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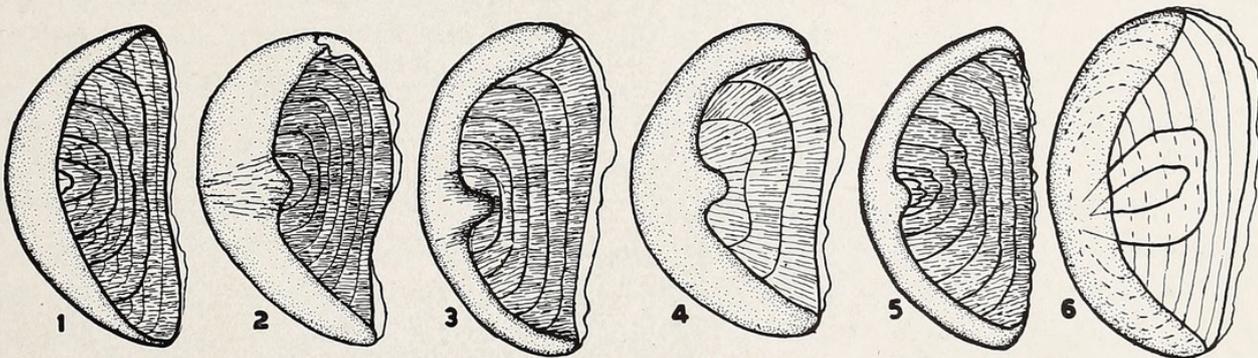
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## THE GENERA PURPURA AND THAIS IN THE WESTERN ATLANTIC

BY  
 WILLIAM J. CLENCH

So far as known, all species contained in these two genera are carnivorous, generally preying upon other members of their own phylum. Most species occur in the intertidal zone, usually on rocks, though a few frequent oyster bars. These latter are referred to as "drills" and become important economically when their depredations occur on commercial oyster grounds such as the coastal areas of Alabama, Mississippi, Louisiana and Texas. Generally, however, they feed upon non-economic forms, such as various species of chitons, *Mytilus*, *Balanus* and probably a host of other genera.

Very probably all species in *Purpura* and *Thais* produce some sort of secretion which turns purple on exposure to air and light though the quantity varies considerably with the species. The color is purely incidental, however, to the poisonous effects of this secretion which is used to immobilize the animal's prey. Its production and use may be in proportion to the type of food the creature generally feeds upon. *Thais lapillus* Linné would hardly have to use this poison while feeding upon either young *Mytilus* or *Balanus*, sessile animals to which *T. lapillus* gains access by drilling through their shells. On the other hand, *Purpura patula* Linné produces a quantity of this secretion and apparently



Drawings by R. D. Turner

Plate 32. Under side of the opercula of *Purpura* and *Thais*. Fig. 1. *Purpura patula* Linné. Gun Cay, Bimini Islands, Bahamas. Fig. 2. *Thais trinitatensis* Guppy, Rio Mucury, Espirito Santo, Brasil. Fig. 3. *Thais haemastoma floridana* Conrad, Cutler Point, Biscayne Bay, Florida. Fig. 4. *Thais rustica* Lamarck, Natal, Brasil. Fig. 5. *Thais deltoidea* Lamarck, Porto Seguro, Brasil. Fig. 6. *Thais lapillus* Linné, Broad Cove, Cushing, Maine (all approximately 2×).

uses it to immobilize chitons, not resorting to drilling through their rather thick plates of shell material. The poisonous qualities of this secretion have been reported upon by Dubois as well as others.

Various species of trematode parasites are reported to occur in *Thais haemastoma haysae* Clench (V. Schechter 1943, Journ. Parasitology **29**, p. 362) and in *Thais (Polytropa) lapillus* Linné (M. V. Labour 1907, Annals and Magazine of Natural History (7) **19**, pp. 102-106, 2 plates; H. W. Stunkard and R. M. Cable 1932, Biological Bulletin **62**, pp. 328-338, 1 plate). The adults of certain of these trematode worms are known to occur as parasites in gulls; for others, the primary host still remains unknown.

Variation among the many species is very extensive and has given rise to a host of names, many of which are rather useless and in general almost impossible to define. We have attempted to figure some of the extremes of variation exhibited by the species with which we are concerned. It is to be understood, of course, that these figures represent only certain variation limits and that in any extensive series, completely intergrading forms will occur. The nomenclature has become highly complicated and much uncertainty still exists as to just what name should be applied to some of the species.

