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THE FAMILY TONNIDAE IN THE WESTERN ATLANTIC

BY
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The family Tonnidae, as here considered, contains four genera, namely *Tonna*, *Malea*, *Eudolium* and *Oocorys*. *Tonna* is by far the largest genus both in the size of the shells and the number of species. It is found in the tropical and warmer portions of temperate seas throughout the world. *Malea*, which is entirely tropical, is represented by relatively few species, none of which is found in the Western Atlantic. However, we include a description of the genus and a figure of the type species to complete the family. *Eudolium* is a rather rare genus and is found mainly in deeper water, occurring in both tropical and temperate portions of the world. *Oocorys* is also rare and world-wide in distribution in temperate and tropical seas, but is usually found only at considerable depths. By far the largest number of species in the family occur in the Indo-Pacific.

According to our present knowledge, members of this family occur mainly in sandy areas, generally just below, to well below, the low-tide mark. Specimens of *Oocorys* have been dredged as deep as 2620 fathoms (almost 3 miles).

The Tonnacea includes the families Cassididae, Cymatiidae, Bursidae, Tonnidae and Ficidae. Even though the radula varies somewhat in the finer structures of the teeth, these variations appear to be just as great within a family as they do among these five families. The radulae of the various genera in all these families as figured by Thiele, Trochel and others are often so close that, on the basis of this character alone, a genus could be placed in any family of the Tonnacea. With a few exceptions, it now appears that the shells are far more diagnostic as a single character in the study of relationships

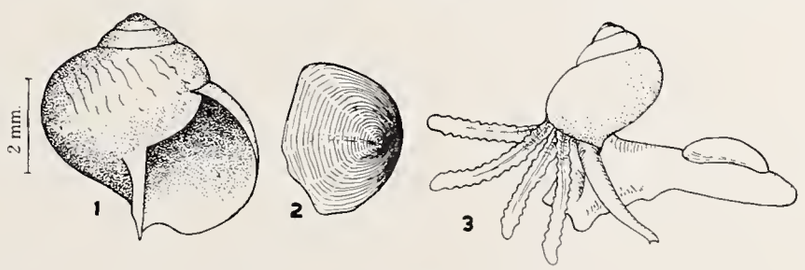


Plate 74
Fig. 1–2. Shell and operculum of pelagic young of *Tonna maculosa*? Dillwyn, from the Campeche Bank, Yucatan. For the radula from this specimen see Plate 75, fig. 3. Fig. 3. The pelagic young of some species of *Tonna*, showing the long velar lobes, the foot and the operculum (Fig. 3, after Fischer).

than are most of the morphological structures of the soft anatomy. However, it is by a consideration of all of the characters involved rather than any one character that a genus can be placed properly in this complex.

From general shell and anatomical characters the Tonnidae appear to be most closely related to the Cassididae and the Ficidae and less so to the Cymatiidae and Bursidae. In the Tonnidae, so far as now known, all species have an operculum in their young stage, but only in *Oocorys* does it persist in the adult.

Certain species in the genus *Tonna* reach a very large size and are among the largest gastropods known, exceeded in length and capaciousness only by *Megalotractus*, *Fasciolaria* and *Melo*. *Tonna melanostoma* Jay is the largest species in the Tonnidae. Our largest specimen has a capacity of about 4 quarts (3170 cc). This specimen measures 280×240 mm. (11×9½ inches).[1]

Very little is known of the life history of the various species of the Tonnidae other than the fact that the sexes are separate and that they produce free-swimming, pelagic young. The embryonic shell of *Tonna* has 3 to 4 whorls, is smooth and has a golden-brown coloration. It consists mainly of periostracum overlaying a thin layer of lime. The aperture is closed with a well-developed, tightly fitting operculum (Plate 74, fig. 2). In adults the early whorls become much thickened by a lime deposit.

The genus *Macgillivrayia* was established by Forbes for the pelagic young of some species of *Tonna* that were found off the eastern coast of Australia. Macgillivray states that it is furnished with a float in the manner of *Ianthina*. Fischer (1885, p. 651) figured the animal of *Macgillivrayia pelagica* showing the four long velar lobes, the large foot, the operculum and the thin transparent shell (Plate 74, fig. 3). He concludes that the young of *Tonna* have the appearance of *Macgillivrayia*. He no doubt based this statement on the work of B. Cazenavette (1853, p. 62) who described the young shells of what he called *Dolium perdix*. However, Cazenavette failed to cite a locality and it may be assumed from the article that he was dealing with *T. galea*, the only species of *Tonna* found off the French coast. After the death of Cazenavette the specimens were sent to Fischer who (1863, page 147) described them fully and pointed out the relationship of *Tonna* and *Macgillivrayia*. These pelagic young possess an operculum which apparently is lost at the time the animal changes from the larval free-swimming stage to the post-larval and bottom-living form. It would be impossible to determine the species of *Tonna* from the embryonic shells as all are nearly uniform in size and coloration and all lack sculptural characters; however, specific differences may occur in the radulae.

In the catalogue of this family by Winckworth and Tomlin 96 names are listed and of these some 50% are considered synonyms. So far as can be determined from the large series available to us, all species appear to be exceedingly variable, not only as to size but also in coloration, sculpture and general shape of the shell. A series from any one locality is usually limited; many times to only a single specimen in a lot. As a consequence, these minor variations have given rise to many names so that it is impossible to separate them into valid categories.

One of the outstanding characters in this family is that of spiral ridges. These may be clear-cut as ridges only, or else associated with small spiral cords or threads between the

[1] A specimen of *Megalotractus arnanus* Linné measuring 560x260 mm. (20¼x10¼ inches) has a capacity of 3650 cc. and a specimen of *Melo aethiopica* Linné measuring 388x223 mm. (13½x8¾ inches) holds 3640 cc.

Radulae and Opercula of the Tonnidae

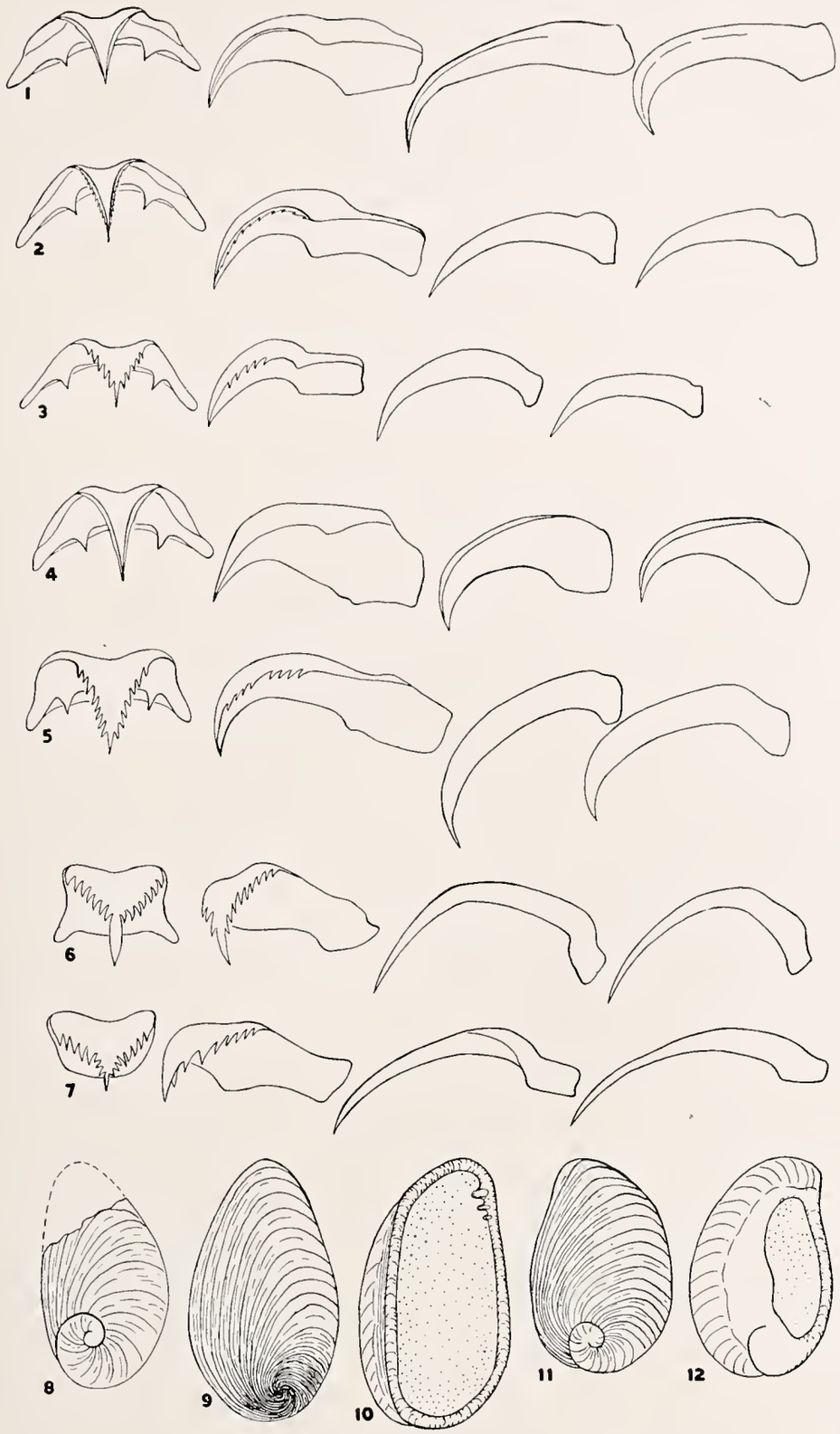


Fig. 1. *Tonna perdix* Linné.

Fig. 2. *Tonna maculosa* Dillwyn.

Fig. 3. Pelagic young of *Tonna*, apparently close to *Tonna maculosa* Dillwyn.

Fig. 4. *Tonna galea* Linné.

Fig. 5. *Endolium crosseanum* Monterosato.

Fig. 6. *Oocorys* (*Benthodolium*) *abyssorum* Verrill and Smith.

Fig. 7. *Oocorys bartschi* Rehder.

Fig. 8. Operculum of *Oocorys sulcata* Fischer (young specimen).

Fig. 9–10. Operculum of *Oocorys bartschi* Rehder. Fig. 9. Outer side. Fig. 10. Inner side. Stippled area indicates the muscle scar.

Fig. 11–12. Operculum of *Oocorys* (*Benthodolium*) *abyssorum* Verrill and Smith. Fig. 11. Outer side. Fig. 12. Inner side. Stippled area indicates the muscle scar. (All radulae drawn with the aid of a camera lucida and greatly enlarged.)

Plate 75

The figures of the radulae shown are all from young specimens or from the least worn portions of the radulae so as to show as much dentition as possible. We have seen the radula of an adult specimen of *E. crosseanum* in which the denticles are worn almost completely smooth. Trochel has shown denticles on the rachidian and marginal teeth of *T. perdix* which were apparently drawn from a much younger specimen than the one we figure.

ridges. The number of ridges and cords has been used to separate different forms, yet many individual specimens show a decided change in the number of cords between the ridges as the animal advances in age. In other words, the early whorls show, for example, only one small cord between two well-developed ridges, yet on the body whorl three cords may exist between these ridges.

Tonna fasciata Bruguière from the Indo-Pacific appears to be the only species in this family that produces true varices though there is some indication that this also occurs in the genus *Oocorys*. Certain species such as *T. perdix* and *T. maculosa* have a simple, thin lip while in other species, such as *Tonna galea*, the degree of development of the lip, which is produced only at maturity, is exceedingly variable.

From the small amount of preserved material at our disposal it would appear that this family has an extremely simple reproductive system. The four males (2 *T. galea*, 1 *T. maculosa* and 1 *E. crosseanum*) which we were able to examine, possess a very large intromittent organ similar to that shown by Bergh in Semper (1904, pl. 8). This appears to be formed by the body wall and is filled with spongy tissue. The seminal groove, a continuation of the vas deferens, runs along the posterior edge of the intromittent organ and disappears on the copulatory papilla. It is the papilla which seems to vary in the few species examined. In *T. galea* it is digitiform, short and rather thick; in *T. perdix*, according to Bergh, it is somewhat longer and thinner and in *T. maculosa* it is extremely long and flagellate. The single male specimen of *Eudolium crosseanum* studied was completely lacking in any trace of a copulatory papilla, but the remainder of the intromittent organ was in all respects similar to that of the other species examined. Unfortunately no male specimens of *Oocorys* have been seen. Far more material must be studied before any complete account of the reproductive anatomy of this group can be given.

The nervous system of *Tonna galea* has been fully discussed and illustrated by B. Haller (1893, p. 563–577) and Hermann Weber (1927) has given a very complete, fully illustrated account of the anatomy, morphology and histology of the digestive tract of this species.

Subfamily **Tonninae**

Shell lacking the operculum in the adult, as far as now known, possessing basal denticles on the rachidian teeth of the radula and having a rather large protoconch.

