

Deep and Shallow-Water Mollusks from the Central Pacific

Harald A. Rehder* and Harry S. Ladd*

Abstract

Recent shelled mollusks were trawled from deep water on four guyots in the Mid-Pacific Mountains and were dredged from shallow waters on Nero Bank and the lee shelf of Kure Island in Hawaii.

Seven species of mollusks, six of which are new, have been identified from the deep waters on the guyots: two are trochids, *Calliotropis hataii* n. sp., and *C. abyssicola* n. sp., three are turrids, *Comitas powelli* n. sp., *Pleurotomella dubia* Schepman and *P. allisoni* n. sp., one is a bullid, *Bulla argoblysis* n. sp., and one a scaphopod, *Dentalium mediopacificensis* n. sp. Five of the seven species are identical or closely related to Indo-Pacific forms, one belongs to a small but cosmopolitan group, one is related to a species living near the Galapagos Islands in the eastern Pacific.

Nine species of mollusks are identified from Nero Bank and 41 from Kure's shelf, one being new. A total of 101 species are listed as occurring on these two sites and the Kure beaches and lagoon. More than one-third of the total listed appear to be endemic to Hawaii.

INTRODUCTION

During the summer of 1968 an expedition (Styx-Leg 7) on board the R/V *Alexander Agassiz* of the Scripps Institution carried out deep dredging and trawling on a number of guyots in the Mid-Pacific Mountains, and shallow rock dredge hauls were made on Nero Bank and on the leeward shelf of Kure Island in Hawaii. The work was supported in part by National Science Foundation grant GB30908X.

The scientific party consisted of William A. Newman and Richard H. Rosenblatt of Scripps Institution, John A. Allen of the Dove Laboratory, England, the late Edwin C. Allison of San Diego State College and Harry S. Ladd of the U.S. Geological Survey. The investigation recovered both Recent and fossil forms in the Mid-Pacific Mountain area but only Recent forms in Hawaii. The present report deals with Recent gastropods and scaphopods.

DEEP-WATER MOLLUSKS

The Mid-Pacific Mountains form a fairly compact group of seamounts lying between the Marshall Islands and the Hawaiian Chain, being connected to the latter by a linear submarine elevation known as Necker Ridge. Many of the seamounts that make up the Mid-Pacific Mountains are now guyots. During Cretaceous time and possibly into the Tertiary they projected above the sea as islands. These were partially or completely truncated by wave action prior to subsiding to their present positions (Hamilton, 1956); such topographic features as remained were partly or completely covered by a blanket of pelagic sediment (Karig, *et al.*, 1970).

The tops of the guyots are fairly flat and large areas are covered by soft sediments. Harder materials in the form of volcanic rocks, limestone, chert and crusts of manganese oxides are exposed, mostly around the edges (Lonsdale, *et al.*, 1962; Ladd and Newman, in press). Rock dredging brought up manganese nodules and manganese-encrusted slabs

* Smithsonian Institution, Washington, D.C.

in great abundance but surfaces of this kind are usually unfavorable for benthic organisms. No living mollusks were recovered by rock dredging on the guyots.

The faunas now living in the area are virtually unknown. The cirriped fauna, though not rich, was found to be diversified, with a number of undescribed forms (Rao and Newman, 1972). Living mollusks were obtained by trawling on a number of guyots. Gastropods and scaphopods were recovered from the four shown in Fig. 1; depths and other data are given below.

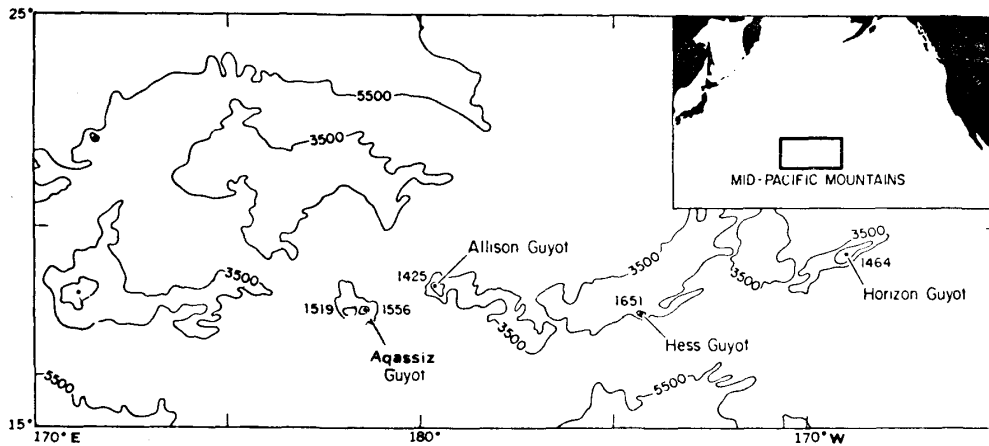


Fig. 1. Sketch map showing location of guyots from which mollusks were trawled. Depths are in meters.

