The Cypraeidae of Fiji

(Mollusca: Gastropoda)

BY

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Vatukoula, Fiji Islands

(Plates 21 to 26; 1 Text figure; 1 Map)

No molluscan family has received more scientific attention than the Cypraeidae. Although almost 4000 papers have been published dealing with various aspects of this group, few of them give detailed descriptions of shells and animals, as well as illustrations. A thorough study of one molluscan family from a restricted area will give prospective authors some of the basic material for a monograph on that group.

It will be seen from the descriptions given that, while the shells of the animals are fairly well known, the information available on the soft parts of the various species is very scanty. Little is known, too, about the factors which cause the different species to prefer different habitats, or even what the preferred habitats are. Nor is it precisely known during what part of the year the cowries reproduce. Recent observations seem to indicate that the two sexes of some of the species have different mantle colours, but little has so far been done to find to which particular species this applies. These are some of the gaps in our knowledge which can be filled by the active field collector, and by recording what is known, it is hoped that at least some of these gaps can be filled.

GEOGRAPHY

The Fiji Islands are predominantly of volcanic origin; however, there is some intrusion of older rocks (granites, diorites) on the Island of Viti Levu. The Fiji Island chain dates back in geological time to early Miocene (mainly in the centre of Viti Levu), to Pleistocene and Recent towards the coast line. The intrusion of the plutonic series dates back to Eocene.

The Fiji Islands can be regarded as the eastern boundary of the Melanesian region in the Pacific ocean. Fiji's molluscan fauna is predominantly Melanesian, but at the same time receives some of the back wash of Polynesian fauna (*Cypraea ventriculus, C. maculifera, C. schilderorum*).

The islands are situated between 16° and 21° South Latitude, and 177° East and 178° West Longitude. They comprise some 300 islands, most of which are uninhabited. The largest island is Viti Levu, followed in size by Vanua Levu, Kadavu, the Yasawa group and the Ono-i-Lau group of islands.

Viti Levu is surrounded by a chain of coral reefs, both fringing and outer reefs. The most accessible localities for collecting are the Suva reef, the Nadroga reef, Vuda Point in the West, Vatia wharf in the North-west, Viti Levu Bay in the North-east and Lodoni in the East of Viti Levu. The Nadroga reef extends for fifty miles from Deuba to Sigatoka. Most of these localities are accessible from the 320 mile-long main road which runs around Viti Levu. Collecting on outer reefs and adjacent islands is more rewarding, but they can only be reached by boat. The shoreline of Viti Levu alternates between sandy beaches, rocky coast and mangroves. Average temperatures from October to February are about 80 to 85 degrees F, with a relative humidity of about 80%. In the cooler months from May to August the average temperature falls to 75 degrees F with a relative humidity of 75%.

HABITAT AND VARIATION

Cowries do not like sunlight, and during the day hide in cracks and crevices of coral boulders. When the loose coral boulders are turned over, the animals will be found clinging underneath. In this dim environment they feed, and in due season, lay and guard their eggs. The importance of returning the boulders to their original position cannot be over-stressed; a boulder left turned the wrong way up leads to the destruction of the algae on which cowries feed, and may lead to the disappearance of the local population. The best times for collecting are the very low tides during which large areas of the reef are exposed, but some species can be found during any low tide. Diving and dredging have (perhaps fortunately) been very little practised in Fijian waters; although some forms can be found only by these means.

It has been noticed in Fiji, as well as in other places, that some species come into shallow water only for limited


VANUA LEVU
Yadua
Yasawa
Nacula
YASAWA GROUP
Naviti
Waya
Waya Lailai
Vomo
MAMANUCA GROUP
Lautoka
Mana
Malolo
Nadi
VITI LEVU
Momi
Natadola
CUVU
Sigatoka
Korotogo
Sovi Bay
Navua
SUVA
Nukulau
Nasilai
Kaba Pt
Bau
TAILEVU
Ludoni
Levuka
OVALAU
Wakaya
Makogai
Viti Levu Bay
Ellington Wharf
RAKIRAKI
Nananu-i Ra
VATIA
TAVUA
Beqa
Yanuca
Vatulele
KADAVU PASSAGE
Ono
KADAVU
Vunisea
17°
18°
19°
20°
M E L A N E S I A
NEW GUINEA
NEW IRELAND
NEW BRITAIN
SOLOMON IS
Port Moresby
Nauru I
GILBERT IS
PHOENIX IS
ELLICE I
TOKELAU IS
SAMOA
Santa Cruz Is
Banks Is
NEW HEBRIDES
FIJI IS
TONGA
NEW CALEDONIA
LOYALTY IS
QUEENSLAND
AUSTRALIA
Brisbane
NEW SOUTH WALES
Sydney
PACIFIC OCEAN
Norfolk I
NEW ZEALAND
NOT TO SCALE
Scale of Miles
0 2 4 6 8 10 20 30 40
Driving Roads
177°
178°
Longitude East 179°

periods. A locality may yield a rich harvest one week, and may be found deserted at the next low tide. It may be that the rarer species only occasionally leave deep water to visit the reefs. Habitat seems to vary from locality to locality. In one place *Cypraea mappa* can be found in ankle-deep water, while elsewhere it is only to be found twenty feet deep.

Shells of most species vary in colour as well as in size. In some localities they are larger than average, while in others they are small and stunted. Small size seems to coincide with overcrowding, and is probably the result of keen competition for the inadequate food supply. Differences in shell colour are possibly due to the chemical properties of the sea water; these can affect the food algae, and consequently the mantle cells which produce shell pigment. Normal genetic variation doubtless also is partly responsible.

THE ANIMAL

The thin mantle can be extended over the shell, and serves both to keep it clear of weed and to deposit new layers of enamel. The mantle papillae are probably tactile organs; they may help in respiration. These papillae may be unbranched (simple), or may divide towards the top into two or more branches (digitated). The siphon takes in water, and thus conveys oxygen to the gills. The cephalic tentacles were originally considered to be olfactory organs, but it now seems more likely that they are tactile. On them are located the eyes. The buccal bulb contains the radula, a pliant file-like ribbon of 100 or so rows each containing seven teeth; as the front portion of the radula is worn away by repeated rasping at vegetation, it is replaced by new rows. The foot is used for locomotion.

CLASSIFICATION

Recent taxonomists have proposed many systems of classification, most of which differ in important particulars. The best arrangement of the species is probably that of F. A. and M. Schilder, and the species list given below is based on this. On the other hand the work of Alison Kay in Hawaii has shown that the soft parts of the animal do not differ significantly within the many genera proposed by the Schilders. As there is little agreement on what constitutes a subspecies, this term as well as the generic term used by the Schilders has been added in brackets.

Steadman & Cotton (1943) published a paper entitled "The cowries of Fiji." They proposed 33 new subspecific or even specific names for Fijian cowries - roughly one for every two species found there. Examination of series of shells from different Fijian localities has shown the described distinctions for these forms to be due to individual or ecological variation, and none of the new names is considered valid. It is unusual in cowries for a subspecies to occupy such a small area as one group of islands. In the Schilders' opinion (1938, 1941 and all papers thereafter) the subspecies extend right across the Pacific. Other investigators consider that many of the species of Cypraeidae do not form separate subspecies. What view is taken on this problem will depend on the definition accepted for the subspecies. However they may differ on this question, few or no authorities support separation of the Fijian forms. These names and other synonyms are listed in the alphabetical index.

METHODS AND OBSERVATIONS

The description of the shell of each species is followed by some indications of size and number of teeth. These consist of:

(a) mean length of the shell in millimeters
(b) width of the shell as a percentage of its length
(c) (d) number of teeth on the labial and columellar sides when converted to the number which would be found on a similar shell 25 mm long.

These four measurements are the means for Pacific shells of the respective subspecies, and are taken from Schilder & Schilder (1938 and 1952). They are followed by indications of the extremes of shell lengths observed in the Fiji Islands. Examination of series of specimens from Fiji showed that they agree closely (with few exceptions only) with the measurements listed by the Schilders for the same subspecies from different Pacific localities.

The animals of very few species of Fijian cowries have been adequately described. The descriptions given are those of animals collected in the Fiji Islands, and were checked from specimens picked at random from different localities. The colour of the mantle, foot and papillae will vary through shades of one colour, and the colour prevalent in the majority of animals has been recorded. In the case where animal descriptions of a species could not be ascertained from Fiji specimens, other authors' descriptions were adopted. The name of the observer and the locality of the animal follow the description.

The relative frequency of the species of *Cypraea* in Fiji has been calculated on the number of specimens obtained by resident collectors and the author's own active collecting experience. Collections of Fijian material in various museums have not been included, owing to lack of proof of reliable locality data. Species of *Cypraea* classed as common in other geographical regions are uncommon or

rare in Fiji. Some *Cypraea,* however, are more frequent in Fiji than in other areas of the species' distribution. The terms indicating relative frequency of *Cypraea* in Fiji have the following meaning:

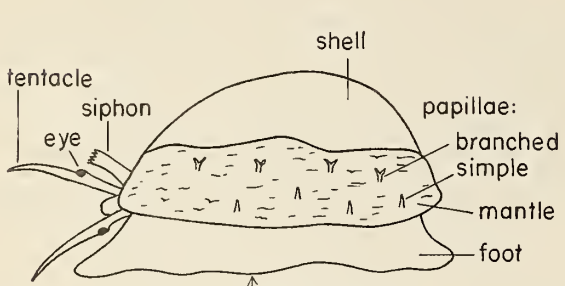
Very common = occurs in unlimited numbers throughout Fiji

Common = fairly frequent in most Fijian localities

Uncommon = Occasionally encountered in certain Fijian localities

Rare = Occasionally encountered during certain times of the year in certain Fijian localities

Very rare = not exceeding 10 specimens in Fiji collections



DISTRIBUTION

In addition to the distribution of each species in Fiji, other geographical distribution data are given, after a dash (—) immediately following the Fijian localities. The geographical regions are designated as follows (adopted from Schilder & Schilder, 1940):

East Australia: Torres Strait, Queensland, Brisbane, Lord Howe Island, Sydney

South-west Pacific: Geelvink Bay, Humboldt Bay, Astrolabe Bay, South-east New Guinea, Bismarck Archipelago, Solomon Islands, New Hebrides, New Caledonia

Central Pacific: Fiji Islands, Tonga, Samoa, Wallis and Futuna, Tokelau, Phoenix Islands, Howland, Ellice and Gilbert Islands (Kingsmill Islands)

West Pacific: Marshall Islands, Caroline Islands, Palau Islands, Yap, Mariana Islands, Bonin Islands

East Pacific: Cook Islands, Tahiti, Tuamotus, Gambier and Henderson Islands, Marquesas Islands, Flint and Malden Islands, Jarvis and Palmyra Islands

North-east Pacific: Johnston Island, Hawaii, French Frigate Shoals, Laysan, Midway

Synonyms are shown in brackets [ ].

The symbol / between name and author indicates incorrect use of a name by a subsequent writer (i. e. not in the original sense).

The symbol // before a name indicates that the name is invalid because it is pre-occupied by an older homonym.

ACKNOWLEDGMENTS

I would like to express my appreciation to Dr. F. A. Schilder for the compilation of literature and museum records on Fijian *Cypraea.* To Dr. R. Stohler for his generous assistance and sound advice on the preparation of this paper, and to Lt. Col. John Griffiths, who with his untiring effort assisted in every way possible. My thanks are due to all active field collectors in Fiji, especially Mr. A. Jennings who supplied animal descriptions for checking purposes, and Messrs. R. Pahl, B. Deane, I. Morse and T. Sanders for the loan of their Fijian study material.

INDEX OF SPECIES

(* denotes synonym, homonym or *nomen nudum*)

DESCRIPTION OF SPECIES

1. *Cypraea testudinaria* LINNAEUS, 1758
[*Chelycypraea testudinaria* (LINNAEUS, 1758)]

(Plate 23, Figure 14)

Cypraea testudinosa PERRY, 1811

Shell: Shell large, elongate-cylindrical, narrow, flattened on top. Dorsum cream to fawn, covered by dark brown and black blotches, often confluent. Shell has a bluish cast over the dorsal pattern, and vivid, conspicuous, small white "dust" spots embedded in the enamel. Base convex, flesh to pale brown, teeth white, short and confined to aperture. The first seven anterior labial teeth are produced; aperture narrow. Fossula very pronounced, wide, deep, and denticulate; extremities calloused.
Size: 102 (50), 28:25; extremes 80, 125 mm.
Animal: Not observed.
Distribution: South and South-west Viti Levu, mainly on the Nadroga reef. Uncommon as live-collected specimens. — Malaysia, Ceylon, Philippine Islands, Formosa, Japan, Torres Strait, Queensland, South-west - Central - West - and East Pacific.
Discussion: The animal usually inhabits holes on the outer edge of coral reefs, mostly in deeper water. During the breeding season the species is encountered in shallow water.

Various authors used *Cypraea testudinosa* PERRY, 1811 to designate the Melanesian race of *C. testudinaria*. The two forms cannot be readily separated.

2. *Cypraea isabella* LINNAEUS, 1758
[*Luria isabella lekalekana* (LADD, 1934)]

(Plate 22, Figure 10)

Cypraea isabella lekalekana LADD, 1934
Basilitrona isabella cavia STEADMAN & COTTON, 1943

Shell: Shell cylindrical, elongate. Dorsum grey, fawn or light brown, crossed by three darker, pale transverse bands and marked with fine, interrupted longitudinal black lines. Extremities blunt, with orange terminal blotches which have black centres; sides rounded. Base white, convex; aperture narrow. Teeth short, very fine and numerous. Fossula steep and denticulate.
Size: 26 (56), 34:26, extremes 20, 42 mm.
Animal: Sole of foot blackish-grey; dorsum of foot black. Mantle blackish brown, spotted with minute, white scattered dots. Papillae appear only as slightly raised fleshy granules. Tentacles blackish-brown; siphon short, blackish-brown, not fringed at the end.

Distribution: West, South and East of Viti Levu. Common. — North-west New Guinea, East Australia, South-west - Central - and West Pacific.
Discussion: Although common in the greater part of Viti Levu, the species has never been recorded from the North of the island.

3. *Cypraea arabica* LINNAEUS, 1758
[*Mauritia arabica* (LINNAEUS, 1758)]

(Plate 21, Figure 3)

Cypraea fragilis LINNAEUS, 1758
C. arabica var. *intermedia* GRAY, 1824
Arabica arabica reticulata / STEADMAN & COTTON, 1943

Shell: Shell subcylindrical, medium in size. The dorsal pattern consists of longitudinal hieroglyphic brown lines interrupted by numerous irregular lacunae; dorsal colour dark grey, lacunae brownish, the pale sulcus clearly visible. Spire conspicuous; margins callous, decorated with fairly large purple-black spots which extend over part of the base. Base flat, rarely convex, cream to grey in colour. Teeth vivid chestnut, labial teeth extend third of the way to the margins, columellar teeth slightly shorter; six or seven central columellar teeth slightly produced. Fossula fairly deep, merging into the columellar sulcus, and denticulate.
Size: 46 (65), 23:19; extremes 39, 70 mm.
Animal: Sole of foot pinkish-grey, edges purplish at the sides, yellow posteriorly; dorsum of foot dark grey. Mantle dark grey; papillae numerous, very short, simple, dark brown. Tentacles dark grey; siphon dark grey, thickly fringed at the end; eyes black and set in white sockets.
Distribution: Throughout Viti Levu. Uncommon — Greater part of Malaysia, Melanesia to Polynesia.
Discussion: STEADMAN & COTTON's *Arabica arabica reticulata* (MARTYN, 1784) (1946, plt. 12, fig. 1) is a typical *Cypraea arabica arabica* LINNAEUS. In their 1946 paper, the authors re-classified the species as *Arabica arabica histrio* (GMELIN, 1791), which does not occur in Fiji.

4. *Cypraea maculifera* (SCHILDER, 1932)
[*Mauritia maculifera* SCHILDER, 1932]

(Plate 21, Figure 4)

Cypraea reticulata MARTYN, 1784 - *nom. nud.*

Shell: Shell solid, slightly pyriform, base convex to flat. Dorsum brown, dorsal sulcus distinct; the prominent white dorsal reticulations are brighter and more numerous than those of *Cypraea arabica,* and the hieroglyphic lines are lacking. Margins swollen, angular, with large purplish lateral spots tending to form patches, and extending over part of the base. Base grey with a purplish cast and a distinct irregular dark blotch on the columella. Teeth dark brown, labial teeth extend one third way down to the margins, labial teeth slightly shorter. Fossula flattish, white and denticulate.
Size: 55 (68), 22:18; extremes 40, 70 mm.
Animal: Sole of foot light grey; dorsum of foot blue-black and finely mottled with a lighter shade. Mantle brown, translucent at the margins. Papillae short, simple and light grey. Tentacles blue-black with a white streak near the base; siphon blue-black, fringed at the end.
Distribution: South-west of Viti Levu. Very rare. — New Caledonia, Central - West - East - and North-east Pacific.
Dicussion: The species has not been recorded as far West as Fiji before. The three specimens so far collected came from a reef near Vatukarasa, in the South-west of Viti Levu.

5. *Cypraea depressa* GRAY, 1824
[*Mauritia depressa depressa* (GRAY, 1824)]

(Plate 22, Figure 9)

Arabica gillei JOUSSEAUME, 1893
Cypraea intermedia / REDFIELD, 1847

Shell: Shell heavy, ovate, broad, base convex. Dorsum depressed, chestnut in colour, ornamented with small white reticulations; dorsal sulcus clear. Sides heavily calloused, and spotted with small indistinct purplish-brown spots which extend over part of the base. Some shells have a broad, transverse dorsal band. Base ivory-white, with chestnut teeth extending one third of the way to the margins; aperture slightly narrow. Fossula fairly deep, white, denticulate and merging with the columellar sulcus.
Size: 35 (72), 22:16; extremes 25, 40 mm.
Animal: Sole of foot orange-brown, dorsum of foot shaded with a darker hue. Mantle brownish-slate; papillae small, simple and pale. Tentacles and siphon slate colour. Other details not observed.
Distribution: South and West of Viti Levu. Very rare. — Philippine Islands, Japan, South-west - Central - West and East Pacific.
Discussion: *Cypraea depressa* is sometimes confused with *C. maculifera.* It is distinguishable by its fewer teeth, smaller size, and the absence of any columellar basal blotch.

6. *Cypraea eglantina* Duclos, 1833
[*Mauritia eglantina eglantina* (Duclos, 1833)]

(Plate 21, Figure 2)

Arabica eglantina momokiti Steadman & Cotton, 1943
Arabica intermedia / Steadman & Cotton, 1943

Shell: Shell oblong-ovate to subcylindrical. Dorsum brown to grey, reticulate with irregular clear patches, lined between; dorsal sulcus always distinct. Sides rounded, sometimes slightly margined, with small dark brown spots. Extremities marked with a large pair of dark brown blotches. Base cream coloured, convex; teeth short, chestnut, finer and more numerous than those of *Cypraea arabica*. The other two differences which separate *C. eglantina* and *C. arabica* are the brown blotch near the spire of the former, and the steep vertical edge to its fossula, with the teeth scarcely extending onto the base above it. Size: 50 (59), 26:22; extremes 30, 75 mm.
Animal: Sole of foot cream, edges and dorsum of foot dark grey. The edges of the mantle are dark grey, remaining mantle area wine red. Papillae numerous, short, simple, grey, tipped with white. Tentacles grey with yellowish circles around the eyes; siphon dark grey.
Distribution: Throughout Fiji. Very common. — Astrolabe Bay, New Caledonia, Central Pacific, Cook Islands.
Discussion: Adult specimens from some Fijian localities have four darker transverse dorsal bands.

7. *Cypraea scurra* Gmelin, 1791
[*Mauritia scurra retifera* (Menke, 1829)]

(Plate 23, Figure 16)

Cypraea scurra retifera Menke, 1829
Arabica scurra vono Steadman & Cotton, 1943

Shell: Shell narrow and cylindrical. Dorsum brown, reticulate, tinged pale orange just above margins; dorsal sulcus straight and distinct. Sides rounded, light brown, with indistinct purple spots; extremities produced with blackish-brown terminal spots. Base convex, bluish-grey; aperture narrow, teeth fine, short, dark brown, interstices pale brown. Fossula deep, white and denticulate.
Size: 36 (50), 35:26; extremes 30, 45 mm.
Animal: Sole of foot pale. Mantle olive-brown; papillae few, simple, rather elongate. Siphon brownish, fringed at the end. Other details not observed.
Distribution: South and West of Viti Levu. Very rare. — Central - West - East - and North-east Pacific.

8. *Cypraea mappa* Linnaeus, 1758
[*Mauritia mappa viridis* (Kenyon, 1902)]

(Plate 21, Figures 1, 1 a)

Cypraea mappa viridis Kenyon, 1902
Leporicypraea mappa rewa Steadman & Cotton, 1943

Shell: Shell ovate, inflated. Dorsum pale to rich brown, with a pattern consisting of a wide and clear dorsal line from which branch a number of feeler-like extensions; the dorsum is marked with many fine brown lines and a few clear round patches. Sides cream to orange, slightly callous: lateral spots medium brown, extending over part of the convex base. The darker central basal blotch on the columella is absent in most specimens. Teeth bright orange, confined to aperture. Extremities margined, suffused creamy-grey. Fossula flattish, crossed by orange ribs which are interrupted by a prominent longitudinal pale ridge.

Size: 71 (64), 25:22; extremes 49, 75 mm.
Animal: Sole of foot cream, veined with black; dorsum of foot grey. Mantle fawn; papillae at the anterior and posterior extremities are numerous, long and simple, coloured white; on the mantle edges papillae are few, short and bushy. Tentacles fawn; siphon translucent fawn and fringed.
Distribution: Throughout Fiji. Uncommon. — Torres Strait, Queensland, Cook Islands, South-west - Central - West Pacific, Tuamotus, Gambier and Henderson Islands.
Discussion: The mean average length of 60 Fijian specimens is only 62 mm.

A few specimens with an unusual shell variation have been collected in Fiji. The dorsum is dark brown. The margins are spotted with large dark purple spots, which tend to merge into still larger blotches. Fine white striations extend from the margins onto the purplish base; teeth are vivid red.

9. *Cypraea mauritiana* Linnaeus, 1758
[*Mauritia mauritiana calxequina* (Melvill & Standen, 1899)]

(Plate 23, Figure 12)

Cypraea mauritiana calxequina Melvill & Standen, 1899

Shell: Shell wide, heavy, with sides very prominently angled. Dorsum humped, dark brown, marked with irregular orange reticulations and a pale dorsal line. Spire

conspicuous, sides and base blue-black (immature specimens chestnut-brown). Aperture wide, base flattened; teeth large and coarse, dark brown with yellow-white interstices; central labial teeth shorter. Fossula slightly concave, white and denticulate, columellar sulcus pronounced.
Size: 73 (71), 18:15; extremes 60, 90 mm.
Animal: Sole of foot purplish-grey, dorsum and sides of foot violet. Mantle slightly paler; papillae short and blackish. Tentacles violet-brown; siphon similar in colour, fringed at the end.
Distribution: South and South-west Viti Levu. Uncommon. — Philippine Islands, Japan, East Australia, South-west - Central - West - and East Pacific, Hawaii.
Discussion: Only one unverified specimen had been recorded from the North of Viti Levu.

The habitat of the species in Fiji is confined to dark basalt boulders and wave swept marine benches.

10. *Cypraea aurantium* Gmelin, 1791
[*Callistocypraea aurantium* (Gmelin, 1791)]

(Plate 21, Figure 5)

Cypraea aurora Lamarck, 1810
Callistocypraea aurantium turanga Steadman & Cotton, 1943

Shell: Shell large, ovate, inflated, slightly margined. Dorsum orange, without pattern. Sides and base creamy-white, finely striated. Aperture wide, base convex; teeth short, orange, extending as heavy ribs across the fairly wide and deep fossula. Interstices are a deeper shade of orange.
Size: 95 (67), 23:20; extremes 80, 110 mm.
Animal: Pinkish-grey (Fiji, Steadman & Cotton, 1943)
Distribution: Habitat of the species is confined to the Nadroga reef, South-west Viti Levu. It inhabits deeper water on the outside ledge of the reef. — Philippine Islands, South-west - Central - and West Pacific, Cook Islands, Tahiti.
Discussion: Three specimens collected at the Nadroga reef had a reddish-brown dorsum, heavily margined sides of a smoky-grey, with distinct fine striations extending to the smoky-grey base. All three specimens were smaller than average.

11. *Cypraea argus* Linnaeus, 1758
[*Talparia argus ventricosa* (Gray, 1824)]

(Plate 22, Figure 6)

Cypraea argus ventricosa Gray, 1824

Shell: Shell cylindrical, elongate. Basic dorsal colour fawn to bluish-grey, with irregular brown rings of varying size and thickness and three slightly darker, broad transverse bands. Sides rounded, sometimes slightly callous; base convex, fawn to pale brown, with two large dark brown irregular patches on each side of the aperture; one or two of these are occasionally absent. Aperture wide, constricted anteriorly; labial teeth extend halfway to the margin, columellar teeth are short. Teeth are edged with thin brown lines and extend as ribs onto the wide and deep fossula.
Size: 78 (53), 25:22; extremes 55, 90 mm.
Animal: Dark grey. Other details not observed.
Distribution: Throughout Fiji. Uncommon in the South and East, rare in the West and North of Viti Levu. — Torres Strait, North Queensland, South-west - Central - and West Pacific.

12. *Cypraea talpa* Linnaeus, 1758
[*Talparia talpa saturata* (Dautzenberg, 1903)]

(Plate 22, Figure 8)

Cypraea talpa saturata Dautzenberg, 1903

Shell: Shell cylindrical to subcylindrical. Dorsum fawn to yellow-orange, crossed by three or four wide brown bands. Sides, base and extremities blackish-brown (light brown in immature specimens). Base convex, aperture narrow and fairly straight. Teeth fine and short, with pale interstices. Teeth extend as coarse ribs onto the wide and steep fossula and are interrupted by a pale longitudinal ridge.
Size: 68 (55), 32:26; extremes 30, 75 mm.
Animal: Sole of foot grey to deep grey, veined with black; dorsum of foot and mantle show two distinct variations, and are represented in about equal numbers in a population:

1. Dorsum of foot black. Mantle smooth, black, with ½ inch long and ⅛ inch wide black cusps on the mantle, resembling an inverted test tube. Tentacles black, eyes blue.

2. Dorsum of foot black, with numerous minute white spots. Mantle black, profusely spotted with white and with a few circular black humps over the mantle, about ⅛ inch in diameter. Tentacles black, eyes blue.

Distribution: Throughout Fiji. Uncommon. — Torres Straits, Queensland, South-west - Central - West - East and North-east Pacific.
Discussion: The frequent occurrence of both types of animals in all localities, points to a possible sexual dimorphism.

Allan (1956) listed Samoa as type locality. Dautzenberg's specimens of *Cypraea talpa saturata* are from an unknown locality. Dautzenberg's racial name had been utilized by the Schilders (1938) for the Pacific race

of *C. talpa*. They selected as lectotype a shell from New Caledonia (1952, plt. 4, fig. 4).

13. *Cypraea tigris* Linnaeus, 1758
[*Cypraea tigris lyncichroa* Melvill, 1888]

(Plate 22, Figures 7, 7 a)

Cypraea tigris lyncichroa Melvill, 1888
Cypraea tigris volai Steadman & Cotton, 1943
Cypraea tigris amboolee Steadman & Cotton, 1943

Shell: Shell ovate, solid and heavy. Dorsum has large blackish spots over a grey, orange or white base; dorsal line orange or white, absent in many specimens; dorsal spots are often large and confluent, giving the shell a very dark appearance. Margins slightly angular, spotted; base white, convex, with an indistinct darker central patch on columella. Aperture wide, slightly dilated anteriorly; teeth coarse and short, central columellar teeth slightly produced. Fossula fairly deep, crossed by ribs which are somewhat shallow but not interrupted by the longitudinal ridge in the fossula.
Size: 85 (68), 18:16; extremes 60, 110 mm.
Animal: Sole of foot dark grey veined with black, edges cream; dorsum of foot grey, mottled with blackish-brown. Mantle mottled with cream and blackish-brown and veined. Papillae numerous and long, some simple, others branched, grey and tipped with white. Tentacles brown, siphon grey with white-tipped fringes.
Distribution: Throughout Fiji. Very common. — Torres Strait, Queensland, South-west - Central - West - and East Pacific.

14. *Cypraea lynx* Linnaeus, 1758
[*Lyncina lynx caledonica* (Crosse, 1869)]

(Plate 24, Figure 20)

Cypraea lynx caledonica Crosse, 1869
Lyncina lynx pacifica Steadman & Cotton, 1943

Shell: Shell ovate to sub-pyriform. Dorsum brown, bluish or orange, with very small brown freckles and larger dark brown to black spots; dorsal line indistinct. Sides rounded or slightly calloused, spotted with brown, finely striated. Base white to light brown, columellar side ridged and flat, labial side rounded. Aperture narrow; teeth large, white, interstices bright orange; teeth on labial side extend one third of the way to the margin, columellar ones are short and extend as ribs onto the wide, pronounced fossula.
Size: 36 (61), 21:17; extremes 22, 55 mm.
Animal: Sole and dorsum of foot cream-yellow, dorsum flecked with dark brown. Mantle olive-brown, veined and flecked with black. Papillae short, thickly branched, white. Tentacles brown, eyes black and set in yellow sockets; siphon translucent grey, fringed at the end.
Distribution: Throughout Fiji. Very common. — Torres Strait, Queensland, South-west - Central - West - and East Pacific, Hawaii.

15. *Cypraea vitellus* Linnaeus, 1758
[*Lyncina vitellus polynesiae* (Schilder & Schilder, 1939)]

(Plate 24, Figure 19)

Cypraea vitellus polynesiae Schilder & Schilder, 1939

Shell: Shell ovate to pyriform, heavy. Dorsum fawn, brown or dark-brown, marked with many irregular white spots of different sizes, and two or three transverse dorsal bands; bands are either pale or distinct. Sides olive, with white spots and fine white striations which extend halfway up the dorsum on the labial side. Base convex, white, sometimes pale lilac. Aperture wide and sinuous, extremities calloused; teeth white, strong, short and extending as ribs onto the deep fossula.
Size: 57 (64), 21:18; extremes 30, 75 mm.
Animal: Sole of foot fawn, dorsum of foot grey. Mantle grey, flecked and marbled with black. Papillae few, short, yellow, branched straight from the base in a fork-like manner; some papillae are short and simple. Tentacles dark grey; siphon white, with bright yellow fringes at the end.
Distribution: Throughout Fiji. Common. — South-west - Central - West - and East Pacific, Hawaii.
Discussion: Steadman & Cotton (1943) and Allan (1956) list Fiji as type locality of *Lyncina vitellus polynesiae*. The correct type locality, however, is Papeete, Tahiti.

16. *Cypraea ventriculus* Lamarck, 1810
[*Lyncina ventriculus* (Lamarck, 1810)]

(Plate 23, Figure 13)

Cypraea achatina Perry, 1811
Ponda ventriculus topee Steadman & Cotton, 1943

Shell: Shell ovate, depressed and heavy. Dorsum reddish-orange, crossed by four transverse bands, usually indistinct in mature specimens; dorsal line white, often very broad. Sides and extremities callous, smoky-grey to chestnut-brown, with fine distinct striations extending halfway up the dorsum. Base fawn, becoming whiter towards the aperture; teeth short, large and white, crossing the fairly shallow fossula.
Size: 50 (67), 19:17; extremes 35, 61 mm.
Animal: Not observed.

Distribution: Ono-i-Lau Group (East of Viti Levu), Suva main reef, and Kadavu Island (South of Viti Levu). — South-west - Central - West - and East Pacific; Philippines.

17. *Cypraea carneola* Linnaeus, 1758
[*Lyncina carneola propinqua* (Garrett, 1879)]

(Plate 24, Figures 21, 22)

Cypraea carneola propinqua Garrett, 1879
Ponda carneola thepalea Iredale, 1939

Shell: Shell ovate to pyriform. Dorsum greyish-red to reddish-brown, crossed by four transverse darker bands. Sides rounded or slightly calloused, with a cream callus faintly mottled with brown; most shells have a pale lilac border above the callus. Base cream, aperture wide; very fine striae extend from the margins to the aperture. Teeth short, interstices purple. Fossula deep, strongly denticulate, with a pale longitudinal rib.
Size: 35 (61), 24:19; extremes 25, 65 mm.
Animal: Sole and dorsum of foot cream-yellow. Mantle dirty-white, heavily veined and flecked with dark brown. Papillae few, short, and branched in a fork-like manner, white; papillae at anterior extremity are simple. Tentacles dark grey; siphon pale grey with long fringes at the end.
Distribution: Throughout Fiji. Uncommon. — East Australia, South-west - Central - West - and East Pacific; Hawaii.