Genus **Tonna** *Brunnich*[1]

Tonna Brunnich 1772, Zoologiae Fundamenta, p. 248.

Cadus Röding 1798, Museum Boltenianum, p. 150 (genotype, *Buccinum perdix*, subsequent designation, Woodring 1928, p. 310).

Dolium Lamarck 1801, Systême des Animaux sans Vertèbres, p. 79 (genotype, *Buccinum galea* Linné, monotypic).

Cadium Link 1807, Beschreibung der Naturalien-Sammlung der Universität zu Rostock, p. 113 (genotype, *Buccinum perdix* Linné, subsequent designation, Woodring 1928, p. 310).

Perdix Denys de Montfort 1810, Conchyliologie Systématique **2**, p. 447 (genotype, *Perdix reticulatus* Denys de Montfort, original designation); *non* Brisson 1760.

[1] Winckworth 1945, Bulletin of Zoological Nomenclature **1**, pt. 5, pp. 113–116 has placed before the International Commission the problem of *Tonna* Brunnich. This genus was outlined by Brunnich though no species was listed. However, the name has been in general use since 1906 and we agree with Winckworth that this well known name should be placed on the official list of Generic Names in Zoology rather than discarded for *Cadus* Röding.

Macgillivrayia Forbes 1852, Voyage of the Rattlesnake **2**, p. 383, pl. 3, fig. 8a–b (genotype, *Macgillivrayia pelagica* Forbes, monotypic); Fischer 1863, Journal de Conchyliologie **11**, p. 147–149; Fischer 1884, Manuel de Conchyliologie, p. 651.

Macgillivraya Forbes 1852, Report British Association Advancement of Science for 1851, **21**, Appendix, p. 77.

Galea 'Klein' Mörch 1852, Catalogus Conchyliorum Comes de Yoldi, p. 110. [This pre-Linnean name of Klein was introduced by Mörch as a synonym of *Dolium*.]

Foratidolium Rovereto 1899, Atti Società Ligustica **10**, p. 107; new name for *Perdix* Denys de Montfort, *non* Brisson 1760.

Parvitonna Iredale 1931, Records of the Australian Museum **18**, p. 216 (genotype, *P. perselecta* Iredale, monotypic).

Genotype, *Buccinum galea* Linné, subsequent designation, Suter 1913.

Shell medium to very large in size, in shape from oval to globose, rather thin but strong and generally sculptured with strong spiral ridges. Axial sculpture consisting only of fine growth lines exeept on the early post-embryonic whorls where a minor reticulated sculpture is apparent in certain species. Parietal shield slightly, to well-developed and reflected over the umbilicus. Aperture large, with or without a reflected lip. Columella nearly straight or moderately twisted. Anal canal inconspicuous, siphonal canal short and broad. Periostracum thin, straw-yellow and deeiduous. Embryonic whorls persistent, covered with a horny periostracum and devoid of sculpture.

The genus *Macgillivrayia* was described by Forbes from some small pelagic mollusks that were collected by Macgillivray some 15 miles off Cape Byron, New South Wales, Australia. These were subsequently eonsidered by Fischer (1863, p. 349; 1884, p. 651) to be the young free-swimming larvae of *Tonna perdix*. There appears to be no question about *Macgillivrayia* being the young of *Tonna*, though it would be difficult to assign these young to any one species.

There appears to be no question that two species of the *perdix* complex exist, one in the Indo-Pacific region and one in the Western Atlantic. Adanson's assertion that it occurs in Sénégal is open to question (Histoire Naturelle du Sénégal, 1757, p. 107, pl. 7, fig. 5). Many species listed by Adanson for Sénégal were obtained from other sources.

Following, we consider both speeies in detail in order to aid in the clarification of this problem.

Tonna maculosa *Dillwyn*, Plate 75, fig. 2; Plate 76, fig. 1–2

Buccinum maculosum Solander 1786, A Catalogue of the Portland Museum, p. 137, no. 3050 [nude name].

Buccinum maculosum 'Solander' Dillwyn 1817, Descriptive Catalogue of Recent Shells, London **2**, p. 583 (no specific locality given). [Dillwyn refers to A. Seba 1758, **3**, pl. 68, fig. 16 which appears to be quite definitely the Western Atlantic form.]

Helix sulphurea C. B. Adams 1849, Contributions to Conchology, New York, no. 3, p. 33 (Jamaica); C. B. Adams *ibid.*, 1850, p. 98.

Dolium pennatum Mörch 1852, Catalogus Conchyliorum Comes de Yoldi, pt. 1, p. 110 (Antilles).

Dolium album Conrad 1854, Proc. Acad. Nat. Sciences Philadelphia **7**, p. 31 (no locality given).

Dolium perdix β brasiliana Mörch 1877, Malakozoologische Blätter **24**, p. 43 [nude name]; *non Dolium antillarum* var. *brasiliana* Mörch, *ibid.*, p. 41 (Bahia, Brasil).

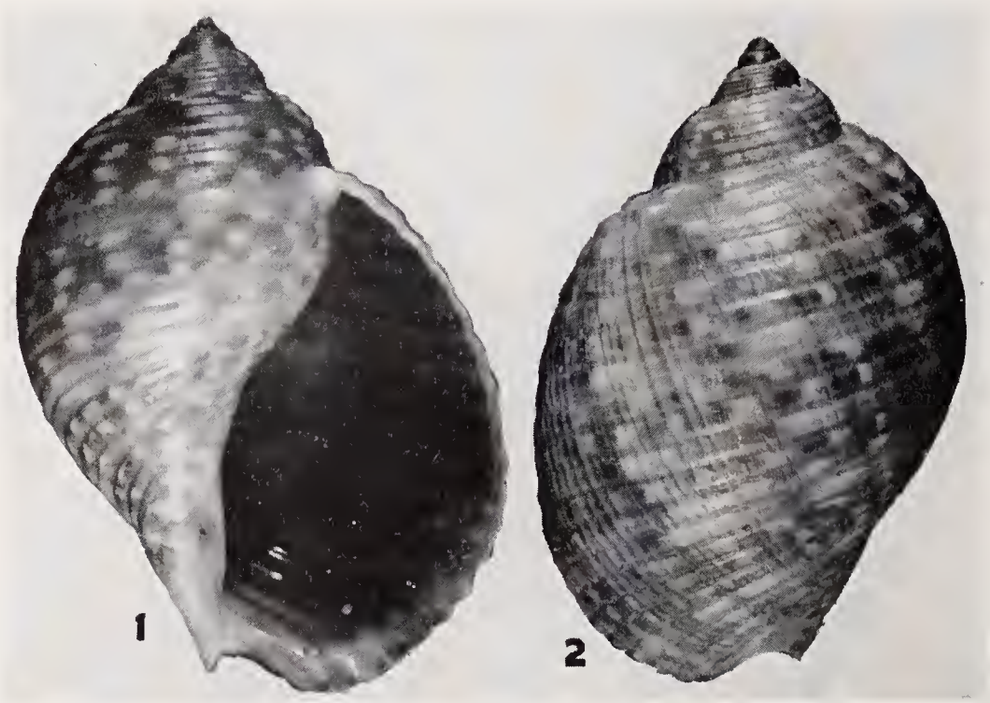
Dolium perdix occidentalis 'Mörch' v. Martens 1878, Zoological Record **14**, Mollusca, p. 35. [Mörch did not intend to use the word *occidentalis* in a subspecific sense but only as a geographic designation for the Western Atlantic area.]

Helix sulfurea 'Adams' Dall 1889, Bull. Museum Comp. Zoöl. **18**, p. 232 [error for *sulphurea* C.B.Adams].

Description. Shell varying in size from 47 to 134 mm. ($1\frac{3}{4}$ to $5\frac{1}{4}$ inches) in length, thin but rather strong and umbilicated. Whorls 6 to 7, strongly convex and rapidly increasing in size. Ground color white. The early post-embryonic whorls generally a light pinkish-brown, remaining whorls irregularly mottled. The brownish coloration is interrupted, mainly on the ribs, by long white bars of color. Two or more ribs may have the same color pattern and in many shells this grouping of the color pattern shows up as poorly defined bands. Nuclear whorls about 3, generally a golden brown. Spire moderately extended. Aperture subovate and large. Outer lip thin, slightly crenulate and occasionally edged with brown and in adults usually margined below by a very slight thickening. Parietal wall thinly glazed by a parietal shield. This shield folds over the rather deep but small umbilicus. Columella moderately arched and margined on its outer side by a ridge which terminates at the short siphonal canal. Spire moderately extended. Suture deeply impressed. Sculpture consisting of about 20 to 22 flattened, spiral ribs, which are separated by narrow and moderately deep grooves. Axial sculpture consisting of very fine and irregular growth lines. Nuclear whorls glass-like and smooth. The shell is generally covered with a thin periostracum which is deciduous.

	length	width	aperture	
(large)	134	96	106x56 mm.	Dunmore, Harbour Id., Eleuthera, Bahama Islands
(average)	97	67	64x38	Monte Cristi, Hispaniola
(small)	47	32	34x18	Barbados

Types. As the whereabouts of the specimen on which Seba's figure was based is not known and is probably not in existence, we here designate as neoholotype, Museum of Comparative Zoölogy, no. 113091, from Simms, Long Island, Bahama Islands (Plate 76, fig. 1).



Photographs by F. P. Orchard

Plate 76. *Tonna maculosa* Dillwyn

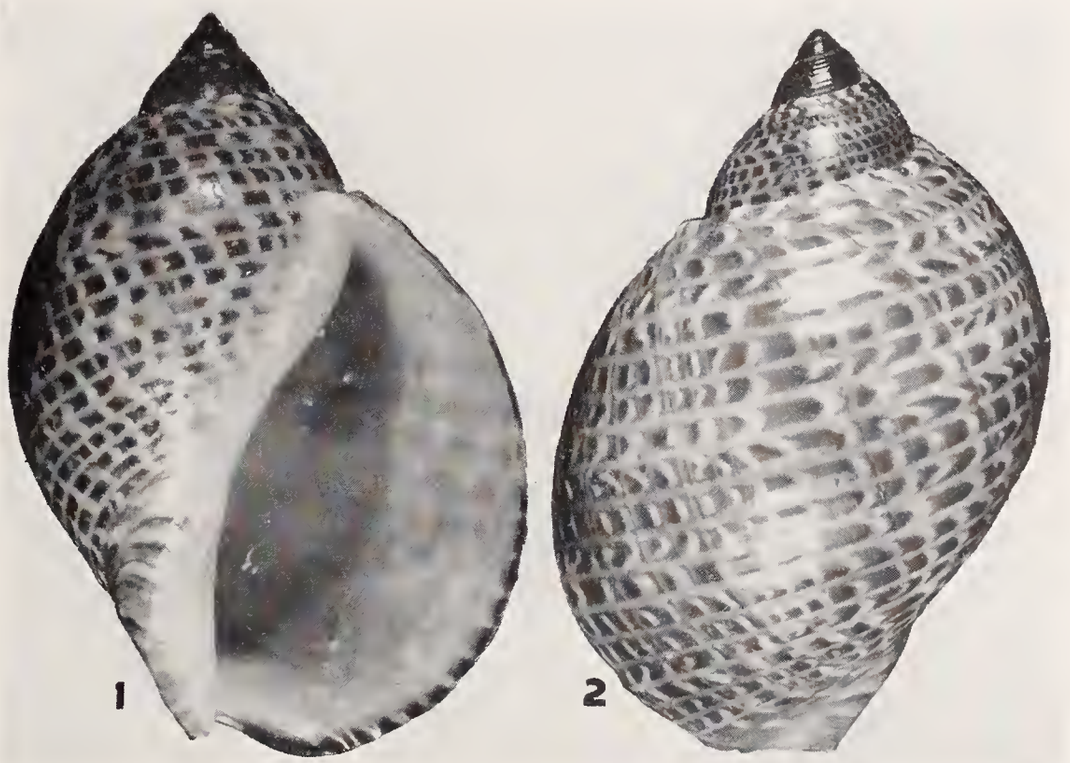
Fig. 1. Simms, Long Island, Bahama Islands (Neoholotype). Fig. 2. Near mouth of Yaqui River, Monte Cristi, Hispaniola; (both natural size).

Remarks. Dillwyn was the first to recognize the existence of two forms in the *perdix* complex. Under the title of "variety" he gives the name *Buccinum maculosum* Solander MSS. and a reference to Seba (3, pl. 68, fig. 16). The figure of Seba, a woodcut, is excellent, and shows the sharply defined grooves between the spiral ridges, and the less definite color markings of the Western Atlantic form. The name must date from Dillwyn as Solander's name was without description or reference to a previously published figure.

T. album Conrad appears to be nothing more than an albino specimen of *maculosa.* Albino specimens are not common but they exist apparently as sporadic examples throughout the range of this species.

