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THE FAMILY PHASIANELLIDAE IN THE WESTERN ATLANTIC

BY
ROBERT ROBERTSON

The Phasianellidae is a family of gastropods found in shallow water in most tropical and temperate seas. The shells are often small and are usually conspicuously colored and patterned. The largest species live in the Australasian region.

The oldest fossil phasianellids are found in European Paleocene deposits (Cossmann 1918). Reports of Cretaceous species are dubious. Like most families of marine mollusks which differentiated in early Tertiary times, the group probably arose in Europe. The European Eocene (Tethyan) marine mollusk fauna not only was in large part ancestral to the modern Indo-Pacific fauna (see in particular Davies 1934) but also to the modern Caribbean and Panamic faunas. The Phasianellidae were derived from a trochacean stock and from Europe they spread around the world by way of the Tethyan Sea. Numerous late Tertiary species have been described.

Plate 136. *Phasianella australis* Gmelin. Semaphore, near Port Adelaide, South Australia (1.5x). The type species of *Phasianella* Lamarck.

The shell is entirely porcellaneous; in the most closely related families, the Turbinidae and Trochidae, it is invariably nacreous within. Both in the Phasianellidae and the Turbinidae the operculum is calcareous and usually paucispiral, while in the Trochidae it is always multispiral and corneous. The Phasianellidae differs from the Turbinidae and Trochidae also in that the shells are usually smooth and bulimoid in shape rather than turbinate or trochoid. All three families belong in the superfamily Trochacea, which, in turn, is grouped in the order Archaeogastropoda, the most primitive living gastropods. Most families in this order have a rhipidoglossate radula, that is, have numerous marginal teeth (the only exception is in the superfamily Patellacea—the true limpets). Primitively, archaeogastropods have a pair of ctenidia ("gills"), but the Trochacea is one of the more advanced groups in which one ctenidium (the one on the right side) has been lost as a result of the long term effects of asymmetrical coiling.

Phasianellid radulae have been studied by Troschel (1878), Pilsbry (1888), Torr (1914), Thiele (1924, 1929), Kuroda and Habe (1954) and Habe (1956). During the present study the radulae of twenty species in the family were examined. Nine of these are type species of supraspecific taxa. Material was not available of the types of the two remaining groups based on Recent species (*Pellax* Finlay and *Gabrielona* Iredale). All six Western Atlantic species were examined.

There are four main kinds of phasianellid radulae. These correlate fairly well with shell form and are here considered indicative of natural groups. Only two of these groups live in the Western Atlantic.

In *Phasianella* Lamarck the central tooth of the radula is needlelike; often it is absent along parts of the length of a ribbon. There are five pairs of laterals and each has an elongate longitudinal attachment. Each transverse row of laterals is fairly straight (Plate 138, fig. 1). The complicated way in which the inner marginals fit into one another is well described and figured by Torr (1914). This group lives from the Red Sea to New Caledonia, north to Japan and south to Tasmania.

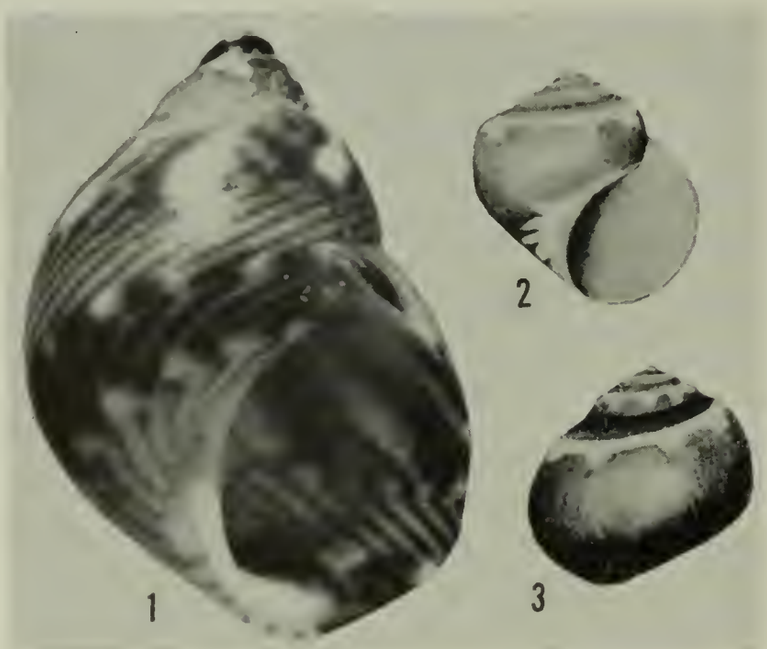

Plate 137. Fig. 1. *Tricolia pullus* Linné. St. Lunaire, near St. Malo, Ille et Vilaine, France (13.5x). The type species of *Tricolia* Risso. Figs. 2–3. *Gabrielona nepeanensis* Gatliff and Gabriel. Point Nepean and Flinders, Victoria, Australia (15x). The type species of *Gabrielona* Iredale. From Gatliff and Gabriel 1908, pl. 21, figs. 9–10.

In *Gabrielona* the central tooth is large, with an entire cusp, and its attachment to the ribbon is neatly fitted between the innermost pair of laterals. There are five pairs of laterals and the transverse rows are fairly straight. The second marginal is large (Plate 138, fig. 2). This group is little known and the description and figure are based on a West Indian species which is here referred to this genus on the basis of shell characters. The type species, *Phasianella nepeancnsis* Gatliff and Gabriel, is Australian.

In the third group, which includes *Hiloa* Pilsbry, *Eotricolia* Kuroda and Habe and probably *Pellaæ*, free laterals are reduced in number to two or three pairs, each with a 'hood.' There is a cusped pseudocentral tooth made up of the reduced central which is fused with the innermost pair of laterals. The median tooth of *Eotricolia* is considered a true central by Kuroda and Habe (1954) and the three innermost pairs of marginals are incorrectly considered laterals. Through comparisons with *Hiloa* it seems almost certain that the median tooth of *Eotricolia* is a pseudocentral rather than a true central. Thiele's description (1929) of the radula of *Eulithidium* Pilsbry is based incorrectly on a species in this group, which is known at present only from Hawaii, Australia and Japan.

In the fourth and largest group, *Tricolia* Risso, s.s., the central tooth is large, membranous, without cusps and variable in shape, even along the length of a single radula. It is usually oval or rectangular. In all species examined there is a structure without cusps, most easily seen through the ribbon, which lies between the outermost longitudinal row of laterals and the innermost row of marginals, usually between the transverse rows. The name lateromarginal plate is here suggested for it. Its function is problematical and it appears not to have been previously described. The transverse rows of laterals are M-shaped. All six European, African and western Indo-Pacific species so far studied have five pairs of laterals (Plate 138, fig. 3). All the American species have four.[1] In the three Eastern Pacific species of *Tricolia* so far studied the innermost laterals are elongate, winged laterally at the anterior end and lie close together beneath the central, with the posterior part of the cusp projecting slightly over the central (Plate 138, figs. 4, 6). The cusps of the laterals in the two species figured are lobed, but in *T. lurida* (Dall)[2] and all five Western Atlantic species they are strongly dentate (Plate 138, fig. 5). The innermost laterals of the Western Atlantic species differ in shape from the three Eastern Pacific species in that they are less elongate and are not winged.

Reduction of the central tooth in this family has occurred in three ways in different groups. In *Phasianella* this tooth has become needlelike or is often absent. In *Hiloa* and related groups it has fused with the innermost pair of laterals. In *Tricolia*, s.s., it has become broad and membranous and is never cusped. In all three cases it seems to be nonfunctional.

The marginal teeth are fairly similar in all four groups. They vary little in all trochaceans. Juveniles seem to have fewer marginals than adults.

There are two main conclusions of phylogenetic significance to be drawn from this brief discussion of phasianellid radulae. One is that within the family there is great diversity in the structure of the radula. The other is that in many cases closely related species

[1] Pilsbry (1888, pp. 163–164) implied that there is no phylogenetic significance in the number of laterals. He ascribed the loss of the outermost pair to inefficiency of minute teeth in small species. This view is no longer tenable as most of the American species are no smaller than the Paleotropical species.

[2] This name may not be applied correctly to this species. The holotype is apparently not the same species as the one for which this name is often used. See Woodring (1957).

Plate 138. Radulae. Fig. 1. *Phasianella australis* Gmelin. South Australia (47x). Fig. 2. *Gabrieloua brevis* d'Orbigny. Antigua, Lesser Antilles (1370x). Fig. 3. *Tricolia pullus* Linné. St. Lunaire, France (280x). Fig. 4. *Tricolia compta* Gould. Santa Barbara, California (280x). Fig. 5. *Tricolia affinis affinis* C. B. Adams. Great Abaco Id., Bahama Islands (280x). Fig. 6. *Tricolia variegata* Carpenter. Bahía Magdalena, Baja California, Mexico (280x).

appear to live in the same region. For example, all the Western Atlantic species of *Tricolia* appear to be more closely related to one another than to species elsewhere. This is surprising and unusual, for as has often been pointed out, closely related species are usually allopatric.

Phasianella jaws consist of two plates weakly joined at the dorsal margin and placed directly above the anterior end of the radula. They probably serve to open the mouth and provide a protective surface against which the radular teeth may rub. The radula slides over the odontophore and abuts anteriorly against the jaws.

Pilsbry (1888, p. 162) describes the jaws in the whole family as "rhomboidal, covered with imbricating scales." He illustrates (pl. 60, fig. 69) the jaws of *Tricolia fordiana* (Pilsbry) from Singapore. However, the jaws of *Phasianella* differ from those of *Tricolia*. Risbec has shown (1940, p. 283) that in *P. variegata* Lamarck [=*P. rubens* Lamarck] they are not scaly. In this species the anterior edge of each plate is slightly thickened and the outer surface is minutely reticulate. The jaws of this species are figured on Plate 139, figs. 1–2. In *P. australis* (Gmelin) they are much larger, corneous and fibrous and vary considerably in thickness from specimen to specimen; some are thin and transparent while others are much thicker and amber-colored. The differences are probably due in part to age. The anterior edge of each plate is greatly thickened. The jaws of *Phasianella* are externally convex and smooth with a large posteroventral gape between them, while in *Tricolia* the plates are more or less flat and are at least occasionally scaly. Jaws may prove to be an important taxonomic character in this family, but they are fairly variable and difficult to study.

The epipodium in this family usually bears three pairs of cirri which presumably are tactile for the epipodium is innervated, as in all rhipidoglossates (Pelseneer 1888). Both the cirri and the tentacles bear fine immobile hairs. In *Tricolia* there is usually a pair of cervical lobes, also part of the epipodium. These have been described and figured for *T. pullus* (Linné) by Forbes and Hanley (1849–50), by Clark (1855) and by Jeffreys (1865). The left lobe is described by Pelseneer (1899) as being wider than the right, and Forbes and Hanley, Clark, and Jeffreys all show that there is asymmetry in other features as well, particularly in the amount of lobing. In *T. bella* (M. Smith) there is no lobe on the right side; on the left it is pedunculate and digitate and serves as a sensory structure which prevents particles in suspension in the ciliary current from entering the mantle cavity (personal observations, Bimini, Bahama Islands). According to Pelseneer (1899) the two lobes in *T. pullus* function like siphons, the one on the left being sensory, directing the ciliary current into the mantle cavity. Thus there is functional significance in the asymmetry. Cervical lobes are lacking in *Phasianella*. However, in this genus there are denticulate frontal lobes attached near the base of the tentacles. These are lacking in *Tricolia*, as has been pointed out by Pilsbry (1888, pp. 164, 167). In all probability they are not of epipodial origin, but are presumably sensory. Illustrations showing these structures in *Phasianella* are given by Quoy and Gaimard (1832–35), Kiener (1847) and Risbec (1940).

Fretter (1955) has discovered that there are two "shell" (columellar) muscles in *Tricolia pullus*, the right one being somewhat the larger. This is surprising for in all other Trochacea that have been studied there is only one. Paired columellar muscles are known in some of the Neritidae which have evolved toward a crepidula-like shell form, but it seems unlikely that this indicates any close relationship between the two families as sug-

gested by Fretter. Whether or not these paired muscles are characteristic of the entire family Phasianellidae is not known and should be investigated.

In both *Phasianella* and *Tricolia* the under side of the foot is divided by a median longitudinal furrow. The waves of progression are direct (posteroanterior) and ditaxic.

The microscopic structure of the eye of *Tricolia pullus* has been studied by Pelseneer (1891) and the nervous system of *Phasianella rubens* by Risbec (1940).

According to Fretter (1955) the gut of *T. pullus* is similar to that in trochids except that the two typhlosoles (folds) on the wall of the stomach continue along the length of the intestine and rectum to the anus which is, as a result, functionally divided into two openings. The feces are cylindrical rods, each with a longitudinal groove, and they are extruded from one of the anal openings. The other opening probably acts as a siphon allowing water to be expelled from the gut when the animal retracts into the shell.

As in all Trochacea the sexes are separate and there is no penis in the male. The sexes can be distinguished (see Fretter 1955) by the appearance of the gonad and the size of the urinogenital papilla (which is larger in the female). According to Lebour (1937) the eggs of *Tricolia pullus* are shed singly into the sea and the veliger stage is short.

The shells in this family are usually bulimoid in shape and smooth except for fine spiral sculpture. There are a few species of *Tricolia*, however, which have strong spiral cords, such as *T. bella* in the Western Atlantic and *T. bicarinata* (Dunker) of South Africa. The shell of *Gabriclona* is globose; a few species of *Tricolia* are more or less similar in shape. *Phasianella* is much larger and usually higher spired than *Tricolia*. The outer lip of *Tricolia* is prosocline, that is, it grows farther forward at the suture than at the base, and so is inclined relative to the axis. This is less marked in *Gabriclona* and *Phasianella*. Periostracum is entirely lacking in the whole family.

The paucispiral, calcareous operculum is externally convex and more or less smooth in *Phasianella* and *Tricolia* (Plate 139, figs. 6–8). In *Gabriclona*, on the other hand, it is spirally ridged externally (Plate 139, figs. 3–4). Cossmann (1918) has pointed out that in *Phasianella* there is a small parietal lamella within the aperture against which the operculum pivots. This is not present in *Gabriclona* or *Tricolia*.

The fact that both primitive and juvenile turbinids often have a perforate operculum has recently been discussed (Robertson 1957). Significantly, the juvenile operculum of *Tricolia bella* is found to be perforate (Plate 139, fig. 5). This is further indication of the fact that the Phasianellidae and Turbinidae are closely related.

There is but a single criterion by which the Phasianellidae are distinguished from the Turbinidae: lack of nacre. According to Böggild (1930) the microscopic structure of the entire shell of *Phasianella* differs considerably from that of turbinids. The form of the shell and the radula is often but not invariably diagnostic. There is also but a single criterion by which these two families are distinguished from the Trochidae: the calcareous operculum. The three families are nevertheless probably more or less natural groups.

In view of the fact that there are numerous differences between *Phasianella* and the other groups which are now placed in the Phasianellidae, two subfamilies are here recognized: the Phasianellinae, comprising the genus *Phasianella*, and the Tricoliinae, comprising the genera *Gabriclona* and *Tricolia*. The distinguishing characters are given below. Very probably these two subfamilies were derived separately from the turbinid stock and the similarities are due in part to convergence. The two groups are given subfamily rather than family rank because the family Phasianellidae itself is at best hardly distinguishable

from the Turbinidae. Thus the Phasianellidae may be considered diphyletic in origin.

The classifications of this family by Cossmann (1918) and Wenz (1938) overemphasize differences which do not prove consistent. The phylogenetic series of species leading to Recent forms suggested by Cossmann are greatly oversimplified. In some cases the relationships he suggests are clearly erroneous, especially in the case of some of the West Indian species.