18. *Cypraea schilderorum* (Iredale, 1939)
[*Lyncina schilderorum* (Iredale, 1939)]

(Plate 24, Figure 23)

Ponda schilderorum Iredale, 1939
Cypraea // arenosa Gray, 1824

Shell: Shell ovate, heavy. Dorsum reddish-brown, with central area bluish-white, crossed by four reddish-brown bands. Sides margined, fawn, mottled with paler dots and occasionally vertical striations. Base convex, brownish at the edges, remainder white. Aperture narrow; teeth white, fine, numerous and short. Fossula deep, strongly denticulate.
Size: 33 (68), 26:21; extremes 30, 38 mm.
Animal: Mantle mottled black, brown and white; tentacles black; dorsum of foot light tan; ventral surface of foot cream. Siphon with a simple fringe. Papillae short, feathery projections, cream-white. (Hawaii - Kay & Weaver, 1963)
Distribution: Nadroga reef, South-west Viti Levu. Very rare. — New Caledonia, Fiji Islands, Samoa, Gilbert & Ellice Islands, East and North-east Pacific.

19. *Cypraea mariae* (Schilder, 1927)
[*Annepona mariae* (Schilder, 1927)]

(Plate 25, Figure 37)

Pustularia (*Pustularia*) *mariae* Schilder, 1927
Cypraea // annulata Gray, 1828

Shell: Shell oval to round, and humped. Dorsum ivory-white, smooth, with yellow spots ocellated with slightly darker rings; the dorsal spots sometimes tend to merge, particularly lower down the dorsum, and extend to the margins. Sides rounded, base white and flattish. Aperture extremely narrow; teeth very fine, numerous, and confined to the aperture. Fossula smooth, forming a broad ledge.
Size: 14 (66), 43:30; extremes 14, 17 mm.
Animal: Not observed.
Distribution: Nadroga reef, South-west Viti Levu. Very rare. — Philippine Islands, South-west and Central Pacific, Palau Islands, Cook Islands, Tuamotus, Gambier-Henderson Islands, Hawaii.

20. *Cypraea globulus* Linnaeus, 1758
[*Pustularia globulus sphaeridium* Schilder & Schilder, 1938]

(Plate 26, Figure 54)

Pustularia cicercula jennisoni Steadman & Cotton, 1943

Shell: Shell globular, slightly humped, with produced extremities, but shorter than *Cypraea cicercula.* Dorsum smooth, pale to dark rusty-brown, with many small, brown spots which extend to the margins; above the posterior extremity is a wart-like callosity (also present in *C. bistrinotata,* but not in *C. cicercula,* nor in *C. margarita*). Dorsal granulations and sulcus are absent. Base convex, light brown; aperture narrow, with a pair of brown, squarish spots on each side; the basal spots are occasionally absent. Teeth dark brown, fine, and extending three quarter way to the margins; the five to six central columellar teeth are very short. Fossula shallow and denticulate.
Size: 15 (61), 34:23; extremes 12, 17 mm.
Animal: Not observed.
Distribution: Throughout Fiji. Rare. — Torres Strait, South-west Pacific, Fiji Islands, Samoa, Jarvis Island.

Explanation of Plate 21

Dorsal views of Figures 1, 1 a, 2, 3: x 0.8; Figure 4: x 0.7; Figure 5: x 0.4. - Ventral views slightly larger.
Figure 1: *Cypraea mappa viridis* Kenyon (typical). Figure 2: *C. mappa viridis* Kenyon (ecological variant)

Figure 1 Figure 1 a

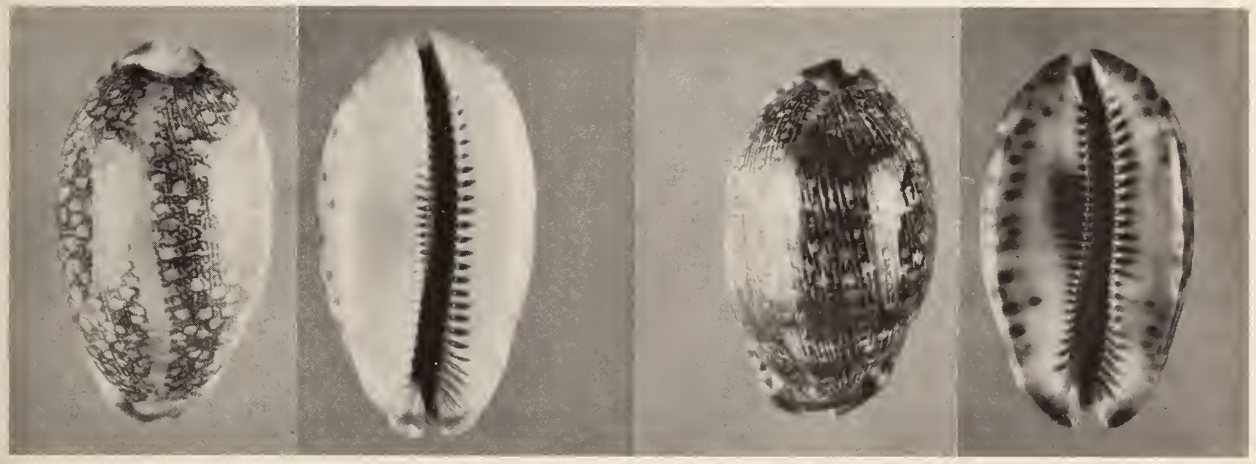


Figure 2 Figure 3

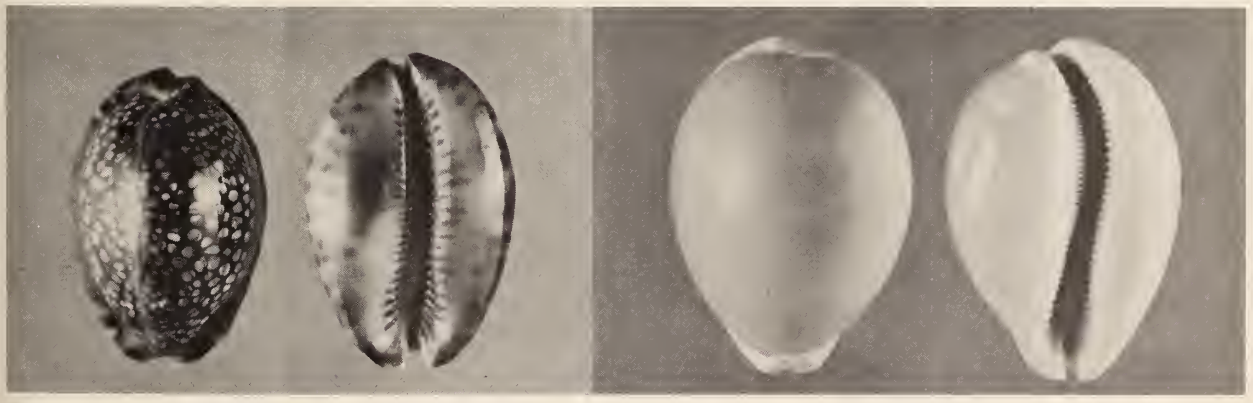


Figure 4 Figure 5

photo. W. O. CERNOHORSKY

21. *Cypraea bistrinotata* (Schilder & Schilder, 1937)
[*Pustularia bistrinotata mediocris* Schilder & Schilder, 1938]

(Plate 26, Figure 55)

Pustularia bistrinotata sublaevis / Steadman & Cotton, 1943

Shell: Shell globular, rounded, slightly rostrate. Dorsum ochraceous-yellow to pale brown, with consistent granulations, becoming obsolete towards the prominent sulcus line; this line is always visible near the extremities, and is often continuous; it passes between three pairs of brown spots, which are usually clearly visible, but occasionally obsolete. Dorsum has small brown spots, and a wart-like callosity situated above the posterior extremity. Base pale yellow, convex, curved upwards posteriorly. Aperture narrow, with a pair of dark brown basal blotches each side of it; these spots are either distinct, faint, or even absent. Teeth fine, numerous, tinged brown, and extend to the margins; central labial teeth slightly shorter. Fossula wide, shallow and denticulate.
Size: 16 (64), 31:21; extremes 12, 20 mm.
Animal: Not observed.
Distribution: Throughout Fiji. Rare. — Philippine Islands, Formosa, Japan, Torres Strait, South-west - Central and West Pacific.
Discussion: The preferred habitat of this species is in the folds of live coral.

22. *Cypraea cicercula* Linnaeus, 1758
[*Pustularia cicercula cicercula* (Linnaeus, 1758)]

(Plate 26, Figure 53)

Pustularia tricornis vulavula Steadman & Cotton, 1943

Shell: Shell humped, slightly rostrate, with produced extremities. Dorsum flesh to pale yellow, faintly or coarsely granulate, with minute brown spots. A distinct dorsal sulcus connects both extremities; above the posterior extremity is a short central groove, brown in colour, resembling a brown streak in a depression. Dorsal and basal blotches are absent. Base convex, curving upward near extremities; aperture narrow. Teeth pale brown, extending fully to the margins; interstices dull. Fossula wide, deep and ribbed.
Animal: Not observed.
Size: 16 (62), 33:23; extremes 12, 21 mm.
Distribution: Throughout Fiji. Rare. — Greater part of Malaysia, Philippine Islands, Japan, South-west Pacific, Fiji Islands, Tonga Islands.
Discussion: The preferred habitat of this species is in the folds of live coral.

23. *Cypraea margarita* Dillwyn, 1817
[*Pustularia margarita* (Dillwyn, 1817)]

(Plate 26, Figure 52)

Cypraea tricornis Jousseaume, 1874
Pustularia globulus sphaeridium / Steadman & Cotton, 1943
? *Pustularia margarita tetsuakii* Kira, 1959 - *ex* Kuroda MS

Shell: Shell very humped, with produced extremities. Dorsum white, rarely very pale yellow, with small brown spots which extend to the margins; above the spire is a brown-coloured groove; the shell is smooth, without a dorsal sulcus or granulations; extremities have a faint orange tinge. Base white and convex; aperture narrow, basal spots absent; outlets tinged pale orange. Teeth extend to the margins, however the central labial and columellar teeth extend only halfway; teeth are finer than in the other three related species. Fossula wide, deep and only faintly denticulate.
Size: 13 (60), 37:26; extremes 10, 13 mm.
Animal: The animal is the colour of the pulp of lemon. The mantle folds are smooth, thin and transparent. Mantle papillae are short and fine, and hardly noticeable. (Hawaii, C. M. Burgess, 1962)
Distribution: Throughout Fiji. Very rare. — Mauritius, Philippine Islands, Japan, South-west - Central - West - and East Pacific, Hawaii.
Discussion: Ladd's record (1945) of *Cypraea margarita* from Fiji is an indeterminable form of one of the *Pustularia* group.

The recent collection of specimens of *Cypraea margarita* from the Philippines and Mauritius confirm the Indo-Pacific distribution of this species. Some writers have suggested that *C. margarita* falls within the range of variability of *C. cicercula*. The smaller size, absence of dorsal sulcus and granulations, the greatest height attained posteriorly, orange tinted extremities, white base, short central teeth and a faintly ribbed fossula of *C. margarita* are of a constant nature. The morphological characteristics are too numerous and constant throughout the whole distributional range of the species, that it appears to be specifically separable.

24. *Cypraea childreni* Gray, 1825
[*Pustularia childreni novaecaledoniae* Schilder & Schilder, 1952]

(Plate 24, Figure 29)

Shell: Shell ovate, broad, slightly inflated, with beaked extremities. Dorsum yellow to yellow-brown, with a brown spot, situated centrally and above each extremity. Dorsum crossed by narrow, transverse ribs, with some short finer

ribs in between; the ribs are interrupted by a central longitudinal dorsal sulcus. Left side rounded, right side with a marginal ledge; base flat. Aperture narrow; the very fine teeth extend to the margins, and are actually a continuation of the dorsal ribs. Fossula wide, deep, ribbed, very short.
Size: 21 (67), 38:24; extremes 18, 23 mm.
Animal: Not observed.
Distribution: Islands West off Nadi and Mamanutha group (West off Viti Levu). Very rare. — Solomon Islands, New Britain, New Hebrides, New Caledonia, Fiji Islands.

25. *Cypraea annulus* Linnaeus, 1758
[*Monetaria annulus noumeensis* (Marie, 1869)]

(Plate 26, Figure 56)

Cypraea annulus noumeensis Marie, 1869
Monetaria annulus sosokoana Ladd, 1934
Monetaria annulus dranga Iredale, 1939
Monetaria annulus dranga / Steadman & Cotton, 1943

Shell: Shell small, ovoid, heavy. Dorsum pale blue, grey or light brown, top encircled by a bright orange line, with fine hair-lines visible in the center. Sides ivory-white, angled. Base white, slightly flattened; aperture wide; teeth are coarse and short, produced halfway to the margins in some specimens. The fossula is almost absent, being formed only by the tapering away of the coarse white teeth inside the aperture.
Size: 20 (71), 13:11; extremes 11, 30 mm.
Animal: Sole of foot cream-white; dorsum of foot white. Mantle grey, veined and flecked with brown and black. Papillae few, short, branched and yellow. Tentacles grey; siphon grey, sparsely spotted with pale grey, fringed at the end.
Distribution: Throughout Fiji. Very common. — East Australia, South-west - Central - and West Pacific, Jarvis-Palmyra Islands, Rarotonga (Cook Islands).

26. *Cypraea moneta* Linnaeus, 1758
[*Monetaria moneta barthelemyi* (Bernardi, 1861)]

(Plate 26, Figure 57)

Cypraea moneta barthelemyi Bernardi, 1861
Cypraea // tuberculosa Quoy & Gaimard, 1834
Monetaria monetoides Iredale, 1939
Monetaria harrisi Iredale, 1939
Monetaria isomeres Iredale, 1939
Monetaria moneta endua Steadman & Cotton, 1943
Monetaria moneta erua Steadman & Cotton, 1943
Monetaria moneta etolu Steadman & Cotton, 1943

Shell: Shell pyriform, deltoidal or pentagonal. Dorsum yellow or greyish-white, sometimes with two faint transverse dorsal bands, and a very pale yellow annular ring. The posterior part of some specimens has four tubercles; other specimens are smooth. Sides angled, yellow or white. Base yellow, white or yellow and white, sometimes slightly tuberculate. Aperture narrow, dilated anteriorly; teeth coarse and short, in some specimens extending three-quarter way to the margins. Fossula very shallow, almost absent, but more pronounced than in *Cypraea annulus*.
Size: 22 (72), 13:12; extremes 14, 35 mm.
Animal: Sole of foot cream-white; dorsum of foot white and flecked with black patches. Mantle pale yellow, densely striated with dark brown latitudinal lines. Papillae numerous, very short, mostly simple (a few are branched), white, with a short, brown horizontal dash just below the tips. Tentacles pale orange; siphon translucent white, flecked with brown, and with about 20 fringes at the end.
Distribution: Throughout Fiji. Very common. — East Australia, South-west - Central - and East Pacific, Marshall Islands, Caroline Islands, Hawaii.
Discussion: In sculpture and colour this is one of the most variable species. The different forms ("ecotypes") have been described by the Schilders (1936).

27. *Cypraea dillwyni* Schilder, 1922
[*Paulonaria dillwyni* (Schilder, 1922)]

(Plate 26, Figure 48)

Cypraea dillwyni Schilder, 1922
Cypraea // margarita Gray, 1828
Pustularia margarita theeva Steadman & Cotton, 1943

Shell: Shell small, pyriform, with slightly produced extremities. Dorsum cream to yellow, smooth, with small and medium white spots, and a faint, white dorsal line. Extremities are tinged orange on top of the outlets. Base white and convex; aperture narrow, curved to the left posteriorly. Teeth very fine, the first five to six anterior and posterior teeth on both sides are produced, remaining teeth confined to aperture. Fossula concave and denticulate, the longitudinal sulcus pronounced but shallow.
Size: 12 (59), 43:26; extremes unknown.
Animal: Not observed.

Explanation of Plate 22

Dorsal views of Figures 6, 7, 7 a, 8: x 0.7; Figures 9, 10, 11: x 1.0. Ventral views slightly larger.

Figure 6

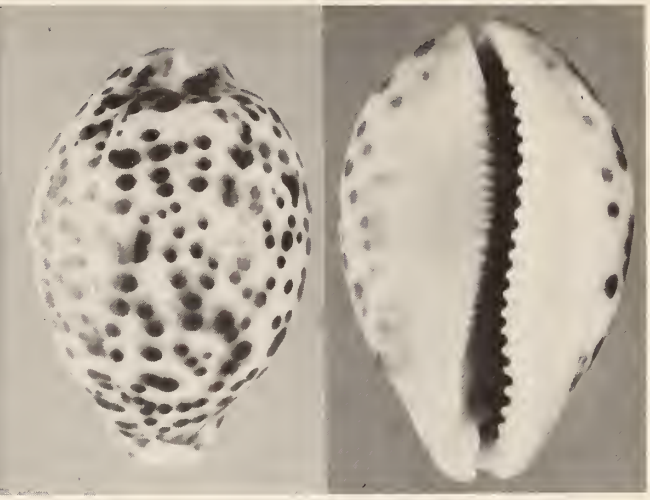


Figure 7

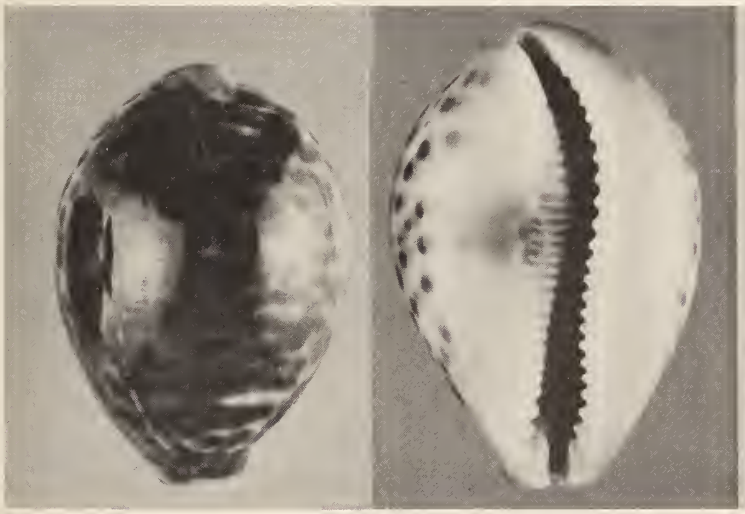


Figure 7 a

Figure 8

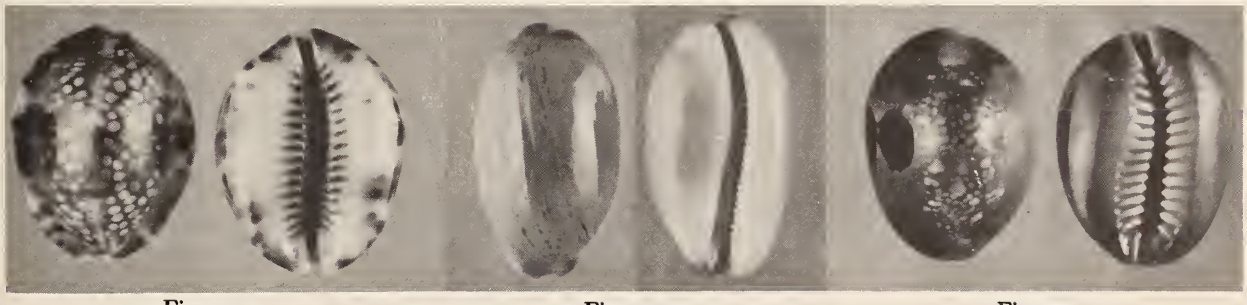


Figure 9 Figure 10 Figure 11

photo. W. O. CERNOHORSKY

Distribution: South-west Viti Levu, and possibly elsewhere. Very rare. — Central Pacific, Cook Islands, Tuamotus, Gambier & Henderson Islands.
Discussion: The species was believed to range only from the Tuamotus to Samoa. It is known from Viti Levu by one recently collected specimen. STEADMAN & COTTON (1943) recorded the species as *Pustularia margarita theeva* from the Nadroga reef and the islands of Kadavu and Ovalau. *Cypraea dillwyni* was recorded from fairly recent fossil deposits in Vanua Levu by LADD & HOFFMEISTER (1945) under the name of *Pustularia margarita* DILLWYN.

28. *Cypraea labrolineata* GASKOIN, 1849
[*Erosaria labrolineata helenae* (ROBERTS, 1869)]

(Plate 26, Figure 46)

Cypraea labrolineata helenae ROBERTS, 1869
Erosaria maccullochi IREDALE, 1939
Erosaria helenae nasese STEADMAN & COTTON, 1943

Shell: Shell small, elongate-ovate. Dorsum greenish-grey or olive-green, with numerous small, whitish-grey spots and a faint dorsal line. Extremities and margins ridged, labial margin strongly edged, pitted, and with dark brown spots; extremities have dark terminal blotches. Base white, convex, with inner lip flattened. Aperture wide, dilated anteriorly; labial teeth extend three quarters the way to the margin, with the first two to three anterior ones produced to the marginal edge; columellar teeth short, slightly thickened at the ends, first two anterior and posterior teeth produced across base. Fossula shallow, not denticulate.
Size: 15 (59), 18:18; extremes 12, 22 mm.
Animal: Sole of foot cream; dorsum of foot cream, sparsely flecked with dark grey. Mantle yellow to pale orange; papillae numerous, thickly branched and translucent white. Some papillae, especially those near the proboscis, are simple. Siphon brown, with translucent white fringes which are tipped with brown. Tentacles pale orange, tipped with dark orange; eyes black, set in cream sockets.

One animal, observed by A. Jennings (personal communication), from Akuilau Island (West Viti Levu), had a grey mantle, with large, branched white-tipped papillae.
Distribution: West, South-west and South Viti Levu. Rare. — Torres Strait, Queensland, South-west Pacific, Fiji Islands, Samoa, Tokelau Islands.
Discussion: Fiji specimens have the central columellar teeth uniformly short. Shells from other Melanesian localities show slightly more produced central columellar teeth.

29. *Cypraea helvola* LINNAEUS, 1758
[*Erosaria helvola callista* (SHAW, 1909)]

(Plate 25, Figure 39)

Cypraea helvola callista SHAW, 1909
Cypraea helvola gereti VAYSSIÈRE, 1910
Cypraea erosaria agassizi LADD, 1934

Shell: Shell ovoid, broad, callous. Dorsum lilac, spotted with small white and slightly larger brown spots; extremities bluish-white, dorsal line obsolete. Sides heavily margined, strongly pitted and with chestnut lateral band. Base chestnut-brown; many specimens have a darker brown elongated blotch on the columellar side. Aperture narrow; teeth coarse, labial ones extend three quarters the way to the margin, columellar teeth cross half the base, central teeth being shorter. Fossula shallow with three to four denticles.
Size: 19 (70), 18:15; extremes 14, 24 mm.
Animal: Sole of foot pink, edges grey; dorsum of foot pink, at times cream. Mantle rusty-brown, papillae numerous, thickly branched; the majority of papillae are yellow, few are translucent grey, occasionally tipped with white. Siphon translucent grey, fringed at the end; fringes are flecked with dark grey. Tentacles pink, eyes black.
Distribution: South, East and West Viti Levu. Uncommon. — East Australia, South-west - Central - and East Pacific, Marshall Islands, Caroline Islands.

30. *Cypraea caputserpentis* LINNAEUS, 1758
[*Erosaria caputserpentis argentata* (DAUTZENBERG & BOUGE, 1933)]

(Plate 22, Figure 11)

Cypraea caputserpentis argentata DAUTZENBERG & BOUGE, 1933

Shell: Shell deltoidal, calloused. Dorsum brown, finely reticulated with small white spots, some larger than others; dorsal line either faint or absent; extremities tinged grey. Sides heavily margined, slightly twisted upwards centrally; deep chocolate in colour. Margins of base chocolate-brown, paling towards aperture. Aperture wide, dilated anteriorly; teeth large and white, interstices white or grey to brown; labial teeth extend one quarter way to the margin, columellar ones to halfway across the base, becoming shorter posteriorly. Fossula narrow, with the first two to three anterior teeth forming denticles.
Size: 30 (75), 17:13; extremes 17, 37 mm.

Animal: Sole of foot pale yellow; dorsum of foot fawn, heavily flecked with grey. Mantle dark-grey; papillae numerous, short, thickly branched, translucent white. Tentacles grey; siphon pale brown with a grey shading, fringed at the end.
Distribution: Throughout Fiji. Very common in the South and South-west, very rare in the North of Viti Levu. — Torres Strait, Norfolk Island, Kermadec Islands, South-west - Central - West - and East Pacific.

31. *Cypraea poraria* LINNAEUS, 1758
[*Erosaria poraria scarabaeus* (BORY, 1827)]

(Plate 25, Figure 43)

Cypraea poraria scarabaeus BORY, 1827
Erosaria poraria theoreta IREDALE, 1939

Shell: Shell ovate to deltoidal. Dorsum brown, freckled with small white spots, most of which are ocellated with violet rings; dorsal sulcus line thin and faint. Sides and extremities margined, weakly pitted, pale violet. Base pale violet, becoming lighter towards aperture. Aperture slightly narrow, fairly straight; teeth white, labial ones extending halfway to the margin, columellar teeth slightly shorter centrally. Fossula deep, with five to six denticles.
Size: 16 (69), 22:17; extremes 13, 22 mm.
Animal: Sole of foot red; dorsum of foot mottled greenish-grey. Mantle greenish-grey; papillae numerous, small, flecked with white and green. Tentacles pale red; siphon red, fringed at the end.
Distribution: West, South-west and South Viti Levu. Rare. — Parts of Malaysia, Philippine Islands, Japan, East Australia, South-west - Central - West - and East Pacific, Hawaii.

32. *Cypraea erosa* LINNAEUS, 1758
[*Erosaria erosa chlorizans* (MELVILL, 1888)]

(Plate 23, Figure 17)

Cypraea erosa chlorizans MELVILL, 1888

Shell: Shell ovate, elongate. Dorsum fawn, brown or olive green, with numerous small white specks and sometimes larger, less numerous, ocellated brownish spots. Labial side, extremities and part of columellar side heavily flanged, pitted and streaked with brown; sides usually have violet rectangular blotches which extend some way onto the base, with fine vertical white hairline striae across them. Base white to yellowish, sometimes streaked with brown. Aperture wide; teeth large, labial ones extend almost to the margin, columellar teeth extend halfway to the margin, central ones being shorter. Fossula shallow and denticulate.
Size: 31 (64), 17:14; extremes 21, 45 mm.
Animal: Sole of foot fawn, becoming paler towards the edges; dorsum of foot white, flecked with dark grey. Mantle dark brown, veined with grey. Papillae numerous, extremely branched, thick at the base, pale to dark brown, some tipped with blue, others white. Tentacles orange-brown, eyes black, set in white sockets; siphon grey, spotted with white; the end of the siphon has about 28 whitish fringes streaked with orange centrally. Some specimens examined had a dark brown siphon, spotted with white, but lacking the orange-brown streak on the fringes.
Distribution: Throughout Fiji. Common. — South-west - Central - and West Pacific.
Discussion: A small percentage of every population of *Cypraea erosa* found in Fijian localities lack either one or both marginal blotches.

33. *Cypraea eburnea* BARNES, 1824
[*Erosaria eburnea* (BARNES, 1824)]

(Plate 23, Figure 18)

Erosaria eburnea mara IREDALE, 1939

Shell: Shell pyriform, occasionally elongate. The shell is pure white and unspotted. Extremities and right margin ridged and pitted. Base convex, aperture wide, dilated anteriorly; teeth large, the first two or three anterior labial teeth extending to the margin, the remaining teeth produced to three quarters of the base; columellar teeth short, crossing the fossula and becoming deeply notched centrally. Interior of shell orange to light brown.
Size: 40 (62), 17:13; extremes 23, 50 mm.
Animal: Sole of foot salmon-pink; dorsum of foot blackish-brown. Mantle blackish-brown, mottled with small spots and yellowish striations. Papillae short and branched, numerous, grey with orange tips. Tentacles deep cream, eyes black; siphon grey, dotted latitudinally with pale yellow and fringed at the end (about 32 fringes).
Distribution: Throughout Viti Levu. Uncommon in the North of Viti Levu, rare elsewhere. The preferred habitat of this species is muddy sand. — North-west New Guinea, Queensland, South-west Pacific, Fiji Islands, Tonga Islands.
Discussion: Occasional specimens are found which have a pale orange to pale brown dorsum or are spotted with

Explanation of Plate 23

Dorsal views of Figure 12: x 0.7; Figures 13, 18: x 0.8; Figure 14: x 0.4; Figures 15, 15 a, 16, 17: x 1.0. Ventral views slightly larger.

Figure 12

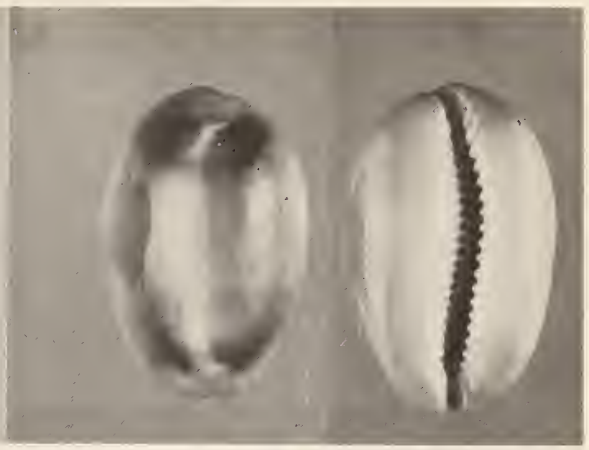


Figure 13

Figure 14 Figure 15 Figure 15 a

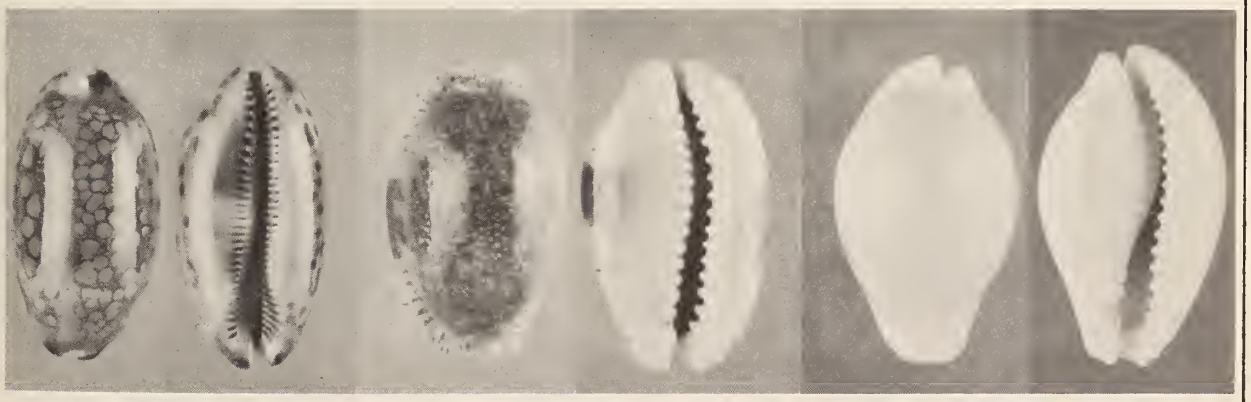


Figure 16 Figure 17 Figure 18

photo. W. O. CERNOHORSKY

milky white. These specimens cannot be interpreted as possible hybrids of *Cypraea eburnea* and *C. miliaris* Gmelin, as the latter species does not occur in Fiji. Reports from Australia indicate that these two allied species interbreed wherever they meet. Until research shows the amount of interbreeding (occasional or frequent) and whether the possible hybrids are fertile, the true status of *C. eburnea* in relation to *C. miliaris* cannot be stated.