Differences between the Western Atlantic and Indo-Pacific species, *maculosa* and *perdix*, have long been appreciated by several workers. Dillwyn was first and he was followed by Mörch, Hanley, Winckworth, Tomlin and Bayer. The question, however, has been as to which species the name *perdix* applies. We are in full agreement with Bayer that *perdix* should be employed for the Indo-Pacific species inasmuch as all of Linné's references are to this form, even though he cited "America" as the locality.

These two species though close can be readily separated. Typical *maculosa* differs from *perdix* by its type of mottling, by having a less produced spire, a more deeply arched parietal-columellar union, and more convex whorls. The ribs of *maculosa* are a little more numerous, narrower and more clearly defined as a sculptural character by the deeper inter-spaces, while in *perdix* the ribs are defined more clearly by the color pattern. In general, specimens of *maculosa* are not quite so large as those of *perdix.*



Photographs by F. P. Orchard

Plate 77. *Tonna perdix* Linné

Fig. 1. Tunuloa, Vanua Levu, Fiji Islands (natural size). Fig. 2. Calapan, Mindoro, Philippine Islands (reduced from 4½ inches).

Range. From southern Florida south through the West Indies to Brasil.

Records. Florida: Boynton (P. McGinty); Key Biscayne, Miami; Sand Key (both MCZ); Molasses Reef, Key Largo (L. A. Burry); Bahia Honda Key; Key West; Tortugas (all USNM). Bermuda: Castle Harbour (fossil, dredged, H. Moore). Bahama Islands: Hawksbill Creek, Grand Bahama Island; Strangers Cay, Little Abaco Island; North Bimini Island; Mangrove Cay, Andros Island; Nassau, New Providence; Dunmore, Eleuthera Island; Arthurstown, Cat Island; Clarencetown, Long Island; Abraham's Bay, Mariguana Island; Watling Island; Matthewtown, Great Inagua (all MCZ); Cay Sal, Cay Sal Bank (R. Humes). Cuba: Caibarién, Las Villas (P. J. Bermúdez); off Punta Alegre, Camagüey (R. Humes); Guarda la Vaca, Banes; Blue Beach, Guantánamo Naval Base, Bahía Honda (all MCZ). Hispaniola: Les Cayes; Port Salut (both USNM); Cap Haitien; Miragoane (both W. J. Eyerdam); Monte Cristi; Puerto Plata and Santa Bárbara de Samaná (all MCZ). Puerto Rico: San Juan (MCZ); Port Real (USNM). Jamaica: Kingston, Port Royal (both USNM); Montego Bay (MCZ). Virgin Islands: Tortola (M. W. Dewey); St. Thomas; St. Croix (both MCZ). Lesser Antilles: St. Christopher; Antigua; St. Lucia (all MCZ). Carriacou Island, Grenadines; Tobago Island (both H. J. Kugler); Barbados (MCZ). Caribbean Islands: Grand Cayman Island; Swan Island (both MCZ); La Orchila Island (USNM). Mexico: Veracruz (M. E. Bourgeois); Cabo Catoche, Yucatan (A. del Valle). British Honduras: Belize (MCZ). Costa Rica: Limón (USNM). Panama: Colón (USNM). Colombia: Mouth of Atrato River (USNM). Venezuela: La Guira (USNM). British Guiana: Corentyne River (H. J. Kugler). Brasil: Praia do Chega Negro, Est. Bahia; Ilha de Itapariea, Est. Bahia (both M. J. de Oliveira).

Tonna perdix *Linné*, Plate 75, fig. 1; Plate 77, fig. 1–2

Buccinum perdix Linné 1758, Systema Naturae ed. 10, p. 734 (America).

Cadus coturnix Röding 1798, Museum Boltenianum, p. 150.

Cadus meleagris Röding 1798, Museum Boltenianum, p. 150.

Perdix reticulatus Denys de Montfort 1810, Conchyliologie Systématique **2**, p. 447, text fig. (Seas of America, in Ethiopia and the Indies).

Dolium perdix ventricosior Menke 1829, Catalog Malsburg, p. 35 [nude name].

Dolium rufum de Blainville 1829, Dictionnaire des Sciences Naturelles **54**, p. 503 (Seas of Australasia).

Dolium plumatum Green 1830, Trans. of the Albany Institute, New York **1**, p. 132 (South Sea Islands); Dunker 1868, Novitates Conchologicae, Abth. 2, p. 106.

Description. Shell varying in size from 75 to 163 mm. (3 to 6½ inches) in length, thin but rather strong. Whorls 5½, strongly convex and rapidly increasing in size. Ground color white. The early post-embryonic whorls generally a more or less uniform pinkish-brown; remaining whorls decidedly mottled. The mottling effect is brought about by the brown coloration which follows the ribs and which is in turn interrupted by axial bars or chevron-shaped white markings. Spaces between the ribs white, though in large adult shells the brownish coloration becomes somewhat suffused on the last half of the body whorl. Nuclear whorls 3 to 3½, generally a golden-brown. Aperture sub-ovate and large. Outer lip thin, edged with brown, somewhat crenulate and, in adults, usually margined below by a slight thickening. Parietal wall thinly glazed by a parietal shield. This shield folds over the rather deep but narrow umbilicus. Occasional specimens have

a large irregular callus of white on the body whorl at the upper insertion of the aperture. Columella slightly arched and margined on its outer side by a ridge which terminates at the short siphonal canal. Spire moderately extended. Suture deeply impressed. Sculpture consisting of about 19 to 20 flattened, spiral ribs which are separated by narrow and shallow grooves. Axial sculpture consisting of very fine and irregular growth lines. Nuclear whorls glass-like and smooth.

	length	width	aperture	
(large)	163	114	125 x 70 mm.	Amboyna, Molucca Islands
(average	114	80	87 x 45	Calapan, Mindoro, Philippine Islands
(small)	75	48	51 x 25	Amouli, Tutuila Islands, Samoan Islands

Types. Plate 27, fig. C, in Rumphius, D'Amboinsche Rariteitkamer, Amsterdam, 1741 is here selected to represent this Indo-Pacific species. This reference is one of the several given by Linné. The type locality, here selected, to be Amboyna, Molucca Islands.

Remarks. (See under *T. maculosa*).

Range. Probably throughout the Indo-Pacific from the Hawaiian Islands to the east coast of Africa.

Records. Hawaiian Islands: Kauai Island (AMNH); Hilo Bay, Hawaii; Laie, Oahu (both MCZ). Society Islands: Raiatea (AMNH). Samoan Islands: Massacre Bay, Tutuila; Tau Island (both R. T. Abbott). Gilbert Islands: Apaiang (MCZ). Marshall Islands: Bikini Island, Bikini Atoll (USNM); Ebon Island (MCZ). Caroline Islands: Ponape (MCZ). Fiji Islands: Levuka, Ovalau Island; Tunuloa, Vanua Levu (both R. T. Abbott). Dutch New Guinea: Wakde Island (R. T. Hatt). New Hebrides: Espiritu Santo Island (MCZ). Loo Choo Islands: Hirame Jima (F. Stearns). Philippine Islands: Calapan, Mindoro; Cuyo Island; Lubang Island (all MCZ). Molucca Islands: Boeroe Island (Fairchild Garden Expedition); Amboyna (MCZ). Australia: Moreton Bay, Queensland (MCZ). Indian Ocean: Mauritius (MCZ).

Tonna galea *Linné*, Plate 75, fig. 4; Plate 78, fig. 1–2

Buccinum galea Linné 1758, Systema Naturae ed. 10, p. 734 (Mediterranean Sea).

Dolium tenue Menke 1830, Synopsis Methodica Molluscorum Pyrmont, p. 143 (near Alexandretta [Iskenderon] Turkey).

Dolium antillarum Mörch 1877, Malakozoologische Blätter **24**, p. 41 (St. Thomas and Jamaica).

Dolium galea var. *epidermata* DeGregorio 1884, Bull. Società Malacologica Italiana **10**, p. 115 (Palermo [Sicily]).

Dolium galea var. *spirintrorsum* DeGregorio 1884, Bull. Società Malacologica Italiana **10**, p. 114 (Italy).

Dolium galea var. *tardina* DeGregorio 1884, Bull. Società Malacologica Italiana **10**, p. 114 (Palermo [Sicily]).

Dolium galea var. *spiritrorsum* 'DeGregorio' Paetel 1887, Catalog der Conchylien-Sammlung **1**, p. 221 [error for *spirintrorsum* DeGregorio].

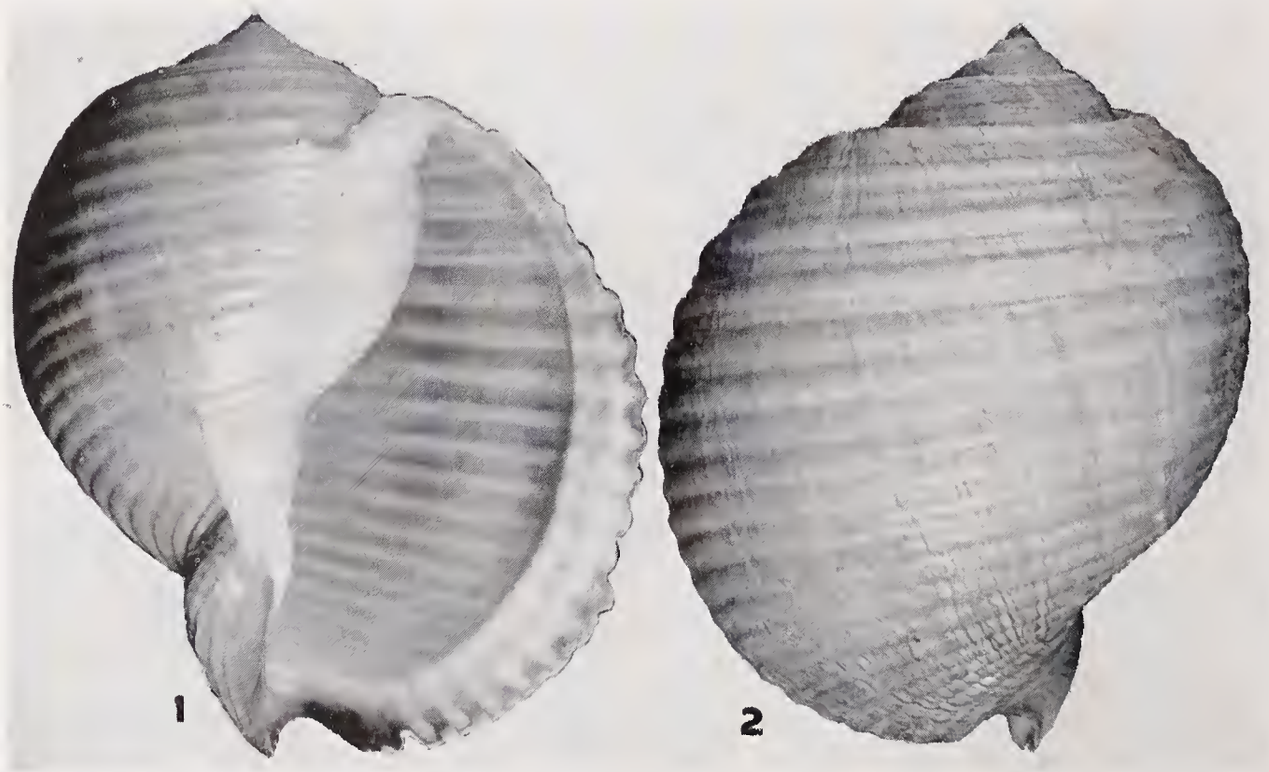
Description. Shells reaching to about 172 mm. ($6\frac{3}{4}$ inches) in length, thin but rather strong and umbilicated. Whorls 7 to $7\frac{1}{2}$, strongly convex and rapidly increasing in size. Ground color white to light coffee-brown, generally uniform but occasionally indistinctly

mottled. Nuclear whorls about 2½, generally a deep golden-brown. Spire slightly extended. Aperture subovate and large. Outer lip rather thin, strongly crenulate in fully adult shells, and with a thickened ridge well below the lip margin. This lip area may also be slightly reflexed and is usually colored a somewhat darker brown. Parietal wall thinly glazed, older specimens forming a well-defined parietal shield. Columella short, twisted and margined on its outer side by a broad ridge which terminates at the siphonal canal. Suture deep, forming a definite channel. Sculpture consisting of 19 to 21 rather broad and somewhat flattened spiral ridges. In addition a narrow ridge may develop between two of the larger ones. These are usually found above the mid-whorl area. Nuclear whorls smooth, first 2 to 2½ post-embryonic whorls finely reticulated. Remaining whorls with only the spiral ridges crossed by very fine axial growth lines. The shell is covered with a moderately strong yellowish to brown periostracum which is somewhat deciduous.

	length	width	aperture	
(large)	172	149	147 x 77 mm.	Amboyna, Molucca Islands
(large)	165	133	139 x 74	Great Abaco Island, Bahama Islands
(medium)	140	110	119 x 60	Naples, Italy

Types. Of the two references cited by Linné we select that of Gualtieri 1742, pl. 42, fig. A to represent the type. We restrict the type locality to Naples, Italy.