Five of the seven species of mollusks recovered from the deep waters on the guyots are identical with or closely related to Indo-Pacific forms. *Calliotropis hataii* n. sp. is related to a Japanese form, *C. abyssicola* n. sp. to a Hawaiian species, *Comitas powelli* n. sp. is close to a species living in Indonesia and the Indian Ocean, *Pleurotomella dubia* Schepman is an Indonesian form, and the scaphopod, *Dentalium mediopacificensis* is close to an Indonesian species. One of the remaining two forms, *Bulla argoblysis* n. sp., belongs to a small but cosmopolitan group of species. The sixth species, *Pleurotomella allisoni* n. sp. seems closest to an eastern Pacific species that lives near the Galapagos Islands. The significance of the *P. allisoni* relationship is difficult to evaluate at present. The affinities of the known molluscan fauna of the guyots seems to be primarily Indo-Pacific, a conclusion also reached by those who studied the cirriped fauna (Rao and Newman, 1972).

Name	Location	Type trawl	Depth		Cat. No.
			fathoms	meters	
Horizon	168°46'W 19°32'N	Otter	909-995	1662-1818	680826 Sta. 2
"	168°44.2'W 19°27.2'N	"	848-1200	1551-2187	680828 Sta. 1
"	168°52'W 19°17.5'N	"	920-938	1683-1715	680828 Sta. 2
Hess	174°28.8'W 17°53.2'N	Sigsbee	940-964	1719-1763	68091 Sta. 3
Allison	179°36.0'W 18°31.0'N	Otter	785-914	1436-1672	68093 Sta. 1
Agassiz	178°14.2'E 17°58.5'N	Sigsbee	865-884	1582-1617	68097 Sta. 4

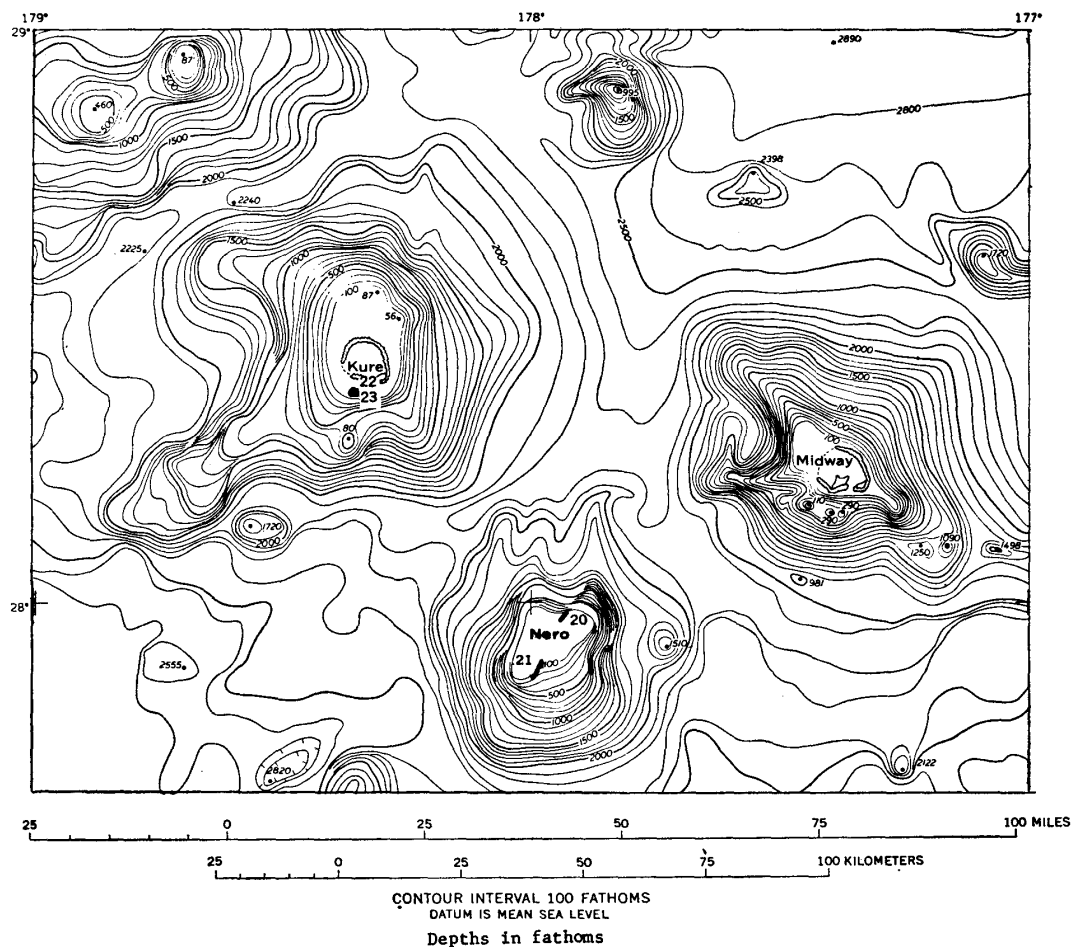
SHALLOW-WATER MOLLUSKS

Nero Bank

Nero Bank is a flat-topped seamount with a least depth of 41 fathoms (73 m.) that lies southwest of Midway at the northwest end of the Hawaiian Chain (Fig. 2). A

profile of the bank, made during the course of the Styx Expedition, is shown by Dana (1971, figure 2). There are a number of shoals and terraces in the Hawaiian Group that lie near this general depth and it may represent a former level of marine erosion. Stearns (1946, p. 94 and 1966, p. 218) gave Nero a depth of 492 feet, grouping it with shoals that he thought were probably submerged atolls.

