# A Revised Classification of the Family Turridae, with the Proposal of New Subfamilies, Genera, and Subgenera from the Eastern Pacific

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(4 Plates)

## INTRODUCTION

THE FAMILY TURRIDAE is exceptionally large in genera and species. POWELL's (1966) review of the 549 generic and subgeneric names proposed in the family, with illustrations of type species of each accepted taxon, has greatly facilitated an approach to this large and otherwise unwieldy family. Chiefly because of this impetus, I undertook a review of the tropical eastern Pacific members of the family as a contribution to the forthcoming revised edition of Dr. A. Myra KEEN's "Sea Shells of Tropical West America," which is now in press.

This paper is offered both to validate the new subfamilies, genera, and subgenera utilized in the new edition, and to present more fully my scheme of classification at the subfamily level, since this departs considerably from previous classifications. Because the classification is based extensively upon the radula, the paper also gives photographic illustrations of radular ribbons of numerous species in order to document this approach.

Publication of the book will follow shortly. Since it will contain diagnoses and new photographs of each of the 295 species of Turridae now recognized in the Panamic Province, shell illustrations need not be included here.

It will be assumed that the reader has access to POWELL's (1966) monograph for a more complete understanding of the available genera. The differences between my concepts of many of these genera and those of previous authors are fully explained in the new edition and will not be repeated here.

Two papers validating new species of tropical eastern Pacific turrids are being published concurrently in this issue of the Veliger. In some cases the type species of the new taxa described herein are introduced as new species by McLEAN & POORMAN (1971), describing 53 new species, or by SHASKY (1971), describing 10 new species.

## ACKNOWLEDGMENTS

My indebtedness, already mentioned, to Dr. A. W. B. Powell of the Auckland Museum, whose monograph provided the groundwork, is here reaffirmed. His findings concerning New World genera were facilitated by Dr. J. P. E. Morrison of the U. S. National Museum, who made numerous radular slides for the late Dr. Paul Bartsch. Many of Morrison's drawings were reproduced by Powell, and I too have been fortunate in being able to use both his slides and drawings.

The continual aid of Mrs. Virginia Orr Maes of the Philadelphia Academy of Natural Sciences, a specialist in the Turridae, is gratefully acknowledged. Many of the critical radular preparations were hers. It should not be implied, however, that she necessarily agrees with all of my conclusions.

I particularly wish to acknowledge the constant encouragement and help of Dr. Myra Keen, of Stanford University.

Evaluation of available names at the specific level has been possible because photographs of type specimens in the principal museums were on hand. Dr. Myra Keen has provided photographs of type specimens in the British Museum, supplemented by others taken by Virginia Maes. I have personally examined and photographed type material at the U. S. National Museum, Washington, D.C.; American Museum, New York; Academy of Natural Sci-

ences, Philadelphia; California Academy of Sciences, San Francisco; Stanford University, California; and the San Diego Museum, California. I am grateful to the curators and staffs of these institutions for the many courtesies extended, both on my visits and in correspondence.

Excellent material in the family Turridae is available in the Los Angeles County Museum of Natural History. In addition to the Museum's holdings, the Hancock Collection, resulting from expeditions of the Allan Hancock Foundation, and now on loan to the Museum, has proven exceptionally rich in turrids. Several private collections, notably those of Helen DuShane of Whittier, Leroy Poorman of Pasadena, and Donald Shasky of Redlands, California, have yielded much information.

## The TURRID RADULA and FEEDING MECHANISM

There are essentially two basic radular types in the Turridae. In the first group, the radular ribbon has a strong basal membrane, and the teeth consist of a singly cusped rachidian, a rachiglossate lateral, and a slender marginal, although many genera retain only the marginal teeth. The marginal teeth are solid in structure, some simple in form, while others appear to have two limbs, the lesser member fused to the greater member at the tip. In the second radular group there are marginal teeth only, which are hollow and truly toxoglossate, used singly as hypodermic needles to paralyze prey, as in the family Conidae. Here the teeth are also on a ribbon, but the basal membrane is vestigial and the teeth easily detached (Maes, 1971: 71).

Feeding mechanisms in the two groups differ markedly. Maes (*op. cit.*) has offered a clear explanation of the major distinctions, which may be summarized as follows: Envenomation in the non-toxoglossates is assumed to take place in the buccal cavity after the prey has been swallowed. The radular ribbon has a "working bend" at the opening into the buccal cavity, where the teeth are used a row at a time and then sloughed off. In the toxoglossates the teeth are sloughed off the vestigial membrane of the ribbon, but rather than being lost are stored in a membranous pouch opening narrowly into the buccal cavity; a single tooth may be squeezed out, charged with toxin, and held at the tip of the proboscis, envenomation taking place upon contact with the prey outside the buccal cavity.

Thus it is clear that the differences between the two groups involve far more than simple differences in radular teeth; the structure and function of the entire buccal cavity differs in the two groups. Very little is known about the specific details of feeding, but it is likely that many modifications and specializations occur, considering the extensive diversity known in shell morphology and radular types.

## SUBFAMILY CLASSIFICATION of TURRIDAE

Thiele (1929) grouped the turrids in the family Conidae, using three subfamilies: Turrinae, Brachytominae, and Cytharinae; the Coninae constituting the fourth subfamily. His Turrinae included all the non-toxoglossate genera, the Brachytominae the operculate toxoglossates, and the Cytharinae the inoperculate toxoglossates. A separation between the toxoglossate and nontoxoglossate groups is definitely indicated, but division of the operculate and inoperculate toxoglossates will not yield natural groups, because the operculum may be fully developed, vestigial, or lacking in some closely related genera. Application of Brachytominae was unfortunate, because the opercular and radular characters of the type species of *Brachytoma* Swainson, 1840 (*Pleurotoma strombiformis* Sowerby, 1839 = *P. stromboides* Sowerby, 1832), remain unknown (Powell, 1966: 89).[1] Usage of Brachytominae has therefore been avoided by subsequent authors.

[1] Habe & Kosuge (1966, p. 336, pl. 29, fig. 5) described a *Brachytoma vexillum* from Formosa, a species here considered congeneric with the type species *B. stromboides* (Sowerby, 1832) (original figure reproduced by Powell, 1966, pl. 13, fig. 21). The Habe & Kosuge species is operculate and has a subsutural cord, suggesting that the radula of *Brachytoma* will prove to be either zonulispirine, or more likely, crassispirine, as defined in this paper.

Powell (1942, 1966) offered classifications employing a number of subfamilies, but relied chiefly on shell characters in defining them. In several instances there are disparate radular types within a single subfamily, some including both the solid and hollow marginal teeth. He felt that toxoglossate dentition could develop independently in different groups. His view is summarized as follows (1966: 55): "The ability to develop this highly specialized use of the radula for predaceous purposes is apparently inherent in all the subfamily groups of the Turridae to a varying extent. . . ." The view that groups having the disparate radular types may be closely related is rejected here and by Morrison and Maes as discussed below.

Morrison (1966) evidently followed Thiele in finding a distinction based on those with solid and those with hollow marginal teeth, but he suggested separation at the family level, utilizing Turridae for those with solid teeth, and introducing Mangeliidae for those with the hollow, toxoglossate teeth. He employed only a few additional subfamilies to account for further radular distinctions. However, I feel that separation at the family level is premature since details of the feeding mechanisms and functional anatomy are known for few species. The fact that all turrids possess a venom gland and that most are easily recognized as turrids on the conchological character of the anal sinus argues for the retention of a single family. Morrison's statement that the toxoglossate group lacks a radular membrane is not supported by Maes (1971), who describes the basal membrane as vestigial.

Maes (*op. cit.*) affirmed the basic distinction between the toxoglossate and non-toxoglossate groups and offered new insights about the phylogeny of the toxoglossates. She did not attempt a new subfamily classification, although she did suggest some modifications of the subfamily definitions of both Powell and Morrison.

I offer here a classification that employs more subfamilies than utilized by Powell or Morrison, defined both on radular features and shell characters. No subfamily in my scheme contains genera with disparate radular types, at least not combining those with solid and those with hollow teeth. Shell characters, however, are not always clear-cut, and somewhat similar shell forms may appear in different subfamilies.