The opercula of *Purpura* and *Thais* are unguiculate, chitinous and rather thin. The underside has the outer margin somewhat thickened and shining. The remaining portion consists of a series of rather pronounced concentric ridges which may be fairly regular to very irregular in arrangement. Very fine sculpture may be present and it is usually in the form of minute discontinuous threads that are set at right angles to the coarse ridges mentioned above.

There appears to be a fair degree of differentiation among the opercula of the species we have figured (Plate 32, fig. 1-6), and there are indications that certain of these differences may be of subgeneric value. This is particularly true of *Thais (Polytropa) lapillus* Linné which differs by having the ridges more or less oval in pattern. This same type of operculum is possessed by *Thais (Polytropa) lamellosa* Gmelin of the American north-west coast. However, far more species should be examined to determine the extent of variation both within and between species.

The eggs of *Thais (lapillus; lamellosa and haemastoma haysae)* are produced in capsules which are clustered together, sometimes in considerable numbers. There are several eggs in each capsule, and it has been reported that in the case of *T. lapillus* Linné, many more young are produced than eventually emerge, as the first few to hatch feed upon the yolk mass formed by the other eggs. According to Pelseneer (1905, pp. 343-345) the original number of eggs in each capsule may be as great as 600, though only from 6 to 40 snails may eventually leave the capsule. The average number of snails is about 12. This does not seem to be true of *T. haemastoma haysae* Clench whose young emerge as larvae in the veliger stage. Almost nothing is known about the egg laying habits of most of our other species of *Thais* and *Purpura*. It is a problem that is in need of study.

### Genus *Purpura* Bruguière

*Purpura* Bruguière 1789, Encyclopédie Méthodique **1**, pt. 1, p. xv; non *Purpura* Bruguière 1792, Journal d'Histoire Naturelle **1**, p. 29, pl. 2, fig. 3-4 [= *Typhis* Denys de Montfort 1810]; non Röding 1798; non Martyn 1784.

*Haustrum* Perry 1811, Conchology, London, text with plate 44.

*Microtoma* Swainson 1840, A Treatise on Malacology, London, p. 301; *non Microtoma* Laporte 1833 (*Microstoma* Cossmann 1903, lapsus).

*Purpurella* Dall 1871, American Journal of Conchology **7**, p. 110 (genotype, *Purpura columellaris* Lamarck); *non* Des Voidy 1853; Bellardi 1882.

*Lepsia* Hutton 1883, Trans. New Zealand Institute **16**, p. 222 (type, *Purpura haustum* Martyn = *Buccinum haustorium* Gmelin).

*Plicopurpura* Cossmann 1903, Essais Paléoconchologie Comparée Livr. 5, p. 69; new name for *Purpurella* Dall, *non* Des Voidy.

*Patellapurpura* Dall 1909, United States Geological Survey, Professional Paper 59, p. 50 (*T. patula* Lamarck = *Buccinum patulum* Linné, monotypic).

Genotype, *Buccinum persicum* Linné (subsequent designation, Denys de Montfort 1810).

The species constituting this genus possess rather large and capacious apertures. The siphonal canal is small and recurved, the anal notch small or absent and the margin of the outer lip very strongly crenulated. The columella is broad and distinctly depressed in the mid-parietal area. The parietal shield is generally partially absorbed and smooth above on the body whorl showing the old and inner shell material. The spire is rather depressed. Sculpture generally consists of spiral incised lines, spiral ridges or strong nodules, the nodules being in spiral arrangement.

Winckworth (1945, p. 143) in a very able report on the types of the Boltenian genera, gives a clear and concise account of the name *Purpura* Bruguière and its history. Bruguière briefly described *Purpura* first in 1789 (p. xv) without mentioning any species. On page 241 in the same report he states that the genus *Buccinum* Linné has been considered by him to constitute four genera, one of which is "Pourpre." By inference and elimination alone, subsequent authors have attempted to group into the genus *Purpura* the several species of Linné that form the assemblage of species headed by *Buccinum persicum* Linné. The first accepted type designation was that of Denys de Montfort (1810) who selected *Buccinum persicum* Linné as the type of *Purpura*. In 1792 (p. 29) Bruguière again defined the genus *Purpura* and described *Purpura tubifer*, a totally different shell, which was subsequently made the type of the genus *Typhis* by Denys de Montfort in 1810. This of course is the type of *Purpura* Bruguière 1792 by monotypy. It is difficult to understand why contemporary and later authors completely overlooked this second definition of *Purpura*. Perhaps Lamarck, as co-author of the Encyclopédie Méthodique, attempted to follow what he believed to be the original understanding of this genus by Bruguière.

