

# STUDIES ON THE GENUS OLIVELLA

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## INTRODUCTION

*Generalities*

This study of the genus *Olivella* commenced some years ago when we were engaged in monographing the Pliocene Mollusca of St. Petersburg, Florida (Monograph no. 8, Academy Natural Sciences of Philadelphia, 1953). It was noticed then that through the doping or whitening of shells with magnesium oxide in preparation for photography that fine details of structure and sculpture were often brought out in sharp relief—details which in Recent or living shells lay masked or unnoticed under a glossy or colored surface. This coating of fossils with a thin film of magnesium or a sublimate of ammonium chloride has been standard practice amongst invertebrate paleontologists for many years but its application to Recent shells has been little used. In this study of *Olivella*, primary consideration is given to the structure of the shell itself rather than to shape and color,

and in the case of the Recent species supplemented by radular observation when such material was available.

On shell characters, the generic distinctions between *Oliva* and *Olivella* are elusive and difficult to define. In general, species of *Olivella* are small, the species of *Oliva* large, although there are many exceptions. *Olivella* has usually a strong, keel-like twist or fold at the anterior end of the columella, and the pillar wall above may be concave and deeply excavated, the results of secondary corrosion or reabsorption. There is often a growth of heavy callus along the inner lip which may extend upward over the parietal wall terminating at the end of the aperture; or it may be extended onto the spire but leaving the sutures usually open. The callous formation along the inner lip may be more or less modified by an accessory growth upon it (the pillar structure) developing smaller secondary folds and lirations. In some species, the cavity within the spire is enlarged through reabsorption of the inner walls of the spire-whorls. Most species of *Olivella* have a thin, chitinous operculum but an operculum is lacking in *Olivella nivea* and probably in all the species belonging to the typical section of the genus. True *Oliva* has no operculum but an operculum is present in *Belloliva* and *Jaspidella*, both of which must be referred to the Olivinae since they have the general radular pattern of *Oliva*.

In most species of *Olivella*, a callous deposit covers the inner lip advancing outward over the parietal wall as the shell grows. In some species, this callous formation is very thin, glassy or transparent, hardly discernible except by careful examination or through whitening with magnesium film; in other species, the callous growth is thick and copious as in *Dactylidia* and *Niteoliva*; often the spire-whorls are excessively thickened or coated by it, their color a plain white or yellow, as their former color beneath is masked. In species of *Olivella* s. s. in which the callous formation over the surface of the spire-whorls is thin or does not extend fully to the suture, the color pattern is retained fully or in part.

Superimposed upon the parietal callus, there is often a special structure of considerable diversity in shape but remaining fairly constant in its essential characters for each subgeneric group. This structure may be called "the pillar structure" since in the following pages it will be referred to frequently. In its simplest form, the pillar structure is a small fold at the anterior end of the columellar pillar as in *Cupioliva*. In *Callianax* (see text-figure 6) and *Tortoliva*, this fold is much enlarged and its face strongly lirated, but the parietal wall above it remains smooth. In some other groups, such as *Dactylidia* and *Niteoliva* (see text-figures 3, 5), the pillar structure is a narrow, raised, lengthened or drawn-out ribbon, forming a shelf-like ridge, its surface smooth or strongly denticulate. Generally, this style of pillar structure ends in a strong, tooth-like projection

above. In *Olivella* s. s., (text-figure 1), the pillar structure is formed by a wedge-shaped, lirated, basal portion followed by a series of small lirations or denticles on the parietal wall above it and which may extend almost to the end of the aperture.

In most olivellas, the pillar is quite straight, but in others it is deeply concave or excavated, an appearance emphasized by the strong fold or twist at the end of the columella. In the first type, the pillar lirations are persistent and coil around the columellar axis passing into the interior with no change (text-figures 4, 7). In *Olivella* s. s. and *Pachyoliva*, the columellar wall above the basal fold is concave or deeply excavated, the result of secondary corrosion of a part of the inner wall of the shell by the growing animal (text-figure 1). This condition is proved by the sharp edge of the excavation and by the cut-off ends of the folds and lirations as if severed by a knife. This character serves for the ready recognition of species belonging to the typical subgenus of *Olivella*. (text-figure 1).

In all olive shells, the anterior portion is marked off sharply by a callous band of variable width sometimes referred to as "the fasciolar band." It is generally set off above by an incised line or a raised edge; if the latter, the fasciolar band is slightly higher than the general surface of the shell above it. As this marginal line rotates into the aperture, it usually crosses the inner lip near the middle point. In some species, the fasciolar band is simple, entire, formed of a single surface; in others, it is divided into two segments by a submedian line, sharp and distinct in some, relatively faint or obscure in others. The anterior segment constitutes the true fasciole, generated by the trace of the lines of growth around the edge of the siphonal canal. The upper segment, originating above the edges of the siphonal canal may be termed the suprasiphonal fasciolar segment. In *Olivella*, the fasciolar band in general covers only one-third or less of the surface of the body-whorl, its edge beginning at the lower corner of the outer lip or a little above it. In most species of *Oliva*, the fasciolar band is similar to that of *Olivella* but in some special groups such as *Strephonella*, *Omogymna* and *Lamprodomina*, an extra callous band of variable size and height is added above, and which is sometimes so wide that it extends across the parietal wall nearly to the suture. Hence, *Lamprodomina* of New Zealand, originally related to *Olivella* by Marwick, should apparently be placed in the Olivinae.

The animal of *Olivella* is like that of *Oliva* but tentacles and eyes are wanting, the foot is shorter, rounded behind and does not extend beyond the tip of the spire. The forward section of the foot or propodium is separated from the metapodium by a deep transverse slit, its surface more or less longitudinally folded, the two sides of which are often much expanded,

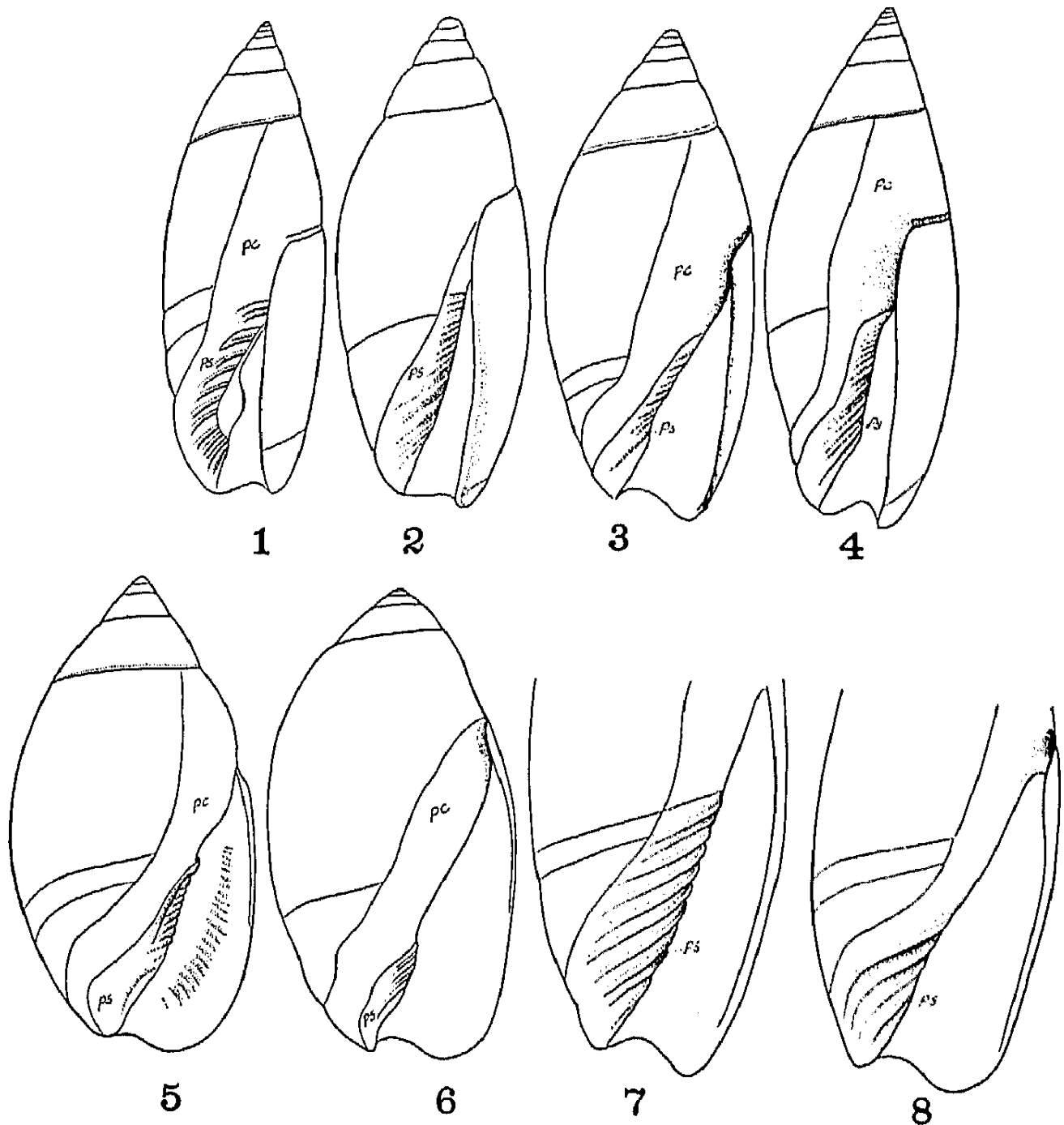


Figure 1, *Olivella (Olivella) nivea* (Gmelin). Rotated so as to show deep excavation of the pillar wall. 2, *Jaspidella jaspidea* (Gmelin). No parietal callus. 3, *Olivella (Dactylidia) mutica* (Say). 4, *Olivella (Dactylidella) anazora* (Duclos). Rotated so as to show an unexcavated pillar. 5, *Olivella (Nitecoliva) nitidula* (Dillwyn). 6, *Olivella (Callianax) biplicata* (Sowerby). 7, *Olivella (Lamprodroma) volutella* (Lamarek). 8, *Olivella (Zanoetella) zanoeta* (Duclos).

Symbols. pc. parietal callus, ps. pillar structure.

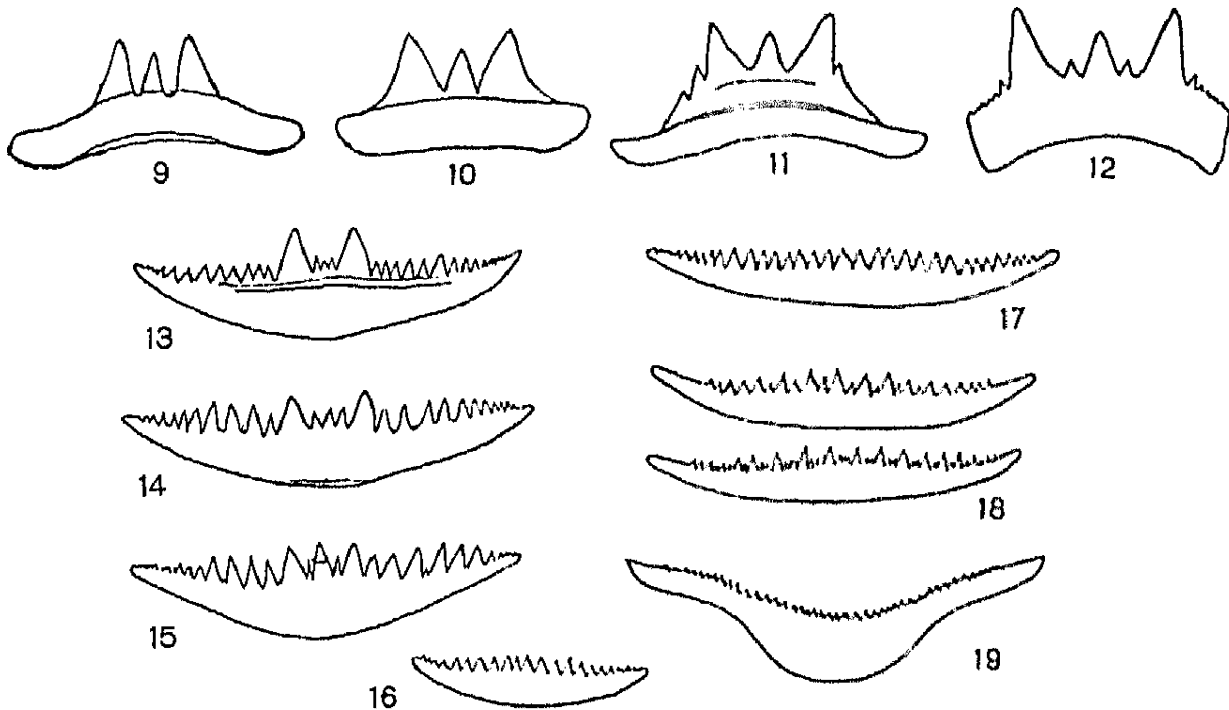
winglike or narrowly pointed and produced into short or quite long, tentacle-like appendages. The hind part of the foot or metapodium is usually wide, rounded or straight across at the end, relatively short, and when fully expanded, capable of being folded laterally so as to meet or overlap along the top of the shell. Siphonal branchial tube is long and slender.

There is no differentiated head, its position indicated by the radular sack which lies just below the dorsal surface close behind the propodial fissure. The mouth opening is on the ventral surface of the metapodium near its forward margin. Locomotion is mostly by burrowing in the sand or crawling along on the surface or swimming by means of the wing-like flaps of the metapodium.

*Radula*.—In *Olivella* as in the other members of the family, the mouth is placed on the ventral surface of the foot at the forward end of the metapodium, directly behind the propodial fissure. Above it, and lying in back of the undifferentiated head and under the dorsal surface is the radular sack. During feeding, the buccal sack becomes extended and forms a short snout or proboscis which can probably be protruded slightly outside the mouth, the forward portion of the radula spreading open for rasping and the conveyance of food into the mouth and towards the stomach. Foraminifera, minute microcrustacea such as ostracods, copepods, etc., and small pelecypods (*Ervillea*) appear to be their principal food and along with grains of sand are to be found in the stomach on dissection, but in the process of food gathering, the teeth of the radula become much worn and are replaced continuously by newer ones moving up from behind.

From *Oliva*, species of *Olivella* are best distinguished by their radula. In *Oliva* (Olivinae), the radular ribbon generally shows but little variation, the differences between species being small. The ribbon of *Oliva* is generally long and narrow with many rows of teeth ( $\pm 100$ ), while the rachidian tooth is tricuspidate, its basal margin wide and often yoke-shaped. In *Olivella*, the ribbon is short and wide, with fewer rows of teeth (generally less than 50), the rachidian tooth is multicuspidate, the cusps being small and numerous, their number, size and spacing varying in the different groups and species. The lateral teeth of *Olivella* are more variable; these may be flat, subtriangular or unciniate with sharp, recurved, awl-shaped ends or they may form flattened, spatula-like blades with rounded or minutely serrate or dentate ends.

Although conforming to a general pattern, the rachidian tooth of *Olivella* assumes various shapes, the principal types observed in this study being illustrated by the figures presented on Plate 16, and text-figures 13 to 19. In the relaxed position, the rachidian tooth does not lie perfectly flat on the radular ribbon, the plane of the tooth being more or less convex or bowed, in some cases quite strongly so, hence its shape is like that of a segment cut from a circular crown, or a ladies side comb, curved to fit the roundness of the head, thus the top view of a single rachidian tooth appears bowed. Along the front or cutting edge of the tooth, there are numerous



#### Rachidian teeth of the Olividae

OLIVINAE: Fig. 9, *Oliva porphyria* (Linné). Width of base .18 mm. Panama Bay.  
10, *Jaspidella jaspidea* (Gmelin). Width .068 mm. Florida.

AGARONINAE: Fig. 11, *Agaronia testacea* (Lamarck). Width .18 mm. Panama.

ANCILLINAE: Fig. 12, *Baryspira australis* (Sowerby). Width .011 mm. New Zealand.

OLIVELLINAE: Fig. 13, *Olivella (Olivella) nivea* (Gmelin). Width .4 mm. Florida.  
14, *Olivella (Olivella) adelae* new species. Width .18 mm. Florida. 15, *Olivella (Niteoliva) minuta* (Link). Width .108 mm. Jamaica. 16, *Olivella (Olivina) bullula* (Reeve). Width .10 mm., Florida. 17, *Olivella (Dactylidia) mutica* (Say). Width .1 mm., Florida. 18, *Olivella (Pachyoliva) columellaris* (Sowerby). Two rachidian teeth from same ribbon. Width .16 mm., Peru. 19, *Olivella (Muggintiella) watermani* McGinty. Width .15 mm., Florida.

cusps, arranged like the teeth of a saw, larger in the middle zone, diminishing in size laterally to fade out entirely at the extreme ends. In *Dactylidia*, *Lamprodoma*, etc., the cusps in the middle zone are of more or less uniform size. In *Olivella* s. s., the middle pair of cusps are much enlarged and stand prominently above the cusps on either side; they frequently may have 2 or more smaller or accessory cusps between them. This peculiarity of greatly enlarged, paired central cusps is characteristic of all the species belonging to the typical subgenus which we have been able to examine. In *Pachyoliva* the rachidian tooth varies much in shape and in the size and distribution of the cusps along it, and scarcely two radula preparations are exactly alike. In *O. watermani*, the rachidian tooth has the shape of a worn-down paint brush. No similar tooth has been observed in any other species.



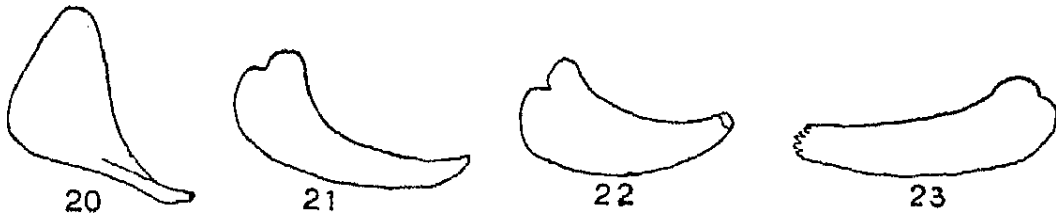


Figure 20, *Oliva porphyria* (Linné). From same ribbon as figure 9. 21, *Olivella* (*Olivella*) *nivea* (Gmelin). From same ribbon as figure 13. 22, *Olivella* (*Callianax*) *pedroana* (Conrad). Length of tooth .16 mm., California. 23, *Olivella* (*Pachyoliva*) *columellaris* (Sowerby). Length of tooth .11 mm., Peru.

In most *Olivellas* the lateral teeth are simple, curved uncinates with sharply recurved tips, the base of the blade wide, flattened and somewhat notched at their lower, outer margins. In both *Lamprodoma* and *Pachyoliva*, the laterals have the shape of flat, spatula-like blades, their ends rounded or weakly dentate. At the base of the laterals and apparently closely affixed to the ribbon is a four-sided or rectangular, thin, flat plate which seems to serve as a basal or strengthening plate against which the laterals are hinged. This third plate is often lost in the preparation of a radular slide, especially if the caustic treatment has been too drastic or prolonged.

In this study, we have been able to examine the radula of the following species.

Subgenus *Olivella* s. s.: *nivea*, *dama*, *floralia*, *dealbata*, *bitleri*, *broggii*, *drangi*.

Subgenus *Dactylidia*: *mutica*, *mutica fimbriata*, *pusilla*.

Subgenus *Niteoliva*: *minuta*, *morrisoni*.

Subgenus *Callianax*: *biplicata*.

Subgenus *Pachyoliva*: *columellaris*, *semistriata*.

Subgenus *Lamprodoma*: *volutella*.

Subgenus *Zanoetella*: *zanoeta*.

Subgenus *Olivina*: *bullula*.

Subgenus *Macgintiella*: *watermani*.

Several dissections of *Olivella* (*Minioliva*) *perplexa* (from alcoholic material) failed to reveal a radula; hence a radula may be lacking or in a degenerate form in this subgenus. A further check is desirable when more material becomes available.

A radula extracted from a specimen of "*Olivella*" *tubulata* Dall, contributed by the National Museum showed a tricuspidate rachidian tooth showing that it belongs in the Olivinae. Provisionally, *tubulata* has been referred to the genus *Belloлива*. *Oliva jaspidea* (Gmelin), referred by authors to both *Oliva* and *Olivella* belongs also to Olivinae, having a tricuspi-

date rachidian tooth. In this group, typified by *Voluta jaspidea* Gmelin, the generic name of *Jaspidella* is herein proposed.

*Sutures*.—Except in *Mansfieldella* from the Pliocene of Florida, the sutures in *Olivella* are open, deeply grooved or channelled. In species having the sutures deeply channelled, the surface of the whorl in front of the suture may appear impressed, the edge of the suture itself becoming somewhat frayed by erosion. This character is very pronounced in *Cupioliva* and in some species of *Macgintiella*. In *Oliva*, the channel in the suture is maintained open and deep by a slender, tail-like appendage attached to the back of the mantle. This appendage lies along the channel of the suture when the animal is expanded but is lifted out as the soft parts are pulled back into the shell. Its real purpose is unknown. In *Mansfieldella*, the sutures are partly covered by callous deposit such as is seen in *Ancilla*.

*General Ecology and Habits*.—Olivellas generally prefer a sand or sandy-mud bottom and in favorable situations such as along some beaches or on bars left exposed by a falling tide, some special species may occur in great numbers. Other species are found only in relative deep water and are known only from dredged material. Around Panama Bay, *Olivella* (*Lamprodoma*) *volutella* is very common, in many color varieties from pure white to dark brown or nearly black, and during a falling tide may be seen gliding rapidly over the surface of slimy mud flats. Both *Olivella columellaris* and *semistriata* are species characteristic of the open beach pounded by heavy surf waves, and in northern Peru, Ecuador and Panama one or both species are found locally in enormous numbers actively feeding during the mid-period of a falling or rising tide. In Peru, *columellaris* along with *Donax* is gathered for food by fisherman and their whitened, bleached shells are often seen covering the surface of Indian mounds or "huacas" like a recent fall of snow. The following incident was observed at Charapota, a village between Manta and Bahia, Ecuador on Dec. 13th, 1936. At low tide a large, wide shelving beach is exposed. Here *Olivella semistriata* was found in large numbers, some specimens crawling or gliding over the surface as if in a great rush, others alternately burrowing and reappearing at the surface as each small wave or ripple passed over them. Present also was *Oliva undatella* and *Agaronia hiatula* in fewer numbers, both species feeding on the smaller *Olivella*. After capture of an *Olivella* by the *Oliva*, the margin of the foot would envelope its victim completely and the smaller shell would be swallowed whole, the body of the *Oliva* swelling into a large, rounded, ball-like mass. Some Olivellas which were freed shortly after having been swallowed, would appear dazed or stunned for a time but in many cases, would recover rapidly after being placed in a pan of salt water.

*Geologic Range.*—As pointed out earlier, the separation of *Olivella* from certain small *Oliva* and other allied forms on shell characters alone is often uncertain, the most reliable character being the formation of a deposit of callus along the parietal wall in *Olivella*. So-called species of *Olivella* recorded in the literature from the Eocene or even earlier rocks are probably incorrectly assigned and belong in the Olivinae. "*Olivella*" *mathewsonii* Gabb from the Tejon Eocene of California should be placed with the *Agaronia*-like species figured by Palmer from the Claibornian Eocene and other similar types illustrated by Deshayes and Cossman from the Eocene of the Paris Basin. It is possible that the genus *Olivella* does not occur in beds older than the Miocene (or Middle Oligocene) but our search of the literature on this point has not been thorough. In the Miocene, however, the genus appears to be as fully developed as in the Recent.

*Recent Distribution.*—The largest number of species of *Olivella* appear to be American although many others have been reported from other parts of the world (Japan, Australia, etc.). It is likely that some of these foreign species, now referred to *Olivella*, will prove to belong elsewhere when more fully studied. In this monograph, the majority of the known American species, Recent and fossil, are given some consideration but a few others described from the West Indies have not been available to us; also some others originally described from unknown localities may well prove to be American species. Most species of *Olivella*, like other members of the family, are warm-water, hence the largest number of species are found in tropical or subtropical waters, but a well-developed fauna of *Olivella* is distributed along the Pacific coast of the United States northward to the states of Oregon, Washington and to southern Alaska. Several species are also found in the southern hemisphere along the coast of Argentina. The genus is absent from the west coast of South America south of Pimental, Peru.

#### CLASSIFICATION

With increasingly closer discrimination of species as currently in use today, facts regarding the affinity or relationship between our shells in time and space tends to become obscured. Most of the older workers, especially amongst the paleontologists, did not hesitate to identify some of their fossil forms (even from the Cretaceous and Eocene) with living species, often from distant, remote regions. Today these fossil forms would be referred to distinct species but the fact remains that most of these species are so closely related that a common origin or ancestry is indicated. In the application of systematic paleontology to geology and stratigraphy, the excessive multiplication of species names to our fossils

tends to destroy their use for age determination, correlation, and in deciphering geologic history. It is important that we endeavor to indicate in our schemes of classification, the close kinship which exists between many species. We have attempted to do this with the *Olivellas* by placing together species which appear to be closely related in the same group or subgenus. In this study, mainly American species have been considered but a more comprehensive treatment of the genus on a world-wide basis would doubtless bring together still more information and of much greater value.

Wenz, the most recent author to treat the genus *Olivella* in a comprehensive manner (Handbuch der Paläozoologie, Gastropoda, Bd. 6, 1943) accepted 6 subgenera or sections in the genus. *Lamprodomina* Marwick is now transferred to the Olivinae for reasons given on page 159. *Toroliva* and *Mansfieldella* were added by Olsson and Harbison in 1953. In this paper, the following groups or subgenera are recognized.