My classification has its limitations in that I have, for the most part, not considered or attempted to assign generic groups unrepresented in the eastern Pacific. My objective has been to present a workable arrangement of the large eastern Pacific fauna, for the tropical element of which I employ a total of 95 genera arranged in 12 subfamilies. A workable arrangement can be offered now, on the basis of shell characters such as the protoconch, presence or absence of columellar plicae, parietal callus, position of the anal sinus, presence or absence of the operculum, and the radula, despite the paucity of other information on anatomy. The salient features of the 12 subfamilies are summarized in Table 1.

Three subfamilies recognized by Powell, the Clavatulinae, Conorbinae, and Thatcheriinae, are not represented in the eastern Pacific. While I believe that the 549 generic names discussed by Powell may be assigned to the 15 proposed subfamilies (including the 3 not represented in the eastern Pacific), it will behoove workers dealing with the family to make further modifications. Other schemes of ranking may eventually be utilized, perhaps by demoting some groups with overlapping radular features to the status of tribes, saving the subfamily category for more fundamental, perhaps yet unknown, distinctions.

### Subfamily Pseudomelatominae Morrison, 1966

(Figures *1* to *3*)

**Diagnosis:** Shells of medium to large size, anterior canal moderately elongate; anal sinus on the shoulder slope, parietal callus lacking, columella smooth. Protoconch smooth. Operculum leaf shaped, with terminal nucleus. Radular ribbon relatively large, rachidian tooth large, with rectangular base and strong central cusp, marginal tooth massive, tapered to a sharp point, lacking a smaller limb.

**Discussion:** Three genera comprise the Pseudomelatominae, all confined to the eastern Pacific: *Pseudomelatoma* Dall, 1918; *Hormospira* Berry, 1958; and *Tiariturris* Berry, 1958. The radula (Figures *1* to *3*) is distinctive, particularly in lacking the smaller limb of the marginal tooth found in most of the non-toxoglossate groups.

Powell (1966) allocated these genera to the Turriculinae on the basis of shell characters. Morrison (1966) designated a subfamily, suggesting placement of the group as a subfamily of the Muricidae or Thaisidae, evidently because he interpreted the outer teeth as laterals rather than marginals, and considered the radula "completely unrelated in structure and function" to that of other turrids. However, the shell exhibits a turrid sinus and a turrid poison gland is present (Maes, personal communication). I follow the suggestion of Maes in interpreting the outer teeth as marginals and recognize a subfamily, in the absence of further published information about the anatomy and function.

### Subfamily Clavinae Powell, 1942

(Figures *4* to *26*)

**Diagnosis:** Shells of moderate to large size, high spired, with short or moderately elongate anterior canals; ground color usually light, surface often glossy. Protoconch smooth or strongly carinate. Sinus deep, bordered on the inside by parietal callus; columella smooth. Operculum leaf shaped, with terminal nucleus. Radula typically with a small, unicuspid rachidian, lacking a broad rectangular base; laterals broad, comblike; marginals long and flattened, lesser limb small.

**Discussion:** The subfamily limitation used here was first proposed by Morrison (1966), who unnecessarily introduced a subfamily name, Drilliinae, rather than restrict the earlier Clavinae. MAES (1971) referred to the group as Clavinae "of Maes unpublished, not of Powell, 1966." As limited by Morrison, Maes, and in the present usage, this is the only group exhibiting the rachiglossate, comb-like lateral teeth, a type of dentition described by Powell as "prototypic." However, that may be an unfortunate appellation, because the presence of lateral teeth may well be primitive, but not necessarily an ancestral character.

Powell's concept of Clavinae embraced genera with diverse radular types, including a number of toxoglossate groups. Such genera, many of which have raised subsutural cords, are assigned to other subfamilies.

Eastern Pacific genera with carinate protoconchs are ***Calliclava,*** new genus; *Elaeocyma* Dall, 1918; *Kylix* Dall, 1919; *Imaclava* Bartsch, 1944; and *Leptadrillia* Woodring, 1928. Genera lacking the carination are *Syntomodrillia* Woodring, 1928; *Agladrillia* Woodring, 1928; *Drillia* Gray, 1838 (and subgenus *Clathrodrillia* Dall, 1918); *Globidrillia* Woodring, 1928; *Cerodrillia* Bartsch & Rehder, 1939; *Splendrillia* Hedley, 1922; *Iredalea* Oliver, 1915; *Bellaspira* Conrad, 1868; and the deep water genus *Spirotropis* G. O. Sars, 1878.

The clavine lateral is most frequently laterally elongate with numerous cusps as in *Kylix* (Figures *9* to *11*) and most of the others illustrated. In *Imaclava* (Figures *12* to *13*) there is a vertical elongation of the lateral, which is carried to an extreme in the new genus *Calliclava* (Figures *4* to *7*), in which the number of cusps on the lateral is markedly reduced. The length of the marginal varies and in *Bellaspira* (Figure *26*) a marked curvature is noticable.

Clavine genera may be recognized on shell characters in having a whitish ground color, the surface usually glossy, spiral sculpture consisting of incised striae. Generic criteria are: 1) protoconch whorls, which may be smooth or carinate, 2) length of anterior canal, and whether nearly straight or at an angle to the edge of the outer lip, 3) back of last whorl—axial ribbing may be normal or obsolete, and there may be a massive hump, and 4) anal sinus, which may be projecting or closely appressed, some having a weak slot directed toward the suture just behind a tubercle of parietal callus.

### ***Calliclava*** McLean, gen. nov.

**Type Species:** *Cymatosyrinx palmeri* Dall, 1919.

**Diagnosis:** Shell small to medium sized, body whorl relatively short, shell surface glossy, often with brown or pink banding. Protoconch large, whorls 2, strongly carinate from the beginning. Axial ribbing weak across the shoulder, tending to form nodes at the periphery, spiral sculpture of incised grooves. Sinus deep, U-shaped, bordered by curved parietal callus on the inside. Lip edge nearly straight, stromboid notch moderately deep, mature lip preceded by a thickened axial rib ¼ turn back; anterior canal short, deeply notched. Operculum leaf shaped, nucleus terminal. Rachidian tooth of radula small, the lateral tooth vertically compressed, with relatively few cusps (Figures *4* to *7*).

**Discussion:** ***Calliclava*** is distinguished from all other clavine genera in having a strongly carinate protoconch from the emergent tip and in having a radula with a compressed rather than elongate lateral tooth. The characteristic radula is found in no other genus known to me, nor is a clavine genus known in which the carination is evident upon the immediately emergent nuclear tip.

In general proportions and sculpture ***Calliclava*** resembles *Elaeocyma,* in which the carination of the protoconch emerges only upon the second nuclear whorl. The radula of *Elaeocyma,* type species *E. empyrosia* (Figure *8*), is typically clavine, with an elongate lateral tooth.

Ten tropical eastern Pacific species are assigned to ***Calliclava*** (see McLEAN *in* KEEN, 1971) and the group is restricted to the eastern Pacific, as far as is known. Radulae of four species of ***Calliclava*** are illustrated (Figures *4* to *7*).

### Subfamily TURRINAE Swainson, 1840

(Figures *27* to *29*)

**Diagnosis:** Shells of medium to large size, anterior canal moderately elongate, anal sinus on the peripheral keel, parietal callus lacking, columella smooth, protoconch smooth. Operculum leaf shaped, with terminal nucleus. Radula with or without a small, or well-developed, unicuspid, rectangular central tooth, marginal teeth wishbone shaped, or of the modified wishbone type with the distal limb severed.

**Discussion:** POWELL'S (1966) concept of the subfamily Turrinae is followed. The group is characterized in having the anal sinus on the peripheral keel, rather than on the shoulder, as in the closely related Turriculinae.

MORRISON (1966) introduced a subfamily name Lophiotominae, which may be synonymized with Turrinae because *Lophiotoma* Casey, 1904, is typically turrine. However, Morrison's concept of Lophiotominae was much broader, embracing all non-toxoglossate genera that lack central and lateral teeth.

The subfamilies Turrinae, Turriculinae, and Clavatulinae (an African group) are defined chiefly on shell characters. Radular characters overlap. In all three groups the marginal teeth may be of the wishbone type, modified wishbone—with severed distal limb, or duplex—with small accessory limb. In some closely related genera, or even species in the same genus such as *Gemmula* (see Powell, 1966: 47), a central may be present or absent. A subfamily distinction on the presence or absence of a central tooth, as proposed by Morrison, cannot be made.