In 1915, Apstein submitted to the International Commission a list of 156 molluscan names to be retained as *nomina conservanda*<sup>1</sup>; among these names was *Purpura* Bruguière 1789 with *B. persicum* Linné as the type. The Commission ruled<sup>2</sup> that these names could not be accepted in toto but must be ruled upon separately at a later date with the acceptance of each genus based upon its own merits. Unfortunately, Thiele (1929, p. 295) overlooked this ruling and listed *Purpura* as a *nomen conservandum* and

<sup>1</sup>C. Apstein 1915: Sitzungsbericht der Gesellschaft Naturforschender Freunde zu Berlin **11**, no. 5, pp. 181-184.

<sup>2</sup>Opinions Rendered by the International Commission on Zoölogical Nomenclature 1922, Smithsonian Miscellaneous Collections **73**, no. 1, Opinion 74, pp. 32-34.

gave, by error, the date of Bruguière as 1792. His error is quite apparent as he proceeds to consider the species under *Purpura* Bruguière 1789 (of authors), and not under the group now known as *Typhis* or *Purpura* Bruguière 1792.

I am in full agreement with Winckworth that *Purpura* Bruguière 1789, with its type, *Buccinum persicum* Linné, should be accepted, and that it should be added to the list of names included in the *nomina conservanda* at an early date by the Commission. To do this will avoid much confusion of name changes and the generic name *Typhis* Denys de Montfort 1810, so long known and understood in the literature, will then be retained.

Winckworth has shown that Martyn's work, *The Universal Conchologist* 1784, cannot be accepted under our present rules as being binomial and consequently his use of the name *Purpura* cannot be considered valid<sup>1</sup>.

If, however, *Purpura* Bruguière 1789 be rejected as inadequately described, the next available name is *Haustrum* Perry 1811 with the type, *Haustrum zealandicum* Perry (= *Buccinum haustorium* Gmelin)<sup>2</sup>.

The family name Thaididae has been retained, even though Purpuridae is much older. This seems best in the light of the fact that the generic name *Purpura* is still of questionable validity so far as its use in this report is concerned. A future ruling may invalidate such use whereas Thaididae, even as a synonym, will be clearly understood for the genera and species it contains.

### ***Purpura patula* Linné, Plate 33, fig. 3-4**

*Buccinum patulum* Linné 1758, *Systema Naturae*, ed. 10, p. 739 (America). [Refers to Gualtieri 1742, *Index Testarum Conchyliorum*, pl. 51, fig. D, E, A].

*Haustrum tuberculatum* Perry 1811, *Conchology*, London, text and plate 44, fig. 4 (South Seas); *non Purpura tuberculata* de Blainville 1832.

*Description.* Adult shell 50 to 85 mm. (2 to 3½ inches) in length, imperforate, the larger size, however, not frequently found. Whorls 4½ to 5½ and rapidly increasing in size, the last or body whorl exceedingly capacious. Color a dull and faintly rusty gray with the columellar area a salmon-brown which is also suffused along the inner margin of the outer lip. Blotches of a deep blackish brown also irregularly disposed along the inner margin of the outer lip and on the parietal wall on its outer margin. Columella short and broad, its inner edge smoothly arched into the parietal wall margin. Aperture broadly elliptical. Outer lip simple and strongly crenulated. A very short and nearly inconspicuous siphonal canal at the base, its left side margined by the columella. Inner lip broad and smooth, its outer edge crenulated at the columellar region. Spire moderately depressed. Suture not well differentiated though indicated by the strongly shouldered

<sup>1</sup> R. Winckworth 1929; *Proceedings Malacological Society of London* 18, pp. 228-229.

<sup>2</sup> The following will outline the relationships of the names involved if *Purpura* Bruguière 1789 is not followed.