34. *Cypraea limacina* Lamarck, 1810
[*Staphylaea limacina facifer* (Iredale, 1935)]

(Plate 25, Figure 30)

Cypraea limacina facifer (Iredale, 1935)
Purperosa facifer monstrans Iredale, 1935
Staphylaea consobrina / Steadman & Cotton, 1943
Staphylaea purperosa ruvaya Steadman & Cotton, 1943 [1]

Shell: Shell pyriformly-elongate, thin. Dorsum grey to purplish-grey, with white spots, more numerous in the centre than on the sides; on some specimens spots are raised; dorsal line weak, hardly visible in most specimens. Labial side and extremities margined and pitted; extremities orange-brown, posteriorly short. The white spots above the margins are raised. Base convex, white with a bluish tinge. Aperture slightly narrow; teeth orange, lined with red, labial teeth almost extending to the margin, columellar teeth never extend more than three quarters of the way to the margin, posterior ones always being the longer. Fossula somewhat concave, weakly denticulate.
Size: 22 (57), 22:18; extremes 15, 33 mm.
Animal: Sole and dorsum of foot vary from pale to dark orange. Mantle pale orange to pale red. Papillae numerous, long, becoming shorter and sparse towards the edges of the mantle; papillae are long, simple, uniformly thick all the way, others stouter at the tips; papillae coloured orange, flecked with white in parts, tipped with white; some papillae have a cluster of white flecks around the base. Tentacles orange, eyes black; siphon pale orange, not fringed at the end.

Among over 100 specimens collected, four animals showed an extreme variation in colouring, which is recorded here:

Sole of foot grey, becoming cream towards the edges; dorsum of foot black. Mantle dusky-black; papillae long, branched, grey tipped with white; few papillae all white, tipped with orange. Tentacles dark grey at the base, becoming cream at the end; siphon transparent greyish-brown, with ten darker latitudinal lines encircling it, not fringed at the end.
Distribution: Throughout Viti Levu. Uncommon. — East Australia, New Caledonia, Central Pacific.
Discussion: It is doubtful that the extreme difference in animal colour is due to sex-differences, as a black-mantled animal was observed sitting on eggs, and red-mantled animals are frequently seen on eggs. These egg cases are normally a purplish-mauve shade. A recently collected *Cypraea limacina* was found sitting on pale creamy-yellow egg cases (T. Saunders, personal communication).

Immature shells of the species (those which have weakly formed columellar teeth, but not labial teeth) have a fully brown dorsum and lack the white spots. The orange-red lining of the teeth is present only in fully mature specimens, and appears to be the final stage in the growth cycle of the shell.

35. *Cypraea staphylaea* Linnaeus, 1758
[*Staphylaea staphylaea consobrina* (Garrett, 1879)]

(Plate 25, Figure 31)

Cypraea staphylaea consobrina Garrett, 1879
Staphylaea nukulau Steadman & Cotton, 1943

Shell: Shell small, ovate, slightly globular. Dorsum pale grey or purplish-green, with numerous raised close-set white granules; dorsal sulcus distinct. Extremities tinged orange to dark brown. Left side rounded, right side slightly margined, the last set of raised pustules connected to the margin by raised lines. Base slightly convex, flesh-coloured. Aperture narrow; teeth pale brown, well-developed, bordered by brown lines, and extending across the base to the margins. Fossula wide, fairly deep, denticulate.
Size: 14 (62), 26:19; extremes 10, 20 mm.
Animal: Sole of foot dark grey; dorsum of foot dark grey, flecked with small white spots. Mantle black, minutely spotted with white. Papillae numerous, short, simple, few branched, black and minutely spotted with white; some specimens have translucent pale grey papillae; only a few papillae (3 to 7) are white and branched. Tentacles black; siphon dark brown, fringed at the end.
Distribution: Throughout Fiji. Uncommon. — South-west - Central - and West Pacific.
Discussion: An interesting observation was made in regard to the animal of *Cypraea staphylaea*. Specimens were collected, which in their natural surroundings displayed a black mantle. After being placed in an air-tight bottle, the animals expired within a short time. When death set in, the animals exuded a bright red pigment which coloured the animal's parts visible in the aperture. The pigment was delible and could be wiped off with the finger.

[1] Iredale (1935) established *Purperosa* as a genus. Steadman & Cotton (1943) used *Purperosa* in a specific sense. When using *staphylaea* in a specific sense the authors spelled it consistently *staphylea* throughout their paper.

36. *Cypraea nucleus* Linnaeus, 1758
[*Nuclearia nucleus granulosa* (Sowerby, 1870)]

(Plate 24, Figure 27)

Cypraea nucleus granulosa Sowerby, 1870
Nuclearia nucleus gemmosa / Steadman & Cotton, 1943

Shell: Shell ovate, solid, fairly broad in centre, extremities rostrate. Dorsum slightly depressed, yellowish to yellowish-brown, with a distinct dorsal groove; the small raised dorsal pustules are ocellated with brown and connected by fine reddish-brown lines. Sides margined, extremities tinged orange. Base fawn to very pale brown, aperture narrow. Teeth well-developed, lined with reddish brown, extending fully to the margins; on the columellar side, smaller teeth extend inwards from the margins, but never extend to the aperture. Fossula shallow, with a longitudinal ridge, denticulate.
Size: 19 (63), 27:17; extremes 15, 26 mm.
Animal: Sole of foot white; dorsum of foot fawn, minutely spotted with white. Mantle rusty-red; papillae numerous, translucent fawn, alternating in geometrical progression from short, simple ones which are tipped with black, to long ones which are thick and branched. Tentacles pale yellow; siphon pale grey, with white, short fringes at the end.
Distribution: West, South and South-east Viti Levu. Rare. — Torres Strait, Queensland ? (they appear to belong to *Cypraea nucleus s. str.*), Central Pacific.

37. *Cypraea walkeri* Sowerby, 1832
[*Erronea walkeri bregeriana* (Crosse, 1868)]

(Plate 26, Figure 58)

Cypraea walkeri bregeriana Crosse, 1868

Shell: Shell ovate to pyriform, light in weight. Dorsum fawn to brown, sprinkled with numerous green spots and crossed by a centrally-placed transverse band; this is sometimes darker at the edges and partly interrupted, forming one or two rectangles. Margins rounded, sometimes slightly callous; base rich brown or ferrugineous, spotted with minute, conspicuous white dots, which extend partly up the dorsum. Extremities tinged pale purple; spire blotch dark brown; anterior extremity has two purplish-brown terminal blotches. Aperture wide, dilated anteriorly; teeth pale brown, interstices very pale purple; columellar teeth extend halfway to the margin, central teeth shorter; labial teeth extend three quarters of the way to the margin. Fossula absent, the ribs crossing it being level and not notched.
Size: 27 (59), 21:20; extremes 15, 23 mm.
Animal: Foot deep orange anteriorly, fading to creamy-white towards the rear, extreme posterior end translucent. Mantle smoky-brown, mottled with minute white spots. Papillae short, branched, white, scattered around the sides of the mantle, absent towards the edges. Tentacles pale orange, eyes black; siphon cream with minute black fringes at the end. Buccal bulb area dark orange.
Distribution: Islands off Nadi Bay and Mamanutha group (West off Viti Levu). — Louisiade Archipelago, New Caledonia, Fiji Islands.
Discussion: All known Fiji specimens were dredged in from 15 to 60 feet; dead specimens dredged from 120 feet. The largest known Fiji specimen is 22.8 mm; others fluctuate between 15 and 21 mm. The brown marginal spots usually present on specimens from New Caledonia are absent in Fiji specimens; the usual lilac rim encircling the dorsum is either very pale or absent.

38. *Cypraea errones* Linnaeus, 1758
[*Erronea errones coerulescens* (Schröter, 1804)]

(Plate 24, Figures 25, 25 a)

Cypraea errones coerulescens Schröter, 1804
Erronea nimisserans kalavo Steadman & Cotton 1943
Erronea nimisserans vivili Steadman & Cotton, 1943 [2]

Shell: Shell subpyriform to cylindrical. Dorsum pale blue or grey, crossed by three wide brownish bands, and mottled with small olive-green freckles; some specimens have a dark brown central blotch. Anterior extremity sometimes has one or two dark brown patches. Sides and base cream-yellow, occasionally light brown and unspotted; base flat. Aperture wide, dilated anteriorly; labial teeth distant, columellar teeth confined to aperture, becoming weak centrally. Fossula slightly narrow, crossed by coarse ribs which are slightly notched.
Size: 24 (55), 15:15; extremes 14, 35 mm.

[2] Iredale (1935) established *nimiserrans* to replace *errones;* Steadman & Cotton consistently quoted this name as *nimisserans.*

Explanation of Plate 24

Dorsal views of Figures 19, 21: x 0.7; Figures 20, 22, 23, 25, 25 a, 28: x 1.0; Figure 24: x 0.8; Figures 26, 27, 29: x 1.2. Ventral views slightly larger.

Figure 15: *Cypraea caurica thema* Iredale (typical). Figure 15 a: *Cypraea caurica thema* Iredale (broad ecological variant).

Figure 19 Figure 20 Figure 21

Figure 22 Figure 23 Figure 24

Figure 25 Figure 25 a Figure 26

Figure 27 Figure 28 Figure 29

photo. W. O. CERNOHORSKY

Animal: Sole of foot pale cream, edge irregularly mottled with black and brown; dorsum of foot cream. Mantle greenish-grey, minutely flecked with black in a few places. Papillae short, branched, black, mottled with white. Tentacles orange, eyes black; siphon pale grey, with 14 fringes at the end.
Distribution: Throughout Fiji. Very common. — South-west - Central - and West Pacific.
Discussion: An ecological variant from Fiji is slightly larger, subpyriform, with dark brown dorsum and transverse bands, without central dorsal blotch. Sides are heavily calloused, aperture is narrow and teeth are stronger on the columellar side. The variant occurs on a shore reef at Vuda Point (West Viti Levu). The reef structure consists of broken crushed dead coral, with hardly any sand pockets and no sea weeds. The reef is exposed during 2½ hours before and after low tide.

39. *Cypraea caurica* Linnaeus, 1758
[*Erronea cauricathema* Iredale, 1939]

(Plate 23, Figures 15, 15 a)

Cypraea caurica var. // *obscura* Rossiter, 1882
Erronea caurica obscurata Schilder & Schilder, 1940

Shell: Shell cylindrical, elongate. Dorsum bluish-white, with numerous small brown specks, and three wide, darker bands, sometimes interrupted to form pale rectangles; extremities with large, blackish-brown terminal spots. Left side rounded, right side and extremities heavily margined, spotted with large, dark brown to black spots. Sides and base fawn to light brown. Aperture wide, dilated anteriorly; labial teeth large, more distant than columellar ones, and extending to the margins; interstices pale or bright orange. Fossula formed only by a slight notch in the coarse ribs.
Size: 40 (55), 16:15; extremes 23, 45 mm.
Animal: Sole of foot white; dorsum of foot white, with a pattern of black and white honey-combs. Mantle grey in appearance, caused by the alternate white and dark brown mottling. Papillae few, short, branched and white. Tentacles bright yellow, eyes black in white sockets, buccal bulb brown; siphon greyish-white, shaded with black, each side of siphon with 7 white, fairly long fringes.
Ditribution: Throughout Fiji. Uncommon. — Torres Strait, South-west and Central Pacific, Cook Islands.
Discussion: The frequent occurrence in Fiji of a broad ecological variant of *Cypraea caurica* with heavily margined sides and more produced columellar teeth appears to confirm the Schilders' opinion as to the cause of it (Schilder & Schilder, 1958 b, p. 404). *Cypraea* found in localities where strong surf-action is prevalent usually grow broader and heavier. *Cypraea caurica* from quiet lagoons and sheltered bays grow cylindrical and elongate, with the left margin rounded.

Schilder & Schilder, 1940 replaced the pre-occupied *Cypraea caurica obscura* Rossiter, 1882 by *Erronea caurica obscurata.* Iredale, 1939, however, had already replaced Rossiter's name by *Erronea caurica thema;* thus the Schilders' *E. c. obscurata* became a junior synonym.

40. *Cypraea listeri* Gray, 1824
[*Melicerona listeri melvilli* (Hidalgo, 1906)]

(Plate 25, Figure 38)

Cypraea listeri melvilli Hidalgo, 1906
Melicerona melvilli velesia Iredale, 1939
Melicerona melvilli vatu Steadman & Cotton, 1943

Shell: Shell cylindrical, depressed. Anterior extremity blunt and rounded, both extremities with a pair of blackish terminal spots. Dorsum bluish-grey, densely freckled with olive-brown, crossed by four to five narrow, usually interrupted blackish bands; these bands are visible on the columellar side of the base and continue into the aperture. Sides cream to fawn, left side rounded, right side margined, with blackish spots. Base flat, whitish; aperture wide, dilated anteriorly. Teeth very short, those on the columella weakly formed and confined to the aperture; interstices dull. Fossula formed only by a slight notch in the ribs.
Size: 15 (56), 16:15; extremes 12, 21 mm.
Animal: Mantle thin, translucent, brownish-flesh, towards the foot pinkish, minutely spotted with brown, edge white with darker line inside; anteriorly the foot has a wavy edge. Siphon pale brown, fringed; tentacles brownish-red. (Long Reef, New South Wales, C. F. & J. Laseron in Iredale, 1939)
Distribution: West to South and East Viti Levu. Rare. — East Australia, South-west and Central Pacific, Caroline Islands.

41. *Cypraea punctata* Linnaeus, 1771
[*Palmadusta punctata iredalei* Schilder & Schilder,

(Plate 25, Figure 45)

Evenaria persticta Iredale, 1939
1938]
Evenaria carula Iredale, 1939
Evenaria punctata trizonata / Steadman & Cotton, 1943

Shell: Shell small. subpyriform to pyriform, posterior extremity slightly produced. Dorsum yellowish-white, with small dark brown spots, and occasionally three faint transverse bands. Extremities with pairs of dark terminal spots, the posterior spot on the labial side absent in most

specimens. Left side rounded, right side slightly margined; lateral spots blackish-brown, smaller than the dorsal spots. Base yellowish-white; aperture slightly narrow. Labial teeth orange, extending three quarters of the way to the margin; columellar teeth confined to aperture, orange lines extending halfway to the margin. Fossula concave and denticulate.
Size: 10 (58), 28:26; extremes 8, 13 mm.
Animal: Sole of foot pale salmon-pink; dorsum of foot is cream, thickly veined with orange in a honey-comb pattern. Mantle orange, with numerous white, minute, slightly raised nodules all over its surface. Papillae few, both simple and branched, pale grey at the base, becoming white towards the tips. Tentacles orange; siphon grey, with white fringes at the end; eyes black, set in pale yellow sockets.
Distribution: Throughout Fiji. Rare. — East Australia, South-west and Central Pacific.

42. *Cypraea asellus* Linnaeus, 1758
[*Palmadusta asellus bitaeniata* (Geret, 1903)]

(Plate 26, Figure 47)

Cypraea asellus bitaeniata Geret, 1903
Evanaria asellus kawakawa Steadman & Cotton, 1943 [3]

Shell: Shell pyriform, slightly constricted anteriorly. Dorsum white, with three broad, dark brown transverse bands which stop at the margins; the dorsal bands are visible on the columella and continue into the aperture; many specimens have fine, white, longitudinal hairlines on the dorsum. Left side rounded, right side margined, white in colour. Base white, hardly convex; aperture only slightly narrow. Labial teeth extend halfway to the margins; the first five to six posterior columellar teeth are produced halfway across the base, all others very short. Fossula wide, shallow and ribbed.
Size: 16 (59), 22:17; extremes 10, 22 mm.
Animal: Sole of foot dark grey, becoming darker towards the edges; dorsum of foot black. Mantle black; papillae few, very short, hardly branched, white. Tentacles orange; siphon black, fringed at the end.
Distribution: Throughout Fiji. Uncommon. — Torres Strait, South-west and Central Pacific, Jarvis Island.

[3] Iredale (1930) established the genus *Evenaria*. Steadman & Cotton spelled it *Evanaria* throughout their paper.

43. *Cypraea clandestina* Linnaeus, 1767
[*Palmadusta clandestina candida* (Pease, 1865)]

(Plate 25, Figure 44)

Cypraea clandestina candida Pease, 1865
Palmadusta clandestina whitleyi Iredale, 1939
Palmadusta clandestina extrema Iredale, 1939

Shell: Shell subpyriform to pyriform, light in weight, anterior extremity slightly constricted. Dorsum ivory-white, with three large, ill-defined, orange-grey areas, usually separated by narrow zones of white; narrow, orange-brown zig-zag lines run from margin to margin. Sides and extremities white; base white, not quite flat. Aperture narrow; teeth white, extending halfway to the margins. Fossula shallow with uninterrupted ribs.
Size: 15 (58), 22:17; extremes 12, 20 mm.
Animal: Sole of foot blackish-grey; dorsum of foot black, minutely spotted with white. Mantle black, with a pattern of minute fleshy granules and a few white spots; some parts of the mantle have cream mottled areas with white rings. Papillae numerous, short, white, branched and simple; approximately 22 papillae are positioned around the anterior part of the animal, and are simple, black, tipped with white. Tentacles black, eyes black; siphon black, with long fringes at the end.
Distribution: Throughout Viti Levu. Uncommon. — East Australia, South-west - Central - and West Pacific, Cook Islands, Jarvis-Palmyra Islands.

44. *Cypraea humphreysii* Gray, 1825
[*Palmadusta lutea humphreysi* (Gray, 1825)]

(Plate 25, Figure 35)

Cypraea lutea Gronow, 1781 [4]
Cypraea lutea humphreysi Gray, 1825
Cypraea nivea Wood, 1828
Palmadusta lutea yaloka Steadman & Cotton, 1943

Shell: Shell small, ovate, sometimes pyriform. Dorsum ivory-white, freckled with small, numerous, irregular olive-green spots, and a few slightly larger black spots. Some specimens have two narrow, whitish transverse

[4] *Cypraea lutea* Gronow, 1781 is not available, as Op. 261 of I. C. Z. N. rejects Gronovius' *Zoophylacium Gronovianum* for nomenclatorial purposes. Unless the name has been validated subsequently (pertinent literature is unfortunately unavailable to me at present) the next available name appears to be *humphreysii* of Gray, 1825.

Explanation of Plate 25

Dorsal views of Figures 30, 32, 39: x 1.0; Figures 31, 33, 34, 36, 37, 38, 41, 43, 44: x 1.2; Figures 35, 40, 45: x 1.5. Figure 42: x 2.0. Ventral views slightly larger.

Figure 30 Figure 31 Figure 32 Figure 33

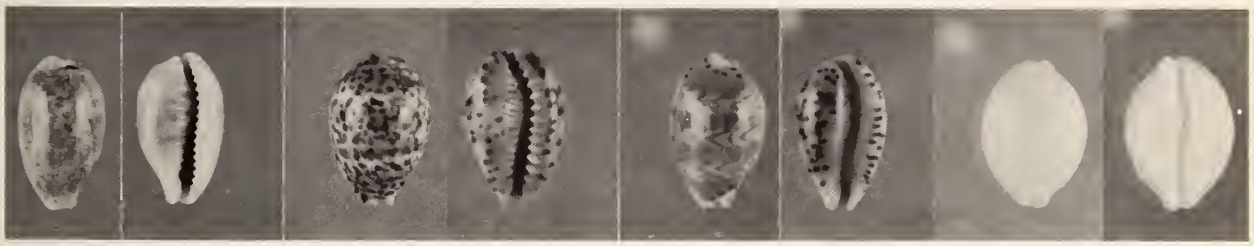


Figure 34 Figure 35 Figure 36 Figure 37

Figure 38 Figure 39 Figure 40 Figure 41

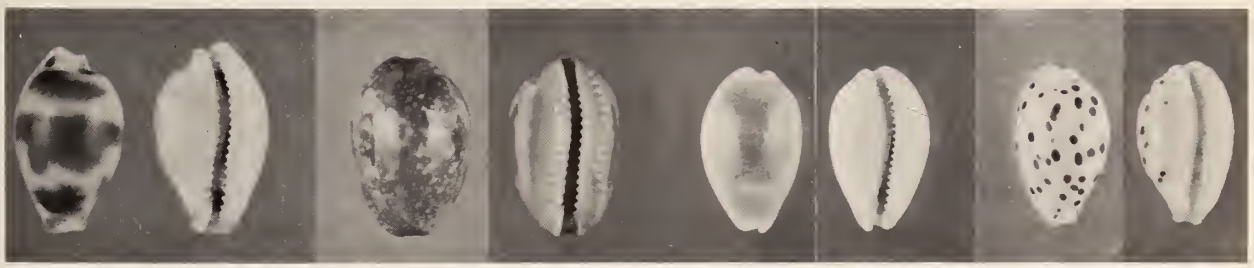


Figure 42 Figure 43 Figure 44 Figure 45

photo. W. O. CERNOHORSKY

bands one third of the way from each extremity; these bands are occasionally faint or even obscured by the dorsal spotting. Left side rounded, right side margined; sides spotted with small, dark brown spots which extend onto the base. Base slightly convex and rich orange-brown. Aperture slightly wide; teeth coarse, labial ones extend halfway to the margin, columellar teeth short, first three posterior teeth slightly longer; teeth are a flesh colour, with interstices darker and dull. There is a dark brown spot at the end of each labial tooth. Fossula concave and denticulate.
Size: 18 (60), 19:18; extremes 11, 18 mm.
Animal: Sole of foot orange; dorsum of foot vermillion, sparsely spotted with minute brown dots. Mantle reddish-brown to reddish-orange, profusely spotted with brown. Papillae short, branched, translucent white. Siphon and tentacles dark orange.
Distribution: Throughout Fiji. Rare. — East Australia, New Caledonia, Fiji Islands, Tonga Island, Samoa.
Discussion: The preferred habitat of this species is a short, coarse weed with round leaves.

Fiji specimens are generally smaller than those from other localities; the average length is only 14 mm.

45. *Cypraea ziczac* Linnaeus, 1758
[*Palmadusta ziczac vittata* (Deshayes, 1831)]

(Plate 25, Figure 36)

Cypraea ziczac vittata Deshayes, 1831
Palmadusta ziczac signata Iredale, 1939

Shell: Shell pyriform, posterior extremity slightly produced. Dorsum light brown, crossed by three bluish-white transverse bands; orange-brown, V-shaped lines are set inside the transverse bands. Four or five small, dark brown spots extend up from the right anterior extremity, at an angle of 45 degrees; another six or seven similar spots form a half-circle around the spire pit. Extremities tinged with orange, area around spire pit bluish-white. Left side rounded, right side margined, bluish-white, spotted with dark spots. Base orange-brown, with numerous, blackish brown spots, those on the labial side more or less coinciding with the ends of the teeth. Aperture slightly wide, dilated anteriorly; labial teeth coarse, extending halfway to the margin; columellar teeth finer, confined to aperture; teeth interstices dull. Fossula wide, very shallow and ribbed.
Size: 16 (61), 22:21; extremes 12, 24 mm.
Animal: Sole of foot cream; edges and dorsum of foot orange. Mantle reddish-orange, profusely spotted with minute black spots. Papillae short, branched, well scattered, white, becoming very small towards the edges of the mantle. Tentacles reddish-orange; siphon pale pink, with black fringes at the end.
Distribution: Throughout Fiji. Very rare. — East Australia, South-west Pacific, Fiji Islands, Tonga Island.
Discussion: This is the first report of *Cypraea ziczac* occurring in Fiji.

46. *Cypraea fimbriata* Gmelin, 1791
[*Palmadusta fimbriata unifasciata* (Mighels, 1845)]

(Plate 26, Figure 50)

Palmadusta waikikiensis Schilder & Schilder, 1933
Cypraea fimbriata unifasciata Mighels, 1845

Shell: Shell subcylindrical, depressed, anterior extremity broad. Dorsum lilac-grey, with distinct minute brown spots, and darker, reddish-brown patches, forming a clear but usually interrupted central transverse band; short, curved lines radiate towards extremities, which have a pair of lilac terminal spots, also extending onto the base. Left side rounded, right side slightly margined, white, unspotted. Base convex, white, dorsal bands visible on columella. Aperture wide, dilated anteriorly; teeth white, less numerous than in *Cypraea minoridens* and *C. microdon;* labial teeth extend one third to the margin, columellar ones confined to aperture. Fossula formed by a notch in the ribs which cross it.
Size: 11 (54), 23:21; extremes 10, 14 mm.
Animal: Mantle, foot and proboscis orange-red; dorsal surface of foot sprinkled with white freckles. Papillae simple, few and scattered, white. Siphon with a simple tentacular fringe. (Hawaii, Kay & Weaver, 1963)
Distribution: Islands off Nadi coast (West of Viti Levu). Very rare. — Fiji Islands, Samoa, East - and North-east Pacific.
Discussion: This is the first record of this species West of Samoa.

47. *Cypraea minoridens* Melvill, 1901
[*Palmadusta minoridens* (Melvill, 1901)]

(Plate 26, Figure 49)

Opponaria minoridens blandita Iredale, 1939
Paulonaria minoridens suvaensis Steadman & Cotton, 1943

Shell: Shell subcylindrical to cylindrical, depressed, small and fragile, extremities blunt. Dorsum light grey to purplish-grey, with numerous, fairly regular, orange-brown spots and three darker transverse bands; the dorsal bands are often interrupted. Extremities have a pair of purplish terminal spots, which extend onto the base. Sides white, unspotted, right side slightly margined. Base whitish,

with dorsal bands visible on columella; aperture wide, dilated anteriorly. Teeth fine, weakly formed; labial teeth extend one third of the way to the margins, columellar teeth confined to aperture. A diagnostic character is that the fossular ribs stand well out from the sides of the shell; the fossula consists of a wide notch in the ribs, considerably wider than that of *Cypraea fimbriata.*
Size: 8 (55), 27:26; extremes 7, 11 mm.
Animal: Mantle pale to dark orange and smooth. Other details not observed.
Distribution: West and South Viti Levu. Rare. — East Australia. South-west - Central - and West Pacific, Cook Islands, Tuamotus, Gambier and Henderson Islands.
Discussion: Steadman & Cotton (1943) accepted *Cypraea minoridens* as a distinct species. In their paper of 1946 the authors reversed their opinion and placed *C. minoridens* into the synonymy of *C. microdon* Gray. The Fijian *C. minoridens*, originally described by Steadman & Cotton (1943) as *Paulonaria minoridens suvaensis*, was changed by the authors in 1946 to *Paulonaria fimbriata suvaensis.*

48. *Cypraea microdon* Gray, 1828
[*Palmadusta microdon granum* Schilder & Schilder, 1938]

(Plate 26, Figure 51)

Shell: Shell small, pyriform, inflated, posterior extremity callouscd. Dorsum orange-brown, with very small pale brown spots, and three transverse bands, extending to the aperture on the columellar side; in some specimens the dorsal bands are bordered by small, darker, evenly spaced squarish spots. Extremities have a pair of lilac terminal spots which extend around to the base. Left side rounded, right side slightly margined, white, with an occasional small, brown spot. Base convex, white; aperture narrow. Teeth finer than in *Cypraea fimbriata;* labial teeth weakly formed, hardly impressed on base, columellar teeth confined to aperture. Fossula is wider, deeper and steeper than that of *C. minoridens.*
Size: 9 (54), 32:29; extremes 8, 12 mm.
Animal: The foot is very pale orange, mantle dark orange. Other details not observed.
Distribution: Throughout Fiji. Very rare. — Torres Strait, South-west and Central Pacific, East Australia.
Discussion: Steadman & Cotton (1943), and Allan (1956) list Fiji as the type locality. The Schilders' holotype, however, came from Mope, New Britain.

49. *Cypraea pallidula* Gaskoin, 1849
[*Bistolida pallidula rhinoceros* (Souverbie, 1865)]

(Plate 25, Figure 33)

Cypraea pallidula rhinoceros Souverbie, 1865
Blasicrura rhinoceros vivia Steadman & Cotton, 1943

Shell: Shell subcylindrical to cylindrical, anterior extremity blunt and rounded. Dorsum grey, freckled with small green spots, and with four darker transverse bands. Sides white, occasionally sparsely spotted; base white and flattened. Aperture fairly straight, slightly narrow; labial teeth extend three quarters of the way to the margin, columellar ones halfway to the margin. Fossula broad, fairly deep and denticulate.
Size: 18 (55), 23:18; extremes 16, 24 mm.
Animal: The mantle is blackish-grey. Other details not observed.
Distribution: West to South and East Viti Levu. Very rare. — Torres Strait, Queensland, South-west and Central Pacific.
Discussion: Fiji specimens appear to have a blunter and more rounded anterior extremity than do specimens from other Melanesian localities. The size formula here is 19 (54), 22:20.

50. *Cypraea summersi* (Schilder, 1958)
[*Bistolida summersi* Schilder, 1958]

(Plate 25, Figure 34)

Shell: Shell small, cylindrically-ovate; the constricted anterior extremity gives the shell a slightly drawn-out appearance. Dorsum bluish-white to grey, thickly freckled with olive-green spots, and with four very faint, but darker transverse bands; these bands are absent in most mature specimens. Left side rounded, right side slightly margined, cream in colour; some specimens have three or four pin-sized olive-green spots on the labial or columellar side. Base cream, aperture wide; teeth coarser than those of *Cypraea pallidula,* labial and columellar teeth extending three quarters of the way to the margins; interstices wide and dull. A brown spot appears on the anterior extremity (labial side), and less frequently on the posterior extremity; spire pit is blackish-brown. Fossula narrow, shallow and denticulate.
Size: 15 (56), 21:15 (mean size for 68 Fiji specimens; extremes 12, 21 mm.

Explanation of Plate 26

Dorsal views of Figures 46, 48, 53: x 1.5; Figures 47, 54, 55, 57, 58: x 1.2; Figures 49, 50, 51, 52: x 2.0; Figure 56: x 1.0.

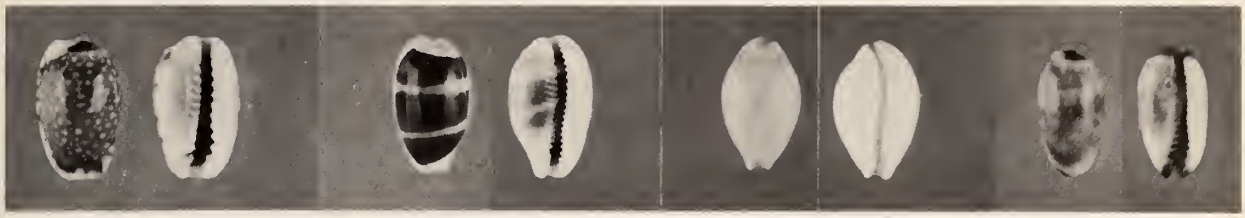


Figure 46 Figure 47 Figure 48 Figure 49

Figure 50 Figure 51 Figure 52 Figure 53

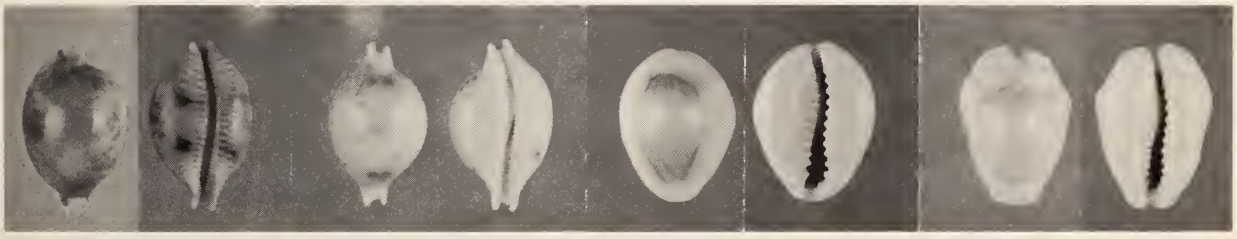


Figure 54 Figure 55 Figure 56 Figure 57

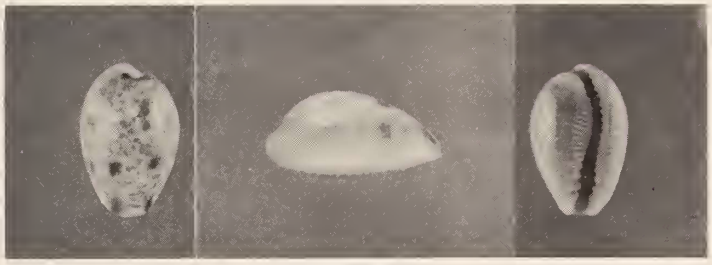


Figure 58

photo. W. O. CERNOHORSKY

Animal: Sole of foot creamy-white; dorsum of foot cream, veined with black on the posterior part. Mantle dark grey, faintly veined with dark brown, edges of mantle flecked with black. Papillae numerous, short, cream tipped with white, and alternating between simple and branched. Tentacles orange, eyes black set in white sockets; siphon grey with fringes at the end pale yellow.
Distribution: Throughout Fiji. Rare live-collected; beach specimens frequent at Caboni and Nananu-i-Ra (North Viti Levu). — Fiji Islands, Tonga Islands.
Discussion: The species was collected as early as July 1926 by Jens Ostergaard (personal communication), near the old pier at Nukualofa, Tonga. It was recorded by Ostergaard (1935 : 29) as *Cypraea interrupta* Gray, 1824. The shell was first described by Schilder (1958) as a subspecies of *C. pallidula,* and was believed endemic to Tonga. The species was first recorded in Fiji in early 1962. The occurrence of both *C. summersi* and *C. pallidula rhinoceros* in the same locality in Fiji, and the complete absence of any hybrids of the two forms, prove *C. summersi* to be specifically separable.

