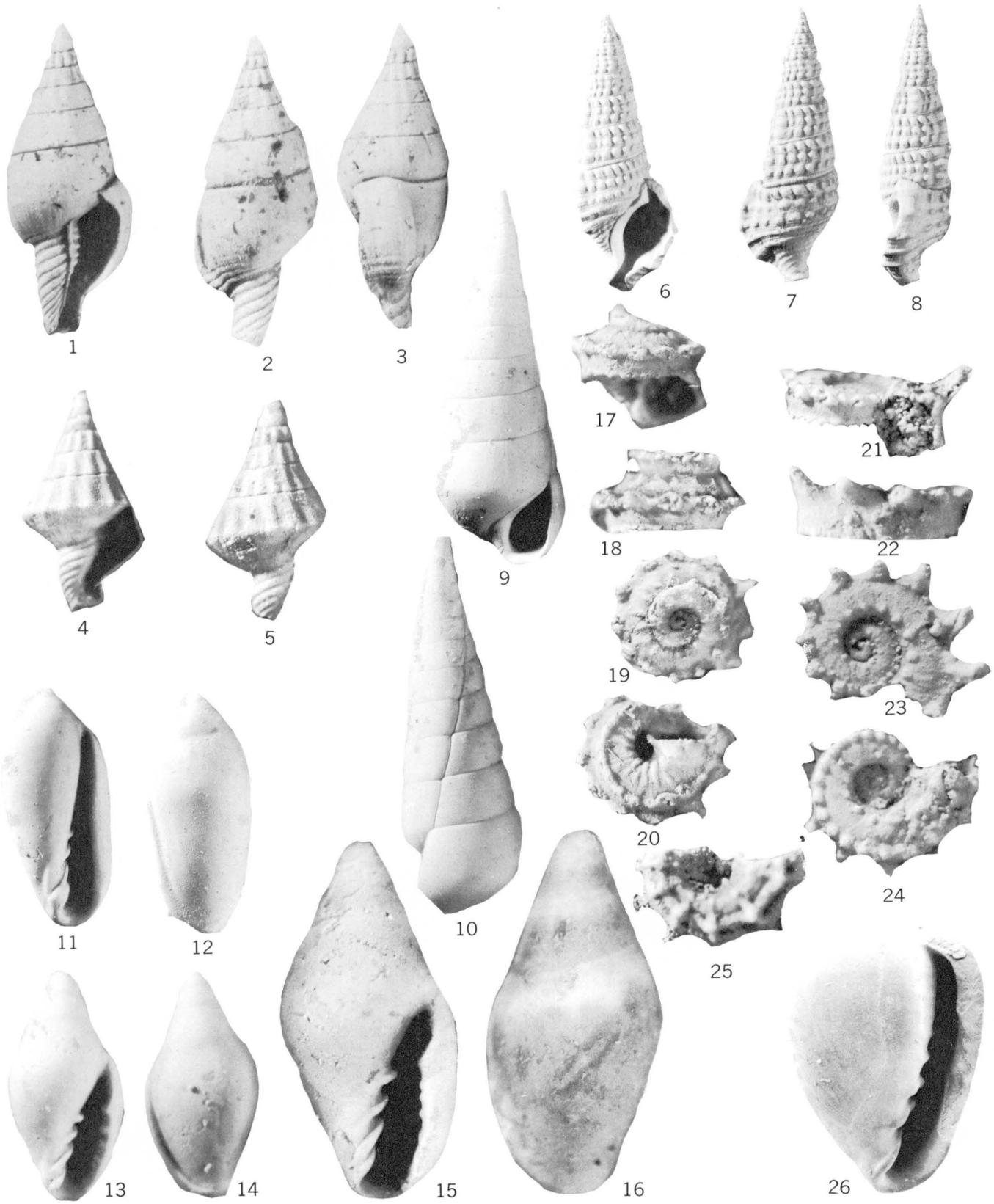
11, 12. *Volvarina* cf. *V. avena* (Kiener) (p. 59).
Length 8.6 mm (× 5). Drill hole F–1 920–930 ft (278–281 m) Eniwetok; early Miocene (Tertiary *f*). USNM 175101.