Two rock dredge hauls were made on Nero, one on the windward edge (no. 20), the other to leeward (no. 21). The windward run was carried for a distance of two miles in



(From U.S. Naval Oceanographic Office unpublished chart)

Fig. 2

40–60 fathoms (73–110 m.) of water. The heavy dredge was 3/4 filled, mostly with subspherical nodules of living coralline algae up to 6 inches in diameter. Many of the purple nodules were bored by at least two species of *Lithophaga*-type pelecypods. There were a few small colonies of living reef corals [*Leptoseris incrustans* (Queleh), according to Dana, 1971, p. 83] and some large slabs of dead coral colonies. Many of the slabs were encrusted with various organisms, including a small spondylid; living gastropods included a mitrid and a columbellid. There were also numerous specimens of a minute brachiopod, identified by G.A. Cooper as a *Thecidellina*.

The dredge haul on the leeward side of Nero Bank (no. 21) was started at 200 fathoms (366 m.) and carried upward to 90 fathoms (165 m.). About 25 pounds of material was recovered. It included a few algal nodules but none alive, a few living solitary corals along with pieces of dead colonial forms, a slab of limestone composed mostly of *Amphiste-*

gina; there were large numbers of dead shells of a large *Spondylus* and rare immature living examples, several living species of arcids and pectinids.

KURE ISLAND

Two rock dredge hauls were made on the lee shelf of Kure Atoll (Fig. 2). The first (no. 22) at a depth of 8–20 fathoms (15–35 m.), the second (no. 23) in somewhat deeper water, about 20–30 fathoms (50–60 m.). These hauls yielded a variety of living algae and invertebrates, a far richer and more diversified assemblage than was dredged from the shallow lagoon of Kure on earlier occasions (Gross, *et al.*, 1959, p. 22). As noted by Dana (1971, p. 83) the only living corals obtained were two small colonies of *Pocillopora damicornis caespitosa* Dana. Living mollusks included several cypraeids, a muricid, a large specimen of *Terebra maculata* Linnaeus and small pectinids; there were also many xanthid crabs and some asteroids.

LIST OF SPECIES

A total of nine species has been identified from Nero Bank, and 41 from Kure's shelf; none of these dredged shells appear to be new. All are listed in the table below, along with species previously collected on the beaches and from the lagoon of Kure. A total of 101 species is listed here as occurring at Kure and nearby Nero Bank. This list undoubtedly does not represent all the mollusks to be found there, but even so, the fauna appears meager when compared with that of the larger islands to the southeast. Thirty-six, or over one-third, of the species listed are at the present time considered to be endemic to the Hawaiian Islands.

Species	Nero Bank	Kure Shelf	Kure beaches and lagoon
GASTROPODA			
Trochidae			
<i>Trochus intextus</i> Kiener		×	×
Turbinidae			
<i>Turbo articulatus</i> Reeve			×
Neritidae			
<i>Nerita (Melanerita) picea</i> Recluz			×
Cerithiidae			
<i>Rhinoclavis tenuisculpta</i> (Sowerby)	×	×	
<i>Rhinoclavis sinensis</i> (Gmelin)			×
<i>Cerithium columna</i> Sowerby			×
<i>Cerithium cf. unilineatum</i> Pease			×
<i>Plesiotrochus luteus</i> (Gould)			×
Triphoridae			
<i>Triphora incisa</i> Pease			×
<i>Mastonia clavata</i> (Hinds)			×
<i>Mastonia cingulifera</i> (Pease)			×
Vermetidae			
<i>Vermetus alii</i> Hadfield & Kay			×
<i>Dendropoma gregaria</i> Hadfield & Kay			×
Modulidae			
<i>Modulus tectum</i> (Gmelin)			×
Janthinidae			
<i>Janthina janthina</i> (Linnaeus)			×
<i>Janthina globosa</i> Swainson			×
Hipponicidae			
<i>Antisabia foliacea</i> (Quoy & Gaimard)			×

Species	Nero Bank	Kure Shelf	Kure beaches and lagoon
Strombidae			
<i>Strombus (Canarium) hellii</i> Kiener	×	×	
<i>Strombus (Canarium) maculatus</i> Sowerby		×	×
Naticidae			
<i>Polinices</i> species ¹			×
<i>Polinices columellaris</i> (Recluz)	×		
<i>Natica</i> cf. <i>venustula</i> Phillippi		×	×
Eratoidae			
<i>Trivia exigua</i> (Gray)			×
<i>Trivia insecta</i> (Mighels)			×
<i>Trivia pellucidula</i> (Gaskoin)			×
Cypraeidae			
<i>Cypraea granulata</i> Pease			×
<i>Cypraea helvola</i> Linnaeus		×	
<i>Cypraea caputserpentis</i> Linnaeus		×	×
<i>Cypraea cernica</i> Sowerby		×	×
<i>Cypraea isabella</i> Linnaeus		×	×
<i>Cypraea semiplota</i> Mighels			×
<i>Cypraea teres</i> Gmelin			×
<i>Cypraea ostergaardi</i> Dall			×
<i>Cypraea tessellata</i> Swainson			×
<i>Cypraea (Lyncina) sulcidentata</i> Gray			×
Cassidae			
<i>Casmaria erinacea kalosmodix</i> (Melvill)		×	×
Cymatiidae			
<i>Cymatium nicobaricum</i> (Röding)			×
Bursidae			
<i>Bursa bufonaria</i> (Gmelin)			×
<i>Bursa asperrima</i> Dunker		×	
<i>Bursa (Colubrellina) granularis</i> (Röding)			×
Tonniidae			
<i>Tonna perdix</i> (Linnaeus)			×
<i>Tonna (Quimalea) pomum</i> (Linnaeus)			×
Muricidae			
<i>Chicoreus insularum</i> Pilsbry		×	
<i>Homalocantha anatomica</i> (Perry)			×
<i>Drupa ricinus</i> (Linnaeus)			×
<i>Drupa morum</i> Röding			×
<i>Drupa (Drupina) grossularia</i> Röding			×
<i>Morula uva</i> (Röding)			×
<i>Morula porphyrostoma</i> (Reeve)			×
<i>Morula fuscoimbricata</i> (Sowerby)		×	
<i>Maculotrion cf. bracteatus</i> (Hinds)			×
<i>Pinaxia coronata</i> (A. Adams)		×	
Magilidae			
<i>Coralliophila violacea</i> (Kiener)		×	×
Columbellidae			
<i>Columbella uvania</i> Duclos ²			×
<i>Columbella (Euphica) palumbina</i> Gould		×	×
Buccinidae			
<i>Clivipollia thaanumi</i> (Pilsbry)	×		×
Colubrariidae			
<i>Colubraria obscura</i> (Reeve)	×	×	×
Nassariidae			
<i>Nassarius</i> species ³			×