Three specimens collected in Fiji show a 3 mm to 3.5 mm long and 1 mm wide brown bar, situated latitudinally on the anterior extremity, instead of the usual brown spot.

51. *Cypraea teres* Gmelin, 1791
[*Bistolida teres subfasciata* (Link, 1807)]

(Plate 25, Figure 32)

Cypraea teres subfasciata Link, 1807
Talostolida teres pentella Iredale, 1939
Talostolida subteres hermanni Iredale, 1939
Talostolida subteres vava Steadman & Cotton, 1943

Shell: Shell subcylindrical to cylindrical. Dorsum grey to greyish-blue, crossed by three, usually discontinuous dark brown bands; the central band sometimes has a blotch-like appearance. Posterior extremity heavily calloused and umbilicate. Left side rounded, right side heavily margined, creamy-white with a few brown spots. Base white and convex; aperture narrow; extremities tinged with pinkish-brown. Labial teeth coarse and extending halfway to the margin, columellar teeth fine and confined to aperture; interstices dull; labial lip curves upwards posteriorly. Fossula wide and deep, and crossed by ribs.
Size: 25 (54), 24:23; extremes 18, 38 mm.
Animal: Foot, mantle, proboscis and tentacles orange-red, the mantle spotted with darker red. Papillae large, simple, rounded. Siphon with simple tentacular fringe, red but spotted with white. (Hawaii. Kay & Weaver, 1963)
Distribution: West to South and East Viti Levu. Rare. – East Australia, South-west and Central Pacific.
Discussion: Steadman & Cotton (1943) state that Fijian specimens seem to belong to the species *Cypraea subteres* Weinkauff, 1881. All specimens recorded from Fiji so far are, however, undoubtedly *C. teres* Gmelin.

52. *Cypraea kieneri* Hidalgo, 1906
[*Bistolida kieneri schneideri* (Schilder & Schilder, 1938)]

(Plate 25, Figure 40)

Blasicrura kieneri schneideri Schilder & Schilder, 1938
Evenaria ursellus marcia Iredale, 1939
Evanaria ursellus vitiensis Steadman & Cotton, 1943

Shell: Shell ovate, depressed, anterior extremity blunt. The dorsum has erratically curved markings, forming irregular greyish patches, separated by whitish zones; the centrally placed dark brown transverse band is usually well visible near the columellar margin in the form of rectangular blotches. Extremities have a pair of blackish brown terminal spots. Dorsum is sprinkled with minute, olive-brown specks, which extend to the margins. Sides white, with small brown spots, right side margined; base white and flattened. Aperture narrow, slightly dilated anteriorly; the first five to seven posterior columellar teeth are long, the others becoming very short anteriorly. This is a distinguishing point of the species; in *Cypraea hirundo* and *C. ursellus* all columellar teeth cross at least three quarters of the base. Fossula shallow and denticulate.
Size: 12 (59), 19:16; extremes 10, 17 mm.
Animal: Sole of foot white; dorsum of foot white, sparsely spotted with minute black dots. Mantle translucent white; papillae few, short and branched, white. Tentacles bright yellow; siphon pure white, with two small black spots on the dorsal side near the edge; siphon thickly fringed.
Distribution: Throughout Fiji. Rare. — East Australia, South-west and Central Pacific.
Discussion: Iredale (1939), Steadman & Cotton (1943) and Allan (1956), adopted the name *Cypraea ursellus* Gmelin, 1791 for this species. Dodge (1953), under *C. hirundo* Linnaeus, gives a detailed account on the use of the name *C. ursellus* by earlier writers. He correctly points out that Gmelin's name of his "sub-pyriform" *C. ursellus* cannot be applied to the ovate to subcylindrical shell known as *C. kieneri.*

53. *Cypraea hirundo* LINNAEUS, 1758
[*Bistolida hirundo rouxi* (ANCEY, 1882)]

(Plate 25, Figure 41)

Cypraea hirundo rouxi ANCEY, 1882
Evenaria hirundo cameroni IREDALE, 1939
Evenaria peropima IREDALE, 1939
Evenaria coffea endela IREDALE, 1939
Evanaria hirundo korolevu STEADMAN & COTTON, 1943

Shell: Shell ovate to subcylindrical, broadened centrally. Dorsum has greyish-blue, irregular patches, with ill-defined edges, separated by white zones; the size of these markings is variable, but the white zones are usually very narrow. The dorsum is sprinkled with small brown spots, and often has a blackish-brown, irregular central blotch. Anterior extremity narrow, posterior extremity produced, and both extremities have a pair of blackish-brown terminal spots. Sides slightly margined, white, with many small brown spots which extend a short way over the white base. Aperture narrow; teeth almost reach the margins, the central columellar ones being largest; interstices dull. Fossula wide and deep, crossed by ribs.
Size: 14 (59), 24:19; extremes 10, 23 mm.
Animal: Sole of foot creamy-white; dorsum of foot white, profusely spotted with small reddish-brown dots. Mantle translucent fawn, covered with small, dark brown spots; the whole mantle area consists of a pattern of small, raised pustules. Papillae numerous, long, whitish to translucent-yellow, branched, becoming sparse towards mantle edges. Tentacles bright orange, eyes black set in grey sockets; siphon creamy-white, thickly spotted with minute brown dots and fringed at the end.
Distribution: Throughout Fiji. Uncommon. — East Australia, South-west and Central Pacific, Rarotonga (Cook Islands).
Discussion: Specimens with the dorsal blotch distinct are only slightly more frequent than those without the blotch.

Fiji specimens of *Cypraea hirundo* differ slightly in size and tooth number from specimens found in other Melanesian localities. Fijian shells are narrower, with less numerous teeth. The mean average size and tooth count of 30 specimens from various Fijian localities is 15 (56), 21:17.

54. *Cypraea ursellus* GMELIN, 1791
[*Bistolida ursellus amoeba* (SCHILDER & SCHILDER, 1938)]

(Plate 25, Figure 42)

Blasicrura ursellus amoeba SCHILDER & SCHILDER, 1938

Shell: Shell pyriform, slightly inflated; anterior extremity narrow, posterior extremity produced; each with a pair of dark terminal spots. Dorsum with three bluish-grey zones, and an anterior spot of the same colour just above the columellar margin; the zones are variable in shape, and separated by whitish spaces. The dorsum has a few small, chestnut or reddish-brown specks, which extend to both margins. Sides and base white; aperture narrow. Teeth fine, extending almost to the margins. Fossula wide and deep, crossed by ribs.
Size: 10 (62), 27:20; extremes 8, 12 mm.
Animal: Not observed.
Distribution: West to South Viti Levu. Very rare. — Queensland, South-west Pacific, Fiji Islands, Tonga Islands.
Discussion: IREDALE, 1939, STEADMAN & COTTON, 1946 and ALLAN, 1956 adopted the name *Cypraea coffea* SOWERBY, 1870 for this species.

55. *Cypraea stolida* LINNAEUS, 1758
[*Bistolida stolida crossei* (MARIE, 1869)]

(Plate 24, Figure 26)

Cypraea stolida crossei MARIE, 1869
Bistolida stolida trakau STEADMAN & COTTON, 1943
Bistolida fluctuans nandronga STEADMAN & COTTON, 1943

Shell: Shell ovate and squarish. Dorsum grey to blue-grey, freckled with small brown specks, and with an irregular, central, red-brown blotch, only occasionally connected to the margins by lines of brown, and expanding at their lower ends to form blotches. Extremities only slightly produced, and with reddish-brown terminal spots. Some specimens have two grey transverse bands, extending from the extremities a short distance up the dorsum. Left side rounded, right side margined, flesh-coloured and sparsely spotted with pale brown. Base white, slightly flattened; aperture slightly wide. Labial teeth extend three quarters of the way to the margin, the first five or six anterior ones reaching the margin; columellar teeth extend half to three quarters of the way to the margin, first four to six anterior ones very short. Fossula wide, fairly deep, crossed by ribs which are nearly interrupted by a longitudinal ridge.
Size: 26 (54), 19:17; extremes 20, 30 mm.
Animal: Sole of foot pale orange; dorsum of foot translucent fawn. Mantle smoky-grey; papillae numerous, branched, translucent fawn. Tentacles yellow; siphon pale cream, fringed at the end.
Distribution: Throughout Fiji. Rare. — New Caledonia, Central Pacific, Marshall Islands, Line Islands.
Discussion: Fiji specimens show a greater affinity to the Queensland race, *Cypraea stolida brevidentata* SOWERBY, 1870, than to the Melanesian *C. s. crossei*. This is especially noticeable in the blunter posterior extremity of Fiji

specimens, and the absence or only slight indication of the reddish-brown lines connecting the dorsal blotch to the margins.

56. *Cypraea chinensis* Gmelin, 1791
[*Ovatipsa chinensis chinensis* (Gmelin, 1791)]

(Plate 24, Figure 24)

Cypraea cruenta / Dillwyn, 1817

Shell: Shell ovate, callous, anterior extremity slightly constricted. Dorsum bluish-white, marked with small rhomboidal orange-brown reticulations; dorsal line faint. Sides creamy-white, calloused, with dark violet spots which extend some way over the flesh-covered base. Aperture fairly wide; labial teeth large, coarse and almost extending to the margin; columellar teeth finer and short; interstices bright orange. Fossula wide, shallow, crossed by ribs.
Size: 32 (61), 17:16; extremes 30, 34 mm.
Animal: Mantle dark red, faintly lined by ribbons of white; proboscis, tentacles and foot dark red. Papillae granular knobs, orange to cream in colour and surrounded by an asterisk of white at the base. Siphon with a weak tentacular fringe. (Hawaii, Kay & Weaver, 1963)
Distribution: Nadroga reef (South-west Viti Levu) and Lau Islands. Very rare. — Parts of Malaysia, Philippine Islands, Japan, South-west Pacific, Gilbert and Ellice Islands, Fiji Islands, West Pacific, Jarvis-Palmyra Islands, Hawaii.
Discussion: The only two specimens collected in Fiji (there are some unverified specimens in local collections) are broader and have fewer teeth than specimens from the Philippines.

57. *Cypraea cribraria* Linnaeus, 1758
[*Cribraria cribraria orientalis* Schilder & Schilder, 1940]

(Plate 24, Figure 28)

Cribraria cribraria northi Steadman & Cotton, 1943
Cribraria cribraria melwardi / Schilder & Schilder, 1938

Shell: Shell ovate to pyriform. Dorsum yellowish-brown, orange-red or dark brown, with fairly close, round white spots; dorsal line situated slightly above the labial margin, and visible as a change in pattern. Sides, extremities and base white, right side margined. Base convex, aperture wide; labial teeth almost extending to the margin, central ones slightly shorter; columellar teeth confined to aperture. Fossula concave and denticulate.
Size: 22 (57), 20:19; extremes 15, 33 mm.
Animal: Sole and dorsum of foot pale orange. Mantle bright red, with faint pustules over the entire area; mantle area in between flecked with crescent-shaped black lines. Papillae numerous, short, simple, orange tipped with white; some papillae are pure white, and have a cluster of white patches at the base. Tentacles red; siphon red and not fringed.
Distribution: Throughout Fiji. Rare. — Parts of Malaysia, Philippine Islands, Japan, South-west - Central - and West Pacific, Line Islands.
Discussion: Only the last layer of the dorsum is brown. In Australian shells it is sometimes partly or entirely absent; the white form was incorrectly named as a species (*Nivigena melwardi*) by Iredale, 1930.

APPENDIX

Cypraea subviridis Reeve, 1835
[*Erronea subviridis subviridis* (Reeve, 1835)]

(Synonym: ? *Solvadusta subviridis kesata* Steadman & Cotton, 1943)

Steadman & Cotton (1943) report a single specimen from the Suva reef. Their description of the shell seems to fit the West Australian *Cypraea subviridis dorsalis* (Schilder & Schilder, 1938), but not the New Caledonian *C. subviridis*. No authentic specimens have been taken in Fijian waters.

Cypraea cylindrica Born, 1778
[*Erronea cylindrica cylindrica* (Born, 1778)]

(Synonym: *Palangerosa cylindrica lenella* Iredale, 1939, ? *Palangerosa cylindrica wangga* Steadman & Cotton, 1943)

Steadman & Cotton report 3 specimens from the Suva reef. No authentic specimens are known from Fijian waters.

Cypraea quadrimaculata Gray, 1824
[*Bistolida quadrimaculata garretti* (Schilder & Schilder, 1938)]

The species was mentioned from Fiji by Garrett, 1879. Dr. Schilder (personal communication) examined several shells (types) collected by Godeffroy, and listed by Schmeltz and Weinkauff; these were destroyed in the Museum of Hamburg. As range of the Malayan species extends as far as the Solomon Islands only and as the species seems to be absent from New Caledonia, its occurrence in Fiji is highly doubtful. It appears now that *Cypraea summersi* replaces *C. quadrimaculata* in Fiji.

Steadman & Cotton (1943) report two specimens as taken from Suva reef.

Cypraea goodalli Sowerby, 1832
[*Bistolida goodalli fuscomaculata* (Pease, 1865)]

(Synonyms: *Cypraea adelinae* Roberts, 1885 and *C. dautzenbergi* Hidalgo, 1907)

The species was recorded by Garrett, 1879 from Fiji, Tonga, and Samoa; the only reliable specimens are from Samoa (*leg.* Hervier). Hidalgo (1906/07) recorded *Cypraea goodalli* from Fiji, which indication seems to be erroneous and highly suspect. The eastern species could possibly reach Fiji, but it is doubtful. No authentic specimens are known from Fijian waters.

Cypraea gaskoini Reeve, 1846
[*Cribraria gaskoini fischeri* (Vayssière, 1910)]

The late Mr. Ditlev Thaanum (Hawaii) is reported to have found this species in Fiji (C. M. Burgess, personal communication). No details are available, but authentic specimens from Fijian waters are not known.

Records of other families of Cypraeacea from the Fiji Islands are not complete at the present time. A provisional list is given, enumerating species so far recorded from Fiji:

Amphiperatidae

Amphiperatinae

1. *Amphiperas* (*Amphiperas*) *ovum* (Linnaeus, 1758)
   Syn.: *Ovula oviformis* Lamarck, 1810
2. *Amphiperas* (*Parlicium*) *costellatum* (Lamarck, 1810)
   Syn.: *Ovulum angulosum* Lamarck, 1822, *O. tortile* Reeve, 1865
3. *Pscudosimnia* (*Diminovula*) *margarita* (Sowerby, 1828)
   Syn.: *Ovula umbilicata* Sowerby, 1849
4. *Pscudosimnia* (*Diminovula*) *punctata* (Duclos, 1831) — First Fijian record.
5. *Primovula* (*Prosimnia*) *coarctata* (Adams & Reeve, 1848)
   Syn.: *Ovula sempcri* Weinkauff, 1881
6. *Calpurnus* (*Procalpurnus*) *lacteus semistriatus* (Pease, 1862)
7. *Calpurnus* (*Calpurnus*) *verrucosus* (Linnaeus, 1758)
8. *Prionovula fruticum* (Reeve, 1865) — First Fijian record.

Pediculariidae

Volvinae

9. *Volva volva* (Linnaeus, 1758) — First Fijian record.

Pediculariinae

10. *Pedicularia* (*Pedicularіona*) *pacifica pacifica* (Pease, 1865) (or *P. pacifica stylasteris* Hedley, 1903 - ?)

Eratoidae

Eratoinae

11. *Proterato* (*Eratoena*) *corrugata* (Hinds, 1844)
12. *Proterato* (*Eratoena*) *sulcifera schmeltziana* (Crosse, 1867)

Triviinae

13. *Trivirostra hordacea hordacea* (Kiener, 1843)
    Syn.: ? *Trivia* (*Trivia*) *koroensis* Ladd, 1934
14. *Trivirostra edgari edgari* (Shaw, 1909)
    Syn.: *Cypraea grando* Gaskoin, 1848
15. *Trivirostra pellucidula* (Gaskoin, 1846) — First Fiji record
16. *Trivirostra exigua* (Gray, 1831)
    Syn.: *Trivia tremeza* Duclos, 1833
17. *Trivirostra oryza* (Lamarck, 1810)
18. *Dolichupis producta* (Gaskoin, 1836) — First Fijian record

CONCLUSIONS

A total of 57 species of *Cypraea* from Fiji have been recorded in this paper. Steadman & Cotton, 1943 record three additional species from the same area. The following species were not listed by the authors: *Cypraea childreni, C. fimbriata, C. maculifera, C. mariae, C. summersi, C. ursellus, C. walkeri* and *C. ziczac.*

The shell listed by Steadman & Cotton (*l. c.*) as *Cypraea microdon granum* (Schilder & Schilder, 1938) was an eroded beach specimen, measuring 9 mm in length, and having 15 labial and columellar teeth. This tooth count does not agree with that of *C. microdon,* but appears to agree with that of *C. fimbriata.*

The following four species have been established from Fiji for the first time: *Cypraea maculifera, C. summersi, C. walkeri* and *C. ziczac.* The recent collection of *C. childreni, C. fimbriata, C. mariae* and *C. ursellus* confirms Garrett's (1879) record.

A solitary specimen of *Cypraea ovum* Gmelin, 1791, was discovered in a local collection. The collector stated that the shell was collected on a reef in Southern Viti Levu and was said to be "common" there. As past and present collecting activity on this reef, as well as in other parts of Viti Levu failed to disclose any further specimens, the shell is regarded as a highly unreliable record. It could have reached Fiji through exchange with other collectors.

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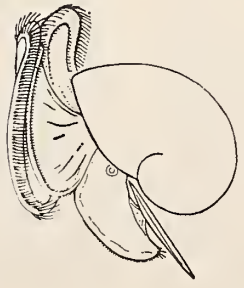

Studies on the *Mytilus edulis* Community in Alamitos Bay, California: II. Population Variations and Discussion of the Associated Organisms

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(3 Text figures)

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INTRODUCTION

In a previous paper the author (1964) described the development and temporary destruction of a *Mytilus edulis* Linnaeus, 1758, community on boat floats in the newly developed marina in Alamitos Bay. The primary consideration was to determine whether or not succession occurred on the floats. The other principal organisms were discussed in connection with the development of the community. These included the green alga *Ulva lobata* (Kützing, 1849) Setchell & Gardner, the polychaete *Hydroides norvegica* (Gunnerus, 1768), the ectoproct *Bugula neritina* (Linnaeus, 1758), and the tunicates *Ciona intestinalis* (Linnaeus, 1767) and *Styela plicata* (Lesueur, 1823). The rôle of *M. edulis* and other large species in the fouling community has received a considerable amount of attention (Anonymous, U. S. Navy Report, 1952), but, with one exception (Newcombe, 1935) known to the author, the other members of the association have not been studied. Newcombe (*l. c.*) described the general seasonal aspects of the intertidal *M. edulis* community in New Brunswick, Canada. The principal and associated species were listed according to their relationship in the community.

All organisms were identified, in so far as was possible, and counted in connection with the development of the *Mytilus edulis* community in Alamitos Bay. In the analyses of these data variations were noted in the occurrence of the associated organisms. The discussion of these data constitute the basis of this report. Since the seasonal occurrence of the principal organisms was discussed previously, they will be mentioned only briefly herein.

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MATERIAL AND METHODS

The methods of collection and the description of the boat floats were given in the previous paper. The collections were sorted and identified. Representative specimens of some of the groups were sent to specialists (named above) for identification; these specimens served as a reference collection for subsequent identification by the author.

DATA

Number of Species: The relationship between the number of species and water temperature has been summarized in Figure 1. A definite seasonal occurrence is noted in the number of species in the *Mytilus edulis* community. Peaks in the number of species were observed during August and September, 1960 to 1962, when the water temperature was highest. Conversely, the minimal periods in the number of species was during the winter months when the water temperature was lowest. The number of species collected averaged 11 when the water temperature was 13 ° C, 23 species at 16 to 18 ° C, and 28 species at 20 to 21 ° C.

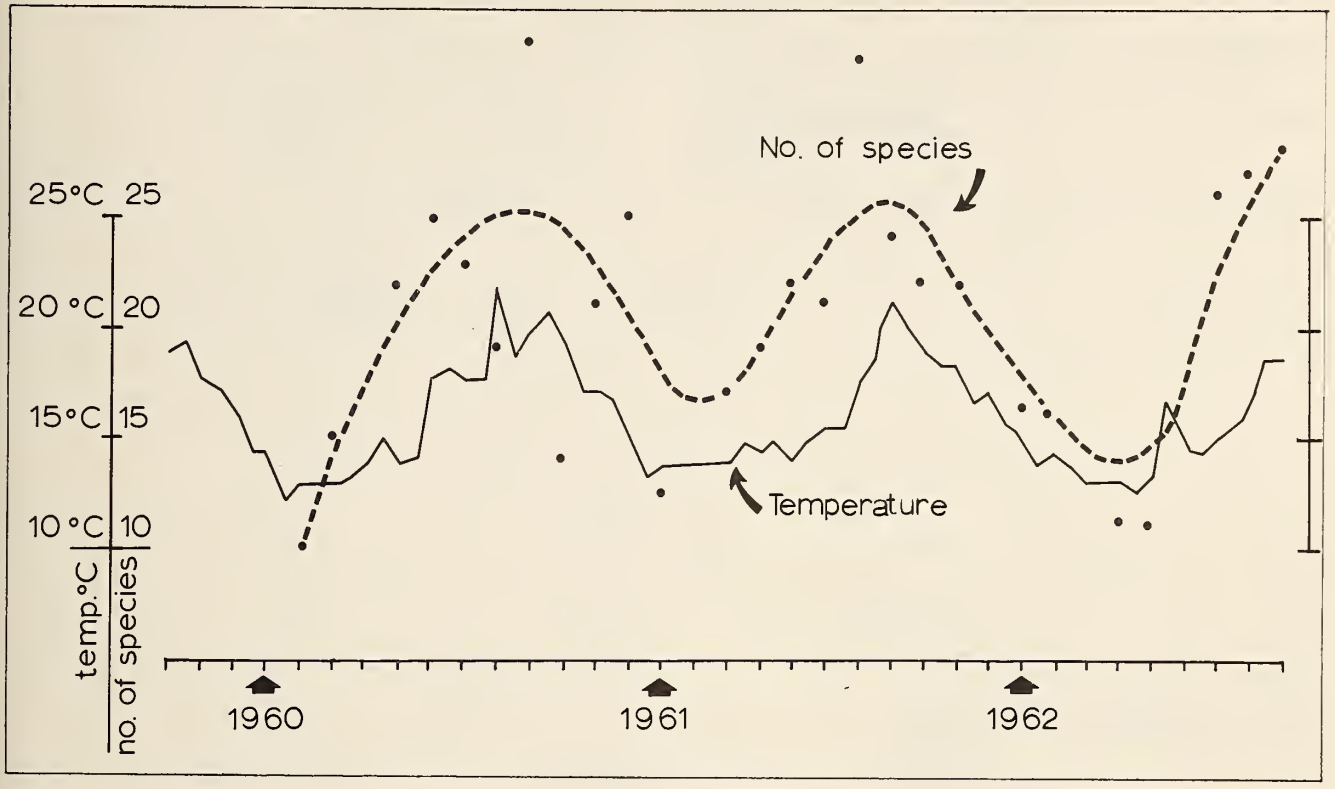

Figure 1: Seasonal Changes in the Number of Associated Species in the *Mytilus edulis* Community. The graph shows the relationship between the number of associated species of the *Mytilus edulis* community and water temperature in Alamitos Bay Marina.

The same seasonal relationship exists as above if we consider the relationship of the biomass of the associated organisms, excluding the weight of *Mytilus edulis*. The weight of the associated organisms averaged only 50 grams during the months of January through March, but reached a maximum of 260 grams during the months of July through September each year. The biomass of the *M. edulis* fluctuated little after establishment of the community.

Algae. Five species of algae were taken from the floats during the 2.7 years of collecting. A surge of algal growth was noted in March with a peak in biomass in June each year. *Ulva lobata* was the dominant alga and second to *M. edulis* in biomass. The spring and fall peaks in occurrence of *U. lobata* were discussed previously. The other species of algae collected included the brown algae *Ectocarpus confervoides* forma *parvus* (Saunders, 1898) Setchell & Gardner and *Leathesia difformis* (Linnaeus, 1755) Areschoug and the reds *Antithamnion ? secundatum* Gardner, 1927, and *Polysiphonia pacifica* Hollenberg, 1942. *Ectocarpus* cf. *parvus* was present, with one exception, only during the months of January through April, *Polysiphonia pacifica* was present during March through September.

Polychaetes. A total of 22 different species of polychaetes was collected during the 2.7 years of study. As a group they showed a definite seasonal occurrence with a peak in summer and a low during the winter months. Only four species were collected frequently; the occurrence and number of specimens taken have been summarized in Figure 2. *Halosydna johnsoni* (Darboux, 1899) is the only free-moving species of the four. It appeared in the *Mytilus edulis* community during the early spring months in each of the three years and was rarely taken during the winter months. The relationship of *Hydroides norvegica* to water temperature and seasonal occurrence has been discussed previously (Reish, 1961). *Platynereis bicanaliculata* (Baird, 1863) constructed mucoid tubes especially on the thalli of *Ulva lobata*. The occurrence of *P. bicanaliculata* was sporadic, but the majority of the specimens was taken during the spring months. *Polydora ligni* Webster, 1879,

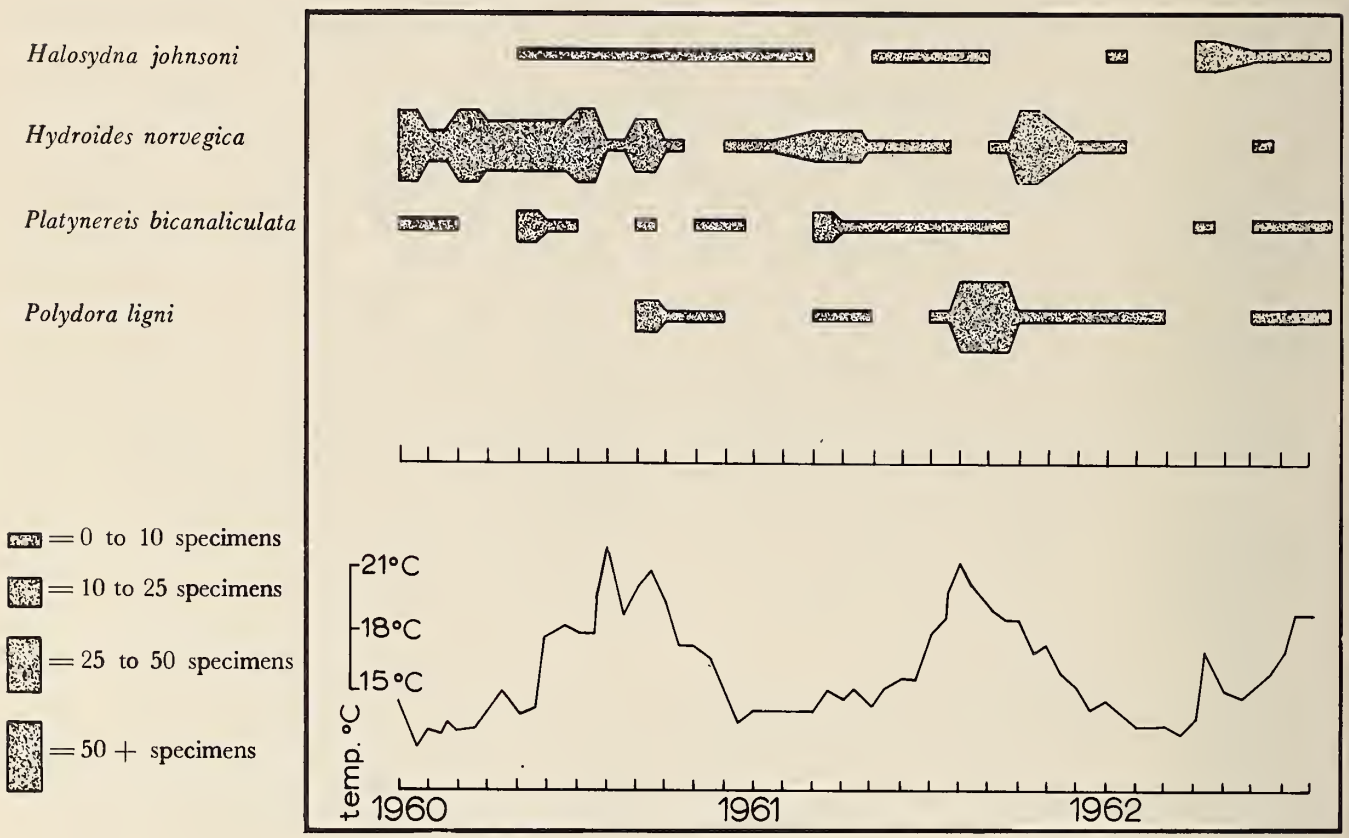

Figure 2: Seasonal Changes in the Polychaete Population associated with the *Mytilus edulis* Community. Diagrammatic representation of the relationship between the number of specimens of the principal species of polychaetous annelids and the water temperature.

built mud tubes on the thalli of *U. lobata* and among *M. edulis*. The majority of the specimens of *Polydora ligni* was taken during the summer months when the water temperature was highest. The other specimens of polychaetes collected included: *Armandia bioculata* Hartman, 1938, *Capitella capitata* (Fabricius, 1780), *Dorvillea articulata* (Hartman, 1938), *Eupomatus* sp., *Neanthes caudata* (delle Chiaje, 1828), *Naineris dendritica* (Kinberg, 1867), *Nereis grubei* (Kinberg, 1866), *N. latescens* Chamberlin, 1919, *Ophiodromus pugettensis* (Johnson, 1901), *Paleonotus bellis* (Johnson, 1897), *Pista alata* Moore, 1909, *Polyophthalmus pictus* (Dujardin, 1839), sabellid, *Spirabranchus spinosus* Moore, 1923, spirorbinid, terebellid, and *Typosyllis* sp.

Amphipoda. Amphipods constituted the dominant group of animals in terms of numbers of specimens (Figure 3). Peaks occurred each summer with 1690, 17450, and 5121 specimens in 1960, 1961, and 1962, respectively. This is in striking contrast to minima of 3, 6, and 71 specimens during the winter months for each of these three years. Nine species of amphipods were taken from the floats during the period of study; the seasonal occurrence and abundance of the five dominant ones are summarized in Figure 3. The correlation between the warmer water temperature and the abundance of these amphipods, and especially *Elasmopus rapax* Costa, 1853, can be seen in Figure 3. *Corophium acherusicum* (Costa, 1857) and *Jassa falcata* (Montagu, 1808) constructed sticky parchment tubes to which mud particles adhere. The tubes occurred on the thalli of *Ulva lobata* and between and on specimens of *Mytilus edulis*. *Ampithoe plumulosa* Shoemaker, 1938, *Caprella californica* Stimpson 1857, and *E. rapax* moved freely about the community. The other species of amphipods taken were *Caprella equilibra* Say, 1818, *Ericthonius brasiliensis* (Dana, 1853), *Leucothoides pacifica* Barnard, 1955, and *Pontogeneia minuta* Chevreux, 1908. Barnard (1958) found heavy settlement of amphipods on 16-week test blocks collected August 17, 1951, in Los Angeles

Harbor. Species in common with the present study included *C. acherusicum, J. falcata,* and *E. brasiliensis.*

Mollusca. Eleven different species of mollusks were present on the floats including species of gastropods, pelecypods, and a chiton. *Mytilus edulis* was the dominant member of the community; its abundance has been discussed earlier. As a group, but excluding *M. edulis,* the seasonal occurrence of the mollusks is striking. They are present abundantly during the spring and summer months but nearly absent during the fall and winter months. Such a cycle is noted with the pelecypod *Hiatella arctica* (Linnaeus, 1771), and the gastropods *Acmaea limatula* Carpenter, 1864, and *Crepidula onyx* Sowerby, 1825. The other mollusks occasionally encountered included the pelecypods *Ostrea lurida* Carpenter, 1863, and *Leptopecten latiauratus* (Conrad, 1837); the gastropods *Acmaea scabra* (Gould, 1846), *Littorina planaxis* Philippi, 1847, *L. scutulata* Gould, 1849, and unidentified nudibranchs; and the chiton *Mopalia muscosa* (Gould, 1846).