13–16. *Marginella* (*Eratoidea*) *ringicula* Sowerby (p. 58).
13, 14. Height 4.0 mm (× 10). USGS locality 21304, Goikul Peninsula, Babelthuap, Palau. Late Miocene (Tertiary *g*). USNM 175094.
15, 16. Height 3.2 mm (× 20). Drill hole K–1B, 663–674 ft (200–204 m), Eniwetok. Late Miocene (Tertiary *g*). USNM 175095.

17–20. *Arene* (*Arene*) sp. B (p. 26).
Diameter 2.8 mm (× 10). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250143.

21–25. *Cyclostrema* cf. *C. somidi* Ladd (p. 28).
21–24. Complete shell. Diameter 0.7 mm (× 23). USNM 250141.
25. Incomplete shell. Diameter 3.2 mm (× 10). USNM 250140.
Both shells from station SM43, Navaka River, Santo, New Hebrides. Pleistocene.

26. *Marginella* cf. *M.* (*Granula*) *iota* Hedley (p. 58).
Length 1.1 mm (× 46). Drill hole on Funafuti, Ellice Islands at depth 65 ft (20 m). Holocene. MCZ specimen.



COLUMBELLIDAE, CERITHIIDAE, EULIMIDAE, MARGINELLIDAE, TURBINIDAE, CYCLOSTREMATIDAE,

PLATE 38

Bathynassa bolangoi Ladd (p. 51).

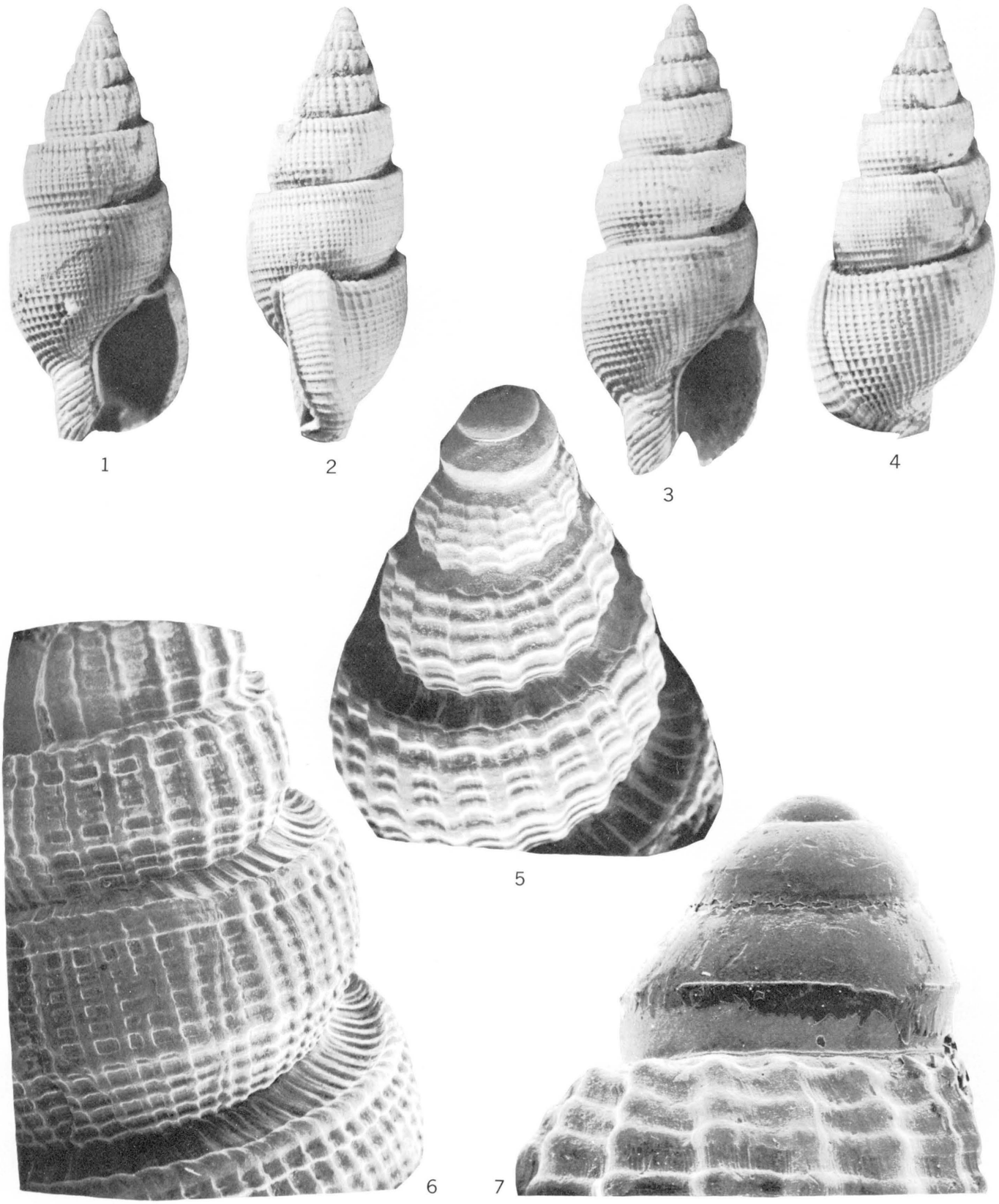
Type specimens from Navaka River outcrops (USGS localities 25736 and 25742), Santo, New Hebrides. Pleistocene.