The Eastern Pacific genus *Prisogaster* Mörch was thought by Thiele (1924, 1929) to be intermediate in character between the Turbininae (=Turbinidae) and Phasianellinae

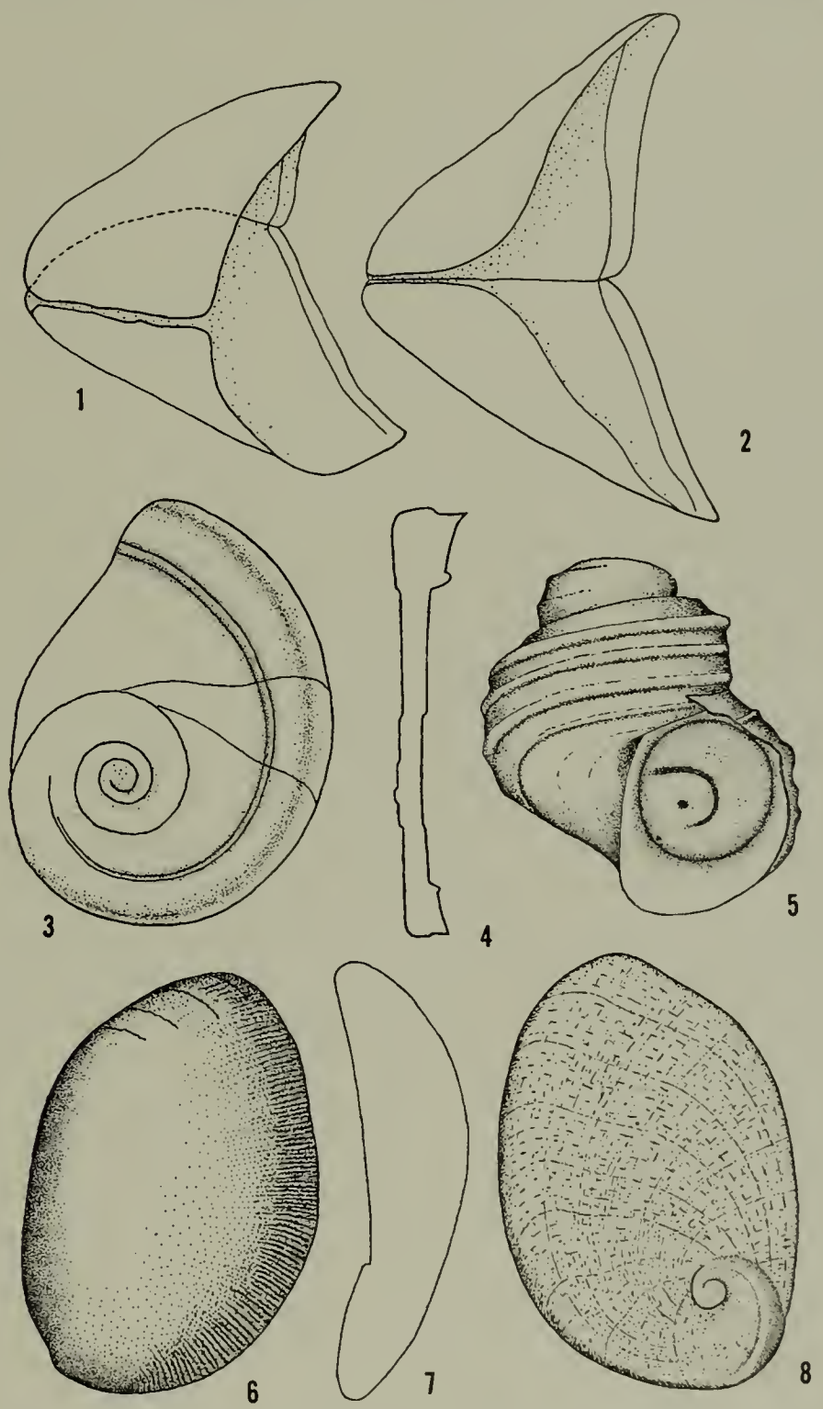

Plate 139. Figs. 1–2. Jaws of *Phasianella rubens* Lamarck. Caloundra, Queensland, Australia. Fig. 1. Oblique posteroventral view. Fig. 2. Posteroventral view (both 38x). Figs. 3–4. Operculum of *Gabrielona brevis* d'Orbigny. Antigua, Lesser Antilles. Fig. 3. External view. Fig. 4. Diagrammatic cross section (both 42x). Fig. 5. Juvenile specimen of *Tricolia bella* M. Smith showing perforate operculum. Pigeon Cays, Andros Id., Bahama Islands (50x). Figs. 6–8. Operculum of *Tricolia affinis affinis* C. B. Adams. Great Abaco Id., Bahama Islands. Fig. 6. External view. Fig. 7. Diagrammatic cross section. Fig. 8. Internal view (all 23x).

(=Phasianellidae) and he grouped it with the latter. The cusp of the wide central tooth of the radula in this genus is reduced and this suggested to Thiele affinity with *Tricolia*, s.s., in which there is no cusp at all. As the shell is nacreous within and turbinate in form, and the radula is not closely similar to that of any phasianellid, the genus is here referred back to the Turbinidae.

The genus *Pseudophasianus* Cossmann (1918), known only from Upper Eocene deposits in Europe, in all probability does not belong in the family. *Aizyella* Cossmann (1889), based on a species from Eocene deposits near Paris, is often accorded generic rank because of the spiral sculpture, but it is here ranked as a subgenus of *Tricolia* for, as mentioned above, there are Recent species which also have such spiral cords.

Some of the many supraspecific taxa in this family based on Recent species may be given subgeneric rank under *Tricolia*. The genus *Tricolia*, as here recognized, comprises the third and fourth groups mentioned above in the discussion of radulae. Despite divergence in structure of the radula there are few shell characters by which species in the two radular groups may be separated. Species in the third group may be placed in *Hiloa*, *Eotricolia* and possibly *Pellax* although differences between them are relatively slight. The shells in this group are fairly thin, the suture is rather deeply impressed, the body whorl is inflated, and the edge of the outer lip is sometimes everted. In the fourth group, *Tricolia*, s.s., the shell is fairly thick and the body whorl is less inflated.

Most phasianellid species are remarkably variable, both in shell form and in coloration. One of the most important taxonomic characters is the color pattern. This is usually fairly constant within a species. The shape of the shell is also moderately constant. Much of the variability, particularly of color, is undoubtedly connected with the variety of substrates selected (and hence food), as in *Turbo* (Ino 1955).

Despite the fact that Quoy and Gaimard report (1834) that *Phasianella* is attracted to meat and that Clark (1855) invariably found foraminiferan tests in the stomach of *Tricolia pullus*, this family, like most archaeogastropods, is predominantly herbivorous. On the British coast *T. pullus* lives in the lower intertidal and Laminarian zones, particularly on the algae *Chondrus*, *Ceramium*, *Rhodophyllis* and *Rhodymenia*, and feeds on diatoms and detritus as well as the surface tissues of these red algae (Jeffreys 1865; Fretter 1955).

The West Indian species of *Tricolia* live on both marine algae and grasses; a few live among rocks, corals and even on sand, but these probably also graze on algae which are present as incrusting films. *T. thalassicola* Robertson has been dredged alive off Florida in 35 fathoms: Forbes (1844) reports that *T. pullus* lives as deep as 80 fathoms in the Aegean Sea. Most species in this family are, however, confined to shallower water where plant life is more abundant. Empty shells have been dredged in great depths in the Caribbean, but these are of no significance as such small shells can easily be transported in a variety of ways.

As far as is now known, *Tricolia affinis pterocladica* Robertson lives only on the red alga *Pterocladia*, and *T. thalassicola* predominantly on Turtle Grass (*Thalassia testudinum* Konig). This is discussed further below. Attention is here drawn to a study by Ostenfeld (1927) in which the distribution of *Thalassia* is mapped. This marine flowering plant may determine the distribution of those herbivorous snails which live on it.

Tricolia and *Gabrielona* are frequently drilled by predaceous gastropods (Plate 142, figs. 1, 3). More often still the outer lip is broken back by fish, but usually such damage is repaired by the animal. Brasilian specimens have been collected in the digestive tracts

of sea hares (*Aplysia*) and of starfish (Haas 1953). Empty *Tricolia* shells, many of them drilled, are remarkably abundant in sands throughout the West Indies and southern Florida. Bleached and worn protoconchs are particularly in evidence. Surprisingly enough, however, the genus is absent throughout most of the Gulf of Mexico, occurring only sporadically on the Texan and Mexican coasts and off western Florida. It may also be absent from Bermuda (see *Notes*).

Some of the syntypes (cotypes) of the five species of *Tricolia* described from Jamaica by C. B. Adams are mixtures of several species. This has been responsible for much confusion as his specimens were widely disseminated. He described the species poorly and some of the descriptions are composite.

Reeve (1862) and Sowerby (1884) incorrectly synonymized most of the West Indian species which had been named at the time with *Tricolia pullus* of Europe. Records of this species from the West Indies are thus erroneous, having been based on other species.

Pilsbry (1888) reviewed the family and laid the foundation for future work. Few taxonomic studies have been published on the Western Atlantic species since his excellent monograph.

Strong (1928) studied the Eastern Pacific species of *Tricolia*. He recognizes 11 species, 3 of which he did not see. The genus *Gabrielona* appears not to be represented. As discussed above, the radulae of the Eastern Pacific species of *Tricolia* so far studied differ consistently from those of the Western Atlantic. There are no clear-cut analogues in the two oceans. The shells of *T. cyclostoma* (Carpenter) and *T. thalassicola* do, however, resemble one another, and several of the Eastern Pacific species have oblique spiral lines of color similar to those in some of the Western Atlantic forms.

The oldest fossil American phasianellid from the Atlantic seaboard was recently named *Tricolia calypta* by Woodring (1957). It is from early Oligocene (or possibly late Eocene) deposits of the Bohio (?) Formation, Gatun Lake area, Panama Canal Zone. An early Miocene species was named *Lacuna precursor* by Dall (1915). It is from the Tampa Limestone, Florida, and, as recognized by Mansfield (1937), it also is a *Tricolia*. Other Miocene species so far described are: *Lacuna punctata* Gabb (1873) from the Cercado Formation, Dominican Republic[1]; *Phasianella* "doubtful species" from Trinidad (Guppy and Dall 1896); *Phasianella mollis* Olsson (1922) from the Gatun Formation, Costa Rica[2]; *Tricolia* (*Eulithidium*) *hadra* Woodring (1928) from the Bowden Formation, Jamaica (a *Gabrielona?*); *Tricolia probrevis* Gardner (the holotype is juvenile), *Didianema ? waltonia* Gardner (a *Gabrielona?*) and *Tricolia affinis chipolana* Gardner (1947), all from the Alum Bluff Group, Florida, and *Tricolia ? syntoma* Woodring (1957) of the Gatun Formation, Panama (a *Gabrielona?*). With the exception of the three species which may be referred to *Gabrielona* all these Miocene forms are similar to *T. affinis* (C. B. Adams), a highly variable Recent species. Pliocene fossils have all been referred to Recent species. It should be stated that the remarks made here about these

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[1] As there was a prior *Tricolia punctata*, Woodring (1928) renamed this *T.* (*Tricolia*) *affinis gabbi*.

[2] This was synonymized by Woodring (1928) with *T. umbilicata* (d'Orbigny), a homonym, as shown in the synonymies below, which has been applied to two Recent species: *T. affinis* and *T. thalassicola*. *T. mollis* may be a synonym of *T. affinis*, but the status of the name will remain in doubt until the type is examined. This type should be in the Paleontological Research Institution, Ithaca, New York, but cannot at present be located. Aguayo (1945) has suggested using Olsson's name in place of *T. umbilicata*.

fossils are made solely on the basis of descriptions and illustrations in the literature, not on specimens. Hence they are especially open to question.

Finlay (1926) and Cotton and Godfrey (1938) use the name Eutropiidae (Eutropiinae H. and A. Adams 1854) for the Phasianellidae. This is inadmissible because the name is based on an objective junior synonym of *Phasianella*. The name Phasianellidae is already well established. Cotton himself does not use the name *Eutropia*.

Acknowledgments

Without the help and cooperation of many individuals this work could not have been completed. Approximately 20,000 Western Atlantic specimens were examined during the study. Well over half of these were sent on loan. To Dr. William J. Clench and to Dr. Ruth D. Turner, under whose direction the work was carried out, I am greatly indebted. All the facilities of the Mollusk Department in the Museum of Comparative Zoölogy (MCZ) were kindly placed at my disposal. To Dr. Myra Keen, Stanford University (LSJU), under whom the work was started, I am also deeply grateful, and to those who so kindly sent material on loan and in many cases gave important information as well. I would particularly like to mention Dr. R. Tucker Abbott, Academy of Natural Sciences of Philadelphia (ANSP); Dr. Fritz Haas, Chicago Natural History Museum (CNHM); Dr. Leo G. Hertlein, California Academy of Sciences (CAS); Mr. Thomas L. McGinty, Boynton Beach, Florida; Dr. Donald F. McMichael, Australian Museum, Sydney; Dr. Harald A. Rehder, United States National Museum (USNM), and Mrs. Germaine L. Warmke, Mayagüez, Puerto Rico. The following also very kindly sent material on loan: Mr. R. M. DeWitt, Florida State Museum (FSM); Mr. George F. Kline, Madison, New Jersey; Mr. Donald R. Moore, Ocean Springs, Mississippi; Dr. and Mrs. David Schmidt, Sarona, Wisconsin; Dr. Henry van der Schalie, Museum of Zoology, University of Michigan (U of M); Dr. Gilbert L. Voss, University of Miami Marine Laboratory (ML), and Mr. Frederick V. Weir, American Museum of Natural History (AMNH).

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Some manuscript notes made by the late Dr. Henry A. Pilsbry on the Western Atlantic species of *Tricolia* were kindly sent on loan toward the end of the study.

Family Phasianellidae

Subfamily Phasianellinae

Adult shell 1 to 10 cm. in length, oval, smooth and polished. Spire high, produced at an angle of from 45° to 55°. Whorls evenly rounded. There is a callus on the parietal region but no umbilicus. The color pattern is made up in part of spiral lines or bands. The operculum, which is externally convex and more or less smooth, pivots against a weak axial lamella on the columella, well within the aperture. The aperture is oval and the outer lip fairly thin and weakly prosocline.

The central tooth of the radula, when present, is needlelike. Each of the five paired laterals has an entire cusp and an elongate longitudinal attachment to the ribbon: the transverse rows are fairly straight. The plates of the jaw are externally convex.

Frontal lobes are present on the head, but there are no cervical lobes.

Genus **Phasianella** *Lamarck*

Phasianella Lamarck 1804, Annales du Muséum National d'Histoire Naturelle (Paris) **4**, p. 295.

Phasianus Montfort 1810, Conchyliologie Systématique **2**, p. 255 [emendation of *Phasianella* Lamarck]; non *Phasianus* Linné 1758 [Aves].

Bolina Rafinesque 1815, Analyse de la Nature, Palermo, p. 144 [new name for *Phasianella* Lamarck].

Eutropia 'Humphrey' Swainson 1840, Treatise on Malacology, p. 21 [merely listed as a synonym of *Phasianella* Lamarck]; 'Humphrey' H. and A. Adams 1854, Genera of Recent Mollusca, London, **1**, pp. 389–390.

Orthopnoea Gistel and Bromme [1847] 1850, Handbuch der Naturgeschichte, p. 556; Gistel 1848, Naturgeschichte des Thierreichs für höhere Schulen, pp. 169, 199 [new name for *Phasianella* Lamarck].

Orthomesus Pilsbry 1888, Manual of Conchology (1) **10**, pp. 163, 179 (type species, *Phasianella variegata* Lamarck 1822, non *P. variegata* de Roissy 1805 [=*P. rubens* Lamarck 1822], by original designation).

Mimelenchus Iredale 1924, Proceedings of the Linnean Society of New South Wales **49**, pp. 182, 232 (type species, *Phasianella ventricosa* Swainson[1] 1822, by monotypy).

Type species: "faisan" [=*Buccinum australe* Gmelin 1791], by subsequent selection, de Roissy 1805.

The characters given above for the subfamily apply to the genus.

Lamarck based his description of the genus on the "faisan" but in the same paper described two fossil species (now referred to *Tricolia*) from the Paris Basin. Harris (1897) has selected *Phasianella turbinoides* Lamarck 1804 as type. Woodring (1928) argued that the type species is the "faisan" by original designation. Lamarck, however, did not use the word 'type' when referring to this species. Fortunately de Roissy selected it as type in 1805, as has been discussed recently by Woodring (1957). The selection made by Harris is therefore invalid.

Neither the shell nor the radula of *Orthomesus* or *Mimelenchus* differs in any significant way from *Phasianella*, s.s.

A figure of a radula published by Eberhard (1865) which was believed by Troschel (1878) to be that of *Phasianella australis* has caused much confusion, for it was a *Tricolia* (probably *T. pullus*), not a *Phasianella*. Pilsbry named *Orthomesus* as a result of this misapprehension. For a long time the major differences between the radulae of *Phasianella* and *Tricolia* were thus not realized. Iredale (1924) and Thiele (1924) were the first to point this out.

The oldest undoubted representatives of this genus appear to be from rocks of Miocene age in Java and Victoria, Australia (Martin 1916; Crespin 1926).

The following synonymy is of the type species of the genus.

Phasianella australis *Gmelin*

Plate 136; Plate 138, fig. 1

Buccinum australe Gmelin 1791, Systema Naturae, ed. 13, p. 3490 (rivers of New Zealand) [based on Favanne de Montcervelle 1784, Catalogue Systématique et Raisonné ou Description du Magnifique Cabinet Ap-

[1] See Iredale's discussion (1924) of Swainson's use of this name prior to Quoy and Gaimard (1834) for the same species.

partenant ci-devant à M. le C[omte] de [La Tour d'Auvergne], p. 11, pl. 1, fig. 46, and Chemnitz 1786, Conchylien-Cabinet (1) **9**, pt. 2, pp. 38–40, pl. 120, figs. 1033–1034].

Helix phasianus Röding 1798, Museum Boltenianum, p. 108 [based on Chemnitz 1786, pl. 120, figs. 1033–1034].

Phasianella variegata[1] de Roissy 1805, Histoire Naturelle Générale et Particulière des Mollusques **5**, p. 331 (islands near New Holland [Australia]) [based on Chemnitz 1786, pl. 120, figs. 1033–1034].

Phasianus variegatus de Roissy. Montfort 1810, Conchyliologie Systématique **2**, p. 255.

Bulimus phasianus Perry 1810, Arcana, sign. Y, 7th page, pl. 43 (New Holland and Van Diemen's Land [Australia and Tasmania]); Perry 1811, Conchology, or the Natural History of Shells, pl. 30, fig. 4.

Trochus phasianella ? Brookes 1815, An Introduction to the study of Conchology, p. 163, pl. 7, fig. 96.

Phasianella varia Lamarck 1816, Tableau Encyclopédique et Méthodique, Mollusques et Polypes Divers, Liste, p. 10, pl. 449, figs. 1a, b, c.