¹ This species, fairly common in the Leeward Islands and growing to large size there, has been assigned by authors to *P. tumidus* Swainson (+*mamilla* Auct., *pyriformis* Recluz). It is however distinct and may need a new name.

² *Columbella micans* 'Pease' Tryon, 1883, is a synonym.

³ This shell, not uncommon in Hawaii, has, erroneously been called *graphipterus* 'Beck' Hombron and Jacquinot, and *reeveanus* Dunker by authors.

Species	Nero Bank	Kure Shelf	Kure beaches and lagoon
<i>Alectrion ravidus</i> (A. Adams)	×		
Fascioliariidae			
<i>Fusinus undatus</i> (Gmelin)		×	
Mitridae			
<i>Mitra</i> (<i>Nebularia</i>) <i>luca</i> A. Adams	×		
<i>Vexillum</i> (<i>Costellaria</i>) <i>rusticum</i> (Reeve)		×	
<i>Cancilla peasei</i> (Dohrn)		×	
<i>Scabricola</i> (<i>Swainsonia</i>) <i>fusca</i> (Swainson)		×	
Turridae			
<i>Xenoturris cerithiiformis</i> Powell		×	
Conidae			
<i>Conus abbreviatus</i> Reeve		×	×
<i>Conus canonicus</i> Hwass			×
<i>Conus lividus</i> Hwass			×
<i>Conus nanus</i> Sowerby			×
<i>Conus pennaceus</i> Born			×
<i>Conus pertusus</i> Sowerby			×
<i>Conus retifer</i> Menke			×
<i>Conus suturatus</i> Reeve			×
<i>Conus vexillum</i> Gmelin			×
<i>Conus vitulinus</i> Hwass			×
Terebridae			
<i>Terebra subulata</i> Linnaeus			×
<i>Terebra</i> (<i>Subula</i>) <i>chlorata</i> Lamarck		×	×
<i>Terebra</i> (<i>Acuminia</i>) <i>lanceata oahuensis</i> Pilsbry		×	
<i>Terebra</i> (<i>Strioterebra</i>) <i>thaanumi</i> Pilsbry		×	
<i>Hastula albula</i> (Menke)		×	
<i>Hastula lauta</i> (Pease)		×	
Hydatinidae			
<i>Hydatina</i> (<i>Aplustrum</i>) <i>amplustre</i> (Linnaeus)			×
PELECYPODA			
Arcidae			
<i>Acar divaricata</i> (Sowerby)		×	
<i>Barbatia parva</i> (Sowerby) ⁴		×	
<i>Barbatia nuttingi</i> Dall, Bartsch, and Rehder		×	
Glycymeridae			
<i>Glycymeris arcodentiens</i> Dall, Bartsch, and Rehder	×		
Mytilidae			
<i>Lithophaga mucronata</i> Hanley		×	
Pectinidae			
<i>Chlamys coruscans hawaiiensis</i> Dall, Bartsch, and Rehder		×	×
<i>Chlamys cookei</i> Dall, Bartsch, and Rehder		×	
<i>Nodipecten langfordi</i> Dall, Bartsch, and Rehder	×	×	
Spondylidae			
<i>Spondylus mimus</i> Dall, Bartsch, and Rehder		×	
Lucinidae			
<i>Codakia thaanumi</i> Pilsbry			×
<i>Codakia</i> (<i>Epicodakia</i>) <i>bella</i> (Conrad)		×	×
<i>Pillucina spaldingi</i> Pilsbry		×	
Chamidae			
<i>Chama hendersoni</i> Dall, Bartsch, and Rehder		×	
<i>Chama iostoma</i> Conrad			×
Mactridae			
<i>Mactra thaanumi</i> Dall, Bartsch, and Rehder		×	
Trapeziidae			
<i>Trapezium oblongum</i> (Linnaeus)			×
Veneridae			
<i>Venus toreuma hawaiiensis</i> Dall, Bartsch, and Rehder		×	
<i>Periglypta reticulata</i> (Linnaeus)			×
<i>Lioconcha hieroglyphica</i> (Conrad)		×	×

⁴ *Calloarca* (*Barbarca*) *maunahuana* Dall, Bartsch, and Rehder is a synonym

SYSTEMATIC ACCOUNT

Class Gastropoda
 Subclass Prosobranchia
 Order Archaeogastropoda
 Family Trochidae
 Genus *Calliotropis* Seguenza

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

Type (by original designation):- *Trochus ottoii* Philippi, Pliocene-Pleistocene, Italy.