Eastern Pacific genera of Turrinae are *Gemmula* Weinkauff, 1875; *Polystira* Woodring, 1928; *Cryptogemma* Dall, 1918; and *Ptychosyrinx* Thiele, 1925, which was introduced in the eastern Pacific by Berry (1968: 158) with the description of *P. chilensis*. Powell (1964, 1966) has included *Antiplanes* Dall, 1902 (and subgenera), and *Carinoturris* Bartsch, 1944, in the Turrinae, genera here considered more appropriately referred to Turriculinae.

## Plate Explanation

Note: Slides of the radulae illustrated here are in 3 collections: LACM, Los Angeles County Museum of Natural History; USNM, United States National Museum of Natural History; ANSP, Academy of Natural Sciences, Philadelphia.

The AHF (Allan Hancock Foundation) Collection is on loan to LACM.

LACM slides were made from mature specimens or large specimens lacking a mature lip, mounted and stained in non-resinous medium (Turtox CMC-10, stained with a dab of CMC-S); ANSP slides made by Virginia Maes are unstained; stain in some of the USNM slides made by J. P. E. Morrison has coagulated.

Magnification of all figures is the same, approximately × 450, thereby facilitating comparison by relative size.

The arrangement follows the sequence used by McLean (*in* Keen, 1971), with but few exceptions, and with the addition of some species from the Californian and Oregonian Provinces.

A superior T ($^T$) preceding the name indicates that the species is the type species of the genus or subgenus.

Subfamily Pseudomelatominae

Figure *1*: $^T$*Pseudomelatoma penicillata* (Carpenter, 1864). AHF 2603-54, Punta San Bartolome, Baja California.
Figure *2*: $^T$*Hormospira maculosa* (Sowerby, 1834). LACM 65-16, Banderas Bay, Nayarit, Mexico, 10 to 15 fathoms.
Figure *3*: *Tiariturris libya* (Dall, 1919). USNM 96576, Cape San Lucas, Baja California, 66 fathoms.

Subfamily Clavinae

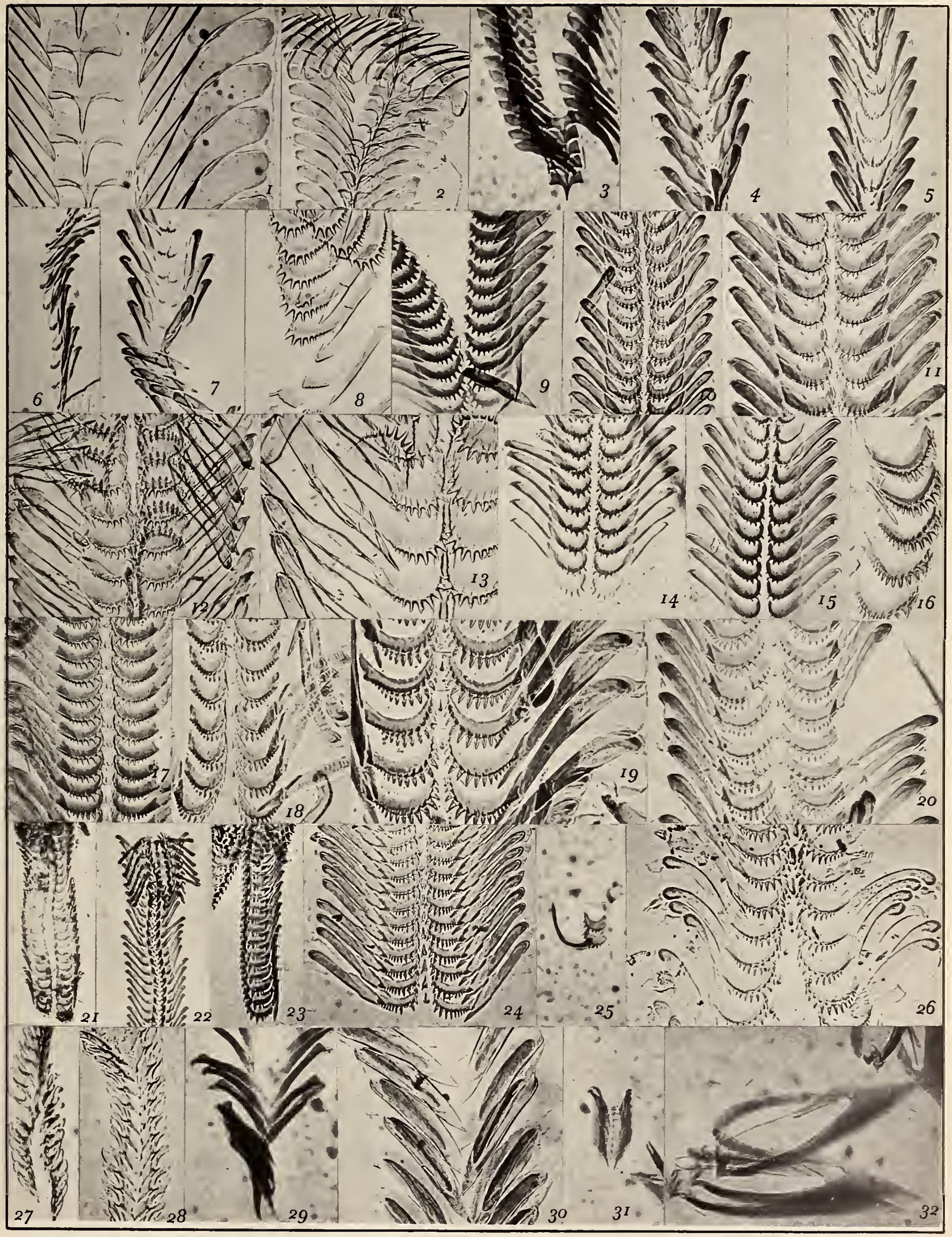
Figure *4*: *Calliclava aegina* (Dall, 1919). LACM 65-43, Bahía de Los Angeles, Baja California, 10 to 20 fathoms.
Figure *5*: *Calliclava craneana* (Hertlein & Strong, 1951). LACM, Salina Cruz, Oaxaca, Mexico, 20 to 50 fathoms.
Figure *6*: *Calliclava jaliscoensis* McLean & Poorman, 1971. LACM 65-16, Banderas Bay, Nayarit, Mexico, 10 to 15 fathoms.
Figure *7*: $^T$*Calliclava palmeri* (Dall, 1919). LACM A.7740, Puertocitos, Baja California.
Figure *8*: $^T$*Elaeocyma empyrosia* (Dall, 1899). AHF 913-39, San Clemente Island, California, 35 to 46 fathoms.
Figure *9*: *Kylix halocydne* (Dall, 1919). AHF 1160-40, Long Beach, California, 32 to 52 fathoms.
Figure *10*: *Kylix hecuba* (Dall, 1919). AHF 721-37, Puerto Peñasco, Sonora, Mexico, 8 to 12 fathoms.
Figure *11*: *Kylix paziana* (Dall, 1919). LACM, Guaymas, Sonora, Mexico, 17 fathoms.
Figure *12*: *Imaclava pilsbryi* Bartsch, 1950. LACM 68-58, Bahía Santiago, Colima, Mexico, 7 to 12 fathoms.
Figure *13*: $^T$*Imaclava unimaculata* (Sowerby, 1834). LACM 66-17, Rancho Palmilla, Baja California, 10 to 20 fathoms.
Figure *14*: *Agladrillia flucticulus* McLean & Poorman, 1971. LACM, Gulf of Tehuantepec, Chiapas, Mexico, 20 to 40 fathoms.
Figure *15*: *Agladrillia pudica* (Hinds, 1843). AHF 214-34, Cape San Francisco, Ecuador, 2 fathoms.
Figure *16*: *Drillia (Drillia) acapulcana* (Lowe, 1935). AHF 535-36, Bahía de Los Angeles, Baja California, 25 to 40 fathoms.
Figure *17*: *Drillia (Drillia) albicostata* (Sowerby, 1834). AHF 325-35, Tagus Cove, Isabela Island, Galápagos Islands, 80 fathoms.
Figure *18*: *Drillia (Drillia) clavata* (Sowerby, 1834). LACM, James Bay, Santiago Island, Galápagos Islands, 11 fathoms.
Figure *19*: *Drillia (Drillia) roseola* (Hertlein & Strong, 1955). LACM 68-58, Bahía Santiago, Colima, Mexico, 7 to 12 fathoms.
Figure *20*: *Drillia (Clathrodrillia) salvadorica* (Hertlein & Strong, 1951). LACM 68-58, Bahía Santiago, Colima, Mexico, 7 to 12 fms.
Figure *21*: *Globidrillia hemphilli* (Stearns, 1871). USNM 268762, San Bartolomé Bay, Baja California.
Figure *22*: *Globidrillia micans* (Hinds, 1843). LACM, Puertocitos, Baja California, 6 to 8 fathoms.
Figure *23*: *Globidrillia strohbeeni* (Hertlein & Strong, 1951). LACM 66-20, El Pulmo, Baja California, 4 fathoms.
Figure *24*: *Cerodrillia cybele* (Pilsbry & Lowe, 1932). LACM 65-16, Banderas Bay, Nayarit, Mexico, 10 to 15 fathoms.
Figure *25*: *Splendrillia bratcherae* McLean & Poorman, 1971. USNM 268911, Agua Verde Bay, Baja California.
Figure *26*: *Bellaspira melea* Dall, 1919. LACM, Guaymas, Sonora, Mexico, 17 fathoms.