Phasianella bulimoides Lamarck 1822, Histoire Naturelle des Animaux sans Vertèbres **7**, p. 52 (seas of New Zealand and New Holland [Australia], common near Maria Id. [off eastern Tasmania]) [based on *Buccinum australe* Gmelin and the preceding].

Phasianella picta de Blainville 1825, Manuel de Malacologie, p. 439: 1827, pl. 37, figs. 5, 5a.

Phasianella tritonis 'Chemnitz' Anton 1839, Verzeichniss Conchylien, Halle, p. 60.

Phasianella lehmanni Menke 1843, Molluscorum Novae Hollandiae, p. 12.

Phasianella preissii Menke 1843, Molluscorum Novae Hollandiae, p. 12.

Phasianella venusta Reeve 1848, Elements of Conchology **1**, p. 132, pl. 12, fig. 58.

Phasianella decorata Chenu 1859, Manuel de Conchyliologie **1**, pp. 342–343, fig. 2530.

Phasianella pulchella Tenison-Woods 1877, Papers and Proceedings and Report of the Royal Society of Tasmania for 1876, p. 141 (Long Bay, Tasmania) [juvenile]; non *P. pulchella* Récluz 1843.

Phasianella delicatula Tenison-Woods 1878, Papers and Proceedings and Report of the Royal Society of Tasmania for 1877, p. 38 [new name for *P. pulchella* Tenison-Woods 1877, non *P. pulchella* Récluz 1843].

Phasianella australis Gmelin var. *subsanguinea* Pilsbry 1888, Manual of Conchology (1) **10**, p. 165, pl. 38, fig. 52.

This species ranges from Western Australia east along the south coast to Victoria and Tasmania. The type locality (rivers of New Zealand) is erroneous. For further information see Cotton (1945).

Subfamily Tricoliinae

Adult shell normally less than 1 cm. in length. Spire usually produced at an angle of 60° or more. Shape and sculpture various, but spiral grooves are often present, particularly on the early whorls. Small species are perforate; large species are imperforate when adult. Color pattern various. Aperture oval or semicircular. A parietal lamella is absent. In *Tricolia* the operculum is similar to that of *Phasianella;* in *Gabrielona* it is naticoid.

The central tooth of the radula may have an entire cusp, may be reduced to a membranous plate, or may be lacking altogether. In the latter case the innermost laterals have fused to form a pseudocentral tooth and the free laterals are reduced in number to two or three pairs.

There are cervical lobes but no frontal lobes on the head.

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[1] This name invalidates *Phasianella variegata* Lamarck 1822 (Histoire Naturelle des Animaux sans Vertèbres **7**, p. 53). The species to which this name has been applied may take the name *Phasianella rubens*, introduced by Lamarck on the same page for a different (possibly geographic) form of the same species. Iredale (1924) and Cotton (1945) believe these are distinct species; this is here believed incorrect. If, however, it can be shown that they are specifically distinct, the name *Turbo lineolatus* Wood (1828, Index Testaceologicus, Supplement, p. 19, pl. 6, **Turbo**, fig. 26 [*Phasianella lineolatus*, p. 48]) is available instead of *P. rubens* for *P. variegata* Lamarck.

Woodring (1928) applied the name Tricoliidae to this group, separating it from the Phasianellidae.

Genus **Gabrielona** *Iredale*

Gabrielona Iredale 1917, Proceedings Malacological Society of London **12**, p. 327.
Gabrielana 'Iredale' Cossmann 1918, Revue Critique de Paléozoologie **22**, p. 42 [error for *Gabrielona*].

Type species: *Phasianella nepeanensis* Gatliff and Gabriel 1908, by monotypy.

Adult shell not more than 2.4 mm. in length, globose, wider than long. Spire low, usually produced at an angle of about 110°. Shell smooth or with fine incised spiral grooves. An umbilicus is present. Whorls inflated. Shell pink or red-brown and white. Aperture semicircular with the outer lip weakly prosocline. The operculum spirally ridged externally, thinnest near the center and thickest near the margin. The central tooth of the radula is large and has an entire cusp. Five pairs of laterals are present, the cusps of which are also entire.

In their original description of the type species of *Gabrielona*, Gatliff and Gabriel (1908) mention a similarity to the type species of *Chromotis* H. and A. Adams. This no doubt induced Thiele (1929) to synonymize *Gabrielona* tentatively with *Chromotis*. However, *Chromotis* is a subjective synonym of *Tricolia* based on a species with an externally convex operculum. As stated by Iredale, the operculum of *Gabrielona* is naticoid and, in addition, there are marked differences in the shell by which this genus differs from *Tricolia*.

Phasianella brevis d'Orbigny is here referred to this genus because of the similarity of the operculum, color pattern and shell form to that of the type species. Dall (1889a) wrongly referred it to *Eucosmia* Carpenter [=*Eulithidium*]. As discussed in the introduction, the radula of this species is of a distinct form.

Tricolia (*Eulithidium*) *hadra* Woodring (1928), *Didianema ? waltonia* Gardner (1947) and *Tricolia ? syntoma* Woodring (1957) may provisionally be referred also to this genus, pending knowledge of the opercula of these Miocene forms.

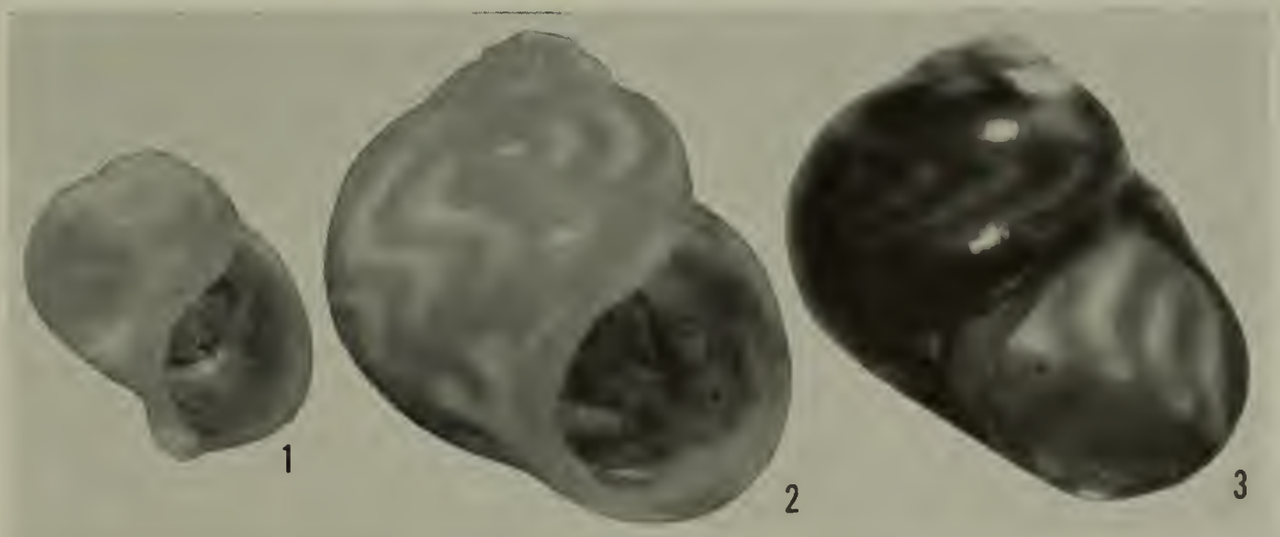

Plate 140. Fig. 1. *Gabrielona nepeanensis* Gatliff and Gabriel. Ocean Beach, near Point Nepean, Victoria, Australia (27x). Paratype, Australian Museum, no. C. 45057. Juvenile specimen with a slightly broken outer lip. Figs. 2–3. *Gabrielona brevis* d'Orbigny. Fig. 2. Antigua, Lesser Antilles (23x). Fig. 3. Off Bahia Honda, Pinar del Rio, Cuba (25.5x). Same specimen figured by Dall 1889, pl. 19, fig. 10b.

Gabrielona nepeanensis *Gatliff and Gabriel*

Plate 137, figs. 2–3; Plate 140, fig. 1

Phasianella nepeanensis Gatliff and Gabriel 1908, Proceedings Royal Society of Victoria (n.s.) **21**, p. 366, pl. 21, figs. 9–10 [reproduced here] (Flinders, Western Port; Ocean Beach, near Point Nepean [Victoria, Australia]); Iredale 1917, Proceedings Malacological Society of London **12**, p. 327.

Gabrielona nepeanensis Gatliff and Gabriel. Cotton 1945, Transactions Royal Society of South Australia **69**, p. 165.

This, the type species of *Gabrielona*, is known only from the type locality in Victoria and possibly from two localities in South Australia. It is likely that Cotton (1945) has misidentified this species, for he states that his specimens are separated with difficulty from "*Pellax virgo.*" The two species are easily distinguished, for they differ greatly in shape and in the structure of the operculum.

Gabrielona brevis *d'Orbigny*

Plate 138, fig. 2; Plate 139, figs. 3–4; Plate 140, figs. 2–3; Plate 141; Plate 142, fig. 1

Phasianella brevis d'Orbigny 1842 [in] Ramon de la Sagra, Histoire de l'Ile de Cuba, Mollusques **2**, p. 79, pl. 20, figs. 19–21 (Martinique and Cuba).

Phasianella brevissima Pilsbry 1888, Manual of Conchology (1) **10**, p. 179 [new name for *P. brevis* d'Orbigny 1842, non *P. brevis* C. B. Adams 1850].

Phasianella (*Eucosmia*) *brevis* d'Orbigny. Dall 1889, Bulletin Museum of Comparative Zoölogy **18**, p. 351, pl. 19, fig. 10b [*Eucosmia brevis* on plate explanation].

Eucosmia brevis d'Orbigny. Cossmann 1918, Essais de Paléoconchologie Comparée, Paris, livr. **11**, p. 162, fig. 55.

Tricolia brevis d'Orbigny. Aguayo 1943, Revista de la Sociedad Malacológica **1**, pp. 39–40.

Description. Shell moderately thin, globose, inflated and reaching 2.4 mm. in length. The color pattern is made up of light to dark brick-red irregular wavy stripes on white. The columellar area is either white and demarcated from the surrounding light brick-red by a crenulate margin, or there are more or less square white spots in a spiral series on dark brick-red. The wavy stripes are widest below the suture and below the periphery. There may be merely series of flames above and below the periphery on the initial whorls. In one specimen the dark wavy stripes are so wide that they have fused to leave wavy white lines on a dark brick-red ground color. Whorls 4, greatly inflated. Spire depressed, set at an angle of 110°. Protoconch minute, depressed and white. Aperture pyriform-ovate. Columellar callus fairly thick, margin raised slightly near the umbilicus. Umbilicus narrow. Suture slightly impressed. Post-nuclear whorls usually with evenly spaced spiral striae; the striae gradually become weaker so that the body whorl is entirely smooth. One specimen is entirely smooth and polished. Operculum (Plate 139, figs. 3–4) naticoid, more or less flat, but ridged near the margin and thinnest at the center.

	length	width	
	2.4 mm.	2.2 mm.	Antigua, Lesser Antilles
	2.0	2.4	Off Bahía Honda, Cuba
	1.5	1.6	Antigua, Lesser Antilles
(juvenile)	1.5	1.4	Habana, Cuba

Types. Three syntypes of *Phasianella brevis* d'Orbigny (one is illustrated here, Plate 142, fig. 1) are in the British Museum (Natural History), no. 54.10.4.282. Gray (1854)

states that all the d'Orbigny types from Cuba were sent to the Museum.[1] They are from Martinique, however, not Cuba as implied by the title of Gray's list. The Cuban specimen(s) mentioned by d'Orbigny may thus have been lost, or were not regarded as types and retained by d'Orbigny. The type locality is Martinique, Lesser Antilles.

Remarks. This species can easily be distinguished from other Western Atlantic phasianellids because the shell is as wide as it is long, or almost so, and the operculum is naticoid. The light to dark brick-red color is also characteristic; there are no spots.

Only thirteen specimens were available for this study. Eleven of them were collected at Antigua by J. B. Henderson, Jr.; one was dredged dead in deep water off Bahía Honda, Cuba, by the *Blake*, and one juvenile is from near Habana, Cuba. The Cuban specimen from deep water differs from the Antiguan specimens in that it is smooth and predominantly dark brick-red, with wavy white streaks, and the outer lip is thickened. All the Antiguan specimens have spiral striae, particularly on the early whorls. They are white, with wavy pale brick-red stripes. The outer lip is thin, even though some of the specimens are larger than the one from Cuba.

One of the Antiguan specimens was collected alive in "deep, fine sand and shells," apparently in shallow water.

Dall (1889a) identified the Cuban specimen from deep water with d'Orbigny's species; however, he misidentified the deep water form of *Tricolia thalassicola* with this species also, as well as juvenile specimens of other West Indian species. The published ranges of this species have been incorrect as a result.

Tricolia probrevis Gardner (1947) was implied to be a precursor of this species. However, it is a juvenile *Tricolia*, not a *Gabrielona*. The specimens with which it was compared were probably misidentified.

Six worn and broken specimens in the United States National Museum (no. 150781) from Ilha de São Sebastião, São Paulo, Brasil, collected by H. von Ihering, may possibly represent another Western Atlantic species of *Gabrielona*. What little remains of the color pattern consists of irregular red-brown spots. The spire is higher than in *G. brevis*, being produced at an angle of about 85°, and the umbilicus is more prominent. The largest specimen is 1.9 mm. in length. Several of the specimens show traces of spiral striae. The Brasilian record of "*Eulithidium brevissimum* (Pilsbry)" given by Lange de Morretes (1949) may have been based on specimens from the same lot.

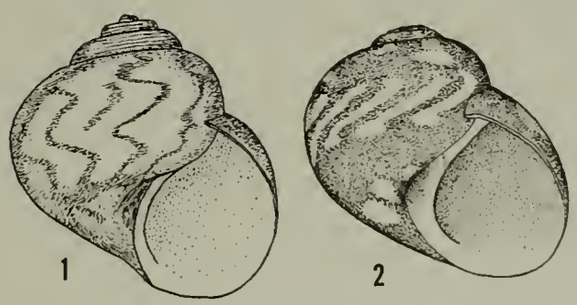

Plate 141. *Gabrielona brevis* d'Orbigny. Fig. 1. Antigua, Lesser Antilles. Fig. 2. Off Bahía Honda, Pinar del Río, Cuba. Same specimen figured by Dall 1889, pl. 19, fig. 10b (both 13x).

[1] In the notes made by P. P. Carpenter while at the Museum in 1863–64 which have been published by Palmer (1947) it is stated that these specimens are "a *Glabella*, very like the commoner C. S. Lucas sp." [Cape San Lucas, Baja California, Mexico]. *Glabella* Swainson is a marginellid: possibly Carpenter intended to use this name for the group he shortly afterwards called *Encosmia* in a paper describing new species from Cape San Lucas.

Range. Cuba, Antigua and Martinique (d'Orbigny).

Specimens examined. Cuba: *Blake*, station 21 [1877–78] (N. Lat. 23°2′; W. Long. 83°13′) in 287 fathoms (dead), off Bahía Honda, Pinar del Río (USNM); Arenas de la Chorrera, Habana (MCZ). Lesser Antilles: English Harbour, Antigua (USNM).

Genus **Tricolia** *Risso*

Tricolia Risso 1826, Histoire Naturelle de l'Europe Méridionale, Paris, **4**, p. 122.

Tricolea "Risso," *Thicolea* "Leach MSS. 1819," *Tricolaea*, all Gray 1847, Proceedings of the Zoological Society of London **15**, pp. 144, 218 [errors for *Tricolia* Risso].

Eulora 'Leach' Gray 1852, Synopsis of the Mollusca of Great Britain, pp. 147, 199 (type species, *Eudora varians* 'Leach' Gray 1852 [= *Turbo pullus* Linné 1758], by monotypy); non *Eudora* Péron and Lesueur 1810 [Coelenterata], etc.

Chromotis H. and A. Adams 1863, Annals and Magazine of Natural History (3) **11**, pp. 19–20 (type species, *Chromotis neritina* Dunker [= *Phasianella neritina* Dunker 1846], by monotypy).

Eucosmia Carpenter 1864, Annals and Magazine of Natural History (3) **13**, p. 475 (type species, *Eucosmia variegata* Carpenter 1864, by subsequent selection, Pilsbry 1888); non *Eucosmia* Stephens 1831 [Lepidoptera].

Tricoliella Monterosato 1884, Il Naturalista Siciliano **3**, p. 110 (type species, *Tricolia pullus* Linné 1758, by subsequent selection, Pilsbry 1888).

Steganomphalus Harris and Burrows 1891, Eocene & Oligocene Beds of the Paris Basin, London, pp. 78–79, 112 [new name for *Eudora* 'Leach' Gray 1852, non *Eudora* Péron and Lesueur 1810, etc.].

Eulithidium Pilsbry 1898, Nautilus **12**, p. 60 [new name for *Eucosmia* Carpenter 1864, non *Eucosmia* Stephens 1831].

Tricola Strong 1928, Proceedings California Academy of Sciences (4) **17**, pp. 189, 191–193, 202 [error for *Tricolia* Risso].

Usatricolia Habe 1956, Venus **19**, pp. 95–96, 98 (type species, *Phasianella compta* Gould 1855, by monotypy).

Type species: *Turbo pullus* Linné 1758 [= *Tricolia pullus* Linné], by subsequent selection, Gray 1847 [misspelled "*Tricolea*"].