Remarks. This species has a very wide distribution, occurring as it does in the Eastern and Western Atlantic and the Indo-Pacific region. Exept in specimens from Brasil there appears to be no character upon which geographic races can be instituted. Specimens from the Indo-Pacific are the same as those from the West Indies. Closely related



Photographs by F. P. Orchard

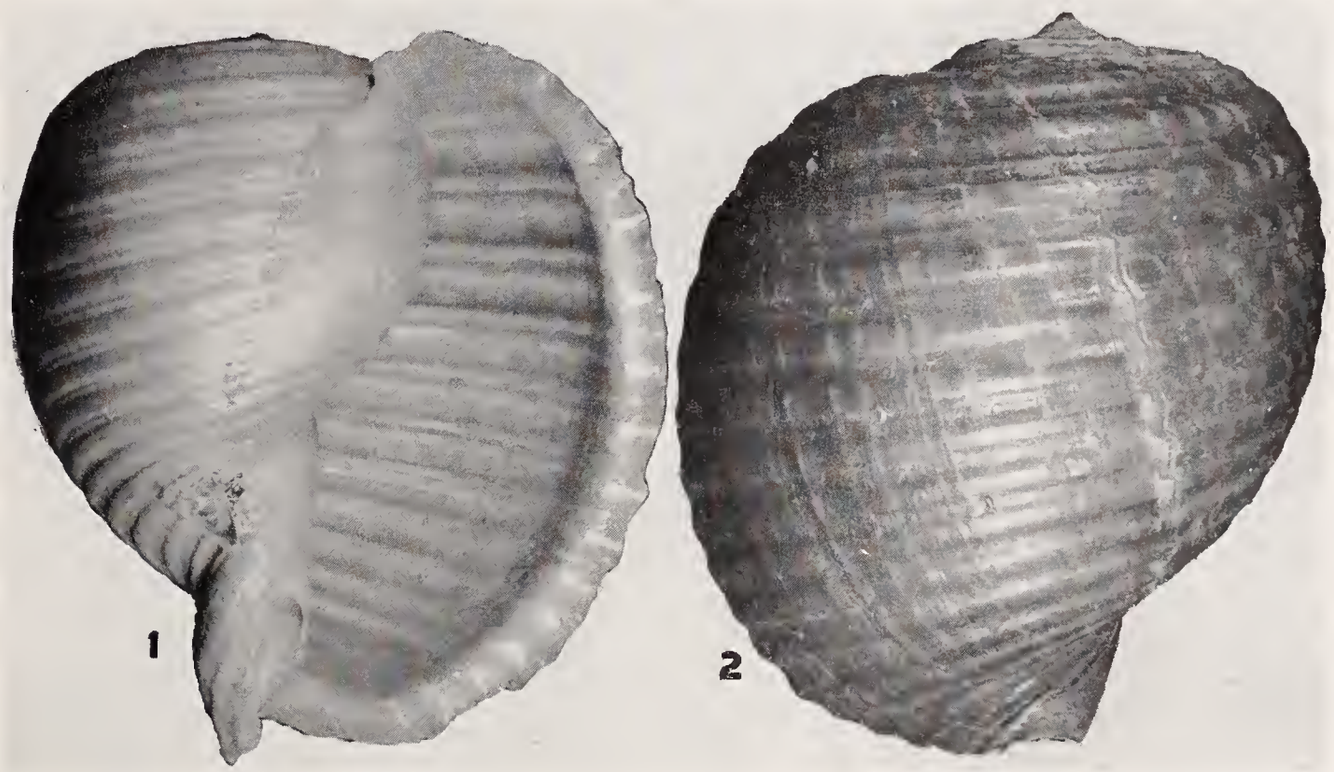
Plate 78. *Tonna galea* Linné

Fig. 1. South side of Great Abaco Island, Bahama Islands (reduced from 4½ inches). Fig. 2. Port Antonio, Jamaica (reduced from 6½ inches).

forms from the Indo-Pacific have been named *zonata* Green, *ampullacea* Philippi and *tenebrosa* Hanley. These may eventually prove to be only subspecies of *T. galea* Linné. However, much more material is needed for a fair comparison of the several named entities that are now believed to be separate species. The three varieties of *T. galea* Linné described by DeGregorio from southern Italy and Sicily are apparently only individual variations.

Range. Eastern Atlantic: Mediterranean Sea and south along the African coast at least as far as Spanish Guinea. Western Atlantic: North Carolina and south probably to Trinidad. Indo-Pacific: From the Hawaiian Islands to Japan and south through the East Indies and Indian Ocean.

Records. Western Atlantic: North Carolina: *Pelican*, station 189, about 12 miles off Ocracoke Inlet in 13 fathoms; Cape Lookout; Beaufort (all USNM). South Carolina: Myrtle Beach; St. Helena Island (both MCZ). Florida: Cape Canaveral (MCZ); Lake Worth, Boynton (P. McGinty); Tortugas (USNM); 15–35 miles off Fort Walton (L. A. Burry); Port St. Joe (A. Merrill). Louisiana: Morgan City in 2 to 5 fathoms; off Timbalier Island in 2 to 5 fathoms (both USNM). Texas: St. Joseph Island (J. W. Hedgpeth); Matagorda Island (USNM). Bahama Islands: Great Abaco Island; Nassau, New Providence (both MCZ); Cay Sal (USNM). Cuba: off Caibarién, Las Villas (P. J. Bermúdez). Hispaniola: Jérémie; Puerto Plata; Santa Bárbara de Samaná (all MCZ). Puerto Rico: Caja de Muertes; Mayagüez (both USNM). Jamaica: Port Antonio (MCZ); Kingston; Annotta Bay (both USNM). Mexico: Tux-



Photographs by F. P. Orchard

Plate 79. *Tonna galea brasiliana* Mörch

Fig. 1. Rio Grande do Sul, Brasil (reduced from $4\frac{3}{4}$ inches). Fig. 2. Ilha Guaiba, Est. do Rio de Janeiro, Brasil (reduced from $5\frac{1}{2}$ inches).

pan, Veracruz (M. E. Bourgeois); Cabo Catoche, Yucatan (USNM); Colombia: Cartagena; Sabanilla (both USNM). Eastern Atlantic: Italy: Naples (MCZ). Malta: (MCZ). Spanish Guinea: Corisco Island; near Benito (both MCZ). Indo-Pacific: Molucca Islands: Amboyna (MCZ). Philippines: Manila Bay, Luzon; Calapan, Mindoro (both MCZ). Indian Ocean Islands: Zanzibar (MCZ).

Tonna galea brasiliana *Mörch*, Plate 79, fig. 1–2

Dolium antillarum var. *brasiliana* Mörch 1877, Malakozoologische Blätter **24**, p. 42 (Brasil); *non Dolium perdix brasiliana* Mörch, *ibid.*, p. 43.

Description. Shell essentially the same as typical *galea* except for the spire which in adult specimens hardly extends above the upper margin of the aperture. The degree of difference in the spire of this form from that of typical *galea* is sufficiently marked to retain the name for this Brasilian subspecies.

length	width	aperture	
155	130	144 x 66 mm.	Rio de Janeiro, Brasil
140	116	129 x 62	Ilha Guaiba, Est. do Rio de Janeiro, Brasil
116	105	110 x 59	Rio Grande do Sul, Brasil

Types. The whereabouts of Mörch's types is unknown to us. Some are in Denmark, others are in the British Museum and probably others are in various European museums. The type locality is Brasil and we here restrict the locality to Rio de Janeiro.

Remarks. The descriptive character of lirae becoming obsolete on the spire, as given by Mörch, does not characterize this subspecies. In fact most of the specimens we have seen from Brasil have well-developed intercostal lirae. However, the greatly depressed spire is present on all specimens that we have seen. Immature specimens, nevertheless, have the spire a little more extended, but as the shell advances in age the aperture becomes larger until eventually it is about as large as the body whorl. This depressed spire seems to be the only tangible character which separates *brasiliana* from typical *galea*.

Range. Known only from Brasil.

Records. Brasil: Ilha Guaiba, Est. do Rio de Janeiro (M. deOliveira); Rio de Janeiro (MCZ); Rio Grande do Sul (MCZ; USNM); São Sebastião, São Paulo (USNM).

* * * *

Though the genus *Malea* is found only in the Eastern Pacific and Indo-Pacific we include a description of the genus and a figure of *Malea ringens* Swainson, the genotype, to complete the generic analysis of the family Tonnidae (Plate 80). In the Western Atlantic the genus *Malea* is known only from the Tertiary (cf. Woodring 1928, p. 311).

Genus **Malea** *Valenciennes*

Malea Valenciennes 1832 [in] Humboldt, Voy. Intér. Amér., Obs. Zool. **2**, p. 325 [we have not seen this paper].

Quimalea Iredale 1929, The Australian Zoologist **5**, p. 345 (genotype, *Buccinum pomum* Linné, original designation).

Genotype, *Malea latilabris* Valenciennes [=*Cassis ringens* Swainson], subsequent designation, Herrmannsen 1847, Indicis Generum Malacozoorum **2**, p. 13.

Shell medium to very large in size, subglobose, rather heavy and sculptured with strong spiral ridges. Axial sculpture consisting of fine growth lines. Parietal shield slightly to well-developed and reflected over a small umbilicus. Aperture moderate in size. Outer lip strongly crenulated, reflected and usually with a definite sulcus behind. Parietal lip with moderate to very strong lamellae grouped on the parietal area and again on the columella.

Photograph by F. P. Orchard

Plate 80. *Malea ringens* Swainson
Panama, west coast (natural size).

Genus **Eudolium** *Dall*

Doliopsis Monterosato 1872, Notizie Intorno alle Conchiglie Mediterranee, Palermo, p. 49[1]; *non* Vogt 1852, Conrad 1865.

Eudolium Dall 1889, Bulletin of the Museum of Comparative Zoölogy **18**, p. 20, 232.

Galeodolium Sacco 1891, Memorie Reale Accademia delle Scienze di Torino (2) **41**, p. 228.

Simplicodolium Sacco 1891, Memorie Reale Accademia delle Scienze di Torino (2) **41**, p. 237.

[1]We have not seen this paper. Dr. Giovanni Giorgi of Rome has kindly sent us the full reference as it occurs in this paper: "*Doliopsis crosseana*, Allery [di Monterosato] Jour. de Conchyl. 1869, p. 228 (Dolium)." This genus along with several others was not described by Monterosato but only indicated as above.

Tuberculodolium Sacco 1891, Memorie Reale Accademia delle Scienze di Torino (2) **41**, pt. 233.

Endolium 'Dall' Preston 1924, Zoological Record **60**, Mollusca, p. 42 [error for *Eudolium*].

Simplicidolium 'Sacco' Wenz 1941 [in] Schindewolf, Handbuch der Palaozoologie, Gastropoda Lief. 7, Bd. 6, p. 1076 [error for *Simplicodolium* Sacco].

Genotype, *Dolium crosseanum* Monterosato, monotypic.

Shell small to medium in size, subglobose, imperforate, and sculptured with strong spiral ridges. Axial sculpture absent or consisting of fine axial ribs. Shell rather thin though strong. Parietal shield slightly to well-developed. Aperture large, outer lip reflected. Periostracum deciduous, thin and light straw-yellow in color. Embryonic whorls rather large, smooth and dark horn color. Operculum lacking in the adult.

Eudolium crosseanum *Monterosato*, Plate 75, fig. 5; Plate 81, fig. 1–2

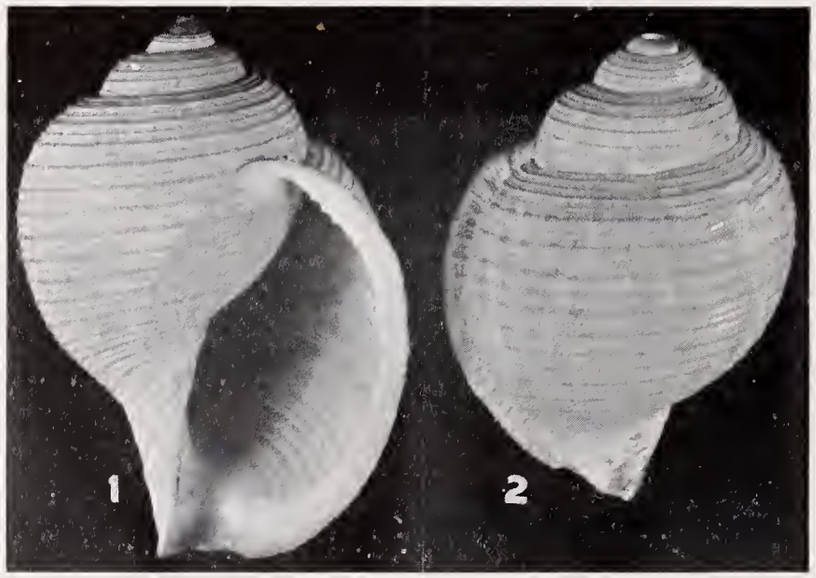
Dolium crosseanum Monterosato 1869, Journal de Conchyliologie **17**, p. 228, pl. 12, fig. 1.