FIGURES 1, 2. Holotype, length 13.9 mm (× 6). USNM 214343.

3, 4. Paratype A, length 12.8 mm (× 6). USNM 214344.

5, 6. Paratype B, length 13.6 mm. Part of spire by scanning electron microscope (fig. 5, × 26; fig. 6, × 21). USNM 214345.

7. Paratype C. Tip of spire by scanning electron microscope × 72. USNM 214346.



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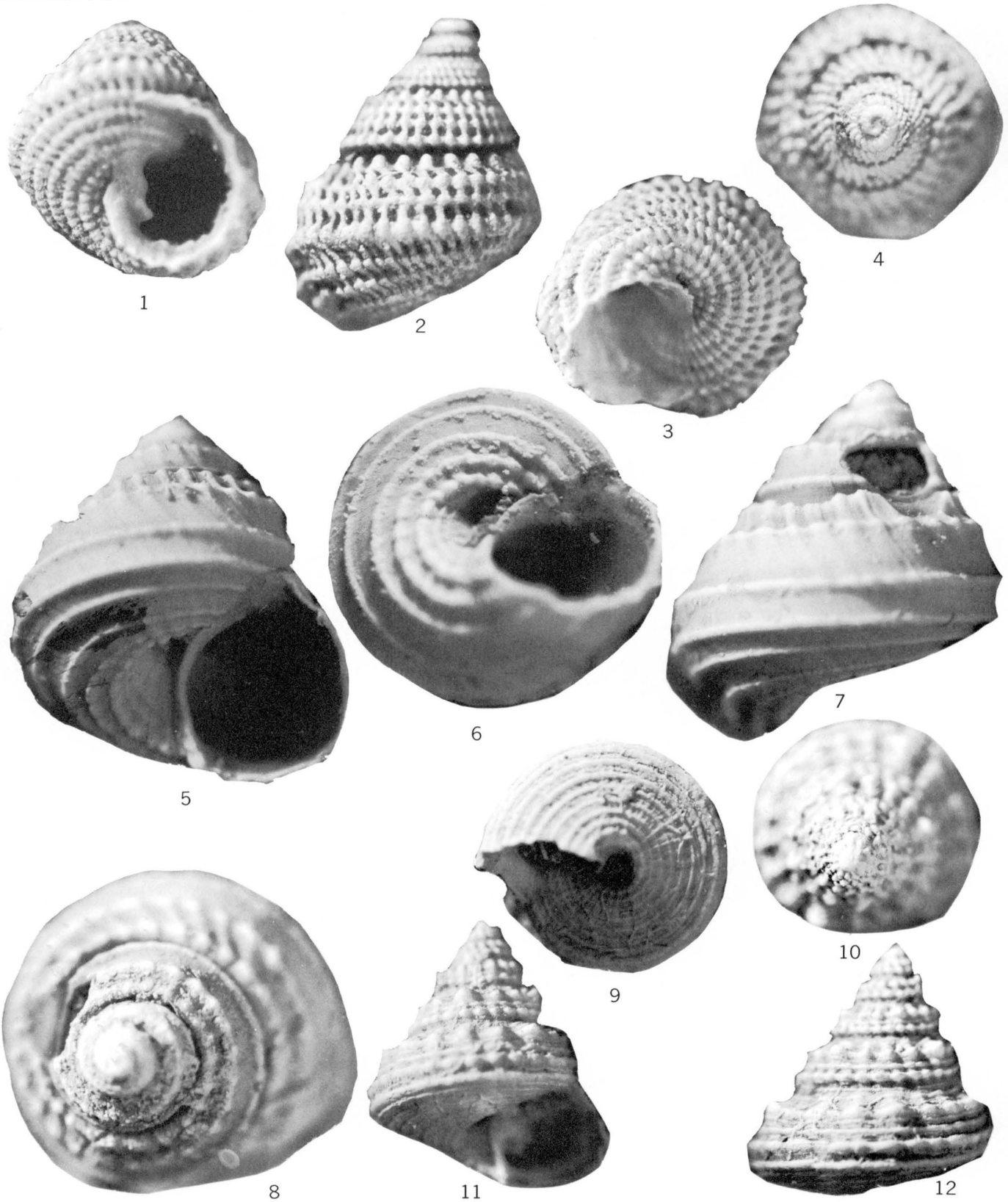
NASSARIIDAE