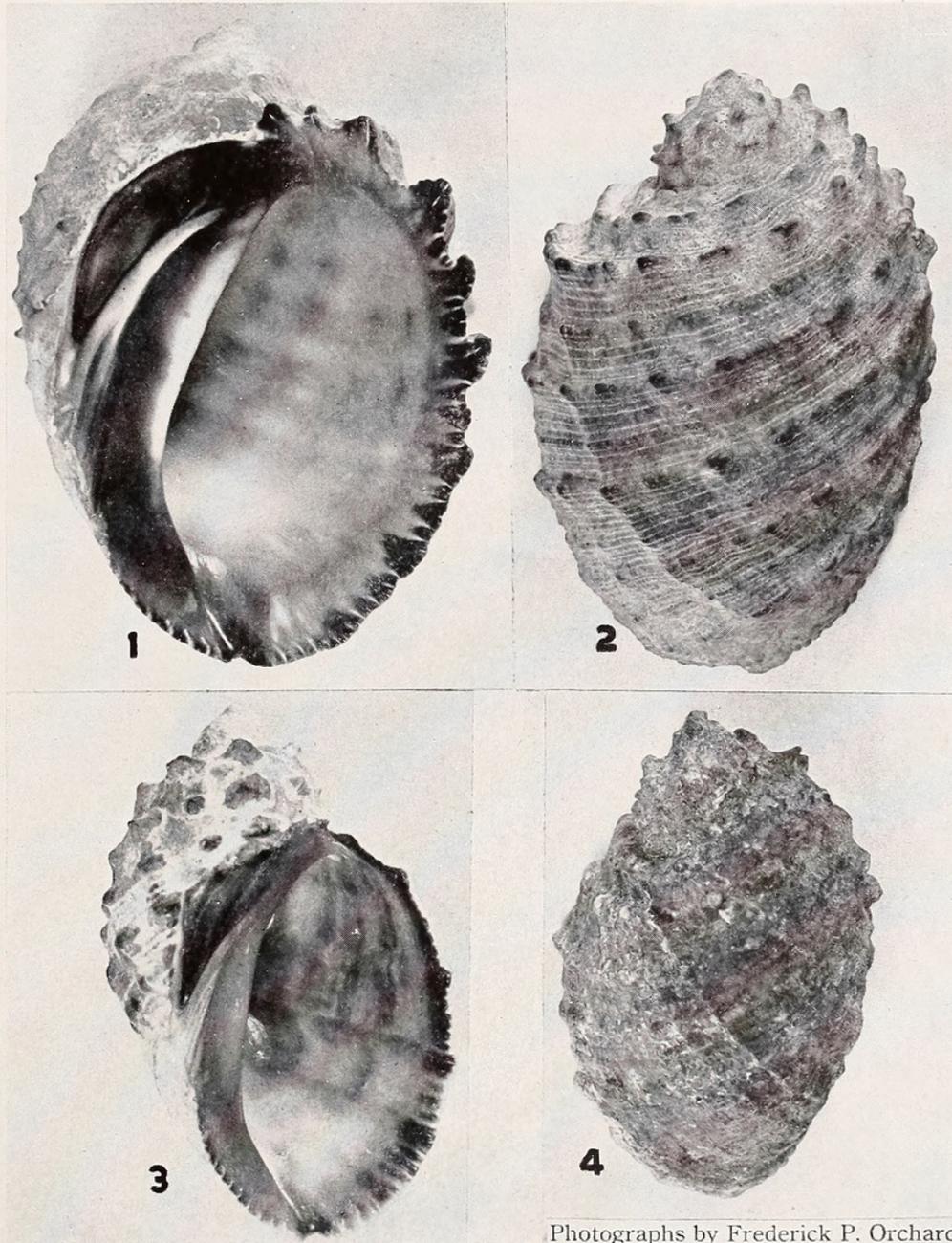
#### Genus ***Haustrum*** Perry

*Haustrum* Perry 1811, *Conchology*, London, text with plate 44, genotype, *Buccinum haustrum* Martyn = *Buccinum haustorium* Gmelin (subsequent designation, Iredale 1915).

All of the synonyms given above under *Purpura*, other than the original reference of *Purpura* by Bruguière 1789, also belong here.

whorls. Nuclear whorls smooth, succeeding whorls nodulose, consisting of 6 or 7 spiral rows of short and rather sharp nodules. Young shells are proportionately more nodulose. A few adults are occasionally found with the body whorl nearly smooth. In addition to the rows of nodules, there are rather numerous and fine incised lines, generally about 4 lines between two rows of nodules. No periostracum. Operculum nearly semicircular, inner side with a series of strong growth ridges about a marginal nucleus which is located on the palatal side. Under side of the operculum sculptured with concentric thread-like ridges. Operculum smaller than the aperture, but capable of closing the latter when the animal recedes well within the opening.

	length	width	aperture	
(large)	85	56	70×35 mm.	Key West, Florida
(average)	61	40	52×28	Navassa Island, Caribbean Sea



Photographs by Frederick P. Orchard

Plate 33. Fig. 1-2. *Purpura patula pansa* Gould, Charles Island, Galápagos Islands. Fig. 3-4. Governors Harbour, Eleuthera Island, Bahamas. (All natural size.)