#### Genus *Olivella* Swainson

Subgenus *Olivella* s. s., type *O. dama* (Sowerby)

Subgenus *Dactylidia* H. and A. Adams, type *O. mutica* (Say)

Subgenus *Dactylidella* Woodring, type *O. anazora* (Duclos)

Subgenus *Olivina* d'Orbigny, type *O. tehuelchana* d'Orbigny

Subgenus *Niteoliva* new subgenus, type *O. minuta* (Link)

Subgenus *Callianax* H. and A. Adams, type *O. biplicata* (Sowerby)

Subgenus *Pachyoliva* new subgenus, type *O. columellaris* (Sowerby)

Subgenus *Toroliva* Olsson and Harbison, type *O. goliath* Olsson

Subgenus *Mansfieldella* Olsson and Harbison, type *O. pugilis* Olsson and Harbison

Subgenus *Lamprodoma* Swainson, type *O. volutella* (Lamarck)

Subgenus *Zanoetella* new subgenus, type *O. zanoeta* (Duclos)

Subgenus *Macgintiella* new subgenus, type *O. watermani* McGinty

Subgenus *Minioliva* new subgenus, type *O. adae* new species

Subgenus *Cupioliva* Iredale, type *O. nymphe* Adams and Angus

#### Subfamily OLIVINAE

Genus *Jaspidella* new genus, type *O. jaspidea* (Gmelin)

#### KEY TO THE SUBGENERA OF *Olivella* ON SHELL CHARACTERS

- I. No callous formation along the parietal wall or inner lip  
Genus *Jaspidella* new genus (Olivinae)
- II. A deposit of callus along the parietal wall ..... (Olivellinae)
  - A. The parietal callus extends only to the posterior end of aperture or but a short way above it.

- B. Shell large or of medium size, variously colored. Pillar structure is a simple fold at the base of columella, sometimes lirate  
 Subgenus *Callianax* H. and A. Adams
- BB. Shell small or of medium size, generally with an elevated spire. Pillar structure a fold at base of columella. Color plain white. Australian .....Subgenus *Cupioliva* Iredale
- BBB. Shell minute, spire elevated or low, with obtuse nuclear tip. Plain white. American .....Subgenus *Minioliva* new subgenus
- AA. The callous formation along the parietal wall is strongly developed, extending above the end of the aperture towards the upper suture of the penultimate whorl.
- Ba. Pillar wall concave or deeply excavated by corrosion, the lirations of the inner lip if present, cut off sharply on their inner ends.
- C. Pillar and parietal wall covered fully by a thick deposit of callus. No pillar or parietal lirations at any stage.  
 Subgenus *Pachyoliva* new subgenus
- CC. Pillar structure formed by lirations along the parietal and columellar wall .....Subgenus *Olivella* s. s.
- BBb. Columellar pillar not secondarily excavated, the pillar folds or lirations continuing undiminished into the interior.
- Ca. Pillar structure formed by more or less uniform revolving plaits or lirations.
- D. Lirations numerous, extending upward along the pillar to the edge of the fasciole; absent from the parietal wall above.  
 Subgenus *Lamprodoma* Swainson
- DD. Lirations fewer and shorter, confined to the columellar portion  
 Subgenus *Zanoetella* new subgenus
- CCb. Pillar structure a simple fold or keel at the end of columella, the parietal wall above smooth, destitute of lirae or similar structures.
- Da. Pillar structure simple. Parietal callus relatively thin. Shell ovate.  
 Subgenus *Olivina* d'Orbigny
- DDb. Pillar structure heavier, strongly plaited, the parietal callous deposit strong.  
 Subgenus *Toroliva* Olsson and Harbison
- CCCc. Lirations or folds on the columella and parietal wall forming a separate structure (pillar structure), in the form of a tongue-shaped ridge which may be smooth or variously denticulate.
- DDa. Pillar structure smooth or weakly lirate, not terminating in an enlarged tooth-like projection above. Outer lip smooth within.  
 Subgenus *Dactylidia* H. and A. Adams
- DDDb. Pillar structure usually strongly denticulate or lirate along its whole length, often terminating in an enlarged tooth above. Outer lip smooth or strongly lirate within.

E. Sutures grooved or channelled, sometimes partly covered by callus, the edge of the forward whorl not appressed or overhanging. Outer lip strongly lirated within.

F. Sutures not covered by callus.

Subgenus *Niteoliva*

new subgenus

FF. Sutures partly covered by callus. Denticulation of the pillar structure very strong, the terminal one large.

Subgenus *Mansfieldella*

Olsson and Harbison

EE. Sutures deeply channelled, overhung by the edge of the whorl in front. The junction of the whorl to the preceding turn widely appressed, developing a long, posterior canal at the end of aperture.

Subgenus *Macgintrella* new subgenus

#### SYSTEMATIC TREATMENT

Superfamily OLIVACEA Swainson, 1840

(Nom. transl. Olsson, herein (ex Olivinae Swainson, 1840))

Propodium separated from the rest of the foot by a deep, transverse fissure.

Family OLIVIDAE Swainson, 1840

(Nom. transl. d'Orbigny, 1841 (ex Olivinae Swainson, 1840))

The shell is spindle-shape, subcylindrical, with a low or elevated spire, no anterior canal, the texture usually solid, porcellaneous, the surface highly polished and without periostracum. The sutures are open, deeply grooved or channelled; or covered by a heavy enamel spread over the spire. Aperture elongate, ovate, often wider in front, the siphonal canal notch wide and deep, its growth trace forming a fasciole or calloused band, often differently colored, around the anterior end. Pillar smooth or strongly lirated.

The animal has the foot divided by a deep transverse slit which passes in front of a poorly defined or concealed head, the forward section of the foot or propodium shorter, usually more or less triangular or shield shaped, often divided along the middle; the hinder portion of the foot or propodium longer, more voluminous, its wide margins capable of being folded over the top of the shell imparting to it a high polish and gloss. Radular ribbon triserial or with three primary teeth in each row, the rachidian tooth tri or multicuspidate, the lateral teeth triangular or hatchet-shape, with pointed or uncinuate tips. A chitinous operculum may be present, wanting in some groups.

The family Olividae is divided into the following subfamilies on basis of shell structure, anatomy and radula.

Subfamily OLIVINAE Swainson, 1840

Animal with the metapodium elongate, pointed at the end and often extending beyond the tip of the spire. Head indistinct but bearing tentacles and usually eyes. Radular ribbon very long, narrow with numerous teeth ( $\pm 100$ ), the central or rachidian tooth simple tricuspidate. Shell often large, finely colored, the sutures typically open, grooved or channelled. Genera *Oliva*, *Olivancillaria*, *Anazola*, *Jaspidella*, etc.

Subfamily ANCILLINAE Cossmann, 1899

(Subf. Ancillarinae Swainson, 1840)

Foot large, the metapodium deeply forked behind. Head with small tentacles, no eyes (?). Radula much like Olivinae, the ribbon long and narrow with numerous teeth ( $\pm 80$ ), the rachidian tooth with a broad, yoke-shaped base, tricuspidate but with smaller denticulations between the main cusps. Shell often large, usually with an elevated spire covered by thick enamel concealing the sutures. Fasciole bordered above by an incised line or deep groove often terminating at the lip margin in a small tooth. Genera *Ancilla*, *Baryspira*, *Eburna*, etc.

Subfamily OLIVELLINAE new subfamily

Metapodium wide and short, not extending beyond the end of spire. Head indistinct, without tentacles or eyes. Operculum chitinous but sometimes wanting. Radula ribbon wider and shorter than in Olivinae, with fewer rows of teeth ( $\pm 50$ ), the rachidian tooth multicuspidate; a third or accessory radular plate is often present. The shell is generally small, the parietal wall covered by enamel growth, the pillar wall often deeply excavated by secondary corrosion, the internal wall of the spire-whorls commonly reabsorbed. Genus *Olivella* with several subgenera.

Subfamily AGARONIINAE new subfamily

The foot is large, broad, rounded behind and but slightly longer than shell, divided across the middle by a dark line; propodium relatively small, narrow; head concealed, bearing no tentacles or eyes. Radular ribbon very long, with numerous rows of teeth, the rachidian tooth tricuspidate and with small denticles on the sides. Shell often large, generally with a pointed or tapered spire, channelled sutures and no surface glaze. The body-whorl is large, spindle-shape, the outer lip thin, somewhat sinuous with a small bulge below, the pillar with several descending plaits, the parietal wall smooth, unglazed. Fasciole wide and more heavily colored than the surface above. Genus *Agaronia* and others.

*Pseudoliva* and *Zemira* were referred to the Olividae by Thiele, 1929 and Wenz, 1943, and placed in a separate subfamily the "Pseudolivinae." A. H. Cooke, 1918 concluded from a radula study of *Zemira* that it was more closely allied to *Murex* than *Oliva*. Most authors have classed *Pseudoliva* amongst the Buccinacea which its radula strongly suggests.

The reference of these genera to the Olividae appears therefore questionable but their true relationship must await further anatomical data.

#### Subfamily OLIVELLINAE

This is a well-marked subfamily of the Olividae, defined as indicated, by the absence of tentacles and eyes, the short, wide foot, the very wide, multicuspid central tooth of the radula and the occasional presence of accessory flat plates outside or under the base of the lateral teeth. A chitinous operculum may be either present or wanting. Shell characters are less distinctive. In this study, only one genus is recognized, the other divisions being considered as subgenera of *Olivella*.

#### Genus OLIVELLA Swainson, 1831

Type by subsequent designation, Dall, 1909; *Oliva purpurata* Swainson = *O. dama* Mawe. Recent, northern part of the Panamic-Pacific faunal province.

The shell is small or of medium size, oliviform, generally with an elevated spire, sometimes with the spire low and obtuse. Surface smooth, polished, in life white or colored. Whorls of the spire numerous, between grooved or channelled sutures. Parietal wall covered by a spread of callus which may extend along it to the upper end of the aperture only, or well beyond it along the spire-whorls. Columella with a heavy keel or twist at its end, often united above with a heavier callous formation, either quite short or extended along the parietal wall (pillar structure) or replaced there by a series of lirations. Internal walls of the spire often reabsorbed. Fasciolar band simple or double. Operculum if present, thin, chitinous. Radula with the central tooth multicuspid, the cusps distributed along its upper or free side, the laterals unciniate, the average ribbon with 30 to 50 rows of well-developed teeth.

Dall's designation of *Olivella purpurea* Swainson (= *O. dama* Mawe) in 1909 as the type for *Olivella* has generally been accepted although the earlier selection of *Oliva nivea* of Hermannsen, 1847 (as *eburnea* in Swainson) would have been preferable on the grounds that the shell and radular characters of *nivea* are more strongly expressed. Fortunately, both species are members of the same subgenus.

#### Subgenus OLIVELLA s. s.

Shell small or of medium size, with a high or low spire. *Parietal callus extending to the upper suture.* Sutures open, grooved or narrowly channelled. *Pillar structure comprising a wedge-shaped fold on columellar portion, replaced on the parietal wall by short, often paired plaits or lirations.* *Columellar pillar deeply excavated above the terminal twist.* *No operculum.*

Rachidian tooth narrowly bow-shaped, the base with an evenly convex curve, the upper margin straight or slightly concave, multicuspidate (about 20 to 24), with the *medial pair greatly enlarged.* Laterals sickle-



shaped, wide at base which is notched, the outer tip somewhat recurved and pointed. An accessory basal plate may be present but is usually thin.

In typical *Olivella* the pillar structure consists of a wide basal portion followed above it by a series of short, often paired lirae which may be rather weakly developed or more strongly so and extending nearly to the upper end of the aperture. If the shell is rotated slightly on its axis, it will be seen that the columellar pillar is deeply excavated above the basal fold, this excavation being the result of secondary corrosion or reabsorption, since the ends of the lirae are cut off sharply. The fasciolar band is wide, divided mesially by a groove into two nearly equal segments. Surface of shell highly polished, white or with color pattern. The radula is of medium size for the animal, distinguished in having the central pair of cusps of the rachidian tooth much enlarged. Typical *Olivella* has no operculum.

*Species referred to Olivella s. s.*

#### *Recent species*

*Olivella nivea* (Gmelin). Florida, Bahamas, West Indies.

*Olivella nivea chiriquiensis* new subspecies. Caribbean coast of Panama.

*Olivella adelae* new species. Florida.

*Olivella petiolita* (Duclos). West Indies and the Caribbean.

*Olivella floralia* (Duclos). Florida and the Gulf of Mexico.

*Olivella macgintyi* new species. Florida.

*Olivella stegeri* new species. Gulf of Mexico.

*Olivella dama* (Mawe). Gulf of California.

*Olivella gracilis* (Broderip and Sowerby). Lower California to Ecuador.

*Olivella tergina* (Duclos). Lower California to Peru.

*Olivella riverae* new species. Peru.

*Olivella broggii* new species. Peru.

*Olivella bitleri* new species. Panama.

*Olivella drangai* new species. Galápagos.

*Olivella cocosensis* new species. Cocos Island.

*Olivella alba* (Marrat). Gulf of California.

*Olivella rehderi* new species. Bay of Panama.

#### *Fossil species*

*Olivella venezuelensis* new species. Miocene of Venezuela.

*Olivella indivisa* Guppy. Miocene of Jamaica and Santo Domingo.

*Olivella muticoides* Gabb. Miocene of Santo Domingo.

*Olivella canaliculata* Gabb. Miocene of Santo Domingo.

*Olivella acra* Woodring. Miocene of Jamaica.

*Olivella wilsoni* new species. Miocene of Florida.

*Olivella eutacta* Dall. Miocene of Florida.

*Olivella eleutheria* Gardner. Miocene of Florida.

*Olivella dodona* Olsson and Harbison. Pliocene of Florida.

*Olivella prefloralia* Olsson and Harbison. Pliocene of Florida.

*Recent Species—West Atlantic*

***Olivella (Olivella) nivea*** (Gmelin)

Plate 11, figs. 3, 3a, 3b.

*Voluta nivea* Gmelin, 1790, Syst. Nat., ed. 13, p. 3442. Based on Martini, 1773, Syst. Conch. Cabinet, vol. 2, pl. 50, figs. 557, 558.

*Oliva eburnea* Lamarck, 1811, Ann. Mus. Hist. Nat. Paris, vol. 16, p. 326.—Lamarck, 1844, Hist. nat. An. s. Vert., ed. 2 (Deshayes), vol. 10, p. 630.—Swainson, 1831, Zool. Illust. ser. 2, vol. 2, pl. 58, fig. 2.—Duclos, 1835, Mon. *Oliva*, pl. 1, figs. 13-16.

*Oliva nivea* Gmelin, Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 23, figs. 64a, b.

*Oliva monilifera* Reeve, 1850, op. cit., pl. 27, figs. 84a, b.

*Oliva parvula* Martini, Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 30, no. 157, pl. 22 (349), fig. 373.

*Oliva (Olivella) nivea* Gmelin, Weinkauff, 1878, Die Gattung *Oliva*, Syst. Conch. Cabinet, p. 136, pl. 3, figs. 17, 18; pl. 35, figs. 9, 10; pl. 37, figs. 3, 4.

Shell of a medium or relatively large size (length to about 34 mm.), the spire about half the total length, the penultimate whorl being rather high and the spire sharply pointed. The color is mostly white or with shadings of brown, often with two bands of heavier, purple-brown, the upper band following below the suture, the other just above the fasciole. The nuclear whorls are relatively small but coiled so as to form a longish, attenuated tip. (See Tucker Abbott, 1951, Nautilus, vol. 64, pl. 7, fig. 4a.)

One of our largest and finest species of *Olivella*, formerly plentiful along the Florida Keys but now much diminished by overcollecting and destructive shore developments. The color is often a pure white or a cream delicately mottled with red, brown and purple, these markings mainly concentrated below the suture and as a band above the fasciole, the fasciole itself being usually white. The pillar wall is deeply excavated on its inner side by secondary corrosion. (See Text-figure 1.)

Duclos' figures 13 and 14 of *eburnea* are much like the common Florida form of this species in shape and weaker coloration but are somewhat smaller than the larger shells from Duck Key.

The radula of *nivea* is relatively large (of an average specimen, its length is 2.7 mm., width of ribbon 1 mm., width of a single rachidian tooth .4 mm.); there are about 37 rows of teeth of which the 3 posterior ones are in a nascent state, while the forward 10 to 12 are found in the folded-over section. The rachidian tooth has about 20 to 24 cusps of which the median pair are enlarged; smaller accessory denticulations may be present between the median pair but these have no regularity of development. An abnormal ribbon taken from a Duck Key specimen showed a single enlarged

central cusp. Dissections show that this *Olivella* lives largely on small mollusks such as *Ervillea*, *Caecum*, foraminifera and microcrustacea which are swallowed whole.

Typical *O. nivea* is unknown to us as fossil.

*Range.*—The east coast of Florida from Miami to the keys. Also the Bahama Islands and probably southward into other parts of the West Indies.

***Olivella nivea chiriquiensis* new subspecies**

Plate 11, fig. 4.

This subspecies differs from the typical form by its constantly smaller size, shorter less attenuated nucleus and often deeper color. The parietal callus is thickest at end of aperture, extending to the upper suture, rather heavily thickening the lower surface of the spire-whorl, much thinner above, so that the color band bordering the suture shows plainly. Well-colored specimens have two deep-brown bands formed by disconnected, offset blotches, the upper band bordering the inferior side of the suture, the lower band lying just above the fasciole, the much wider space between them colored by lighter mottlings of brown. Some specimens are pure white. The pillar wall is deeply excavated.

Length 15.8 mm., diameter 5.8 mm. (Holotype, ANSP. 194579.)

North coast of Panama. Bocas del Toro.

***Olivella (Olivella) adelae* new species**

Plate 10, figs. 8, 8a; plate 16, figs. 9, 9a.

Shell of medium size (length about 12 mm.), subovate, thin or of medium texture, with a rather high body-whorl and an elevated, evenly conic spire half the total length. Sutures linear, grooved, the edge of the whorl in front forming a narrow, slightly overhanging collar. Parietal callus extending weakly beyond the end of aperture about half-way to the suture, the pillar structure formed by a few small lirations which end sharply at the edge of the excavation of the pillar wall. Color is a leaden white except for a band of broken brown spots below the suture and another arranged at the edge of the fasciole, the fasciole itself white; the spire may be of uniform color or in some cases much darker approaching a blotched black.

Radular ribbon like that of *nivea* but much smaller (a ribbon with about 30 rows of teeth has a length of 1.20 mm, the rachidian tooth about .18 mm. wide (longer diameter). (Text-figure 14.) The paired medial cusps of the rachidian tooth are more widely separated with smaller accessory ones between.

Length 12.4 mm., diameter 4.5 mm. (Holotype, ANSP. 194582.)

This is a wider, more stubby shell than *floralia* with which it has sometimes been associated; it also resembles a small *nivea* but differs by its more uniformly tapering spire and the nuclear whorls form a small conic and not drawn-out or tapering tip. The radular ribbon is much smaller than that of *nivea*.

Apparently a common and widely distributed species in Florida, named for Miss Adele Koto of Beloit, Wisconsin, as a tribute to her outstanding ability as a collector of rare and minute shells.

*Range*.—Florida: Bradenton Beach. (types).

**Olivella (Olivella) petiolita** (Duclos) Plate 8, figs. 8, 8a; Pl. 12, figs. 1, 1a.

*Oliva petiolita* Duclos, 1835, in Chenu, III. Conch., vol. 4, p. 5, pl. 1, figs. 21, 22.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 33, no. 172, pl. 23, figs. 394, 395, 418.

*Olivella petiolita* (Duclos), Tryon, 1883, Manual of Conch., vol. 5, p. 66, pl. 14, figs. 61 (62, 63).

*Olivella esther* Dall and Simpson, 1901, U. S. Fish Comm., Bull. for 1900, vol. 1, p. 392 (Not of Duclos, 1835).

Shell moderately large, solid, with a high, conic spire not fully one-half the total length. Sutures grooved and forming a deep, notch-like cut in the parietal callus at the end of aperture. Parietal callus strong, extending to the suture and forming a whitened enamel-like deposit over the surface of the penultimate whorl. Parietal wall straight, the pillar structure formed by a series of more or less paired lirations which extend upward nearly to the end of the aperture. There is a strong, keel-like fold at the end of the columella bordered internally by the excavation of the pillar wall. Color pattern on the body-whorl is formed by coalescing arrow-shaped lines. Fasciole wide, double, somewhat convex with a medial incised line and colored with alternating brown and white bands.

An average specimen measures length 18 mm., diameter 8.4 mm.

The above description is based on specimens from the Academy collection labelled "Panama" but without indicating from which coast, but they are assumed to be from the Caribbean side. Marrat, however, gives Mazatlan as locality for the species. Other specimens in the Academy collection come from the north coast of Venezuela. In the National Museum collection, specimens of these species from Puerto Rico and other Caribbean localities are identified as *O. esther* Duclos. No locality is given by Duclos for his figure of *esther*. His small-sized figure (reproduced by Marrat) is shown as having a deeply concave pillar wall and may possibly represent a species of *Callianax*.

*Range*.—West Indies and the Caribbean region along the coast of Venezuela westward to Panama.

**Olivella (Olivella) floralia** (Duclos) Plate 15, figs. 12, 12a.

*Oliva oryza* Duclos, 1835, Mon. *Oliva*, pl. 1, figs. 9, 10.—Duclos Chenu, 1853, Illustr. Conch. vol. 4, pl. 1, figs. 9, 10.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 27, figs. 81a, b. (Not of Lamarek, 1922).

*Oliva floralia* Duclos, 1853, Chenu, Illustr. Conch., vol. 4, p. 6.—Duerox, 1857, Revue Critique de Genre *Oliva*, p. 103.

*Oliva alba* Marrat, 1871, Thes. Conch., vol. 4, p. 32, no. 169, pl. 22 (349), fig. 390 (Guatemala). Types ANSP. 16018.

*Olivella oryza* (Lamarck), Dall and Simpson, 1901, U. S. Comm. of Fish and Fisheries, Bull. for 1900, vol. 1, p. 392. (Not of Lamarck).

*Olivella floralia* (Duclos), Perry, 1940, Bulls. Amer. Paleont., vol. 26, no. 95, p. 159, pl. 36, fig. 249.—Perry and Schwengel, 1955, Marine Shells of West. Florida, p. 176, pl. 36, fig. 249.

Shell small, slender, elongate, with an elevated sharply pointed spire of about 6 whorls, the nucleus minute. Color often a milky white grading to subtranslucent, often with the spire colored gray, brown, yellow or rose-pink, sometimes with the body-whorl mottled or flecked with brown. Sutures distinct, narrowly or deeply grooved. Parietal callus thin, narrow, extending upward beyond the end of the aperture towards the suture. Columellar wall excavated, usually showing some corrosion. Pillar structure is formed by a series of small, parallel lirae above the basal fold. Fasciole double.

Radula like *nivea* but smaller (an average specimen, length .9 mm., width .3 mm.), with about 23 rows of teeth. Rachidian tooth with 20 to 26 cusps, the end members very small, the medial pair large, often with 2 or 3 subsidiary cusps between them. Lateral teeth strongly curved. Animal pure white, no operculum.

This common Florida species was first well illustrated by Duclos as *Oliva oryza* Lamarck, also again under the same name by Reeve. Lamarck's description of *oryza* by itself is too brief for identification, but the figure referred to in the synonymy in Martini, Conch. Cab., vol. 2, pl. 50, fig. 348 represents the back view of a small shell with a medium-height spire and strongly calloused penultimate whorl. This figure does not represent a shell of the *floralia* type and may be an immature *mutica* or *minuta*. The name *floralia* was used by Duclos in the text of Chenu's Illustrations, but no similar correction was made to the explanation of plates, the species there being labeled *O. oryza*.

From *O. nivea*, this species is separated by its much smaller size, more slender form and a much higher, more sharply pointed spire. From small specimens of *nivea*, the finer lirations of the parietal wall and less deeply excavated pillar are helpful in distinguishing the species. Two color forms are present; commonly the shell is pure white, an occasional one in each lot having a colored spire which may be yellow, gray to a beautiful rose-pink, only rarely do all the specimens from the same locality show uniformly white shells; the other color form has the body-whorl marked or flecked with brown.

This is the common *Olivella* in Florida, distributed along both east and west coast. Dall gives its range as Hatteras to Tortola. *O. prefloralia* Olsson and Harbison from the Pliocene of Florida is an allied fossil species.

*Olivella* (*Olivella*) *macgintyi* new species

Plate 12, fig. 3.

Shell of medium size, subcylindrical, stout, widest opposite the end of aperture, with a small pointed spire of about 6 whorls, about one-third the

total length. Sutures narrowly grooved. Color porcellaneous, white, polished, with a few faint brown flecks below the suture. Parietal callus rather strong, thickest opposite the end of aperture and extending upwards over the penultimate whorl to the suture, thickly coating the surface of the spire-whorls between the sutures. Pillar structure strong, formed by 8 to 10 lirations which commence a short way below the upper end of inner lip and extend anteriorly, the lower 4 or more smaller, more crowded and passing a short distance outwardly but not forming a noticeably enlarged fold. Fasciolar band wide, about  $\frac{2}{3}$  of the length of the aperture, divided unequally into two segments by a weakly incised line. The pillar and parietal wall are deeply excavated internally, the end of the pillar enlarged and fold-like.

Length 10 mm., diameter 4.3 mm.

Holotype, McGinty collection.

Based on a single specimen dredged off Palm Beach, Florida in 20 fathoms (rocky reef) by Thomas L. McGinty, 1940, for whom the species is named. Much like *Olivella canaliculata* Gabb from the Miocene of Santo Domingo, but much smaller and with a different pillar structure.

***Olivella (Olivella) stegeri* new species**

Plate 14, fig. 10.