Subfamily Turrinae

Figure *27*: $^T$*Gemmula hindsiana* Berry, 1958. LACM 60-9, Guaymas, Sonora, Mexico, 40 to 125 fathoms.
Figure *28*: *Polystira oxytropis* (Sowerby, 1834). AHF 941-39, Gulf of Dulce, Costa Rica, 19 to 48 fathoms.
Figure *29*: *Cryptogemma quentinensis* Dall, 1919. USNM 214068, off San Diego, California, 822 fathoms.

Subfamily Turriculinae

Figure *30*: $^T$*Fusiturricula armilda* (Dall, 1908). LACM, Bahía Bamba, Oaxaca, Mexico, 25 to 50 fathoms.
Figure *31*: *Cochlespira çedonulli* (Reeve, 1843). USNM 123102, Gulf of Panama, 153 fathoms.
Figure *32*: *Knefastia tuberculifera* (Broderip & Sowerby, 1829). USNM 96648, La Paz, Baja California, 21 fathoms.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*Gemmula hindsiana,* the type species of *Gemmula,* has wishbone shaped marginals with a central tooth (Figure *27*); *Polystira oxytropis* (Figure *28*) is similar but lacks a central, and *Cryptogemma quentinensis* (Figure *29*) has slender wishbone marginals with a detached distal limb.

### Subfamily Turriculinae Powell, 1942

(Figures *30* to *43*)

**Diagnosis:** Shells of medium to large size, anterior canal moderately elongate, somewhat flexed, anal sinus on the shoulder, usually deep, J-shaped or U-shaped; parietal callus lacking, early whorls of protoconch smooth. Operculum leaf shaped, nucleus usually terminal. Radula with or without a small or well developed, unicuspid, rectangular central tooth; marginal teeth wishbone shaped, or of the modified wishbone type with the distal limb severed.

**Discussion:** The subfamily limitation employed here follows Powell's concept (1966, 1969), the group distinguished from Turrinae in having the sinus on the shoulder rather than on the peripheral keel. Cochlespirinae Powell, 1942, is synonymous. It was intended originally to apply to genera having a broad based, unicuspid rachidian. Powell later retracted it (1966) upon noting that the presence or absence of a rachidian varies extensively in the Turrinae and Turriculinae, as discussed above.

Shallow water genera of the tropical Eastern Pacific are *Fusiturricula* Woodring, 1928; *Cochlespira* Conrad, 1865; *Knefastia* Dall, 1919; and ***Pyrgospira,*** new genus. Northeastern Pacific genera are *Aforia* Dall, 1889; *Antiplanes* Dall, 1902 (and subgenera *Rectiplanes* Bartsch, 1944; and *Rectisulcus* Habe, 1958); *Carinoturris* Bartsch, 1944; *Megasurcula* Casey, 1904; and *Rhodopetoma* Bartsch, 1944. Abyssal genera are *Aforia* Dall, 1889; *Anticlinura* Thiele, 1934; *Leucosyrinx* Dall, 1889; and *Steiraxis* Dall, 1896. In *Antiplanes* and *Carinoturris* the sinus is relatively low on the shoulder, but not on a raised peripheral keel as in the Turrinae, where these genera were assigned by Powell (1964, 1966).

A rachidian tooth with rectangular base is found in *Cochlespira cedonulli* (Figure *31*) and *Aforia* (Figures *34* to *35*); other genera have wishbone shaped marginals only, some are broad with the small distal limb detached as in *Knefastia tuberculifera* (Figure *32*), others narrow as in *Fusiturricula armilda* (Figure *30*), and in the new genus ***Pyrgospira*** (Figure *33*), the secondary limb is greatly reduced.

#### ***Pyrgospira*** McLean, gen. nov.

**Type Species:** *Pleurotoma obeliscus* Reeve, 1843 (Synonyms: *Clathrodrillia aenone* Dall, 1919; *Crassispira tomliniana* Melvill, 1927; *Clathrodrillia nautica* Pilsbry & Lowe, 1932).

**Diagnosis:** Shell of small to medium size, yellowish with brown periostracum, high spired, whorls tabulate below a concave shoulder bearing a raised subsutural thread. Protoconch of 2 smooth whorls, passing gradually to mature sculpture. Axial ribbing numerous on early whorls, crossed by spiral cords, producing a coarse clathrate sculpture across the body whorl. Sinus on the shoulder slope, narrow at the entrance, moderately deep, its termination U-shaped; parietal callus lacking except for a slight thickening in mature specimens. Anterior canal moderately elongate, deeply notched, stromboid notch moderately deep, lip crenulated by the spiral sculpture, inner lip projecting over the curved siphonal fasciole. Operculum leaf shaped, nucleus terminal. Radula with marginal teeth only, of modified wishbone type, main limb of tooth massive, distal limb small and narrow (Figure *33*).

**Discussion:** ***Pyrgospira*** has a shorter canal than most turriculine genera, but lacks the development of parietal callus and the thickened rib on the back of the last whorl that characterizes most crassispirine genera. The radula is distinctive.

In addition to the wide ranging eastern Pacific type species, ***Pyrgospira obeliscus,*** there are two Atlantic representatives, ***P. ostrearum*** (Stearns, 1872) and ***P. tampaensis*** (Bartsch & Rehder, 1939), as pointed out by Virginia Maes. The typical radula also occurs in these species.

### Subfamily Crassispirinae Morrison, 1966

(Figures *44* to *71*)

**Diagnosis:** Shells of medium to large size, with well developed parietal callus about the sinus and usually a narrow, projecting subsutural fold, the shoulder area otherwise sculptured only by growth lines. Protoconch smooth-whorled at first, often developing fine axial riblets before passing to the mature sculpture. Body whorl sculptured with axial ribs and spiral cords. Operculum leaf shaped, with terminal nucleus. Radula rarely with a rachidian tooth, usually of marginals only, of the modified wishbone type with the distal limb severed, or the duplex type, in which a narrow, much smaller accessory limb is superimposed on the larger main member.

**Discussion:** Powell (1966) grouped the crassispirine genera in the Clavinae because of similarities in shell characters. Morrison (1966) introduced Crassispirinae as an alternative name for Lophiotominae, in which he placed all non-toxoglossate genera that lack central and lateral teeth, as discussed above under Turrinae. Maes (1971) referred to the Crassispirinae: "in part of Morrison, 1966," but did not offer a diagnosis. Crassispirinae is here restricted to apply to genera with strong parietal callus about the sinus and a radula that usually lacks a rachidian and has a modified wishbone or duplex type of marginal.