PLATE 39

FIGURES 1–4. *Turcica* (*Perrinia*) *fijiensis* Ladd, n. sp. (p. 23).
Holotype. Height 3.6 mm (× 15). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 250128.

5–8. *Calliotropis rewaensis* Ladd, n. sp. (p. 23).
Holotype. Height 3.2 mm (× 20). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 250126.

9–12. *Calliotropis*? sp. A (p. 23).
Height 5.0 mm (× 10). USGS locality 25731, Navaka River, Santo, New Hebrides. Pleistocene. USNM 214421.



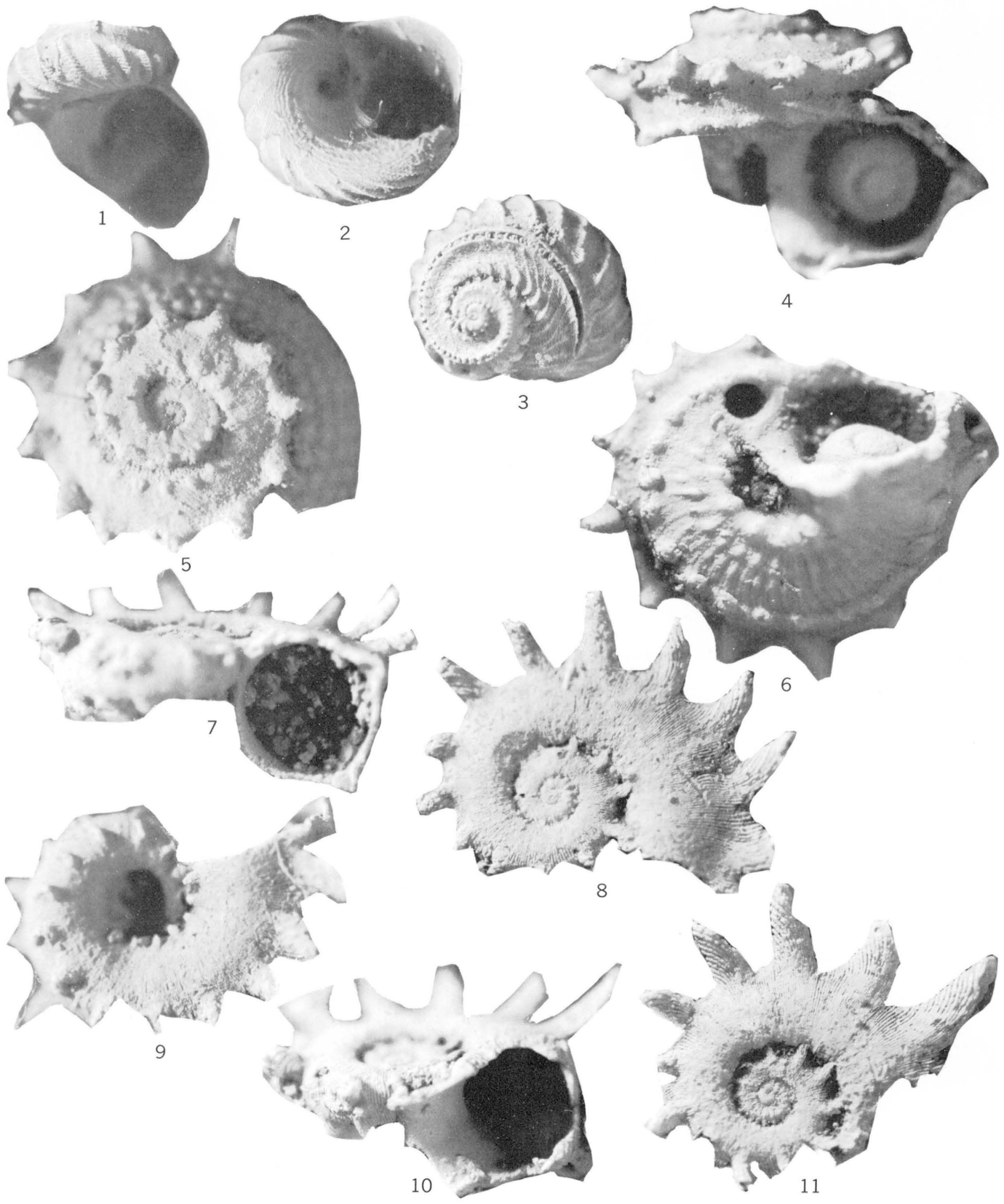
TROCHIDAE

PLATE 40

FIGURES 1–3. *Sinezona cingulata* (O. G. Costa) (p. 20).
Height 2.6 mm (× 15). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene.. USNM 250154.

4–6. *Dentarene navakaense* Ladd, n. sp.(p. 26).
Holotype. Diameter 3.5 mm (× 20). USGS locality 25734, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250163.

7–11. *Dentarene depressa* Ladd, n. sp. (p. 27).
7–9. Holotype. Height (upper spines omitted) 1.5 mm (× 20). Station SM43, Navaka River, Santo, New Hebrides. Pleistocene. USNM 250161.
10, 11. Paratype. Height (upper spines omitted) 1.6 mm (× 20). USGS locality 25731, Navaka River. Pleistocene. USNM 250162.



SCISSURELLIDAE, TURBINIDAE

PLATE 41

FIGURES 1–3. *Solariella* (*Ethaliopsis*) *vitilevensis* Ladd, n. sp.(p. 25).
Holotype. Height 3.6 mm (× 10). Station C1764, Viti Levu, Fiji. Probably Pliocene. USNM 214407.

4–6. *Colubraria obscura* (Reeve) (p. 49).
Height 22.6 mm (× 3). Station SM242, Kere River, Santo, New Hebrides. Pleistocene. USNM 214394.

7–9. *Colubraria tortuosa* (Reeve) (p. 49).
Height 27.3 mm (× 2). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene. USNM 214393.

10, 11. *Vexillum* (*Vexillum*) *subdivisum* (Gmelin) (p. 54).
Height (incomplete) 53.4 mm (× 1). Station MWC40, Maewo, New Hebrides. Probably Pleistocene. USNM 214401.