Dolium bairdii Verrill and Smith 1881, American Journal of Science (3) **22**, p. 299 (*Fish Hawk*, station 945, N. Lat. 39°58′00″, W. Long. 71°13′00″, 84½ miles SW of Marthas Vineyard in 207 fathoms); Verrill 1884, Transactions of the Connecticut Academy of Arts and Sciences **6**, p. 253, pl. 29, fig. 2a–b.

Dolium bayrdi 'Verrill' Paetel 1888, Catalog de Conchylien-Sammlung **1**, p. 221 [error for *bairdii* Verrill and Smith].

Eudolium testardi 'Montrouzier' Osima[1] 1943, Conchologia Asiatica **1**, p. 132, pl. 4, fig. 3.

? *Eudolium lineatum* 'Schepman' Osima[2] 1943, Conchologia Asiatica **1**, pl. 5, fig. 1.



Photographs by F. P. Orchard

Plate 81. *Eudolium crosseanum* Monterosato

Fig. 1. *Fish Hawk*, station 1113, about 168 miles off Barnegat, New Jersey, in 192 fathoms. Fig. 2. *Atlantis*, station 3447, off Sagua la Grande, Las Villas, Cuba, in 375 fathoms; (both natural size).

[1]In the Manual of Conchology 1885 (1) **7**, p. 263 and 305, Tryon transposed his plate references to the figures of *Tonna testardi* Montrouzier and *Eudolium crosseanum* Monterosato. Osima, not aware of this error, figured *crosseanum* for *testardi* and placed it in the genus *Eudolium*.

[2]The specimen figured by Osima is not *lineatum* Shepman as figured in the Siboga-Expeditie Monograph **49**, 1 b, p. 124, pl. 10, fig. 5. Osima's figure compares very closely with *Eudolium crosseanum* and probably is that species. From the description and figure of *lineata* as given by Shepman it appears to be in the genus *Oocorys*.

Description. Shell moderately large, reaching about 81 mm. ($3\frac{1}{2}$ inches) in length, imperforate, thin but strong and with well-developed spiral ridges. Whorls 6, strongly convex and rather rapidly increasing in size. Color white to light cream with spiral ridges of straw-yellow. Aperture elliptical. Outer lip reflected and slightly thickened, its inner edge crenulated. Parietal area with a thin glaze through which the sculpture is visible. Spire moderately extended. Suture distinct. Anal canal slightly developed. Siphonal canal short, broad and a little recurved. Columella twisted and nearly vertical. Sculpture consisting of numerous coarse spiral ridges between which there may be from one to three fine thread-like cords. There are numerous very fine growth lines which cross the spiral ridges and cords. Periostracum thin and light yellow-brown in color. Embryonic whorls $2\frac{1}{2}$, smooth, large and with a dark horny periostracum.

	length	width	aperture	
(large)	81	56 [59]	62 x 28 mm.	Holotype,[1] off Palermo, Sicily
(large)	68	51	51 x 25	Holotype of *E. bairdii* Verrill and Smith
(average)	53	35	35 x 14	off Sagua la Grande, Las Villas, Cuba
(small)	33	22.5	25 x 12	off Charleston, South Carolina

Types. The type of *crosseanum* from off Palermo, Sicily is in the collection of T. Allery di Monterosato which is now in the University of Rome. The holotype of *D. bairdii* Verrill and Smith is in the United States National Museum no. 51385, from *Fish Hawk*, station 945 (N. Lat. 39°58′; W. Long. 71°13′) in 207 fathoms, $84\frac{1}{2}$ miles southwest of Marthas Vineyard [about 130 miles east of Barnegat, New Jersey].

Remarks. Eudolium crosseanum Monterosato has a very wide range of distribution and is probably quite common in some localities to judge by the number of specimens dredged by the *Fish Hawk* off New Jersey.

E. crosseanum is readily distinguished from others in the genus by its light weight, and characteristic sculpture which consists of spiral ridges alternating with thin spiral cords, both being crossed by very fine axial threads giving the shell a fine irregular reticulated appearance when examined with a 10x lens. Verrill and Smith in the original description of *D. bairdii* (*E. crosseanum*) have given a detailed account of the external anatomy of this species.

See also *Remarks* under the genus *Oocorys.*

Range. Eastern Atlantic: Mediterranean Sea, the Azores and south to South Africa. Western Atlantic: From off New Jersey south through the West Indies to the Barbados.

Records. New Jersey: about 190 miles off Barnegat in 180–190 fathoms (J. Miller); *Fish Hawk*, station 945, about 130 miles off Barnegat (N. Lat. 39°58′; W. Long. 71°13′) in 207 fathoms[2]; *Fish Hawk*, station 1036, about 220 miles off Barnegat (N. Lat. 39°58′; W. Long. 69°30′) in 94 fathoms; *Fish Hawk*, station 1113, about 168 miles off Barnegat (N. Lat. 39°57′; W. Long. 70°37′) in 192 fathoms; *Fish Hawk*, station 1097, about 200 miles off Barnegat (N. Lat. 39°54′; W. Long. 69°44′) in 158 fathoms (all USNM); *Fish*

[1] Measurements as given by Monterosato in the original description.

[2] Though the *Fish Hawk* station records were given as off Marthas Vineyard, they were always to the south. It has been the policy in *Johnsonia* to associate all off-shore dredging stations with a locality on the coast in approximately the same latitude.

Hawk, station 1046, about 85 miles off Cape May (N. Lat. 38°33′; W. Long. 73°18′) in 104 fathoms (Peabody Museum, Yale University). VIRGINIA: *Albatross*, station 2264, about 80 miles off Norfolk (N. Lat. 37°07′50″; W. Long. 74°34′20″) in 167 fathoms (USNM). NORTH CAROLINA: *Albatross*, station 2601, about 50 miles off Cape Lookout (N. Lat. 34°39′15″; W. Long. 75°33′30″) in 107 fathoms (USNM). SOUTH CAROLINA: *Albatross*, station 2314, about 100 miles off Charleston (N. Lat. 32°43′; W. Long. 77°51′) in 159 fathoms; *Albatross*, station 2676, about 145 miles off Charleston (N. Lat. 32°39′; W. Long. 77°01′) in 407 fathoms (both USNM). FLORIDA: *Atlantis*, station 3779, about 80 miles off Jacksonville (N. Lat. 30°21′; W. Long. 79°55′) in 230–250 fathoms (MCZ); *Albatross*, station 2665, about 65 miles off St. Augustine (N. Lat. 29°47′; W. Long. 80°05′45″) in 263 fathoms (USNM); about 5 miles east of Carysfort Light, Key Largo in 96–107 fathoms; about 7½ miles N. E. of Sombrero Light, Key Largo in 20 fathoms [fragments] (both L. A. Burry). CUBA: *Blake*, station 16, off Habana (N. Lat. 23°11′; W. Long. 82°23′) in 292 fathoms; *Atlantis*, station 3447 and 3448, off Sagua la Grande, Las Villas (N. Lat. 23°21′; W. Long. 79°55′) in 375–380 fathoms; *Atlantis*, station 3376, off Puerto Tanamo, Oriente (N. Lat. 20°47′; W. Long. 75°11′) in 450 fathoms; *Atlantis*, station 3414, off Punta Alegre, Camagüey (N. Lat. 22°50′31″; W. Long. 78°52′) in 230 fathoms (all MCZ). LESSER ANTILLES: *Blake*, station 192, off Dominica (N. Lat. 15°17′20″; W. Long. 61°24′22″) in 138 fathoms; *Blake*, station 238, off the Grenadines (N. Lat. 12°46′10″; W. Long. 61°23′35″) in 127 fathoms; *Blake*, station 291, off Barbados (N. Lat. 13°12′; W. Long. 59°41′) in 210 fathoms; *Blake*, station 273, off Barbados (N. Lat. 13°03′05″; W. Long. 59°36′18″) in 103 fathoms (all MCZ).

* * * *

Frederico Sacco (1891, pp. 225–241) has described a number of species and subspecies from the Tertiary of Italy.

So far as we can trace, three other species of recent *Eudolium* have been described and two of these, namely *aulacodes* Tomlin and *solidior* Dautzenberg and Fischer may eventually be found in the Western Atlantic. We include references to all to complete the record. From the published description and figures *aulacodes* Tomlin and *solidior* Dautzenberg and Fischer appear to be very close in their relationship to each other and they may both eventually prove to be in the genus *Oocorys*.

Eudolium solidior *Dautzenberg and Fischer*

Dolium (*Eudolium*) *crosseanum* var. *solidior* Dautzenberg and Fischer 1906, Resultats des Campagnes Scientifiques de Monaco, Fasc. 32, p. 38, pl. 3, fig. 1 (Princesse Alice, station 866, Açores [Azores] in 599 meters).

Eudolium aulacodes *Tomlin*

Eudolium aulacodes Tomlin 1927, Annals of the South African Museum **25**, pt. 1, p. 83, fig. 4a (Cape Point, N. E. 40 miles in 560 to 700 fathoms).

Eudolium pyriforme *Sowerby*

Dolium pyriforme Sowerby 1914, Annals and Magazine of Natural History (8) **14**, p. 37, pl. 2, fig. 14 (Kii, Japan).

Subfamily **Oocorythinae**

Shell retaining the operculum in the adult, lacking basal denticles on the rachidian teeth of the radula and having a smaller protoconch.

Genus **Oocorys** *Fischer*

Oocorys Fischer 1883, Journal de Conchyliologie **31**, p. 392.

Genotype, *Oocorys sulcata* Fischer, monotypic.

Shell small to medium in size, elliptical to globose, imperforate or perforate or, rarely, with a minute umbilicus formed by the non-adherence of the parietal shield to the columella. Sculpture consisting of well-developed spiral ridges with the axial sculpture absent or ranging from fine growth lines to fine ribs. Parietal shield slightly to well-developed. Aperture large, outer lip generally reflected. Periostracum thin, deciduous. Embryonic whorls or protoconch rather small and devoid of sculpture. Operculum chitinous and paucispiral.

There has been considerable controversy as to the relationship of the genus *Oocorys*. We agree with Watson (1886, p. 412) in placing this genus in the family Tonnidae and not in the Cassididae or in a separate family, the Oocorythidae,[1] as it appears to be most closely related to the genus *Eudolium*. When Fischer created the family Oocorythidae he stated that he was uncertain as to its affinities but thought it was most closely related to the Tritonidae [Cymatiidae]. Watson, however, included the genus in the family Doliidae [Tonnidae] and Tryon states that, considering the shell characters, it is essentially an operculated *Dolium* [*Tonna*]. Dall (1907, p. 67) places *Oocorys* in the family Cassididae close to *Galeodea* and *Sconsia* on the basis of the small protoconch, the presence of the operculum, and the lack of basal denticles on the rachidian teeth of the radula. However, the presence of an operculum in adult *Oocorys* is perhaps not so great a difference as it at first appears for it has been known for some time that the young of *Tonna* possess an operculum that is lost in the adult stage. From the information now available the presence of basal denticles on the rachidian teeth of the radula does not appear to be of family significance. According to Trochel (1856–1863, Pl. 19), there are several species of *Ranella* [*Bursa*] which possess basal denticles on the rachidian teeth and in all other respects so closely resemble the radula of *Dolium* [*Tonna*] *perdix* Linné that they would appear to belong to the same genus. Consequently, the lack of these basal denticles hardly seems sufficient to exclude *Oocorys* from the *Tonnidae*. Though the protoconch of *Oocorys* is small it is very similar to that of *Eudolium* from which the periostracum has been removed. We have in our collection two fine specimens of *Sconsia striata* Lamarck which have perfect protoconchs still covered with periostracum and resembling very closely those of *Tonna* and *Eudolium*. When more is known of the genera *Dalium* and *Sconsia* it may well be that they will be placed in the *Tonnidae*. The shell characters of *Oocorys* are much closer to those of *Eudolium* than to those of any other known genus. Until sufficient material is available for a complete anatomical study of the entire Tonnacea it seems best to place *Oocorys* in the Tonnidae.

The genus *Oocorys* differs from *Eudolium* by having smaller embryonic whorls, by possessing an operculum in the adult and by having a slightly heavier shell. The radula

[1] Not Oocoritidae as occasionally spelled.

of *Oocorys* lacks the two accessory denticles on the basal plate of the rachidian teeth which are present in *Endolium* (Plate 75, fig. 6–7). *Oocorys* has been dredged in far greater depths than has *Endolium*.