*Crassispira* Swainson, 1840, is the most characteristic New World group. Eight additional subgenera defined chiefly on the structure of the sinus are recognized: (***Glossispira***), new subgenus; *Burchia* Bartsch, 1944; (***Crassiclava***), new subgenus; *Crassispirella* Bartsch & Rehder, 1939; (***Gibbaspira***), new subgenus; *Dallspira* Bartsch, 1950; *Striospira* Bartsch, 1950; and *Monilispira* Bartsch & Rehder, 1939. The type species of *Monilispira* is *Drillia monilifera* Carpenter, 1857, not *M. monilis* Bartsch & Rehder, 1939, as was indicated by Powell (1966). This distinction significantly changes the concept

## Plate Explanation

Subfamily Turriculinae (continued)

Figure *33*: [T] *Pyrgospira obeliscus* (Reeve, 1843). LACM A.6573, Tastiota, Sonora, Mexico. 35 to 45 fathoms.
Figure *34*: *Aforia goodei* (Dall, 1890). LACM A.8998, Queen Charlotte Sound, British Columbia, 1050 fathoms.
Figure *35*: *Aforia kincaidi* (Dall, 1919). Holotype, USNM 151581, Shelikof Strait, Kodiak Island, Alaska.
Figure *36*: "*Leucosyrinx*" *clionella* Dall, 1908. USNM 97069, off Manta, Ecuador, 401 fathoms.
Figure *37*: "*Leucosyrinx*" *exulans* (Dall, 1890). Holotype, USNM 96499, Galápagos Islands, 634 fathoms.
Figure *38*: *Leucosyrinx equatorialis* (Dall, 1919). USNM 97070, off Manta, Ecuador, 401 fathoms.
Figure *39*: [T] *Antiplanes (Rectiplanes) santarosana* (Dall, 1902). AHF 1396-41, San Miguel Island, California, 57 fathoms.
Figure *40*: *Antiplanes (Rectisulcus) strongi* (Arnold, 1903). AHF 1384-41, Santa Catalina Island, California, 108 fathoms.
Figure *41*: [T] *Carinoturris adrastia* (Dall, 1919). Paratype, USNM 226154a, Monterey Bay, California, 581 fathoms.
Figure *42*: [T] *Rhodopetoma rhodope* (Dall, 1919). Holotype, US NM 212361, Santa Rosa Island, California, 82 fathoms.
Figure *43*: [T] *Megasurcula carpenteriana* (Gabb, 1865). AHF 1141-40, El Segundo, California, 28 to 30 fathoms.

Subfamily Crassispirinae

Figure *44*: *Crassispira (Crassispira) maura* (Sowerby, 1834). LA CM 68-58, Bahía Santiago, Colima, Mexico, 7 to 12 fathoms.
Figure *45*: [T] *Crassispira (Glossispira) harfordiana* (Reeve, 1843). LACM 70-16, Veracruz, Panama.
Figure *46*: [T] *Crassispira (Burchia) semiinflata* (Grant & Gale, 1931). LACM 65-2, Point Fermin, Los Angeles County, California, 16 fms.
Figure *47*: *Crassispira (Burchia) unicolor* (Sowerby, 1834). LACM 70-15, Venado Island, Panama Canal Zone.
Figure *48*: *Crassispira (Crassiclava) cortezi* Shasky & Campbell, 1964. LACM 60-6, Espíritu Santo Island, Gulf of California, 40 to 90 fathoms.
Figure *49*: [T] *Crassispira (Crassiclava) turricula* (Sowerby, 1834). AHF 1031-40, Santa Maria Bay, Baja California, 25 to 22 fathoms.
Figure *50*: *Crassispira (Crassispirella) ballenaensis* Hertlein & Strong, 1951. LACM, Gulf of Fonseca, El Salvador, 18 to 45 fms.
Figure *51*: *Crassispira (Crassispirella) brujae* Hertlein & Strong, 1951. LACM 38-6, Chamela Bay, Jalísco, Mexico.
Figure *52*: *Crassispira (Crassispirella) chacei* Hertlein & Strong, 1951. LACM 60-9, Guaymas, Sonora, Mexico, 40 to 125 fathoms.
Figure *53*: *Crassispira (Crassispirella) discors* (Sowerby, 1834). LA CM 68-41, Cuastecomate, Jalísco, Mexico, 15 to 65 feet.
Figure *54*: *Crassispira (Crassispirella) epicasta* Dall, 1919. LACM 70-15, Venado Island, Panama Canal Zone (ANSP, slide).
Figure *55*: [T] *Crassispira (Crassispirella) rugitecta* (Dall, 1918). AHF 1259-41, Dewey Channel, Baja California, 49 fathoms.
Figure *56*: *Crassispira (Crassispirella) rustica* (Sowerby, 1834). LA CM 70-15, Venado Island, Panama Canal Zone.
Figure *57*: [T] *Crassispira (Gibbaspira) rudis* (Sowerby, 1834). LA CM 70-16, Veracruz, Panama.
Figure *58*: [T] *Crassispira (Dallspira) abdera* (Dall, 1919). LACM 70-15, Venado Island, Panama Canal Zone.
Figure *59*: *Crassispira (Dallspira) bifurca* (E. A. Smith, 1888). LA CM 67-17, Libertad, Sonora, Mexico.
Figure *60*: *Crassispira (Dallspira) cerithoidea* (Carpenter, 1857). LACM 68-41, Cuastecomate, Jalísco, Mexico, 15 to 65 feet (AN SP, slide).
Figure *61*: *Crassispira (Dallspira) coelata* (Hinds, 1843). LACM 70-15, Venado Island, Panama Canal Zone (ANSP, slide).
Figure *62*: *Crassispira (Dallspira) eurynome* Dall, 1919. LACM, Mazatlan (ANSP, slide).
Figure *63*: *Crassispira (Dallspira) martiae* McLean & Poorman, 1971. Paratype, LACM 70-15, Venado Island, Panama Canal Zone.
Figure *64*: [T] *Crassispira (Striospira) kluthi* E. K. Jordan, 1936. LA CM 70-16, Veracruz, Panama.
Figure *65*: *Crassispira (Striospira) nigerrima* (Sowerby, 1834). LA CM 66-18, Punta Gorda, Baja California, 10 to 20 fathoms.
Figure *66*: *Crassispira (Striospira) tepocana* Dall, 1919. AHF 535-36, Bahía de Los Angeles, Baja California, 25 to 40 fathoms.
Figure *67*: *Crassispira (Striospira) xanti* Hertlein & Strong, 1951. LACM 66-18, Punta Gorda, Baja California, 10 to 20 fathoms.
Figure *68*: *Crassispira (Monilispira) appressa* (Carpenter, 1864). LACM 66-15, Rancho El Tule, Baja California.
Figure *69*: *Crassispira (Monilispira) currani* McLean & Poorman, 1971. Paratype, LACM 70-4, Sayulita, Nayarit, Mexico.
Figure *70*: [T] *Crassispira (Monilispira) monilifera* (Carpenter, 1857). LACM, Mazatlan.
Figure *71*: *Crassispira (Monilispira) pluto* Pilsbry & Lowe, 1932. LA CM 67-17, Libertad, Sonora, Mexico.


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of *Monilispira,* which has been used for species here placed in *Pilsbryspira* Bartsch, 1950, a toxoglossate group.

Other Crassispirine genera represented in the eastern Pacific are *Hindsiclava* Hertlein & Strong, 1955; ***Doxospira,*** new genus; *Buchema* Corea, 1934; *Lioglyphostoma* Woodring, 1928; ***Maesiella,*** new genus; *Miraclathurella* Woodring, 1928; and *Carinodrillia* Dall, 1918.

Radulae of most of the eastern Pacific species of *Crassispira* are shown in Figures *44* to *71*. Of particular interest is the presence of a rachidian tooth in both species of the new subgenus ***Crassiclava*** (Figures *48* to *49*), the only crassispirine group known to have a rachidian tooth. Particularly small ribbons are found in three species of the subgenus *Striospira* (Figures *64* to *65, 67*). Two species allocated to the subgenus *Crassispirella, C. discors* (Figure *53*) and *C. rustica* (Figure *56*) have teeth most resembling those of *Pyrgospira obeliscus* (Figure *33*), in which the secondary limb is reduced.

*Lioglyphostoma* (Figures *75* to *76*) and *Miraclathurella* (Figures *79* to *80*) have been regarded by previous authors as related to the toxoglossate genus *Glyphostoma,* but are, in fact, operculate with duplex dentition. The genus *Carinodrillia* (Figures *81* to *85*) has a marginal tooth with a long, flattened main member and a much reduced (if detectable at all) secondary limb, thereby resembling the marginal of the Clavinae. However, on shell characters *Carinodrillia* is allocated to the Crassispirinae and the modified lateral tooth interpreted as a duplex derivative.