Ectoprocta. Six species of ectoprocts were present during the study. A slight increase of species was noted during the course of the year with a peak occurring during the summer months; this was followed by a sharp decrease in the fall months. This was especially true for the most frequently encountered species, *Schizoporella unicornis* (Johnston, 1847). Other species included *Bugula californica* Robertson, 1905, *B. neritina* (Lin-

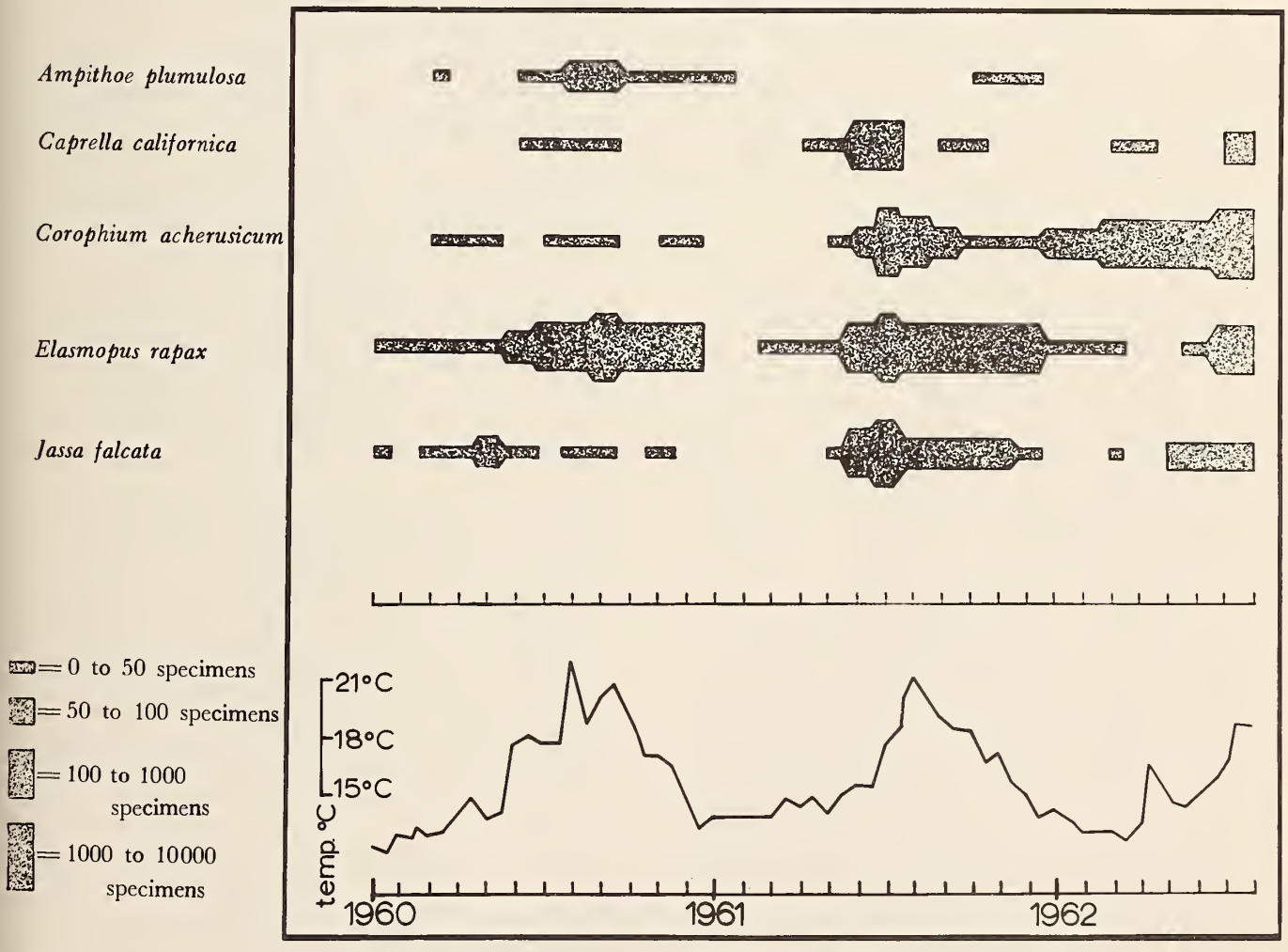

Figure 3: Seasonal Changes in the Amphipod Population Associated with the *Mytilus edulis* Community. Diagrammatic representation of the relationship between the number of specimens of the principal species of amphipods and the water temperature.

NAEUS, 1758), *Cryptosula pallasiana* (MOLL, 1803), *Holoporella brunnea* (HINCKS, 1884), and *Scrupocellaria bertholetti* (AUDOUIN, 1826).

Tunicata. Six species of tunicates exhibited definite seasonal differences with a peak in summer and a low in fall and winter. *Ciona intestinalis* was the most abundant one taken. While individual specimens can be seen generally more frequently during the summer, the larval settlement is earlier in the year when the water temperatures are lower. *Amaroucium californicum* RITTER & FORSYTH, 1917, *Botryllus* sp., *Diplosoma pizoni* RITTER & FORSYTH, 1917, and *Styela plicata* were limited to the months of May through September with only a few exceptions (13 per cent). *Styela montereyensis* (DALL, 1872) was present throughout the year.

The remaining species of animals, none present frequently and some only once, included two unidentified sponges, sea anemones, polyclad flatworms, nemerteans, barnacles (*Balanus amphitrite* DARWIN, 1854, *B. crenatus* BRUGUIÈRE, 1789, and *B. glandula* DARWIN, 1854), an isopod, a shrimp, the crab *Hemigrapsus oregonensis* (DANA, 1851), and one juvenile sea urchin, *Strongylocentrotus purpuratus* STIMPSON).

DISCUSSION

The relationship between the number of species and the water temperature is clearly evident in Figure 1. The greater number of associated species was found during the summer months and the lesser number was collected during the winter months for three successive years. While comparative data are not available, it has been demonstrated throughout the world that the heavier attachments of fouling organisms take place in the warmer water (summarized in ANONYMOUS, U. S. Navy report, 1952). Presumably, the smaller associated animals would be more abundant at this time.

The reproduction, development, life history, and length of life are unknown for the majority of the organisms encountered. *Mytilus edulis* is undoubtedly the longest living member of the community. Some species of animals, for example *Ciona intestinalis,* have one life cycle a year in which the larvae settle in spring, grow in summer, and die in fall. Other organisms exhibiting this type of cycle probably include most of the other species of tunicates and the ectoprocts. Other species, and this is especially the case with amphipods, have many cycles during the spring and summer months. In this manner large populations are built up and undoubtedly the same female broods several successive generations. The population diminishes with the drop in water temperature in the fall. Undoubtedly a few larvae of a species, which are typical inhabitants of some other ecological niche, may settle in the *Mytilus edulis* community. This is evident with the polychaetes; the majority of the polychaetes collected is more commonly encountered in the benthos.

The breeding period and subsequent settling period has been divided into four categories depending upon the seasonal aspects of attachment (ANONYMOUS, U. S.Navy report, 1952). These categories may be modified slightly and the more frequently encountered species grouped according to: (1) occurrence throughout the year without fluctuations: *Holoporella brunnea, Scrupocellaria bertholetti,* and *Styela montereyensis;* (2) occurrence throughout the year but with a definite spring or summer peak: *Halosydna johnsoni, Hydroides norvegica, Platynereis bicanaliculata, Polydora ligni, Elasmopus rapax, Corophium acherusicum, Schizoporella unicornis,* and *Styela plicata;* (3) occurrence limited to a definite period of the year which is usually either spring or summer: *Polysiphonia pacifica, Ectocarpus* cf. *parvus, Ampithoe plumulosa, Jassa falcata, Pontogenia minuta, Hiatella arctica, Acmaea limatula, Crepidula onyx, Bugula californica, B. neritina, Cryptosula pallasiana, Amaroucium californicum, Ciona intestinalis, Botryllus* sp., and *Diplosoma pizoni;* and (4) peaks occurring in the spring and fall: *Ulva lobata* and *Polyophthalmus pictus.*

SUMMARY

1. A seasonal quantitative study was made for 2.7 years of the associated species of the *Mytilus edulis* community of the boat floats in Alamitos Bay Marina, California.
2. The principal associated groups include species of polychaetes, amphipods, mollusks, ectoprocts, and tunicates.
3. A direct relationship between the number of species and water temperature was observed; the warmer the water, the greater the diversity of the organisms.
4. The occurrence of the principal species was arranged according to the following categories: (1) occurrence throughout the year without fluctuations (3 species) (2) occurrence throughout the year but with a definite spring or summer peak (8 species), (3) occurrence limited to a definite period which was usually spring or summer (15 species), and (4) peaks occurring in the spring and fall (2 species).

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A Note on the Synonymy of *Tellina subtrigona* Sowerby, 1866

(Mollusca: Bivalvia)

BY

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(Plate 27, Figures 1, 1 a)

In 1866, Sowerby first described *Tellina subtrigona* in volume 17 of Reeve's Conchologia Iconica; the type figure is figure 9, plate 3 of *Tellina*; no locality datum was given. Later, in 1868, in the same monograph, he again described a species with the name *Tellina subtrigona* (plate 44, figure 259). After he discovered his error, he corrected the latter to *Tellina subangulata* in the index; *T. subangulata* is synonymous with the Indo-Pacific species, *T. juvenilis* Hanley.

Recently, Keen (1958) has suggested the probable identity of *Tellina erythronotus* Pilsbry & Lowe with *T. subtrigona* Sowerby, 1866. Hertlein & Strong (1949) in their remarks under *T. erythronotus*, did not mention *T. subtrigona*, but have listed the names of a number of species which are synonymous with or closely related to *T. subtrigona*. In 1852, C. B. Adams described *T. puella* from the Pacific coast of Panama; this name was unfortunately preoccupied by *T. puella* Hanley 1846. Salisbury (1934) recognized *T. puella* Adams as a junior homonym and renamed it *T. puellula*. Turner (1956) selected and figured the lectotype of *T. puella* Adams. Keen (1958) considered *T. puellula* as valid but mentioned that it was very close to *T. erythronotus*. Olsson (1961) recognized that *T. puella* Adams and its substitute name, *T. puellula* Salisbury, were synonymous with *T. erythronotus*.

Presently, we are able to include *Tellina subtrigona* Sowerby, 1866 in this synonymy, and this name will replace *T. erythronotus*. An examination of the type material has indicated the identity of the following: *Tellina subtrigona* Sowerby, 1866; *T. puella* C. B. Adams; *T. puellula* Salisbury; and *T. erythronotus* Pilsbry & Lowe. Plate 27, figures 1 and 1 a illustrate the holotype of *T. subtrigona* Sowerby, 1866 and the following is the synonymy of the species:

Tellina subtrigona Sowerby, 1866 [in] Reeve, Conchologia Iconica, vol. 17, *Tellina*, pl. 3, fig. 9 (type locality unknown; holotype, BMNH, no catalog number; 22 mm in length and 13 mm in height), *non* Sowerby, 1868.

Tellina puella C. B. Adams, 1852, Ann. and Lyceum Nat. Hist. New York, 5: 507 and 546 (reprint pagination, 283 and 322); Turner, 1956, Occ. Pap. Moll., Harvard University, 2 (20): 77, pl. 19, figs. 13, 14 (type locality, Panama [Pacific coast]; lectotype, selected by Turner, 1956, MCZ 186305; 22 mm in length, 13 mm in height and 7 mm in diameter), *non* Hanley, 1846.

Tellina erythronotus Pilsbry & Lowe, 1932, Proc. Acad. Nat. Sci. Philadelphia, 84: 94, pl. 12, fig. 7 (type locality, Panama, east of the city; holotype, ANSP 115010; 19.5 mm in length, 10.7 mm in height, and 5 mm in diameter).

Tellina puellula Salisbury, 1934, Proc. Mal. Soc. London, 21 (2): 86 (new name for *T. puella* C. B. Adams, 1852, *non* Hanley, 1846).

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The Status of *Scrobicularia viridotincta* Carpenter

(Mollusca: Bivalvia)

BY

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(Plate 27, Figures 2, 2 a)

In 1856, P. P. Carpenter described a new species of bivalved mollusk as '? *Scrobicularia virido-tincta.*' The type specimen was collected by Mr. T. Bridges in the Bay of Panama and was later deposited in the collection of Mr. Hugh Cuming. Presently the holotype is in the type collection of the British Museum (Natural History).

Notwithstanding the incomplete description and the lack, until recently (see Palmer, 1963), of an illustration of the holotype, there have been virtually no questions concerning the identity of *Scrobicularia viridotincta.* Dall (1900) created a new section, *Scrobiculina,* of the subgenus *Arcopagia* with *Scrobicularia viridotincta* Carpenter as type, and nearly all modern authors have followed this scheme in systematic treatments of the Tellinidae. Dall considered that *Tellina (Peronaeoderma) ochracea* Carpenter, 1864 also belonged to the section *Scrobiculina* and, further, that the species *T. ochracea* and *S. viridotincta* were distinguished from each other by the umbo, the former species being ochraceous or somewhat yellow-orange while the latter was greenish. However, an examination of the type of *Scrobicularia viridotincta* Carpenter shows this species to possess macomid characteristics, and the following figures, description and remarks attempt to clarify the definition of *S. viridotincta* Carpenter and *Scrobiculina* Dall.

DESCRIPTION OF

Scrobicularia viridotincta Carpenter

Original description: *? S. testa. ? S. productae simili; sed latiore, ovali tenuiore, magis planata, antice haud producta, alba; umbonibus viriditinctis.*

Redescription of holotype (Plate 27, figures 2, 2 a): Shell 51.8 mm in length and 35.1 mm in height; diameter, 16.0 mm; distance from anterior margin to umbonal axis, 28.5 mm, distance from anterior margin to anteriormost extension of the pallial sinus, 12.8 mm. Shell white and ovate, slightly inequivalve with the right valve larger and of greater convexity, slightly inequilateral and with a slight posterior flexure to the right, inflated anteriorly and somewhat compressed posteriorly. Umbones just behind the middle, blunt, with conspicuous dark grey-green coloration, slightly elevated and somewhat inflated, with a deep umbonal cavity beneath. Anterior margin rather broadly and smoothly rounded; ventral margin slightly arcuate and convex; posterior margin but slightly produced, rather narrowly rounded. Sculpture consisting of closely spaced weak concentric lirae; no true radial sculpture evident. Right valve with a posterior ridge, left valve with a corresponding furrow. Ligament light brown in color, sunken and subtended by a strong calcareous element or resilium, shorter than the ligament

Figure 1 Figure 1 a

Figure 1, 1a: The holotype of *Tellina subtrigona* SOWERBY, 1866 (about x 2.3).

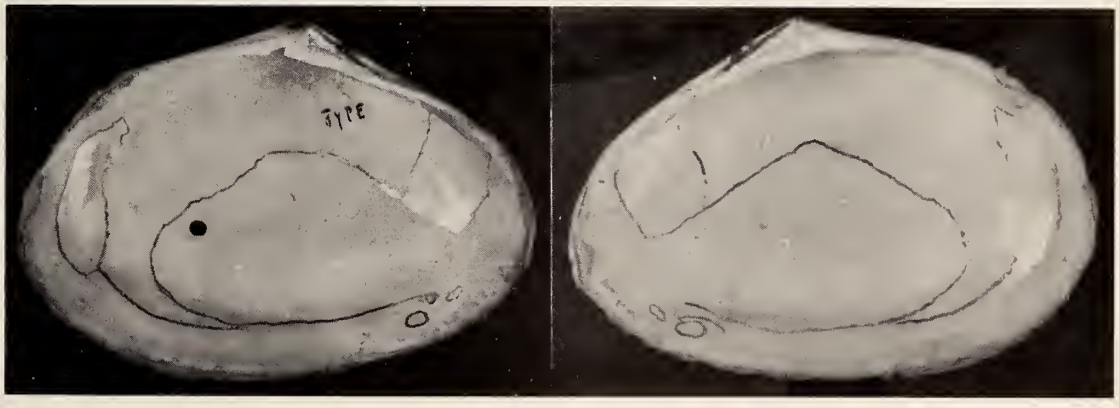

Figure 2 Figure 2 a

Figures 2 and 2 a: The holotype of *Scrobicularia viridotincta* CARPENTER in the type collection of the British Museum (Natural History); Reg. No. 19621115. Figure 2: Right valve internal; Figure 2 a: Left valve internal (both about x 1.4).

proper. Cardinal complex in the left valve consists of a short narrowed anterior bifid tooth with more or less equal lobes and of an elongate posterior laminate tooth which is obsolete and adpressed to the calcareous element of the ligament; no lateral teeth present. Cardinal complex in the right valve consists of a short posterior bifid tooth with subequal lobes and of an anterior laminate tooth; the single anterior laminate cardinal tooth is broken as is part of the hinge plate which supports it; no lateral teeth present. Anterior adductor muscle scar elongate and narrow, weakly lunate; posterior adductor scar transversely quadrate, nearly rhomboid. Pallial sinus rising behind to an apex beneath the umbo but not higher than the dorsalmost extension of the posterior adductor muscle scar; the sinus descending in an arcuation toward the pallial line, paralleling it for a distance and then becoming confluent with it well in front of the umbonal axis, about the beginning of the hinge plate. Cruciform muscle scars unequal, the anterior scar subquadrate and the posterior one more nearly rounded; the terminus of the pallial line arcuate and near to the posterior cruciform muscle scar.

Remarks: The most important characteristic to be considered in the holotype is the complete absence of lateral teeth. Although a portion of the shell is broken in the vicinity of the anterior lateral hinge plate in the right valve, enough structure is evident to indicate that no lateral tooth was present. It is only possible for the broken anterior portion to have contained the most distal part of the anterior laminate cardinal tooth. The lack of any lateral teeth, the thickness, coloration and dullness of the shell, and the deep placement of the ligament indicate that this species is a member of the genus *Psammotreta* of the subfamily Macominae. By no stretch of definitions could it be considered a *Tellina* or a *Semele*.

Olsson (1961) elevated *Psammotreta* to the generic level, while Hertlein & Strong (1949) considered it a subgenus. The latter authors listed two species in this taxon, *Macoma* (*Psammotreta*) *aurora* (Hanley, 1844) and *M.* (*P.*) *pacis* (Pilsbry & Lowe, 1932). Olsson listed *P. aurora* (Hanley, 1844), *P. dombei* (Hanley, 1844), *P. grandis* (Hanley, 1844), *P. asthenodon* (Pilsbry & Lowe, 1932), and *P. gubernacula* [*sic*] (Hanley, 1844), under which *M.* (*P.*) *pacis* (Pilsbry & Lowe) is treated as a synonym. Keen (1962) maintained *Psammotreta* Dall at the generic level and indicated that *Psammotreta* (*P.*) *pacis* (Pilsbry & Lowe) is not synonymous with *P.* (*P.*) *gubernaculum* Hanley, 1844), an interpretation which is followed here. Of all the species in *Psammotreta*, it appears that *Scrobicularia viridotincta* Carpenter is a senior synonym of *Psammotreta pacis* (Pilsbry & Lowe).

The discovery of the correct identity of *viridotincta* of Carpenter upsets the traditional usage of *Scrobiculina*. Dall (1900) established *Scrobiculina* as well as *Psammotreta*, but *Scrobiculina* has page priority over *Psammotreta*. However, Article 24 (a) of the International Code of Zoological Nomenclature insures that if more than one name for a single taxon has been published simultaneously, relative priority and the choice of one of the names to represent the taxon may be determined by the first person to point out the synonymy. Further, Recommendation 24 A of the Code instructs the first reviser to select the name 'that will best ensure stability and universality of nomenclature.' In this particular case, I hereby select *Psammotreta* as the name to be preserved and *Scrobiculina* is assigned the status of a junior synonym.

Dall's concept of *Scrobicularia viridotincta* Carpenter does not actually represent a valid species. An examination of the material of *Tellina ochracea* and the so-called '*viridotincta* Carpenter' of Dall in the British Museum (Natural History), the Museum of Comparative Zoology, and the United States National Museum indicates that *T. ochracea* is a polymorphic species in which green and yellow colored specimens are identical morphologically and represent nothing more than color variations.

The closest relative to *Tellina ochracea* is the western Atlantic species, *T. laevigata* Linnaeus, 1758, which also possesses a wide range of color variation. Probably *T. ochracea* was derived from *T. laevigata* after the closure of the Central American isthmus in the Pliocene. *Tellina laevigata* appears to be more heavily shelled and more tumid; its color is generally red and often disposed in rays, although colorless individuals are frequently encountered in populations.

A problem arises in subgenerically placing *Tellina ochracea*. *Laciolina* Iredale, 1937, based on *T. quoyi* Sowerby, suitably fills the need. In addition to *T. quoyi*, *T. chloroleuca* Lamarck, 1818 also represents *Laciolina* in the Indo-Pacific, and both are very similar to *T. laevigata* and *T. ochracea*. Their common ancestry becomes immediately evident when samples of each species are compared.

In summary, the status of *Scrobicularia viridotincta* Carpenter is discussed. An examination of the holotype shows this species to be synonymous with *Psammotreta pacis* Pilsbry & Lowe. The sectional or subgeneric name *Scrobiculina* Dall, based upon *Scrobicularia viridotincta* Carpenter, is herein designated (interpreted) as a junior synonym of *Psammotreta*. Dall's *S. viridotincta* 'Carpenter' is synonymous with the species *Tellina ochracea* Carpenter. *Laciolina* Iredale is an available subgenus into which are placed *T. ochracea* Carpenter, *T. laevigata* Linnaeus, *T. quoyi* Sowerby and *T. chloroleuca* Lamarck.

ACKNOWLEDGMENTS

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Notes on the Terebridae of the Philippine Islands

(Mollusca: Gastropoda)

BY

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THE INCREASING NUMBER of students and collectors of Mollusca and the several collecting expeditions of the past decade have resulted in the addition of new records for terebrid species in the Philippine fauna. As this collecting is extended to the northern islands of the archipelago, it is to be expected that additional species, especially those known from the Japanese and Malaysian areas, will be encountered. It should be noted that several such species of wide distribution which have been collected at such diverse localities as Hawaii, Japan, Israel, and South Africa have not yet been seen by this author in the Philippine material examined to date.

These notes are the result of the examination of more than 4000 specimens of Terebridae collected exlusively at Philippine localities. Through the courtesy of Mr. John E. duPont and the Delaware Museum of Natural History, I have had the opportunity to examine Terebridae collected by the late Colonel John Root and those later collected by Mr. duPont and Dr. R. T. Abbott. A large quantity of specimens collected at Luzon, Samar, and Sulu were generously made available for study by Dr. Alan Solem and the Chicago Natural History Museum. Dr. Arthur Clarke and the National Museum of Canada have provided specimens collected by the Norton Expedition to Alabat Island. A number of Philippine students and collectors have given valuable assistance by making their personal collections available, providing quantities of specimens with exact locality data. Numerous private collections have been examined for specimens of the area.

It has been sixty years since, in 1904, J. G. Hidalgo published the "*Catálogo de los molluscos testaceos de las islas Filipinas, Joló y Marianas*" in which he listed the species cited from the area to that time. It has seemed desirable that this list be followed in the present notes; therefore all of the species he listed are repeated here with the new records incorporated in the alphabetical arrangement. Those familiar with Hidalgo's publication will notice that some liberties have been taken in making this arrangement; his appended list under "Other species cited" has also been incorporated. Specimens from Guam and the Marianas Islands have not been included here, nor have several species which have eluded identification.

The most recent publication of species from this area appears to be that of LEOPOLDO A. FAUSTINO (1928), Summary of Philippine Marine and Fresh-water Mollusks. In this extensive list an attempt is made to include the original citation and locality records for the area; however, many species are cited only from HIDALGO's

Catalogue of Shells, and no attempt is made to verify the citations listed. This summary resulted in the addition of only a single species, *Terebra tuberosa* HINDS, 1844; on the other hand, six species listed by HIDALGO were omitted, as follows: *T. argus* HINDS, 1844, *T. nebulosa* KIENER, 1839, *T. pallida* DESHAYES, 1859, *Hastula lanceata* (LINNAEUS, 1767), *H. philippiana* (DESHAYES, 1859), and *H. verreauxi* (DESHAYES, 1859). Also excluded were all of the species listed by HIDALGO in his appended "Other species cited". This summary contains an excellent bibliography for the area.

In the present notes no attempt is made to repeat the locality records or citations of either of the two mentioned authors. Only a general collecting locality for the species listed here is given; more accurate data are available for those interested. All species listed have been compared with the original descriptions and figures; with photographs of several of the holotypes or paratypes; with some species in the author's collection which came originally from the Cuming Collection; and with many homeotype specimens from the Philippines, Australia and Japan. The references and figures cited by both HIDALGO and FAUSTINO have also been compared with the specimens at hand.

Much of the synonymy for species listed remains to be investigated and I have, for this reason, included all of the specific names of the two lists mentioned above. A comparison will show that a number of these names have been placed in the synonymy. It is apparent that additional changes will be necessary in the specific nomenclature of several of the listed species. Corrections in nomenclature made here are of the less well-known species, and it is expected that others more familiar to the general collector will be individually reviewed in the future.

These notes are not intended as a systematic arrangement of the species. For the present purpose, it has seemed sufficient to list the species in alphabetical order, placing them in the broad generic groups of *Duplicaria, Hastula,* and *Terebra,* with appropriate sub-genera. For those who prefer the more detailed arrangements, a list of the generic names used, with author, date of publication, and type species follows the list of species.

All species cited by lot number will be found, as indicated, in the collections listed below. In order to incorporate these new records with those of HIDALGO, the following symbols and abbreviations have been used:

* = species listed by HIDALGO
(x) = species not verified by HIDALGO
CM = Chicago Natural History Museum, Chicago, Illinois.
DM = Delaware Museum of Natural History, Greenville, Delaware.
O = Olivera Collection, Quezon City, Philippines.
B = Burch Collection, Houston, Texas

Duplicaria

*(x) *D.* (*? Pristiterebra*) *badia* (DESHAYES, 1859): Proc. Zool. Soc. London, p. 300, no. 132; Fig.: Thes. Conch., 1844, T., Pl. 43, fig. 59.
Terebra castanea HINDS, 1844: HINDS in SOWERBY, Thes. Conch. 1: 161, pl. 43, fig. 59 (*non* KIENER, 1839).
T. ligneola REEVE, 1860: Conch. Icon. T., pl. 7, no. 25.
This species from western Africa has not been among specimens examined.

*(x) *D.* (*Duplicaria*) *bernardi* (DESHAYES, 1857): Journ. Conchyl., p. 84, pl. 4, fig. 10.
This species, commonly collected in Queensland and northern Australia (B no. 412), has not been included in the collections examined.

* *D.* (*Duplicaria*) *duplicata* (LINNAEUS, 1758): Syst. Nat., Ed. 10, p. 742, no. 419; KIENER: Icon. Coq. Viv., 1839, T., pl. 9, fig. 19 and pl. 12, figs. 26 (both)
Terebra chalybeus (MARTINI, 1780): Conch. Cab., p. 301, pl. 155, fig. 1455.
* *T. lamarcki* KIENER, 1839, Icon. Coq. Viv.. T., p. 30, no. 25, pl. 9, fig. 19.
T. reevei DESHAYES, 1857: Journ. Conchyl., p. 88, pl. 4, fig. 14.
? T. japonica E. A. SMITH, 1873: Ann. & Mag. Nat. Hist. 11 (ser. 4): 265.
A wide range of color and color pattern is exhibited by this species, the sculpture remaining constant except for the varying width of the axial ribs. Specimens of an unusual dark-gray color with maroon flammules are collected rarely at Batangas Bay (B no. 212).

*(x) *D.* (*Duplicaria*) *dussumieri* (KIENER, 1839): Icon. Coq. Viv., T., p. 31, no. 26, pl. 8, fig. 17.
This species of Formosa (B no. 131) and Japan (B no. 423) has not been included among the specimens examined.

*(x) *D.* (*Duplicaria*) *evoluta* (DESHAYES, 1859): Proc. Zool. Soc. London, p. 292, no. 88; Fig.: REEVE; Conch. Icon. 1860 T., pl. 8, no. 55.
The single specimen seen in the Olivera Collection, was collected at Batangas Bay.

D. (*Duplicaria*) *raphanula* (LAMARCK, 1822): Anim. sans Vert. 7: 288, no. 16; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 10, fig. 20.
An uncommon species. Samar, Sulu, Luzon. (CM no. 127146, DM no. 3558, B no. 035).

Hastula

* *H.* (*Hastula*) *aciculina* (Reeve, 1860): Conch. Icon., T., pl. 23, figs. 121 (all) (*non* Lamarck, 1822).

Reeve has incorrectly figured three distinct species under this name, all of which had been described as new species by Hinds. Two of these, *Hastula casta* and *H. inconstans,* are indigenous to the area; the third, *H. stylata,* has not been among specimens examined, although it is found in Japan (B no. 516). E. A. Smith's *H. confusa* (Ann. & Mag. Nat. Hist., 19 (scr. 4): 229, 1877) is founded on two of the species figured by Reeve.

H. (*Punctoterebra*) *anomala* (Gray, 1834): Proc. Zool. Soc. London, p. 62; Fig.: Hinds in Sowerby, Thes. Conch., T., 1844, pl. 44, fig. 97.

Uncommon at Alabat Island (B no. 179).

H. (*Impages*) *bacillus* (Deshayes, 1859): Proc. Zool. Soc. London, p. 285, no. 49.

This small species is very close to juvenile forms of *H. caerulescens* (Lamarck, 1822). Common in several localities. Luzon. (B. no. 442).

* *H.* (*Impages*) *caerulescens* (Lamarck, 1822): Anim. sans Vert. 7: 288, no. 12; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 6, fig. 12 a, 12 b, 12 c.

Terebra hectica (Linnaeus, 1758) (in part possibly): The description is too vague and includes several species. (*non* Chemnitz, 1780; *non* Woodarch, 1822, *non* Küster, 1841).

? *T. edentula* (Gmelin, 1790): Syst. Nat., Ed. 13, p. 3505, no. 155.

? *T. nivea* (Gmelin, 1790): *l. c.,* p. 3504 (*non* pp. 3471 and 3495).

? *T. bifasciata* (Dillwyn, 1817): Descr. Cat., 2: 651, no. 155.

T. terebralis (Menke, 1828): Synops. Moll., p. 84.

T. otaitensis (Lesson, 1830): Voy. Coq., 2 (1): 407.

T. nimbosa Hinds, 1844: Proc. Zool. Soc. London, p. 151.

T. flammulata Martens. 1880: Mauritius, p. 230, pl. 20, fig. 5.

H. hectica alba Dautzenberg, 1935: Mem. Mus. Hist. Nat. Belg., 17 (scr. 2): 42, pl. 2, fig. 4.

H. hectica fusca Dautzenberg, 1935, *l. c.,* p. 42, pl. 2, fig. 2

Extremely variable in color arrangement. Not uncommon. Cebu, Luzon. (CM no. 127144; DM no. 3552; B no. 450).

* *H.* (*Hastula*) *casta* (Hinds, 1844): Proc. Zool. Soc. London for 1843: 156; Fig.: Hinds in Sowerby, Thes. Conch., 1844, T., pl. 44, fig. 84.

*(x) *T. albula* Menke, 1843: Moll. Nov. Holl., p. 30, no. 163; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 45, fig. 126. Menke's description of this colorless variety would appear to have priority.