Adult shell rarely over 1 cm. in length, globose, oval or elongate, usually smooth, but a few species have strong spiral cords. Spire moderately elevated, usually produced at an angle of from 60° to 80°, but very occasionally as low as 100° or as high as 40°. Initial whorls sometimes with strong spiral threads. Shell imperforate or rimately perforate. Color pattern various, often consisting in part of oblique spiral lines. Aperture oval. Outer lip strongly prosocline. Operculum white, externally convex and more or less smooth, perforate when juvenile. Cervical lobes are present, but not frontal lobes. The plates of the jaw are more or less flat.

The type species of *Chromotis*, from South Africa, is low-spired. However, the radula differs in no observable way from that of *Tricolia pullus* and the operculum has the same general form as in all other species of *Tricolia*. As there are several species transitional in shell form, it seems unnecessary to maintain such monotypic subgenera.

Low-spired forms of *Tricolia* (especially American species) have frequently been referred to *Eulithidium*. However, the spire of the type species (Plate 148, fig. 1) is no lower than in *Tricolia*, s.s. (Plate 137, fig. 1). The assemblage of species referred by Dall (1908) to this subgenus is clearly heterogeneous. As discussed in the introduction, the radulae of the American species of *Tricolia* differ consistently from those from the Old World in having four rather than five pairs of radular laterals. The name *Eulithidium* could be applied subgenerically to the American species, but at the present time it is

thought that this would be confusing for this name has long been applied incorrectly only to low-spired species.

Usatricolia was separated from *Tricolia* because the central tooth of the radula was "distinctly transversely narrower" and because there were four pairs of laterals rather than five. There is great variability in the shape of the central tooth, even in a single radula. The tooth figured by Habe is merely abraded. The radula of *Usatricolia* (Plate 138, fig. 4) is strikingly similar to that of *Eulithidium* (Plate 138, fig. 6) and the two cannot possibly be considered even subgenerically distinct (Plate 148). Both have four pairs of laterals.

Six subgenera may be recognized within the genus: *Tricolia*, s.s., *Aizyella* Cossmann (1889), *Phasianochilus* Cossmann (1918), *Hiloa* Pilsbry (1917), *Pellax* Finlay (1926) and *Eotricolia* Kuroda and Habe (1954).

Subgenus **Tricolia**

Shell fairly thick; suture never deeply impressed; whorls moderately inflated. Central tooth of the radula not cusped, reduced to a membranous plate. Four or five pairs of laterals are present, each with incised cusps. Rows of lateromarginal plates lie between the marginals and laterals.

All the Western Atlantic species belong in this subgenus.

Varietal names are omitted in the following synonymy of the type species. For more complete synonymies, which include some of the many varietal names, see Bucquoy, Dautzenberg and Dollfus (1884) and Priolo (1953).

Tricolia pullus *Linné*

Plate 137, fig. 1; Plate 138, fig. 3

Turbo pullus[1] Linné 1758, Systema Naturae, ed. 10, p. 761 (Mediterranean Sea); Hanley 1855, Ipsa Linnaei Conchylia, pp. 327–328.

Turbo pictus da Costa 1778, British Conchology, p. 103, pl. 8, figs. 1, 3 (coast of Cornwall, and Exmouth, Devonshire; Mediterranean) [refers to the preceding].

Turbo flammeus von Salis 1793, Reisen in versch. Prov. Königreich Neapel, p. 377, pl. 8, fig. 11 (Naples, Italy). Not seen.

Phasianella pullus Linné. Sowerby 1825, Catalogue of the Shells contained in the collection of the late Earl of Tankerville, p. 56.

Tricolia pullus Linné. Risso 1826, Histoire Naturelle de l'Europe Méridionale, Paris, **4**, p. 123.

Tricolia punctata Risso 1826, Histoire Naturelle de l'Europe Méridionale **4**, p. 123 (coast of Provence).

Phasianella pullulus Anton 1839, Verzeichniss Conchylien, Halle, p. 60.

Phasianella pulchella Récluz 1843, Revue Zoologique par la Société Cuvierienne **6**, pp. 10–11 (coasts of the English Channel).

Phasianella tenuis Philippi 1844, Zeitschrift für Malakozoologie **1**, p. 110 (Sicily); non *P. tenuis* Michaud 1829.

Eudora varians 'Leach' Gray 1852, Synopsis of the Mollusca of Great Britain, p. 200 [new name for *Turbo pullus* Linné 1758].

Phasianella crassa Brusina 1864, Verhandlungen zoologisch-botanischen Gesellschaft in Wien **15**, p. 23 (Dalmatia).

? *Phasianella exigua* Brusina 1864, Verhandlungen zoologisch-botanischen Gesellschaft in Wien **15**, p. 24 (Dalmatia).

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[1] The name *Pullus* was capitalized by Linné, indicating that he used it as a noun. See Cooke 1899, Journal of Malacology **7**, pp. 31–32.

? Tricoliella jolyi Monterosato 1889, Journal de Conchyliologie **37**, p. 30 (Casablanca and near Algiers).
Eulora dubia Monterosato 1889, Journal de Conchyliologie **37**, p. 31 (Casablanca).

This species ranges from the British Isles south to West Africa, west to the Azores and east along the shores of the Mediterranean to the Black Sea.

Plate 142. Figs. 1–3. D'Orbigny types. Fig. 1. *Phasianella brevis* [= *Gabrielona brevis*]. Syntype, Martinique, Lesser Antilles (6x). Fig. 2. *Phasianella umbilicata* [= *Tricolia thalassicola* Robertson]. Invalid syntype, Cuba (4x). Fig. 3. *Phasianella zebrina* [= *Tricolia tessellata* Potiez and Michaud]. Syntype, Guadeloupe, Lesser Antilles (6x). Figs. 4–5. Syntypes of *Littorina adamsii* Reeve [= *Tricolia bella* M. Smith]. Jamaica (both 6x). Photographs by courtesy of the British Museum (Natural History).

Tricolia affinis affinis *C. B. Adams*

Plate 138, fig. 5; Plate 139, figs. 6–8; Plate 143, figs. 1–2; Plate 145, fig. 1

Phasianella umbilicata d'Orbigny 1842 [in] Ramon de la Sagra, Histoire de l'Ile de Cuba, Mollusques **2**, p. 77, pl. 19, figs. 32–34 (Martinique, Guadeloupe, Jamaica and Cuba) [in part only]; non *Littorina umbilicata* d'Orbigny 1840 [a *Tricolia*].
Phasianella affinis C. B. Adams 1850, Contributions to Conchology, no. 4, p. 67 (Jamaica).
Phasianella concinna C. B. Adams 1850, Contributions to Conchology, no. 5, p. 69 (Jamaica).

Description. Shell fairly thin, inflated, elongate, reaching 8 mm. in length. The color pattern consists of irregularly arranged minute brick-red or red dots each of which is usually paired with a somewhat larger white spot. These are produced subsequent to each red dot in spiral sequence. The ground color is light orange-brown or pink and is partially transparent. Irregular wavy axial streaks are superimposed which are either red or alternately light brick-red and white. The white streaks are often broken at the periphery. Occasionally the whole shell is suffused with rose. Whorls 5, evenly rounded. Spire produced at an angle of from 60° to 63°. Protoconch minute, depressed and colored white or pale pink. Aperture elongate-ovate. Columella with a thick white callus. Umbilicus fairly wide. Suture impressed. Post-nuclear whorls smooth except for minute spiral striae. Operculum elongate, white and minutely striated exteriorly. The striae are near and at right angles to the margin.

	length	width	
	7.5 mm.	5.0 mm.	Lectotype of *Phasianella affinis* C. B. Adams
	6.8	4.2	Norris Cut, near Miami, Florida
	5.0	3.2	Aguadilla, Puerto Rico
(juvenile)	2.7	1.9	Big Pine Key, Florida

Types. The lectotype of *Phasianella affinis* C. B. Adams (Plate 143, fig. 2), selected by Clench and Turner (1950, pl. 36, fig. 6), is in the Museum of Comparative Zoölogy, no. 186020. Lectoparatypes from Jamaica are in the United States National Museum

(no. 61764) and the Academy of Natural Sciences of Philadelphia (no. 199422). The lectotype of *Phasianella concinna* C. B. Adams (Plate 143, fig. 1), also selected by Clench and Turner (1950, pl. 36, fig. 4), is in the United States National Museum, no. 54766. See under *T. thalassicola* concerning *Phasianella umbilicata* d'Orbigny. The type locality of this species is Jamaica.

Remarks. This is the largest and one of the most abundant forms of *Tricolia* in the West Indies. See *Remarks* on other species and subspecies of *Tricolia* for characters by which it may be distinguished. In the Florida Keys it lives predominantly on Turtle Grass (*Thalassia testudinum* Konig); at Great Abaco, in the northern Bahama Islands, it was collected alive by the writer both in deep crevices in dead coral and on *Thalassia*.

Range. The Florida Keys, the Bahama Islands, the Greater Antilles east to Saint Martin, northern Lesser Antilles. Replaced in most of the remainder of the Lesser Antilles by *T. affinis beaui*, by *T. affinis cruenta* on the continental shores of the Caribbean and the coast of Brasil, and by *T. affinis pterocladica* north of the vicinity of Miami, Florida.

Specimens examined. Florida: Miami Beach (FSM); Fisher Id., Miami (T. McGinty); Norris Cut (MCZ); Key Largo (MCZ; ANSP; ML; CNHM; D. Moore); Teatable Key (FSM; T. McGinty); Lower Matecumbe Key (USNM); Little Duck Key (T. McGinty); West Sister Key, off Vaca Key (FSM); Bahia Honda Key (T. McGinty;

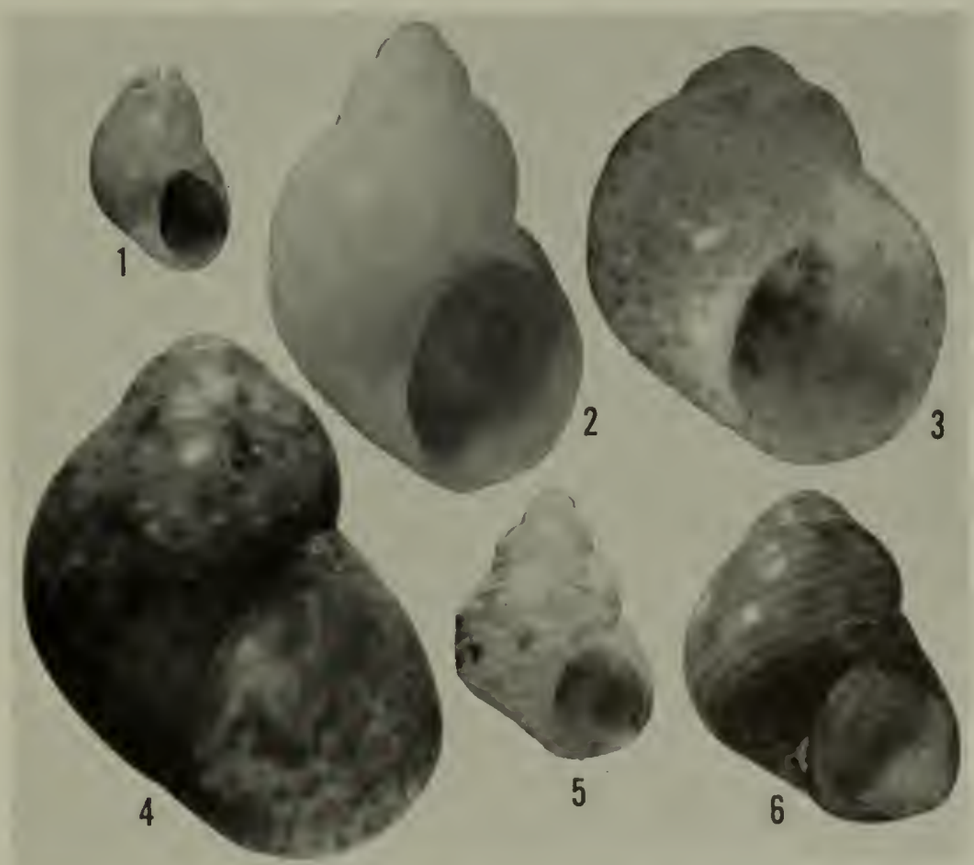

Plate 143. C. B. Adams types. Fig. 1. *Phasianella concinna* [= *Tricolia affinis affinis* C. B. Adams]. Lectotype, Jamaica (4x). Fig. 2. *Phasianella affinis* [= *Tricolia affinis affinis*]. Lectotype, Jamaica (8x). Fig. 3. *Phasianella brevis* [= *Tricolia adamsi* Philippi]. Holotype, Jamaica (16.5x). Fig. 4. *Phasianella breris* [= *Tricolia adamsi* Philippi]. Invalid neotype, St. Thomas, Virgin Islands (15x). Fig. 5. *Turbo* (?) *pulchellus* [= *Tricolia bella* M. Smith] Lectotype, Jamaica (10x). Fig. 6. *Phasianella tesselata* [= *Tricolia tessellata* Potiez and Michaud]. Lectotype, Jamaica (10x).

D. and N. E. Schmidt); Big Pine Key; Summerland Key (both D. and N. E. Schmidt); Middle Sambo Shoals, S of Boca Chica Key (T. McGinty); Boca Grande Key; Garden Key (both FSM); Loggerhead Key (T. McGinty), both Dry Tortugas. Bahama Islands: Elbow Cay, Great Abaco Id. (R. Robertson); S of North Cay, in 2 fathoms; off Nassau Harbour; Lyford Cay, all New Providence (all T. McGinty); Governors Harbour, Eleuthera; Campdown, northern Cat Island (both MCZ). Cuba: Cabo San Antonio; Cabo Cajon; off Los Arroyos; Dimas, in 4–5 fathoms; Santa Lucía, in 2–4 fathoms; La Esperanza; Cayo Arenas, in 2 fathoms; Cayo Levisa, in 2–3 fathoms; Cabañas, all Pinar del Río (all USNM); near Habana, Habana; Bahía de Cárdenas, Matanzas (both ANSP); off Cayo Fragoso; Caibarién, both Las Villas; off Punta Alegre, Camagüey; Guarda la Vaca, near Puerto Samá, Oriente (all MCZ). Jamaica: (MCZ; AMNH; CNHM); Jack's Bay, St. Mary (USNM); Port Antonio, Portland (ANSP); Port Royal (USNM). Hispaniola: Cap Haïtien, Dépt. du Nord (MCZ); Port Salut; Les Cayes; Aquin, all Dépt. du Sud; Saltrou, Dépt. de l'Ouest, all Haiti (all USNM); Montecristi; El Canal, Cabo Macorís (both MCZ); Bahía de Samaná (USNM), all Dominican Republic. Puerto Rico: Aguadilla (G. Warmke); Arecibo; Boca de Congrejos (both MCZ); Guánica (AMNH); Cabo Rojo (G. Warmke; MCZ); Rincón (LSJU). Virgin Islands: St. Thomas (MCZ; USNM; CNHM); St. John (MCZ). Lesser Antilles: Saint Martin (ANSP).

Tricolia affinis pterocladica, new subspecies

Plate 144, fig. 3; Plate 145, fig. 3

Description. Shell fairly solid, elongate, inflated and reaching 8 mm. in length. The color pattern consists of wavy brown spiral lines which descend from the suture at an angle of about 45°. There are usually white lines next to the brown lines. Below the suture and at the periphery there are usually irregular, more or less axial, patches of white. On the body whorl there are 7 or 8 of these. The ground color is light yellowish brown. Occasionally the brown lines break up into dots on the lower part of the body whorl. At the northern end of the range some specimens are red rather than brown. Whorls 5, evenly rounded. Spire produced at an angle slightly less than 60°. Protoconch white, minute and depressed. Aperture elongate-ovate. Columellar callus thin. Umbilicus reduced to a minute chink. Suture impressed. Post-nuclear whorls smooth except for minute axial growth lines. Operculum tinged with brown at the margin.

	length	width	
(large)	8.0 mm.	4.6 mm.	Miami Beach, Florida
	4.6	3.1	Holotype, Boynton Beach, Florida
(juvenile)	2.5	1.9	Yamato Rocks, Florida

Types. The holotype is in the Museum of Comparative Zoölogy, no. 215662. It was collected by Thomas L. McGinty on March 20, 1957, amongst *Pterocladia* growing on rocks in shallow water at Boynton Beach, Florida. Paratypes are in the Museum of Comparative Zoölogy (no. 215663) and the United States National Museum, at Stanford University, the Academy of Natural Sciences of Philadelphia (nos. 150755, 189846, 195923), the Chicago Natural History Museum (nos. 26483, 53118) and the private collection of T. McGinty.

Remarks. This new subspecies can readily be distinguished from the nominate form by the brown (rarely red) color, and, in particular, the color pattern of descending wavy lines. From *T. tessellata*, with which it has been confused, it differs in shape, the spire being higher and the shell growing to a larger size. The spiral lines are far more irregular and descend more rapidly.