*Types.* Figure E on plate 51 in Gualtieri is here selected as the type figure. We limit the type locality to Puerto Sosúa, Hispaniola.

*Common name.* Wide Mouthed Rock Shell.

*Remarks.* This species is rather common throughout its range though individuals are not particularly abundant at any one locality. It grips the rocks very firmly and is difficult to remove by hand. It is intertidal though most commonly found near the low water line.

A remarkable use of the dye produced by *P. patula pansa* Gould is given in considerable detail by Z. Nuttall.<sup>1</sup> On the Pacific coast of the Isthmus of Tehuantepec, Mexico, fishermen, by means of boats at low water, search the rocks for *Purpura patula pansa* Gould. Carrying skeins of loosely twisted cotton thread, the natives collect individual specimens of *Purpura*, "blow" upon them, and, as the mollusk recedes into the shell exuding a "milky froth," they dab this froth upon the cotton thread. The shell is then placed back on the rock or in a tide pool and used again upon the return journey. The "milky froth" turns purple and the threads are thus dyed. Skirts made from this hand-dyed cotton thread are called "de caracolillo" and sell for \$10.00 gold. This is a case of real native conservation. This same method of primitive dyeing was commonly practiced along much of the west coast of Central America.

I have seen the exuding of this dye many times. It appears as a milky fluid, always associated with an exceedingly disagreeable odor. It soon turns purple on contact with the air, probably by oxidation, the salt water acting as a mordant. This dye is very difficult to remove from the hands; on cotton bags, it will remain indefinitely even when the bags have been in alcohol for several years.

I suspect that this exudate may possibly be a narcotizing agent used by *Purpura* to paralyze its prey. I have found, several times, four to six *Purpura* feeding upon a large overturned chiton. Generally this species is found singly other than at such meal times when several are grouped around the "kill." The odor may possibly be a means of bringing them to the feast or stimulating several to work together on the victim. Complete observations on this procedure are certainly needed but may prove rather difficult to obtain, as this species inhabits rocks exposed to the open sea and its movements appear to be made during the high water stage of the tide. Exposed, they continue to feed but isolated specimens at low water stage are generally immobile. It would seem almost impossible for a single or even several *Purpura* to have the power to remove a large chiton from the rocks unless possessing something in addition to mere physical force.

*Purpura patula* Linné is very easily separated from the Eastern Pacific subspecies, *pansa* Gould, by the uniform salmon-brown coloration on *patula* and the lengthened white area on the parietal margin of *pansa*. Confusion existed in the mind of Carpenter as to the validity of this west coast form, probably as he was working with some material that was itself of indefinite locality. It is to be remembered that much early material came into the hands of students, either without locality or with only general locality data. Specimens from different localities were "lumped" together, so that the overall picture of a species, and its limitations as to characters, were often confused. Thus, the

<sup>1</sup> A Curious Survival in Mexico of the Use of the Purpura Shell-Fish for Dyeing. Putnam Anniversary Volume Anthropological Essays. G. E. Stechert Co., New York, 1909, pp. 368-384, pl. 1-2.

white parietal area in *pansa* Gould and the salmon-brown of the parietal area in *patula* Linné were "lost." Specimens accurately localized indicate that these characters are exceedingly constant for the two different regions.

Carpenter included the Philippines as a record based upon shells contained in the Cuming collection. This is certainly an error and again due to a wrong assignment of locality, not at all infrequent in Cuming's material.

Records of *P. patula* from West Africa are open to question. Mr. J. R. leB. Tomlin has written to me that he has seen no authentic specimens from this area and believes none are in the British Museum. The only published record known to me is that of Adanson who included in his *Histoire Naturelle du Sénégal* many species now known to be found in other portions of the world and not known to occupy the coastal area of West Africa. In relationship, however, *P. patula* is close to *P. eudeli* Sowerby from Gorée Island, Sénégal (1903, *Journal of Malacology*, **10**, p. 74, plate 5, fig. 3).

Recently Fischer-Piette (*Jour. de Conch.* **85**, p. 202, pl. 5, fig. 3 a-b) has written upon the mollusks of Adanson and has figured specimens of *P. patula* from the Adanson collection. These certainly are of this species, but as stated above, Adanson's collection contains many species not of West African origin. In his catalogue, Adanson referred to it as "the Purple of Panama."