The Recent species, *C. regalis* (Verrill and Smith) (1880, American Jour. Sci., 3rd ser., v. 20, p. 397), found in the northwestern Atlantic, from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, has been frequently listed as a synonym of the type species. It is, however, a distinct, though related species, being larger and more sharply sculptured than the type. The radula of *C. regalis* which has been figured by Verrill (1884, Trans. Conn. Acad. Sci., v. 6, pt. 1, pl. 29, fig. 14), shows three lateral teeth and numerous (more than 15) subequal marginals. It thus belongs in the subfamily Margaritinae according to the classification outlined by Powell (1951, Discovery Reports, v. 26, p. 88) and emended by Keen and Cox (1960, Treatise on Invert. Paleontology (I) Mollusca 1, p. I249).

Calliotropis has been considered a subgenus of *Lischkeia* Fischer, 1879, by most recent workers, including the senior author of the present paper (Rehder, 1955, Proc. Mal. Soc. London, v. 31, p. 225). The radula characters of *Lischkeia* are unknown to us but because of the distinctive shell characters of the species belonging to this group — large size, rather solid shell, umbilicus-entering callus with the columellar lip reflected over it — we are inclined to consider *Calliotropis* as a distinct genus.

Subgenus *Solaricida* Dall

Dall, 1919, Proc. U.S. Nat. Mus., v. 56, p. 361.

Type (by monotypy):- *Solariella* (*Solaricida*) *hondoensis* Dall, Recent, Japan.

This group has been considered by some authors to be a synonym of *Calliotropis* and by others a subgenus of *Bathybembix* Crosse, 1893. Keen and Cox (*l.c.*, p. I262) have made *Solaricida* a subgenus of *Solariella* Wood, 1842, in the subfamily Solariellinae; the subfamily is characterized (Powell, *l.c.*, p. 86) by the possession of few (5–10) marginal teeth. Habe (1955, Illust. Cat. Japanese Shells, Ser. B, no. 12) says that the radula features of the type species of *Solaricida* show that it does not belong in *Solariella*. Although he figures the radula, he does not give the number of marginals present. A related species, however, "*Basilissa*" *aethiopica* Martens, 1901, from off East Africa, is said to have 12 marginals (Thiele, 1903, ..Gastropoden der deutschen Tiefsee-Exped., v. 7, p. 162.)

Because of the rather close resemblance of the species grouped under *Solaricida* to those of *Calliotropis*, the principal difference being in the wider and deeper umbilicus of the former, we follow Habe (*l.c.*) in removing *Solaricida* from *Bathybembix* and allocating it as a subgenus of *Calliotropis*.

Calliotropis (*Solaricida*) *hataii* Rehder and Ladd, n. sp.

Pl. 3, figs. 16–18

Shell moderate in size, thin, pearly, height slightly exceeding diameter; protoconch incomplete on all specimens but apparently composed of about three smooth, convex

whorls; spire composed of about four sculptured whorls; suture deeply excavated, base convex, aperture subcircular; umbilicus wide and deep; lips thin, inner lip slightly reflected over umbilicus. Sculpture consisting of three prominent spirals that are beaded by regularly-spaced retracted axials; two or three secondary axials are present between primary axials on some shells. Base with five spirals, the upper four only slightly beaded, the lowest, encircling the umbilicus, sharply beaded.

Measurements of the types from Hess Guyot:— holotype, USNM 703263, height 16.1 mm, diameter 15.1 mm.; paratype, an immature shell, USNM 703265, height 7.3 mm, diameter 7.5 mm.

C. hatai is very closely related to *C. hondoensis* Dall, a species that occurs at comparable depths off Japan. The chief difference lies in the axial sculpture which is invariably more strongly developed on the new species, especially on the early whorls.

This species most closely related to a living Japanese form, is named for Dr. Kotora Hatai, a leader in Japanese malacology and Cenozoic paleontology.

Occurrence:— A total of 16 specimens, including the types, from Hess Guyot at depth of 940–964 fathoms (1719–1763 m.); one specimen from Horizon Guyot, depth 909–1200 fathoms (1662–2187 m.); one specimen from Allison Guyot, depth 785–914 fathoms (1436–1672 m.); one specimen from Agassiz Guyot, depth 845–884 fathoms (1545–1617 m.).

Calliotropis (Solaricida) abyssicola Rehder and Ladd, n. sp.

Pl. 3, figs. 13–15

Shell small, thin, pearly, spire low, diameter greatly exceeding height; protoconch incomplete on all specimens; spire consisting of about four convex whorls; suture excavated; base convex, aperture subquadrate; umbilicus wide and deep; lips thin, inner lip sigmoid, reflected over umbilicus. Sculpture consisting of three prominent spirals that are strongly beaded by irregular, close-set, retracted axial ribs; base with six to eight beaded spirals that become progressively weaker and more closely spaced from the periphery downward to the prominent beaded spiral that encircles the umbilicus. The beads of the umbilical spiral are extended into the umbilicus where they taper off and are bent posteriorly across a strap-like band.