At Boynton Beach this subspecies lives amongst the red alga *Pterocladia* (*P. americana* Taylor?) which grows on rocks in shallow water. I am indebted to Mr. Thomas L. McGinty for collecting specimens of this alga and to Dr. William Randolph Taylor for the identification. In the Florida Keys *T. affinis affinis* is known to live on Turtle Grass (*Thalassia*). *Thalassia* does not live north of the Biscayne Bay area on the east coast of Florida (Voss and Voss 1955). As the range of *T. affinis affinis* is coextensive with that of *Thalassia* in southern Florida it is here assumed that *pterocladica* is a geographically segregated ecologic race which is adapted to live on *Pterocladia* rather than on *Thalassia* and hence is able to live farther to the north than the nominate form. The range, however, of *pterocladica* does not coincide with the range of *Pterocladia americana* Taylor (1943). This alga is found from North Carolina and Bermuda to Texas and the Caribbean. It is significant to observe in this connection that the ranges of *T. affinis affinis* and *affinis pterocladica* overlap slightly, the latter appearing sporadically in the northern Florida Keys, and that there is barely any intergradation between the two. It is to be hoped that field studies can be carried out to confirm or modify the suggestions made here on the basis of the preliminary information available. *Tricolia* may possibly not be as dependent on specific plant substrates as here implied.

Range. The southeast coast of Florida, from Fort Pierce to the Biscayne Bay area, sporadically as far south as the northern Florida Keys (Grassy Key). Three specimens have also been collected off northwest Florida.

Specimens examined. Florida: Fort Pierce (D. and N. E. Schmidt: Mary Godwin); Palm Beach (USNM; ML; G. and M. Kline); NE of Lake Worth, in 45 ft. (FSM); Peanut Id., North Inlet, Lake Worth (T. McGinty); off Lantana, in 10 fathoms (FSM); Boynton Beach (MCZ; T. McGinty; ANSP; CNHM); South Inlet, Lake Worth (MCZ; FSM); Yamato Rocks (MCZ; FSM); Miami Beach (MCZ; ANSP; FSM; USNM; U of M); Miami (MCZ; USNM); Fisher Id., Miami (T. McGinty); Norris Cut (MCZ); Virginia Key (FSM); Bear Cut (D. Moore); Cape Florida, Biscayne Key (FSM); Ragged Keys (USNM); Lower Matecumbe Key (MCZ); Grassy Key (U of M); off Destin, near Fort Walton, in 14 fathoms (T. McGinty).

Tricolia affinis beaui, new subspecies

Plate 144, fig. 4; Plate 145, fig. 5

Description. Shell solid, elongate, inflated and reaching 7.5 mm. in length. The color pattern consists of irregular red spiral lines, each bordered by a white line, which descend across the whorls from the suture at an angle of about 40°. The ground color is light pink or pale orange. Below the suture and at the periphery there are red (occasionally brown) patches; often these fuse to form irregular axial stripes. The red lines sometimes break up into dots on the body whorl. Between the red patches below the suture there are often white patches which are sometimes tinged with yellow. On the body whorl

there may be as many as 9 of these. Whorls 6, slightly flattened at the periphery. Spire produced at an angle of 60°. Protoconch minute, white, depressed. Aperture oval. Columellar callus thick, white. Rimately perforate. Suture moderately impressed. Postnuclear whorls smooth except for minute spiral striae. Operculum fairly thin, white.

length	width	
7.0 mm.	4.8 mm.	Holotype, Barbados, Lesser Antilles
3.2	2.4	Barbados, Lesser Antilles

Types. The holotype is in the Museum of Comparative Zoölogy, no. 215664. It was collected by Mrs. F. G. Kellett at Bathsheba, Barbados. Paratypes are in the Museum of Comparative Zoölogy, no. 215665, and in the United States National Museum, the Academy of Natural Sciences of Philadelphia, the American Museum of Natural History, the Chicago Natural History Museum, at Stanford University and the California Academy of Sciences.

Remarks. This new subspecies is similar to the red phase of *T. affinis pterocladica* which appears only in the vicinity of Fort Pierce on the southeast coast of Florida. It differs in reaching a larger size, and by having the subsutural patches smaller, more numerous and often tinged with yellow. From the nominate form of the species it differs in having the wavy red spiral lines which descend obliquely across the whorls.

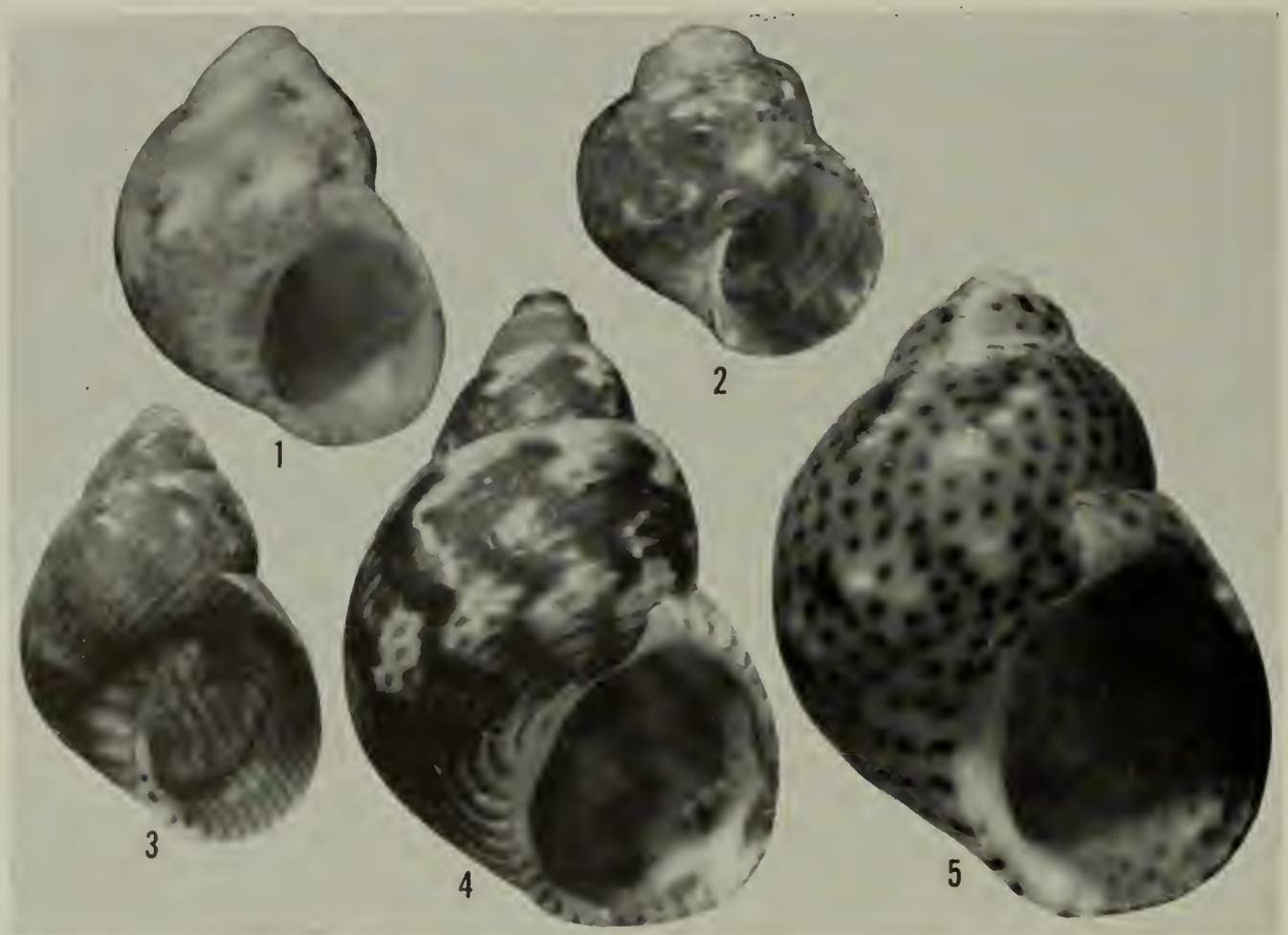

Plate 144. Figs. 1–2. *Tricolia thalassicola* Robertson. Fig. 1. Holotype, near Elbow Cay, Great Abaco Id., Bahama Islands (11.5x). Fig. 2. Deep water form (juvenile), 30 fathoms, off Palm Beach, Florida (22x). Fig. 3. *Tricolia affinis pterocladica* Robertson. Holotype, Boynton Beach, Florida (11x). Fig. 4. *Tricolia affinis beaui* Robertson. Holotype, Bathsheba, Barbados, Lesser Antilles (10x). Fig. 5. *Tricolia affinis cruenta* Robertson. Holotype, Bahia do Flamengo, Ubatuba, São Paulo, Brasil (18x).

The subspecific name is given in memory of Commandant Beau, an ardent collector in Guadeloupe and Martinique over a century ago. It was through his efforts that many of the more interesting marine mollusks of the Lesser Antilles were first discovered. For his obituary see Journal de Conchyliologie **7**, p. 393, 1858.

Range. The Lesser Antilles from Antigua to Tobago.

Specimens examined. Lesser Antilles: Falmouth and English Harbour, Antigua (USNM); Martinique (AMNH); Bathsheba, Barbados (MCZ); Barbados (USNM: ANSP; LSJU); Pigeon Pt., Tobago (MCZ).

Tricolia affinis cruenta, new subspecies

Plate 144, fig. 5; Plate 145, figs. 4, 6

Tricolia (*Tricolia*) *pygmaea* 'Philippi' Haas 1953, Fieldiana: Zoology **34**, pp. 204–205 (Ilha Grande, Rio de Janeiro, Brasil); non *Phasianella pygmaea* Philippi 1848.

Description. Shell solid, oval, inflated and reaching 6.2 mm. in length. The color pattern consists of rather large more or less square or oblong dark red spots, arranged in regular spiral rows; occasionally some of the spots are white. The ground color is light orange or white, tinged with red. Below the suture and at the periphery there may be irregular white or red axial stripes. The spots are whitish on the white stripes and darker red on the red stripes. Sometimes the subsutural and peripheral stripes fuse. Whorls $4\frac{1}{2}$, evenly rounded and smooth. Spire usually produced at an angle of from 65° to 75°; apex rounded. Protoconch minute, depressed and white. Aperture oval. Columellar callus fairly thin, white. Umbilicus reduced to a chink. Suture impressed. Operculum dark olive-green at the margin. Two specimens from Pernambuco, Brasil, are unusually elongate, with the spire produced at an angle of about 50° (Plate 145, fig. 6). On these specimens the red spots are less regular and have fused in patches here and there.

	length	width	
(large)	6.2 mm.	3.9 mm.	Pernambuco, Brasil
	4.8	3.3	Puerto Cabello, Venezuela
	4.0	3.0	Holotype, Ubatuba, São Paulo, Brasil
	3.2	2.3	Itajaí, Santa Catarina, Brasil

Types. The holotype is in the Museum of Comparative Zoölogy, no. 215666. It was collected at Bahia do Flamengo, Ubatuba, São Paulo, Brasil, by W. Narchi on January 7, 1956, and was donated by João de Paiva Carvalho. Paratypes are in the Museum of Comparative Zoölogy, no. 215667, and in the Instituto Oceanográfico, São Paulo, the Academy of Natural Sciences of Philadelphia, and at Stanford University. Paratypes from São Sebastião and Villa Bella, Ilha de São Sebastião, both São Paulo, are in the United States National Museum (nos. 150775, 180790, 364140).

Remarks. This new subspecies can be recognized by the regularly spaced large red spots. The spire is usually lower than in other forms of *T. affinis*. It was incorrectly identified by Haas (1953) as *Phasianella pygmaea* Philippi (1848). Philippi described this from an unknown locality and figured it in 1853 (pl. 4, fig. 11). The spire is much higher than is usual in *cruenta*, being produced at an angle of 55°, the suture is more

impressed and the aperture is circular rather than oval. Furthermore, the color pattern is entirely different. The red spots are much smaller than in *cruenta* and, in addition, *pygmaca* has large yellow flames below the suture and at the periphery. Pilsbry (1888, p. 284) inadvertently synonymized Philippi's name with *T. tessellata*. The identity of Philippi's species still remains in doubt.

The Brasilian records of *Tricolia concinna* C. B. Adams given by Lange de Morretes (1949) and Gofferjé (1950) are no doubt based on this subspecies.

Specimens from Texas are probably Pleistocene or sub-Recent fossils. Some approach *T. affinis pterocladica* in color pattern.

The subspecific name is a Latin adjective meaning stained or spotted with blood.

Range. Along the Caribbean coast of Central and northern South America, ranging as far north as the Grenadines in the Lesser Antilles and south along the coast of Brasil to the State of Santa Catarina. Sporadic on the shores of the western Gulf of Mexico.

Specimens examined. Texas: Rockport (J. Bequaert); Ransom Island, Aransas Bay (D. Moore). Mexico: Veracruz (MCZ; ANSP); Dzilam de Bravo (ANSP); Yucatan Channel (USNM). Honduras: (USNM; ML). Panama: Bocas del Toro, Isla de Colón (T. McGinty; ANSP). Colombia: Cartagena (CAS). Caribbean Islands: Curaçao: Bonaire (both ANSP). Venezuela: Puerto Cabello (MCZ). Lesser Antilles: Admiralty Bay, Bequia, Grenadines (MCZ); Tobago (USNM); Buccoo Bay, Tobago (ANSP). Brasil: Fortaleza, Ceará (H. de Souza Lopes); Pernambuco (MCZ); Ponta Verde, Maceió, Alagoas; Itapoan, Salvador, Bahia; Macaé (all H. de Souza Lopes); Ilha Grande (CNHM), both Rio de Janeiro: Bahia do Flamengo, Ubatuba (João de Paiva Carvalho); São Sebastião; Villa Bella, Ilha de São Sebastião; Guarujá, near Santos (all USNM); Santos (H. de Souza Lopes; ANSP), all São Paulo; Cabeçudos, Itajaí, Santa Catarina (H. de Souza Lopes).

Tricolia adamsi *Philippi*

Plate 143, figs. 3–4; Plate 145, fig. 2

Phasianella brevis C. B. Adams 1850, Contributions to Conchology, no. 4, p. 67 (Jamaica); non *P. brevis* d'Orbigny 1842, etc.

Phasianella adamsi Philippi 1853, Systematisches Conchylien-Cabinet, Nürnberg, (2) **2**, pt. 5, p. 27 [new name for *P. brevis* C. B. Adams 1850, non *P. brevis* d'Orbigny 1842, etc.].

Eulithidium minutissimum 'C. B. Adams' Dall 1908, Proceedings United States National Museum **34**, p. 255 [*nomen nudum*].

Description. Shell fairly thin, subglobose, inflated and reaching 3.8 mm. in length. The color pattern consists of irregularly spaced, rather small, round or oval red dots on a light pink ground color which is partially transparent, except below the suture where it is pure white. The margin of this white area is incised, so that there are lobes of white extending down toward the periphery of each whorl. Between each lobe (of which there are about 8 on the body whorl) the reddish white ground color is intensified. The white subsutural area often becomes obscure on the body whorl. Interspersed between the red dots are a few white dots, except at the periphery. There may also be patches below the periphery where the ground color is darkened. Whorls $3\frac{1}{2}$ to 4, evenly rounded. Spire low, produced at an angle of from 76° to 85°; apex rounded. Protoconch minute, de-

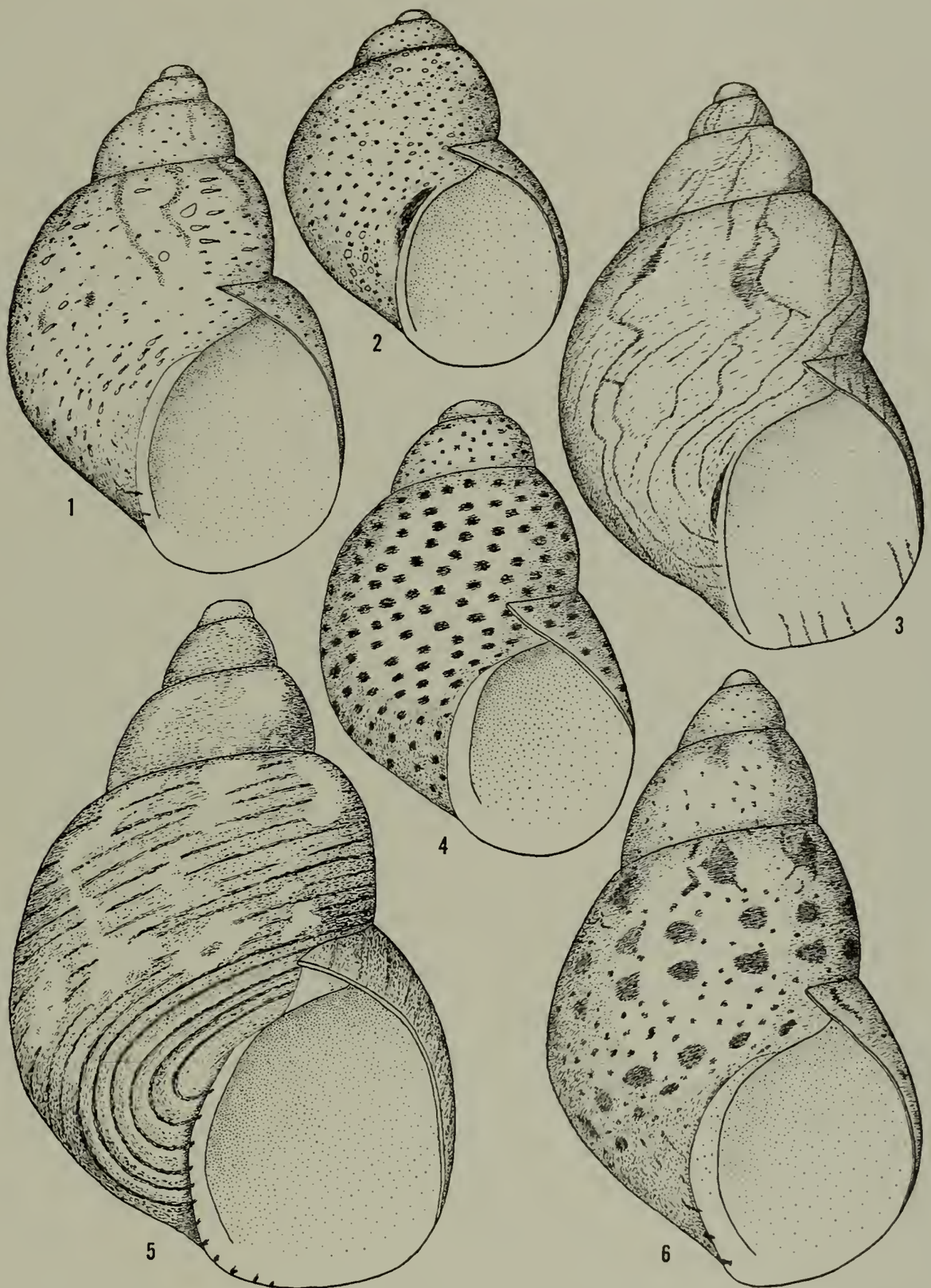

Plate 145. Fig. 1. *Tricolia affinis affinis* C. B. Adams. Great Abaco Id., Bahama Islands. Fig. 2. *Tricolia adamsi* Philippi. Guana Id., Virgin Islands. Fig. 3. *Tricolia affinis pterocladica* Robertson. Miami Beach, Florida. Figs. 4, 6. *Tricolia affinis cruenta* Robertson. Fig. 4. Puerto Cabello, Venezuela. Fig. 6. Elongate form, Pernambuco, Brasil. Fig. 5. *Tricolia affinis beaui* Robertson. Barbados, Lesser Antilles (all 13x).