The relationship of *patula* and *pansa* is similar to that of many other mollusks that are to be found on both coasts of Central America. When the isthmus was submerged many species probably migrated both ways and later became differentiated when the isthmus again separated the Atlantic and the Pacific Oceans.

*Range.* Palm Beach, Florida south to Trinidad. (? Brasil, Dall 1889, p. 122). A record from Bermuda by Dall in the same publication is open to question. It is not listed by Piele.

*Records.* FLORIDA: Palm Beach (MCZ); Boca Raton (B. R. Bales); Miami Beach (A. H. Patterson); Key West; Tortugas (both MCZ). BAHAMAS: Eight Mile Rock, Grand Bahama; Sweetings Village, Great Abaco; Gun Key, Bimini Ids.; Andros Id.; Nassau, New Providence; Governors Harbour, Eleuthera; Arthurstown, Cat Id.; Clarendon, Long Id.; Watlings Id.; Matthewtown, Great Inagua Id. (all MCZ); Elbow Cay, Cay Sal Bank (R. Humes). CUBA: Cabo San Antonio (USNM); Mariel (MCZ); Habana (R. W. Jackson); Peninsula de Hicacos, Cárdenas (C. J. Finlay); Cayo Francés; Caibarién (both P. J. Bermúdez); Gibara; Baracoa; Guantánamo Naval Base; Cienfuegos Harbor (all MCZ); Levisa Bay, Mayari (A. Queñones). HISPANIOLA: Gonaive Id.; Cap Haitien (both W. J. Eyerdam); Puerto Sosúa; Cabo Macorís; Santa Bárbara de Samaná (all MCZ). PUERTO RICO: San Juan (MCZ); Borinquen (D. Thomas). AGUADILLA; Cayo de Muertos; Hucares (all MCZ). VIRGIN ISLANDS: Virgin Gorda; Guana Id., Tortola; St. John (all M. W. Dewey); Saint Croix (H. A. Beatty); St. Thomas (USNM). JAMAICA: Port Henderson; Runaway Bay, St. Ann (both MCZ). LESSER ANTILLES: Fort James, Antigua; Barbados (both C. M. Pomerat); Martinique (USNM); Grenada (H. G. Kugler); Toco; Balata Bay, Trinidad (both MCZ). CARIBBEAN ISLANDS: Navassa Id.; Swan Id.; Uvilla Id., Bay Ids. (all MCZ). MEXICO: Veracruz (USNM). PANAMA: Isle of Pines, San Blas; Porto Bello (both J. Zetek); Colón (USNM). COLOMBIA: Cartagena; Santa Marta (both MCZ). VENEZUELA: La Guaira (MCZ).

**Purpura patula pansa** Gould, Plate 33, fig. 1-2

*Purpura pansa* Gould 1853, Boston Journal of Natural History **6**, p. 406 [p. 33 of separate]. (West coast of Central America).

*Purpura patula* 'Linné' Gould and Carpenter 1856 [1857] Proc. Zoological Society of London, p. 208.

*Purpura patula* 'Linné' Carpenter 1857, Catalogue of Mazatlan Shells, British Museum, London, p. 474 (Mazatlan, Mexico).

**Description.** General characters quite similar to those of *P. patula* Linné other than the white coloration on the inner margin of the parietal area. In the case of *pansa*, the inner margin of the parietal area is white throughout most of its length. This color shades evenly into the salmon-brown of the parietal shield about one-fourth to one-half inch behind the edge. Young specimens of *P. p. pansa* appear to be a little more strongly nodulose than those of *P. patula*.

	length	width	aperture	
(large)	94	69	85 × 46 mm.	Mazatlan, Mexico
(average)	64	41	54 × 21	Acapulco, Mexico

**Types.** The type specimens are probably in the New York State Museum, Albany, New York. Gould and Carpenter (1856, p. 208, above) cite Mazatlan, Mexico for this subspecies which is here selected to be the type locality.

**Remarks.** A. A. Gould (1853, p. 406, above) apparently intended to institute the name *Purpura pansa* for the West Coast specimens of *Purpura patula* auct. His description, however, is a curious mixture of the characteristics of both East and West Coast forms and a muddle of geographic localities. Gould and Carpenter used the name *pansa* for the West Coast forms but considered it synonymous with *patula*. Carpenter's use of the name can be accepted as applying to this subspecies that occurs from Lower California south to Colombia. (See remarks under *P. patula*).

This subspecies has been included to aid in clarifying the differences that exist between these two forms.