Measurements of the holotype from Hess Guyot, USNM 703266:— height 7.3 mm, diameter 11.3 mm.

C. abyssicola is most closely related to *C. reticulina* (Dall) (1895, Proc. U.S. Nat. Mus., v. 18, p. 684, pl. 26, fig. 9), a species recovered from many shallower stations in Hawaii (222–498 fathoms, 106–911 m.) but that species does not have an excavated suture as does the form here described.

Occurrence:— A total of eight specimens: holotype and three others from Hess Guyot at depth of 940–964 fathoms (1719–1763 m.); one shell from Horizon Guyot, 920–938 fathoms (1683–1715 m.); one incomplete specimen from Allison Guyot, 914–895 fathoms (1436–1672 m.); two specimens from Agassiz Guyot, 865–884 fathoms (1582–1617 m.).

Order Neogastropoda
Family Turridae
Subfamily Turriculinae
Genus *Comitas* Finlay

Finlay, 1926, Trans. New Zealand Institute, v. 56, p. 251.

Type (by original designation):— *Surcula oamarutica* Suter. Miocene, New Zealand.

Comitas powelli Rehder and Ladd, n. sp.

Pl. 3, figs. 11, 12

Shell small, biconic, spire slightly longer than aperture; whorls five or more (apex incomplete), strongly shouldered at the midpoint and slightly shouldered immediately below the suture; aperture lenticular, produced anteriorly into a short, wide canal; posterior sinus broad, occupying the entire area above the main shoulder; outer lip thin, inner lip callused. Surface of entire shell covered uniformly by spiral threads; main shoulder composed of large rounded axial folds that are a little narrower and more oblique on the upper whorls of the spire than at lower levels; twelve axial folds are present on the penultimate whorl.

Measurements of the holotype, USNM 703267:- height (incomplete) 13.0 mm, diameter 6.0 mm.

The holotype and only specimen of *C. powelli* is less than half the size of *C. eurina* (E.A. Smith), a species that lives today south of India at 430 fathoms and off Borneo at 890 fathoms (Powell, 1969, Indo-Pacific Mollusca, v. 2, no. 10, p. 269, pl. 217) but it resembles that species in many important features. *C. powelli*, however, has fewer whorls, a proportionately longer aperture and the axial folds on its body whorl are longer than those on *C. eurina*.

The Mid-Pacific species is named for A.W.B. Powell of New Zealand, world authority on the Turridae.

Occurrence:- A single specimen from Agassiz Guyot at a depth of 865-884 fathoms (1582-1617 m.).

Subfamily Turrinae
Genus *Cryptogemma* Dall

Dall, 1918, Proc. U.S. Nat. Mus., v. 54, p. 318 (as section of *Gemmula* Weinkauff).
Type (by original designation):- *Gemmula benthina* Dall. Holocene, Gulf of Panama.

Cryptogemma species
Pl. 3, figs. 3, 4

A single specimen, 10.4 mm. in length (USNM 703271), with the apical whorls and parts of the rest of the shell eroded, appears to belong to the genus *Cryptogemma* Dall. In proposing this name Dall cited only the type species, but a year later (Dall, 1919, Proc. U.S. Nat. Mus., v. 56, p. 30-33), he added seven new species to *Cryptogemma*, raising it to generic rank. Of these, however, only one, *C. quentinensis* Dall, from off Lower California, seems a true *Cryptogemma*. Powell (1966, Bull. Auckland Inst. and Mus., no. 5, p. 49) under the genus cites three species (one of these, *C. serilla* Dall, 1908, is not a *Cryptogemma*), and mentions, in addition, an undescribed species from Hawaii. Because our single specimen is somewhat worn, and since we are unable to compare our shell with the Hawaiian species, the material being in Dr. Powell's hands, we are not placing a name on this specimen.

Subfamily Daphnellinae
Genus *Pleurotomella* Verrill

Verrill, 1873, Amer. Jour. Sci., ser. 3, v. 5, p. 15.
Type (by monotypy):- *Pleurotomella packardi* Verrill. Holocene, Northwestern Atlantic.

Pleurotomella dubia Schepman

Pl. 3, figs. 9, 10

Pleurotomella dubia Schepman, 1913, Prosobranchia, Siboga-Expeditie, v. 49, pt. e, p. 448, pl. 3. fig. 8.

Medium in size, fusiform, thin, white except for the protoconch whose three slightly convex whorls are dark brown and finely sculptured by diagonally crossed riblets; whorls of the spire, about six in number, strongly shouldered; upper third of each whorl slightly concave, crossed by regularly spaced, oblique cords; remainder of whorl rising to a shoulder that bears rounded, elongated, oblique nodes, fifteen on penultimate whorl. Spiral sculpture consisting of faint, close-set riblets that are stronger on the lower part of the body whorl than elsewhere. Aperture lenticular, extended anteriorly into a long canal; outer lip sharp, inner lip thinly callused. Growth lines are convex posteriorly over the upper part of the whorls, reversing at the shoulder in a broad curve that is convex anteriorly.

Measurements of the figured specimen, USNM 703268:- height 15.6 mm, diameter 6.4 mm.