Shell short, stubby and solid, with a large, roundly shouldered body-whorl widest opposite the end of the aperture. Spire elevated, narrowed, composed of about 6 whorls between deeply channelled sutures, overhung by the edge of the whorl in front. Parietal callus thick, heaviest near the end of the aperture and passing upwards towards the suture. Pillar structure strong, formed by a low, plaited anterior fold followed above by 5 or 6 plaits on the parietal wall, the lower ones strong, the others diminishing in size upwards. Fasciole weakly divided. Color a glossy, porcellaneous white or pale brown, the fasciole in the latter case remaining white. Pillar wall deeply excavated.

Length 11.2 mm., diameter 5.3 mm. (Holotype, ANSP. 194587.)

This is a very striking species, distinguished by its solid, porcellaneous shell, usually white or light brown, the fasciole white. The pillar structure is strong.

Named for Mr. Dan Steger of Tampa, Florida to whom we owe many recent discoveries amongst the Gulf mollusks.

One hundred miles east of Alacran, Mexico in 28 fathoms.

### *Pacific Species*

***Olivella (Olivella) dama* (Mawe)**

Plate 8, figs. 3, 3a, 3b.

*Voluta dama* Mawe, 1828, in Wood, Index Test., Suppl., p. 11, pl. 4, fig. 37.

*Oliva dama* (Mawe), Duclos, 1835, Mon. *Oliva*, pl. 3, figs. 5, 6.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 30, pl. 22 (349), figs. 368, 369.

*Oliva purpurata* Swainson, 1831, Zool. Illust. ser. 2, vol. 2, pl. 2 (58), fig. 1.

*Oliva lineolata* Gray, 1839, Zool. Beechey's Voyage, p. 131.—Reeve, 1850, Conch. Icon., vol. 6, pl. 23, fig. 63.

*Olivella dama* (Mawe), Carpenter, 1857, Mazatlan Cat., British Mus., p. 471.

Shell of medium size (average length 18-20 mm.), stout, with a spire nearly the same length as the aperture. The wide, fasciolar band encircling the base is white or yellow, and contrasts with the obscure, brownish, sometimes faintly zigzag pattern of the main surface, the sutures more deeply stained. Enamel of the spire-whorls rather heavy, white or plain except for the edge of the sutures which are brown, marked with fimbriated lines. Apex of spire generally violaceous. Inner lip with a large, pillar fold below, followed above by a few small plaits which do not extend above the middle line, the parietal callus lightly violaceous. Outer lip often brown within. Pillar wall excavated.

Radular ribbon essentially that of *O. nivea* but smaller, its length about 2 mm., width .67, width of each rachidian tooth about .3 mm. Rachidian tooth curved, bow-shaped, with about 24 cusps, the medial pair large. Radular ribbon from specimen contributed by Dr. Myra Keen.

This species was well figured by Swainson, as *purpurata*, so named in allusion to its purple-colored aperture. It is apparently common along the Mexican coast. Fossil in the Pleistocene of Lower California.

*Range*.—Lower California and adjacent coast of Mexico proper.

**Olivella (Olivella) gracilis** (Broderip and Sowerby) Plate 11, figs. 5, 5a.

*Oliva gracilis* Broderip and Sowerby, 1829, Zool. Jour., vol. 4, p. 379.—Duclos, 1835, Mon. *Oliva*, pl. 1, figs. 17, 18.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 20, fig. 46.

—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 30, no. 156, pl. 22 (349), figs. 370-372.

*Oliva (Olivella) gracilis* Broderip and Sowerby, Weinkauff, 1878, Die Gattung *Oliva*, Syst. Conch. Cabinet, p. 133, pl. 35, figs. 2, 3.

*Olivella gracilis* (Broderip and Sowerby), Maxwell Smith, 1944, Panamic Marine Shells, p. 35, fig. 434 (copy of Marrat).

Similar to *Olivella nivea* but smaller, more slender and more richly colored. Described originally from the coast of Ecuador, the species ranges southward to Paita, Peru where it is rare, and possibly northward to the Gulf of California. The radula has been figured by Thiele in the second volume of Troschel's *Das Gebiss der Schnecken*, pl. 10, fig. 13.

Recorded as fossil from the Pliocene of Ecuador and also from the Pliocene and Pleistocene of Mexico and Lower California.

**Olivella (Olivella) tergina** (Duclos) Plate 9, figs. 4, 4a

*Oliva tergina* Duclos, 1835, Mon. *Oliva*, pl. 2, figs. 13-16.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 26, figs. 86a-c.—Ducrox, 1857, Revue Critique de Genre *Oliva*, p. 91.

—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 33, no. 173, pl. 23(350), figs. 395-398.

*Oliva (Olivella) tergina* (Duclos), Weinkauff, 1878, Die Gattung *Oliva*, Syst. Conchy. Cabinet., p. 118, pl. 31, figs. 5-8.

*Olivella salinasensis* Bartsch, 1928, Jour. Wash. Acad. Sci., vol. 18, no. 3, p. 67, figs. 1-12.

Shell narrowly egg-shape, the length up to about 18 mm. The spire, nearly half the length, is full, its whorls flat to slightly convex. Protoconch small, glassy, elevated or slightly projecting. Sutures are narrowly

grooved. Color pattern is fairly constant, mainly in tones of gray or yellow with arrow-shaped blotches of white edged with brown, these markings being largest in a zone encircling the whorls just above the end of the aperture. The spire-whorls are white or yellow, the suture margined by a band of frilled brown lines. Pillar structure consists of several (6 or 7) rather strong lirae which extend along the parietal wall nearly to the end of aperture.

This fine species is moderately common along the Ecuadorian coast. Its color pattern is quite constant in most specimen seen, but the general shade of color may vary from gray, brown to yellow. The shape of the shell is elongated, egg-like, the small nucleus elevated and projecting in a peculiar fashion. A faded beach specimen from Santa Elena was described by Bartsch under the name of *salinasensis*.

*Range*.—Peru to Lower California.

PERU: Zorritos. ECUADOR: Santa Elena, Manta. PANAMA: Venado Beach. Pearl Islands.

*Olivella (Olivella) bitleri* new species

Plate 15, figs. 4, 4a.

Shell of medium size (length up to about 16 mm.), with an elevated sharp spire about half the total length. Whorls about 8, of which the initial 2 belong to a small glassy nucleus. Sutures grooved, the bordering edge of the whorl in front, sharp and slightly overhanging. On the type, the parietal callus is colored a rich brown and extends upward past the end of the aperture but not quite reaching to the suture, the callus being thickest at the end of the aperture and just above it, the general surface of the penultimate whorl being covered and colored by its enamel. Coloration variable; the type has the body-whorl between the suture and the fasciole a steel-gray which forms a broad band between the deep, rich brown of the penultimate whorl above and a narrow brown band below which colors the upper band along the fasciole; other shells have the surface colored a light-brown formed by a sprinkling of small spots. Upper band of the fasciole usually brown, the lower part white. Sutures edged below with a lighter colored zone with small, broken, brown lines. Interior of outer lip a dark brown. Radula typical for the subgenus, the ribbon of medium length, with about 28 rows of teeth, the rachidian tooth with about 20 cusps, the central pair largest and in the specimen examined, the central pair of cusps have 2 secondary ones between them.

Length 15.2 mm., diameter 5.8 mm. (Holotype, ANSP. 194586.)

In size and general coloration, this species might easily be mistaken for *Olivella volutella* (Lamarck) but closer inspection will show that it has the pillar structure of true *Olivella*. The radula is also of true *Olivella*, the rachidian tooth having the central pair of cusps greatly enlarged.

Our shells were received from Capt. W. S. Bitler, U. S. Navy formerly stationed at Balboa, who has contributed substantially to our knowledge of the Panama fauna by his extensive collecting.

Panama, Panama Bay.



**Olivella (Olivella) broggi** new species

Plate 9, figs. 5, 5a.

Shell of medium size, our largest specimen about 17.5 mm. Form broadly subelliptical with a small, stout, conic spire about half the length of shell and terminating in a small, projecting nucleus. Color in shades of gray or purplish-brown formed by a dense pattern of small brown dots spread over the surface or concentrated into ill-defined bands. Suture generally bordered by small brown dots. Fasciolar band wide, simple or indistinctly divided, white except for a row of brown spots near its upper margin. Aperture relatively narrow, the outer lip straight. Parietal callus spread upward towards the suture but not noticeably thickening the spire-whorls, the color underneath preserved. Suture bordered by a series of widely spaced brown lines, placed at nearly right angles to it. Pillar structure consists of a series of small lirations extending along the columellar portion upward towards the parietal wall.

Length 13.9 mm., diameter 5.9 mm. (Holotype and figured specimen, ANSP. 194592.)

Related to *Olivella tergina*, this species is distinguished by its more elliptical shape, coloration, and in details of its pillar structure. As far as present records indicate, the species seems limited to northwestern Peru.

This distinctive Peruvian species is named to honor Dr. Jorge Alberto Broggi, professor of geology in the Escuela de Ingenieros de Lima in recognition of his many contributions to Peruvian science.

*Range*.—Northwest coast of Peru. Bayovar. Mancora. Zorritos.

**Olivella (Olivella) riverae** new species

Plate 10, figs. 4, 4a.

Shell of medium size (length about 12 mm.), relatively thin, spindle-shaped, with an elevated spire of about 5 whorls, the body-whorl large, subelliptical. The parietal callus is developed as a thin enamel spread along the inner lip of the aperture and passing above the end of the aperture but spread so lightly that it does not obscure the color of the penultimate whorl beneath. Pillar structure weak, forming a low ridge along the columella, finely lirated below. Aperture effuse in front, the notch of the siphonal canal wide, the outer lip thin. Color is a mottled brown or rich mahogany formed by the coalescence of small blotches of color on a gray-yellow base which at the suture form into short, crooked lines. Fasciole is similarly colored brown, the upper band yellow, with brown spots. Aperture has the parietal callus often white, the interior of outer lip a deep brown.

Length 12.7 mm., diameter 5.1 mm. (Holotype, Zorritos, Peru. ANSP. 194583.)

A relatively rare but seemingly widely distributed species, ranging from northwestern Peru to Costa Rica. Its beautiful, deep, mahogany-brown color distinguishes the species easily from its associates. We take pleasure in naming this species for Miss Rosalvina Rivera, paleontologist associated with Dr. J. Broggi at the Instituto Geologico in Lima.

PERU: Zorritos. COSTA RICA: Islas Tortugas, Gulf of Nicoya, Costa Rica (collected by Mr. Ted Dranga, 1952. Dr. Jeanne Schwengel Coll.).

**Olivella (Olivella) cocosensis** new species

Plate 14, figs. 9, 9a.

Similar to *O. gracilis* in color and general characters but much smaller (specimens in the type lot not exceeding 11 mm.), the spire shorter, its whorls more heavily calloused. Whorls about 6, of which the first two are glassy and form the small, elevated and projecting nucleus. The color may be a plain white but more often mottled with brown, the general pattern that of *Olivella gracilis* and *nivea*; this consisting of an upper darker band bordering the suture and a lower darker band bordering the fasciole, the area in between mottled more lightly with brown flecks. Fasciole porcelainous white, the surface of the spire-whorls similar. The pillar structure, as in *gracilis*, consists of about 7 lirations along the inner lip, some of which may be paired.

Length 9.8 mm., diameter 4 mm.

Chatham Bay, Cocos Island. Holotype, ANSP. 155004, Pinchot Exp. collected by H. A. Pilsbry, 1928.

**Olivella (Olivella) drangai** new species

Plate 15, fig. 7.

Shell small (length about 10 mm.), relatively thin, white or yellowish-brown, subtranslucent except for the fasciole which is opaque white. Spire elevated, evenly tapering and composed of about  $6\frac{1}{2}$  whorls, the nuclear one quite small. Sutures are narrowly grooved with the anterior margin slightly overhanging, the sutural junction underneath generally showing through the thin texture of the shell as a faint line. Parietal callus well developed, heaviest near the end of the aperture, extending more thinly above to the suture. Pillar structure consists of several small lirations extending upward along the inner lip about half way, internally the pillar is deeply excavated by corrosion.

Length 10 mm., diameter 3.9 mm. type. (Holotype, ANSP. 194581.)

Resembles *O. floralia* of the Atlantic coast of the United States but with a stouter, less attenuated spire.

Named for Mr. Ted Dranga who collected the species in the Galápagos Islands.

*Range*.—Galápagos Islands.

GALAPAGOS: Dredged in 5 fms. Bahia Wreck, San Cristobal Island (Ted Dranga).

**Olivella (Olivella) alba** (Marrat)

Plate 8, fig. 6.

*Oliva alba* Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 32, no. 169, pl. 22 (Thes. 349), fig. 390.

The shells are small, with a conic spire about half the total length. Sutures are widely grooved (as in *Oliva*) without an appressed or overhanging collar. Parietal callus extends to the upper suture, heaviest opposite end of aperture. Pillar structure carrying 3 or 4 large, oblique lirations below and 3 or more shorter ones above. Color white, the apex often much darker.

In the explanation for Plate 22 of the Thesaurus, Guatemala is given as the locality for this species. A small lot received from the Liverpool Museum in the Academy collection (ANSP. 16018) which are labelled types of *alba* have the locality label Acapulco? They consist of 4 small shells, more or less weathered and were probably picked out of beach drift. They agree well with the original figure of *alba* in the Thesaurus. In one shell, the apex is colored gray-black. Another lot in the National Museum at Washington (USNM. 182566) identified as *alba* are from Margarita Bay, Lower California. Nichols collector. The National Museum specimens range from about 7.8 mm. to 9.3 mm.

*Olivella (Olivella) rehderi* new species

Plate 10, fig. 7.

Shell small (length 7 to 8 mm.), rather light and thin, with an elevated, turreted spire of about 6 whorls, nearly half the total length. Sutures are widely grooved, the collar-like edge of the forward whorl rather narrow. Parietal callus extends to the upper suture of the penultimate whorl, heaviest at the posterior end of aperture. Pillar structure formed by 4 or 5 descending, strong lirations on the anterior portion of the columella. Color a dull white or cream, and slightly variegated with faint spots or flammules of brown arranged roughly in 3 zones, an upper set of spots just below the suture, the other two around the middle and base. Fasciole white.

Length 7.7 mm., diameter 3.3 mm. (Holotype, USNM. 96799.)

There is some variation in contour from relatively stout to more narrow. Somewhat similar in shape to *O. alba* but with a thinner shell, a more reduced pillar structure and different coloration. Color nearly white but with a pattern of brown spots and flammules showing faintly in the specimens at hand.

Bay of Panama. sta. 2799. U. S. Fish. Comm., in 30 fms. USNM. 96799.

Probably Santa Elena, Ecuador.

*Fossil Atlantic and Caribbean Species*

*Olivella (Olivella) venezuelensis* new species

Plate 13, fig. 3.

Shell large for the genus, solid, the spire elevated, between a third and half the total length, composed of 4 or more whorls, the apical one missing from the type. Sutures narrowly channelled or grooved. Body-whorl large, of medium inflation, widest opposite end of aperture. Parietal callus strong, thick, extending to the upper suture, heaviest at the end of aperture and thickening the surface of the spire-whorls, especially just above the suture. Pillar structure with a lirated basal fold revolving outward and down and a few smaller lirae along the parietal wall. Fasciole rather large, thickened by callus, divided nearly equally by a medial incised line. Anterior end of shell somewhat impressed or obliquely flattened.

Height 27.2 mm., diameter 12.1 mm. (Holotype, ANSP.)

Related to *Olivella canaliculata* Gabb from the Miocene of Santo Domingo, this species differs by its larger size and higher spire. We have but one specimen.

Occurrence. Upper Miocene. Punta Blanco beds to the north of La Guaira, Venezuela.

***Olivella (Olivella) indivisa* Guppy**

Plate 12, fig. 9.

*Olivella indivisa* Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 308, pl. 30, fig. 10. (Miocene of Jamaica).—Maury, 1917, Bulls. Amer. Paleont., vol. 5, p. 233, pl. 11, fig. 3.

*Olivella (Dactylidia) indivisa* Guppy, Woodring, 1928, Carnegie Inst. Wash., no. 385, pp. 232, 233, pl. 14, fig. 3.

*Olivella floralia* Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 336. Probably not *O. floralia* Duclos.

Shell uniformly small, thin with a high, sometimes slender spire composed of 6 or more whorls between narrowly grooved sutures. Parietal callus thin, narrow and generally extending to the upper suture or ending at some intermediate point on the penultimate whorl. Pillar structure narrow and formed by a series of weak lirations along the parietal wall. Columella excavated.

Originally described as a Miocene fossil from Jamaica but the species is more common in beds of the same age in Santo Domingo, particularly at Baitoa. The fossils are questionably distinct from Recent *O. floralia* Duclos and pass through the same range of variation.

Miocene of Bowden Jamaica and in beds of same age at Baitoa, Cercado de Mao, Santo Domingo.

***Olivella (Olivella) canaliculata* (Gabb)**

Plate 13, fig. 5.

*Oliva canaliculata* Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 215.

*Olivella canaliculata* (Gabb), Maury, 1917, Bulls. Amer. Paleont., vol. 5, p. 232, pl. 11, figs. 1, 2.—Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 336, pl. 23, figs. 5, 6 (only).

This is a characteristic Miocene species common in Santo Domingo and well figured by Pilsbry. The fossil was collected by the Maury expedition along the Rio Cana and Rio Gurabo; it is also common on the Rio Yaqui del Norte. The shell is short, broad and stubby. The spire is short, the penultimate whorl rather large and appearing as if swollen on the back. The parietal callus is well developed, generally thickest at the end of the aperture, the spire-whorls usually thickened by enamel. Pillar structure typical of the subgenus.

Miocene of Santo Domingo.

***Olivella (Olivella) muticoides* (Gabb)**

Plate 13, fig. 6.

*Oliva muticoides* Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 215.

*Olivella muticoides* (Gabb), Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 336, pl. 23, fig. 7 only.—Olsson, 1922, Bulls. Amer. Paleont., vol. 9, p. 264, pl. 10 (7), fig. 11 only.

Although *O. muticoides* and *canaliculata* were regarded as constituting a single species, they appear to be distinct. In *muticoides*, the form is narrowly cylindrical, the lower part of the body-whorl having an even, gradual slope while in *canaliculata*, the anterior portion of the shell is contracted sharply. Other characters distinguishing the two species will be seen from the figures.

Miocene of Santo Domingo, exact locality not known. The small shell from Costa Rica, figured by Olsson although much worn appears to belong to this species.

***Olivella* (*Olivella*) *wilsoni* new species**

Plate 14, figs. 4, 4a.

Shell of medium or large size (length up to about 20 mm.), solid, slender, with an elevated pointed spire of 7 whorls, not quite half the total length. Sutures deeply grooved. Parietal callus heaviest at the end of aperture and extending upwards towards the suture. Pillar structure formed by a large, weakly lirated fold at the anterior end, succeeded by weak or fine lirations along the parietal wall, the pillar column of the inner lip stout, straight and hardly affected by any corrosion. Fasciole simple, undivided.

Length 17.6 mm., diameter 6.6 mm. (Type, ANSP. 30433.)

Large specimens attain a length of about 20 mm. About equal in size to *Olivella nivea*, this species is more slender, the penultimate whorls not appearing swollen and the pillar column is large, stout and shows no evidence of corrosion.

Named for Mr. Druid Wilson of the United States Geological Survey, who for many years has made a special study of the Acline fauna.

Pliocene or Uppermost Miocene. Alligator Creek, near Acline, Florida. Locklin collection.

Subgenus DACTYLIDIA H. and A. Adams, 1853

Type by subsequent designation, Cossmann, 1899, *Olivella mutica* (Say). Recent, Cape Hatteras south to Florida.

Shell stout, with a moderately high spire. Parietal callus strong, extending to the upper suture and covering the spire whorls with an enamel-like coating but leaving the sutures unaffected. Pillar structure is a narrow, tongue-shaped ledge, comprising a basal fold below and a lengthened extension along the parietal wall, above the upper segment smooth or bearing a few, irregular denticles. Columellar pillar not excavated, bearing a strong fold at the end. Operculum chitinous, thin. Radula with the rachidian tooth rather narrowly comb-shaped, its basal margin straight, curving upward at the ends, its upper margin multicuspidate, most of the

cusps along it of uniform height and size, diminishing rapidly in size only at the ends; lateral teeth curved, uncinatate and appear to be hinged on quadrate, accessory plates.

*Species referred to this subgenus*

*Recent*

- Olivella mutica* (Say). Hatteras southward to Florida.  
*Olivella mutica fimbriata* (Reeve). Florida.  
*Olivella pusilla* (Marrat). Florida.  
*Olivella dealbata* (Reeve). Florida and the West Indies.

*Fossil*

- Olivella carolinae* Gardner. Miocene of the Carolinas.  
*Olivella mutica* (Say). Pliocene of Florida.  
*Olivella mansfieldi* new species. Miocene of Florida.  
*Olivella clewistonensis* Olsson and Harbison. Pliocene of Florida.  
*Olivella cotinados* Gardner. Miocene of Florida.  
*Olivella dasa* Gardner. Miocene of Florida.

***Olivella (Dactylidia) mutica* (Say)**

Plate 9, figs. 7, 7a, 7b.

- Oliva mutica* Say, 1822, An account of some of the marine shells of the United States, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 228.—Duclos, 1835, Mon. *Oliva*, pl. 2, figs. 5-8.—Duclos, 1845, Chenu, Illustr. Conch., pl. 2, figs. 5-8.—Ducrox, 1857, Revue Critique de Genre *Oliva*, p. 96.  
*Oliva rufifasciata* Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 28, figs. 88a, b.—Marrat, 1871, Thes. Conch., vol. 4, p. 29, no. 149, pl. 25(351), fig. 449.  
*Oliva fimbriata* Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 29, figs. 92, a-d.—Marrat, 1871, op. cit., p. 29, no. 148, pl. 21(348), fig. 355.  
*Olivella mutica* (Say), Dall, 1889, Blake Report, Bull. Mus. Comp. Zool., vol. 18, pt. 2, pp. 133, 134, pl. 34, figs. 1, a-r, 2.

“Shell suboval, white or yellowish-white; *body whorl* with about three revolving maculated bands of pale rufous, of which the superior one is continued upon the spire, the intermediate one is dilated so as to be sometimes confluent with the inferior one, which is narrowest; *spire* short; *suture* very narrow; *columella* destitute of striae.

Length more than two-fifths of an inch.

Inhabits the southern shores.

Cabinet of the Academy and Philadelphia Museum.

A common shell, varying somewhat in colour; the bands are sometimes deep reddish-brown, sometimes livid, rarely all united and offering only a white line near the base. It seems allied to the *O. zonalis* as described by Lamarck, but is a larger species.” (Say, 1822.)

No figure of *mutica* was given by Say but his description, quoted above, applies well to the Florida form of this common species. He mentioned

three revolving *maculated* bands, the superior one *continued upon the spire*, the intermediate one *dilated* so as to be confluent with the inner one. This description fits the condition generally found amongst shells collected at Lake Worth as well as Reeve's *fimbriata*. Reeve's *fimbriata* may be accepted as a subspecific name for such shells which have the sutural color band formed by a series of broken brown lines or frills. The more northerly form of *mutica* has the spiral bands in solid color, usually narrower and alternately deep brown and white, the spire whorls being usually yellow. Earliest and best figures of *mutica* are those of Duclou, his figures 5 and 6 depicting the northern form with narrow color bands and yellow spire, while his figure 7 (*mutica* var.) is the commoner southern form to which Reeve later gave the name "*fimbriata*." (Plate 9, figs. 6, 6a.)

*Olivella mutica* has often been recorded as a fossil species but most records below the Pliocene refer to some other species.

A radula extracted from a Miami specimen has the following characters. Length of ribbon 1.2 mm., width of ribbon .5 mm., width of an individual rachidian tooth .1 mm. There are 27 cusps on the rachidian tooth, which are nearly uniform in size and spacing except near the ends where they diminish in size very rapidly. The lateral teeth are large, curved and appear as if hinged to a thin, quadrate accessory, basal plate.

*Range*.—Cape Hatteras southward along the coasts of Florida and to the Bahamas.

***Olivella (Dactylidia) dealbata* (Reeve)**

Plate 15, figs. 6, 6a, 6b.

*Oliva dealbata* Reeve, 1850, *Conch. Icon.*, vol. 6, *Oliva*, pl. 25, fig. 71.—Marrat, 1871, *Thes. Conch.*, vol. 4, *Oliva*, p. 31, no. 161, pl. 22 (349), figs. 381, 382.

*Oliva rubra* Marrat, 1871, *Thes. Conch.*, vol. 4, *Oliva*, p. 40, no. 217, pl. 25 (351), figs. 459, 460.

Like *O. nivea* in general shape, whitish shell but much smaller, less than half as long, the apical tip stubby, conic and not produced or attenuated as in the larger species. Color white or cream, usually with a band of broken brown spots or streaks below the suture and another similar band borders the fasciole below. Fasciole white, the middle line depressed. Some specimens are darker, the mid-zone of the body-whorl being brownish, formed by small, irregularly zigzag lines. A thin, chitinous operculum is present.

Length 11 mm., diameter 5.5 mm. (Bradentown Beach, Florida.)

The radula taken from a specimen contributed by Miss Adele Koto and collected at Bradentown Beach has 31 rows of teeth, the length of radular ribbon about 1.3 mm., width 5.5 mm., width of a rachidian tooth about 2 mm.

This species is plentiful on Grand Cayman near Cuba and probably elsewhere in the West Indies, extending to the Keys and along the west coast of Florida. Most specimens are relatively small, the average about 8 mm. but occasionally attain a length of about 14 mm. Some records of *nivea* in the West Indian-Caribbean area may represent this species. The pure white form of this species, common throughout the West Indian region, may be the shell described by Lamarck as *oryza*.