T. bipartita Deshayes, 1859: Proc. Zool. Soc. London, p. 284, no. 47.

*(x) *T. incolor* Deshayes, 1859: Proc. Zool. Soc. London, p. 283, no. 44.

*(x) *T. philippiana* Deshayes, 1859: Proc. Zool. Soc. London, p. 289, no. 68 (*non* Dall, 1920).

* *T. aciculina* Reeve, 1860: Conch. Icon., T., pl. 23, (in part) fig. 121 a only (*non* Lamarck, 1822).

T. medipacifica Pilsbry, 1921: Marine Moll. Hawaii, p. 308, pl. 12, figs. 8, 9, 10. In this somewhat more obese variety the axial ribs extend from suture to suture on each whorl.

T. medipacifica melior Pilsbry, 1921: *l. c.,* p. 308, pl. 12, fig. 11. Described from a larger specimen of the preceding.

H. casta natalensis E. A. Smith, 1903: Proc. Mal. Soc., 5 (6): 360.

Variable in color, sculpture and form. Color often completely absent as in *H. albula* or distinct and coalesced as in *H. philippiana.* Sculptural and form variations appear in about equal numbers in specimens taken from the same colony by divers. A common species in all localities (CM no. 127140; DM no. 3538; B no. 259; Olivera Collection contains superior examples of the *philippiana* variety).

*(x) *H.* (*Hastula*) *cinerea* (Born, 1778): Mus. Vind., p. 267, pl. 10, figs. 11, 12.

Terebra aciculina Lamarck, 1822: Anim. sans Vert. 7: 290, no. 22 (*non* Hinds, 1844; *non* Reeve, 1860).

Common in Florida (B no. 128), the Gulf of Mexico, northern Panama (B no. 183) to Rio de Janeiro, Brazil (B no. 535). Many Indo-Pacific species have been incorrectly placed in the synonymy.

H. (*Hastula*) *concinna* (Dillwyn, 1817): Descr. Cat., p. 647, no. 144; Fig., Born; Mus. Vind., 1778, p. 264, pl. 10, fig. 10 (*non* Deshayes, 1857).

* *T. strigilata* (Linnaeus, 1758): Syst. Nat., Ed. 10, p. 741, no. 418 (the description is too brief, and the species cannot be determined with any certainty).

T. strigilata (Born, 1778): Mus. Vind., p. 264, pl. 10, fig. 10. This specific name is a homonym and was replaced by Dillwyn. The figure fails to show the prominent axial ribs distinctive of this species, which superficially resembles several other forms (*non* Chemnitz, 1780; *non* Gmelin, 1790, *non* Kiener, 1839).

T. striatula Kiener, 1839: Icon. Coq. Viv.,T.. pl. 9, (in part). fig.18

T. acumen Deshayes, 1859: Proc. Zool. Soc. London, 287, no. 58.

T. argenvilli Deshayes, 1859: *l. c.,* p. 286, no. 56.

? *T. modesta* Deshayes, 1859: *l. c.,* p 288, no. 64.

* ?*T. matheroniana* Deshayes, 1859: *l. c.*, p. 287, no. 60.

* *T. verreauxi* Deshayes, 1859: *l. c.*, p. 286, no. 55.

A widely distributed species which exhibits a remarkable range of color variations; yellow, fawn, white, light-blue, dark-gray, and in Queensland, Australia, an unusual green color without the white line on the body whorl. Individual specimens will occasionally make a transition from yellow to dark gray in mid-growth. The sculpture remains constant except for the varying width and number of axial ribs. A common species. Sulu; Luzon (CM no. 127163; DM no. 3557; B no. 458).

*(x) *H.* (*Hastula*) *dispar* (Deshayes, 1859): Proc. Zool. Soc. London, p. 284, no. 46; Fig.: Reeve; Conch. Icon., 1860, T., pl. 25, no. 137.

This species is commonly collected at Broome, Western Australia (B no. 317), but has not been among Philippine specimens examined.

H. (*Impages*) *exacuminata* Sacco, 1891: I Moll. d. Terr. Terz. Piem. e Liguria, pt. 10, T., p. 18.

T. acuminata Reeve, 1860: Conch. Icon., T., pl. 26, no. 143 (*non* Borson, 1820).

An uncommon species. Batangas Bay, Luzon (B no. 161).

* *H.* (*Hastula*) *hastata* (Gmelin, 1791): Syst. Nat., Ed. 13, p. 3502; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 10, fig. 23.

This common species of Florida and the Caribbean Sea areas (DM no. 1746; B no. 312) has not been among specimens in the collections examined.

H. (*Hastula*) *inconstans* (Hinds, 1844): Proc. Zool. Soc. London for 1843: 156; Fig.: Hinds in Sowerby, 1844, Thes. Conch., T., pl. 44, fig. 83.

* *T. aciculina* Reeve, 1860: Conch. Icon., T., pl. 23, (in part), figs. 121 b, 121 d, 121 e (*non* Lamarck, 1822).

H. confusa E. A. Smith, 1877: Ann. & Mag. Nat. Hist., p. 299; Fig.: Reeve; Conch. Icon., 1860, T., pl. 23 (in part), fig. 121 d; (*non* vars. 121 c, 121 f).

T. inconstans confusa Pilsbry, 1921: Marine Moll. Hawaii, p. 301.

Uncommon in Batangas Bay, Luzon (B no. 441).

* *H.* (*Hastula*) *lanceata* (Linnaeus, 1767): Syst. Nat., Ed. 12, p. 1206, no. 486; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 10, fig. 22 (*non* figs. 22 a, 22 b).

A common species; Luzon; Sulu (CM no. 127145; DM no. 3554; B no. 205).

H. (*Punctoterebra*) *lauta* (Pease, 1869): Am. Journ. Conch. 5: 66; Fig.: Weaver: Hawaiian Mar. Moll., 1 (8): 30, no. 2.

Alabat Island; Luzon (DM no. 3574; B no. 049).

H. (*Punctoterebra*) *nitida* (Hinds, 1844): Proc. Zool. Soc. for 1843: 152; Fig.: Hinds in Sowerby; Thes. Conch., T., 1844, pl. 45, fig. 103.

T. plicatella Deshayes, 1857: Journ. Conchyl., p. 96, no. 32, pl. 3, fig. 5.

T. cernica Sowerby, 1893: Proc. Mal. Soc., 1: 43, pl. 4, fig. 1.

T. nitida var. *sicyodes* Melvill & Sykes, 1898: Proc. Mal. Soc. 3 (1): 43, pl. 3, fig. 8.

T. clappi Pilsbry, 1921: Mar. Moll. Hawaii; Proc. Acad. Nat. Sci. Phila. 69: 306; Fig.: Weaver; Hawaiian Mar. Moll. 1 (6): 22, 1960 (juvenile and sub-adult forms).

Uncommon in Batangas Bay, Luzon (Olivera; B no. 555).

H. (*Hastula*) *penicillata* (Hinds, 1844): Proc. Zool. Soc. London for 1843: 157; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 91.

*(x) *T. venosa* Hinds, 1844: Proc. Zool. Soc. London for 1843: 157; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 90.

T. lanceata Kiener, 1839: Icon. Coq. Viv., T., pl. 10, figs. 22 a, 22 b (*non* fig. 22).

T. crossi Deshayes, 1859: Proc. Zool. Soc. London, p. 289, no. 67.

A species of wide distribution, described by Hinds from the Seychelles Islands and recorded at Mauritius by Viader. It also occurs in Japan (B no. 505), New Guinea (B no. 297) and at Easter Island (B no. 169), all Pacific localities. I have not yet seen it in Philippine material.

* *H.* (*Punctoterebra*) *plumbea* (Quoy & Gaimard, 1832): Voy. Astrolabe, Moll., p. 470, pl. 36, figs. 29, 30.

T. bourguignati Deshayes, 1859: Proc. Zool. Soc. London, p. 288, no. 66.

T. hoffmeyeri Abbott, 1952: Nautilus 65 (3): 78, pl. 5, figs. 5 to 9.

A variable species in that occasional specimens do not have the punctate sulcus; some are quite without spiral sculpturing, while others from the same colony are microscopically striate. Mindanao; Luzon (DM no. 3572; B no. 376).

H. (*Hastula*) *solida* (Deshayes, 1857): Journ. Conchyl., p. 78, pl. 3, fig. 11.

T. clarkei M. Smith, 1912: Nautilus 26 (6): 75, pl. 4, fig. 18.

Common in Cebu; Luzon (CM no. 127153; DM no. 3537; B no. 201).

*(x) *H.* (*Hastula*) *stylata* (Hinds, 1844): Proc. Zool. Soc. London for 1843: 152; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 79.

H. confusa E. A. Smith, 1877: Ann. & Mag. Nat. Hist., p. 299; Fig.: Reeve; Conch. Icon., 1860, T., pl. 23, (in part), figs. 121 c, 121 f, only).

"Philippines" and "Japan" given as localities by Hinds.

The species has not been among specimens examined, although it is collected, rarely, at Ogasawara Island, Japan (B no. 516).

Terebra

Terebra (*Cinguloterebra*) *adamsi* E. A. Smith, 1873: Ann. & Mag. Nat. Hist., 6: 264. Unfigured.

Some resemblance in superficial appearance to *T. serotina* Adams & Reeve. Rare in Batangas Bay, Luzon. (Olivera; B no. 085).

* *T.* (*Decorihastula*) *affinis* Gray, 1834: Proc. Zool. Soc. London, p. 60; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 78 (*non* Turton, 1932).

T. striata Quoy & Gaimard, 1832: Voy. Astrol., p. 468, pl. 36, figs 23, 24 (*non* Basterot, 1825; *non* Gray, 1834).

T. pertusa Kiener, 1839: Icon. Coq. Viv., T., pl. 11, fig. 24 b only. (*non* Born, 1780).

Common in many localities; Cebu; Luzon; Alabat Island (CM no. 127138; DM no. 3570; B no. 370).

*(x) *T.* (*Dimidacus*) *albomarginata* Deshayes, 1859: Proc. Zool. Soc. London, p. 314, no. 212; Fig.: Reeve; Conch. Icon., 1860, T.,, pl. 15, fig. 65.

Apparently a rare species. Luzon. (DM no. 3539, in part).

T. (*Dimidacus*) *amanda* Hinds, 1844: Proc. Zool. Soc. London for 1843: 154; Fig.: Hinds in Sowerby; Thes. Conch. 1844, T., p. 166, no. 46, pl. 45, fig. 100.

A rare species. Batangas Bay, Luzon (Olivera Collection).

T. (*Strioterebrum*) *ambrosia* Melvill, 1912: Proc. Mal. Soc. 10: 250, pl. 11, fig. 10.

A rare species. Batangas Bay, Luzon (B no. 249).

T. (*Perirhoe*) *anilis* (Röding, 1798): Mus. Bolt., p. 95, no. 46; Fig.: Chemnitz; Conch. Cab., (4), pl. 155, no. 1456.

T. strigilata Chemnitz, 1780: Conch. Cab., above fig. (*non* Linnaeus, 1758).

6 4 111

T. cancellata Röding, 1798): Mus. Bolt., p. 95, no. 47; Fig.: Chemnitz; Conch. Cab., above fig. (*non* Quoy & Gaimard, 1832; *non* Gray, 1834; *non* Cossman, 1900).

T. myuros Lamarck, 1822: Anim. sans Vert., 7: 289; no. 18; Fig.: (in part) Conch. Cab., above fig.(*non* Kiener, 1839; *non* Reeve, 1860).

* *T. straminea* Gray, 1834: Proc. Zool. Soc. London, p. 62; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 42, figs. 22, 23.

T. acuta Deshayes, 1857: Journ. Conchyl. 6: 100, pl. 4, figs. 4, 5.

T. circinata Deshayes, 1857: *ibid.*, p. 99, pl. 4, figs. 6, 7.

Common in many localities. Luzon (CM no. 127130; DM no. 3542; B no. 220).

T. (*Perirhoe*) *archimedes* Deshayes, 1859: Proc. Zool. Soc. London, p. 314; Fig.: Schepman; Siboga Exped., 1913, pt. 5, Toxoglossa, pl. 25, fig. 12.

Batangas Bay, Luzon (CM no. 127136; B no. 458).

T. (*Subula*) *areolata* (Link, 1806): Beschr. Nat. Samm. Univ. Rostock, p. 128; Fig.: Chemnitz; Conch. Cab., 1780, (4), T., pl. 153, fig. 1441 and pl. 154, fig. 1443 (*non* Adams & Reeve, 1850).

T. subulata (Martini-Chemnitz, 1780): Conch. Cab., pl. 153, fig. 1441 (*non* Linnaeus, 1767).

* *T. muscaria* Lamarck, 1822: Anim. sans Vert. 7: 285, no. 5; Fig.: Chemnitz; Conch Cab., 1780, (4), T., pl. 153, fig. 1441; pl. 154, fig. 1443 (*non* Kiener, 1839, pl. 3, fig. 4 b only; *non* Küster, 1841; *non* Dall, 1915).

Common throughout the area. Cebu; Luzon (CM no. 127160; DM no. 5228; B no. 424).

* *T.* (*Subula*) *argus* Hinds, 1844: Proc. Zool. Soc. London for 1843: 160; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 23, fig. 64.

? *T. candida* (Born, 1780): Mus. Vind., p. 263, pl. 10, fig. 8.

T. nebulosa Kiener, 1839: Icon. Coq. Viv., T., p. 23, no. 18, pl. 10, fig. 21 (*non* Sowerby, 1825; *non* Lorois, 1858).

A common species. Luzon; Sulu (CM no. 127164; DM no. 3571; B no. 189).

* *T.* (*Perirhoe*) *babylonia* Lamarck, 1822: Anim. sans Vert., 7: 287, no. 9; Fig.: Kiener, Icon. Coq. Viv., 1839, T., pl. 14,(in part), fig. 35 only.

T. striata Gray, 1834: Proc. Zool. Soc. London, p. 60 (*non* Basterot, 1825; *non* Quoy & Gaimard, 1832).

A common species. Batangas Bay, Luzon (CM no. 127158; DM no. 773; B no. 192).

*(x) *T.* (? *Hastula*) *caliginosa* Deshayes, 1859: Proc. Zool Soc. London, p. 287, no. 62; Fig.: Reeve; Conch. Icon., 1860, T., pl. 20, no. 100.

Has not been among specimens examined.

* *T.* (*Strioterebrum*) *cancellata* Quoy & Gaimard, 1832: Voy. Astrol., Moll., 2: 471, pl. 36, figs. 27, 28 (*non* Röding, 1798; *non* Gray, 1834).

In the Manual of Conchology, Vol. 7, 1885, Tryon has placed some eleven specific names in the synonymy of this species; almost all of them are in error. Common in several localities. Luzon (DM no. 3576; B no. 444).

* *T.* (*Abreticlla*) *cerithina* Lamarck, 1822; Anim. sans Vert. 7: 288, no. 15; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 11, fig. 25.

T. pulchra Hinds, 1844: Proc. Zool. Soc. London for 1843: 151; Fig.: Hinds in Sowerby; Thes. Conch.,

1844, T., p. 178. pl. 45, fig. 129.

Common at Cebu; Luzon; Sulu (CM no. 127159; DM no. 3541; B no. 182).

* *T.* (*Oxymeris*) *chlorata* LAMARCK, 1822: Anim. sans Vert. 7: 288, no. 14; Fig.: KIENER; Icon. Coq.Viv., 1839, T., pl. 4, figs. 8, 8 a (*non* MARTENS, 1902).

T. knorri GRAY, 1834: Proc. Zool. Soc. London, p. 59.

Common at Cebu; Luzon; Sulu (CM no. 127162; DM no. 4397; B no. 106).

*(x) *T.* (*Dimidacus*) *cingulifera* LAMARCK, 1822: Anim. sans Vert., 7: 289, no. 17; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 13, fig. 30.

T. punctulata SOWERBY, 1825: Tank. Cat. App., p. 24.

T. punctatostriata GRAY, 1834: Proc. Zool. Soc. London, p. 61.

T. pallida DESHAYES, 1857: Journ. Conchyl., p. 87, no. 22, pl. 4, fig. 3.

T. chinensis DESHAYES, 1859: Proc. Zool. Soc. London, p. 309, no. 189.

T. columnaris DESHAYES, 1859: *ibid.*, p. 310, no. 195.

T. crenifera DESHAYES, 1859: *ibid.*, p. 298, no. 115.

Common at Luzon; Samar (CM no. 127156; DM no. 4480; B no. 211).

T. (*Decorihastula*) *columellaris* HINDS, 1844: Proc. Zool. Soc. London for 1843: 151: Fig.: HINDS in SOWERBY; Thes. Conch., 1844, T., pl. 44, fig. 77.

T. areolata ADAMS & REEVE, 1850: Voy. Samarang, p. 30, no. 4, pl. 10, fig. 23 (*non* LINK, 1806).

? *T. propinqua* PEASE, 1869: Amer. Journ. Conch., 5: 66.

Common. Batangas Bay, Luzon (CM no. 127150; DM no. 3540 in part; B no. 217).

*(x) *T.* (*Dimidacus*) *consobrina* DESHAYES, 1857: Journ. Conchyl., p. 72, pl. 3, fig. 3.

This species of the Red Sea area (B no. 431) is easily confused with some sculptural variations of *T. subulata* (LINNAEUS). It has not been included among specimens examined.

T. (*Subula*) *consors* HINDS, 1844: Proc. Zool. Soc. London for 1843: 150; Fig.: HINDS in SOWERBY; Thes. Conch., 1844, T., pl. 42, fig. 26.

T. virginea DESHAYES, 1857: Journ. Conchyl., p. 83, no. 18, pl. 4. fig. 12.

T. glabra DESHAYES, 1857: *ibid.*, p. 101, no. 37, pl. 5, fig. 13.

Apparently an uncommon-to-rare species. Closely resembling *T. dimidiata* (LINNAEUS), it can be recognized by the less-subulate form, much weaker color pattern, and more prominent subsutural collar (Olivera; B no. 500).

*(x) *T.* (*Decorihastula*) *conspersa* HINDS, 1844: Proc. Zool. Soc. London for 1843: 153; Fig.: HINDS in SOWERBY; Thes. Conch., 1844, T., pl. 44, fig. 74.

Rare among specimens examined, a single specimen collected at Luzon, representing the only example seen from this area. It is a not uncommon species in Fiji Islands localities (B no. 227). Batangas Bay (Olivera).

* *T.* (*Oxymeris*) *crenulata* (LINNAEUS, 1758): Syst. Nat., Ed. 10, p. 741, no. 416; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 5, figs. 9, 9 a.

T. dentata (PETIVER, 1767): Anim. Amboin.; pl. 8, fig. 13.

T. varicosa (GMELIN, 1791): Syst. Nat., Ed. 13, p. 3505, no. 165 (*non* HINDS, 1844).

T. coronatus (HUMPHREY, 1797): Mus. Calonn., p. 31.

T. maculata PERRY, 1811: Conch. 5:pl. 16, fig. 2 (*non* LINNAEUS, 1758).

*(x) *T. fimbriata* DESHAYES, 1857: Journ. Conchyl., p. 71, pl. 5, fig. 1.

*(x) *T. interlineata* DESHAYES, 1859: Proc. Zool. Soc. London, p. 277, no. 8.

T. crenulata var. *booleyi* MELVILL & SYKES, 1898: Proc. Mal. Soc. Lond., 3: 44, pl. 3, fig. 5

Common in almost all localities. Luzon; Samar; Sulu (CM no. 127142; DM no. 4296; B no. 145).

*(x) *T.* (*Strioterebrum*) *cumingi* DESHAYES, 1857: Journ. Conchyl., p. 66, no. 2, pl. 3, fig. 1.

Uncommon in Batangas Bay, Luzon, where two color forms are found; both noted by DESHAYES (Olivera; B no. 036).

* *T.* (*Subula*) *dimidiata* (LINNAEUS, 1758): Syst. Nat., Ed. 10, p. 420, no. 420; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 2, figs. 2, 2 a.

T. pantherina (HUMPHREY, 1797): Mus. Calonn.,p. 31.

T. carnea PERRY, 1811: Conch. 5: pl. 16, fig. 1.

*(x) *T. splendens* DESHAYES, 1857: Journ. Conchyl., p. 73, pl. 5, fig. 11.

T. chlorata MARTENS, 1902: Rumphius Ged., p. 120 (*non* LAMARCK, 1822).

T. dimidiata var. *pallida* DAUTZENBERG, 1935: Mem. Mus. Hist. Nat. Belg., Ser. 2, 17: 23 (*non* DESHAYES, 1857).

T. dimidiata var. *circumvoluta* DAUTZENBERG, 1935: *ibid.*, p. 22, pl. 1, fig. 4.

Common in many localities. Luzon; Samar; Sulu (CM no. 127161; DM no. 3099; B no. 176).

T. (*Oxymeris*) *felina* (DILLWYN, 1817): Cat. Shells, p. 644, no. 135; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 3, fig. 4 b only (*non* fig. 4).

T. tigrina (GMELIN, 1791): Syst. Nat., Ed. 13, p. 3502 (*non* p. 3475); (*non* CHENU, 1859).

T. tigrina DESHAYES, 1844: Anim. sans Vert., 2nd. Ed., p. 252, no. 26.

T. suffusa PEASE, 1869: Am. Journ. Conch. 5: 65.

Not uncommon. Cebu; Luzon; Samar (CM no. 127149; DM no. 3550; B no. 120).

*(x) *T.* (*Strioterebrum*) *fenestrata* HINDS, 1844: Proc. Zool. Soc. London for 1843: 153; Fig.: HINDS in SOWERBY; Thes. Conch., 1844, T., pl. 44, fig. 86.

*(x) *T. caelata* ADAMS & REEVE, 1850: Voy. Samarang, Moll., p. 30, pl. 10, fig. 22.

Very uncommon. Maqueda Bay, Samar; Batangas Bay, Luzon (Olivera; B no. 037).

T. (*Decorihastula*) *fijiensis* (E. A. SMITH, 1873): Ann. & Mag. Nat. Hist. 11 (ser. 4): 266; unfigured.

Closely resembles *Terebra undulata* GRAY, *T. columellaris* HINDS and *T. paucistriata* E. A. SMITH in superficial appearance. The slender form, style of coloration and more numerous spiral striae serve to assist in identification. Uncommon in Batangas Bay, Luzon (B no. 221).

*(x) *T.* (*Terebra*) *flammea* LAMARCK, 1822: Anim. sans Vert., 7: 284, no. 2; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 5, fig. 10.

This name is a synonym for *Terebra taurina* SOLANDER, 1786; LIGHTFOOT has recently been recognized as the author of the Portland Catalogue in which this name is first applied to the species (Bibliog. Nat. Hist., 4 (1): 30 to 34, 1962). The species ranges through the Gulf of Mexico and to northern Brazil (B no. 159) but is not known from the Philippine area.

T. (*Strioterebrum*) *flavescens* DESHAYES, 1859: Proc. Zool. Soc. London, p. 299, no. 122; Fig.: REEVE, Conch. Icon., 160, T., pl. 14, fig. 59.

Very uncommon. Subic Bay (Ames Collection, San Diego, California; B no. 214).

*(x) *T.* (*Clathroterebra*) *fortunei* DESHAYES, 1857: Journ. Conchyl., p. 79, pl. 4, fig. 1.

Not uncommon in Japan (B no. 320); the species has not been among specimens seen from Philippine localities.

* *T.* (*Perirhoe*) *funiculata* HINDS, 1844: Proc. Zool. Soc. for 1843: 153; Fig.: HINDS in SOWERBY; Thes. Conch., 1844, T., pl. 43, fig. 63.

A common species. Luzon; Samar; Alabat Island (CM no. 127129; DM no. 3562; B no. 001).

T. (*Terebra*) *guttata* (RÖDING, 1798): Mus. Bolt., p. 14, no. 1214; Fig.: CHEMNITZ; Conch. Cab., 4, 1780, pl. 153, fig. 1442.

T. varia (MEUSCHEN, 1787): Mus. Gevers., p. 294 (*non* MARTYN, 1784).

T. maculata var. c. (GMELIN, 1790): Syst. Nat., Ed. 13, p. 3499, no. 130 (*non* LINNAEUS, 1758).

* *T. oculata* (DILLWYN, 1817): Descr. Cat., 2: 642, no. 133. LAMARCK, 1822, repeated this name and cited same figures.

T. nebulosa LOROIS, 1858: Journ. Conchyl. 7: 90, pl. 1, fig. 4 (*non* SOWERBY, 1825, *non* KIENER, 1839).

T. loroisi DESHAYES, 1859: Proc. Zool. Soc. London, p. 313, no. 211.

T. ornata (MARTYN, 1784): Univ. Conch., pl. 33, fig. 1 (invalid) (*non* GRAY, 1834).

Not uncommon. Batangas Bay, Luzon (DM no. 3565, juvenile specimen; B no. 097).

T. (*Perirhoe*) *laevigata* GRAY, 1834: Proc. Zool. Soc. London, p. 61; Fig.: HINDS in SOWERBY; Thes. Conch. 1844, T., pl. 44, fig. 93.

Uncommon. Luzon; Samar (CM no. 127137; DM no. 3544; B no. 233).

T. (*Strioterebrum*) *lima* DESHAYES, 1857: Journ. Conchyl., p. 69, pl. 4, fig. 2.

Rare in Batangas Bay, Luzon (CM no. 127135; B no. 457).

* *T.* (*Decorihastula*) *livida* REEVE, 1860: Conch. Icon., T., no. 116, pl. 22.

Rare at Bataan and Batangas Bay, Luzon (CM no. 127131; DM no. 3573; Olivera).

*(x) *T.* (*Decorihastula*) *longiscata* DESHAYES, 1859: Proc. Zool. Soc. London, p. 294, no. 94; Fig.: REEVE; Conch. Icon., 1860, T., no. 103, pl. 21.

T. swainsoni DESHAYES, 1859: Proc. Zool. Soc. London, p. 299, no. 126; Fig.: REEVE; Conch. Icon., 1860, T., no. 118, pl. 22.

Very uncommon. Batangas Bay, Luzon (CM no. 127133; DM no. 4572; B no. 178).

* *T.* (*Oxymeris*) *maculata* (LINNAEUS, 1758): Syst. Nat., Ed. 10, p. 741, no. 415; Fig.: KIENER; Icon. Coq. Viv., 1839, T., pl. 1, fig. 1).

Common. Luzon; Mindoro; Sulu (CM no. 127143; DM no. 4395; B no. 454).

*(x) *T.* (*? Strioterebrum*) *mamillata* WATSON, 1886: Voy. Challenger, 15: 381, no. 15, pl. 16, fig. 1.

I have not seen this species among the specimens examined.

* *T.* (*Cinguloterebra*) *monilis* QUOY & GAIMARD, 1832: Voy. Astrol., Moll., 2: 467, pl. 36, figs. 21, 22 (*non* LINNAEUS, 1771; *non* MENKE, 1830).

Not uncommon. Cebu; Luzon; Alabat Island (CM no. 127132; DM no. 3568; B no. 011).

*(x) *T.* (*Decorihastula*) *nebulosa* SOWERBY, 1825: Tank. Cat. Append., p. 25 (*non* KIENER, 1839; *non* LOROIS, 1858).

Common in most localities. Luzon; Sulu (CM no. 127148; DM no. 3561; B no. 215).

T. (*Decorihastula*) *paucistriata* (E. A. SMITH, 1873): Ann. & Mag. Nat. Hist. 11: 269. Unfigured.

Superficially resembles sub-adult specimens of *T. undulata* GRAY. It can be distinguished by the smaller size, more slender form, spiral sculpture, and style of coloration. Rare in Batangas Bay, Luzon (B no. 588).

T. (*Decorihastula*) *pertusa* (BORN, 1780): Mus. Vind., p. 267, pl. 10, fig. 13 (*non* BASTEROT, 1825; *non* KIENER, 1839; *non* SOWERBY, 1897).

T. undata DeFrance, 1829: Dict. Sci. Nat.

T. bermonti Lorois, 1857: Journ. Conchyl., 2nd. ser., p. 389, pl. 12, fig. 2. The figure does not fit the description.

The single specimen seen was collected at Luzon (DM no. 3101).

*(x) *T.* (*Decorihastula*) *picta* Hinds, 1844: Proc. Zool. Soc. London for 1843: p. 156; Fig.: Hinds in Sowerby; Thes. Conch., 1844. T., pl. 45, fig. 105.

Very uncommon. Luzon; Alabat Island (Olivera; B no. 007).

*(x) *T.* (*Strioterebrum*) *polygyrata* Deshayes, 1859: Proc. Zool. Soc. London, p. 301, no. 138; Fig.: Reeve; Conch. Icon., 1860, T., pl. 26, no. 146.

* *T. polyanata* Paetel, 1888: Cat. Conch.-Samml., p. 253.

Uncommon. Luzon (DM no. 3236; B no. 513).

*(x) *T.* (*Myurella*) *pretiosa* Reeve, 1842: Proc. Zool. Soc. London, p. 200; Fig.: Reeve; Conch. Icon., 1860, T., no. 30, pl. 8.

This species of Japan (B no. 191) has not been among Philippine specimens examined.

*(x) *T.* (?*Strioterebrum*) *pulchella* Deshayes, 1857: Journ. Conchyl., p. 94, pl. 5, fig. 4 (*non* Röding, 1798; *non* Adams & Angas, 1863).

Not among the specimens seen.

*(x) *T.* (*Strioterebrum*) *roseata* Adams & Reeve, 1850: Voy. Samarang, Moll., p. 30, pl. 10, fig. 24.

Rare. Bataan, Luzon (CM no. 127134).

T. (*Myurella*) *scabrella* Lamarck, 1822: Anim. sans Vert., 10: 247, no. 19; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 14, fig. 34 a only.

T. myuros Kiener, 1839: Icon. Coq. Viv., T., pl. 14, fig. 34 a; *non* fig. 34.

T. myuros Reeve, 1860: Conch. Icon., T., no. 31, pl. 8 (*non* Lamarck, 1822).

A single specimen collected at Luzon (DM no. 3560).

*(x) *T.* (*Cinguloterebra*) *serotina* Adams & Reeve, 1850: Voy. Samarang, Moll., p. 30, pl. 10, fig. 20.

This species of Japan (B no. 329) has not been among specimens examined.

*(x) *T.* (*Oxymeris*) *strigata* Sowerby, 1825: Tank. Cat. App., p. 25 (*non* Gmelin, 1790).

Ranging the eastern area from Mexico (B no. 276) to Peru, this speciees has not been among specimens examined.

* *T.* (*Terebra*) *subulata* (Linnaeus, 1767): Syst. Nat., Ed. 12, p. 1205, no. 480; Fig.: Kiener, Icon. Coq. Viv., 1839, T., pl. 4, fig. 6.

T. cornu (Bonanni, 1773): Mus. Richter., p. 98, pl. 3, fig. 118.

T. varia (Martyn, 1784): Univ. Conch., Chenu Ed., 1845, pl. 33, fig. 2 a (*non* Meuschen, 1787).

T. leopardalis (Humphrey, 1797): Mus. Calonn., p. 31.

Terebrum tigreum Montfort, 1810: Conch. Syst., 2: 430, fig. 2.

T. fusca Perry, 1811: Conch., T. 16, fig. 3 (*non* Martyn, 1784).

T. tigrina Chenu, 1859: Man. Conch. 1: 219, fig. 1207.

Common at Cebu; Luzon; Samar (CM no. 127141; DM no. 4470; B no. 175).

*(x) *T.* (*Dimidacus*) *succinea* Hinds, 1844: Proc. Zool. Soc. London for 1843: 149; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 42, fig. 40.

This, species, also cited from Japan (Oyama, Venus, 21 (4): 454, 1961), has not been among specimens examined.

* *T.* (*Strioterebrum*) *textilis* Hinds, 1844: Proc. Zool. Soc. London for 1843: 156; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 73.

While the species is wide-ranging and not uncommon in the Indo-Pacific, it has not been among the Philippine specimens seen.

* *T.* (*Triplostephanus*) *triseriata* Gray, 1834: Proc. Zool Soc. London, p. 61; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 45, fig. 119.

T. praelonga Deshayes, 1859: Proc. Zool. Soc. London, p. 315, no. 221; Fig.: Reeve; Conch. Icon., 1860, T., pl. 8, fig. 28.

Very uncommon. Batangas Bay, Luzon (DM no. 3551; B no. 032).

T. (?*Strioterebrum*) *tuberosa* Hinds, 1844: Proc. Zool. Soc. London for 1843: 291; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 45, fig. 99.