MacNeil described *Pleurotomella? ryukyuensis* from the late Tertiary Shinzato Tuff Member of the Shimajiri Formation of Okinawa (1960, U.S. Geol. Surv. Prof. Paper, 339, p. 117, pl. 9. fig. 22) and suggested a close relationship to *P. dubia* Schepman. MacNeil's specimen is more slender than the shells here described, having a proportionately longer spire and shorter anterior canal.

Occurrence:- Figured specimen and two incomplete shells from Hess Guyot, Sta. No. 3, at depth 940-964 fathoms (1719-1763 m.); one incomplete specimen from Horizon Guyot, Sta. No. 1, at depth of 848-1200 fathoms (1551-2187 m.). The specimens described by Schepman were obtained in the Ceram Sea at a depth of 835 meters.

Pleurotomella allisoni Rehder and Ladd, n. sp.

Pl. 3, figs. 7, 8

Shell small, elongate-biconic, strongly shouldered; apex incomplete on all three specimens but whorls of spire probably about seven; below the suture a wide, smooth, slightly concave anal fasciole is marked by close-set growth lines convex posteriorly; below the fasciole the whorls are shouldered by moderately strong elongate nodes that are directed anteriorly; about 18 nodes on the penultimate whorl, becoming obscure on the body whorl. Close-set, low, rounded spiral riblets are present over the entire shell. Aperture lenticular, extended into a moderately long anterior canal that is slightly recurved; outer lip thin and deeply indented at the suture; inner lip smooth and callused.

Measurements of the holotype, USNM 703269:- height (incomplete) 14.9 mm, diameter 7.5 mm; paratype, USNM 703270 height (incomplete) 17.6 mm, diameter 6.6 mm.

P. allisoni seems to be closely related to *P. dinora* described by Dall from a specimen obtained by the U.S.A. *Albatross* in 812 fathoms near the Galapagos Islands (1908, Bull. Mus. Comp. Zool. Harvard, v. 43, no. 6, p. 281). Dall did not figure *P. dinora* but the type in the National Museum (no. 96479) is a stouter shell than *P. allisoni*, its nodes are less oblique and its spiral sculpture is weaker.

This species is named for the late Edwin C. Allison who was an active member of the group aboard the R/V *Alexander Agassiz* when the species was collected.

Occurrence:- Three specimens from Agassiz Guyot at depth of 865-884 fathoms (1582-1617 m.).

Subclass Opisthobranchia
Order Tectibranchia
Family Bullidae
Genus *Bulla* Linnaeus

Linnaeus, 1758, Syst. Naturae, 10th ed., p. 725.

Type (by subsequent designation, Montfort, 1810, Conch. Syst., v. 2, p. 331):- *Bullus ampulla* Linnaeus (= *Bulla ampulla* Linnaeus). Holocene, Indo-Pacific.

Subgenus *Leucophysema* Dall

Dall, 1908, Bull. Mus. Comp. Zool. Harvard, v. 43, p. 244. (as subgenus of *Bullaria* Rafinesque)

Type (by original designation):- *Bulla abyssicola* Dall. Holocene, Eastern Atlantic.

Bulla abyssicola Dall was described in 1881 from two specimens, one dredged in 640 fathoms (1170 m.) in Yucatan Strait in the Caribbean, the other from 339 fathoms (620 m.) off Dry Tortugas, Florida. Eight years later Dall (1889, Bull. Mus. Comp. Zool., v. 18, p. 56, pl. 17, fig. 11) figured the holotype and referred to the species a specimen from 508 fathoms (929 m.) off Frederiksted, St. Croix, Virgin Islands. At the same time he placed under this name the specimens dredged in the Bay of Biscay, Spain to which Jeffreys had given the manuscript name *Bulla pinguicola* in 1880. Watson in 1886 (Voy., H.M.S. Challenger, Zool., v. 15, p. 638) lists a specimen under this manuscript name from 450 fathoms (823 m.) off Fayal, Azores. An examination of material of this species received from Jeffreys appears to indicate that the eastern Atlantic form is distinct, being more inflated, with relatively stronger sculpture and with the adapical end of the outer lip more strongly arched. Jeffreys' name should, therefore, be validated.

When Dall proposed *Leucophysema* he described a new species from 1270 fathoms (2323 meters) off the Gulf of Panama, *B. (Leucophysema) morgana*. In 1925 Thiele (Gastropoda der Deutschen Tiefsee-Exped., v. 2, p. 243, pl. 32, fig. 18) described *Roxania aequatorialis* from several stations in the Indian Ocean (from off the East African coast to the Nicobars and off the west coast of Sumatra) in depths of from 378.7 to 620 fathoms (691-1134 meters). This is not a *Roxania*; it should be transferred to the subgenus *Leucophysema*.

The specimens which Dall described from off Fernandina, Florida, as *Bullaria (Leucophysema) eburneola* (1927, Proc. U.S. Nat. Mus., v. 70, p. 25) do not belong in this subgenus, as they are umbilicate and lack the punctate striae.

The following new species represents, therefore, a fifth member of this subgenus, a group now represented by a single species each in the deep waters of the Eastern Atlantic, Western Atlantic, Eastern Pacific, Mid-Pacific, and Indian Oceans.

Bulla (Leucophysema) argoblysis Rehder and Ladd, n. sp.