**Olivella (Dactylidia) pusilla** (Marrat) Plate 8, figs. 5; plate 14, figs. 7, 7a, 7b.

*Oliva pusilla* Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 29, no. 150, pl. 21 (348), figs. 356-358. Gulf of Florida.

*Olivella pusilla* (Marrat), Perry, 1940, Bulls. Amer. Paleont., vol. 26, no. 95, p. 159, pl. 36, fig. 248.—Perry and Schwengel, 1955, Marine Shells of the western coast of Florida, p. 176, pl. 36, fig. 248.

Shell small, rather stout, subelliptical to bullet-shaped, widest about the middle line opposite to the end of the aperture. Spire about half the length of shell, or nearly equal to that of the aperture. Whorls about 5, uniformly tapering, the apical whorl being very small. The sutures are narrowly channelled, the edge of the whorl sharp and slightly overhanging. The parietal callus extends as a thin wash of enamel to the upper suture but so lightly as to be visible only in the living shell, not obscuring the underlying pattern, the callous deposit being heaviest at the upper end of the aperture where it is often stained a deep brown. Pillar structure is a heavy, descending fold in its lower part, bordered by 4 smaller plaits above which do not quite extend to the end of aperture, generally ending at the upper edge of the fasciolar band. Fasciole faintly divided. Color is variable but mostly in tones of rich mahogany brown, often gray, but some specimens may be entirely white. In the dominant color pattern, there is a broad brown band around the middle bordered above by a white band or one with brown flecks around the suture. Outer lip is generally edged with white, internally a solid brown. Operculum chitinous. Radula similar to that of *mutica* but smaller.

This is the commonest *Olivella* in Florida, particularly along the west coast.

### *Fossil Species*

**Olivella (Dactylidia) carolinae** Gardner

*Olivella carolinae* Gardner, 1948, Prof. Paper. U. S. Geol. Surv., no. 109-B, p. 259, pl. 38, figs. 22, 23.

Shell of medium size, commonly between 15 to 17 mm., ovate, the spire and aperture of about equal length. Whorls 6 to 6½, the first whorl and a half comprising the small protoconch, together forming an evenly tapering spire. Body-whorl moderately inflated and evenly convex, its greatest diameter falling near the median line of the shell. Sutures are narrowly grooved. Surface smooth, polished and of a uniform color. Parietal callus



strong, thickest opposite the posterior end of aperture and extending upwards to the suture. Pillar structure is formed by an outwardly revolving basal fold with weak lirations over it, followed above by a narrow ridge covered by closely packed lirations. Fasciole wide, divided by a faint line forming a narrow band along its upper side.

The holotype (U. S. Nat. Museum, no 325378) comes from the Miocene, Duplin marls, 1 mile west of Lumberton, North Carolina. The species is also found at Natural Well. It is related to *O. mutica* but distinguished by its stronger pillar structure.

**Olivella (Dactylidia) mansfieldi** new species

*Olivella mutica* Mansfield, 1930, Miocene Gastropods and Scaphopods of Choctawhatchee Formation of Florida. Florida State Geol. Surv., Bull. no. 3, p. 51, pl. 4, fig. 1.—Gardner, 1937, Prof. Paper, U. S. Geol. Surv. no. 142-F, p. 384, pl. 46, fig. 14 (not of Say).

Shell very small, the average length about 7 mm., solid, biconic, the spire and aperture of about equal length. Surface smooth, polished, the body-whorl between the fasciole and suture colored light brown or tan, the remainder white. Sutures narrowly grooved. Whorls 5, the first comprising a small, blunt and partly immersed nucleus. Body-whorl moderately inflated, evenly rounded along its sides, its greatest diameter placed near the median line. Parietal callus strong, heaviest opposite the lip junction and extending upward to the suture as a thin wash. Pillar structure is a narrow fold bordered above by 3 small, often paired lirations. Outer lip thickened internally but not lirated.

Length 6.7 mm., diameter 3.3. (Type, ANSP. 30434.)

This is a small species from the Miocene of Jackson Bluff. Originally identified by Mansfield with *O. mutica* (Say), it appears to us to be distinct, differing by its constantly smaller size and in details of its pillar structure.

Miocene of Jackson Bluff, Florida. Specimens seen are from the Locklin Collection.

Subgenus DACTYLIDELLA Woodring, 1928

Type by original designation, *Oliva anazora* Duclou.

Shell resembling *Dactylidia*, though the type specimen is larger and more slender. Apertural features as in *Dactylidia*, except that the interior of outer lip bears fine, low lirations. Woodring, 1928.

Olivellas of medium or large size, slender, with an elevated acute spire. Parietal callus extending upwards to the sutures, thickest at the end of aperture or just above, the spire-whorls covered with a porcellaneous layer of enamel but the sutures remaining open and grooved. Pillar structure much as in *Dactylidia*, consists of a narrow, weak ridge or platform, wider below and narrowing upward along the parietal wall and bearing along it a few, small plaits in the columellar section. Color in *O. anazora* is formed

by a pattern of confluent, zigzag, brown lines. Outer lip either smooth or weakly lirated within. Radula not known.

The shells are often quite large, in shape like *Agaronia*, having a high, slender, acute spire.

Two known species.

*Recent.* *Olivella anazora* Duclos. Panamic-Pacific faunal area.

*Fossil.* *Olivella paraisa* new species. Miocene of Costa Rica.

***Olivella (Dactylidella) anazora* (Duclos)**

Plate 8, figs. 1, 1a, 1b.

*Oliva anazora* Duclos, 1835, Mon. *Oliva*, pl. 5, figs. 3, 4.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 25, figs. 74a, b.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 36, no. 189, pl. 23 (350), fig. 419.

Shell with a high, attenuated spire tipped with a small, sharp apex. Greatest diameter of shell placed opposite the end of the aperture. Sutures distinct, widely grooved, in perfect shells overhung somewhat by the sharp edge or margin of the whorl in front. Parietal callus well formed, heaviest above, notched or grooved by the termination of the suture. Pillar structure as described for the subgenus. Color generally brownish, often showing a pattern of fine, zigzag darker lines, more or less confluent. Fasciole generally colored solid brown. Inner side of outer lip smooth or faintly lirated. Columella with a strong keel or fold at the end.

Height 18.2 mm., diameter 7.4 mm. aperture 5.1 mm. (figured specimen).

Duclos' figure of this species is taken as typical, and shows the pattern of fine zigzagged lines assumed by the adult shell as well as the deep brown coloration of the fasciole. In shape, the shell is like *Agaronia* with a high, slender spire.

*Range.*—Gulf of California to northern Peru.

MEXICO: Mazatlan (Carpenter). PANAMA: Buearu; Venado Beach. ECUADOR: Manta; Santa Elena; Puerto Callo. PERU: Lobitos; Zorritos.

### *Fossil Species*

***Olivella (Dactylidella) paraisa* new species**

Plate 13, fig. 1.

*Olivella Boussaci* variety, Olsson, 1922, Bull. Amer. Paleont., vol. 9, no. 39, p. 265, pl. 7, figs. 15, 16. (Not of Cossmann, 1913, Jour. de Conchy., vol. 61, p. 60, pl. 5, figs. 16-19.)

Shell of medium size (average length about 13 mm.), with a high, sharply pointed spire about half the total length. Whorls 6 or 7 separated by narrowly grooved sutures and ending above in a small nucleus. Body-whorl subelliptical, not expanded, and widest opposite the end of the aperture. Parietal callus well developed, thickest near the posterior end of aperture and extending upward to the suture; below narrowing and curving around the end of the columella, forming a hook-shaped extension. The pillar structure is formed by a narrow ridge, more or less tongue-shaped, finely plaited along its surface and set off quite sharply from the callous

deposit surrounding it. The outer lip is thin and weakly lirated within. Fasciole wide, double, the upper band slightly less than a half.

Length 13.3 mm., diameter 5 mm. (Holotype), 20997, Paleontological Research Institution, Ithaca, N. Y.

The Costa Rican fossils were first identified as a variety of Cossmann's *Olivella boussaci* described from the Miocene of Martinique. Cossmann's figures are too poor for certain identification and his specimens are shown as having the aperture filled with matrix. In all probability they represent a different species. *O. paraiso* is closely related to *anazora* of the Recent Pacific fauna but is more slender, the body-whorl less expanded and the spire more elevated.

Miocene of the Banana River, Costa Rica.

#### Subgenus NITEOLIVA new subgenus

Type. *Olivella minuta* (Link) (*Voluta nitidula* Dillwyn). Recent, West Indies and the Caribbean.

Small or medium size olivellas, often with a color pattern of brown zig-zag lines on a white or cream-colored base. Parietal callus strong, generally wide, extending to the upper suture but the sutures not covered. Pillar structure strong, forming a shelf or tongue along the inner lip, widest below where it extends outward usually assuming a hook-shaped form, narrower and much lengthened above along the parietal wall and bearing at its end a small hook, the rest of its surface finely and evenly crenulate. Outer lip sharp and usually lirated within.

*Niteoliva* is not closely related to *Dactylidella*, as might be suspected from its lirated outer lip, the lirations of the lip being developed most strongly in those species in which the pillar structure is strongly emphasized; thus *Mansfieldella* having the strongest pillar structure of any *Olivella* has also the heaviest lirations on the inner side of the outer lip.

*Niteoliva* is a very natural group, comprising several small species and common in our Tertiary and Recent faunas. Its principal characteristics are the strong, pillar structure which forms a tongue-shaped ridge along the inner lip, strongly lirated and generally with the uppermost liration forming a tooth-like projection. Color pattern mostly in the shape of zig-zag lines.

The following species are referred to *Niteoliva*.

#### Recent

*Olivella minuta* (Link). West Indian and Caribbean region. Probably with many local subspecies and races.

*Olivella verreauxi* (Ducros). West Indies and north coast of South America.

- Olivella peterseni* new species. Northwestern Peru and Ecuador.  
*Olivella morrisoni* new species. Pearl Islands, Panama.

### Fossil

- Olivella galvestonensis* Harris. Miocene, Galveston, Texas deep well.  
*Olivella colpus* Woodring. Miocene of Bowden, Jamaica.  
*Olivella terryi* new species. Miocene of Costa Rica.  
*Olivella marksi* new species. Miocene of Ecuador.  
*Olivella floridana* Mansfield. Miocene of Florida.  
*Olivella tapira* Olsson. Miocene of Peru.

- Olivella* (*Niteoliva*) *minuta* (Link)** Plate 9, figs. 1, 2, 2a, 2b; plate 12, figs. 2, 2a.  
*Porphyria minuta* Link, 1807, Besch. der Nat.-Samml. der Univ. zu Rostock, p. 98.  
 (For illustration refer to Mart. Conch. 2. t. 50, f. 545).—Tomlin and Winckworth, 1931, reprint of Link, p. 98.  
*Voluta nitidula* Dillwyn, 1817. A descriptive catalogue of Recent Shells arranged according to the Linnean Method, vol. 1, p. 521, no. 45.  
*Oliva Zig-Zag* Duclos, 1835, Mon. *Oliva*, pl. 2, figs. 1-4.  
*Oliva mutica* Say, Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 28, fig. 86a (Not to Say.)  
 —Marrat, 1871, Thes. Conch., vol. 4, p. 29, no. 151, pl. 21 (348), figs. 359-361; pl. 25 (351), figs. 465-467 (Not of Say.)  
*Oliva cyanea* Reeve, 1850, op. cit., vol. 6, (erratum on p. ii of index to *Oliva*), pl. 24, sp. 70.

I am indebted to Dr. Tucker Abbott for indicating to me that Link's *Porphyria minuta* and Dillwyn's *Voluta nitidula* are the same species, since both refer to the same figure of Martini for illustration.

As type illustration of this species, I would designate figure 545 in Martini, 1773, Neues Systematisches Conchylien Cabinet, vol. 2, p. 182, taf. 50. This figure is referred to by both Link and Dillwyn, and illustrates quite well the common species, usually known as *nitidula* throughout the Caribbean area.

The typical form of *minuta* has a short, globose shell with a conic spire, slightly shorter than the length of the aperture, the body-whorl being evenly convex, its greatest diameter placed opposite end of aperture. The sutures are open and grooved. Parietal callus strong, extending upward towards the suture. The pillar structure is formed by a tongue-shaped ridge, widest below, evenly and finely crenulated along its full length and terminating in a prominent tooth above. The outer lip is thin, smooth or lirate within, the lirac beginning a short way in from the edge. The spire-whorls are plain, their original coloring concealed or covered over by enamel; on the body-whorl, the color pattern is quite variable but usually formed of more or less zigzagged lines; these may be best developed on young shells. Fasciole wide, colored by a median brown band along the lower edge of an incised line. The nucleus is small, glassy and somewhat elevated or projecting.

The radular ribbon extracted from a specimen from Port Morant, Bay, Jamaica has the following characters. The radula is relatively small (as mounted and spread, length about 1 mm., width .4 mm., width of individual rachidian tooth abt. .1 mm.). The rachidian tooth with a saucer-shaped, subtriangular base, the sides narrowing, the upper side straight to mildly depressed, multicuspidate (about 20 cusps). A pair of medial cusps are placed medially, often with 2 minute cusps between them, the lateral cusps progressively and somewhat irregularly smaller towards the ends, the extreme ones extremely minute. Lateral teeth long, slender, uncinata, somewhat curved with a small knob at their ends. Approximately 34 rows of teeth.

*Olivella minuta* has often been confused with *O. mutica*, sometimes united with or considered a varietal form, but the radular and shell characters show it to be quite distinct. Most records of *mutica* from the West Indies appear to be based on this species.

***Olivella (Niteoliva) verreauxii* (Ducros)**

Plate 9, fig. 3.

*Oliva mutica* Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 28, figs. 86 b, c; pl. 29, figs. 93, a, b. (Not of Say, 1822.)

*Oliva Verreauxii* Ducros, 1857, Revue Critique du Genre *Oliva* de Bruguières, p. 97, pl. 3, figs. 86, a, b.—Tryon, 1883, Manual of Conch., vol. 5, p. 64, pl. 14, figs. 41, 42.

“Coquille petite, ovale-allongée, sub-biconique; spire élevée; tours convexes, calleux; sillon très-développé;—couleur blanc-jaunâtre, avec des lignes brunes flexueuses; columelle blanchâtre, très-calleuse supérieurement, concave à son milieu, très-légèrement plissée; intérieur semblable à l'extérieur, dont on voit les lignes par transparence.”

Rapports et différences.

Cette coquille a les plus grands rapports avec *Ol. nitidula*, Desh. (*mutica*, Reeve, non Say), mais elle s'en distingue constamment par sa forme générale plus allongée, par sa spire conséquemment plus élevée, par ses tours plus convexes, par le callus columellaire qui est beaucoup plus développé postérieurement.—Nous avons une suite assez nombreuse d'individus, et ils présentent bien tous le mêmes caractères, ne passant jamais à l'*Ol. nitidula* Desh.—Les dessins de M. Reeve ne sont pas pour cette espèce d'une très-grande exactitude.

Nous la dédions avec plaisir à M. Edouard Verreaux qui a bien voulu nous la donner. (Ducros de St. Germanin, 1857.)

*Olivella verreauxii* is closely related to *minuta* and at times may be difficult to separate but it is generally a more slender form and with different pattern of coloration. Commonly, the body-whorl is flesh-colored with delicate lines of zigzag which are more widely spaced than usual in *minuta*. Other shells are yellow or brown.

***Olivella (Niteoliva) peterseni* new species**

Plate 11, figs. 7, 7a, 7b.

Shell narrowly subovate with a high, conic spire slightly less than half the total length. Our largest specimen has a length of about 13.5 mm. Protoconch small, glassy. Parietal callus heavy, extending beyond the end

of aperture to the suture, heaviest near the end of aperture, coating the surface of the spire-whorls to impart to them a dull white color. Pillar structure strong, elongate, finely lirated and terminating in a larger denticle at each end, the pillar wall not deeply excavated. Aperture sub-elliptical, the outer lip with a sharp edge and often finely lirated within. Color gray and marked with a rather coarse pattern of brown zigzagged lines on a white or yellow base except near the suture which is bordered by a yellow band edged with gray or brown, the parietal callus white. Fasciole wide, double, the upper band narrow, white or colored, the lower band gray or brown.

Length 12.9 mm., diameter 5.7 mm. (Holotype, ANSP. 194591.)

This is a well-marked species distinguished by its stout form, strong pillar structure and pattern of zigzag brown lines on a white or yellow base. Some shells resemble the young of *anazora* but are stouter.

We take pleasure in naming this species for Dr. G. Petersen, formerly manager of the Zorritos Oil Fields in recognition of his many contributions to Peruvian geology and as a token of a long friendship.

*Range*.—Zorritos, Peru.

*Olivella (Niteoliva) morrisoni* new species

Plate 15, figs. 3, 3a.

Shell small or of medium size. Spire high, pointed, formed of about 6 whorls between grooved sutures, the general shape of the shell being spindle like, widest opposite the end of lip. Parietal callus is thick, extending along the face of the inner lip to the upper suture where it ends abruptly, its outside edge limited sharply. Anteriorly, the parietal callus and the end of the pillar structure form a double fold. The pillar structure is that of *Niteoliva* comprising an elongated ledge along the inner lip, its end above bearing a strong, tooth-like plication and a descending plait at its lower end; between these, there are smaller plaits to the number of about 7. Fasciole wide, dark brown in color except for a narrow white band above, divided. Outer lip is sharp, without any sign of internal lirations. Base color is a dull white with zigzag dark-brown markings, the spire whorls white.

Length 9.2 mm., diameter 4.4 mm.

Length 9.4 mm., diameter 4.4 mm.

Types. U. S. National Museum, no. 587797. San José Island, Pearl Islands, Panama. Coll. J. P. E. Morrison, 2-19-1944. From sand near low tide line near Rio Marina mouth on East Beach.

#### FOSSIL SPECIES

*Olivella (Niteoliva) galvestonensis* Harris

Plate 14, fig. 3.

*Olivella galvestonensis* Harris, 1895, *Bulls. Amer. Paleont.*, vol. 1, no. 3, p. 100, pl. 3, fig. 13.

“General form as indicated by the figure; whorls about 5, smooth; suture deep and prominent, well calloused as it approaches the aperture; outer lip rather thin on the margin, with numerous lirations within; inner

lip with a callosity which extends to the suture of the penultimate whorl, and upon this callosity a second extending from the base upwards two thirds the length of the columella; columella dentato-lirate, at base with a strong fold which follows up the axis of the shell to the apex as seen in broken specimens."

"Range in depth.—From 2,410 to 2,871 feet."

Harris's figured specimen (indicated length 13 mm.) agrees well with the Academy specimen figured on our plate.

*Olivella colpus* Woodring from the Bowden Miocene of Jamaica is similar but somewhat stouter, a character which may not be constant if larger series were available for study.

Probably Miocene. Galveston Deep Well.

***Olivella (Niteoliva) terryi* new species**

Plate 13, figs. 4, 4a.

*Olivella muticoides* Olsson, 1922, *Bull. Amer. Paleont.*, vol. 9, no. 39, pp. 264, 265, pl. 7, figs. 14, 17, 18 (not fig. 11). Not of Gabb, 1873.

Shell of medium size, stout, with an elevated spire somewhat shorter than the aperture. Sutures narrowly grooved. Parietal callus strong, forming a large, knob-like mass at end of aperture and passing upward to the suture and covering the surface of the spire-whorls as well. Pillar structure as typical of *Niteoliva*. Fasciolar band wide, divided nearly equally by a ridged line. Siphonal canal notch wide. Outer lip with a sharp edge, internally thickened and marked with fine, parallel lirations.

Length 13.3 mm., diameter 6.1 mm. Olsson, 1922, fig. 14.

Length 12.1 mm., diameter 5.8 mm. Olsson, 1922, fig. 18.

Length 15.1 mm., diameter 6.8 mm. Olsson, 1922, fig. 17.

Holotype no. 20998, Paleontological Research Institute, Ithaca, N. Y.

This species bears a superficial resemblance to *O. muticoides* Gabb of the Miocene of Santo Domingo but differs by its internally lirated outer lip.

Named for Mr. Robert A. Terry, associated with the author on many geological projects in Panama and Costa Rica.

Miocene of northeastern Costa Rica.

***Olivella (Niteoliva) floridana* Mansfield**

*Olivella (Dactylidella) floridana* Mansfield, 1930, *Bull. Florida State Geol. Surv.*, no. 3, p. 53, pl. 4, fig. 3.

Shell small, solid, subovate. Whorls about 5, the apical ones minute and together forming a short, conic spire nearly half the full length of the shell. Parietal callus strong, thickest near the lip junction and extending upward to the suture. Pillar structure quite heavy and forming an elevated ridge, hook-shaped below where it borders the siphonal canal, and bearing along its upper surface 4 to 6, large, tooth-like lirations, the upper one quite the strongest. Outer lip not thickened but with a series of fine, narrow lirations within.

Length 7 mm., diameter 3.8 mm.

A small species from the Miocene of Jackson Bluff and elsewhere in northern Florida.

**Olivella (Niteoliva) marksi** new species

Plate 14, fig. 6.

Shell small or of medium size (type. length 12.5 mm.), with a relatively large body-whorl comprising about  $\frac{3}{4}$  of the total length and a smaller, elevated and somewhat narrowed spire. Whorls about 6, between small, narrowly grooved sutures, the nucleus itself being small and composed of about 2 turns. Parietal callus extends to the upper suture, most heavily developed at the end of the aperture. The pillar structure is a strong, lirated, plate-like ridge along the inner lip; at its anterior end it is produced outward as a curved tongue; the two end lirations are heaviest and between these there are about 6 smaller plaits but of unequal size and stoutness. Outer lip, thin and sharp, weakly lirated within.

Length 12.5 mm., diameter 5.5 mm. (Holotype, ANSP. 30435.)

From the Miocene of western Ecuador; the species is named for Dr. J. Glenn Marks, formerly paleontologist for the International Petroleum Co., in Ecuador. Our specimens were collected by Mr. O. D. Boggs and the author during a geological trip along the Rio Santiago in northwestern Ecuador in 1935.

Miocene. Cueva de Angostura, Rio Santiago, Province of Esmeraldas, Ecuador.

**Olivella (Niteoliva) tapira** Olsson

*Olivella (Callianax) tapira* Olsson, 1932, *Bulls. Amer. Paleont.*, vol. 19, no. 68, pp. 164, 165, pl. 16, figs. 11, 12.

From the Miocene of northwestern Peru. The types have not been re-examined but the figures show by its apertural characters that it belongs to *Niteoliva*.

Miocene of Quebrada La Cruz, Zorritos, Peru.

Subgenus MANSFIELDELLA Olsson and Harbison, 1953

Type by original designation. *Olivella pugilis* Olsson and Harbison.

Shell short and stout. Parietal callus wide, spreading outward beyond the axial line of the shell and upward beyond the aperture to the apex, partly covering the sutures. Pillar structure is formed by a platform of callus bearing strong lirations along it, the two terminal ones enlarged and tooth-like while at the anterior end, it is outlined by a deep, hooked sulcus. Outer lip strongly lirated within.

Much like *Niteoliva* in the development of its pillar structure and lirated outer lip but with the parietal callus much thicker, spreading over the spire-whorls so as to partly cover the sutures as in *Ancilla*. Known by a single species, the *Olivella pugilis* Olsson and Harbison from the Pliocene of St. Petersburg, Florida. (*Mon. Acad. Nat. Sci. Phila.*, no. 8, p. 188, pl. 24, fig. 7; pl. 29, figs. 5, 5a.) See Plate 5, figs. 7, 7a.



## Subgenus CALLIANAX H. and A. Adams, 1853

Type by subsequent designation, Cossmann, 1899, *Oliva biplicata* Sowerby.

Shell large or small, stout with a moderately high spire. Parietal callus extending to the end of the aperture or but a short ways above it. Pillar structure is a heavy fold at the end of the columella, smooth or plaited. Fasciole divided, the upper segment generally narrow. Inner walls of the spire whorls fully reabsorbed. Radula with 38 to 40 rows of teeth, the central or rachidian tooth fairly large with a saucer-shaped base, multi-cuspidate, the three middle cusps quite large, the others smaller and diminishing towards the ends; the lateral teeth curved unciniate or broadly hatchet-shaped, with a wide, notched base and a pointed or knobbed end; the third or accessory tooth of rectangular form, much thicker at the inner side.

*Callianax* is typically a West American group of Olivellas but certain Atlantic species are referred to it tentatively, pending information on the radula of the Recent forms.

*Species referred to this subgenus*

## Recent, Pacific

- Olivella biplicata* (Sowerby). Oregon to Lower California. Also fossil.  
*Olivella boetica* Carpenter. Alaska to Cape San Lucas. Also fossil.  
*Olivella pedroana* Conrad. Puget Sound to Cape San Lucas. Also fossil.  
*Olivella porteri* Dall. California and Lower California.  
*Olivella pycna* Berry. Oregon and California.

## Recent, Atlantic

- Olivella moorei* Tucker Abbott. Florida Keys.  
*Olivella thompsoni* new species. Florida Keys.

## Fossil, Atlantic

- Olivella coënsis* Mansfield. Miocene of Florida.  
*Olivella johnsoni* new species. Chipola Miocene of Florida.

***Olivella (Callianax) biplicata* (Sowerby)**

Plate 10, figs. 1, 1a, 1b.

*Oliva biplicata* Sowerby, 1825, Cat. Shells Tankerville, App. p. XXXIII.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 20, fig. 48.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 23, no. 121, pl. 18 (345), figs. 288, 289, 290.

*Olivella biplicata* (Sowerby), Grant and Gale, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, pp. 625, 626, pl. 24, fig. 15.—Woodring, Bramlette and Kew, 1946, Prof. Paper, U. S. Geol. Surv., no. 207, p. 77.