Subgenus **Oocorys** *Fischer*

Oocorys Fischer 1883, Journal de Conchyliologie **31**, p. 392.

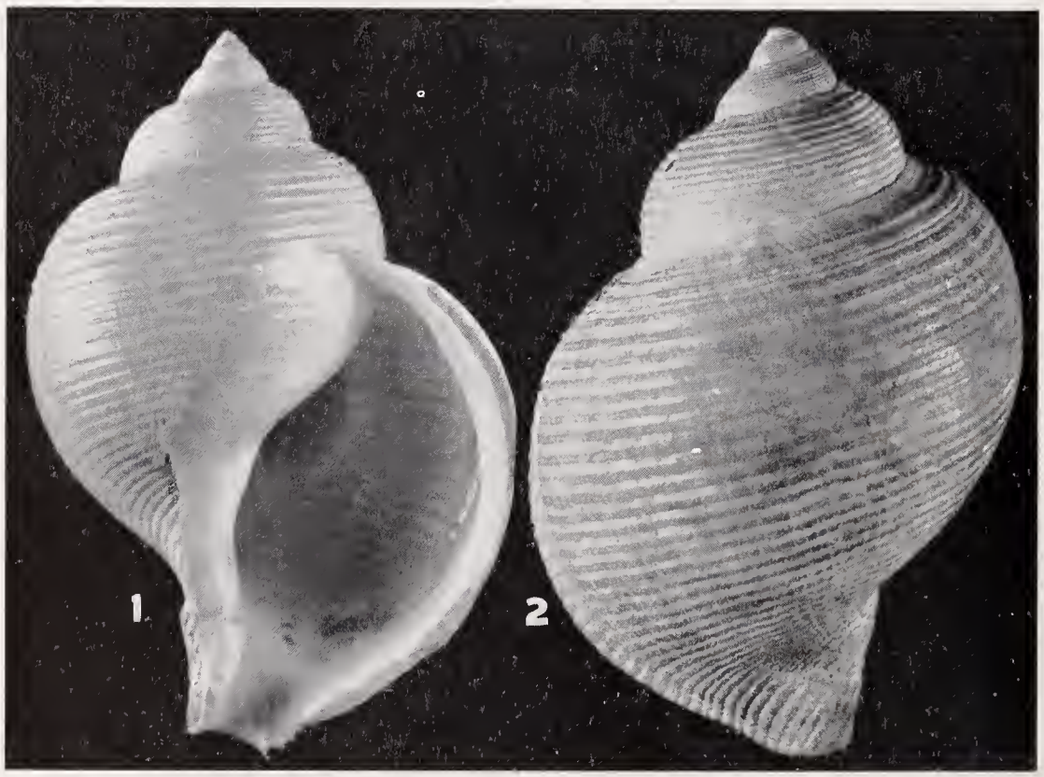
Subgenotype, *Oocorys sulcata* Fischer, monotypic.

Shell rather thin but strong, porcellaneous, imperforate or, rarely, with a slight indication of an umbilicus due to the non-adherence of the parietal shield to the columella. Sculpture consisting of well developed spiral ridges with the axial sculpture ranging from fine growth lines to rather coarse axial ribs. Parietal shield moderately to well-developed. Aperture elliptical to ovate. Outer lip reflected and generally thickened. Embryonic whorls small. Periostracum very thin, deciduous. Operculum paucispiral. The radula of only one species of *Oocorys* ss. (*O. bartschi* Rehder) is known but this differs from that of *Oocorys* (*Benthodolium*) *abyssorum* Verrill and Smith in lacking the two lobes on the basal plate of the rachidian tooth (Plate 75, fig. 7).

Oocorys (Oocorys) bartschi *Rehder*, Plate 75, fig. 7, 9–10; Plate 82, fig. 1–2

Oocorys bartschi Rehder 1943, Proceedings of the United States National Museum **93**, no. 3161, p. 197, pl. 10, fig. 16 (off Tortugas, Florida).

Description. Shell large, reaching about 111 mm. (about $4\frac{1}{4}$ inches) in length, thin but strong, imperforate and sculptured by rather coarse flattened spiral ridges. Whorls 7,



Photographs by F. P. Orchard

Plate 82. *Oocorys bartschi* Rehder

Fig. 1. From off Tortugas, Florida (Holotype). Fig. 2. Florida (both reduced from $4\frac{1}{2}$ inches).

strongly convex and regularly increasing in size. Shell a pale flesh color. Aperture elliptical. Outer lip reflected, only slightly thickened and crenulated, these crenulations appearing more as gentle undulations. Parietal area with a thin glaze through which the sculpture is visible. Along the columella the inner lip becomes somewhat thickened. Spire moderately extended. Anal canal lacking. Siphonal canal short, broad and slightly recurved. Suture distinct but not indented. Sculpture consisting of rather broad, flattened spiral ridges which are crossed by numerous very fine axial growth lines. There are 37 broad ribs on the body whorl of the holotype. Whorls slightly shouldered, the first broad rib being set at some distance from the suture. Embryonic whorls smooth, white. Operculum chitinous, ovate, paucispiral and with a very large muscle scar covering most of the inner surface.

length	width	aperture	
111.7	71.7	75 x 33.5 mm.	Holotype

Types. Holotype, United States National Museum no. 535689, from off Tortugas, Florida in 79 to 140 fathoms, Dr. W. L. Schmitt, collector.

Remarks. Oocorys bartschi Rehder is by far the largest species so far known in the genus. It appears to be most closely related to *O. sulcata* and *O. barbouri*, and is readily distinguished from both these forms by being nearly three times as large and by having a slightly crenulated outer lip. From *O. sulcata* it is further differentiated by having broad flattened spiral ridges and flesh coloration. It differs from *O. barbouri* in being more globose, in having a uniform coloration and in lacking the beading on the whorl shoulder. The operculum of *O. bartschi* is much heavier than that of *O. sulcata* and has a very large padded muscle scar whereas the muscle attachment of *sulcata* is small and inconspicuous.

Range and Records. Known only from the type locality. See under *Types.* One additional paratype specimen in the collection of the National Museum is labeled only Florida.

Oocorys (Oocorys) barbouri *Clench and Aguayo*, Plate 83, fig. 1–2

Oocorys barbouri Clench and Aguayo 1939, Memorias de la Sociedad Cubana de Historia Natural **13**, no. 3, p. 193, pl. 29, fig. 2 (off Sagua la Grande, Las Villas, Cuba in 280–300 fathoms).

Description. Shell reaching about 50 mm. (2 inches) in length, strong, imperforate and sculptured with numerous well-marked spiral ridges. Whorls 7, moderately convex and regularly increasing in size. Color white with a broad pinkish-brown band extending from the suture to below the periphery. Aperture elliptical. Outer lip smooth, reflected and moderately thickened. Parietal shield well-developed, forming a fold over the columella. Spire extended. Anal canal lacking. Siphonal canal short, broad and slightly recurved. Suture distinct, whorls shingled. Sculpture consisting of flattened spiral ridges which are crossed by exceedingly fine growth lines. There are 28 flattened ridges on the body whorl of the holotype. Whorls slightly shouldered, the ridge margining the shoulder finely beaded. Embryonic whorls smooth. Operculum unknown.

length	width	aperture	
50	29	34 x 16 mm.	Holotype
48.5	29	32 x 15	Paratype

Types. Holotype, Museum of Comparative Zoölogy no. 135055, *Atlantis*, station no. 2987 (N. Lat. 23°22′; W. Long. 79°53′) off Sagua la Grande, Cuba in 280–300 fathoms. Two paratypes from the same region, *Atlantis*, stations 3451 and 3437, are in the Museum of Comparative Zoölogy and the Museo Poey, Habana, Cuba.

Remarks. This species differs from others in the genus by its more attenuated shape, by its pinkish-brown color band and by the beading on the shoulder of the whorls. See *Remarks* under *bartschi.*

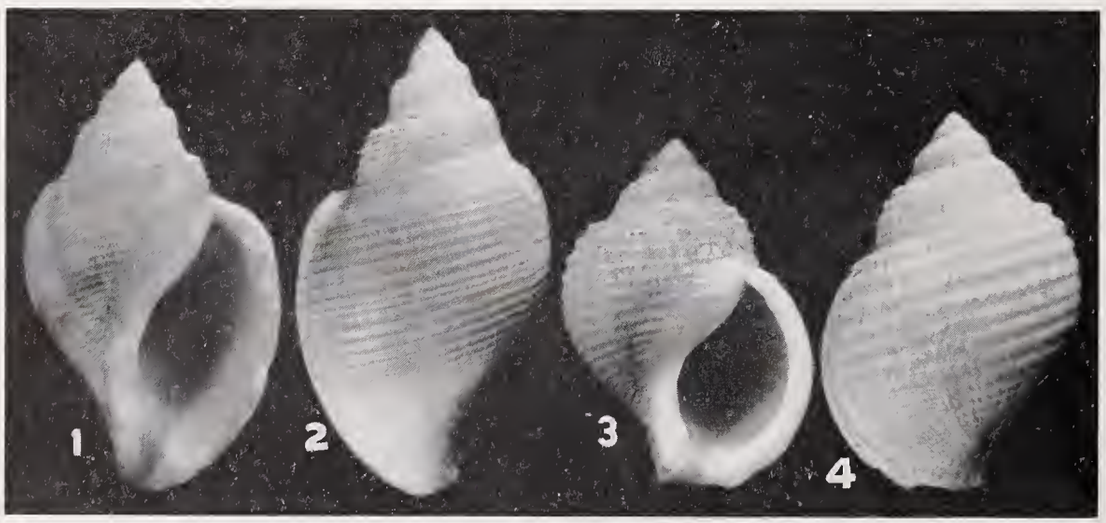
Range. Known only from off northern Cuba.

Records. The following station records are all from the dredgings of the *Atlantis.* Cuba: station 2987 (N. Lat. 23°22′; W. Long. 79°53′) in 280–300 fathoms; station 3541 (N. Lat. 23°20′; W. Long. 79°59′) in 405 fathoms; station 3437 (N. Lat. 23°05′; W. Long. 79°32′) in 260 fathoms—all off Sagua la Grande, Las Villas (all MCZ and Museo Poey); station 3359 (N. Lat. 20°38′; W. Long. 74°32′) from off Baracoa in 1000 fathoms (MCZ).

Oocorys (Oocorys) caribbaea *Clench and Aguayo,* Plate 83, fig. 3–4

Oocorys sulcata caribbaea Clench and Aguayo 1939, Memorias de la Sociedad Cubana de Historia Natural **13,** no. 3, p. 192, pl. 29, fig. 3 (from off Bahía de Corrientes, Pinar del Río, Cuba in 615 fathoms).

Description. Shell reaching 35 to 40 mm. (about 1½ inches) in length, rather thin but strong, imperforate and with coarsely sculptured beaded spiral ridges. Whorls 6, strongly convex and regularly increasing in size. Color ivory-yellow. Aperture elliptical and constricted toward the posterior end. Outer lip smooth, reflected, moderately thickened and with a slight sulcus behind. Parietal area with a thin glaze through which the sculpture is visible. Spire moderately extended. Anal canal lacking, siphonal canal short, broad and slightly recurved. Suture distinct but not indented. Sculpture consisting of coarse spiral ridges which are crossed by flattened axial threads giving the effect of a



Photographs by F. P. Orchard

Plate 83. Fig. 1–2. *Oocorys barbouri* Clench and Aguayo, from off Sagua la Grande, Las Villas, Cuba (Holotype). Fig. 3–4. *Oocorys caribbaea* Clench and Aguayo, from off Bahía de Corrientes, Pinar del Río, Cuba (Holotype; both natural size).

beaded, reticulated surface. There are 20 spiral ridges on the body whorl of the holotype. Whorls shouldered, the first ridge being set at some distance from the suture. Axial ribs showing rather distinctly over the shoulder. Embryonic whorls $2\frac{1}{2}$, small, smooth. Periostracum thin, a very light straw-yellow. Operculum unknown.

length	width	aperture	
41	29	21 x 12.5 mm.	Holotype
34	25.5	18 x 10.5	Paratype
47	34	25 x 15	"

Types. Holotype, Museum of Comparative Zoölogy no. 135072, from *Atlantis*, station 2953 (N. Lat. 21°47′30″; W. Long. 84°32′30″), from off Bahía de Corrientes, Pinar del Río, Cuba in 615 fathoms. Paratypes from this locality and from off southeastern Oriente Province, Cuba in 1600 to 1800 fathoms are in the Museum of Comparative Zoölogy and the Museo Poey.