pressed, white or reddish purple. Aperture round to oval. Columellar callus obscure; rimately perforate. Suture impressed. Post-nuclear whorls smooth except for fine spiral striae on the penultimate whorls. Operculum oval, white, strongly convex exteriorly and polished.

	length	width	
(large)	3.8 mm.	3.0 mm.	Guana Id., Virgin Islands
	3.7	2.8	Boca de Congrejos, Puerto Rico
	2.8	2.4	Holotype of *Phasianella brevis* C. B. Adams
(juvenile)	1.2	1.3	Off Punta Alegre, Camagüey, Cuba

Types. Turner (1956, pl. 21, fig. 4) selected a neotype of *Phasianella brevis* C. B. Adams (Plate 143, fig. 4) from St. Thomas, Virgin Islands, believing that the types were lost. This specimen is in the Museum of Comparative Zoölogy, no. 186592. Subsequently a single Jamaican specimen from the C. B. Adams collection has been recovered (Plate 143, fig. 3). Both specimens had been borrowed by Pilsbry from Amherst College before the collection was obtained on exchange by the Museum of Comparative Zoölogy in 1942. The neotype specimen was not returned until after the first paper on C. B. Adams' types was published (Clench and Turner 1950) and the holotype was not returned until after the supplement was published by Turner (1956). The holotype is now in the Museum of Comparative Zoölogy, no. 215661. The neotype as a result is invalid. The type locality is Jamaica.

Remarks. This species can be distinguished from *T. affinis affinis*, with which it commonly occurs and has been confused, by the smaller size, the lower spire, and the different color pattern. The white subsutural area of *adamsi* is characteristic and the small red spots are not consistently paired with white spots as they are in *T. affinis affinis*. The present species varies little in color throughout its range. No information is available on its ecology.

Dall (1889a) states that *Phasianella brevis* C. B. Adams "is merely a young specimen of the shell he [C. B. Adams] had previously named *Turbo pulchella.*" The specimens seen by Dall must have been misidentified.

Three specimens in the United States National Museum are labeled "*Eulithidium minutissima* C. B. Ads." Although Dall, as indicated in the synonymy above, has referred to this name, it was never published by C. B. Adams.

Range. Throughout the West Indies, from the Bahama Islands to the Lesser Antilles, and the coast of Central America (Honduras and Panama). Not present on the coast of Florida.

Specimens examined. Bahama Islands: Elbow Cay, Great Abaco Id. (R. Robertson); Mangrove Cay, Andros Id. (USNM). Off Nassau Harbour (T. McGinty); Treasure Island (G. and M. Kline); Clifton Bluff (T. McGinty), all New Providence; Campdown, northern Cat Island (MCZ). Cuba: Dimas and Cabañas, Pinar del Río (both USNM); near Habana (ANSP); Arenas de la Chorrera, both Habana; off Punta Alegre, Camagüey; Guantánamo, Oriente (all MCZ). Jamaica: (MCZ; AMNH; CNHM); Jack's Bay, St. Mary; Port Royal (both USNM). Hispaniola: Les Trois Pavillons, Dépt. du Nord-Ouest; Les Cayes; St. Louis du Sud; Aquin, all Dépt. du Sud; Saltrou,

Dépt. de l'Ouest, all Haiti (all USNM); El Canal, Cabo Macorís (MCZ); Bahía de Samaná (USNM), both Dominican Republic. PUERTO RICO: Aguadilla (G. Warmke); Boca de Congrejos (MCZ). VIRGIN ISLANDS: St. Thomas (MCZ; USNM; U of M; CNHM); Guana Id., near Tortola (MCZ); St. Croix (G. Usticke). LESSER ANTILLES: Saint Martin (ANSP); English Harbour, Antigua (USNM); Bathsheba, Barbados (MCZ); Barbados (USNM; ANSP); Buccoo Bay, Tobago (ANSP). HONDURAS: (USNM). PANAMA: Bocas del Toro, Isla de Colón (T. McGinty; ANSP); Colón (LSJU).

Tricolia thalassicola, new species

Plate 142, fig. 2; Plate 144, figs. 1–2; Plate 146

Phasianella umbilicata d'Orbigny 1842 [in] Ramon de la Sagra, Histoire de l'Ile de Cuba, Mollusques 2, p. 77, pl. 19, figs. 32–34 (Martinique, Guadeloupe, Jamaica and Cuba) [in part only]; non *Littorina umbilicata* d'Orbigny 1840 [a *Tricolia*].

Description. Shell solid, oval, inflated and reaching 7.1 mm. in length. The color pattern consists of a series of regularly spaced, large, light to dark brown, orange or olive-green spots. There are about 7 pairs of axial to oblique flames of color on the body whorl just below the suture and at the periphery; these are the same color as the spots but darker. The spots on the flames are darkened. Between the flames the ground color is cream-white; elsewhere it is cream. The spots are coalesced into oblique spiral bands in some specimens (Plate 146, fig. 3). The spots are occasionally obscure and they then alternate with pale patches. Whorls 6, evenly rounded. Spire usually produced at an angle of from 65° to 77°; apex obtuse. Protoconch minute, depressed and white. Aperture oval. Columella with a white callus. Umbilicus fairly narrow. Suture impressed. Postnuclear whorls with evenly spaced spiral striae; body whorl smooth except for minute growth lines. Operculum white, strongly convex exteriorly and nearly smooth.

	length	width	
(large)	7.1 mm.	4.5 mm.	Cabo San Antonio, Cuba
	4.3	3.3	Holotype, Great Abaco Id., Bahama Islands
(banded form)	2.9	2.3	Cabañas, Cuba
(deep water form)	2.4	1.8	Off Cape Lookout, North Carolina

Types. The holotype is in the Museum of Comparative Zoölogy, no. 213260. It was collected by the author at Johnnie's Cay, Drunken Cays, near Elbow [Little Guana] Cay, Great Abaco Id., Bahama Islands, on July 28, 1953. Paratypes from the vicinity of Elbow Cay are in the Museum of Comparative Zoölogy, no. 213261, the United States National Museum, the Academy of Natural Sciences of Philadelphia, the American Museum of Natural History, the Chicago Natural History Museum, at Stanford University, the California Academy of Sciences, the Institute of Marine Biology, Puerto Rico, and the private collection of Thomas L. McGinty.

Remarks. This species has been called *Phasianella umbilicata* d'Orbigny. However, d'Orbigny's figure and part of his description were based on *T. affinis affinis*. Unfortunately, the seven syntypes in the British Museum (Natural History) [no. 54.10.4.283] are *thalassicola* (one is figured here, Plate 142, fig. 2). The specimen figured originally by d'Orbigny is evidently lost. It was deemed wiser to describe the present species as new

rather than merely to rename d'Orbigny's homonym after selecting the syntype figured here as the lectotype. These syntypes hence become invalid.

The species can readily be distinguished from *T. affinis* and *T. adamsi*, with which it has been confused, by the regularly spaced brown, orange, or olive-green spots, which are relatively much larger than the red and the white spots of both these other species. Also, *T. affinis* is more elongate and grows to a larger size. The whorls of *thalassicola* are more rounded, and the early whorls are evenly spirally striated, while in *T. affinis* they are smooth.

In a rare color form of *thalassicola* the spots are coalesced so that the color pattern consists of broad yellowish brown obliquely spiral bands on a cream ground color (Plate 146, fig. 3). This form has been referred to as *T. tessellata*, but it is clearly distinguishable by the shape of the shell, the spirally striated initial whorls and the thickness of the obliquely spiral bands of color. Sometimes some of the spots near the base of the columella do not coalesce, showing that this is merely a color form differing in no significant way from the spotted form. It occurs sporadically in shallow water along the Florida Keys and in the Caribbean.

A deep water form (Plate 144, fig. 2; Plate 146, fig. 2) occurs at both the northern and southern ends of the range—North Carolina and Brasil—as well as off southern, western, and northwestern Florida and off Yucatán, all in depths of from 10 to 35 fathoms. Empty shells have been dredged as deep as 117 fathoms. This form was erroneously identified by Dall, in part, as *Phasianella brevis* d'Orbigny, an entirely different species, here referred to the genus *Gabrielona*. The deep water form is much smaller than the shallow water forms of *thalassicola*. The suture is more impressed and the whorls are more inflated. The characteristic spots of *thalassicola* are much smaller but are similarly arranged, often with axial to oblique stripes below the suture and at the periphery. The initial whorls are spirally striated as in the shallow water forms. This deep water form may possibly be a species distinct from *thalassicola* but its discontinuous and peripheral distribution suggests that this is not the case.

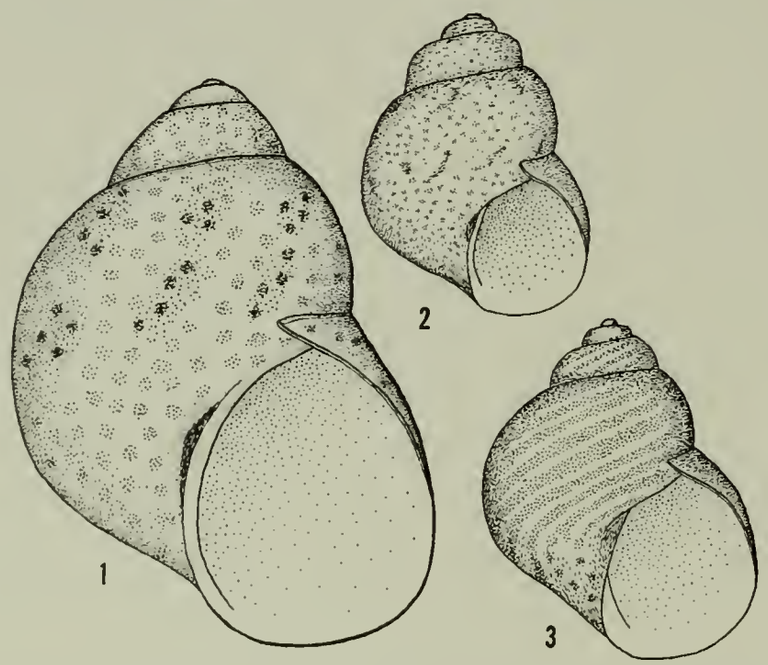

Plate 146. *Tricolia thalassicola* Robertson. Fig. 1. Great Abaco Id., Bahama Islands. Fig. 2. Deep water form, off Cape Lookout, North Carolina. Fig. 3. Banded form, Cabañas, Pinar del Río, Cuba (all 13x).

This species normally lives on Turtle Grass (*Thalassia testudinum* Konig). The specific name is derived from this fact. It may feed on the *Thalassia* itself, or, which is more likely, on the epiphytic algae. Little information has been published on the distribution of *Thalassia* in the Western Atlantic except that by Ostenfeld (1927) and by Voss and Voss (1955) on Florida. It does not live off North Carolina and it is unlikely that it would grow in water deeper than 10 fathoms, so the deep water form of *thalassicola* probably lives in another habitat. *Thalassia* does not live in Lake Worth, Florida, yet specimens of *thalassicola* have been collected there, but they are small and do not show the color pattern of spots clearly. The large specimens with prominent spots, so abundant in the Bahama Islands and along the north coast of Cuba, live invariably on *Thalassia*. They have been dredged in shallow water to a depth of 5 fathoms, being most abundant where the sediment is calcareous. Variation in this species is probably due in part to different plant foods.

Range. From off Cape Hatteras, North Carolina, throughout the West Indies, to off Cabo de São Roque, Rio Grande do Norte, Brasil. There are no records from the western half of the Gulf of Mexico and the Atlantic coast of Central America and Colombia. *Thalassia*, however, does live in these areas.

Specimens examined. North Carolina: *Albatross*, station 2596 (N. Lat. 35°08′30″; W. Long. 75°10′00″) in 49 fathoms (dead); *Albatross*, station 2595 (N. Lat. 35°08′00″; W. Long. 75°05′30″) in 63 fathoms (dead), both off Cape Hatteras; *Albatross*, station 2617 (N. Lat. 33°37′30″; W. Long. 77°36′30″) in 14 fathoms (dead), off Cape Lookout (all USNM). Florida: off Palm Beach in 30 fathoms (T. McGinty); Boynton Beach (ANSP; T. McGinty); *Eolis*, stations 49, 51, 70, 113, 124, in 10–35 fathoms, all off Miami (all USNM); Fisher Id., Miami (T. McGinty); *Eolis*, stations 8, 105, 107, 123, 142, 150, 306, in 22–100 fathoms (all dead), all off Fowey Light (all USNM): Turtle Harbor (ANSP; U of M); *Eolis*, station 59, in 20 fathoms (dead), off Turtle Harbor (USNM): off Carysfort Light, in 66–117 fathoms (dead); off The Elbow, Key Largo, in 66–75 fathoms (dead; both MCZ); Upper Matecumbe Key (USNM); Conch Keys (T. McGinty); off Sombrero Light, in 58 fathoms (dead; MCZ); Key West: *Eolis*, station 44, in 50 fathoms (dead), off Key West (both USNM); Garden Key (FSM): Loggerhead Key (USNM; FSM; T. McGinty), both Dry Tortugas; 90 miles SW of Egmont Key, S of St. Petersburg, in 70 fathoms (dead); off Destin, near Fort Walton, in 14 fathoms (dead; both T. McGinty). Bahama Islands: N of Little Abaco Id. (MCZ); Drunken Cays, Elbow [Little Guana] Cay and Tilloo Cay, Great Abaco Id. (all R. Robertson); Sweetings Village, Great Abaco Id. (MCZ); Great Isaac (U of M): 10 miles NE of North Point, North Bimini (R. Robertson); North Bimini and South Bimini (both USNM); off Gun Cay (U of M); South Cat Cay (USNM: T. McGinty), all Bimini Ids.; South Riding Rock (R. Robertson); Mangrove Cay, Andros Id. (MCZ: USNM): Lyford Cay, S of North Cay in 2 fathoms and off Nassau Harbour (all T. McGinty): North Cay (CNHM), all New Providence Id.; Galloway Landing, Long Id.; Matthew Town, Great Inagua Id. (both MCZ). Cuba: Cabo San Antonio: Punta del Tolete, in 2–3 fathoms: off Los Arroyos; Dimas, in 4–5 fathoms; Santa Lucía, in 2–4 fathoms; La Esperanza, in 2–3 fathoms; Cayo Arenas, in 2 fathoms: Cayo Levisa, in 2–3 fathoms; Punta Colorado, in 2–3 fathoms; Cabañas, all Pinar del Río (all USNM):

Arenas de la Chorrera, Habana: Bahía de Matanzas: *Atlantis*, station 2993 (N. Lat. 23°24′; W. Long. 80°44′) in 580 fathoms (dead), off Bahía de Cárdenas, both Matanzas: off Cayo Fragoso, Las Villas: off Punta Alegre, Camagüey: Guarda la Vaca, near Puerto Samá, Oriente (all MCZ). Cayman Islands: Grand Cayman (MCZ; ANSP). Jamaica: Montego Bay, St. James: Port Antonio, Portland (both USNM). Hispaniola: Bariadèle: Les Cayes: Ile-à-Vache, all Dépt. du Sud, Haiti (all USNM): Montecristi (MCZ: ANSP): Bahía de Samaná (USNM), both Dominican Republic. Puerto Rico: Vieques (USNM). Virgin Islands: St. Thomas (USNM; ANSP): St. John (MCZ). Lesser Antilles: Saint Martin (ANSP): Falmouth and English Harbour, Antigua: Carlisle Bay, Barbados (all USNM): Admiralty Bay, Bequia, Grenadines (MCZ). Caribbean Islands: Curaçao (USNM: ANSP). Mexico: Dzilam de Bravo (ANSP): off Cabo Catoche (USNM), both Yucatán. Brasil: *Albatross*, station 2758 (S. Lat. 6°59′30″; W. Long. 34°47′00″) in 20 fathoms, off Cabo de São Roque, Rio Grande do Norte (USNM).