This species is common along the Californian coast where it is known as the "Purple Olive". The shell is quite large (length about 23 mm.), solid with a large, broad body-whorl and a conic, elevated spire, the whorls 6 or 7, tipped by a small, elevated, glassy nucleus. Color often pure white

but more often in shades of gray and brown, the sutures lined, brown. The upper band of the fasciole is generally brown, the outer lip edge with brown but stained with purple in the interior as is also the columellar pillar. Radula as described for the subgenus. A ribbon extracted from a specimen submitted by Dr. A. S. Fischer shows the following characteristics: length 3 mm., width 1.00 mm., width of a rachidian tooth .4 mm. It shows 38 rows of teeth.

*Olivella biplicata* is a very distinctive and outstanding species, recognized by its relatively large size, thick shell and stout form. It is reported as common at many localities along the Californian coast, as well as being an abundant fossil in some Pliocene and Pleistocene beds in southern California. Several varieties or subspecies have been described; references for these names may be found in the complete synonymy given by Grant and Gale.

*Range*.<sup>1</sup>—State of Washington (47° 30' N. Lat. A. M. Keene) to Lower California.

*Olivella (Callianax) pedroana* (Conrad)

Plate 10, fig. 2.

*Strephona pedroana* Conrad, 1856, Pacific R. R. Reports, vol. 5, p. 327, pl. 6, fig. 51.

*Olivella pedroana* (Conrad), Grant and Gale, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, pp. 626, 627, pl. 24, fig. 10.—Woodring, Bramlette and Kew, 1946, Prof. Paper, U. S. Geol. Surv., no. 207, p. 77.

*Olivella intorta* Carpenter, 1857, Proc. Zool. Soc. London for 1856, p. 207 (Jan. 7, 1957).

For a discussion of this species, its synonymy and geological distribution, the reader is referred to the works of Grant and Gale, and of Woodring, Bramlette and Kew, recorded above.

As fossil, the species has been reported from the Miocene, Pliocene and Pleistocene in the states of Washington, Oregon and California.

*Range*.—Puget Sound to Cape San Lucas, Lower California.

*Olivella (Callianax) baetica* Carpenter

*Olivella baetica* Carpenter, 1864, Brit. Assoc. Adv. Sci., Rept. for 1863, p. 661.—Tryon, 1883, Manual of Conch., ser. 1, vol. 5, p. 71, pl. 17, figs. 28-31, 34.—Grant and Gale, 1931, Mem. San Diego Soc. Nat. Hist., vol. 1, p. 627.

*Olivella boetica* Carpenter, Dall, 1921, Bull. U. S. Nat. Mus., no. 112, p. 85, pl. 15, fig. 1.

*Olivella boetica diegensis* and *mexicana* T. S. Oldroyd, 1921, Nautilus, vol. 34, p. 118, pl. 5, figs. 2, 3.

Distributed along the entire west coast from Cape San Lucas to Alaska, this species, according to Oldroyd and others, grows larger and is more finely marked in the northern part of its range. As fossil, it has been reported as far back as the Pliocene.

*Range*.—Kodiak Island, Alaska to Cape San Lucas, Lower California.

<sup>1</sup> D. S. and E. W. Gifford, 1948, Oregonian Olivellas, Nautilus, vol. 62, no. 2, pp. 51-54.

**Olivella (Callianax) pycna** Berry

Plate 10, figs. 3, 3a.

*Olivella pycna* Berry, 1935, Proc. Mal. Soc. London, vol. 21, pp. 262-265, 1 figure.

—D. S. and E. W. Gifford, 1942, Nautilus, vol. 55, no. 3, pp. 92-93.

Recognized by its shape and markings as illustrated by the figure.

*Range*.—Oregon to California.**Olivella (Callianax) moorei** Abbott

Plate 15, figs. 11, 11a.

*Olivella moorei* Abbott, 1951, Nautilus, vol. 64, no. 4, pp. 112, 113, pl. 7, figs. 1a-b.

Shell small, subsolid or of medium weight, widest opposite end of aperture and from there the spire tapers regularly, its sides straight to the apex. Whorls about 5, nuclear one being relatively large, blunt, resembling a half-sunken, glassy sphere. The sutures are narrowly channelled, the lower bordering edge sharp and appressed. Parietal callus weak, distributed only along the inner lip to the end of aperture. Pillar structure is like that of *thompsoni*, consisting of a double fold at the end of columella, externally bordered by the spread-out margin of the parietal callus. Base color white, with narrow, axial streaks of brown. Fasciole narrow, also marked with diagonal streaks of brown. Outer lip thin or of normal thickness, somewhat wider or effuse below. Siphonal canal notch wide. Faint spiral striations may be seen on high magnification, otherwise the surface is smooth. Length 7 to 8 mm.

Related to *Olivella thompsoni* but smaller, judging by the specimens seen, also narrower and with a more conic, straight-sided spire.

From off the Florida Keys. For locality stations see Tucker Abbott, 1951.

**Olivella (Callianax) thompsoni** new species

Plate 14, figs. 8, 8a.

Shell small, solid with an elevated spire of about 6 whorls, the first 2 forming a relatively large, blunt nucleus. The body-whorl is fairly large, convex. Sutures are narrowly grooved with a slightly appressed margin in front. Parietal callus narrow and extends to the end of aperture. The pillar structure forms a small, double fold at the end of the pillar, often much heavier within; opposite to it at the lower end of the outer lip there is sometimes a small liration. Inner wall of the pillar shows no sign of corrosion, its form being normally concave. Surface smooth and polished, white or yellow, sometimes with longitudinal streaks or flammules of brown. Lip simple and unthickened.

Length 11 mm., diameter 5 mm. Type in McGinty coll.

This is an interesting species characterized by its stout build and form. It is named for Mr. Arthur Thompson, a noted collector of Florida Shells.

Edge of Pourtales Plateau southward of Sombrero Light off Marathon, Florida Keys, in 100 fms. McGinty 6/19/50.

*Fossil Species**Olivella (Callianax) johnsoni* new species

Plate 12, figs. 8, 8a.

Shell of medium size, our largest specimen being nearly 14 mm. in length. Spire about one-half the total length and composed of 6 or 7 whorls separated by small, narrowly grooved sutures and tipped above by a small nucleus. Body-whorl narrowly elliptical, its greatest diameter placed just below the end of aperture. Surface smooth and polished, white but showing a faint brown band a short way below the suture. Parietal callus extends only to the end of the aperture, the pillar structure formed by a strong fold at the end of the aperture, its lower edge carrying a strong twist and two smaller plaits above it. Inner lip smooth. Fasciole wide and undivided. Lip sharp, smooth within.

Length 13.3 mm., diameter 5.3 mm.

Length 13.8 mm., diameter 5.4 mm.

Length 13.5 mm., diameter 5.3 mm.

A Miocene species named for Mr. C. W. Johnson, former curator of the Isaac Lee collection at the Academy.

Miocene. Bailey's Ferry, Chipola, Florida. ANSP, 10773.

*Olivella (Callianax) coënsis* Mansfield

*Olivella nutica coënsis* Mansfield, 1930, Bull. Florida State Geol. Surv., no. 3, p. 52, pl. 4, fig. 2.

Shell small (generally 6 mm. or less), solid, polished, somewhat variable in shape from rather short stubby forms to more slender, the spire generally about half the total length. Sutures are narrowly channelled, their lower edge forming a sharp, overhanging shelf. Parietal callus of medium strength, usually extending to the middle zone of the penultimate whorl, the surface of the spire-whorls often appearing as if double banded by it. Pillar structure consists mostly of a single fold at the end, the parietal wall above it smooth or weakly lirated. Fasciole wide, smooth and simple. Siphonal notch wide and shallow.

This small species is referred with some hesitation to *Callianax*, the parietal callus being rather strongly developed and generally extending a short way above the aperture. It is common as a Miocene fossil at Jackson Bluff, Florida.

Subgenus TOROLIVA Olsson and Harbison, 1953

Type by original designation, *Olivella goliath* Olsson.

Miocene of Costa Rica.

Shell large for the genus with a high, pointed spire of several whorls. Sutures grooved. Parietal callus extending beyond the end of the aperture to the suture, coating the spire-whorls with a thick deposit of enamel. Pillar structure formed by a single, wide, lirated fold at the end of the columella, the parietal wall above smooth.

This group differs from *Callianax* in that the parietal callus extends well beyond the end of the aperture, coating the spire-whorls between the sutures with a thick layer of enamel.

*Recent.* *Olivella fulgida* (Reeve) probably belongs here. West Indies.

*Fossil.* *Olivella goliath* Olsson. Miocene of Costa Rica.

*Olivella fargoii* Olsson and Harbison. Pliocene of Florida.

*Olivella* (*Toroliva*) *goliath* Olsson

Plate 13, figs. 2, 2a.

*Olivella goliath* Olsson, 1922, *Bulls. Amer. Paleont.*, vol. 9, no. 39, p. 264, pl. 7, figs. 22, 23.

Shell large, with a pointed spire about half the total length. Whorls about 6 with nearly straight sides. Sutures distinct, narrowly grooved, the edge of the preceding whorl not overhanging. Body-whorl of medium convexity, its zone of maximum inflation lying opposite the end of aperture. Aperture subelliptical, widest in front and with a deep, wide canal at the end. Outer lip smooth within. Parietal callus thinly developed above the end of aperture. Pillar structure is a wide, ribbon-like fold at the end of columella, its surface covered by three or four descending plaits. Parietal wall smooth. Fasciole undivided.

Length 26.2 mm., diameter 9.6 mm. (Holotype, Red Cliff Creek, Costa Rica. Miocene.) Paleontological Research Institute.

Length 24 mm., diameter 8.5 mm. Banana River, Costa Rica.

This species is recognized by its large size, its *Agaronia*-like shape, the end of the columella with a single large fold. The type specimens come from the Miocene of Costa Rica but an allied species occurs also in the Miocene of Tubara, Colombia. *Olivella fulgida* Reeve (*Conch. Icon.*, pl. 26, figs. 78a, b), a Recent species described from the West Indies (exact locality not given), is probably related to *goliath*.

Miocene of Costa Rica and probably also Colombia.

Subgenus OLIVINA d'Orbigny, 1839

Type, *Olivella tehuelchana* d'Orbigny.

Shell thin or of medium thickness, generally with a moderately high, pointed spire of several whorls. Sutures distinct, grooved or narrowly channelled. Parietal callus thin, transparent, extending beyond the aperture towards the suture. Pillar structure is a low, simple or double fold at the end of the columella, the wall above it smooth. Fasciole undivided or with an obscure line near its upper side forming a narrow band. Outer lip thin, smooth within. Operculum chitinous.

The typical species of *Olivina* belong to the southern hemisphere but some northern species such as *O. bullula* appear referable to the subgenus also. These northern shells have narrower sutures and the parietal callus extends somewhat higher along the surface of the penultimate whorls, but these differences would hardly seem more than specific.

The name, *Olivina*, was originally proposed as a subgenus of *Oliva* to contain the small Olive shells having a chitinous operculum, or "Les Ancilloides of Duclos", hence the name has been treated by most authors as a synonym of *Olivella*. There seems to be no valid type designation for *Olivina*, that of Hermannsen of *Oliva jaspidea* is invalidated by the reason that *jaspidea* was not mentioned amongst the three species discussed by d'Orbigny in his original paper. *Olivina* is similar to *Cupiolina* but has a simpler pillar structure, the parietal callous wash is thinner and the shell form is broadly subovate.

***Olivella (Olivina) bullula* (Reeve)**

Plate 16, figs. 6, 6a.

*Oliva bullula* Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 30, figs. 96 a, b.

*Oliva (Olivella) bullula* Reeve, Weinkauff, 1878, Gattung *Oliva*, Syst. Conchy. Cabinet, p. 146, taf. 37, figs. 15, 16.

*Olivella bullula* (Reeve), Dall, 1889, Blake Report, Bull. Mus. Comp. Zool., vol. 18, p. 135.—Dall, 1889, Bull. 37, U. S. Nat. Mus., p. 106.

*Olivella bayeri* Abbott, 1951, Nautilus, vol. 64, no. 4, pp. 111, 112, pl. 7, figs. 2a-b.

Reeve's description of the species is as follows:

"The Little Bubble Olive.

Shell acuminate oblong, thin, rather inflated, spire much exerted, columella arched, rather callous at the base; transparent-white, with a narrow opaque zone beneath the sutures.

Hab. West Indies.

Like the smaller *O. myriadina*, this shell is of a thin, pellucid substance without color or marking."

Although *Olivella bullula* is a common species, living off-shore, it is obtained only by dredging and its characters have been much misunderstood by collectors. It appears to be quite plentiful along the east coast of Florida where it has been obtained in numbers by the McGintys in waters ranging in depth from 50 to 130 fathoms. Dall gives the range of the species from Hatteras to Brazil in depths of 72 to 464 fathoms.

Specimens from Florida collected by the McGintys, agree closely with Reeve's figure in shape and general size. Adult specimens attain a length slightly over 10 mm., the scale of Reeve's figure would indicate a length of about 11.7 mm. They vary from broadly to narrowly subovate with a relatively high spire of about 6 whorls. Sutures distinct, narrowly channelled. The parietal callus is thin, extending to the end of the aperture only, the surface along the penultimate whorl free. The pillar straight, not noticeably concave, the pillar structure itself formed by a single fold. In good shells, the surface is highly polished, usually a translucent white, sometimes faintly yellow or pellucid. A narrow band along the suture is often stained a little darker and a faint suffusion of brown may color the

body-whorl as well. Fasciolar band is simple, white, often slightly depressed along the middle. A thin, brown operculum is present.

The radular ribbon is fairly small, with about 23 rows of teeth, the rachidian tooth boat-shaped, with a convex base and about 20 cusps; these are of uniform height and size in the middle zone, fade out rapidly at the ends. Laterals are curved, uncinatate blades.

A detailed description of this species (under the name of *bayeri*) has been published by Tucker Abbott, based in part on large collections dredged by the "Eolis" off the southeast coast of Florida (from Miami to Key West). The species resembles *O. blanesi* Ford but is a larger, thinner shell and its pillar is nearly straight.

*Range*.—Florida southward into the West Indies and Caribbean. Common off Palm Beach and Lantana, Florida in 50 to 130 fms.

Subgenus PACHYOLIVA new subgenus

Type. *Olivella columellaris* (Sowerby). Recent, coast of northwestern Peru.

Shell small or of medium size, solid, with a low or elevated, pointed spire and a relatively large body-whorl. Color pattern predominantly banded. Pillar structure is formed by a single, keel-like plait at the end of the columella, above which the pillar wall is deeply excavated. Parietal wall smooth, typically covered by a thick layer of callus which may enlarge into a knob-like mass at the end of the aperture and continue across the penultimate whorl to the suture. Sutures distinct, deeply grooved or channelled. Operculum chitinous.

Radular ribbon small, with about 34 rows of teeth. Rachidian tooth, curved, crown-shaped, the basal margin nearly straight, the top convexly elevated in the middle, the sides narrowed, the cusps variable in number, often numerous ( $\pm 34$ ), larger in the middle zone, smaller towards the ends, often with one to several subsidiary or needle-like denticles between them. Laterals blade- or spatula-like, with rounded or minutely denticulate ends.

Animal, see description for *semistriata*.

To *Pachyoliva* belong two of the commonest *Olivella* in the Panamic-Pacific faunal area, *O. columellaris* and *semistriata*, often appearing in countless numbers along certain sandy beaches. In both species, the inner lip is covered with a layer of callus which in *columellaris* may become excessively thickened by it.

*Olivella* (*Pachyoliva*) *columellaris* (Sowerby)

Plate 8, figs. 2, 2a.

*Oliva columellaris* Sowerby, 1825, Tankerville Catalogue, app. xxxiv.—Duclos, 1835, Mon. *Oliva*., pl. 2, figs. 11, 12.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 23, fig. 62.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 28, pl. 21 (348), figs. 348, 349. *Olivella columellaris* (Sowerby), Dall, 1910, Proc. U. S. Nat. Mus., vol. 37, no. 1704, pp. 166, 210.

A heavily calloused species with a short, knob-like spire and a large body-whorl. Immature specimens have a thin shell with a wide, shallow, siphonal notch and a strongly twisted keel at the end of the columella; the parietal callus begins to form at an early stage at the upper end of aperture and rapidly spreads upward towards the suture which, however, remains open. Adult characteristics are well shown by the figure. The radula is quite small and often difficult to extract unless special care is exercised. An average ribbon will show about 34 rows of teeth and measure about 1.2 mm. in length, its width about .5 mm., an individual rachidian tooth about .15 mm. Relatively high magnification may be required to show the minute accessory cusps between the primary ones. Primary cusps are numerous and variable in shape, sometimes becoming quite elongate and needle-like.

This is the commonest *Olivella* in northern Peru, often appearing in large swarms along some sandy beaches during the periods of mid and low tide. The species was apparently gathered as a sea-food along with *Donax* and *Tivela* by the early Peruvian Indians and large accumulation of their whitened, bleached shells mark the sites of Indian settlements and their "huecos" at many points in coastal Peru. Pimental, near Chiclayo is the most southerly point where we have observed the species but it may extend still further southwards. To the north, *columellaris* becomes replaced by *semistriata* but it has been recorded from Panama, Mazatlan and the Gulf of California, but these records have not been checked.

*Range*.—Coast of northwestern Peru; from Pimental to Mancora, and possibly northward to Panama and the Gulf of California.

*Olivella (Pachyoliva) semistriata* (Gray) Plate 8, figs. 4, 4a; plate 15, figs. 5, 5a, 5b.

*Oliva semistriata* Gray, 1839, Zool. Beechey's Voyage, p. 130, pl. 36, fig. 10.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 23, fig. 61.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 28, no. 144, pl. 21 (348), figs. 350, 351.

*Oliva affinis* Marrat, 1871, op. cit., p. 28, no. 145, pl. 21 (348), fig. 352.

*Oliva attenuata* Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 29, figs. 90a-b. Marrat, 1870, Thes. Conch., vol. 4, *Oliva*, p. 28, pl. 21 (348), fig. 353.

*Oliva (Olivella) semistriata* (Gray), Weinkauff, 1878, Die Gattung *Oliva*, Syst. Conchy. Cabinet, p. 117, pl. 31, figs. 3, 4.

*Olivella semistriata* (Gray), Dall, 1910, Proc. U. S. Nat. Mus., vol. 37, no. 1704, pp. 166, 210.

This is a more northerly species than *columellaris*, with a higher, more slender and more sharply pointed spire, and less heavily calloused. Dall has recorded the species from Sechura Bay. *O. zonalis* DuRoi is a small, thin-textured shell with a thin callus cover on the inner lip and a large keel or fold at the tip of the columella. This shell is imperfectly known to us from a small lot collected at Mazatlan. (ANSP no. 28939.) These



shells resemble Duclos figure (Duclos, pl. 1, figs. 3, 4.) and possibly should be regarded as immature *semistriata*.

Animal (see Plate 15, figs. 5, 5a, 5b); lateral margins of the propodium with large, tentacle-like appendages; color generally blackish, the edges of the foot margined with white. Radula like *columellaris*, an average specimen with 31 rows of teeth, measures length .9 mm. width .4 mm.

A small form of *semistriata*, perhaps deserving subspecific separation, is common at Esmeraldas.

*Range*.—Gulf of California southward to northern Peru.

MEXICO: Mazatlan (as *zonalis* by Carpenter). PANAMA: Guanico. El Largartillo near Las Tablas, etc. COLOMBIA: Isla del Gallo. ECUADOR: Santa Elena. Manta. Charapota, Sua, Esmeraldas. PERU: Zorritos.

*Olivella* (*Pachyoliva*) *locklini* new species

Plate 14, fig. 5.

Shell large for the genus, adult specimens reaching a length of nearly 25 mm., solid, spindle-shaped, somewhat wider around a line a little above the posterior end of aperture. Suture grooved. Spire about one-third the total length, formed of about 7 whorls, the nuclear ones forming an elevated tip. Parietal callus strong, very heavy at end of aperture and extending to the suture. The pillar structure is a single, large, keel-like fold at the end of columella, occasionally becoming obscurely bifid, the pillar wall directly above deeply concave.

Length 18.2 mm., diameter 8.5 mm. (Holotype, ANSP. 30436.)

Length 24.5 mm., diameter 11.4 mm.

This species is referred to *Pachyoliva* with some hesitation since the adult shell does not resemble the two typical members of the subgenus. This is the largest species of *Olivella* so far discovered in our East Coast Tertiaries. Specimens collected by Mr. Charles P. Locklin from the Miocene of Alligator Creek, Florida.

SUGENUS LAMPRODOMA Swainson, 1840

Type by monotypy; *Oliva volutella* Lamarck.

Recent, Panamic-Pacific faunal province.

Shell spindle-shaped, of medium size, with a high spire. Parietal callus heavy, thickest near the end of aperture and extending upward towards the suture. Pillar structure formed by a series of uniform, narrow, mitra-like lirations which revolve outwardly around the lower end of inner lip, covering the columellar portion but not extending above the fasciolar portion. Color variable, in shades of white, gray, brown to nearly black. Radula relatively small, the rachidian tooth narrowly elongate, curved, with numerous, small, subequal cusps, the lateral teeth forming large, flattened, curved blades, rounded at the end. Operculum chitinous. Internal walls of the spire-whorls reabsorbed.

*Recent*.—*Olivella volutella* (Lamarck). Panamic-Pacific faunal area.

**Olivella (Lamprodoma) volutella** (Lamarck)

Plate 11, figs. 2, 2a.

- Oliva volutella* Lamarck, 1811, Ann. Mus. Hist. Nat. Paris, vol. 16, p. 322, no. 43.—Swainson, 1823, Zool. Illust. ser. 2, pl. 40, fig. 1.—Duclos, 1835, Mon. *Oliva*, pl. 6, figs. 7-14.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 21, fig. 54.—C. B. Adams, 1852, Ann. Lyceum Nat. Hist. New York, vol. 5, p. 281, no. 41.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 29, no. 152, pl. 22 (349), figs. 362-367.
- Olivella volutella* (Lamarck), Dall, 1910, Proc. U. S. Nat. Mus., vol. 37, no. 1704, p. 211.—Maxwell Smith, 1944, Panamic-Marine shells, p. 35, fig. 447.

This species is very abundant at Panama where it may be seen gliding over slimy mud-flat in large numbers. Coloration varied from nearly pure-white varieties through shades of gray to rich deep brown, the fasciole often remaining white, or the whole shell may be of one color. It is distinguished from all other *Olivellas* by its unique pillar structure consisting of fine, uniform lirations which encircle the columella, covering the fasciolar portion but not extending upward over the parietal wall. The radular ribbon is small; in an example extracted, the length of the ribbon is .85 mm., width .35 mm., width of an individual rachidian tooth .10 mm. or less. The rachidian tooth is generally narrow, elongate, curved, crown-shaped, the basal margin quite straight, curving upward towards the ends, the upper margin multicuspidate (32 or more cusps), which are fairly large and uniform in the middle zone, diminish in size towards the ends. Lateral teeth are formed by flattened, curved blades, rounded at the ends, accessory, basal plate rectangular.

*Range*.—Mexico to Ecuador.

ECUADOR: Limones, Galeras. COLOMBIA: Isla del Gallo, near Tumaco. PANAMA: Puerto Mensabi; Pearl Islands; Garachine; Rio Chimán; Isla Chepillo; Panama City; Amador Bar; Venado Beach; Burica peninsula.

Subgenus ZANOETELLA new subgenus

Type. *Olivella zanoeta* (Duclos).

Shell of medium size, with elevated, pointed spire. Color white, brown, more often zoned. Parietal callus extending beyond the end of aperture to the suture, its surface smooth. Pillar structure simple, consisting of 4 or 5, long lirations around the anterior end of pillar. Fasciole unequally divided by an incised line, the upper segment relatively narrow. Radular ribbon quite small, with about 31 rows of teeth, the rachidian tooth, narrowly bow-shaped, with numerous (about 30) cusps, subequal in the middle, fading out towards the ends; laterals unciniate, with strongly curved, pointed ends.

**Olivella (Zanoetella) zanoeta** (Duclos)

Plate 11, figs. 1, 1a, 1b.

- Oliva zanoeta* Duclos, 1835, Mon. *Oliva*, pl. 2, figs. 9, 10.—Reeve, 1850, Conch. Icon., vol. 6, *Oliva*, pl. 26, figs. 76a, 76b.—Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 34, no. 176, pl. 23 (350), fig. 404.

*Olivella zonalis* Dall, 1910, Proc. U. S. Nat. Mus., vol. 37, no. 1704, p. 211. (Not of Lamarck).

*Olivella guayaquilensis* Bartsch, 1928, Jour. Wash. Acad. Sci., vol. 18, p. 67, pl. 1, fig. 10.

Shell oliviform, with an elevated, sharply pointed spire, nearly half the total length, the greatest convexity placed opposite the end of aperture. Sutures deeply grooved, partly overhung by the sharp margin of the whorl in front. Color is sometimes pure white but more often zoned by two purple-brown bands separated by white, the lower band widest and bordering the fasciole, the upper band, narrower and bordering the suture; occasionally the color is a uniform brown, the middle white band changing to yellow or fading out completely. Fasciole white or brown. Internal whorls of the spire reabsorbed. Length generally between 16 to 18 mm.

This species is common along the coast of Ecuador, southern Colombia and Panama. Duclos and Reeve mention no locality for the species but their figure leaves no doubt of identification. Marrat gives a recognizable figure and cites Acapulco, Guatemala and California as localities. Weinkauff gives both Japan and Westamerika. Bartsch has redescribed the species as *Olivella guayaquilensis* from specimens obtained at Salinas, Ecuador.