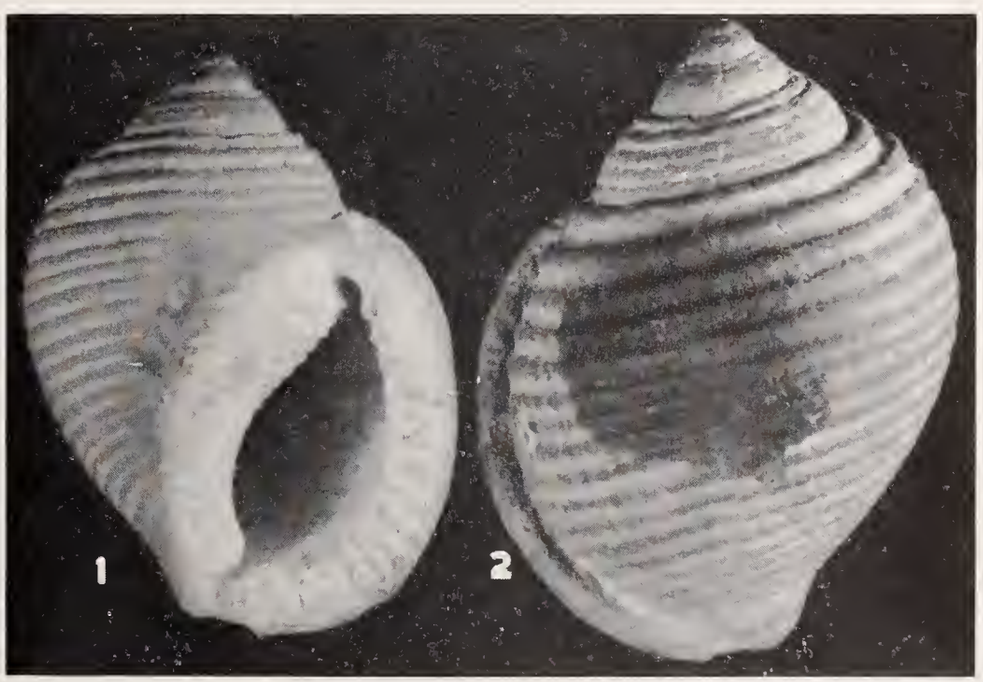
Remarks. *Oocorys caribbaea* is not closely related to any of the Western Atlantic species and can readily be differentiated by its strong reticulated sculpture. *O. sulcata cancellata* Dautzenberg and Fischer may be very close to this species but unfortunately was not figured.

Range. West Indies.

Records. Cuba: *Atlantis*, station no. 2953 from off Bahía Corrientes, Pinar del Río (N. Lat. 21°47′30″; W. Long. 84°32′30″) in 615 fathoms; *Atlantis*, station 2970 from off the southeastern coast of Oriente Province, about 40 miles east of Guantánamo (N. Lat. 19°51′; W. Long. 74°26′) in 1600 to 1800 fathoms. Caribbean Islands: *Blake*, station 111, off Navassa Island (N. Lat. 19°05′55″; W. Long. 74°49′05″) in 1200 fathoms.

Oocorys (Oocorys) verrillii *Dall*, Plate 84, fig. 1–2

Dolium (*Eudolium*) *verrillii* Dall 1889, Bulletin Museum of Comparative Zoölogy **18**, p. 233, pl. 35, fig. 12 (*Albatross*, station 2120, from off Grenada in 73 fathoms).



Photographs by F. P. Orchard

Plate 84. *Oocorys verrillii* Dall
From off Grenada, Lesser Antilles (Holotype; 2x).

Description. Shell reaching about 33 mm. (1¼ inches) in length, imperforate, heavy and solid, with coarsely sculptured spiral ribs. Whorls 5, moderately convex and regularly increasing in size. Color a dull grayish-white [dead specimen]. Aperture elliptical but constricted toward the posterior end. Outer lip greatly thickened, reflected backwards, with a deep sulcus behind. The inner edge of the outer lip with low ridges which run back a short distance within the aperture. Inner lip and parietal area thickened by a heavy callus or parietal shield which is marked with numerous ridges which run back within the aperture. Anal canal short but well defined. Siphonal canal narrow, deep and set obliquely. Spire moderately extended. Suture slightly indented. Columella arched to the left. Spiral sculpture consisting of coarse and rather evenly-spaced ridges, there being 19 on the body whorl. These ridges decrease in size and are more closely spaced near the base of the body whorl. Axial sculpture barely visible on the single worn specimen but apparently consisting of very fine growth lines. Embryonic whorls small and smooth.

length	width	aperture	
32.5	23.6	17 x 8 mm.	Holotype[1]

Types. Holotype, United States National Museum no. 87208, *Albatross*, station 2120, from off Grenada (N. Lat. 11°07′; W. Long. 62°14′30″) in 73 fathoms.

Remarks. We are including *verrillii* in the genus *Oocorys* because of its small protoconch, strongly developed parietal shield and its much heavier shell. It does not appear to be closely related to any species in the Western Atlantic and is readily differentiated by its heavy shell, very coarse spiral ridges, strongly crenulated and greatly thickened outer lip, thick, ridged parietal shield and marked anal canal.

After examining the single specimen of *verrillii* it does not appear that the suture is "deeply channelled" as stated by Dall in his original description. The suture is only slightly indented but as it is built on one of the spiral ridges it gives a false impression of depth to the suture. The transverse sculpture mentioned by Dall is barely visible in the holotype, though it may well be that in a fresh specimen this character would be more apparent.

Range and Records. Known only from the type locality, see under *Types.*

Oocorys (Oocorys) sulcata *Fischer*, Plate 75, fig. 8; Plate 85, fig. 1–2

Oocorys sulcata Fischer 1883, Journal de Conchyliologie **31**, p. 392 (coast of Sahara; Sénégal; Azores in 1258 to 3655 meters); Watson 1886, Report of the Scientific Results of H. M. S. Challenger **15**, p. 412, pl. 17, fig. 11; Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusques Testacés **1**, p. 288.

Oocorys sulcata var. *minor* Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusques Testacés **1**, p. 290 (no definite locality given—from off the northwest coast of Africa and the Azores).

Oocorys sulcata var. *elongata* Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusqes Testacés **1**, p. 291 (no definite locality given—off the northwest coast of Africa).

Description. Shell reaching about 51 mm. (2 inches) in length, thin but strong, imperforate or very rarely with a slight indication of an umbilicus due to the non-adherence of

[1] Dall's measurement of 22 mm. for the length of the aperture includes the thickness of the lip at both ends of the aperture.

the parietal shield to the columella, and sculptured with numerous fine spiral ridges. Whorls 5, convex and regularly increasing in size. Shell white with a light ivory-colored periostracum. Aperture ovate. Outer lip smooth, slightly to moderately reflected and, in adults, moderately thickened. Parietal area with a medium glaze through which the sculpture is visible. Along the columella the parietal shield is a little more thickened and, rarely, slightly free for a short distance over the columella. Anal canal lacking. Siphonal canal very short, broad and oblique. Suture distinct though not impressed. Sculpture consisting of rather fine but clearly defined spiral ridges which are crossed by numerous very fine growth lines. There are 26 to 30 spiral ridges on the body whorl. Whorls slightly shouldered, subglobose. Embryonic whorls $2\frac{1}{2}$, small and smooth. Periostracum a very light ivory and deciduous. Opereulum chitinous, paucispiral.

length	width	aperture	
51	35	31 x 17 mm.	off Cape Hatteras, North Carolina
39	26	21 x 12	off Guadeloupe, Lesser Antilles
28.5	20	15 x 9.5	off Charleston, South Carolina

Types. The types of *Oocorys sulcata* are probably in the collection of the Paris Museum. As Fiseher apparently had at least three lots in the original series we here restrict the type locality to off Sénégal.

Remarks. Oocorys sulcata Fiseher is most elosely related to *O. bartschi* Rehder from which it is readily distinguished by its mueh smaller size, its narrow rather than flattened spiral ridges, smooth outer lip, and by being white rather than flesh-colored.

From *O. abyssorum* with whieh it has been so often eonfused, it is differentiated by being less globose, imperforate, having a more refleeted and thickened outer lip, much finer growth lines, a much thinner, lighter periostracum and a more porcellaneous shell.

Oocorys sulcata has been dredged in depths ranging from 88 to 2512 fathoms in the Western Atlantic.

Range. Western Atlantic: from Cape Hatteras, North Carolina south through the West Indies to Grenada. Eastern Atlantic: The Azores and off the northwest eoast of Africa. J. R. le B. Tomlin has reported *O. sulcata watsoni* Loeard from Cape Town, South Africa.

Records. North Carolina: *Albatross*, station 2225, 280 miles off Cape Hatteras (N. Lat. 36°05′30″; W. Long. 69°51′45″) in 2512 fathoms (Peabody Museum, Yale University). South Carolina: *Albatross*, station 2678, about 165 miles off Charleston (N. Lat. 32°40′; W. Long. 76°40′30″) in 731 fathoms; *Albatross*, station 2677, about 155 miles off Charleston (N. Lat. 32°39′; W. Long. 76°50′30″) in 478 fathoms (both USNM). Cuba: *Atlantis*, station 3344, off Cienfuegos (N. Lat. 21°38′; W. Long. 80°12′) in 1440 fathoms (MCZ). Lesser Antilles: *Blake*, station 173, off Guadeloupe in 734 fathoms (MCZ); *Albatross*, station 2751, south of St. Kitts (N. Lat. 16°54′; W. Long. 63°12′) in 687 fathoms (USNM); *Blake*, station 227, off St. Vincent (N. Lat. 13°10′10″; W. Long. 61°18′15″) in 573 fathoms; *Blake*, station 232, off St. Vincent (N. Lat. 13°06′45″; W. Long. 61°06′55″) in 88 fathoms (both MCZ); *Blake*, station 268, off Grenada (N. Lat. 12°07′15″; W. Long. 61°50′50″) in 955 fathoms (USNM).

Subgenus **Benthodolium** *Verrill and Smith*

Benthodolium Verrill and Smith 1884, Transactions of the Connecticut Academy of Arts and Sciences **6**, pt. 1, p. 177.

Subgenotype, *Benthodolium abyssorum* Verrill and Smith, monotypic.

Shell thin, chalky and not very strong, umbilicated or, rarely, with the umbilicus nearly closed by the parietal shield. Sculpture consisting of numerous well-developed spiral ridges which are crossed by numerous fine growth lines. Embryonic whorls small, devoid of sculpture. Operculum chitinous, paucispiral. Periostracum thin, deciduous. Radula similar to that of *O. bartschi*, but with two lobes on the basal plate of the rachidian tooth (Plate 75, fig. 6).

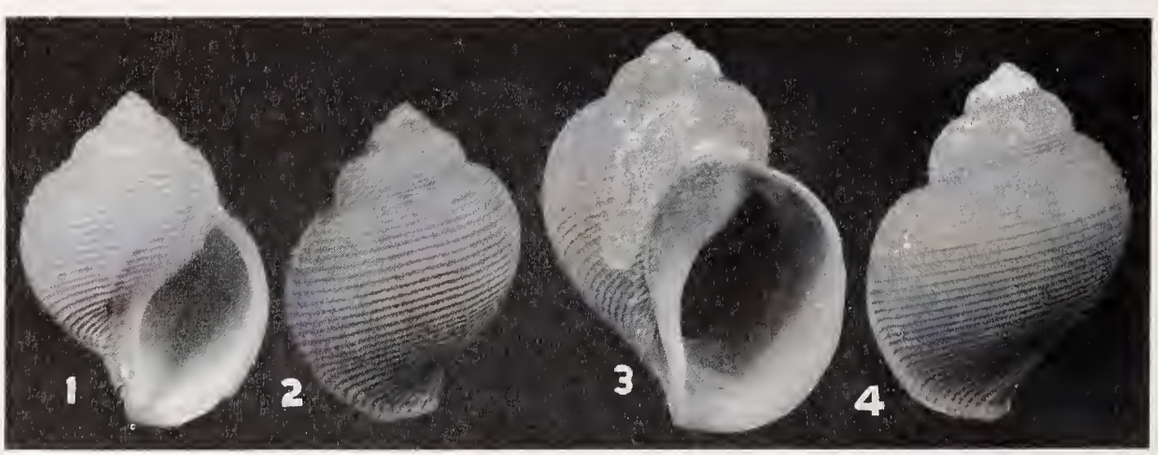
Verrill and Smith in the original description of the genus state that there is no umbilicus, but in the specific description of *abyssorum* it is mentioned and the type specimen is definitely umbilicated; only rarely does the parietal shield develop so as nearly to close the umbilicus.

Oocorys (Benthodolium) abyssorum *Verrill and Smith*

Plate 75, fig. 6, 11–12; Plate 85, fig. 3–4

Benthodolium abyssorum Verrill and Smith 1884, Transactions of the Connecticut Academy of Arts and Sciences **6**, pt. 1, p. 117, pl. 31, fig. 12a–b (*Albatross*, station 2098, from off Cape Charles, Virginia, in 2221 fathoms).