This species has not been among the specimens examined.

*(x) *T.* (*Strioterebrum*) *undatella* Deshayes, 1859: Proc. Zool. Soc. London, p. 300, no. 129; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 44, fig. 80.

This is *T. cancellata* Quoy & Gaimard, 1832 (*non* Röding, 1798).

* *T.* (*Decorihastula*) *undulata* Gray, 1834: Proc. Zool. Soc. London, p. 61; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 43, fig. 55 (*non* Grateloup, 1841).

T. pertusa Kiener, 1839: Icon. Coq. Viv., T., pl. 11, fig. 24 c only.

T. approximata Deshayes, 1859: Proc. Zool. Soc. London, p. 299, no. 125.

T. undulata var. *laevior* Schepman, 1913: Siboga Exp., Toxoglossa, pt. 5, p. 372, no. 21, pl. 25, fig. 9.

Common. Luzon; Samar (CM 127155; DM 4295; B no. 159).

*(x) *T.* (*Striotcrebrum*) *variegata* Gray, 1834: Proc. Zool. Soc. London, p. 61; Fig.: Kiener; Icon. Coq. Viv., 1839, T., pl. 2, fig. 3.

A species of western Mexico (B no. 171); not among Philippine specimens seen.

*(x) *T.* (*Clathroterebra*) *violascens* Hinds, 1844: Proc. Zool. Soc. London for 1843: 154; Fig.: Hinds in Sowerby; Thes. Conch., 1844, T., pl. 45, fig. 98.

This small species was described from the "Philippines," but it has not been among specimens of the area, seen by the author to date. It has been recorded in New Guinea (Hinds, Voy. Sulphur), Mauritius (Viader, Maurit. Inst. Bull. 1 (2)) and the Fijis (Cate & Burch, The Veliger 6 (3)).

Several of the above unverified species were described from the "Philippines" or have been reported as collected in that area. When possible, I have attempted to provide a general locality for those listed species which have not been among specimens seen during this study.

Generic and sub-generic names, with authors and type species, are as follows:

Abretiella Bartsch, 1923: *T. corithina* Lamarck, 1822.
Cinguloterebra Oyama, 1961: *T. hedleyana* Pilsbry, 1905
Clathroterebra Oyama, 1961: *T. fortunei* Deshayes, 1857.
Decorihastula Oyama, 1961: *T. affinis* Gray, 1834.
Dimidacus Iredale, 1929: *T. melamans* (Iredale, 1929).
Terebrina Bartsch, 1923: *T. cingulifera* Lamarck, 1822.
Duplicaria Dall, 1908: *T. duplicata* (Linnaeus, 1758).
Diplomeriza Dall, 1919: *T. duplicata* (Linnaeus, 1758).
Hastula H. & A. Adams, 1853: *H. concinna* (Dillwyn, 1817); Syn.: *T. strigilata* (Linnaeus, 1758) in part.
Acuminia Dall, 1908: *T. lanceata* (Linnaeus, 1767).
Hastulina Oyama, 1961: *H. casta* (Hinds, 1844).
Impages E. A. Smith, 1873: *H. caerulescens* (Lamarck, 1822).
Myurella Hinds, 1844: *T. myuros* Lamarck, 1822.
Noditerebra Cossman, 1896: *T. geniculata* Tate, 1886.
Oxymeris Dall, 1908: *T. maculata* (Linnaeus, 1758).
Acus Humphrey, 1840; *non* Müller, 1767.
Perirhoe Dall, 1908: *T. circumcincta* Deshayes, 1857.
Pristiterebra Taki & Oyama, 1954: *T. tsuboiana* Yokoyama, 1922; = *T. bifrons* Hinds, 1844.
Punctoterebra Bartsch, 1923: *T. nitida* Hinds, 1844.
Strioterebrum Sacco, 1891: *T. basteroti* Nyst, 1843.
Subula Schumacher, 1817: *T. dimidiata* (Linnaeus, 1758).
Terebra Bruguière, 1789: *T. subulata* (Linnaeus, 1767)
Triplostephanus Dall, 1908: *T. triseriata* Gray, 1834.

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The kindness of those who have made their collections available is acknowledged with gratitude. In addition to the large collections cited here, many friends have contributed specimens and information without which this project could not have been completed. Since comparison specimens from other than Philippine areas were necessary in order to establish satisfactory identification of some species, the assistance of students and collectors in other areas has been invaluable. In addition to the species cited from the collection of Mr. Baldomero M. Olivera, large quantities of specimens with excellent locality data have been provided by Mrs. Nieves Dayrit, Mr. Pedro de Mesa and Mr. Donald Dan of the Philippines. Among the larger of the world-wide collections of Terebridae loaned for study were those of Mr. Walter Eyerdam of Seattle, Washington, and Mr. Harold P. Post of Lantana, Florida. Specimens and collections from more restricted localities which have been important in establishing identifications were generously loaned or donated by Dr. Tokyo Shikama and Mr. Akibumi Teramachi of Japan; Mr. and Mrs. C. H. Ames, currently of San Diego, California, generously loaned their large collection made in Japan and at Guam. Also from Guam were many specimens collected by Mr. Herbert T. Ward. Other specimens used in making identifications were sent in quantity with excellent data by Mrs. Mary Elborne of Queensland and Mr. Ted Crake of Western Australia, by Mrs. Isobel Pert of New Guinea, and by Mrs. Mary Saul of Sabah (formerly North Borneo). To all of these and the many others who generously gave of their time, assistance and advice, I wish to express my gratitude.

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A New Species of *Mitra* from the Western Indian Ocean

(Mollusca: Gastropoda)

BY

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(Plate 28)

In mid-July of 1962 I was sent a large and unusual specimen of *Mitra* for identification. The data with it and subsequent correspondence concerning it proved as interesting as the shell itself; it is *ex pisce,* collected off Durban, South Africa. by the same individual who has from time to time furnished, also *ex pisce,* such rare molluscan species as *Voluta* (*Alcithoe*) *ponsonbyi* E. A. Smith, 1901, *V.* (*A.*) *africana* Reeve, 1856, *Cypraea* (*Bernaya*) *fultoni* Sowerby, 1903 and others, mostly of unknown habitat. Along with some additional conchological rarities, the miter was obtained in January 1962 by Mrs. Helen Boswell, who was at that time living in Johannesburg.

Unable to identify this unfamiliar mitrid from the literature and comparative material available to her, Mrs. Boswell forwarded it to Mr. S. P. Dance at the British Museum (Natural History), who some months later sent it on to me at Mrs. Boswell's suggestion. Mr. Dance's letter accompanying the shell stated that nothing like it existed in the collections at the British Museum, and that after a thorough search there he was now convinced it must be an undescribed species.

In September 1962 Mrs. Boswell had the opportunity to visit the British Museum personally, at which time she also carefully looked through the *Mitra* collection without being able to locate a specimen resembling her own, thus verifying Mr. Dance's earlier conclusion that it was probably an unknown species. Meanwhile, I had been searching through all the specialized literature on Mitridae available to me, as well as checking other collections — always with the same result. A few possibilities came to mind while I was studying the type figures of certain species unfamiliar to me; Mr. Dance very kindly rechecked these in the British Museum's type collection and eliminated them a second time, stating emphatically that they were quite different from Mrs. Boswell's shell.

Although they have done more work on this problem than I have, both Mrs. Boswell and Mr. Dance have requested that I describe the species, since it comes within the scope of my particular interest. We realize it is not ordinarily considered good malacological practice to describe a new species from a unique specimen, especially a dead one from an unknown locality — but the fact that the incomparable mollusk collection at the British Museum, which probably houses at least three-fourths of the type material in Mitridae, has on two occasions been thoroughly searched for a similar species without success, and further, that nothing like it can be found in existing literature, make the deviation from the unwritten rule in this case seem justifiable. It therefore gives me a great deal of pleasure to describe the newly-discovered form as

Mitra (Mitra) boswellae J. Cate, spec. nov.

(See Plate 28, figures 1, 2)

Shell large (70.5 mm long, 24.1 in greatest diameter, 38.8 mm aperture length), smooth; apex white, slightly eroded; 7 post-nuclear whorls convex, shining; sutures impressed and slightly crenulated. Early whorls finely spirally puncto-striate; spiral punctations obsolete on last three whorls except immediately below the sutures, where 3 to 4 faint impressed lines may be seen.

Aperture longer than the spire; outer lip smooth, though chipped posteriorly and broken off at abapical end. Columella with four strong oblique folds and one weak fold abapically; columellar lip thin, translucent.

Color of shell generally rusty-brown, with pale mauve irregular patches and smooth, narrow spiral lines of a deeper rust-brown at more or less regular intervals. The brown lines coincide with some of the impressed punctate striae, except where these become obsolete; possibly in live-collected specimens all of the brown lines may be punctate. The aperture is a uniform medium beige color.

The type locality of *Mitra boswellae* is off Durban, Natal, southeast Africa (29° 51′ So. Lat., 31° 00′ E. Long.); however, when living specimens are found it may be necessary to designate a different type locality, more appropriate for this mollusk, rather than its predator fish.

The holotype has been deposited in the type collection of the South African Museum, Capetown, where it is catalogued as S. Afr. Mus. Reg. no. A 29799.

This unique shell seems to be in a fairly good state of

preservation, though without additional material for comparison it is impossible to know whether its color and pattern are typical of those in living animals, and whether the surface ornament may have become eroded through contact with the stomach fluids of the fish. There are two or three unidentified small barnacles and a minute coral growth within the abapical end of the aperture, which would indicate that the specimen may have been dead when ingested by the fish; it is not possible to tell how long it had been dead nor how long it was retained in the fish stomach — and both these circumstances could have an important influence on the condition of the specimen. The fishes generally acknowledged as predatory on the rare molluscan forms already mentioned are migratory species with relatively wide-ranging habits of travel; furthermore, the fishes themselves are rare enough that their usual migratory patterns have not been established and therefore no accurate surmise may be made as to where the mollusks were picked up.

There are only three species even remotely comparable to *Mitra boswellae* that are figured in the various monographs on Mitridae. These are *M. nubila* (Gmelin, 1791) (*M. versicolor* Martyn, 1784), *M. nebulosa* Reeve, 1844 (*non* Broderip, 1836), and *M. brettinghami* E. A. Smith, 1906 (*M. propinqua* Sowerby, 1874, *non* A. Adams, 1853). Mr. Dance has compared *M. boswellae* with the first two of these; his reply states "I have checked on *Mitra versicolor* Martyn — figures and specimens so-labelled in B. M. Coll. — it is not the same as Mrs. B's shell and not really very similar either. It is not *M. nebulosa* Brod. either. In fact it's like nothing in our collections as far as I can see. As such a large shell would not be easily overlooked in collections or in the literature it would indicate a n. sp."

I compared *Mitra boswellae* with a fine example of *M. brettinghami* in the collection of E. W. Ulrich of Long Beach, California, and found it different from that species also, being less obese than *M. brettinghami,* with a smoother and less flaring lip, and with a more patchy, map-like pattern, whereas *M. brettinghami* has a wavy, strigate pattern.

I am honored by the compliments implicit in having been consulted regarding this problem, and am grateful to both Mrs. Boswell and to Mr. Dance for allowing me the privilege of collaborating with them.

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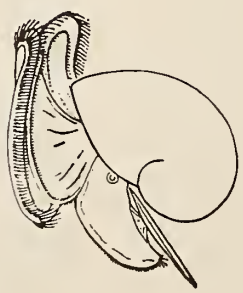

Figure 1 a Figure 1 b

Ventral and dorsal aspects of
Mitra (*Mitra*) *boswellae* J. CATE, spec. nov.

photo. TAKEO SUSUKI

The Cowrie *Mauritia eglantina* (Duclos, 1833) in Fiji

BY

FRANZ ALFRED SCHILDER

AND

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University of Halle, German Democratic Republic

(1 Map)

Mr. Walter O. Cernohorsky, Vatukoula, Fiji, was so kind to send us, since 1961, about 2500 cowries collected by himself on the reefs surrounding Vitilevu, the largest island in the Fiji Islands. Most shells contained the animals well preserved in alcohol so that we could ascertain the sex of adult specimens and study the features of the radula.

Mauritia (*Arabica*) *eglantina* (Duclos, 1833) is the most frequent species in these collections, represented by 647 specimens, 548 of which are adult with the sex well recognizable. This great number justifies a special study of variation by statistical methods.

Our map shows the exact place of 12 localities from which Mr. Cernohorsky has sent us satisfying numbers of cowries. In Table 1 these 12 localities have been listed in a counter-clockwise sequence, beginning with the east coast of the island of Vitilevu and ending with the small island of Vatulele about 20 miles off its south coast.

We did not think it necessary to publish the sum of each frequency distribution, nor the standard error of each mean, though we have calculated these figures. In discussing the mathematical significance of differences we have indicated the index t, which expresses the difference divided by its mean error, so that in our large populations

$t > 2.0$ indicates $P < 0.05$
$t > 2.6$ indicates $P < 0.01$
$t > 3.0$ indicates $P < 0.0027$
$t > 3.4$ indicates $P < 0.001$

(see Bancroft, 1959. p. 174); differences with $t > 3.0$ should be regarded as absolutely significant.

Table 1

column number	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
indicating	sp.	%	%	♀	♂	♀%	L	L%	BL	LT	CT	col.	mar.	spi.	pen.	rows	med.
E Lodoni	50	19	19	23	25	48	49.2	97	58.5	*u*.5	*t*.5	3.5	3.7	4.5	51.4	12.0	8.2
N Vitilevu Bay	132	35		62	50	55	44.2	87	59.0	*u*.1	*t*.3	3.3	3.9	4.2	54.2	12.0	8.1
Nananu-i-ra	90	37		44	40	52	50.4	99	59.1	*u*.2	*t*.5	3.1	3.5	4.3	50.6	12.6	8.2
Caboni (No. 2)	17	31	36	9	3		55.4	109	58.9	*u*.7	*t*.4	3.3	3.7	4.6	(50.0)	(11.5)	(8.0)
Manava Island	18	14		5	11		56.1	110	58.4	*u*.5	*t*.9	3.2	3.3	3.6	54.4	12.3	8.1
Vatia Wharf	191	44		81	67	55	57.1	112	58.5	*u*.5	*t*.7	3.2	3.2	4.5	47.7	11.7	7.8
Twin Rocks	11	37		5	6		49.1	96	59.2	*u*.7	*t*.5	3.2	3.5	4.8	(49.2)	(11.1)	8.2
W Vuda Point	91	19	20	47	29	62	47.5	93	58.8	*u*.9	*u*.0	3.4	3.2	4.5	45.2	12.5	7.8
Momi	10	33		5	5		48.1	94	60.1	*u*.4	*t*.1	4.0	2.9	3.9	(58.0)	12.1	8.4
S Cuvu	28	17		10	15		51.8	102	58.6	*u*.1	*t*.2	3.3	3.0	3.3	42.7	12.2	7.0
St. Annes-on-the-Sea	6	3	8	4	2		(55.0)	108	(58.5)	(*u*.0)	(*u*.2)	3.3	(3.0)	4.8	(57.7)	(11.8)	(8.0)
Lomalagi	—	0		—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vatulele Island	3	14		—	—	—	(47.3)	93	(58.0)	(*t*.4)	(*r*.3)	(4.0)	(2.3)	4.0	—	—	—
Total	647	26		295	253	54	50.9	100	58.7	*u*.4	*t*.6	3.3	3.5	4.3	50.1	12.1	8.0

DISTRIBUTION AND FREQUENCY

Mauritia eglantina spreads from the Ryukyu Islands and North West Australia to Samoa so that it reaches in Fiji almost its eastern limit. Nevertheless it is the most frequent species collected in Vitilevu, as it represents about one quarter of the cowries sent us by Mr. Cernohorsky. In various localities, however, the relative frequency of *M.*

eglantina is very different, varying from total absence in Lomalagi (among 89 cowries) to almost one half of all cowries (Vatia Wharf).

This fact has been illustrated by columns 1 and 2 of Table 1: column 1 gives the number of *Mauritia eglantina* present in each population, whereas column 2 expresses this in per cent of the sum of all cowries we have received from the locality.
Sixten Bock in 1917).

The centre of abundance of *Mauritia eglantina* evidently lies on the north coast of Vitilevu, where the environments of Vatia Wharf seem to be most favorable for this species; on the east and west coasts its frequency decreases, and on the south coast *M. eglantina* generally is less than a quarter as frequent as on the north coast, though it occurs around the entire island (Namuka, *leg.*

SEX

In Table 1, columns 3 and 4 indicate the number of female and male specimens respectively; the difference between the sum of the two sexes and the figure given in column 1 is due to young animals and empty shells. Column 5 expresses the number of females in per cent of the sum of both sexes; in populations containing too few *Mauritia eglantina* to yield a statistically reliable figure, the percentage of females (easily calculated) has been replaced by a point. The number of females slightly exceeds that of males, as we noted before in other cowrie species; only the population of Lodoni seems to be contradictory.

SIZE

The length of the shells has been measured in tenths of a millimeter; the mean length of adult shells (those of unknown sex included) has been indicated in column 6 of Table 1.

A rather large difference between the means of several populations is noteworthy: in fact the difference between Vitilevu Bay and Vuda Point, between Nananu-i-ra and Vatia Wharf, and between Vitilevu Bay and Vatia Wharf are mathematically significant ($P < 0.001$) as the index t is 6.6, 12.4, and even 28.3, respectively; several other differences, however, cannot be proved statistically. Similar differences in size have also been reported for other cowrie species from Fiji by ourselves as well as by Cernohorsky (1963) who suggests them to be caused by food supply. Additionally, there seems to exist also a general tendency of growing large in some regions: column 7, which contains the means expressed in per cent of the total mean 50.9 mm, shows that the populations of *Mauritia eglantina* living in the north east of Vitilevu and along its west coast are small, while those living on the south coast and particularly in the north western localities exceed the average size: these facts may possibly be an indication that currents are also responsible for the differences in size. Specimens from reefs far off the coast of Vitilevu do not differ constantly from those living at the coasts themselves: *M. eglantina* from Vatulele Island is small, that from Manava Island is large.

The variation in size within each population is rather large; we limit ourselves to indicate the variation of the four most numerous populations in classes of 5 mm (c. g. 40 = 38 to 42 mm):

millimeters:	40	45	50	55	60	65	70	75
Vitilevu Bay	43	71	15	3	—	—	—	—
Nananu-i-ra	—	21	48	18	2	1	—	—
Vatia Wharf	—	—	30	72	72	13	3	1
Vuda Point	10	40	27	14	—	—	—	—
Total	59	159	175	143	92	15	3	1
including:								
females	24	67	82	73	42	6	1	—
males	27	72	70	48	31	5	—	—

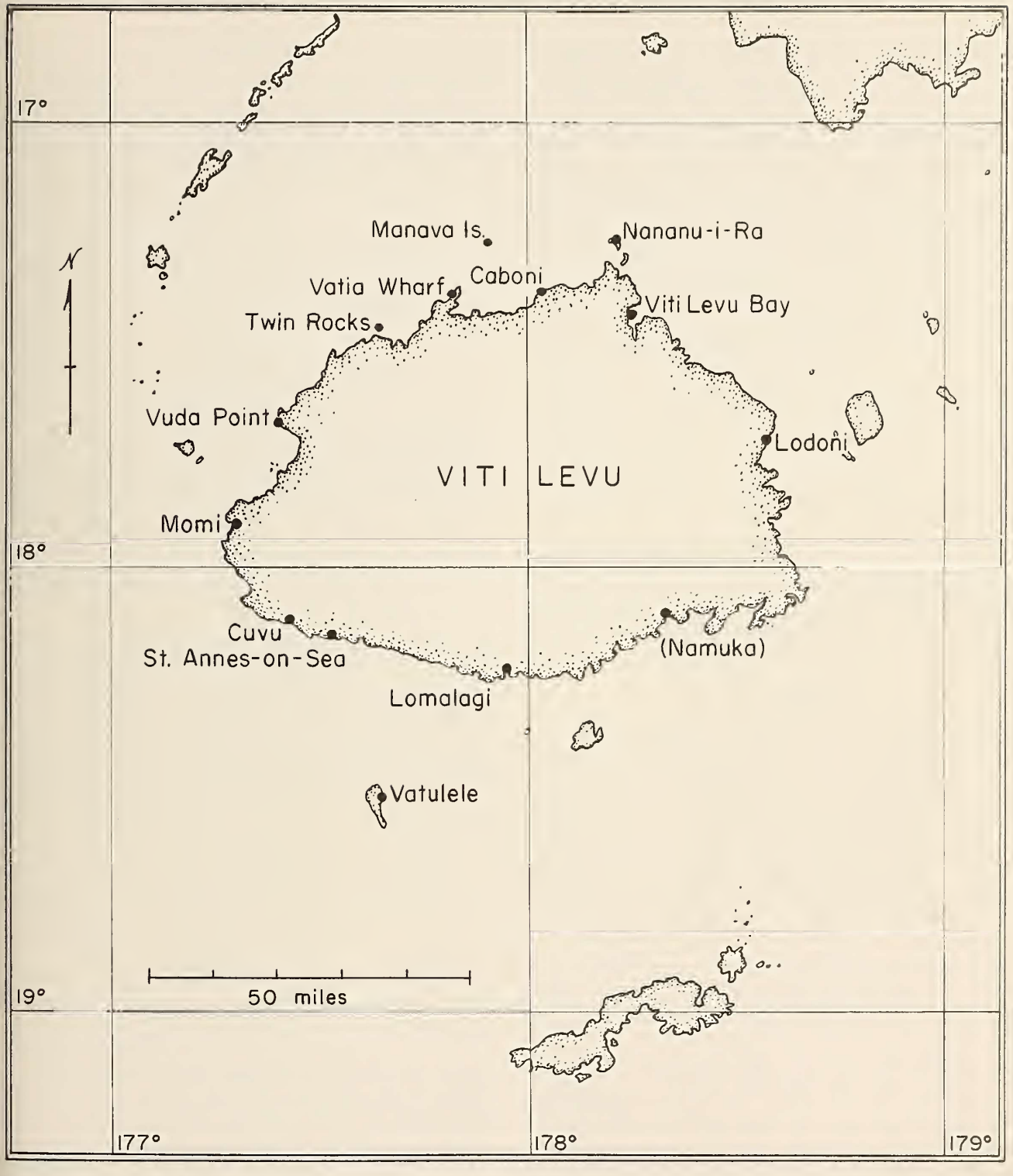
The two lowermost lines indicate that there is a slight difference in size between the sexes: as in most cowries, the females are slightly larger than the males, the difference between the means (51.06 and 50.05) is, however, not significant ($t = 1.9$); in these four large populations the value of t varies only between 0.8 and 2.1, but the females are always the larger sex.

BREADTH

The relative breadth, expressed in per cent of the length, has been indicated in column 8 of Table 1. The differences between populations are rather small, though the shells from Manava Island and from Vatia Wharf are rather narrow, those from Momi rather broad: this fact may be influenced by the length of the shells, as in cowries generally large specimens tend to be less broad than small shells. The total variation of relative breadth in 627 adult shells is rather small, so that the general appearance of *Mauritia eglantina* is fairly uniform; the difference of sexes, however, is obvious:

relative breadth:	53	54	55	56	57	58	59	60	61	62	63	64	65
Total	1	9	15	43	92	115	135	101	77	29	8	1	1
including:													
♀ ♀	—	2	4	13	26	44	65	63	52	19	5	1	1
♂ ♂	1	6	10	27	53	61	49	27	14	5	—	—	—

The difference between the mean of females (59.3) and that of males (58.0) is significant ($t = 9.2$), as are the differences also in the three largest populations ($t =$ 3.5 to 5.3).


17°
Manava Is.
Nananu-i-Ra
Vatia Wharf
Caboni
Viti Levu Bay
Twin Rocks
N
Vuda Point
Lodoni
VITI LEVU
Momi
18°
Cuvu
St. Annes-on-Sea
(Namuka)
Lomalagi
Vatulele
50 miles
19°
177°
178°
179°

DENTITION

The relative closeness of labial teeth (LT) and of columellar teeth (CT) has been recorded in column 9 and 10 of Table 1, respectively, by letters with decimal figures according to SCHILDER, 1958; there is no significant difference between populations. The total variation and that of sexes is as follows:

class:	*p*	*q*	*r*	*s*	*t*	*u*	*v*	*w*	*x*	*y*	*z*
Total: LT	—	2	7	21	125	173	207	80	26	2	2
Total: CT	1	10	37	103	154	166	104	59	9	1	1
LT: ♀ ♀	—	1	2	10	56	82	99	34	9	—	2
LT: ♂ ♂	—	1	3	7	50	71	75	35	10	1	—
CT: ♀ ♀	—	4	11	46	67	81	53	30	2	—	1
CT: ♂ ♂	1	4	19	43	71	56	34	18	6	1	—

The teeth of both lips are rather identical in closeness, as the mean of each lip is about *u* (*u*.41, *t*.60). The sexes, however, show a curious discrepancy: the closeness of labial teeth is absolutely identical in both sexes (mean = *u*.40), but the columellar teeth of females (*t*.72) are distinctly closer than those of males (*t*.47), though the difference hardly can be called significant ($t = 2.0$).

COLOR

The color of the dorsal markings has been classified in six degrees (see SCHILDER, 1964, table 2): 1 = pale fulvous; 2 = fulvous; 3 = fulvous brown; 4 = chestnut; 5 = dark brown; 6 = blackish. The variation is rather slight, as the Fijian specimens vary from class 2 to class 4 only, and the means of populations vary from 3.1 to 4.0, according to column 11 of Table 1. The total and sexual variation are as follows:

class	1	2	3	4	5	6	Mean
Total	—	81	333	157	44	—	3.3
including:							
females	—	38	153	78	21	—	3.3
males	—	33	144	58	15	—	3.2

Generally, paler shells (class 2 to 3) are slightly more frequent than darker ones. There is no sexual difference in this character.

The color of the base varies from yellowish or pinkish white to dark greyish brown or bluish grey; the frequent differences between the two lips and the multiplicity of tints make a statistical treatment of this character almost impossible.

DORSAL MARKINGS

In adult *Mauritia eglantina* the dorsum is covered by brown longitudinal lines which become interrupted by roundish lacunae; in these lacunae the transversal zones and the zigzag lines of young shells are still better visible than between the longitudinal striae. According to SCHILDER *et al.*, 1964 (Table 2), we have distinguished six classes: 1 = lacunae almost absent so that the dorsum is striate; 2 = lacunae scarce; 3 = lacunae less scarce, but striae still slightly predominant; 4 = the areas covered by lacunae are about equal to the striate areas; 5 = lacunae more numerous or larger; 6 = lacunae predominant, striae reduced and often dilacerate. According to column 12 of Table 1 the populations are similar to each other, except the ten shells from Momi in which the striae are more predominant than in other populations. The total and the sexual variation are as follows:

class	1	2	3	4	5	6	Mean
Total	44	173	41	238	36	80	3.47
including:							
females	23	72	24	111	21	37	3.51
males	15	74	13	103	12	31	3.47

The constant irregularity in these distributions of frequency has been caused by using the main classes 2, 4, and 6 more frequently than the intermediate classes 3 and 5. In our *Mauritia eglantina* the striae occupy a slightly larger area than the lacunae; the sexual difference must be regarded as accidental ($t = 0.3$).

SPIRE BLOTCH

In *Mauritia eglantina* there is a dark brown blotch on the labial border of the spire; it is said to be characteristic for this species as it is in *M. histrio* (GMELIN, 1791), *M. mappa* (LINNAEUS, 1758), and *M. grayana* SCHILDER, 1930, while it is always absent in other allied *Mauritia*, viz. *M. arabica* (LINNAEUS, 1758), *M. maculifera* SCHILDER, 1932, *M. depressa* (GRAY, 1824), and *M. scurra* (GMELIN, 1791). The size of this blotch has been classified in six degrees (according to SCHILDER, 1964, Table 2): 1 = absent; 2 = obsolete; 3 = small; 4 = rather large; 5 = typically large; 6 = extremely large. Column 13 of Table 1 shows the differences of populations; the total and the sexual variation are as follows:

class	1	2	3	4	5	6	Mean
Total	12	21	79	182	277	47	4.35
including							
females	3	8	37	87	130	24	4.40
males	7	8	28	73	117	17	4.34

The most frequent class is 5 ("normal") in both sexes, though the mean tends towards the class 4 on account of the five per cent of adult shells in which the spire blotch is absent or obsolete.

SHELL ABNORMALITIES

Among the 647 *Mauritia eglantina* from Fiji there are two slightly subrostrate shells (Vitilevu Bay, Vuda Point) and one rather melanistic female (Momi), but no truly melanistic rostrate shell has been sent us by Mr. Cernohorsky from Fiji, whereas such shells are rather frequent in New Caledonia. One male from Nananu-i-ra is rather pellucid in texture. Four shells are pathologically suffused by green enamel, and one shell by greyish enamel, each from different localities. Besides, particles of mud are enclosed in the dorsal enamel, or forming whitish tiny holes in the surface of at least 25 specimens from 6 localities, chiefly from Vatia Wharf and from Lodoni: 20 such specimens are females which number far exceeds the probability of random distribution. In one male from Vatia Wharf the dorsum is much worn like in beach shells though the animal was living when collected; three live specimens show the juvenile zigzag markings uncovered though the lateral and basal callosities are at least as developed as in other adult shells. One female from Vitilevu Bay shows a dark blotch on the inner lip, comparable to that of *M. maculifera* SCHILDER. In many shells there are the usual holes, traces of bites, or fractures suffered in juvenile stages, all wounds healed during the animal's later life; one shell from Vuda Point shows the columellar margin inflated, though to a lesser degree than figured by SCHILDER, 1936, figure 3.

YOUNG SHELLS

Among the 647 shells sent by Mr. Cernohorsky, 26 are not fully grown (i. e. 4 per cent); following SCHILDER (1938, page 123) they should be classified as: 7 subjunior, 4 junior, 14 juvenis and 1 perjuvenis. Besides there are 4 oliviform shells not included in the total mentioned above.

PENIS

The length of the penis, expressed in per cent of the length of the shell, varies from about 20 to 85 per cent in 240 specimens, as follows:

%	20	25	30	35	40	45	50	55	60	65	70	75	80	85
♂♂	2	—	6	11	30	54	60	28	20	17	2	6	2	2

This surprisingly considerable variation may be caused partially by different erection of the penis at the moment of the death of the animal in alcohol, partially by different times elapsing between collecting, preserving, and examining the specimens. The mean, however, undoubtedly is 50.1 per cent of the shell length; the local differences of means are relatively small (see column 14, Table 1).

ROWS OF THE RADULA

According to SCHILDER, 1960 and 1961, the number of rows of the radula has been expressed in dozens (e. g. 5 = 54 to 66 rows); it is evidently independent from the size of the shell. The range of variation is rather large, ranging from 5 to 21 dozens (the single specimen with 21 dozen rows may be pathological):

dozens	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Total	1	2	5	6	9	35	90	124	102	52	15	4	1	—	—	—	1
including:																	
females	1	—	3	2	4	7	25	61	71	46	12	4	1	—	—	—	1
males	—	2	2	4	5	28	65	63	31	6	3	—	—	—	—	—	—

But according to column 15 of Table 1, the means of populations vary rather little around the total mean of 12.06 (i. e. exactly 145 rows), viz. from 11.7 to 12.6 dozens (if one omits the figures put in brackets as these populations include less than ten complete radulae); however, the difference between the two extremes (Vatia Wharf and Nananu-i-ra) should be regarded as significant ($t = 3.4$).

The females possess more rows than the males, as the difference between the total means (12.67 and 11.46) is very significant ($t = 8.2$), and it is also mostly significant in each large population, viz.:

mean of	females	males	t
Vitilevu Bay	12.24	11.59	2.0
Nananu-i-ra	13.45	11.59	5.5
Vatia Wharf	12.17	11.19	3.1
Vuda Point	12.91	11.68	3.2

MEDIAN TOOTH

The relative size of the median tooth of the radula has been expressed, as in previous papers (SCHILDER, 1960) by an index representing 200 times the maximum transverse diameter of the median tooth, divided by the length of the shell. The variation of this index is as follows:

index	4	5	6	7	8	9	10	11
Total	1	8	24	158	185	92	48	9
including:								
females	—	1	19	137	112	12	—	—
males	1	5	5	21	73	80	48	9

The local means (column 16, Table 1) generally approach the total mean (7.96) rather closely so that the differences between the populations are mostly not signi-

ficant; however, the difference between Nananu-i-ra and Vatia Wharf or Cuvu is significant, as $t = 3.0$ and 5.4 respectively.