A radula extracted from a specimen submitted to us by Captain W. S. Bitler, U. S. Navy, formerly stationed at Balboa, Canal Zone has the following characters. Radular ribbon small, with about 31 rows of teeth. Rachidian tooth, narrow, linear and strongly curved, the small cusps placed on the outer or convex side; there are 30 to about 35 cusps, the central ones (8-10) quite large and uniform, the laterals ones diminish in size and fade out completely at the ends. The rachidian tooth is about .1 mm. wide. Lateral teeth form uncinat blades, strongly curved and pointed at the tips.

*Range*.—Ecuador to Mexico.

PANAMA: Venado Beach in the Canal Zone. Guanico. COLOMBIA: Tumaco (common). ECUADOR: Santa Elena. Manta. MEXICO: Mazatlan (Hawkins), USNM. 56747.

Subgenus MACGINTIELLA new subgenus

Type. *Olivella watermani* McGinty.

Shell small, bullet-shaped with a low, conic spire, the body-whorl large, subelliptical. Parietal callus strong, extending past the end of the aperture to the suture, thickening the surface of the spire-whorls. Pillar structure much as in *Olivella* s. s., consisting of a large, plaited lower portion followed by small denticles or lirations along the parietal wall, the inner side of the pillar wall deeply excavated. Outer lip thin, passing well above the end of aperture, its junction with the body-whorl forming a long, narrow commissure joining the grooved suture above. Operculum chitinous. Radula: rachidian tooth inversely hat-shaped, with a deep, central convex base, the sides narrowed and lid-like, the outer or cutting margin concave

with numerous, small, single or double-rooted cusps, of nearly equal strength along it. Laterals are solid, hooked, uncinates with recurved tips and notched base; basal plate rectangular.

Distinguished by its bullet-shaped shell with a relatively low spire and long, narrow, commissural canal along the lip junction. The peculiarly shaped rachidian tooth of *O. watermani* (the only Recent species so far examined) is completely different from that shown by any other *Olivella*.

#### *Recent species*

*Olivella watermani* McGinty. Florida and the Gulf of Mexico.

*Olivella rotunda* Dall. West Indies.

*Olivella fuscocincta* Dall. Antilles.

*Olivella rosolina* (Duclos). Bermuda and the West Indies.

#### *Fossil species*

*Olivella oryzoides* Gardner. Chipola Miocene, Florida.

*Olivella limonensis* Olsson. Miocene of Costa Rica.

*Olivella bocasensis* Olsson. Miocene of Panama.

*Olivella unica* Woodring. Miocene of Jamaica.

*Olivella clarki* Woodring. Miocene of Jamaica.

*Olivella watermani* McGinty. Miocene of Jackson Bluff, Florida.

*Olivella (Macgintiella) watermani* McGinty Plate 15, figs. 10, 10a.

*Olivella watermani* McGinty, 1940, Nautilus, vol. 54, p. 64, pl. 3, figs. 4, 5.—Tucker Abbott, 1951, Nautilus, vol. 64, no. 4, p. 114, pl. 7, figs. 5a-b.

The shell is generally small, solid, subelliptical or lens-shaped, the sides showing a regular elliptical or moderately convex contour tapering towards the ends, the anterior-apertural margin somewhat wider. Whorls 4 to 6 between deep sutures, the spire being moderately low, in some cases slightly depressed with its apex forming a small, knob-like projecting nucleus. Outer lip thin, widely appressed to the body-whorl at the sutural junction and there forming a drawn-out posterior canal. Inner side of outer lip smooth or faintly lirate. The parietal callus is heavy, well-developed at the end of the aperture and spreads upward towards the suture. Pillar structure formed by a large fold below and a set of short but strong lirations along the parietal wall above, the pillar itself deeply excavated by secondary corrosion. Fasciole wide and divided by an incised line, its upper segment narrow. Color glossy white, sometimes with three obscure bands of pink, orange or yellow spots or flammules on the body-whorl. Operculum thin, chitinous. Radula as described for the subgenus.

Length 10.5 mm., diameter 4.6 mm. (Type, ANSP. 176446.)

Length 13.5 mm., diameter 6.1 mm. Gulf of Mexico. C. R. Locklin coll.

Typical *watermanni* is a species of the Florida East Coast and commonly dredged in waters of 50 to 100 fms. The form is closely related to *O. rotunda* Dall of the West Indies, differing principally by its somewhat smaller size. Gulf of Mexico specimens are generally larger than those from the east coast of Florida but otherwise are closely similar.

*Olivella (Macgintiella) rotunda* Dall

Plate 15, fig. 9.

*Olivella jaspidea* var *rotunda* Dall, 1889, Blake Report, Bull. Mus. Comp. Zool., vol. 18, pt. 2, pp. 134, 135.

*Olivella rotunda* Dall, Dall and Simpson, 1901, U. S. Fish. Com. Bull. for 1900, vol. 1, p. 392, pl. 56, fig. 11.

Shell stout, inflated, with a sloping, rounded shoulder and a small, pointed spire, shorter than the aperture. Color a pale, ashy yellow with faint, irregular, broken zigzag, darker, violaceous markings, somewhat heavier near the suture. Sutures deeply grooved, their lower edge a little overhanging and sharp, and forming a lengthened, appressed anal canal at the end of the aperture. Parietal callus extending above the end of the aperture but so light and thin on the penultimate whorl that it does not mask the underlying color pattern. Parietal structure of 15 or more, strong, parallel lirations which extend to within a quarter of the end of the inner lip. Pillar wall deeply excavated. Fasciole wide, calloused, faintly divided and of a light faun color.

Length 21.8 mm., diameter 10 mm. Type USNM. no. 62707. Sta. 299. 140 fms. Barbados. Blake coll.

*Range.*—West Indies, Porto Rico, Barbados.

*Olivella (Macgintiella) fuscocincta* Dall

Plate 11, figs. 6, 6a.

*Olivella fuscocincta* Dall, 1889, Blake Report, Bull. Mus. Comp. Zool., vol. 18, no. 29, pt. 2, p. 134.

Shell relatively small, egg-shaped with a large, convex body-whorl and a short spire of about 5 whorls. Sutures grooved. Parietal callus extends to the end of aperture or a short ways above it. The pillar structure is formed by a plaited fold at the end of the columella, somewhat like that of *Callianax* but succeeded above by 4 small lirations of the parietal wall. Lip thin, sharp, smooth within. Color is a light cream with a faint white band around the middle, the fasciole more heavily colored by a brown band, the pillar fold itself white.

Length 9.5 mm., diameter 5 mm. (Type, USNM. no. 62703, sta. 36. off Barbados, in 84 fms.)

Through the courtesy of Dr. H. Rehder, we are able to present figures of two specimens of this hitherto unfigured species from the original lot. *Olivella limonensis* Olsson from the Miocene of Costa Rica is related.

*Distribution.*—Lesser Antilles.

**Olivella (Macgintiella) rosolina** (Duclos)

Plate 10, figs. 6, 6a.

*Oliva rosolina* Duclos, 1835, Mon. *Oliva*, pl. 1, figs. 1, 2.*Oliva rosolina* Duclos, Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 38, no. 204, pl. 24 (350), fig. 436.—Tryon, 1883, Manual of Conchology, vol. 5, p. 65, pl. 14, fig. 58.

Shell of medium size (length of largest specimen examined about 8.7 mm), subelliptical, the two ends subequal, solid, white except for a pink coloration at the end of the columella and sometimes with faint blotches of brown scattered over the body-whorl. Whorls 5 or 6 between channelled sutures which are overhung by a narrow thin-edged collar of the whorl in front. Parietal callus is weak and extends only to the end of the aperture. The pillar structure is a narrow fold along the rather short columella, the surface of the parietal wall above smooth.

Average length 7.5 mm., diameter 3.7 mm.

A distinctive species easily recognized by its shape and coloration.

*Range*.—Bermuda and the West Indies.

**Olivella (Macgintiella) limonensis** Olsson

Plate 13, figs. 8, 8a.

*Olivella limonensis* Olsson, 1922, Bulls. Amer. Paleont., vol. 9, no. 39, pp. 265, 266, pl. 7, figs. 19, 20.

Shell rather solid and plump with a short, wide, conic spire. Whorls about 5 between deeply channelled sutures; the last whorl very large, broadly cylindrical, its greatest diameter placed about the middle line. The parietal callus is heavy and extends to the upper suture but thickest near the end of the aperture. Pillar structure consists of 4 or 5, rather strong lirations which extend up along the inner lip or parietal wall nearly to its end; at the lower end, the pillar structure carries a large, plaited fold which internally connects with a strong twist at the end of columella. Columellar wall internally deeply excavated. Outer lip sharp but slightly contracted in the middle. Fasciole rather wide and about one-third the total length of the shell, nearly equally divided by a central line. In most specimens, the body-whorl has a brownish coloration but with the spire and fasciole a porcellaneous white, the contrast in color being very marked.

Length 10.2 mm., diameter 5.2 mm. Holotype. Paleontological Research Institute.

Length 9.7 mm., diameter 5.4 mm. Paratype.

The characteristics of this common fossil species are well expressed by the figures. The species is closely related to the Recent, *Olivella fusco-cincta* Dall.

*Range*.—Miocene of Port Limon, Costa Rica.

**Olivella (Macgintiella) bocasensis** Olsson

Plate 12, figs. 7, 7a.

*Olivella limonensis* var. *bocasensis* Olsson, 1922, Bulls. Amer. Pal., vol. 9, no. 39, p. 289, pl. 7, figs. 24, 25.

Shell rather small, solid, stout, with a short spire and a larger body-whorl. Nucleus of  $2\frac{1}{2}$  whorls, projecting as a small, elevated apex above the general contour of the spire. Sutures narrowly grooved, continued as a

posterior, ventral channel along the forward edge of the widely appressed junction of the outer lip with the body-whorl. Parietal callus heavy, thickest opposite the end of aperture and extending upward to the suture. Pillar structure has a strong, plaited fold at the anterior end and is bordered along the parietal wall by four, double lirations or denticles. Fasciolar zone wide, bearing an incised line near the upper border, forming a narrow, ribbon-like band.

Length 6.4 mm., diameter 3 mm.

This is a common fossil in the Miocene of Bocas del Toro, Panama, but varies somewhat in shape from rather stubby shells to others more slender. *Olivella unica* Woodring from the Miocene of Bowden, Jamaica is very similar and perhaps should be considered the same.

Miocene of Bocas del Toro, Panama.

Subgenus *MINIOLIVA* new subgenus

Type. *Olivella perplexa* new species.

Shell very small or minute, the spire elevated. Nucleus relatively large, partly immersed in the apex. Sutures deeply channelled, overhung widely by the thin, shelf-like edge of the whorl in front. Parietal callus strong, extending to the end of the aperture. The pillar structure is a small, simple fold at the end of the columella. Operculum chitinous.

A group of small to minute American species, perhaps allied to *Cupioliva*.

Repeated attempts to obtain a radula from *Olivella perplexa* have so far failed, so that a radula is probably lacking or so small as to be invisible under a 30x microscope. Small foraminifera and other microorganisms were found as stomach contents.

Species referred to this subgenus.

*Recent, Atlantic*

*Olivella perplexa* new species. Florida.

*Olivella acteocina* new species. Bahamas to Panama.

*Olivella myrmecoön* Dall. Caribbean coast of Panama.

*Recent, Pacific*

*Olivella inconspicua* C. B. Adams.

*Fossil*

*Olivella* sp. Pliocene of Ecuador.

*Olivella (Minioliva) perplexa* new species

Plate 16, fig. 7.

The shell is small (maximum length about 5 mm.), relatively solid and porcellaneous white, glossy, usually with an elevated stubby spire of about 5 whorls and about half the total length. The nuclear whorls are small,

convex and partly immersed so as to appear to lie below the general level of the succeeding turn. The sutures are deeply channelled, widely overlapped by the sharp and often frayed margin of the whorl in front. Parietal callus is thick, particularly so near the end of the aperture from which it extends downward along the surface of the parietal wall as a thickened ribbon to the end of the columella which it partly encircles. The pillar structure is a simple fold at the end of the columella. Fasciole small and simple. The outer lip has a straight, thin edge, its posterior junction with the body-whorl enclosing a short canal.

Length 3.8 mm., diameter 1.8 mm. (Holotype, ANSP. 199584.)

This small species is common in beach drift along the Florida east and west coasts and its range in all probability extends southward into the West Indies and the Caribbean. Living specimens are seldom collected, the only ones which I have seen being specimens obtained by Miss Adele Koto who found them crawling over the surface of sand cones formed around upwellings of submarine springs.

*Range*.—East and west coasts of Florida, probably also southward.

FLORIDA: Lake Worth (McGinty). Miami (common). Keys. Charlotte Harbor. Sanibel Is., St. Petersburg.

*Olivella (Minioliva) acteocina* new species

Plate 12, figs. 6.

The shell is small (average length about 4 mm.) with a relatively high, subcylindrical body-whorl which is generally about  $\frac{3}{4}$  the total length, the narrower, tapering, sealar spire forming the remainder. The sutures are deeply sealar, so widely overlapped by the thin, collar-like edge of the whorl in front as to be nearly concealed, but in fresh shells may show through the semitransparent surface of the whorl as a thin line. Whorls about 5, seated together like the collapsing sides of a telescope, the apical whorl forming the small, blunt, hemispherical nucleus. Fasciole simple, the pillar structure a single fold at the end of the columella. Parietal wall with a thin wash of callus.

Length 3.8 mm., diameter 1.4 mm.

The type is a specimen (Pl. 12, fig. 6) from the John Ford collection (ANSP. 111791) labelled Panama but the exact locality not stated; however it is assumed that it is from the Caribbean coast. Another lot referred to the same species, is a fine series from Lyford Cay, W. New Providence, Bahama Islands, collected by McGinty, in 1947.

This species is closest to *O. perplexa* but differs by its more cylindrical form, generally higher spire, more deeply sealar and nonappressed sutures, and larger nucleus. The species is probably widely distributed through the West Indian and Caribbean areas. A closely similar form occurs in the Pliocene of Ecuador (Rio Camarones, Esmeraldas). See also discussion under *O. myriadina* Duclou.

*Range*.—Bahamas to Panama and perhaps throughout the Caribbean.



PANAMA: North coast ? (John Ford coll.). BAHAMAS: Lyford Cay, West New Providence (McGinty, drift).

*Olivella (Minioliva) inconspicua* (C. B. Adams) Plate 10, fig. 5; Pl. 16, fig. 8.

*Oliva inconspicua* C. B. Adams, 1852, Ann. Lyceum Nat. Hist. New York, vol. 5, pp. 274, 528, no. 34.

Shell very small (the average about 3.5 mm. in length), white, with an elevated, turritid spire of five or six whorls, the apex tipped by a small, blunt nucleus. Sutures deeply channelled, the margin of the whorl in front thin, sharp and sometimes frayed, widely overhanging. Parietal callus thin, but not extending above the end of aperture. Pillar structure is a small, plain fold at the end of the columella, bordered externally by a low groove. Fasciolar band small, narrow, not extending higher than the lower one-third of the aperture.

Length .15 in. (3.80 mm.), diameter .055 in. (1.4 mm.).

The original material from which this species was named by C. B. Adams consists of 2 mature and 1 immature specimens obtained after picking over several quarts of fine drift gathered on the shore near the city wall of Panama. A figure of the type specimen from the original lot is given on Plate 16. *O. inconspicua* appears to be a rare species at Panama but a few specimens can generally be obtained in the careful picking of shell drift. Although somewhat similar to *O. perplexa* from Florida in general shape and great variability, *inconspicua* is generally smaller, its nucleus higher and less deeply immersed, the tip of the spire therefore appearing more pointed.

*Range*.—Panama.

PANAMA: Vicinity of Panama City. Puerto Armuelles.

*Olivella (Minioliva) myrmecoön* Dall Plate 12, figs. 10, 10a.

*Olivella myrmecoön* Dall, 1912, Smith. Misc. Coll., vol. 59, no. 2, p. 4.

"Shell very small, stout, solid, short, of about five whorls; the spire about one-third the whole length, the suture narrowly and deeply channelled. Surface smooth, whitish in the fossils; body with a thin coat of callus, pillar excavated, with a single prominent plait on the outer edge; anterior fasciole short, smooth, the posterior edge abrupt. Length 4.5; max. diameter 2.0 mm." (Dall, 1912.)

This small species was described as a Pleistocene fossil from material dredged or excavated from drainage canals in the vicinity of Colon, Panama and in the adjacent sections of the Canal Zone. The species is still living in the same general region. The shell is small, white, rather widely sub-ovate, with a small, elevated spire of 4 to 5 whorls. The callus wash on the parietal wall is thin and does not extend above the end of the aperture.

*Range*.—Pleistocene and Recent silts at Colon, Panama. Also in beach drift at Piña, Panama.

## Subfamily OLIVINAE

## Genus JASPIDELLA new genus

Type. *Voluta jaspidea* Gmelin.

Oliviform shell with a high spire of several whorls terminating in an obtuse nucleus. Sutures narrowly grooved, the collar of the preceding whorl appressed. *No callous wash on the parietal wall. Pillar structure is a low, finely plaited fold at the end of the columella.* Fasciole wide and undivided. Internally with a fold at the end of the pillar, the internal walls of the spire-whorls reabsorbed. Operculum present, chitinous. The radular ribbon is very long, with numerous teeth ( $\pm 100$ ), the rachidian tooth tricuspidate.

This group of species has commonly been referred to *Olivella*, largely because of the small size but its position in the Olivinae is shown by its radula, as well as the lack of a callous wash along the parietal wall.

Except for *Jaspidella jaspidea* (Gmelin), the assignment of the other Recent species such as *blanesi* and *miris* is tentative pending a radular check.

The following species are placed in this genus.

*Recent*

*Jaspidella jaspidea* (Gmelin).

*Jaspidella blanesi* (Ford).

*Jaspidella miris* new species.

*Fossil*

*Jaspidella liveoakensis* (Mansfield). Oligocene of the Suwannee Limestone, Florida.

*Jaspidella sancti-dominici* (Maury). Miocene of Santo Domingo.

*Jaspidella cofacorys* (Gardner). Miocene of Chipola, Florida.

*Jaspidella jacksonensis* (Mansfield). Miocene of Florida.

*Jaspidella jaspidea* (Gmelin)

Plate 15, figs. 1, 1a.

*Voluta jaspidea* Gmelin, 1791, *Systs. Nat.* ed. 13, p. 3442.

*Oliva conoidalis* Lamarck, 1811, *Ann. Mus. Hist. Nat. Paris*, t. 16, p. 325.—Duclos, 1835, *Mon. Oliva*, pl. 2, figs. 17, 18.

*Oliva jaspidea* (Gmelin), Deshayes (d. Lamarck), 1844, *Hist. Nat. an. s. vert.*, t. 10, p. 631.—Reeve, 1850, *Conch. Icon.*, vol. 6, *Oliva*, pl. 22, figs. 58, a, b, c.—Ducrox, 1857, *Revue critique de Genre Oliva*, p. 88.

*Oliva exigua* Martini, Marrat, 1871, *Thes. Conch.*, vol. 4, *Oliva*, p. 33, pl. 23 (350), figs. 399, 400.

*Olivella jaspidea* (Gmelin) of numerous authors.

Small or medium-sized shells with a high spire terminating in a small, obtuse, solid, glassy nucleus. Sutures distinct, open, narrowly grooved, the

edge of the preceding whorl somewhat appressed. No callous wash on the parietal wall. End of columella sharply keeled, the fold scarcely visible from the outside. Pillar structure is formed by a rather wide, finely plaited fold bordered above by a series of small unequal plaits or threadlike lirations on the parietal wall. Fasciolar band wide, undivided. Color white or brown, often finely flecked or speckled with brown lines, often with a row of broken, fimbriated brown streaks along the suture. Operculum chitinous. Radular ribbon very long, narrow, an average specimen showing about 58 fully formed teeth and about 38 nascent teeth, the length of ribbon about 2.2 mm., width .7 mm., width of an individual rachidian tooth .1 mm. Rachidian tooth with three large cusps.

A common species in its range, easily recognized by its unglazed inner lip.

*Range.*—Florida east coast southward through the Keys to the West Indies.

FLORIDA: Lake Worth, Miami to Key West. WEST INDIES: Dominican Republic.

*Jaspidella blanesi* (Ford)

Plate 8, fig. 7.

*Olivella blanesi* Ford, 1898, *Nautilus*, vol. 12, p. 66.—Vanatta, 1915, *Nautilus*, p. 72.—

Perry, 1940, *Bulls. Amer. Pal.*, vol. 26, p. 159, pl. 36, fig. 250.—Perry and Schwengel, 1955, *Marine shells of the western coast of Florida*, p. 176, pl. 36, fig. 250.

*Olivella blanesi alba* Ford, 1898, *op. cit.*, p. 67. (Not of Marrat.)

*Olivella blanesi albata* Vanatta, 1915, *op. cit.*, p. 72, new name for *alba* Ford.

Shell rather small, subovate, solid, with a moderately elevated spire of about 5 whorls, the nucleus rather large and obtuse. Color is generally white to subtranslucent, sometimes with irregularly shaped light brown or crimson spots arranged in three rows, one at the suture, the others at the middle and at the base, the surface between often showing a faint reticulation of the same color. Sutures distinct, narrowly channelled, the forward margin with a sharp edge and sometimes forming a narrow coronation. The parietal callous wash is thin to nearly absent in some specimens, and extends to the end of the aperture. Pillar or columella short, deeply concave above it so that the shells appear as if beaked, or as if twisted or distorted towards the right. The pillar structure is a small flat fold at the end of the pillar; above it the face of the inner lip is smooth. Fasciole narrow and plain, slightly bulging in the middle. Aperture about half the length of the shell, widest just below the middle where the side of the outer lip is nearly straight. Siphonal notch wide and shallow.

The reference of *blanesi* to *Jaspidella* is tentative, pending observation of the radula. It is a relatively small species, its size ranging from about 7 to 10 mm. The body-whorl is large, inflated, with evenly convex sides. The shell is moderately solid, its thickness often shown by the fractured edge of the outer lip. Often confused or compared with *Olivella bullula*, it will be distinguished by its heavier shell and deeply concave and twisted pillar.

*Jaspidella blanesi* (as *Olivella*) has often been reported from Florida, but most of these records from the east coast refer to *Olivella bullula*. The McGintys have collected authentic specimens from Grassy Key. Perry gives a good figure of *blanesi*, evidently based on a west Florida shell, but no specimens from that coast have been seen by us.

The figure of *Oliva miriadina* as given by Duclos, strongly suggests a young *blanesi*.

*Range*.—Florida southward to the West Indies to northern Panama.

FLORIDA: Grassy Key (McGinty), West Florida (Perry). BAHAMAS: New Providence (McGinty). CUBA: Cardenas, etc. PANAMA: Bocas del Toro.

*Jaspidella miris* new species

Plate 15, figs. 2, 2a.

Shell small, the length from 8 to 10 mm., subovate, solid, with an elevated, stout spire nearly half the total length. Whorls about 5, mildly convex, the apical one deeply immersed in an obtuse tip of the spire. Sutures narrowly grooved. No callus on the parietal wall, the pillar structure a large, simple or double fold at end of columella. Fasciolar band small, colored. Surface glossy, the color a light shade of brown formed by small, indistinct, tent-shaped markings, often with three more strongly colored brown bands, one at the suture, one around the middle and the other around the base, the pillar fold stained with violet.

Length 8.9 mm., diameter 4.3 mm. (Holotype, ANSP. 194588.)

A small, solid shell marked with tent-shaped brown lines recalling those of *Oliva porphyria* but much lighter, and seen only on close inspection. In shape, this species resembles the *Olivella liveoakensis* Mansfield, 1937 from the Oligocene, Suwannee limestone of Florida. The generic reference is tentative, pending the receipt of specimens with the soft parts.

Specimens received from Mr. Charles P. Locklin, Gulf of Mexico, but exact locality not known.

*Jaspidella jacksonensis* (Mansfield)

Plate 16, fig. 5.

*Olivella jacksonensis* Mansfield, 1930, Bull. Florida State Geol. Surv., no. 3, p. 53, pl. 4, fig. 6.

Shell small (length up to 8.0 mm.), subovate, thin to subsolid, smooth and polished. Whorls 5 to 6 and forming an elevated, blunt spire. Sutures narrowly grooved and weakly appressed. Body-whorl is somewhat inflated, subelliptical, widest opposite the end of the aperture, its length  $\frac{2}{3}$  to  $\frac{3}{4}$  of the total length. Parietal wall has a thin wash of callus extending to the end of the aperture or wholly wanting. The pillar structure is a small, biplicate fold at the end of the short columella, the parietal wall above it being smooth. Fasciole small and simple. Outer lip thin, its edge slightly flattened or reflected.

Length 8 mm., diameter 3.6 mm.

Typical specimens from Jackson Bluff show a well-developed callus along the parietal wall extending to the end of the aperture but other shells from Alligator Creek, quite clearly the same species have no callous wash. In general shape, this species recalls *J. miris* but is smaller and less solid.

Miocene. Jackson Bluff and Alligator Creek, Florida.

Genus **BELLOLIVA** Peile, 1922

Type by original designation, *Olivella brazieri* Angas. Recent, Australia.

Radula having the central teeth moderately wide and short, armed with three large cusps, and sometimes with smaller accessory ones flanking each lateral cusp; lateral teeth with rather wide base and slender, recurved cusps.

This genus was founded for two Australian species described as *Olivella Brazieri* (Angas) and *O. pardalis* (Adams and Angas). In the latter the minute additional cusps outside of each lateral cusp of *B. brazieri* may be very small or missing.

Reference of our American species, *tubulata* to *Belloliva* is provisional, pending more complete information regarding the Australian species.

**Belloliva tubulata** (Dall)

Plate 12, fig. 5.

*Olivella (bulbula* var.?) *tubulata* Dall, 1889, Bull. Mus. Comp. Zool., vol. 18, p. 136.