**Range.** West Coast of Mexico south to Colombia (possibly Ecuador) and the Galápagos Islands.

**Records.** MEXICO: Magdalena Bay; Cape San Lucas; Mazatlan; Acapulco (all MCZ); Tres Marias Ids. (USNM). SAN SALVADOR: Libertad (Yale University). COSTA RICA: Golfo Dulce (M. Valerio). PANAMA: Pacheca Id., Pearl Ids. (J. Zetek); Flamingo Id., Panama Bay (W.D. Clark). COLOMBIA: Malpelo Id.; Village Ardito (both AMNH). EASTERN PACIFIC ISLANDS: Cocos Id. (MCZ); Clarion Id.; Socorro Id. (both USNM). Charles Id. and Indefatigable Id., Galápagos Ids. (both MCZ); Chatham Id. and James Id., Galápagos Ids. (both USNM).

Genus **Thais** Röding

*Thais* Röding 1798, Museum Boltenianum (2) p. 54. [*T. lena* Röding = *Murex fuscus* Gmelin 1790. Röding refers to Martini 1777, Conchy.-Cab. (1), **3**, pl. 100, fig. 959-960]; non *Thais* Fabricius 1807; Holiday 1838.

*Sinusigera* d'Orbigny 1842, [in] Ramon de la Sagra, Histoire de L'Ile de Cuba, Mollusques **2**, p. 149 (monotypic, *Sinusigera cancellata* d'Orbigny 1842, l. c. above) p. 150, pl. 23, fig. 7-9, off Jamaica). [This genus was based upon the embryonic shell of some West Indian species of *Thais*. The shell is very different from that

of an adult *Thais*. The outer lip of the shell is thrust forward in the center, forming two embayments for the reception of the paired velar lobes. These embayments disappear when the velum is absorbed and the shell assumes the adult form. See Pelseneer 1906, A Treatise on Zoology 5, Mollusca, London, p. 140, fig. 122.]

*Sinugigera* 'd'Orbigny' Jousseume 1882, Le Naturaliste 4, p. 183 (error for *Sinusigera* d'Orbigny 1842). Jousseume was the first to point out that *Sinusigera* was the embryonic shell of *Thais*.

Genotype, *Thais lena* Röding = *Murex fuscus* Gmelin = *Nerita nodosa* Linné (subsequent designation, Stewart 1926).<sup>1</sup>

The shells are usually solid and strong, occasionally smooth, but generally with spiral ridges which may be imbricated or nodulose. The aperture is moderately large, and the parietal wall narrow or broad and either straight or somewhat inwardly arched. The siphonal canal is rather short and slightly oblique; the anal canal may be indicated by a parietal ridge and a small palatal sinus or these characters may be lacking entirely. The spire may be short or moderately extended.

### Subgenus **Thais** Röding

(See synonymy under the genus *Thais*).

Subgenotype, *Nerita nodosa* Linné

Shells in the subgenus are solid, strongly nodulose with a well developed anal canal. The parietal wall is inwardly arched and broad. The spire is very short.

No members of the subgenus *Thais* exist in the Western Atlantic. A subspecies, *Thais nodosa ascensionis* Quoy and Gaimard, of the west African *T. nodosa* Linné occurs on Ascension Island in the South Atlantic Ocean. It has not been reported west of this small island.

### Subgenus **Thaisella**, new subgenus

Shells subglobose to moderately elongate with both anal notch and siphonal canal well developed. Spiral sculpture of fine threads or cords and generally spirally nodulose. Old margins of the anal canal remain as a series of flutings or scales at the union of the whorls. The various species may be nearly smooth to strongly nodulose.

Subgenotype, *Purpura trinitatensis* Guppy

### **Thais (Thaisella) trinitatensis** Guppy, Plate 34, fig. 1-4

*Purpura trinitatensis* Guppy 1869, Proc. Scientific Association Trinidad 1, p. 366; *ibid.* 1875, Annals and Magazine of Natural History (4) 15, p. 50 (Gulf of Paria, Trinidad); *ibid.* 1878, Proc. Scientific Association of Trinidad 2, p. 179, pl. 7, fig. 17; G. D. Harris 1921, Bull. American Paleontology 8, no. 35, p. 100, pl. 5, fig. 17. [This is a reprint of Guppy's 1878 paper.]

*Purpura haemastoma trinidadensis* 'Guppy' Dall 1889, Bull. Museum Comparative Zoölogy 18, pt. 2, p. 217.

*Purpura coronata* 'Lamarck' Pilsbry 1900, Nautilus 13, p. 130.