The sexual differences in the size of the median tooth are very considerable: the median of the females is much narrower than that of males, as the two means (7.39 and 8.63) differ in a highly significant way ($t = 15.1$); the difference becomes also distinctly significant at least in relatively large populations, for example:

index	females	males	t
Vitilevu Bay	7.66	8.82	6.7
Nananu-i-ra	7.68	8.89	7.7
Vatia Wharf	7.27	8.50	8.1
Vuda Point	7.20	8.62	6.7

ROWS AND MEDIAN

There is a negative correlation between the number of rows and the size of the median tooth, as the number of rows is larger in females than in males, but the median tooth is less broad in females than in males although of similar shape. It may be illustrated by Table 2 in which the figures for females and for males have been separated by the symbol / (the aberrant specimen with 21 dozen rows and the median index 7 has been omitted):

Table 2

dozens of rows	Index of the Median Tooth 4	5	6	7	8	9	10	11
17	·	·	·	1/—	·	·	·	·
16	·	·	·	4/—	·	·	·	·
15	·	·	1/—	5/2	6/—	—/1	·	·
14	·	·	·	22/1	23/1	1/3	—/1	·
13	·	·	5/—	34/4	28/12	4/12	—/3	·
12	·	1/—	3/1	26/3	29/24	2/23	—/12	·
11	·	·	2/1	10/4	9/16	4/26	—/14	—/4
10	·	·	·	6/2	1/5	—/5	—/13	—/3
9	·	1/1	2/—	1/1	·	—/1	·	—/2
8	·	—/1	1/2	1/1	·	·	·	·
7	—/1	—/1	3/—	·	·	·	·	·
6	·	—/2	·	·	·	·	·	·
5	·	1/—	·	·	·	·	·	·

One will observe the negative correlation mentioned above, in that the females cluster on the left in Table 2 (classes 7 to 13), the males in the right center (classes 9 to 11); but off from this main sequence of typical specimens there are about 16 specimens listed in the left lower corner (mean about in classes 5 to 7). These 16 specimens originating from various localities are characterized by a reduced radular ribbon which shows exceptionally few rows and very small medians: we suspect them to be pathological. If it is true, the normal range of variation is less wide: 5 to 11 instead of 4 to 11 relative to the size of the median tooth, and 8 to 17 instead of 5 to 21 relative to the number of rows.

CORRELATION BETWEEN POPULATIONS AND BETWEEN CHARACTERS

All figures in Table 1 can also be expressed in per cent of the mean of *Mauritia eglantina* in Fiji, as we have done in column 7 with regard to the length of the shells. Table 3 contains the positive and negative differences between these percentages and 100, so that positive figures indicate figures exceeding the total mean, while negative figures indicate lesser values. We have limited Table 3 to the ten populations with sufficient numbers of specimens; figures calculated from insufficient material have been put in brackets [ ].

As we have stated above, the length of shells (column 6) from the north (D to F, i. e. Caboni to Vatia Wharf) is large. The breadth (8) is rather similar in all localities. The teeth (9 to 10) tend to be close and numerous in the north-east (E to H). The dorsal color (11) is darker in the east (A to B) and west (H to I) than elsewhere. The dorsal lacunae (12) become more prevalent in the north-east (A to D). The spire blotch (13) is rather small in E and in I to K. The penis (14) is relatively long in the north-east (A to E) and in I. The average number of radular rows (15) varies irregularly, but the size of the median tooth (16) varies in a way comparable to the penis (14).

Table 3

column no.	6	8	9	10	11	12	13	14	15	16
indicating:	L	BL	LT	CT	col.	mar.	spi.	pen.	rows	med.
A Lodoni	—3	0	0	—1	+6	+6	+5	+3	—1	+2
B Vitilevu Bay	—13	0	—1	—2	0	+11	—2	+8	—1	+1
C Nananu-i-ra	—1	+1	—1	—1	—6	0	0	+1	+4	+2
D Caboni (No. 2)	+9	0	+1	—1	0	+6	+7	[0]	—5	[0]
E Manava Island	+10	+1	0	+2	—3	—6	—16	+9	+2	+1
F Vatia Wharf	+12	0	0	+1	—3	—9	+5	—5	—3	—2
G Twin Rocks	—4	+1	+1	0	—3	0	+12	[—2]	[—8]	+2
H Vuda Point	—7	0	+2	+2	+3	—9	+5	—10	+3	—8
I Momi	—6	+2	0	—3	+21	—17	—9	[+16]	0	+5
K Cuvu	+2	0	—1	—2	0	—14	—23	—15	+1	—13

Therefore, some adjacent populations seem to be linked by a common development of various characters. The characters themselves, however, seem to be independent from each other, with the following exceptions:

There is some parallelism in closeness of labial and columellar teeth (9 and 10), as one would expect; but there is also some parallelism between the size of the penis (14) and of the median tooth of the radula (16), indicating that the size of the whole animal (represented by these two characters) is not constant in comparison with the shell, but there are populations with relatively small or large animals within shells of equal size.

COMPARISON WITH PENRITH ISLAND

In our paper on the cowries of Penrith Island off Mackay, Queensland (Schilder *et al.*, 1964) we have compared 56 *Mauritia eglantina* with the mean of 272 specimens from Fiji, all localities included. Since we wrote this paper last year, the number of *M. eglantina* from Fiji has been more than doubled, but the means of characters remained practically unchanged. Now we can investigate which characters of the *M. eglantina* from Penrith Island lie amidst the means of various Fijian populations, and which characters exceed the extreme means of any Fijian locality.

To the former group belong the percentage of sexes, the average length of shells, the dorsal markings, and the size of the median tooth of the radula, which four characters may be called identical in Penrith Island and in Fiji.

In seven characters, however, there is a distinct difference between animals from Penrith Island and from Fiji: With regard to the closeness of teeth, the less close labial and the more close columellar teeth of the population from Penrith Island exceed the limits of all populations from Fiji, but each with one exception concerning the poorest Fijian series (Vatulele Island and St. Annes-on-Sea, respectively). With regard to the other characters, however, there is no exception: *Mauritia eglantina* from Penrith Island are less broad, slightly darker, with the spire blotch less accentuated, the penis relatively much shorter, and the rows of the radula more numerous than in any population from Fiji.

However, the single population from Penrith Island examined so far does not reveal general differences between *Mauritia eglantina* from Queensland and from Fiji: it is still necessary to examine several populations from Australian waters, such as we were fortunate enough to receive from Vitilevu through the kindness of Mr. Cernohorsky.

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Snails and Other Invertebrates from Indian Village Sites, Principally Contra Costa County, California

BY

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In 1957 the senior author described *Speleodiscoides spirellum,* a new snail genus and species from North America (Smith, 1957). The description was based upon specimens collected in two limestone caves in Amador County, California, by speleologists of the Stanford Grotto National Speleological Society. The typical adult specimen has a small, tightly-coiled, flat, whitish shell with six to seven whorls and is one-quarter of an inch in diameter. No living snails of this species have as yet been found.

The species is of special interest because it had been collected sparingly in the San Francisco Bay region as early as 1872 by the western naturalist C. D. Voy, and later by the ornithologist W. Otto Emerson, and the conchologist Professor William J. Raymond of the University of California. In at least one instance shells were reported in an Indian mound (Smith, 1957: 37). There are no records of occurrence between the localities reported in the San Francisco Bay region and those in the limestone caves of Amador County — a curious instance of discontinuous distribution that is not usual with species of California land snails.

The finding of *Speleodiscoides spirellum* recently during the excavation of three Indian village sites in Contra Costa County by the junior author, an archeologist, and her colleague, David A. Fredrickson, therefore seems worth reporting, considering the relative rarity of shells of the species in museum collections. Data from the three archeological sites are as follows:

CCo-309. Site in Walnut Creek, Contra Costa County, California, on the east side of Tice Creek, two miles from downtown Walnut Creek. The specimens were collected from a special excavation unit, S-36, that received fine screening (⅛ inch mesh) and laboratory sorting. The pit yielded cultural material to about 24 inches. The remains of a child's cremation were recovered in a sub-midden pit in S-36, which was located in an area where other cremations and burials were found. Grave offerings of shell artifacts, most of them burned, consisted of *Olivella biplicata, Saxidomus nuttalli,* and *Haliotis sp.* beads and ornaments (the site is archeologically dated in the Late Horizon, 1500 to 1790 A. D.). Remains of mollusca used for food were plentiful in the midden, the most common being *Mytilus edulis, Macoma nasuta,* and *Ostrea lurida.*

Of the total of ten snails recovered in S-36, three were found at 12 to 18 inches, one at 18 to 24 inches, five at 24 to 30 inches (and here we entertain the possibility that they were dispersed cremation material) and one in the sub-midden cremation material itself at 30 to 35 inches below surface.

The snails were also observed in other cremation and burial areas during excavation, but were not collected. In other parts of the site, where such features were absent, the snails were not recorded as being present.

The ten dead, bleached *Speleodiscoides spirellum,* adult or nearly so, were accessioned in the California Academy of Science, Department of Geology Collection, Loc. No. 38823. Other land snails taken from unit S-36 include one dead adult specimen of the small, carnivorous *Haplotrema duranti continentis* H. B. Baker (C. A. S. Geology Coll. Loc. No. 38822), a single dead shell of *Helminthoglypta nickliniana bridgesi* (Newcomb), two dead adult *H. diabloensis* (Cooper), and several dead juveniles, probably of one or both of these latter species. Also identified were examples of the common sessile barnacle, *Balanus nubilis,* which were observed attached to many of the *Mytilus* shells mentioned above.

CCo-308. Site at Alamo, on the west side of the then existing channel of San Ramon Creek, Contra Costa

County, California. While numerous land snails were seen during excavation, only a sample was retained for analysis and identification.

The material from this small sample consisted of two fragments of the freshwater mussel, *Margaritifera margaritifera falcata* (Gould) and three small dead, bleached land snails. Two of the snails are *Speleodiscoides spirellum* (C. A. S. Geol. Coll. Loc. No. 38822); the third is a very young *Helminthoglypta cf. H. diabloensis* (Cooper).

The snails were recovered in a burial area of the site at depths from 45 to 60 inches below the surface (Note: At least 12 inches at the surface was recent alluvium. The archeological context provides a date of about 100 B. C. to 300 A. D.).

CCo-30. The third site in the same general area is located one-half mile south of CCo-308 and is also in the community of Alamo. Sorting of the shell refuse produced five dead shells of *Speleodiscoides spirellum* (C. A. S. Geol. Coll. Loc. No. 38826). Three of the five were recovered in or near burials; one lay in the top 0 to 6 inch-excavation level; and the fifth was found in an area of concentrated food-shell debris.

Recovered also at CCo-30 were fragments of the whale barnacle (*Cryptolepas rachianecti* Dall), described in 1872 from specimens imbedded in the flippers of a California Gray Whale (*Eschrichtius glaucus*). The presence of these fragments in an Indian village in interior Contra Costa County presents an interesting archeological problem.

Also of interest is the occurrence of the dead shells of *Haplotrema duranti continentis* H. B. Baker in fair quantity in an Indian village site (Lak-261), located two miles south of Lower Lake, near Copsey Creek, in Lake County, California. The site was excavated by Fredrickson in 1961; dating of the site has as yet not been completed. In this instance the shells were found in the 1/8 inch screenings to a depth of 36 inches in a cemetery area. The frequency of occurrence of the shells generally decreased with depth. (These shells have also been accessioned in the C. A. S. Geol. Coll. Loc. No. 38824.)

The finding of dead snails in Indian village sites is cause for speculation. As Matteson (1959) points out, one possible theory can be based on the fact that all snails need a certain amount of lime for building their shells. Therefore, they might gravitate naturally to a location where the lime content in the soil is greater. In an Indian village site containing the remains of marine and fluviatile shells brought in for food, decoration, or whatever other purposes, the lime content would be higher than in the surrounding area. Land snail collectors nearly always find more interesting and better collecting in limestone areas. As the snails in question are not known ordinarily to be deep burrowers, even when in estivation, an explanation for their occurrence as deep as five feet must be sought.

It is apparent that the smaller snail shells, which are delicate and light in weight, are late intruders in the sites. In the contexts described above they would have tended to disintegrate after any extended period of time unless a special situation existed leading to actual fossilization, which is evidently not found at the cited localities. At sites CCo-308 and Lak-261 shell beads and ornaments, deriving from the same depths as most of the snails, were found badly eroded; and these decorative items were made from much hardier shells.

If the occurrence of the snails at the depths reported is due to fortuitous causes, two possibilities can be suggested: 1) they fell down rodent burrows, and 2) they were transported by the re-working of the soil over a considerable period of years by small burrowing mammals. The high incidence of rodent activity in softer soils of archeological sites has often been noted in the literature.

It can also be suggested that the live snails used open burrows to reach specific types of localities as is indicated in the sites described above. However, it must be pointed out that exceptional care is taken both in the field and laboratory with material from burial and cremation areas. This special attention may weight the picture somewhat in favor of locating the small snails in these areas.

This occurrence of *Speleodiscoides spirellum* raises other questions for which answers need to be sought. Why is it, in a period of about ninety years, during which there has been more or less assiduous collecting of land snails in central California, that this species has been taken only four times, the present occurrence being the fifth? Why should it be so rare? Why should it turn up in such an assortment of widely separated localities? Why has it not yet been found living? Are we in this instance dealing with a relict genus and species that, for some unknown reason, has not been able to adjust to possible changes in ecological conditions and is practically at the point of extinction?

At least three facts about this rare shell can be stated with some confidence. One is that the shells found to date are not fossil, although earlier malacologists thought they might be. Another is that with more diligent collecting in the limestone areas of California's Mother Lode it possibly can be discovered alive. A third is that the species in all probability is indigenous and not adventitious. Nothing quite like it has ever been reported, at least from North America, although South American species seem to be close in appearance, if not definitely related morphologically.

Thanks are due to David A. Fredrickson, who supplied many of the archeological data and who reviewed the manuscript.

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NOTES & NEWS

The Department of Invertebrate Zoology of the California Academy of Sciences

BY

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The Department of Invertebrate Zoology of the California Academy of Sciences in San Francisco has established a new repository for type specimens of marine, land, and freshwater invertebrates preserved in alcohol or formalin. The need for such action became apparent upon reactivation of the Department in July, 1960, with responsibility for the curation and systematic arrangement of the Academy's large and steadily growing collection of invertebrates, including a number of types.

Preserved invertebrate type specimens of both primary and secondary rank are deposited in the new type series. Types are numbered serially, regardless of phylum, beginning with No. 1. A detailed card catalogue is maintained covering all pertinent data including citations to publications. Cards are filed alphabetically, by species, and include references to case and tray location.

Larger invertebrate types are curated in accordance with department standards in suitable-sized glass containers with a hard, plastic (or other) closure and a thin polyethylene insert to inhibit evaporation. Smaller specimens will be: (a) sealed permanently in glass tubing with a contained label; or (b) placed in standard containers in long-style shell vials plugged with cotton and placed into the containers upside down.

Microscope slide mounts relating to invertebrate types are filed separately in standard plastic slide boxes, 100 slides to a box. These are stored with the slides horizontal to prevent possible drifting of the mount. Mounted serial sections of a type animal, or a part of it, will carry a single file number that has been assigned to the rest of the animal, if preserved separately.

Recent mollusk types preserved dry will continue to be deposited in the Academy's Geology Type collection. Invertebrate types, other than mollusks, which are preserved dry, will be given special storage treatment.

Specialists in invertebrate phyla are invited to deposit type specimens in the Academy's Invertebrate Type Series. They can have the assurance that their material will be handled and stored with care, with adequate provisions for future safety and security. Specimens in this Type Series may be studied by experts and qualified students upon advance arrangement with the Department's Curator.

This work is aided by N. S. F. grant GB-1535.

A. M. U.

Pacific Division

The Seventeenth Annual Meeting of the American Malacological Union, Pacific Division, is to be held this year June 18 to 21 (Thursday to Sunday), inclusive, at Asilomar Conference Grounds, Pacific Grove, California. Already the program is beginning to take shape: a film is promised, on shellfish management in Europe; and two paleontologists who are taking part in marine expeditions this winter and spring have agreed to report on their experiences in the Indian Ocean and the Galapagos Islands.

The meeting is open to anyone interested in the study of mollusks, whether or not a member of the A. M. U. Reservation forms for housing may be obtained from the Secretary, Mrs. Lucille Zellers, 714 Elm Street, El Cerrito, California 95432; non-members should send her 50 cents for mailing costs. Reservations should be in by May 15 but will be accepted later if space remains available.

Anyone having unusual or interesting shell material that may be exhibited should contact the exhibit chairman, Mr. Howard Fletcher, 1008 La Hermosa Drive, Redlands, California, who will help with the planning and placing of the exhibits.

Dr. Edwin Allison, Vice-Chairman, is assisting me in the planning of the program, and offers of papers may also be sent to him. These should be in before May 15 and should be on the "Call for Papers" form sent out by the Secretary.

We hope — as do all slates of officers each year — that this will be a banner meeting, and it can be with our combined efforts. Let's see *you* at Asilomar!

Myra Keen, Chairman

Errata

BY

FRANZ ALFRED SCHILDER

University of Halle, German Democratic Republic

In "The Cowrie Fauna of Penrith Island" published in The Veliger 6(3): 155 - 161, the following passages should be emended:

In the list of species on pp. 155-156: *Erosaria labrolineata, Palmadusta gracilis* and *Bistolida pallidula* were established in 1849, not in 1848; IREDALE (1939, Austral. Zoologist 8(2): 99) has pointed out that GASKOIN's paper in Proc. Zool. Soc. London for 1848 was published March 13, 1849. *Erronea listeri* GRAY was published in 1824, while the preoccupied name *listeri* GRAY 1825 is a synonym of *Erosaria marginalis* DILLWYN 1827 (see SCHILDER, 1922, Proc. Malacol. Soc. London 15(2/3): 118).

In Table 1, pp. 158 - 159 the figures on the fifth line (pertaining to *Monetaria moneta*) must be changed as follows:

column r/12	10.0 > 9.1	(instead of 8.0 = 8.1)
m/L	10.5 > 9.1	(11.7 > 9.8)
dr/L	9.5 > 8.3	(9.9 > 8.0)
♀ %	64 = 64	(41 < 51)

Finally, there is a transposition of names in the last two lines of the first column: instead of *Calpurnus verrucosus* in the penultimate line read *Palmadusta gracilis* and in the last line read *Calpurnus verrucosus* instead of *Palmadusta gracilis.*

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BOOKS, PERIODICALS, PAMPHLETS

Notices of New Eastern Pacific Mollusca. - V

by S. Stillman Berry in Leaflets in Malacology, Editor and Publisher, S. Stillman Berry, Redlands, California, vol. 1, no. 23, pp. 139 to 146, September 30, 1963.

This paper continues a series of preliminary accounts of west American mollusks that was initiated in 1957. According to the preface to the first report, detailed descriptions and illustrations are in preparation and are promised by the author for subsequent publication elsewhere.

In this paper, a diagnosis, the type locality, and brief comparisons are given for ten new species, namely: *Pecten lunaris, Tellidorella cristulata, Crenimargo electilis, Transenella caryonautes, "Acmaea" concreta, Cirsotrema pentedesmium, Crucibulum castellum, Crucibulum subactum, Solenosteira gatesi, Olivella (Dactylidella) cymatilis.* Two generic names, *Tellidorella* and *Crenimargo,* are proposed for *T. cristulata* new species and *C. electilis* new species, respectively. Unfortunately, the descriptions of these generic taxa lack definite type designations.

Under the present International Code of Zoological Nomenclature [Articles 13 (b) and 68 (a, i)], genus-group names published after 1930 must have a definite fixation of a type species. Therefore, these generic taxa and five other generic taxa that were proposed in previous articles in this series are unavailable and must stand as *nomina nuda* until a type species is properly proposed for each taxon.

W. K. Emerson.

The Miocene Mollusca from Quilon, Kerala (India)

by A. K. Dey. Memoirs of the Geological Survey of India, Palaeontologia Indica, New Series, volume 36, pp. i to vii plus 1 to 129, plates 1 to 10. 1961 (on title page), 1962 (on cover).

This paper contains a discussion of a marine molluscan fauna collected from strata near Quilon, Kerala, India. The author describes 165 forms (43 pelecypods, 1 scaphopod, 121 gastropods); 59 new species, 96 identified with previously known species and 10 identified only as to genus. Of the total number of species, 31.5% are living in the seas today. A Vindobonien, late Miocene, age is assigned to this fauna. The affinities of the species in this assemblage are predominantly with the Recent and fossil mollusks of the Indopacific province.

The record of the new species *Pitar (Hyphantosoma) simonnei* (p. 35, pl.2, figs. 5, 6) in this assemblage of late Miocene age in India furnishes an interesting addition to the known occurrences of *Hyphantosoma.* Species referred to this subgenus have been reported previously from Oligocene to Pliocene in southeastern United States and in the West Indies, in the Miocene of New Zealand, in Pleistocene and Recent in the eastern Pacific and probably Recent in the East Indies.

LGH

Rearing of Bivalve Mollusks

by Victor L. Loosanoff and Harry C. Davis. in: Advances in marine biology, vol. 1; pp. 2 to 138; 43 figs. Academic Press Inc., London, 1963.

This lucidly written and well illustrated summary of work carried out by the senior author and his associates over many years, may well be a "classic" of the future. Many puzzles of taxonomic relationships can be solved only by careful breeding experiments. Marine mollusks have presented a series of obstacles which now appear to be resolved — at least for the bivalves (or, to be still more cautious, for *some* bivalves). Future work will have to establish how the Loosanoff Method can be modified in its application to the gastropods.

RS

A New Species of *Acmaea* (Archaeogastropoda) from the Pleistocene of San Nicolas Island, California.

by Jere H. Lipps. Los Angeles County Mus. Contr. in Sci., no. 75, 15 pp., 6 figs.

This paper describes and well illustrates a new species of limpet, *Acmaea mitchelli,* from the Pleistocene terrace on San Nicolas Island off the coast of Southern California. Interesting paleo-ecologic interpretations about this new species suggest that it lived in the high intertidal zone. Seven other California species of the genus *Acmaea* are illustrated and compared with the new species. A fine piece of work, marred only by the dark (over-inked?) reproductions of what seem to be excellent photographs.

RS

Type specimens of Marine Mollusca described by P. P. Carpenter from the West Coast of Mexico and Panama

by Katherine V. W. Palmer. Bull. Amer. Paleont., vol. 46, no. 211; pp. 289 to 408; plts. 58 to 70.

This is a companion volume to the earlier work by Dr. Palmer (1958: Type specimens of marine mollusca described by P. P. Carpenter from the West Coast (San Diego to British Columbia). Like the earlier work, this very important contribution will be of inestimable value to all students of mollusks from the eastern Pacific.

RS

Studies on Tertiary and Recent Giant Limidae

by Harold E. Vokes. in: Tulane Studies in Geology, vol. 1; pp. 73 to 92; plts. 1. 2. 18 January 1963

A new species, *Lima* (*Acesta*) *bullisi,* is described from 300 and 600 fathoms off Mobile Bay, Alabama. This represents the first reported occurrence of *Acesta* in the western Atlantic and contiguous basins. A catalogue of the recognized species of the Cenozoic subgenus *Acesta* includes 13 modern species and 31 fossil species distributed through North America, Asia, New Zealand and Europe.

A new subgenus, *Plicacesta,* is proposed for four plicately ribbed species of Asia. The living *Lima smithi* Sowerby from Japan is designated the type species of *Plicacesta.*

ECA

Additions to a Catalogue of the Described Recent and Tertiary Species of *Acesta* and *Plicacesta*

by Harold E. Vokes. in: Tulane Studies in Geology, vol. 2: no. 1; pp. 18 to 20.

Additions to the author's previously published catalogue of these *Lima* subgenera (vol. 1, no. 2 of the same series) include considerations of one living and one Miocene species of *Acesta*, two doubtful Eocene species of *Acesta,* and one living and one Miocene species of *Plicacesta.*

ECA

Cenozoic Muricidae of the Western Atlantic Region Part I - *Murex sensu stricto*

by Emily H. Vokes. in: Tulane Studies in Geology, vol. 1; pp. 93 to 123; plts. 1 to 4; tables 1, 2. 18 January 1963.

A systematic review of the marine gastropods of the Neogene subgenus *Murex sensu stricto* (type: *M. tribulus* Linnaeus) reveals the occurrence of 19 fossil species and subspecies and 15 living species which can be assigned to that taxon. Two subgroups are recognized: a "Western Atlantic" subgroup and an "Indo-Pacific" subgroup. Both are represented in modern Western Atlantic faunas, with the "Indo-Pacific" subgroup generally inhabiting water less than 50 fathoms deep, and the "Western Atlantic" subgroup ranging into slightly cooler and deeper water.

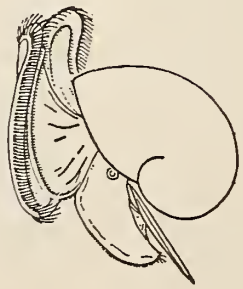
ECA

The so-called *Patinopecten* of Japan

by Kôichirô Masuda. in Palaeont. Soc. Japan, Trans. Proc., N. S., no. 52; pp. 145 to 153; plts. 22, 23 (in English with Japanese abstract). 10 December 1963

A critical review of fossil (Neogene) and modern scallops conventionally labeled *Patinopecten* reveals consistent differences between species from opposite sides of the North Pacific. The living eastern Pacific type species of *Patinopecten, Pecten caurinus* Gould, with numerous western North American fossil species of *Patinopecten* and *Lituyapecten,* are characterized by well-developed auricular crurae with distal denticles and by squarish right valve ribs which are found on *P. caurinus.* A single Japanese species, the Pliocene *Pecten tokunagai* Yokoyama, exhibits both the *Patinopecten*-like form and distinct cardinal crura. That species is made the type species of a new monotypic genus, *Yabepecten,* by Masuda. *Yabepecten* is grouped with the eastern Pacific *Patinopecten s. s.* and *Lituyapecten,* and with the restricted genus *Pecten* to form a newly constituted subfamily Pectininae. The many Japanese species formerly treated as *Patinopecten* are placed in a new genus, *Mizuhopecten,* with *Pecten yessoensis* Jay the type and sole living species. *Mizuhopecten* is grouped with previously segregated *Patinopecten*-like scallops (*Masudapecten* Akiyama, *Fortipecten* Yabe & Hatai, *Kotorapecten* Masuda, and *Nipponopecten* Masuda) as a new subfamily, Fortipectininae.

ECA



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This is meant to make facilities available for publication of original articles from a wide field of endeavor. Papers dealing with anatomical, cytological, distributional, ecological, histological, morphological, physiological, taxonomic, etc., aspects of marine, freshwater or terrestrial mollusks from any region, will be considered. Even topics only indirectly concerned with mollusks may be acceptable. In the unlikely event that space considerations make limitations necessary, papers dealing with mollusks from the Pacific region will be given priority. However, in this case the term "Pacific region" is to be most liberally interpreted.

It is the editorial policy to preserve the individualistic writing style of the author; therefore any editorial changes in a manuscript will be submitted to the author for his approval, before going to press.

Short articles containing descriptions of new species or lesser taxa will be given preferential treatment in the speed of publication provided that arrangements have been made by the author for depositing the holotype with a recognized public Museum. Museum numbers of the type specimens must be included in the manuscript. Type localities must be defined as accurately as possible, with geographical longitudes and latitudes added.

Short original papers, not exceeding 500 words, will be published in the column "NOTES & NEWS"; in this column will also appear notices of meetings of the American Malacological Union, as well as news items which are deemed of interest to our subscribers in general. Articles on "METHODS & TECHNIQUES" will be considered for publication in another column, provided that the information is complete and techniques and methods are capable of duplication by anyone carefully following the description given. Such articles should be mainly original and deal with collecting, preparing, maintaining, studying, photographing, etc., of mollusks or other invertebrates. A third column, entitled "INFORMATION DESK," will contain articles dealing with any problem pertaining to collecting, identifying, etc., in short, problems encountered by our readers. In contrast to other contributions, articles in this column do not necessarily contain new and original materials. Questions to the editor, which can be answered in this column, are invited. The column "BOOKS, PERIODICALS, PAMPHLETS" will attempt to bring reviews of new publications to the attention of our readers. Also, new timely articles may be listed by title only, if this is deemed expedient.

Manuscripts should be typed in final form on a high grade white paper, 8½″ by 11″, double spaced and accompanied by a carbon copy.

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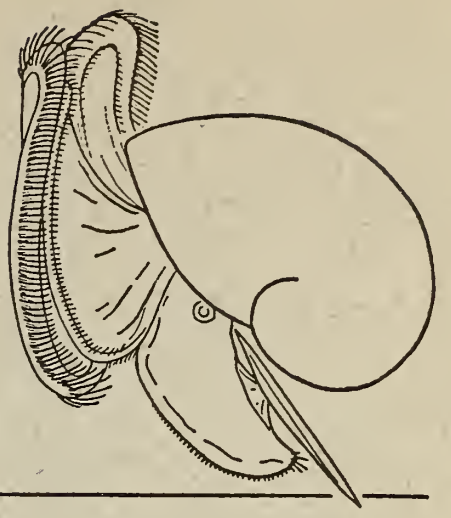

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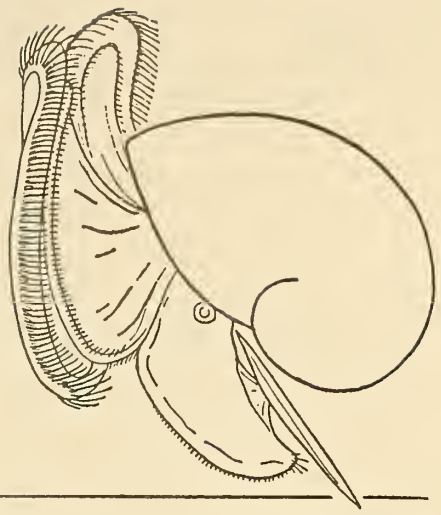

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TABLE OF CONTENTS

[continued next page]

TABLE OF CONTENTS [continued]

Foreword

When Dr. Donald P. Abbott of Stanford University's Hopkins Marine Station described to me the aims and methods of the course "Problems in Marine Biology" (see the article by Drs. Abbott, Blinks and Phillips below), I was impressed by the novel approach to the teaching of the subject. Since the Northern California Malacozoological Club, the publisher of the Veliger at that time, is a corporation devoted to all scientific and educational aspects pertaining to mollusks in any way whatever, I, as the Editor of the journal expressed my interest in the experiment. It is unnecessary to repeat here much of what is recorded in the introductory article as this may be regarded as "history." However, as will be seen in perusing the following papers, the various studies submitted by the students show remarkable results. But what was most gratifying was the fact that, although each paper was reviewed by at least two (in many cases four) outside referees only six papers were not accepted.

As all studies dealt with *Tegula funebralis* (A. Adams, 1854), it seemed desirable to include other papers concerned with the same species, i. e. papers submitted by authors not connected with the course in any way whatever. It was deemed appropriate to do so because it would allow this symposium of papers to be more complete. Of course, it was also recognized that the inclusion of papers by more experienced authors would tend to throw the variability of the other papers into sharper relief. However, this was not considered detrimental. Certainly, it is very evident that each relatively small project has uncovered research problems with great promise of yielding, eventually, important results.

The papers are presented to the critical eyes of the professional malacologists with the understanding that not all would have been submitted for publication by their respective authors in a context other than this particular one; nor would all have been accepted, perhaps, in their present form for publication had they been submitted as single, separate contributions. Since all together they throw light upon many diverse aspects of the biology of one molluscan species, they each contribute perhaps more to our understanding, not only of *Tegula funebralis,* but of other gastropods as well, than they would if they were published only after each study had been brought to a much more mature conclusion — and then scattered through various specialized journals. Still more important, I think, is the fact that this symposium demonstrates a vital, exciting approach to the teaching of a very general subject through the utilization of a common, single species.

The Veliger has passed into the ownership of the California Malacozoological Society, Inc. The aims and purposes of this new corporation, in relation to The Veliger, are the same. Thus, the Society now presents this Supplement to Volume 6 of The Veliger as a record of an experiment in teaching marine biology.

R. Stohler, Editor.