Tricolia bella *M. Smith*

Plate 139, fig. 5: Plate 142, figs. 4–5; Plate 143, fig. 5; Plate 147, figs. 1–2

Turbo (?) *pulchellus* C. B. Adams 1845, Proceedings Boston Society of Natural History **2**, p. 7 (Jamaica); non *Phasianella pulchella* Récluz 1843 [a *Tricolia*].

Littorina adamsii Reeve 1857, Conchologia Iconica **10, Littorina**, no. 85 (Jamaica) [“*Littorina pulchella*, C. B. Adams, MS., Mus. Cuming” cited as a synonym]; non *Phasianella adamsi* Philippi 1853 [a *Tricolia*].

Phasianella bella ‘Pilsbry’ M. Smith 1937, East Coast Marine Shells, p. 81, pl. 31, fig. 20 [new name for *Tricolia pulchella* C. B. Adams 1845, non Récluz 1843, in Pilsbry’s MS. This is listed as a synonym of *bella* by Maxwell Smith].

Description. Shell solid, conical, more or less carinate, with spiral cords and reaching 5.2 mm. in length. The color pattern consists of red, pink, brown or orange-yellow spots or flames on a white ground color. Sometimes the shell is greenish or khaki-colored; rarely it is unicolored. The flames usually form irregular axial stripes and the spots are usually delimited by the width of the spiral cords. Whorls 4½ to 5, angular in the middle, with the body whorl biangular, or rounded. Spire produced at an angle of from 59° to 64°. Protoconch fairly large and prominent, flattened apically and either white or bright purple. Aperture nearly round. Columellar callus obscure. Rimately perforate. Suture impressed. The keel above the periphery is usually strongly developed while the keel below on the body whorl is always less prominent: both are usually spotted with white. Above and below these keels and between them there are fine irregularly beaded spiral cords. In a smooth form of the species (Plate 147, fig. 2) the initial whorls are threaded but on the evenly rounded body whorl the cords are obscure and the keels are replaced by stripes on which the color pattern differs from that on the remainder of the whorl. The upper keel can always be seen on the early post-nuclear whorls. The operculum is round-ovate, white, externally convex and threaded near the margin. The juvenile operculum is perforate (Plate 139, fig. 5).

	length	width	
(smooth form)	5.2 mm.	3.3 mm.	Miami Beach, Florida
	4.3	3.0	St. Thomas, Virgin Islands
	3.0	2.3	Lectotype of *Turbo* (?) *pulchellus* C. B. Adams
(juvenile)	0.7	0.6	Pigeon Cays, Andros Id., Bahama Islands

Types. The lectotype of *Turbo* (?) *pulchellus* C. B. Adams (Plate 143, fig. 5), selected by Clench and Turner (1950, pl. 40, fig. 9), is in the Museum of Comparative Zoölogy, no. 156358. Lectoparatypes from Jamaica are in the Museum of Comparative Zoölogy (no. 186165), the Academy of Natural Sciences of Philadelphia (no. 6453) and the United States National Museum (no. 64386). Two syntypes of *Littorina adamsii* Reeve (Plate 142, figs. 4–5) are in the British Museum (Natural History), nos. 1957.6.3.4–5. The type locality is Jamaica.

Remarks. This species can readily be identified by its characteristic shape. It was identified by Pilsbry (1888, pl. 39, fig. 95), in part, as *Phasianella umbilicata* d'Orbigny, a name here discussed in the *Remarks* on *T. thalassicola.*

Maxwell Smith unintentionally renamed C. B. Adams' homonym by using Pilsbry's manuscript name. The specimen he figures and describes is the smooth form from Florida.

The smooth form of this species (Plate 147, fig. 2) occurs with, and intergrades with, the ribbed form and is most abundant from Miami to the Florida Keys and in parts of the Bahama Islands, but also appears occasionally on the north coast of Cuba, on the east coast of Guatemala and in the Lesser Antilles at Antigua. Even where it occurs the smooth form is not uniformly distributed, for at many localities in the Florida Keys and in the Bahama Islands only the ribbed form has been collected.

A specimen of the smooth form was collected by the author at Great Abaco Id., Bahama Islands, on *Thalassia* in shallow water. These two variants are not ecologic forms, however, because the ribbed form also lives on *Thalassia*, as well as in a variety of other habitats, such as in calcareous gravel and beneath gorgonian holdfasts. The dimorphism is probably entirely genetic. In general, the specimens mottled with green or khaki (both smooth and ribbed forms) live on *Thalassia*, while those spotted with red are found elsewhere.

Range. From Lake Worth south along the east coast of Florida, throughout the Florida Keys and the West Indies, west to the coast of Central America and south at least to the State of Alagoas, Brasil. Dall (1892) records the species from the Cedar Keys on the west coast of Florida and as a Pliocene fossil in South Carolina.

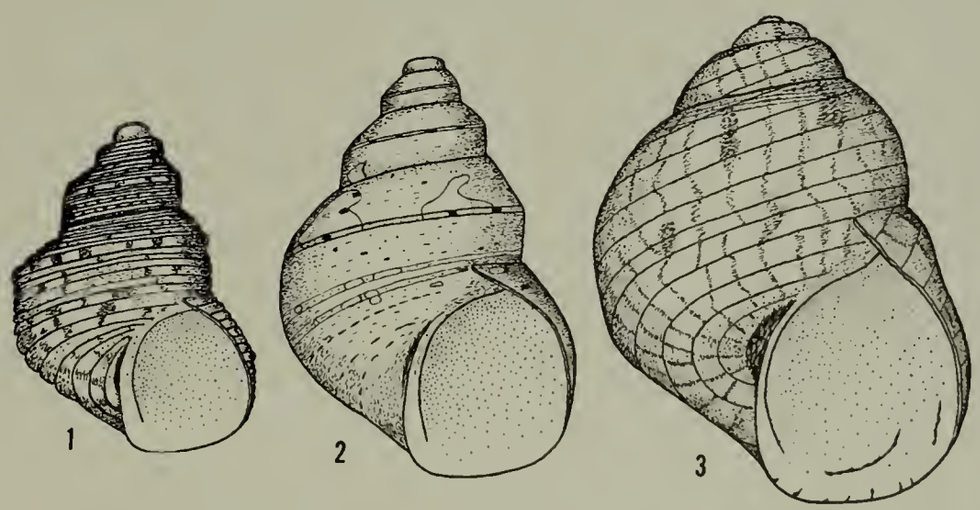

Plate 147. Figs. 1–2. *Tricolia bella* M. Smith. Great Abaco Id., Bahama Islands. Fig. 1. Ridged form. Fig. 2. Smooth form. Fig. 3. *Tricolia tessellata* Potiez and Michaud. Barbados, Lesser Antilles (all 13x).

Specimens examined. Florida: North Inlet (T. McGinty); South Inlet (MCZ), both Lake Worth; Bakers Haulover, Miami (ANSP); Miami Beach (ANSP; FSM); off Government Cut, Miami; *Eolis*, stations 49, 51, 70, in 10–30 fathoms (dead), off Miami (all USNM); Fisher Id., Miami (T. McGinty); Ragged Keys; *Eolis*, station 366, in 75–90 fathoms (dead), east of Ragged Keys; *Eolis*, stations 8, 80, 306, in 25–100 fathoms (dead), off Fowey Light (all USNM); Sands Key, Biscayne Bay (MCZ; USNM); Caesars Creek Bank, north of Key Largo (USNM); Key Largo (LSJU); Turtle Harbor, in 4–10 fathoms: Upper Matecumbe Key (both USNM); Teatable Key (T. McGinty); Indian Key (USNM); Lower Matecumbe Key (USNM; CAS); Center Key (LSJU); Conch Keys (T. McGinty; ANSP); Grassy Key (ANSP); Bonefish Key (MCZ; ANSP; CNHM; LSJU; U of M; FSM); Little Duck Key; Missouri Key (both MCZ); Bahia Honda Key (USNM; ANSP); Noname Key (LSJU); Big Pine Key (MCZ; ANSP); Newfound Harbor Key (USNM); Torch Key (ANSP); Summerland Key (D. and N. E. Schmidt); Loggerhead Key (USNM); Sugarloaf Key; Boca Chica Key (both ANSP); Middle Sambo Shoals, S of Boca Chica Key (T. McGinty); Key West (MCZ; USNM; ANSP; LSJU; U of M); Boca Grande Key (USNM). Garden Key (USNM; FSM); Loggerhead Key (USNM; T. McGinty); Sand Key; Bush Key (both FSM), all Dry Tortugas. Bahama Islands: N of Little Abaco Id.; Whale Cay Channel; Sweetings Village, both Great Abaco Id. (all MCZ); Elbow [Little Guana] Cay; between Channel Cay and Wilson City, both Great Abaco Id. (both R. Robertson); Great Isaac (U of M). 5 miles NE of North Point, North Bimini (R. Robertson); North Bimini (USNM); South Bimini (MCZ; USNM); South Cat Cay (USNM; T. McGinty), all Bimini Ids.; South Riding Rock; Deep Creek, Andros Id. (both R. Robertson); Pigeon Cays (T. McGinty) and Mangrove Cay (MCZ; USNM), Andros Id.; Clifton Pt., Lyford Cay, S of North Cay, and off Nassau Harbour, all New Providence Id. (all T. McGinty); Simms; Galloway Landing, both Long Id. (both MCZ); Acklins Id. (USNM). Cuba: off Los Arroyos; Dimas; Cayo Arenas; Cayo Levisa; Bahía Honda; Cabañas, all Pinar del Río (all USNM); Arenas de la Chorrera, Habana (MCZ; CNHM); Bahía de Matanzas; Varadero (both MCZ); Bahía de Cárdenas (USNM), all Matanzas; off Cayo Fragoso, Las Villas; off Punta Alegre, Camagüey; Guarda la Vaca, near Puerto Samá; Guantánamo, both Oriente (all MCZ). Jamaica: Montego Bay, St. James; Jack's Bay, St. Mary (both USNM); Port Royal (MCZ; USNM); Mouth of Rio Cobre, St. Catherine (USNM). Hispaniola: Les Trois Pavillons, Dépt. du Nord-Ouest; Bariadèle; Coteaux; Les Cayes; Aquin, all Dépt. du Sud; Saltrou, Dépt. de l'Ouest, all Haiti (all USNM); Montecristi; Puerto Plata; El Canal, Cabo Macorís (all MCZ); Bahía de Samaná (USNM), all Dominican Republic. Puerto Rico: Rincón (LSJU); Aguadilla; Boca de Congrejos (both G. Warmke). Virgin Islands: St. Thomas (USNM; ANSP); St. Croix (G. Usticke). Lesser Antilles: Falmouth and English Harbour, Antigua (USNM); Martinique (AMNH); Crane Pt., Barbados (USNM); Barbados (MCZ; ANSP; LSJU); Pigeon Pt. (MCZ); Buccoo Bay (MCZ; ANSP), both Tobago. Guatemala: Lívingston and Puerto Barrios (ANSP). Honduras: Isla Utila (USNM). Panama: Bocas del Toro, Isla de Colón; Piña, west of Colón; Colón (all T. McGinty). Brasil: Maceió, Alagoas (H. de Souza Lopes).

Tricolia tessellata *Potiez and Michaud*

Plate 142, fig. 3; Plate 143, fig. 6; Plate 147, fig. 3

Phasianella tessellata 'Beck' Potiez and Michaud 1838, Galerie des Mollusques, Paris, **1**, p. 312, pl. 29, figs. 7–8 (Martinique).

Phasianella minuta Anton 1839, Verzeichniss Conchylien, Halle, p. 60; non *P. minuta* J. Sowerby 1817 [is a synonym of *P. tessellata* Potiez and Michaud according to Philippi 1853, p. 19].

Phasianella zebrina d'Orbigny 1842 [in] Ramon de la Sagra, Histoire de l'Ile de Cuba, Mollusques **2**, p. 78, pl. 19, figs. 35–37 (Guadeloupe).

Phasianella tesselata C. B. Adams 1850, Contributions to Conchology, no. 4, pp. 67–68 (Jamaica) [misspelled *tessellata* in republication by Clench and Turner 1950, p. 351].

Phasianella lipeata 'Dkr.' Krebs 1864, The West-Indian Marine Shells, p. 79 (republished by Clench, Aguayo and Turner 1947, Revista de la Sociedad Malacológica **5**, p. 109) [*nomen nudum;* cited as a synonym of *P. tesselata* C. B. Adams "according to specimens in the collection of A. H. Riise"].

Description. Shell solid, smooth, oval, inflated and reaching 5.2 mm. in length. The color pattern consists of regularly spaced spiral lines which descend obliquely, arising from the suture at an angle of about 15°. There are irregular axial streaks between these, often in subsutural and peripheral patches. The lines and streaks are red or brown (sometimes with an olive-green tint) on a pale cream or pink ground color with irregular white spots adjacent to them. The entire shell is sometimes brownish black, with the oblique spiral lines darkest. Whorls 5, convex, slightly flattened or even concave above the periphery. Apex obtuse and the spire produced at an angle of from 72° to 76°. Protoconch minute, red or purple. Aperture oval. Columella with a white callus. Umbilicus narrow. Suture slightly impressed. Body whorl often spirally striated, the striae deepest just below the suture. Operculum white, tinged marginally with dark green and brown, spirally striated internally; radially striated externally, most strongly near the margin.

	length	width	
	5.2 mm.	4.5 mm.	Jamaica
	3.7	3.0	Barbados
(juvenile)	1.5	1.4	Aquin, Haiti

Types. According to Gaillard (in Kaas, Basteria **21**, p. 84, 1957) the Potiez and Michaud types formerly in the Musée de Douai, Dépt. du Nord, France, have disappeared. Hence there are now no type specimens of *Phasianella tessellata* Potiez and Michaud. The whereabouts of Anton's types is unknown to the author. Seven syntypes of *Phasianella zebrina* d'Orbigny (one is illustrated here, Plate 142, fig. 3) are in the British Museum (Natural History), no. 54.10.4.284. The lectotype of *Phasianella tesselata* C. B. Adams (Plate 143, fig. 6), selected by Clench and Turner (1950, pl. 36, fig. 12), is in the Museum of Comparative Zoölogy, no. 186067. Lectoparatypes from Jamaica are in the Museum of Comparative Zoölogy (nos. 119308, 186068), the Academy of Natural Sciences of Philadelphia (no. 6463) and in the United States National Museum (nos. 6418, 54762, 64387). The type locality of *P. tessellata* Potiez and Michaud is Martinique, Lesser Antilles.

Remarks. This abundant species is easily recognized by the oblique spiral lines and the shape of the shell. It is highly variable in coloration: some specimens are red, others are light brown and a few are brownish black. The light brown form is abundant in Jamaica

but decreases in frequency to the east and south. In the Lesser Antilles where the red form is abundant the brown form is scarce. The red form is infrequent in Jamaica. The brownish black form appears sporadically throughout the range. Specimens from Venezuela, Colombia and Panama are of all three color forms and are strongly pigmented.

The differences between the present species and the banded form of *T. thalassicola* are discussed in the *Remarks* under the latter species.

Records of this species in Florida are based on *T. affinis pterocladica.*[1] No specimens have been seen by the author from the Bahama Islands,[2] Cuba or the northern portion of Haiti. It probably does not live in these areas. The Brasilian record of *Tricolia minuta* Anton given by Lange de Morretes (1949), which presumably is based on this species, is questionable.

Range. Jamaica, Hispaniola, Puerto Rico, south through the Lesser Antilles to Trinidad and west along the coast of northern South America to Panama.

Specimens examined. Jamaica: Montego Bay, St. James: Jack's Bay, St. Mary; Port Morant, St. Thomas (all USNM); Port Royal (MCZ; USNM); Mouth of Rio Cobre; Old Harbour, both St. Catherine (both USNM). Hispaniola: Port Salut; Torbeck; Les Cayes; St. Louis du Sud; Aquin, all Dépt. du Sud; Saltrou, Dépt. de l'Ouest, all Haiti (all USNM). Montecristi (MCZ; ANSP); Puerto Plata; El Canal, Cabo Macorís (both MCZ); Bahía de Samaná (USNM), all Dominican Republic. Puerto Rico: Aguadilla (G. Warmke); Arecibo; Boca de Congrejos (both MCZ); Guaniquilla (LSJU); Mayagüez (USNM); off Mayagüez, in 40–100 ft.; Rincón (both G. Warmke); Rincón Lighthouse; Bahía de Añasco; Pta. Arenas, Vieques (all MCZ). Virgin Islands: St. Thomas (USNM: AMNH); Guana Id., near Tortola (MCZ); St. Croix (G. Usticke). Lesser Antilles: Saint Martin (ANSP); Falmouth, Antigua (USNM); Guadeloupe (MCZ: ANSP); Martinique (AMNH); Bathsheba, Barbados (MCZ: USNM); Barbados (ANSP; AMNH; LSJU; CNHM); Anse Fourmi, Tobago; Carenage, Trinidad (both MCZ). Venezuela: Maiquetía, Federal District (ANSP). Colombia: Cartagena (CAS). Panama: Bocas del Toro, Isla de Colón (T. McGinty).