"This form varies from moderately stout, or a little more slender than Reeve's figure, to extremely attenuated. It is in the last case about the shape of *O. nymphe* Adams and Angas, but more cylindrical, pure white, the walls and spire sometimes translucent; the broader form recalls *O. floralia* (Duclos) Tryon, from the white varieties of which it is at once distinguishable by the large size of its nuclear whorls. The soft parts dried up in one specimen show no sign of an operculum. The slender form is 11.3 mm. long and 3.5 mm. in greatest diameter, with five whorls. The length of the aperture is almost exactly half that of the shell. The stouter form is 13.3 mm. long, 5.0 mm. in diameter, with five whorls, and the aperture 8 mm. in length. The suture in both is deeply channelled, except between the two nuclear whorls, which are rounded and flattened on the summit. A specimen was obtained at Station 20, in 220 fms., off Cuba, and another by the Fish Commission in 225 fms., off the northeastern end of the same island." (Dall, 1889.)

There are three specimens in the collection at the U. S. National Museum bearing the nos. 62722, 62723 and 107458. The first or more slender form is indicated as being the holotype. It is a white, polished shell with 5 whorls and a large blunt nucleus. The sutures are deeply channelled, the bordering edge of the forward whorl being sharp and overhanging. The parietal wall is without callous wash, the pillar structure reduced to three lirations. The fasciole is double, and reaches a little above the middle line of the aperture. This specimen bears the no. 62723.

The stouter form (no. 62722) has a broken apex. It is closely similar to the slender form, differing principally by its fasciole which is not so clearly divided into two zones. Through the cooperation of Dr. Rehder, we were permitted to extract the radula from the dried-up remains of the soft parts, the radula proving to be similar to that of *Oliva*. Details of ribbon are as follows; the ribbon is quite long with about 107 rows of teeth, of which the hinder 34 are thin and nascent; the rachidian tooth is broadly rectangular, with a slightly concave basal margin and higher ends, the free or cutting margin with three, high, fang-like cusps in the middle, of which the central cusp is the largest; the lateral teeth are broadly subtriangular or cleaver-shaped, with a recurved awl-shaped point. Length of ribbon 1.4 mm., width .20 mm., width of rachidian tooth .07 mm.

A third specimen (107458) from off Cape Canaveral, Florida, 540 fms. This is long, moderately slender, the spire about half the length of shell, with a large, rounded, blunt nucleus. No parietal callus. The specimen is figured on Plate 12, figure 5.

Genus *LAMPRODOMINA* Marwick, 1931

Type by original designation, *Oliva neozelanica* Hutton.

Shell of moderate size, ovoid-conic and of rather solid texture. Spire about one-third the total length. Body-whorl subcylindrical, tapering towards the anterior end, the general shape of the shell being spindle-like. Sutures open and narrowly channelled. Aperture elongate, narrow, its sides subparallel. The body-whorl is divided into two zones by an encircling incised line which emerges near the upper end of the aperture, the upper segment of the surface of the body-whorl, smooth and polished, the lower dull as if encrusted with a thin wash of callus. Fasciolar band wide, limited at its upper margin by a raised edge, the lower portion bearing a series of strong, revolving lirations which decrease in strength anteriorly. Inner lip smooth on the parietal wall and without callous deposit or if it is present, quite narrow and extending above the end of the aperture but shortly forming a thickened band along the suture. Fossil in the Late Tertiary of New Zealand.

Although *Lamprodomina* is not represented in our American faunas, it is included in this study, because it has been referred to *Olivella* and since it shows some unusual characters. As indicated by its name, Marwick as well as Cossmann considered the form as related to *Lamprodoma* but its true place seems to be with the Olivinae. The most characteristic feature of *Lamprodomina* (not mentioned clearly in Marwick's description) is the encircling but variably placed incised line which emerges from near the upper end of the aperture. In Hutton's original figure (copied by Wenz), this line is shown as emerging at the sutural junction but in the two specimens of this species in the collection of the Academy, it is placed lower.

*Status Uncertain*Genus **CUPIOLIVA** Iredale, 1924

Type by original designation, *Olivella nympha* Adams and Angas. Plate 12, figs. 4, 4a.

Shell small or of medium size with an elevated spire of about 6 whorls tipped by a small or medium-sized nucleus; sutures channelled. Parietal callus rather thin and extending to the end of the aperture only, the parietal wall plain or without lirations. Pillar structure is a simple fold at the end of the columella, the pillar wall above somewhat concave but not secondarily excavated. Fasciole rather wide and undivided. Lip thin. Color plain white. Radula unrecorded.

*Cupioliva* is an Australian group, classed as a subgenus of *Olivella* by Wenz. Its apertural characters are similar to those of *Minioliva* but it differs from that American group by its much higher spire, simpler sutures and smaller nucleus. The figures given on Plate 12 were made from specimens in the Academy collection.

***Olivella miriadina*** (Duclos)

*Oliva miriadina* Duclos, 1835, Mon. *Oliva*, pl. 5, figs. 1, 2.

*Oliva myriadina* Duclos, Marrat, 1871, Thes. Conch., vol. 4, *Oliva*, p. 39, no. 208, pl. 24 (350), fig. 440.

*Olivella myriadina* (Duclos), Tryon, 1883, Manual of Conchology, vol. 5, p. 68, pl. 15, fig. 90.

Duclos' figures are those of a small shell (small scale figure indicates a length of about 4.5 mm.). It has an elevated, sharply pointed spire, the sutures appear merely grooved without an overlapping collar. The parietal callus is not shown clearly but may have been thin and covering the parietal wall only. The pillar wall is concave, the end of the columella provided with a simple fold. The shape of the shell is suggestive of *O. blanesi* but only half its size. A similar figure is given by Marrat and by Weinkauff. D'Orbigny in a brief note on the species remarks as follows: "Es la mas prolongada de las especies que acabamos de describir, y se distingue ademas por la falta de dientes o plieques en la columella, su cabeza es de color blanco uniforme. Habite en todas las Antillas." (Moluscos de Cuba, p. 215.)

This species might prove to belong to *Minioliva* but until larger collections of the minute *Olivellas* of the West Indian and Caribbean area are available, the identification of this species is uncertain.

*Species Incorrectly Assigned to Olivella*

*Olivella brooksvillensis* Mansfield, 1937 = ? *Omogymna* Martens, 1897.

Oligocene, Suwannee Limestone, Florida.

*Olivella eutorta* Dall, 1915 = ? *Omogymna* Martens.

Tampa Silex beds, Florida.

*Olivella colleta* Dall, 1915 = ? *Jaspidella*

Tampa Silex beds, Florida.



## EXPLANATION OF FIGURES

## PLATE 8

- Figures 1, 1a, 1b. *Olivella (Dactylidella) anazora* (Duclos) page 188  
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 fig. 1a. base of same specimen, much enlarged.  
 Zorritos, Peru. ANSP. 194577.
- Figures 2, 2a. *Olivella (Pachyoliva) columellaris* (Sowerby) page 201  
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 Mancora, Peru. ANSP. 194576.
- Figures 3, 3a, 3b. *Olivella (Olivella) dama* (Mawe) page 176  
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 Lower California. Robert Walton, collector. ANSP. 66988.
- Figures 4, 4a. *Olivella (Pachyoliva) semistriata* (Gray) page 202  
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- Figure 5. *Olivella (Dactylidia) pusilla* (Marrat) page 186  
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 Charlotte Harbor, Englewood. Coll. B. R. Bales
- Figure 6. *Olivella (Olivella) alba* (Marrat) page 180  
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 USNM. 182566.
- Figure 7. *Jaspidella blanesi albata* (Vanatt). page 213  
 Whitened, length 8.9 mm.  
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- Figure 8, 8a. *Olivella (Olivella) petiolita* (Duclos) page 174  
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## PLATE 9

- Figures 1, 2, 2a, 2b. *Olivella (Niteoliva) minuta* (Link) page 190  
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 West Indies. ANSP. 11810
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- Figures 5, 5a. *Olivella (Olivella) broggi* new species page 179  
 Holotype, natural and whitened, length 13.7 mm.  
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- Figures 6, 6a. *Olivella (Dactylidia) mutica fimbriata* (Reeve) page 184  
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 Boynton, Lake Worth, Florida. Coll. T. C. McGinty.  
 ANSP. 184653.

- Figures 7, 7a, 7b. *Olivella (Dactylidia) mutica mutica* (Say) page 184  
 Same specimen, natural and whitened, length 17.2 mm.  
 Cape Lookout, North Carolina. Coll. H. C. Yarrow.  
 ANSP. 28928.

## PLATE 10

- Figures 1, 1a, 1b. *Olivella (Callianax) biplicata* (Sowerby) page 195  
 Same specimen, natural and whitened, length 25 mm.  
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- Figure 2. *Olivella (Callianax) pedroana* (Conrad) page 196  
 Whitened, length 20 mm.  
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- Figures 3, 3a. *Olivella (Callianax) pycna* Berry page 197  
 Same specimen, natural and whitened, length 12.1 mm.  
 Bolinas, Calif. ANSP. 179758.
- Figures 4, 4a. *Olivella (Olivella) riverae* new species page 179  
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 Zorritos, Peru. ANSP. 194583.
- Figure 5. *Olivella (Minioliva) inconspicua* C. B. Adams page 211  
 Length 3.4 mm.  
 Bella Vista, Panama City. Olsson coll.
- Figures 6, 6a. *Olivella (Macgintiella) rosolina* (Duclos) page 208  
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- Figure 7. *Olivella (Olivella) rehderi* new species page 181  
 Holotype, slightly whitened, length 7.7 mm.  
 Panama Bay in 30 fms. U. S. Fish Comm.  
 USNM. 96799.
- Figures 8, 8a. *Olivella (Olivella) adelae* new species page 173  
 Natural and whitened, length 11.4 mm.  
 Lake Worth, Florida. Coll. McGinty.  
 ANSP. 176341.

## PLATE 11

- Figures 1, 1a, 1b. *Olivella (Zanoetella) zanoeta* (Duclos) page 204  
 One specimen, natural and whitened, length 16.3 mm.  
 Manta, Ecuador. ANSP. 194589.
- Figures 2, 2a. *Olivella (Lamprodoma) volutella* (Lamarck) page 204  
 Natural and whitened, length 19.1 mm.  
 French Plaza, Panama City. ANSP. 194578.
- Figures 3, 3a, 3b. *Olivella (Olivella) nivea* (Gmelin) page 172  
 Natural and whitened.  
 figs. 3, 3b. length 23.7 mm.  
 fig. 3. length 22.9 mm.  
 Little Duck Key. ANSP.
- Figure 4. *Olivella (Olivella) nivea chiriquiensis* new subspecies page 173  
 Holotype, length 15.7 mm.  
 Bocas del Toro, Panama. ANSP. 194579

- Figures 5, 5a. *Olivella (Olivella) gracilis* (Broderip and Sowerby) page 177  
 Same specimen, natural and whitened, length 12.4 mm.  
 Manta, Ecuador. ANSP. 194584
- Figures 6, 6a. *Olivella (Macgintiella) fuscocincta* Dall page 207  
 Paratypes, fig. 6, length 9.2 mm., fig. 6a., length 9.3 mm.  
 Gulf of Mexico, stat. 36, 84 fms. USNM. 62703.
- Figures 7, 7a, 7b. *Olivella (Niteoliva) peterseni* new species page 191  
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 Zorritos, Peru. ANSP. 194591.

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- Figures 1, 1a. *Olivella (Olivella) petiolita* (Duclos) page 174  
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 North coast of Venezuela. ANSP. 11766.
- Figures 2, 2a. *Olivella (Niteoliva) minuta* (Link) page 190  
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 Jamaica, Olsson coll.
- Figure 3. *Olivella (Olivella) macgintyi* new species page 175  
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 Dredged off Palm Beach, Florida. T. L. McGinty.  
 McGinty Coll.
- Figures 4, 4a. *Olivella (Cupioliva) nympa* Adams and Angas page 217  
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 Sydney, Australia. ANSP. 16037
- Figure 5. *Belloлива tubulata* (Dall) page 215  
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- Figure 6. *Olivella (Minioliva) acteocina* new species page 210  
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- Figures 7, 7a. *Olivella (Macgintiella) bocasensis* Olsson page 208  
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 fig. 7a. length 8 mm.  
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 Olsson Coll.
- Figures 8, 8a. *Olivella (Callianax) johnsoni* new species page 198  
 fig. 8, length 13.7 mm.  
 fig. 8a, length 14 mm.  
 Miocene, Chipola, Florida. ANSP. 10773.
- Figure 9. *Olivella (Olivella) indivisa* Guppy page 182  
 Length 9 mm.  
 Miocene of Baitoa, Santo Domingo. Olsson coll.
- Figures 10, 10a. *Olivella (Minioliva) myrmecoön* Dall page 211  
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 figure 10a, length 3.8 mm.  
 From Recent or Pleistocene silts, Colon, Panama.  
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## PLATE 13

- Figure 1. *Olivella (Dactylidella) paraisa* new species page 188  
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- Figure 2, 2a. *Olivella (Toroliva) gobiath* Olsson page 199  
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 Miocene of northeastern Costa Rica. PRI
- Figure 3. *Olivella (Olivella) venezuelensis* new species page 181  
 Holotype, length 27.2 mm.  
 Upper Miocene. Punta Blanco beds near La Guaira, Venezuela.  
 ANSP.
- Figures 4, 4a. *Olivella (Niteoliva) terryi* new species page 193  
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 Miocene of northeastern Costa Rica. PRI 20998
- Figure 5. *Olivella (Olivella) canaliculata* Gabb page 182  
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- Figure 6. *Olivella (Olivella) muticoides* Gabb page 182  
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- Figures 7, 7a. *Olivella (Mansfieldella) pugilis* Olsson and Harbison page 194  
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 Miocene of Port Limon, Costa Rica.

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- Figure 2. *Olivella (Toroliva) fargoii* Olsson and Harbison page 199  
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- Figure 3. *Olivella (Niteoliva) galvestonensis* Harris page 192  
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- Figures 4, 4a. *Olivella (Olivella) wilsoni* new species page 183  
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- Figure 6. *Olivella (Niteoliva) marksi* new species page 194  
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- Figure 7. *Olivella (Dactylidia) pusilla* (Marrat) page 186  
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- Figures 8, 8a. *Olivella (Callianax) thompsoni* new species page 197  
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- Figures 9, 9a. *Olivella (Olivella) cocosensis* new species page 180  
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- Figure 10. *Olivella (Olivella) stegeri* new species page 176  
Gulf of Mexico.  
Holotype, length 11.2 mm.  
100 miles east of Alacran, Mexico. 28 fms.  
ANSP. 194587.

## PLATE 15

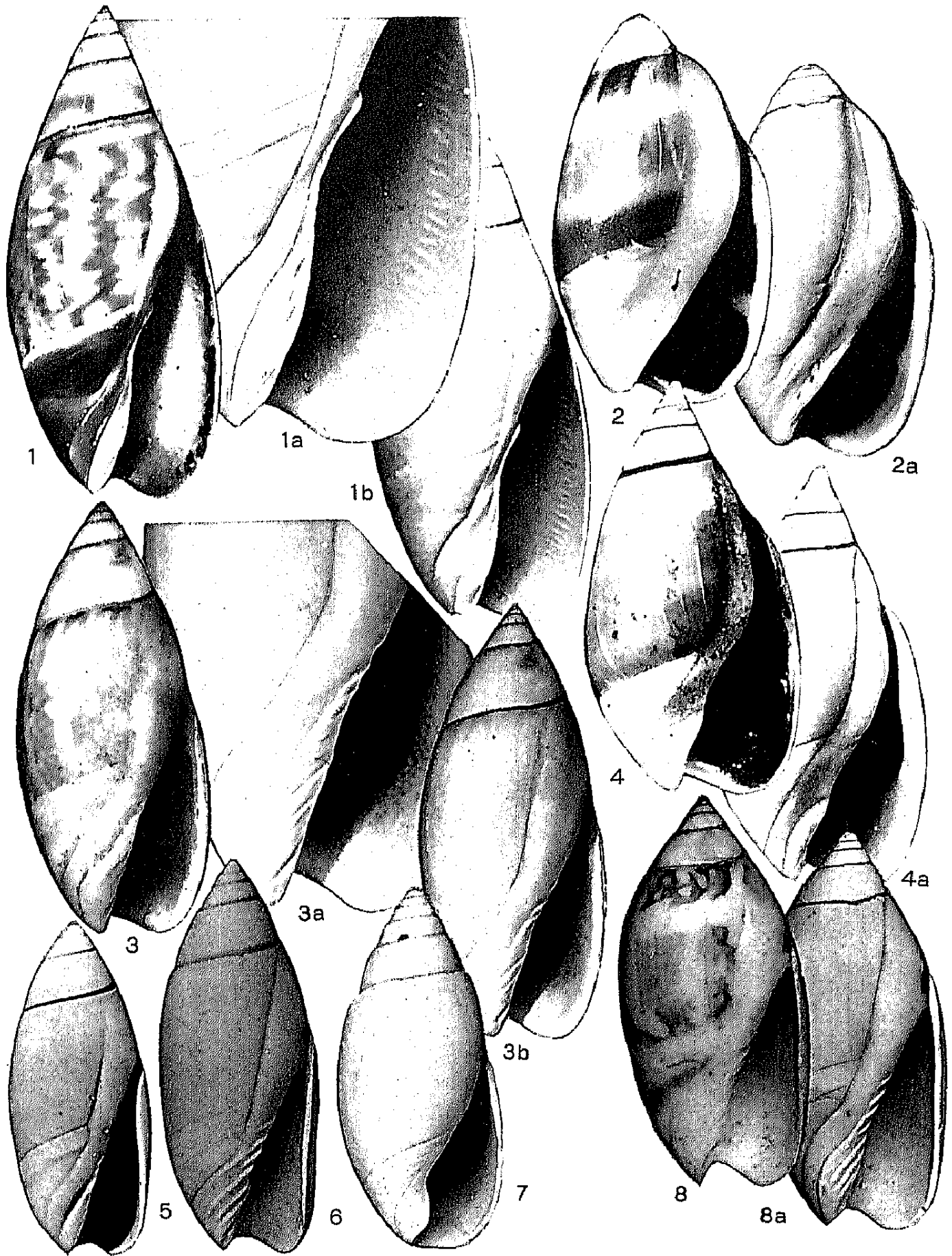
- Figures 1, 1a. *Jaspidella jaspidea* (Gmelin) page 212  
Natural and whitened, length 17.6 mm.  
Miami, Florida.
- Figures 2, 2a. *Jaspidella miris* new species page 214  
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Gulf of Mexico. From the collection of Mr. C. R. Locklin.  
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- Figures 3, 3a. *Olivella (Niteoliva) morrisoni* new species page 192  
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- Figures 4, 4a. *Olivella (Olivella) bitleri* new species page 178  
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- Figures 5, 5a, 5b. *Olivella (Pachyoliva) semistriata* (Gray) page 202  
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- Figure 7. *Olivella (Olivella) drangai* new species page 180  
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- Figures 8, 8a. *Olivella (Minioliva) sp.*  
Whitened. Gulf of Mexico.  
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- Figure 9. *Olivella (Macgintiella) rotunda* Dall page 207  
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Barbados.
- Figures 10, 10a. *Olivella (Macgintiella) watermani* McGinty page 206  
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Natural and whitened, length 8 mm.  
Off the Florida Keys, between Key Largo and Key West.  
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- Figures 12, 12a. *Olivella (Olivella) floralia* (Duclos) page 174  
Natural and whitened, length 12.8 mm.  
Grassy Key, Florida. Coll. Miss Adele Koto.

## PLATE 16

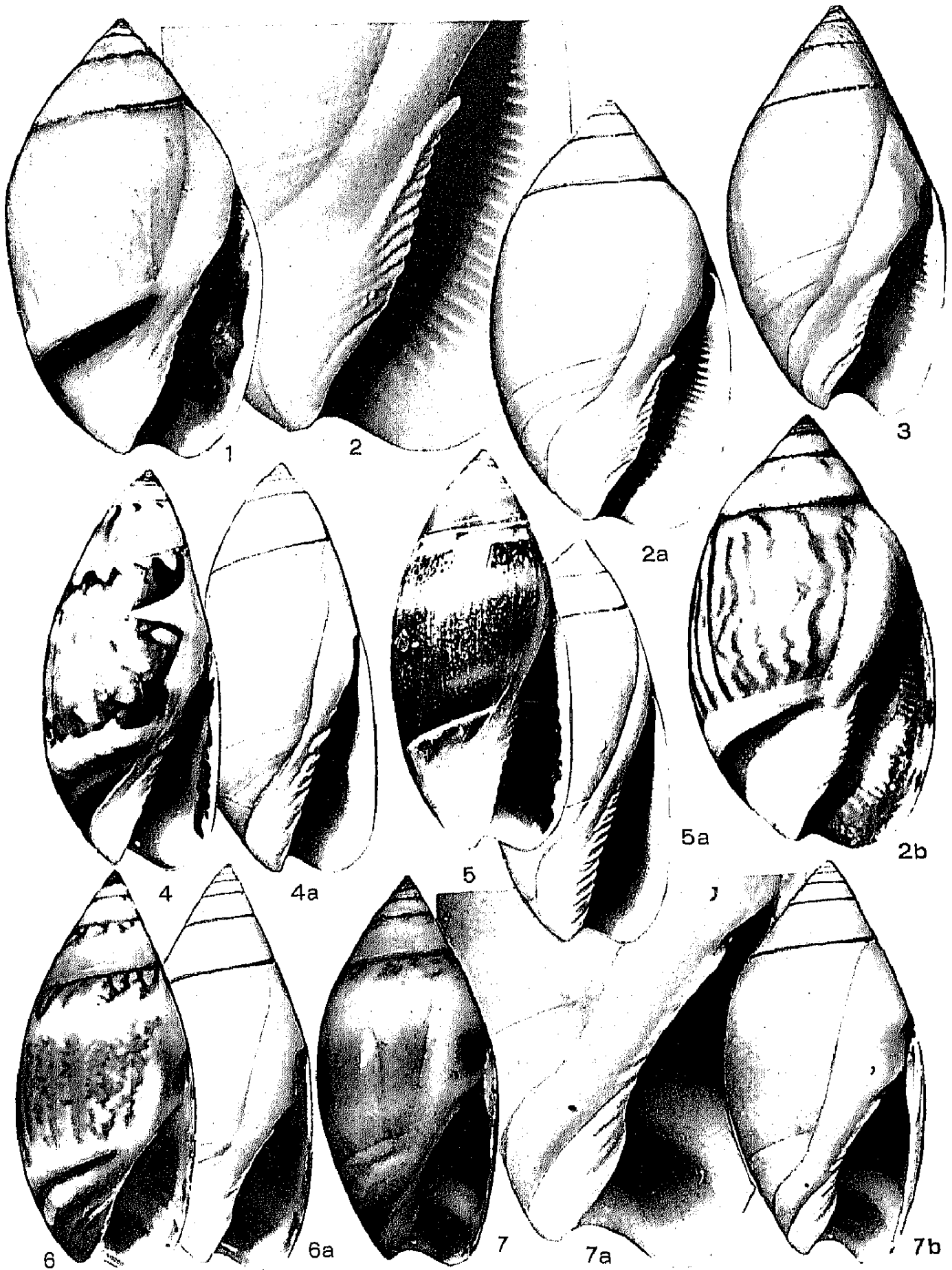
- Figures 1, 2, 3, 4. Olivellinae radulae from microphotographs.
- Figures 1, 1a. *Olivella (Olivella) nivea* (Gmelin) page 172  
Fig. 1. An entire ribbon as extracted from the radular sack, the forward section folded under, elevating the teeth into a rasping position. Length of ribbon about 2.7 mm.  
Fig. 1a. A portion of the spread-out ribbon with 5 rows of teeth, the lateral teeth on the right side eliminated. The irregular rectangular outlines of the third or accessory plate shows faintly under the laterals. Width or greatest length of an individual rachidian tooth is 4 mm. Little Duck Key, Florida
- Figure 2. *Olivella (Pachyoliva) columellaris* (Sowerby) page 201  
Portion of ribbon with 5½ rows of teeth. Width of ribbon is about .5 mm. Peru.
- Figure 3. *Olivella (Callianax) biplicata* (Sowerby) page 195  
Portion of a ribbon with 7 rows of teeth. Width of ribbon .9 mm.  
Ocean Beach, San Diego, California. Collector Dr. A. Fischer.
- Figure 4. *Olivella (Olivella) drangui* new species page 180  
Portion of a ribbon with 7 rows of teeth.  
Width of an individual rachidian tooth is .14 mm.  
Galapagos.
- Shell figures.
- Figure 5. *Jaspidella jacksonensis* (Mansfield) page 214  
Length 8.3 mm.  
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- Figures 6, 6a. *Olivella (Olivina) bullula* (Reeve) page 200  
Natural and whitened, length 10.2 mm.  
Off Lake Worth, Florida in 90 to 100 fms.  
Coll. McGinty.

- Figure 7. *Olivella (Minioliva) perplexa* new species page 209  
Holotype, length 3.8 mm.  
Marathon, Florida Keys. Coll. Adele Koto.
- Figure 8. *Olivella (Minioliva) inconspicua* C. B. Adams page 211  
Holotype, length 3.80 mm.  
Panama. (Coll. C. B. Adams, MCZ).
- Figures 9, 9a. *Olivella (Olivella) adelae* new species page 173  
Holotype, length 12.4 mm.  
Bradenton Beach, Florida. Coll. Adele Koto.  
ANSP. 194582.