### (*Glossispira*) McLean, subgen. nov.
(of *Crassispira* Swainson, 1840)

**Type Species:** *Pleurotoma harfordiana* Reeve, 1843 (Synonym: *Crassispira adamsiana* Pilsbry & Lowe, 1932).

**Diagnosis:** Shell relatively large and high spired; subsutural cord raised, weakly noded, shoulder concave below; periostracum thin, light brown; color gray with irregular white mottling. Protoconch white, whorls 2, smooth. Mature sculpture of narrow axial ribs and spiral cords, coarsely beaded at intersections; entire shell finely spirally striate. Sinus relatively shallow, entrance narrow, posterior part of aperture narrowed above the sinus into a vertical slot; lip edge forming a projecting tongue between the sinus and vertical slot. Lip edge thin, strengthened behind by a massive axial rib, stromboid notch shallow. Anterior canal short, deeply notched, inner lip callus slightly raised above the siphonal fasciole. Operculum leaf shaped, nucleus terminal. Radula of the duplex type (Figure *45*).

**Discussion:** The infolded tonguelike extension of the lip between the sinus and the sutural slot is the characteristic feature of ***Glossispira.*** The subgenus *Crassispira,* s.s., seems to be the most closely related. It has a sutural slot, but the sinus entrance is broad and the infolded extension of the lip is lacking. The surface of *Crassispira,* s.s., differs in having a glossy, closely adherent dark periostracum. In surface texture, *C.* (***Glossispira***) *harfordiana* most resembles *C. rudis,* which has a different sinus structure.

***Glossispira*** is monotypic; living or fossil congeners are as yet unknown.

### (*Crassiclava*) McLean, subgen. nov.
(of *Crassispira* Swainson, 1840)

**Type Species:** *Pleurotoma turricula* Sowerby, 1834 (Synonyms: *P. corrugata* Sowerby, 1834; *P. sowerbyi* Reeve, 1843).

**Diagnosis:** Shell relatively large, high spired, aperture elongate, subsutural cord weakly noded, shoulder concave below; periostracum thin, dark colored, color yellowish brown beneath, darker along the axial ribs. Protoconch whorls 2½, smooth, rounded, axial sculpture of strong, narrow ribs arising at the periphery and extending across the base; spiral sculpture of fine cording, increasing in strength toward the pillar, slightly nodulous on crossing the axial ribbing. Sinus broad at the entrance, deep, U-shaped, bordered on the inside by a massive pad of parietal callus. Lip edge thin, crenulated by the spiral sculpture, stromboid notch relatively shallow, lip preceded by a thickened axial rib ⅙ turn back. Anterior canal broad, deeply notched, inner lip raised. Operculum leaf shaped, nucleus terminal. Radula with a unicuspid rachidian tooth on a broad rectangular base, marginal teeth of modified wishbone or duplex type (Figures *48* to *49*).

**Discussion:** ***Crassiclava*** is unique in the subfamily in having a well formed rachidian tooth. The sinus is unlike that of other subgenera of *Crassispira* in having a strong parietal tubercle bordering the broad sinus entrance. Yet on all other shell characters the group seems closely related to other subgenera of *Crassispira* such as *Crassispira,* s.s., *Crassispirella, Burchia,* and *Gibbaspira.*

In addition to the type species, *Crassispira cortezi* Shasky & Campbell, 1964, is referred. It differs in having a narrower sinus, weaker spiral sculpture, and attains a smaller size, but otherwise strikingly resembles the type species. The radula (Figure *48*) is similar.

(***Gibbaspira***) McLean, subgen. nov.
(of *Crassispira* Swainson, 1840)

Type Species: *Pleurotoma rudis* Sowerby, 1834 (Synonym: *Drillia albovallosa* Carpenter, 1857).

**Diagnosis:** Shell relatively large, the subsutural cord swollen and bluntly noded, shoulder concave below; ground color dark, periostracum thin. Protoconch of 2 smooth, dark whorls, followed by a whorl with slanted axial ribs. Mature sculpture of minute spiral striae throughout, base with strong axial and spiral sculpture, noded at intersections; axial sculpture terminating above in white-tipped nodes at the periphery. Sinus deep, entrance narrow, bordered by prominent callus tubercles on the parietal wall and outer lip. Lip edge not thickened, preceded by a massive thickened axial rib ⅙ turn back, stromboid notch only weakly indicated. Anterior canal short, deeply notched, inner lip callus raised. The suture descends on the final whorl and then rises on the final

## Plate Explanation

Subfamily Crassispirinae (continued)

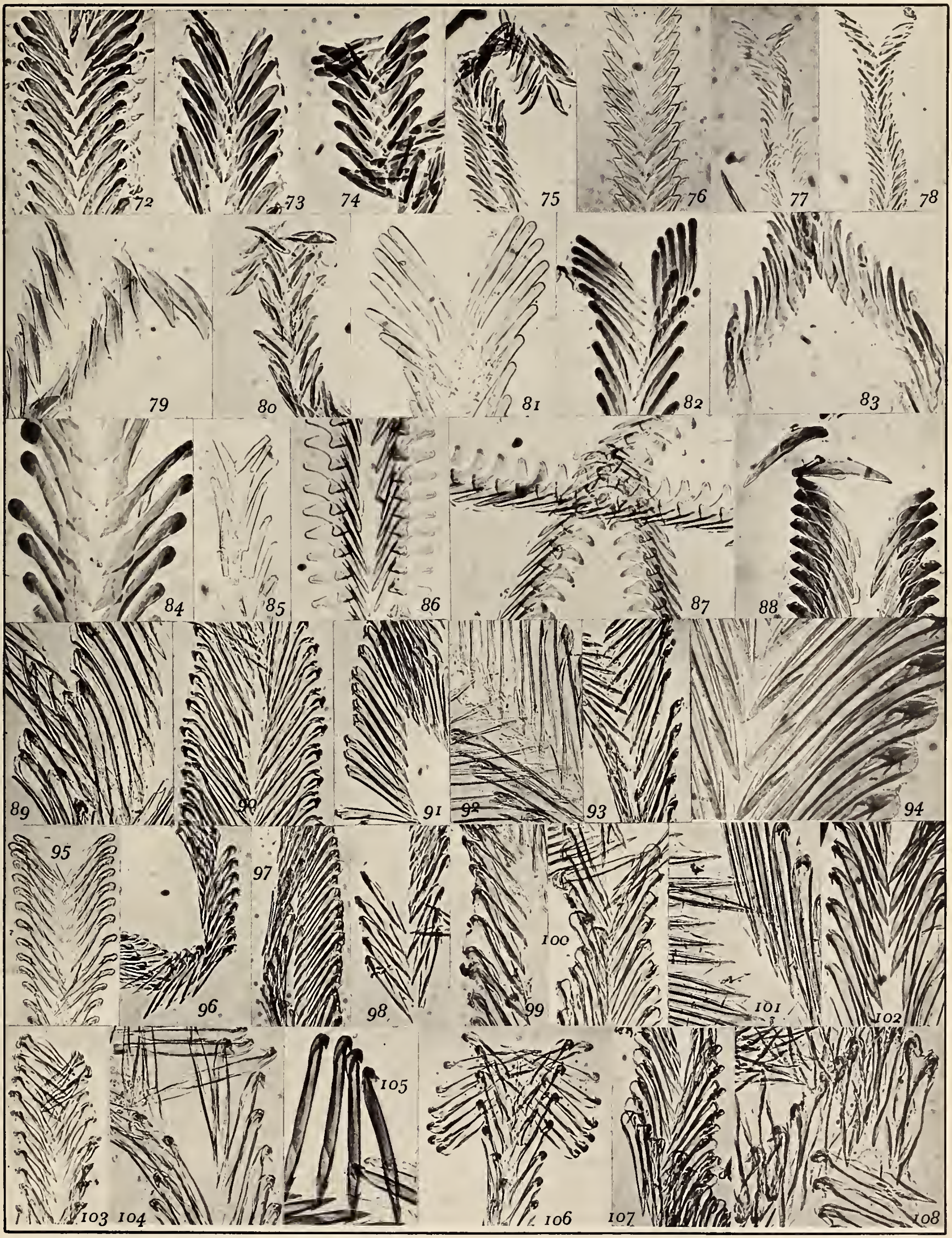
Figure *72*: [T]*Hindsiclava militaris* (Reeve, 1843). LACM 65-16, Banderas Bay, Nayarit, Mexico, 10 to 15 fathoms.
Figure *73*: [T]*Doxospira hertleini* Shasky, 1971. AHF 941-39, Gulf of Dulce, Costa Rica, 19 to 48 fathoms.
Figure *74*: *Buchema granulosa* (Sowerby, 1834). AHF 209-34, Santa Elena Bay, Ecuador, 8 to 10 fathoms.
Figure *75*: *Lioglyphostoma ericea* (Hinds, 1843). AHF 1055-40, Angel de La Guarda Island, Gulf of California, 57 fathoms.
Figure *76*: *Lioglyphostoma rectilabrum* McLean & Poorman, 1971. Holotype, LACM 1512, Guaymas, Sonora, Mexico, 40 to 125 fathoms (ANSP, slide).
Figure *77*: *Maesiella hermanita* (Pilsbry & Lowe, 1932). LACM 65-16, Banderas Bay, Nayarit, Mexico (ANSP, shell and slide).
Figure *78*: [T]*Maesiella maesae* McLean & Poorman, 1971. Paratype, LACM 1514, Guaymas, Sonora, Mexico (ANSP, slide).
Figure *79*: *Miraclathurella bicanalifera* (Sowerby, 1834). LACM, Guaymas, Sonora, Mexico, 20 to 40 fathoms.
Figure *80*: *Miraclathurella mendozana* Shasky, 1971. LACM, Gulf of Tehuantepec, Chiapas, Mexico, 40 fathoms.
Figure *81*: *Carinodrillia adonis* Pilsbry & Lowe, 1932. AHF 1733-49, Cabo Pulmo, Baja California, 18 to 21 fathoms.
Figure *82*: *Carinodrillia dichroa* Pilsbry & Lowe, 1932. LACM 68-27, Guaymas, Sonora, Mexico, 30 to 60 feet.
Figure *83*: [T]*Carinodrillia halis* (Dall, 1919). LACM 66-22, Muertos Bay, Baja California, 10 to 20 fathoms.
Figure *84*: *Carinodrillia hexagona* (Sowerby, 1834). LACM 65-17, La Cruz, Banderas Bay, Nayarit, Mexico, 12 feet.
Figure *85*: *Carinodrillia lachrymosa* McLean & Poorman 1971. Paratype, LACM 1516, Cuastecomate Bay, Jalísco, Mexico, 15 to 65 feet (ANSP, slide).