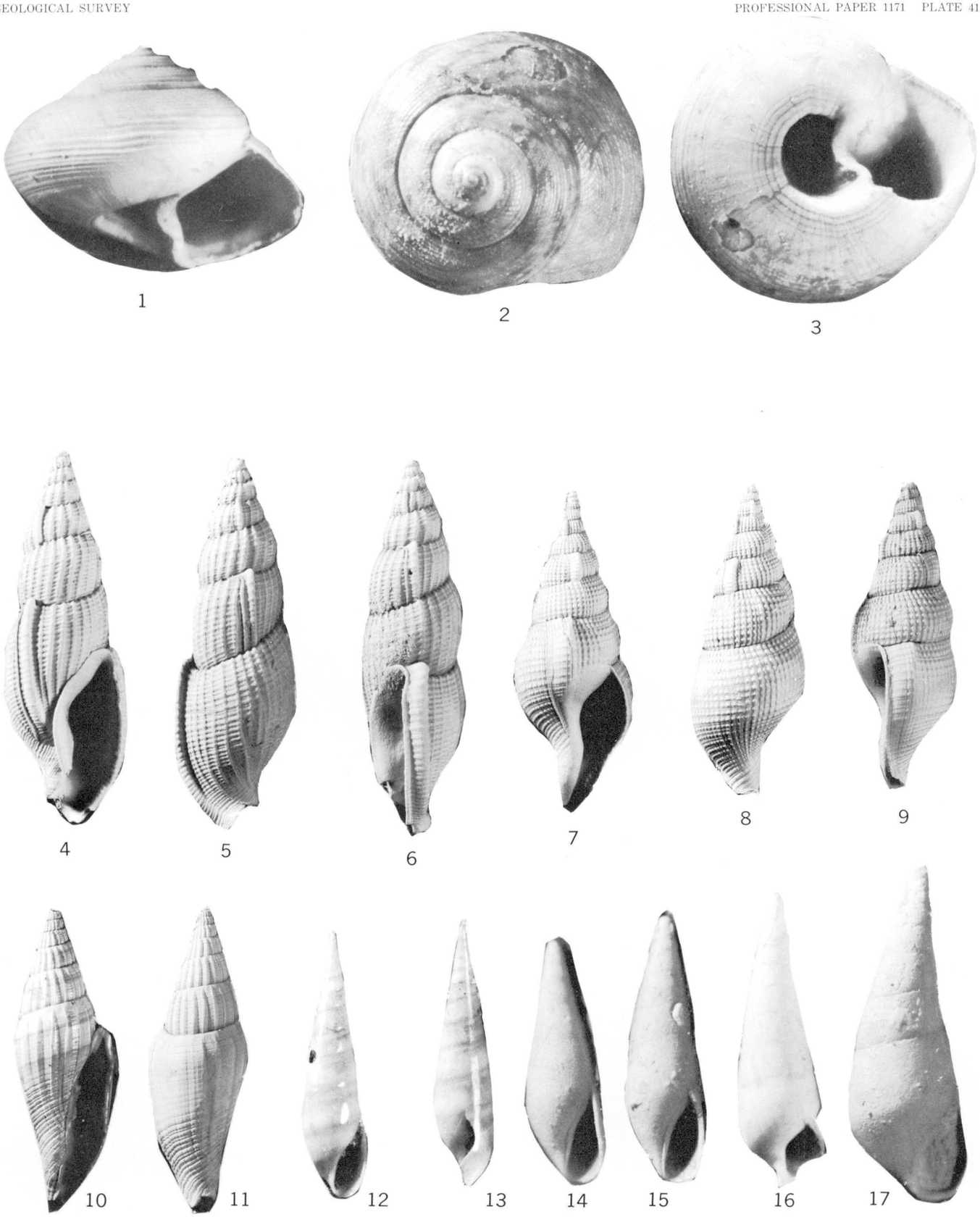
12, 13. *Eulima santoensis* Ladd, n. sp. (p. 55).
Holotype. Height 9.5 mm (× 5). USGS locality 25715, Kere River, Santo, New Hebrides. Pleistocene, USNM 250158.

14. *Eulima* sp. A (p. 55).
Height 2.7 mm (× 20). USGS locality 21304, Goikul Peninsula, Babelthuap, Palau. Late Miocene. USNM 250155.

15. *Eulima* sp. A (p. 55).
Height 2.1 mm (× 20). Drill Hole E–1, Eniwetok. Early Miocene (Tertiary *f*). USNM 250156.

16. *Balcis* aff. *B. vitrea* (A. Adams) (p. 56).
Height 4.9 mm (× 10). Station C2026, Viti Levu, Fiji. Pliocene (Tertiary *h*). USNM 214386.

17. *Balcis* aff. *B. kanaka* (Pilsbry) (p. 55).
Height 4.0 mm (× 15). Drill hole 2B, Bikini, 1,629–1,640 ft (497–500 m), early Miocene (Tertiary *e*). USNM 250157.



TROCHIDAE, COLUBRARIIDAE, MITRIDAE, EULIMIDAE