Description. Shell reaching about 45 mm. (about $1\frac{3}{4}$ inches) in length, thin and rather chalky, umbilicate and sculptured with numerous fine spiral ridges. Whorls 5, strongly convex and rather rapidly increasing in size. Shell white with a brownish-yellow periostracum which is deciduous. Aperture ovate. Outer lip smooth, thin and only very slightly reflected. Parietal area with a light to moderately heavy glaze through which the sculpture is barely visible in some specimens. In adults the parietal shield is somewhat thickened and extends as a free fold the length of the columella. Spire moderately extended. Anal canal lacking. Siphonal canal very short and broad. Suture impressed. Sculpture consisting of 30 to 35 very narrow but clearly defined spiral ridges which are crossed by numerous growth lines, giving the shell a fine reticulated appearance when ex-



Photographs by F. P. Orchard

Plate 85. Fig. 1–2. *Oocorys sulcata* Fischer. Fig. 1. From off Guadeloupe. Fig. 2. From off Grenada, Lesser Antilles. Fig. 3–4. *Oocorys* (*Benthodolium*) *abyssorum* Verrill and Smith. From off Cape Charles, Virginia. Fig. 3. Holotype (all natural size).

amined with a 10x lens. Whorls shouldered and very globose. Embryonic whorls $2\frac{1}{2}$, small and devoid of sculpture. Operculum thin, chitinous and paucispiral.

length	width	aperture	
47	35	30 x 18 mm.	Holotype
40.5	31	25 x 16.5	off Cape Charles, Virginia
36.5	27.5	22 x 14	" " " "

Types. Holotype, United States National Museum no. 35273, from *Albatross*, station 2098, from off Cape Charles, Virginia (N. Lat. 37°40′30″; W. Long. 70°37′30″) in 2221 fathoms.

Remarks. Though *Oocorys abyssorum* has often been confused with *O. sulcata* Fischer it is readily differentiated from it by being umbilicated and more globose, by having a thin and only very slightly reflected outer lip and by being a thinner, more fragile shell with a more conspicuous periostracum.

Range. From off New Jersey south through Virginia, with one specimen from the Gulf of Mexico off Pensacola, Florida.

Records. New Jersey: *Albatross*, station 2196, about 220 miles off Atlantic City (N. Lat. 39°35′; W. Long. 69°44′) in 1230 fathoms (USNM); *Albatross*, station 2221, about 200 miles off Cape May (N. Lat. 39°05′30″; W. Long. 70°44′30″) in 1525 fathoms (Peabody Museum, Yale University). Maryland: *Albatross*, station 2714, about 220 miles off Ocean City (N. Lat. 38°22′; W. Long. 70°17′30″) in 1825 fathoms. Virginia: *Albatross*, station 2098 (N. Lat. 37°40′30″; W. Long. 70°37′30″) in 2221 fathoms; *Albatross*, station 2229 (N. Lat. 37°38′40″; W. Long. 73°16′30″) in 1423 fathoms; *Albatross*, station 2566 (N. Lat. 37°23′; W. Long. 68°08′) in 2620 fathoms; *Albatross*, station 2226 (N. Lat. 37°00′; W. Long. 70°54′) in 2021 fathoms—all off Cape Charles (all USNM). Florida: *Albatross*, station 2400, off Pensacola (N. Lat. 28°41′; W. Long. 86°07′) in 169 fathoms (USNM).

* * * *

The list given below includes the remaining species of recent *Oocorys;* species described as such or recognized as belonging to this genus. No attempt is made to allocate these species to subgenera.

Oocorys alcocki *Smith*

Morio alcocki Smith 1906, Annals and Magazine of Natural History (7) **18**, p. 170 (*Investigator*, station 280, from off the Coromandel Coast [India]; N. Lat. 11°29′45″; E. Long. 80°02′30″ in 446 fathoms); Shepman 1909, Siboga-Expeditie Monograph 49b, Prosobranchia, pt. 2, p. 124, pl. 10, fig. 6.

Oocorys sulcata var. cancellata *Dautzenberg and Fischer*

Oocorys sulcata var. *cancellata* Dautzenberg and Fischer 1897, Memoire de la Société Zoologique de France **10**, p. 162 (*Princesse Alice*, station 90, off the Azores in 1600 meters).

Oocorys elevata *Dall*

Oocorys elevata Dall 1908, Bulletin Museum of Comparative Zoölogy **43**, no. 6, p. 322. pl. 8, fig. 9 (*Albatross*, station 4649, between the Galápagos Islands and Sechura Bay, Peru, S. Lat. 5°17′; W. Long. 85°20′, in 2235 fathoms).

Oocorys fischeri *Locard*

Oocorys fischeri Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusques Testacés **1**, p. 291 (*Talisman*, 38, 76, 78 and 291 from off Morocco, Soudan and between Pico and St. George Islands, in the Azores).

Oocorys fischeri var. *minor* Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusques Testacés **1**, p. 292 (no definite locality given—from off the northeast coast of Africa and the Azores).

Oocorys granulosa *Schepman*

Morio granulosa Schepman 1909, Siboga-Expeditie Monograph 49b, Prosobranchia, pt. 2, p. 123, pl. 10, fig. 4 (*Siboga*, station 316 [Java Sea], S. Lat. 7°19′; E. Long. 116°39′, in 538 meters).

Oocorys sulcata var. indica *Smith*

Oocorys sulcata var. *indica* Smith 1906, Annals and Magazine of Natural History (7) **18**, p. 170–171 (*Investigator*, station 278, off the south of Ceylon in 1912 fathoms).

Oocorys lineata *Schepman*

Morio lineata Schepman 1909, Siboga-Expeditie Monograph 49b, Prosobranchia, pt. 2, p. 124, pl. 10, fig. 5 (*Siboga*, station 173, Ceram Sea, S. Lat. 3°27′; E. Long. 131°05′, in 567 meters).

Oocorys pacifica *Dall*

Bathodolium pacifica Dall 1895, Proc. United States National Museum **18**, p. 11 (*Albatross*, station 3375 from near Malpelo Island, Gulf of Panama in 1201 fathoms. Holotype, United States National Museum no. 123031); Dall 1908, Bulletin Museum of Comparative Zoölogy **43**, no. 6, p. 323, pl. 4, fig. 7.

Oocorys rotunda *Dall*

Oocorys rotunda Dall 1908, Bulletin Museum of Comparative Zoölogy **43**, no. 6, p. 322, pl. 4, fig. 9 (*Albatross*, station 3360, Gulf of Panama in 1672 fathoms. Holotype, United States National Museum no. 123029).

Oocorys schepmani, new name

Oocorys elongata Schepman 1909, Siboga-Expeditie Monograph 49b, Prosobranchia, pt. 2, p. 121, pl. 10, fig. 3 (*Siboga*, station 221, from the Banda Sea, S. Lat. 6°24′; E. Long. 124°39′, in 2798 meters); *non O. sulcata* var. *elongata* Locard 1897.

Oocorys watsoni *Locard*

Oocorys watsoni Locard 1897, Expéditions Scientifiques du Travailleur et du Talisman, Mollusques Testacés **1**, p. 290; Watson 1886, Voyage of H.M.S. Challenger **15**, pp. 412, pl. 17, fig. 11 (*Challenger*, station 106, Mid-Atlantic, N. Lat. 1°47′; W. Long. 24°26′, in 1850 fathoms).

This species was named by Locard from the description and figure of a specimen obtained by the *Challenger* and identified by Watson as *Oocorys sulcata* Fischer. More material is necessary before the species complex of the Eastern Atlantic can be clearly understood.

Oocorys weberi *Schepman*

Oocorys weberi Schepman 1909, Siboga-Expeditie, Monograph 49b, Prosobranchia, pt. 2, p. 120, pl. 10, fig. 2 (*Siboga*, station 175, from the Ceram Sea, S. Lat. 2°37′; E. Long. 130°33′, in 1914 meters).

Buccinum (?) *aquilarum* Watson 1882, Journ. Linnean Soc. London **16**, p. 359; Watson 1886, The Voyage of H.M.S. Challenger **15**, pp. 212–213, pl. 13, fig. 4 (*Challenger*, station 78, from off San Miguel, Azores: N. Lat. 39°26′; W. Long. 25°13′, in 1000 fathoms).

This species has been referred to the genus *Oocorys* by Dautzenberg, Locard and Dall, but J. R. leB. Tomlin (1927, p. 81) who has examined the type in the British Museum agrees with E. A. Smith who has placed it in the family Cancellariidae and states that it probably belongs in the genus *Admete*.

* * * *

I am most grateful to Harald Rehder of the United States National Museum and Percy Morris of Peabody Museum, Yale University for the loan of their collections. I am particularly indebted to William J. Clench, under whose guidance this work was done, and to Merrill E. Champion who was so helpful in reading manuscript and proof.

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BIBLIOGRAPHY

Alcasid, G. 1936: Philippine Journal of Science **61**, no. 4, pp. 489–498, pl. 1–2.

Bayer, C. 1937: Zoologische Mededeelingen **20**, p. 29–50, 1 plate.

Bergh, R. 1904: [in] C. Semper, Reisen im Archepel der Philippinen **9**, pt. 6, pp. 105–107, pl. 8, figs. 16–27.

Cazenavette, B. 1853: Actes de la Société Linnéenne de Bordeaux **19**, pp. 62–64.

Dall, W. H. 1908: Bulletin Museum of Comparative Zoölogy **43**, no. 6, pp. 321–323.

Dall, W. H. 1909: United States Geological Survey, Professional Paper, no. 59, pp. 67–70.

Dall, W. H. 1924: Journal Washington Academy of Sciences **14**, no. 8, pp. 177–180.

Fischer, P. 1863: Journal de Conchyliologie **11**, pp. 147–149.

Fischer, P. 1885: Manuel de Conchyliologie, pp. 651, 660–661, 769–770.

Haller, B. 1893: Morphologisches Jahrbuch **19**, pp. 563–577, pl. 19.

Hanley, S. 1859 [1860]: Proceedings Zoological Society of London, pp. 487–493.

Kiener, L. C. 1835: Iconographie des Coquilles Vivantes **9, Tonne,** pp. 1–16, pl. 1–5.

Mörch, O. A. L. 1852: Catalogus Conchyliorum Comes de Yoldi, pt. 1, pp. 110–111.

Osima, K. 1943: Conchologia Asiatica **1**, pt. 4, pp. 111–136, pl. 1–5.

Sacco, F. 1891: Memorie della Reale Accademia delle Scienze di Torino (2) **41**, pp. 226–241, pl. 1.

Suter, H. 1913: Manual of the New Zealand Mollusca, pp. 314–315.

Tomlin, J. R. le B. 1927: Annals South African Museum **25**, pp. 80–83.

Troschel, F. H. 1856–1863: Das Gebiss der Schnecken **1**, pp. 220–230, pl. 18–19.

Tryon, G. 1885: Manual of Conchology **7**, pp. 257–264, 267.

Vredenburg, E. W. 1919: Memoirs of the Indian Museum **7**, no. 2, pp. 145–187.

Watson, B. 1886: Report of the Scientific Results of H.M.S. Challenger **15**, p. 412, pl. 17, fig. 11.

Weber, H. 1927: Zeitschrift für Morphologie und Ökologie der Tiere **8**, pp. 665–804, text figures 1–60.

Wenz, W. 1941: [in] Schindewolf, Handbuch der Paläozoologie, Gastropoda, Lief. **7**, Bd. 6, pp. 1046, 1076–1078.

Winckworth, R. and J. R. le B. Tomlin 1933: Proceedings Malacological Society of London **20**, pp. 206–213.

Woodring, W. P. 1928: Carnegie Institution of Washington, Publication no. 385, pp. 310–313.

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Book Reviews

Conchologia Asiatica—A New Japanese Publication—The first volume of this publication consists of four parts, each dealing with a separate genus or family, with a total of 136 pages, 22 plates and numerous text figures. These are as follows: Part 1. Limidae by K. Oyama; Part 2. Genus Lepidodesma Simpson by K. Suzuki; Part 3. Genus Turicula Dall by Y. Otuka; Part 4. Tonnidae by K. Osima. All were published in 1943. The text is entirely in Japanese with the standard latinized captions for genera and species and similarly for the references on the plates. Most of the synonymies are given as in the original; Japanese references are all in Japanese.

To judge by the species included, this work embraces the Japanese Empire, China, Korea, the Philippines and the East Indian Islands. Many genera and species are described as new.—W. J. Clench

Mazÿck, W. G. 1913: Catalogue of Mollusca of South Carolina. Contributions from the Charleston Museum no. 2, pp. 14+39. A total of 534 species and subspecies are given in this very important list of the land, freshwater and marine forms occurring in South Carolina. Six species are described as new.

This is an exceedingly important work. It has been very carefully prepared and it is the result of many years of collecting and study. It embodies not only the material of W. G. Mazÿck but also that of previous students such as Edmund Ravenel, Lewis R. Gibbes, J. D. Kurtz and others.—W. J. Clench