Pl. 3, figs. 5, 6

Shell small, broadly ovate, inflated, involute, imperforate, white in color. Adapical umbilicus probably moderately deep (in the unique type it is filled by a hardened brownish deposit), upper portion of umbilicus marked by somewhat irregular spiral grooves; the groove at the top of the gently rounded umbilical edge, and those of the adapical fourth of the body whorl consist of a series of crowded pits separated from each other by a narrow vertical ridge. These spiral furrows are rather broad, and are separated from each other by narrow spiral ridges. Following the adapical fourth the spiral series of pits become smaller, resulting in a series of moderately distant spiral rows of distant pits over the

remainder of the body whorl, except that towards the base the spiral pits become again more crowded, and the last few spiral furrows in the umbilical region are essentially irregular grooves. The pits in the midregion of the whorl are somewhat obscure under low power magnification, but under higher magnification, the distant spiral rows of pits are distinctly visible. The inner lip gently sinuate, the columellar portion being thick and strongly concave, with a well marked callus covering the umbilical area, and a thin marginate callus on the basal portion of the parietal wall. Outer lip strongly and evenly curved, with a thin edge, the adapical end curving slightly above the edge of the apical umbilicus.

Holotype:- (USNM 703272) measures 6.35 mm in length, 5.0 mm in diameter. Type locality:- Horizon Guyot, Mid-Pacific Mountains (19°40'N; 168°30'W), in 909-995 fathoms (1662-1818 m.); MPE 680826-Stat. #2.

This species is close to *B. (L.) aequatorialis* (Thiele, 1925) from the Indian Ocean, but the latter is slightly more inflated, the adapical umbilicus is almost closed by the less strongly concave upper end of the outer lip; the upper portion of the aperture is apparently somewhat broader in the Indian Ocean species. The two American species are more narrowly ovate, while the European species has a similar shape to the new species but the spiral sculpture is stronger, and the upper end of the outer lip is more strongly arched, rising higher above the edge of the apical umbilicus, and is protractively curved here forming a pronounced labial sinus.

Class Scaphopoda
Family Dentaliidae
Genus *Dentalium* Linnaeus

Linnaeus, 1758, Syst. Naturae, 10th ed., p. 785.

Type (by subsequent designation, Montfort, 1810, Conchyliologie systematique, v. 2, p. 23):-
Dentalium elephantinum Linnaeus. Holocene, western Pacific.

Dentalium mediopacificensis Rehder and Ladd, n. sp.

Pl. 3, figs. 1, 2

Shell of medium size, very slightly and evenly curved, finely costulate throughout, white in color. Apex without slit or notch, slightly compressed laterally resulting in a somewhat oval cross-section though the orifice is less oval and almost round; the dorsal wall is thicker than the ventral wall. The sculpture at the apex consists of about 13 to 16 sharp, subequal lirae with broad interspaces; lirae closer on dorsal side than on ventral; a few of the lirae at the apex may be weaker. At the anterior end, which is circular in cross-section, the lirae number 40 to 42, are more crowded, rounded-depressed, and irregular in strength; the increase results from the gradual intercalation of additional lirae. Although there is no apparent spiral sculpture except for occasional irregular remains of former anterior apertures, the lirae are slightly and irregularly undulate when viewed laterally; the resulting somewhat nodulose appearance is heightened by the irregular, more or less annular, patches of opaque white on the shell.

Holotype:- (USNM 703273), paratype (USNM 703274) Agassiz Guyot, Mid-Pacific Mountains; in 865-884 fathoms (1562-1617 m.); MPE 68097-8, Stat. #4.

<i>Measurements</i> (in mm):-	<i>Holotype</i>	<i>Paratype</i>
Length	33.4	27.3
Maximum diameter at posterior end	1.1	1.48
Minimum diameter at posterior end	1.14	1.6
Diameter at anterior end	3.6	3.3

D. mediopacifensis appears to be most closely related to *D. compressiusculum* described by Boissevain (1906, The Scaphopoda of the Siboga Exped., Siboga-Expeditie, v. 54, p. 33, pl. 6, fig. 12), a single specimen collected from south of Ceram, Indonesia, at a depth of 1570 meters. On that species, however, the apex shows a slight notch on the ventral side.

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Plate 3

- Figs. 1, 2. *Dentalium mediopacificensis* Rehder and Ladd, n. sp.; holotype, USNM 703273; length 33.4 mm.
- Figs. 3, 4. *Cryptogemma* species, USNM 703271; height 10.4 mm.
- Figs. 5, 6. *Bulla (Leucophysema) argoblysis* Rehder and Ladd, n. sp.; holotype, USNM 703272; height 6.35 mm.
- Figs. 7, 8. *Pleurotomella allisoni* Rehder and Ladd, n. sp.; holotype, USNM 703269; height 14.9 mm.
- Figs. 9, 10. *Pleurotomella dubia* Schepman, USNM 703268; height 15.6 mm.
- Figs. 11, 12. *Comitas powelli* Rehder and Ladd, n. sp.; holotype, USNM 703267; height 13.0 mm.
- Figs. 13, 14, 15. *Calliotropis (Solaricida) abyssicola* Rehder and Ladd, n. sp.; holotype, USNM 703266; diameter 11.3 mm.
- Fig. 16. *Calliotropis (Solaricida) hataii* Rehder and Ladd, n. sp.; paratype, USNM 703265; immature specimen, height 7.3 mm.
- Figs. 17, 18. *Calliotropis (Solaricida) hataii* Rehder and Ladd, n. sp.; holotype, USNM 703263; height 16.1 mm.