Subfamily Strictispirinae

Figure *86*: [T]*Strictispira ericana* (Hertlein & Strong, 1951). LACM 66-22, Muertos Bay, Baja California, 10 to 20 fathoms.
Figure *87*: *Strictispira stillmani* Shasky, 1971. Paratype, LACM 70-15, Venado Island, Panama Canal Zone.
Figure *88*: [T]*Cleospira ochsneri* (Hertlein & Strong, 1949). AHF 167-34, Santa María Island, Galápagos Islands, 15 fathoms.

Subfamily Zonulispirinae

Figure *89*: *Zonulispira chrysochildosa* Shasky, 1971. Paratype, LA CM 70-15, Venado Island, Panama Canal Zone.
Figure *90*: *Zonulispira grandimaculata* (C. B. Adams, 1852). LA CM 70-15, Venado Island, Panama Canal Zone.
Figure *91*: *Compsodrillia albonodosa* (Carpenter, 1857). LACM, San Felipe, Baja California.
Figure *92*: *Compsodrillia alcestis* (Dall, 1919). AHF 1087-40, Ensenada de San Francisco, Sonora, Mexico, 15 to 18 fathoms.
Figure *93*: *Compsodrillia bicarinata* (Shasky, 1961). LACM 60-6, Espíritu Santo Island, Gulf of California, 40 to 90 fathoms.
Figure *94*: *Compsodrillia excentrica* (Sowerby, 1834). LACM 70-15, Venado Island, Panama Canal Zone.
Figure *95*: *Compsodrillia gracilis* McLean & Poorman, 1971. Paratype, LACM 1518, Isla Santa Cruz, Galápagos Islands, 55 to 110 fathoms.
Figure *96*: *Compsodrillia haliplexa* (Dall, 1919). AHF 963-39, White Friars, Guerrero, Mexico, 20 to 25 fathoms.
Figure *97*: *Compsodrillia jaculum* (Pilsbry & Lowe, 1932). AHF 763-38, Cabo Corrientes, Jalísco, Mexico, 5 to 10 fathoms.
Figure *98*: *Compsodrillia olssoni* McLean & Poorman, 1971. Paratype, AHF 209-34, Santa Elena Bay, Ecuador, 8 to 10 fathoms.
Figure *99*: *Compsodrillia opaca* McLean & Poorman, 1971. AHF 1253-41, 8 miles west of Cedros Island, Baja California, 64 to 65 fathoms.
Figure *100*: *Compsodrillia thestia* (Dall, 1919). LACM, Puertocitos, Baja California.
Figure *101*: *Compsodrillia undatichorda* McLean & Poorman, 1971. LACM, Isabela Island, Galápagos Islands, 41 to 55 fathoms (DeRoy Collection, shell).
Figure *102*: *Pilsbryspira (Pilsbryspira) albinodata* (Reeve, 1843). LACM, 70-15, Venado Island, Panama Canal Zone.
Figure *103*: *Pilsbryspira (Pilsbryspira) aterrima* (Sowerby, 1834). LACM, 70-15, Venado Island, Panama Canal Zone.
Figure *104*: *Pilsbryspira (Pilsbryspira) aureonodosa* (Pilsbry & Lowe, 1932). LACM, 70-15, Venado Island, Panama Canal Zone.
Figure *105*: *Pilsbryspira (Pilsbryspira) collaris* (Sowerby, 1834). LA CM, 70-15, Venado Island, Panama Canal Zone.
Figure *106*: *Pilsbryspira (Pilsbryspira) garciacubasi* Shasky, 1971 LACM 69-13, Banderas Bay, Nayarit, Mexico.
Figure *107*: *Pilsbryspira (Nymphispira) bacchia* (Dall, 1919). LA CM 68-27, Guaymas, Sonora, Mexico, 30 to 60 feet.
Figure *108*: [T]*Pilsbryspira (Nymphispira) nymphia* (Pilsbry & Lowe, 1932). LACM 67-17, Libertad, Sonora, Mexico.



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⅓ whorl, producing a lateral twist to the shell. Operculum leaf shaped, nucleus terminal. Radula of the duplex type (Figure *57*).

**Discussion:** ***Gibbaspira*** is the only subgenus of *Crassispira* with a marked twist to the mature aperture and two prominent tubercles bordering the sinus.

In addition to the type species, which ranges from Mazatlan, Mexico, to Ecuador, the subgenus is represented in the Caribbean by *Crassispira dysoni* (Reeve, 1846) which is particularly common on the Caribbean coast of Panama. It has a brown rather than the gray ground color of *C. rudis,* with more numerous and finer tubercles across the base.

The name is taken from a manuscript label of Bartsch in the National Museum, derived from Latin, *gibber*—hunch-backed.

***Doxospira*** McLean, gen. nov.

**Type Species:** *Doxospira hertleini* Shasky, 1971 (described elsewhere in this issue of The Veliger).

**Diagnosis:** Shell relatively large, fusiform, with high spire and moderately elongate anterior canal; shoulder concave and smooth, lacking a subsutural cord except for a trace on the early whorls. Protoconch of 4 smooth whorls with deeply impressed sutures, gradually changing to mature sculpture. Axial sculpture of massive rounded ribs, crossed by numerous fine spiral cords. Sinus broad and deep, U-shaped, bordered within by a large parietal callosity extending forward into a spur, as in *Hindsiclava.* Lip not greatly thickened, not preceded by a massive axial rib; stromboid notch shallow. Operculum leaf shaped, nucleus terminal. Radula of the duplex type (Figure *73*).

**Discussion:** ***Doxospira*** is monotypic. In profile it resembles a number of other fusiform genera in different subfamilies. It resembles *Hindsiclava* in sinus structure, duplex radula, and lack of a thickened rib on the back of the last whorl, but does not have the flat sided whorls and reticulate sculpture of that genus. It recalls *Carinodrillia adonis* but has a different radula (compare Figures *73* and *81*). It also resembles the zonulispirine genera *Compsodrillia* and *Ptychobela,* differing in sinus structure and radula.

***Maesiella*** McLean, gen. nov.

**Type Species:** *Maesiella maesae* McLean & Poorman, 1971 (described elsewhere in this issue of The Veliger).

**Diagnosis:** Shell small to medium sized, whorls rounded, shoulder not deeply concave, subsutural cord a narrow raised thread. First 2 nuclear whorls smooth, rounded; strong diagonal axial ribs arise on the third nuclear whorl, persist for ½ turn and abruptly cease, replaced by weaker vertical ribs and spiral cords. Mature sculpture of sinuous axial ribs (obsolete on final whorl in some species), crossed by spiral cords and microscopic spiral striae. Sinus deep, the opening nearly obstructed by downward growth of the lip between the sinus and body whorl. Lip thickened by a massive varix, stromboid notch shallow, aperture elongate but not drawn into an anterior canal. Operculum with terminal nucleus. Radula of duplex type (Figures *77* to *78*).