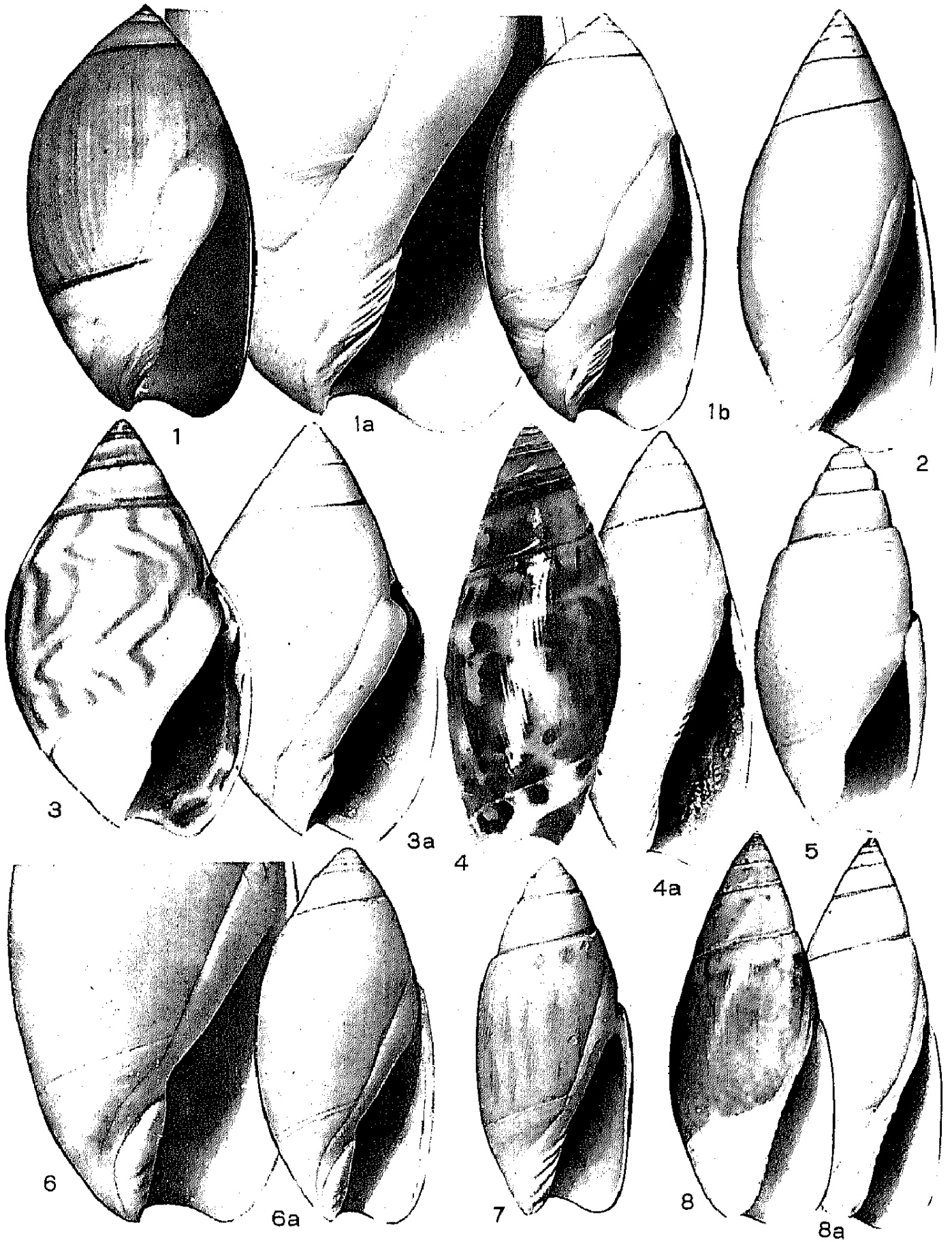


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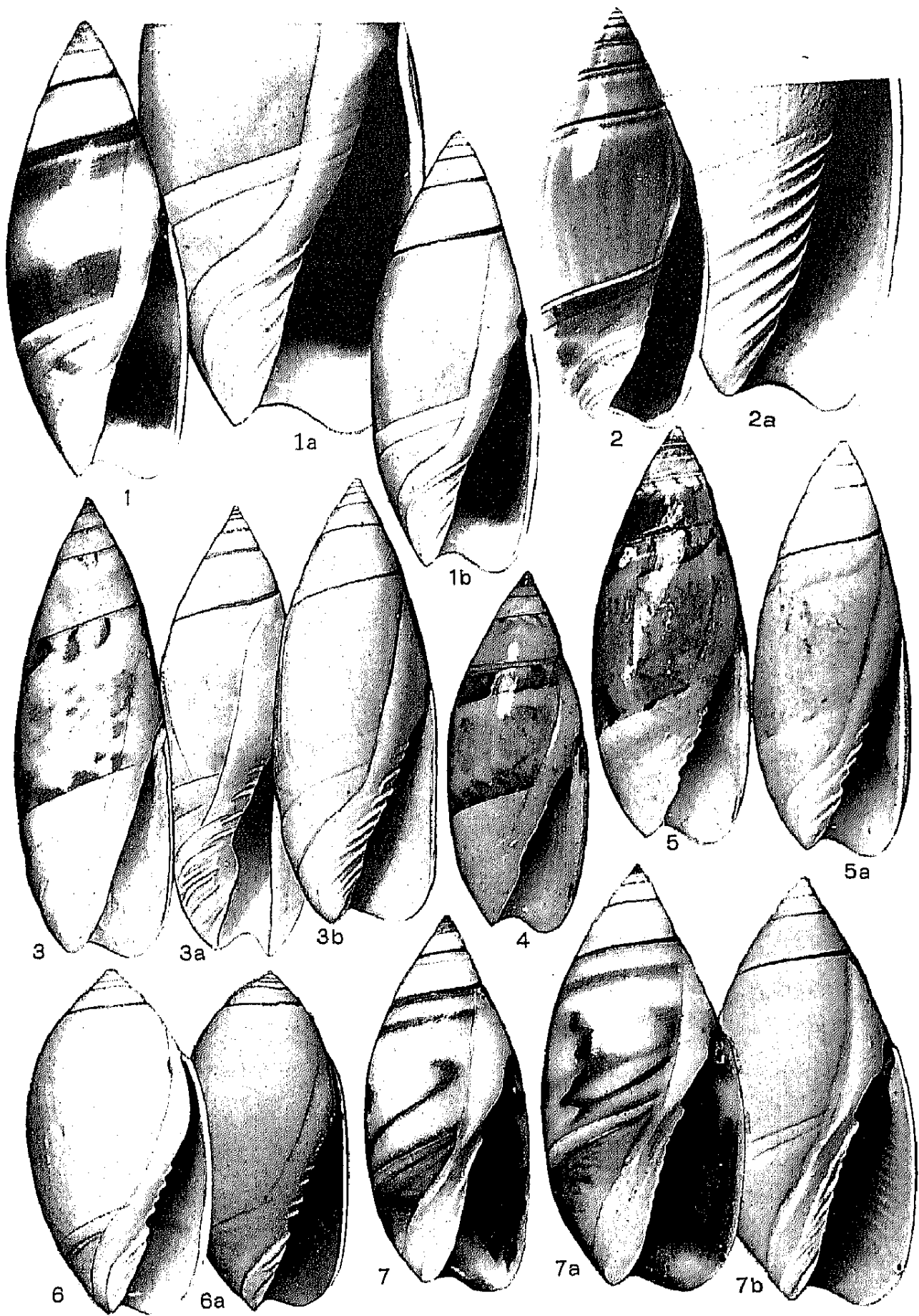




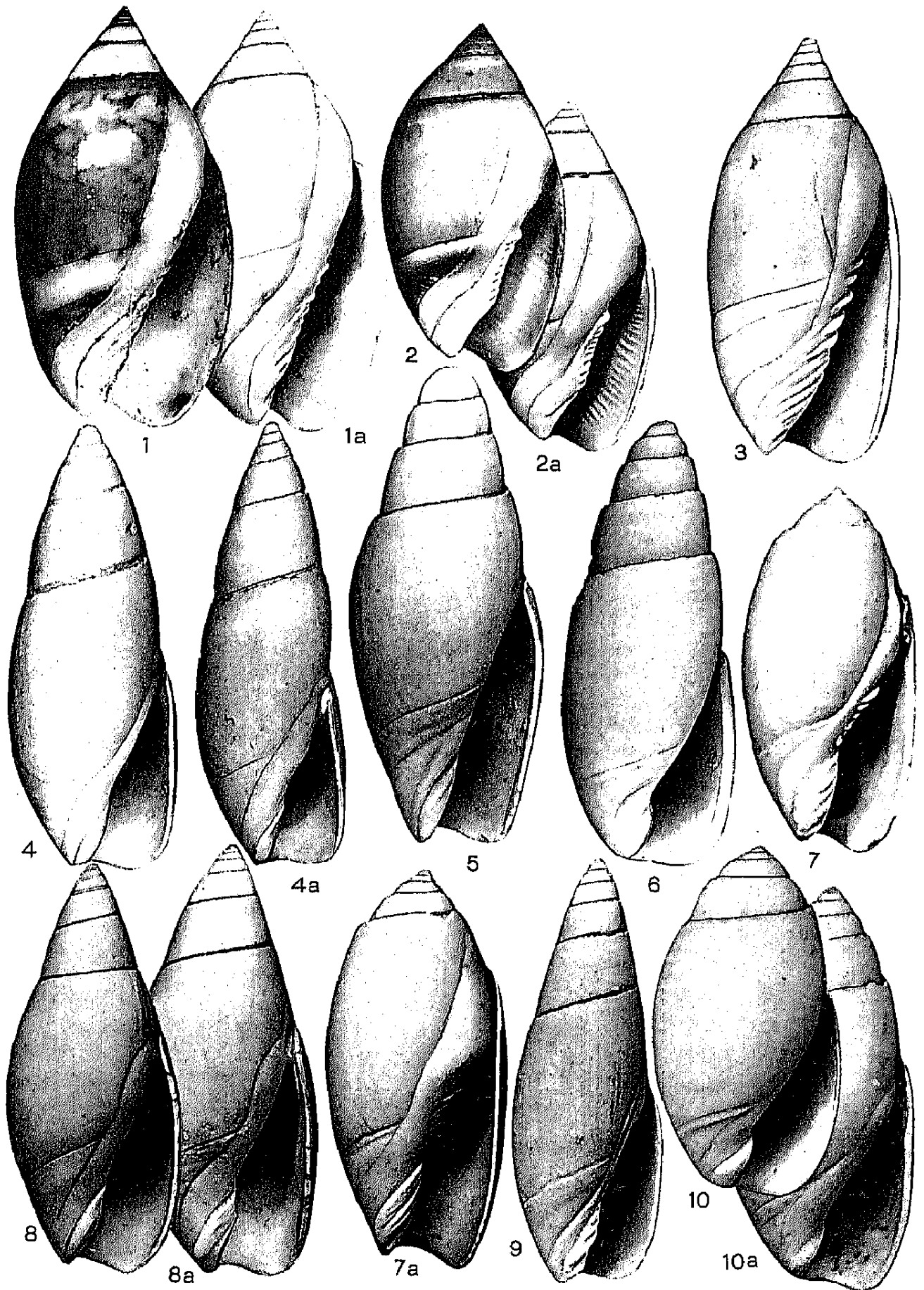
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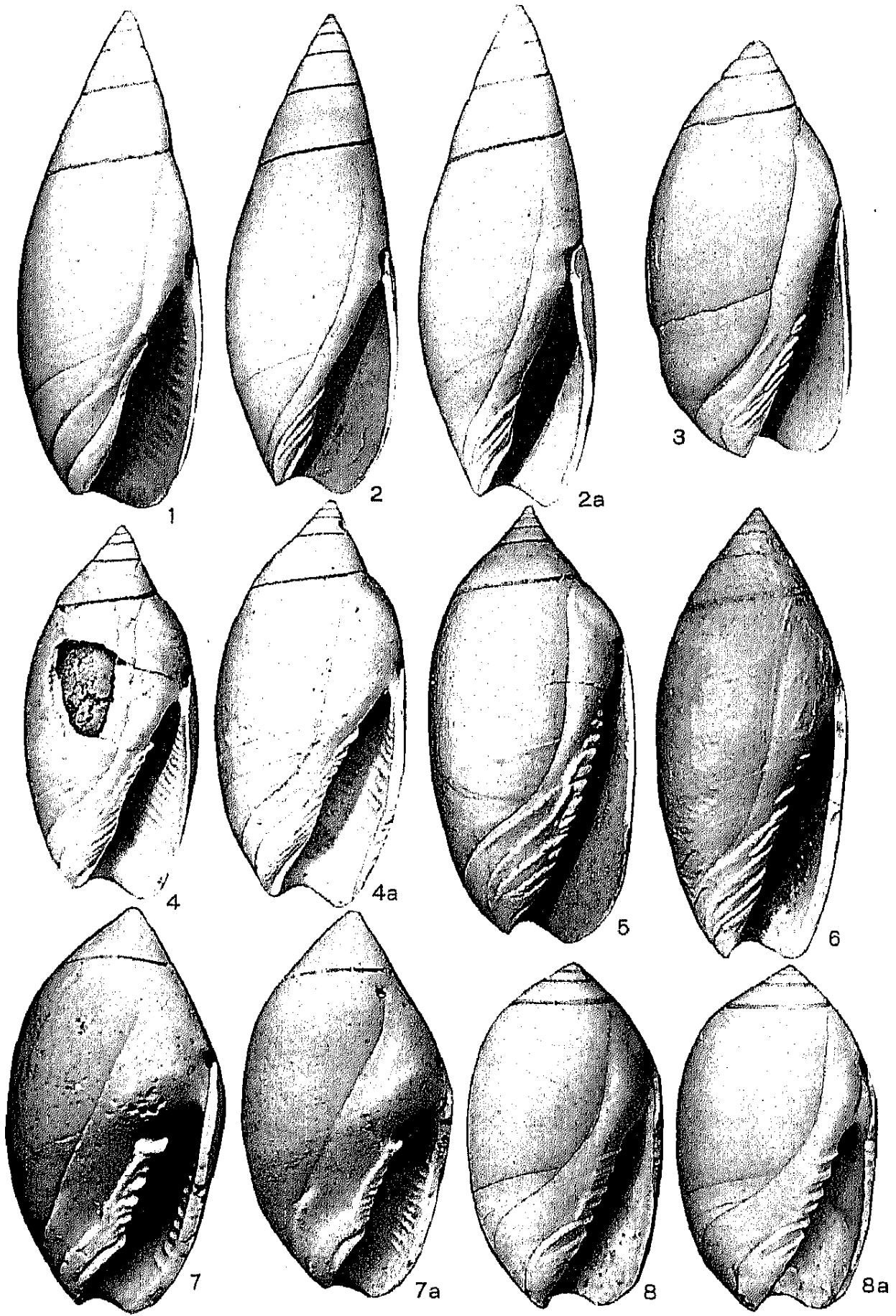
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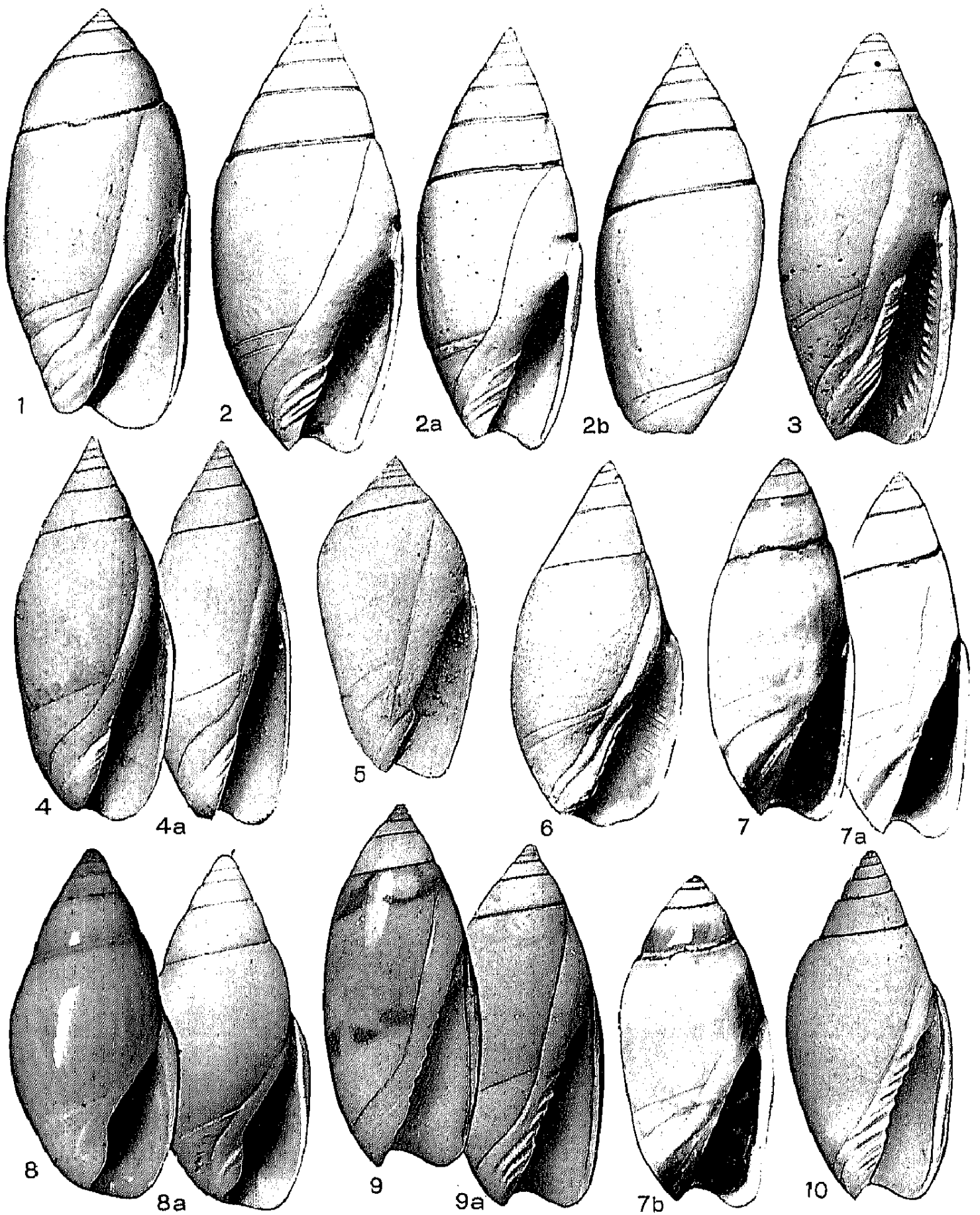


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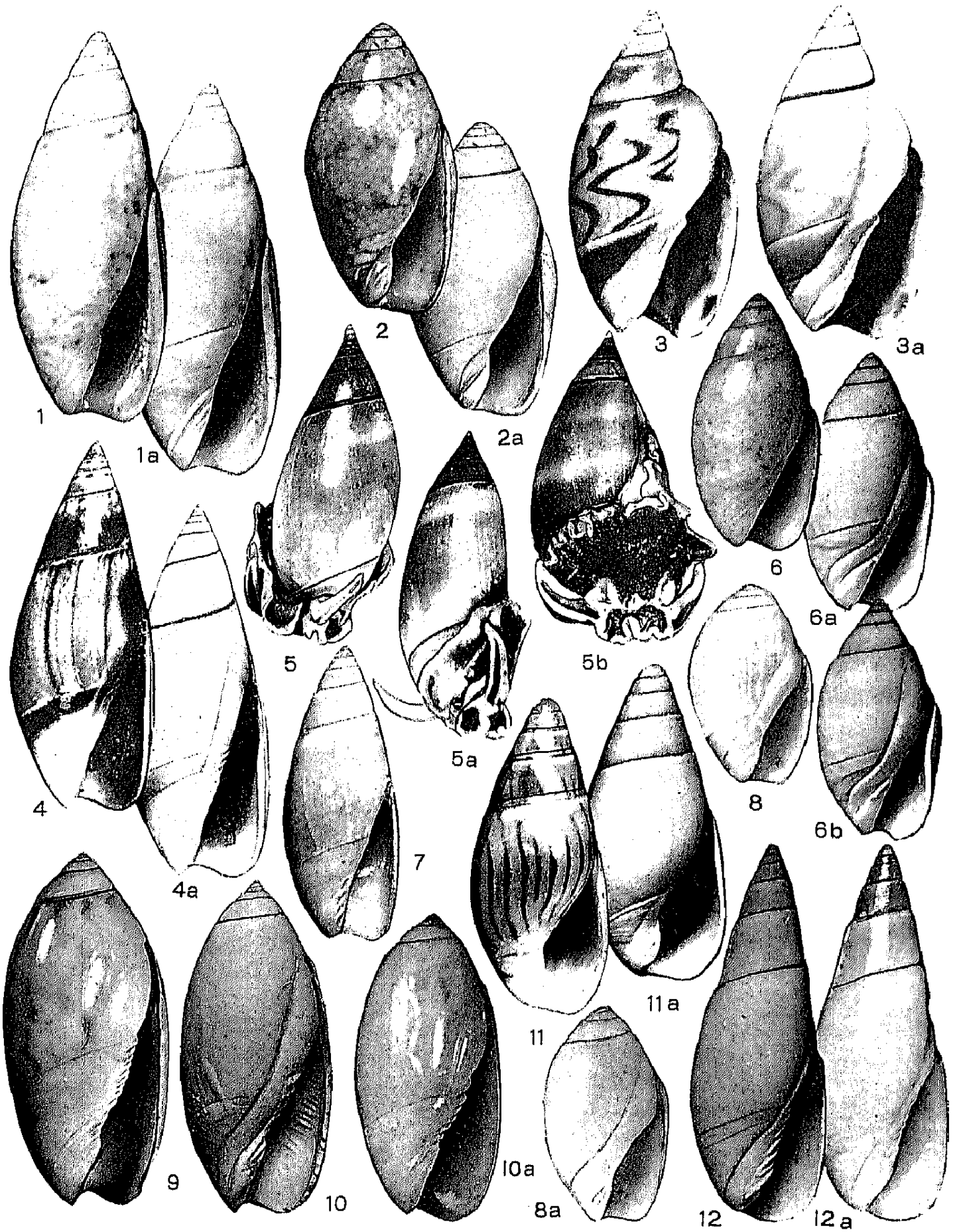


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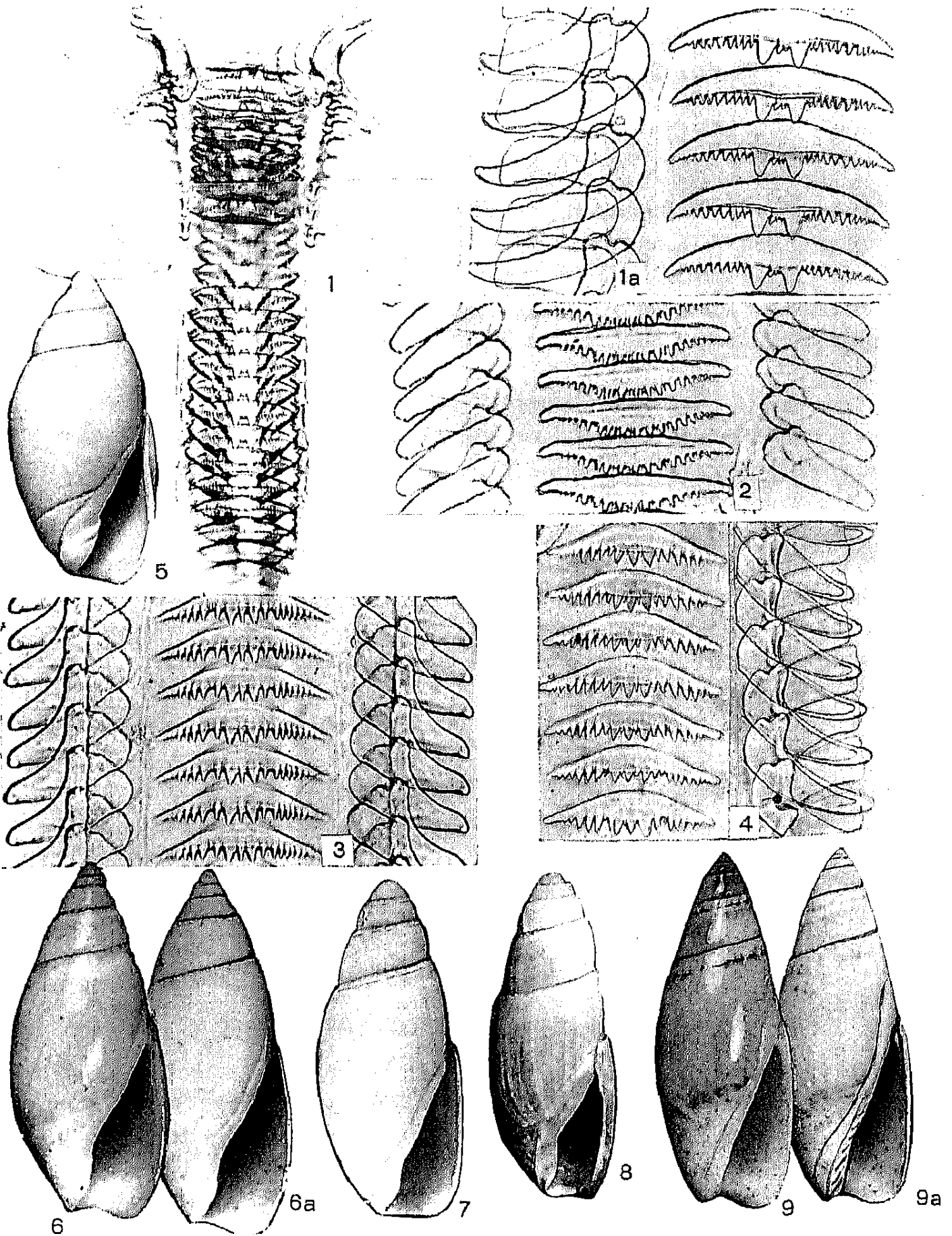




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