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[1] M. Smith (1937) identified both species as *tessellata*. One of the specimens he illustrates is *T. affinis pterocladica* (pl. 29, fig. 18a) and the other is true *tessellata* (pl. 29, fig. 18b). The latter could not have been collected in Florida.

[2] Ford's record (1944) is erroneous.

Notes

The synonymies are given here of two Eastern Pacific species which are the types of *Eulithidium* Pilsbry and *Usatricolia* Habe, here considered synonyms of *Tricolia*, s.s.

Tricolia variegata *Carpenter*

Plate 138, fig. 6; Plate 148, fig. 1

Eucosmia variegata Carpenter 1864, Annals and Magazine of Natural History (3) **13**, p. 475 (Cape San Lucas [Baja California, Mexico]).

Eulithidium typicum Dall 1908, Proceedings United States National Museum **34**, p. 255 [new name for *Eucosmia variegata* Carpenter 1864, non *Phasianella variegata* Lamarck 1822].

Phasianella (*Eulithidium*) *typica* Dall. Strong 1928, Proceedings California Academy of Sciences (4) **17**, p. 194, pl. 10, figs. 12–13.

This species is the type of *Eulithidium* Pilsbry. It is to be observed that the spire is not particularly low. It is known only from Cape San Lucas and Bahía Magdalena, Baja California, Mexico. The holotype is in the United States National Museum, no. 11836.

Tricolia compta *Gould*

Plate 138, fig. 4; Plate 148, fig. 2

Phasianella compta Gould 1855, Appendix to the Preliminary Geological Report of William P. Blake (Palaeontology). Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean (War Department), U.S. House of Representatives Doc. 129, 33d. Congress, 1st. Session, pp. 22, 25 (San Diego, California) [published as a separate but not included in the Congressional Reports]; 'Gould, ms.' Carpenter 1856 (May), Catalogue of the Reigen Collection of Mazatlan Mollusca in the British Museum, pp. 225–226 (San Diego and Santa Barbara, California; Mazatlan, Mexico); 'Gould, MS.' Carpenter 1857 (January 7), Proceedings Zoological Society of London **24**, p. 204 (Santa Barbara and San Diego); Gould 1857, Pacific Railroad Reports **5**, pt. 2, pp. 330, 333–334, pl. 11, figs. 25–26 (San Diego).

Plate 148. Fig. 1. *Tricolia variegata* Carpenter. Bahía Magdalena, Baja California, Mexico (21x). The type species of *Eulithidium* Pilsbry. Specimen collected and identified by A. M. Strong (CAS Loc. 24036). Fig. 2. *Tricolia compta* Gould. Ideotype, Santa Barbara, California (11x). The type species of *Usatricolia* Habe.

Phasianella (*Tricolia*) *compta* Gould var. *producta* Dall 1908, Proceedings United States National Museum **34**, p. 256 [refers to Pilsbry 1888, pl. 39, fig. 69].

Phasianella (*Tricola*) *compta* Gould. Strong 1928, Proceedings California Academy of Sciences (4) **17**, p. 191, pl. 10, fig. 1.

This species is the type of *Usatricolia* Habe. It is apparently restricted to the coast of California and northern Baja California. The specimen figured is an ideotype mentioned by Carpenter from Santa Barbara. The location of Gould's holotype of this species is unknown. According to Palmer (1951) two specimens from Mazatlan ("Tablet 1086" listed by Carpenter in 1856) are in the New York State Museum. These are probably a different species.

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Phasianella bicarinata *Poulsen*

Phasianella bicarinata 'd'Orbigny' Poulsen 1878, Catalogue of West-India Shells, Copenhagen, p. 13 [*nomen nudum*]; non *P. bicarinata* Dunker 1846.

This was probably a misidentification of *Tricolia bella*. *T. bicarinata* Dunker is a similar South African species.

Phasianella concolor *C. B. Adams*

Phasianella concolor C. B. Adams 1850, Contributions to Conchology, no. 4, p. 68 (Jamaica).

This is a synonym of *Assiminea auberiana* (d'Orbigny), as was first shown by Dall (1892). The lectotype, selected by Clench and Turner (1950, pl. 36, fig. 3), is in the Museum of Comparative Zoölogy, no. 186022; so also are lectoparatypes, no. 186023. Pilsbry (1888, pp. 171, 275, pl. 45, fig. 1) erroneously applied this name to the dark brown form of *Tricolia tessellata*.

Phasianella tessellata *Anton*

Phasianella tessellata Anton 1839, Verzeichniss Conchylien, Halle, p. 61 (South America); non *P. tessellata* Potiez and Michaud 1838.

As suggested by Philippi (1853, p. 32) this is probably a *Littorina*.

* * * *

Dall (1889b) records both "*Phasianella umbilicata* Orbigny" and "*P. pulchella* C. B. Adams" [= *Tricolia bella* M. Smith] from Bermuda. Two species of *Tricolia* are also listed from the island by Tristram (1862). I have seen no authentic Bermuda specimens.

REFERENCES

Adams, H. and A. 1854, The Genera of Recent Mollusca, London, **1**, pp. 389–390.

Aguayo, C. G. 1945, Revista de la Sociedad Malacológica **3**, p. 84.

Böggild, O. B. 1930, Det Kongelige Danske Videnskabernes Selskabs Skrifter, Naturvidenskabelig og Mathematisk Afd. (9) **2**, p. 301, pl. 9, fig. 5.

Bucquoy, E., P. Dautzenberg and G. Dollfus 1884, Mollusques Marins du Rousillon, Paris, **1**, pp. 337–339.

Clark, W. 1855, British Marine Testaceous Mollusca, London, pp. 320–322, 516–517.

Clench, W. J. and R. D. Turner 1950, Occasional Papers On Mollusks, Harvard Univ., **1**, no. 15.

Cossmann, M. 1889, Annales de la Société Royale Malacologique de Belgique **24**, pp. 3–4.

Cossmann, M. 1918, Essais de Paléoconchologie Comparée, Paris, livraison **11**, pp. 156–167.

Cotton, B. C. and F. K. Godfrey 1938, Malacological Society of South Australia Publication No. 1, p. 9.

Cotton, B. C. 1945, Transactions Royal Society of South Australia **69**, pp. 163–165.

Crespin, I. 1926, Proceedings Royal Society of Victoria (2) **38**, p. 119, pl. 9, figs. 16–17.

Dall, W. H. 1889a, Bulletin of the Museum of Comparative Zoölogy **18**, p. 351, pl. 19, fig. 10b.

Dall, W. H. 1889b, United States National Museum Bulletin **37**, pp. 158–159, pl. 19, fig. 10b.

Dall, W. H. 1892, Transactions Wagner Free Institute of Science of Philadelphia **3**, pt. 2, pp. 347, 381.

Dall, W. H. 1908, Proceedings United States National Museum **34**, p. 255.

Dall, W. H. 1915, United States National Museum Bulletin **90**, pp. 94–95, pl. 12, fig. 5.

Davies, A. M. 1934, Tertiary Faunas, London, **2**, pp. 104–105.

Eberhard, E. 1865, Über die Schneckenzungen. Programm der Herzogleich realschule zu Coburg, p. 16, pl. 5, fig. 98. Not seen.

Finlay, H. J. 1926, Transactions and Proceedings of the New Zealand Institute **57**, p. 368.

Forbes, E. 1844, British Association for the Advancement of Science Report of the Thirteenth Meeting, p. 138.

Forbes, E. and S. Hanley 1849–50, History of British Mollusca, London, **1**, pl. DD, figs. 5, 5a; **2**, pp. 537–540.

Ford, P. D. 1944, A Complete List of Bahamian Shells, p. 9. Privately printed: Nassau, Bahama Islands.

Fretter, V. 1955, Proceedings Malacological Society of London **31**, pp. 159–162.

Gabb, W. M. 1873, Transactions American Philosophical Society (n.s.) **15**, p. 240.

Gardner, J. 1947, United States Geological Survey Professional Paper **142-H**, pp. 608–613, pl. 40, figs. 6–8, 13.

Gatliff, J. H. and C. J. Gabriel 1908, Proceedings Royal Society of Victoria (n.s.) **21**, p. 366, pl. 21, figs. 9–10.

Gofferjé, C. N. 1950, Arquivos do Museu Paranaense, Curitiba, Brasil, **8**, p. 232.

Gray, J. E. 1847, Proceedings Zoological Society of London **15**, p. 144.

Gray, J. E. 1854, List of the shells of Cuba in the collection of the British Museum, pp. [iii], 22–23.

Guppy, R. J. L. and W. H. Dall 1896, Proceedings United States National Museum **19,** pp. 322–323.

Haas, F. 1953, Fieldiana: Zoology **34,** pp. 204–205.

Habe, T. 1956, Venus **19,** pp. 95–96, figs. 1–2.

Harris, G. F. 1897, Catalogue of Tertiary Mollusca in the Department of Geology British Museum (Natural History). Part I. The Australian Tertiary Mollusca, p. 275.

Ino, T. 1955, American Malacological Union Annual Reports for 1955, p. 30.

Iredale, T, 1924, Proceedings of the Linnean Society of New South Wales **49,** pp. 230–232.

Jeffreys, J. G. 1865, British Conchology, London, **3,** pp. 337–341, pl. 8, fig. 1.

Kiener, L.-C. 1847, Spécies des Coquilles Vivantes, Paris, **10,** Genre Phasianelle, pp. 1–11, pls. 1–5.

Kuroda, T. and T. Habe 1954, Venus **18,** pp. 86, 93–94, figs. 2, 5, 6.

Lange de Morretes, F. 1949, Arquivos do Museu Paranaense, Curitiba, Brasil, **7,** p. 62.

Lebour, M. V. 1937, Journal Marine Biological Association of the United Kingdom **22,** pp. 109, 110, 124, fig. 1m.

Mansfield, W. C. 1937, State of Florida Department of Conservation Geological Bulletin **15,** p. 180.

Martin, K. 1916, Sammlungen des Geologischen Reichs-Museums in Leiden (2) **2,** pt. 6, p. 260, pl. 3, figs. 85, 85a.

Olsson, A. A. 1922, Bulletins of American Paleontology **9,** pp. 332–333.

Ostenfeld, C. H. 1927, Die Pflanzenareale **1,** pt. 3, pp. 35–36, map 22.

Palmer, K. V. W. 1947, Memorias de la Sociedad Cubana de Historia Natural **19,** p. 96.

Palmer, K. V. W. 1951, New York State Museum Bulletin **342,** p. 35.

Pelseneer, P. 1888, Bulletin Scientifique de la France et de la Belgique **19,** p. 190.

Pelseneer, P. 1891, Sur l'oeil de quelques Mollusques Gastropodes. Annales Société Belge de Microscopie **16,** p. 66. Not seen.

Pelseneer, P. 1899, Mémoires Couronnés par l'Académie Royale des Sciences de Belgique **57,** pt. 3, p. 46.

Philippi, R. A. 1848, Zeitschrift für Malakozoologie **5,** p. 18.

Philippi, R. A. 1853, Systematisches Conchylien-Cabinet, Nürnberg, (2) **2,** pt. 5, pp. 1–32, pls. 1–5.

Pilsbry, H. A. 1888, Manual of Conchology, Philadelphia, (1) **10,** pp. 162–184, pls. 37–40, 45, 60–61, 64.

Pilsbry, H. A. 1917, Proceedings Academy of Natural Sciences of Philadelphia **69,** p. 207.

Priolo, O. 1953, Atti della Accademia Gioenia di Scienze Naturali in Catania (6) **8,** pp. 109–113.

Quoy, J. R. C. and J. P. Gaimard 1832–35, Voyage de l'Astrolabe, Zoologie, Atlas, pl. 59, figs. 1–2; text, 1834, **3,** pp. 233–238.

Reeve, L. A. 1862, Conchologia Iconica **13, Phasianella,** pls. 1–6.

Risbec, J. 1940, Annales des Sciences Naturelles, Zoologie, (11) **2,** pp. 282–286, pl. 6, figs. 62–64, 66–70, pl. 7, figs. 75, 77.

Robertson, R. 1957, Journal Washington Academy of Sciences **47**, pp. 316–319, figs. 1–3.

Roissy, F. de 1805, Histoire Naturelle Générale et Particulière des Mollusques, Paris, **5**, p. 330.

Smith, M. 1937, East Coast Marine Shells, Ann Arbor, Mich., p. 81, pls. 29, 31.

Sowerby, G. B. II 1884, Thesaurus Conchyliorum **5**, pp. 149–152, pls. 475–476.

Strong, A. M. 1928, Proceedings California Academy of Sciences (4) **17**, pp. 187–202, pl. 10.

Taylor, W. R. 1943, Papers Michigan Academy of Sciences (Botany and Forestry) **28**, pp. 154–156, pl. 4, fig. 1.

Thiele, J. 1924, Mitteilungen Zoologischen Museum in Berlin **11**, pp. 63–64, 72, fig. 23.

Thiele, J. 1929, Handbuch der systematischen Weichtierkunde, Jena, **1**, pp. 70–71, fig. 49 (see correction published in 1935, **2**, p. 1154).

Torr, C. M. 1914, Transactions and Proceedings Royal Society of South Australia **38**, p. 364, pl. 19, figs. 5a, 5b.

Tristram, H. B. 1862, Proceedings Zoological Society of London for 1861, p. 405.

Troschel, F. H. 1878, Gebiss der Schnecken, Berlin, **2**, pp. 200–203, pl. 18, figs. 9–16.

Turner, R. D. 1956, Occasional Papers On Mollusks, Harvard Univ., **2**, no. 20, p. 136, pl. 21, fig. 4.

Voss, G. L. and N. A. Voss 1955, Bulletin of Marine Science of the Gulf and Caribbean **5**, pp. 220–221.

Wenz, W. 1938, Handbuch der Paläozoologie, Berlin, **6**, pt. 2, pp. 361–364, figs. 853–862.

Woodring, W. P. 1928, Carnegie Institution of Washington Publication **385**, pp. 418–421, pl. 34, figs. 7–11.

Woodring, W. P. 1957, United States Geological Survey Professional Paper **306-A**, pp. 65–66, pl. 15, figs. 1–2, pl. 17, fig. 47.

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The Museum Boltenianum or the Bolten Catalogue

Probably no one book and particularly one so small has brought forth so much comment or caused so much controversy in the field of malacology as the 199 page catalogue of the Museum Boltenianum which was published in 1798. The Bolten Catalogue, as it is commonly called, was originally a manuscript classification which Dr. J. F. Bolten of Hamburg, Germany, had worked out for his large shell collection. It is believed that he had intended to publish his system of classification but he died before it was completed. Later, P. F. Röding, a book dealer and student of malacology, added to the manuscript references to Gmelin 1791, the Conchylien-Cabinet and other publications in order that the names might be identified. This was done at the request of the family and the catalogue was published and offered for sale, partly as a tribute to the late Doctor but also with the hope that the collection would be purchased as a unit by some museum or scholar. Dr. Bolten had disagreed with much that had been done in malacology up to that time and so, diverging greatly from the Linnean system, instituted a multitude of

new generic and specific names. Thus the catalogue consists simply of a list of genera and species with references to other publications.

Though offered for sale, the catalogue apparently was not widely distributed and was little used, and Lamarck's classification and names which were published in 1799 were followed for many years. Of the early workers who referred to the Museum Boltenianum, O. A. Mörch and H. and A. Adams were the most important. It was in 1906 that Dall brought the Museum Boltenianum to the fore and in the same year Sherborn and Sykes brought out a photographic facsimile of the catalogue, thus making it more available. This was followed by a lively discussion as to whether or not the catalogue was truly a publication or only a sales catalogue, and an equally ardent controversy waged concerning the author—was it Bolten or Röding? It is generally considered today that since it was Röding who added the necessary references to identify Bolten's names he should be considered the author.[1] When in 1926 the International Commission on Zoological Nomenclature made a ruling (Opinion 96) that the Museum Boltenianum was an acceptable publication in systematic zoology, the names instituted in it had priority over those of Lamarck and several other workers. Consequently many old and well-known names were put into synonymy and most malacologists, following the ruling of the Commission, set themselves to the task of revising various groups, using Röding's names. Now, after more than 30 years of recognition, the names instituted in the Museum Boltenianum have come into general use.

The following partial bibliography is given for those who wish to go further into the history and discussion concerning this famous little book.

Dall, W.H. 1906, Early History of the Generic Name Fusus. Journal of Conchology **11**, pp. 289–297.

Dall, W.H. 1915, An Index to the Museum Boltenianum. Smithsonian Institution Publication, no. 2360, pp. 1–64.

International Commission on Zoological Nomenclature 1926, Opinion 96. Smithsonian Miscellaneous Collections **73**, no. 4, pp. 16–18.

Iredale, T. 1939, Mollusca Part I. Great Barrier Reef Expedition Scientific Reports **5**, no. 6, pp. 373–374.

Rehder, H.A. 1945, A Note on the Bolten Catalogue. Nautilus **59**, pp. 50–52.

Röding, P.F. 1798, Museum Boltenianum, Hamburg, pp. viii+1–199 [photographic facsimile by Sherborn and Sykes, London 1906].

Röding, P.F. 1819, Museum Boltenianum, Second Edition, pp. 1–156, 4 plates. [This edition was prepared specifically for the sale of the Bolten collection at auction.]—RUTH D. TURNER

[1] Article 21, International Rules of Zoological Nomenclature (1905).