**Discussion:** In addition to the type species the other members of the genus are ***Maesiella*** *hermanita* (Pilsbry & Lowe, 1932) and ***M.*** *punctatostriata* (Carpenter, 1865).

***Maesiella*** is related to *Lioglyphostoma* and *Miraclathurella,* genera characterized chiefly by the greatly thickened final lip varix. ***Maesiella*** shares with *Lioglyphostoma* a tendency toward obstruction of the sinus resulting from a downward growth of the lip, a trait not shown in *Miraclathurella.* ***Maesiella*** differs from *Lioglyphostoma* in having strong axial ribbing between the protoconch and the mature sculpture, a shorter anterior canal, more laterally directed sinus, more prominent stromboid notch, and lacking the thin leading edge of the lip.

The species of ***Maesiella*** are characteristic of gravel bottoms near rock, while those of *Lioglyphostoma* and *Miraclathurella* are characteristic of soft, offshore bottoms.

Shuto (1969: 202–209) placed some Neogene species from the Philippines in the genus *Euclathurella* Woodring, 1928, using subgenera *Miraclathurella* Woodring, 1928, *Thelecythara* Woodring, 1928, *Euclathurella,* s.s., and *Thelecytharella* Shuto, 1969. None of the species discussed by Shuto meet the criteria of the Woodring genera as used by McLean (*in* Keen, 1971). *Thelecytharella* has the appearance of a crassispirine genus related to ***Maesiella,*** but having a broadly open rather than constricted sinus.

***Maesiella*** is dedicated to Virginia Maes, who first examined the radula of two of the species.

Subfamily **STRICTISPIRINAE** McLean, subfam. nov.

(Figures *86* to *88*)

**Diagnosis:** Dark colored shells of moderate size, sculpture both axial and spiral, shoulder concave, with a well marked subsutural cord. Sinus deep, laterally directed; parietal callus well developed. Operculum leaf shaped, nucleus terminal. Radular ribbon relatively large, rows of teeth numerous; marginal teeth only, solid and massive, lacking a smaller limb, elbow shaped, with a projecting collarlike flange on the inner side.

**Discussion:** Two new genera with a distinctive and hitherto unrecorded radular pattern are here grouped as a subfamily. The collarlike flange on the inner side of the marginal tooth is unique. The radula most resembles that of the Pseudomelatominae, although the rachidian of that group is lacking. The collarlike structure could be interpreted as a thickening at the point of contact of adjacent teeth.

On the basis of shell characters, however, affinity to the Crassispirinae is suggested, particularly in the surface texture and presence of well developed parietal callus about the sinus.

Study of the anatomy and functional morphology should eventually reveal the true affinity of this group. I am much indebted to Virginia Maes for an exchange of ideas concerning the group, of which she has for some time been aware.

## Plate Explanation

Subfamily Borsoniinae

Figure *109*: *Borsonella (Borsonella) bartschi* (Arnold, 1903). AHF 981-39, Santa Barbara Island, California, 76 to 78 fathoms.
Figure *110*: *Borsonella (Borsonella) galapagana* McLean & Poorman, 1971. Paratype, LACM 1526, Isla Santa Cruz, Galápagos Islands, 93 to 110 fathoms (ANSP, slide).
Figure *111*: *Borsonella (Borsonellopsis) callicesta* (Dall, 1902). Holotype, USNM 109030, off Acapulco, Guerrero, Mexico, 660 fms.
Figure *112*: T *Borsonella (Borsonellopsis) erosina* (Dall, 1908). Holotype, USNM 123106, Gulf of Panama, 1672 fathoms.
Figure *113*: *Cruziturricula arcuata* (Reeve, 1843). AHF 448-35, Secas Islands, Panama, 12 fathoms.
Figure *114*: *Suavodrillia willetti* Dall, 1919. LACM 66-66, Graham Island, Queen Charlotte Islands, British Columbia, 30 fathoms.
Figure *115*: T *Suavodrillia kennicotti* (Dall, 1871). Holotype, US NM 206201, Unga Island, Aleutian Islands, Alaska, 6 fathoms.
Figure *116*: T *Ophiodermella ophioderma* (Dall, 1908). AHF 1165-40, San Pedro, California, 14 fathoms.

Subfamily Mitrolumninae

Figure *117*: T *Mitromorpha carpenteri* Glibert, 1954. USNM 153445, San Pedro, California.

Subfamily Clathurellinae

Figure *118*: *Clathurella rigida* (Hinds, 1843). LACM 66-15, Rancho El Tule, Baja California.
Figure *119*: T *Nanodiella nana* (Dall, 1919). USNM 211485, off La Paz, Baja California.
Figure *120*: *Glyphostoma (Glyphostoma) pustulosa* McLean & Poorman, 1971. LACM, Santiago Island, Galápagos Islands, 17 fathoms.
Figure *121*: T *Glyphostoma (Euglyphostoma) candida* (Hinds, 1843). AHF 941-39, Gulf of Dulce, Costa Rica, 19 to 49 fathoms.
Figure *122*: *Glyphostoma (Euglyphostoma) immaculata* (Dall, 1908). Holotype, USNM 123115, Gulf of Panama, 153 fathoms.
Figure *123*: T *Strombinoturris crockeri* Hertlein & Strong, 1951. AHF 948-39, Bahía Honda, Panama, 30 to 35 fathoms.
Figure *124*: T *Crockerella crystallina* (Gabb, 1865). USNM 109302, Catalina Island, California, 50 fathoms.

Subfamily Mangeliinae

Figure *125*: *Glyptaesopus oldroydi* (Arnold, 1903). USNM 110611, Ballenas Bay, Baja California.
Figure *126*: *Kurtziella (Kurtziella) plumbea* (Hinds, 1843). USNM 206548, Monterey Bay, California, 13 fathoms.
Figure *127*: *Kurtziella (Kurtzina) cyrene* (Dall, 1919). USNM 331706, off Baja California (USFC sta. 2828), 10 fathoms.
Figure *128*: T *Kurtzia arteaga* (Dall & Bartsch, 1910). USNM 211 605, Barclay Sound, Vancouver Island, British Columbia, 8-34 fms.
Figure *129*: *Pyrgocythara danae* (Dall, 1919). USNM 266350, Agua Verde Bay, Baja California.
Figure *130*: "*Clathromangelia*" *fuscoligata* (Dall, 1871). USNM 56213, San Diego, California.
Figure *131*: "*Clathromangelia*" *nitens* (Carpenter, 1864). USNM 334446, San Pedro, California.
Figure *132*: *Euclathurella acclivicallis* McLean & Poorman, 1971. LACM, Isla Santa Cruz, Galápagos Islands, 82 fathoms.
Figure *133*: T *Bellacythara bella* (Hinds. 1843). AHF 770-38, San Jose Point, Guatemala, 7 to 11 fathoms.
Figure *134*: *Tenaturris verdensis* (Dall, 1919). LACM 66-19, El Pulmo, Baja California, 5 to 20 feet.
Figure *135*: *Tenaturris janira* (Dall, 1919). USNM 127534a, San Diego, California.

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Figure *136*: *Daphnella bartschi* Dall, 1919. USNM 267341, "Baja California."
Figure *137*: *Rimosodaphnella deroyae* McLean & Poorman, 1971. Paratype, LACM 1544.
Figure *138*: *Xanthodaphne agonia* (Dall, 1890). USNM 123136, Cocos Island, Costa Rica, 1010 fathoms.
Figure *139*: *Xanthodaphne argeta* (Dall, 1890). Holotype, USNM 96552, Galápagos Islands, 812 fathoms.
Figure *140*: *Xanthodaphne egregia* (Dall, 1908). Holotype, USNM 110610, off Peru, 2222 fathoms.
Figure *141*: *Xanthodaphne imparella* (Dall, 1908). Holotype, US NM 123114, Gulf of Panama, 1270 fathoms.
Figure *142*: *Pleurotomella orariana* (Dall, 1908). Holotype, USNM 123117, Gulf of Panama, 1270 fathoms.