*Thais floridana trinidadensis* 'Guppy' M. Smith 1939, An Illustrated Catalogue of the Recent Rock Shells, Lantana, Florida, p. 25.

*Thais coronata brujensis* M. Smith 1946, Nautilus 60, p. 61 (Bruja Point (Caribbean) Canal Zone).

<sup>1</sup> Dall's type designation of "*T. neritoides* Lamarck" is completely invalid as no species by this name is cited by Röding under his genus *Thais*. The subject of a type designation for *Thais* has been carefully studied by Stewart (1926, Proc. Academy Natural Sciences, Philadelphia, 78, p. 386).

*Description.* Shell 35 to 45 mm.  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inches) in length, rather heavy, solid and coarsely sculptured. Whorls convex, angular at the shoulder and six to seven in number. Color a dull brown to gray, occasional specimens possessing a few spiral and interrupted lines of white. Aperture pinkish (Guppy) to rather dark salmon brown, often with numerous lines which are continuous from the margin to within the aperture. Occasionally these lines exist as dark spots at the crenulations and become faint or entirely absent within. Spire moderately extended, and produced at an angle of  $72^\circ$  to  $82^\circ$ . Suture indistinct. Aperture subcircular to elliptical. Posterior canal or anal notch well developed, occasionally margined on the parietal wall with a well defined ridge which follows back within the aperture. Anterior (siphonal) canal deep and recurved, its successive growth stages producing a broad umbilical area with the small opening rimate or evenly circular, but only extending a short distance within. Outer lip slightly thickened and finely crenulated. Parietal wall heavily glazed, sometimes ridged over the basal margin. Columella nearly straight and rounded in contour. Sculpture consisting of from one to four nodulose spiral ridges, the shoulder ridge being the most prominent. In addition, there are numerous spiral threads. Axial sculpture consists of very fine imbricated growth lines which cross the nodules and fine spiral threads. At the suture the successive margins of the posterior canal remain as a series of large imbrications.

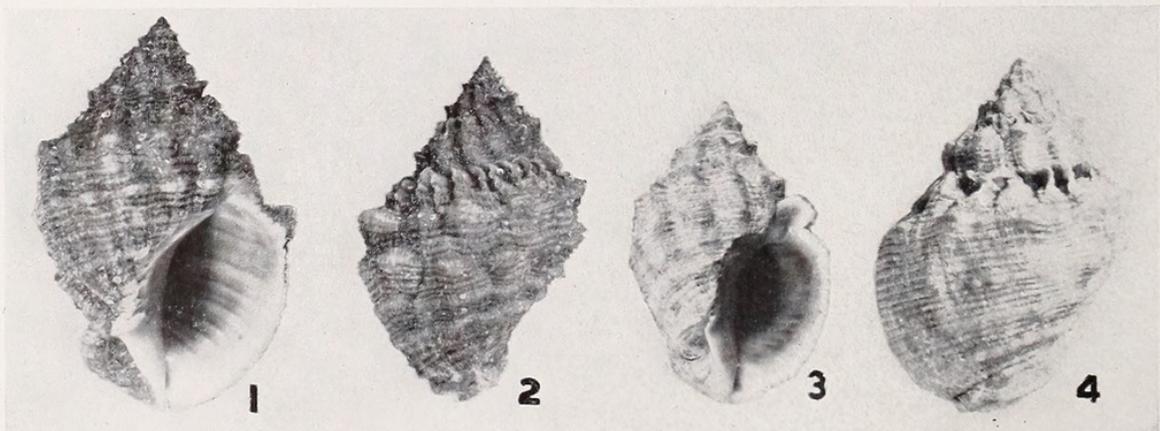
	length	width	aperture	
(large)	43.5	29	$24 \times 13$ mm.	Claxton Bay, Trinidad
(average)	34	20.5	$19 \times 8.5$	Punta Brujas, Panama
(small)	31	21.5	$18 \times 9$	Río Mucury, Espirito Santo, Brasil

*Types.* Neoholotype, Museum of Comparative Zoölogy no. 177755, Claxton Bay, Trinidad, Lesser Antilles, H. G. Kugler collector.

Neoparatype in the Kugler Collection. So far as we can determine, Guppy's collection was destroyed when the Victoria Institute was burned in Port of Spain, Trinidad.

*Common name.* Trinidad Rock Shell.

*Remarks.* This is a rather distinctive species though rather closely related to *Thais coronata* Lamarek of the West African and Brazilian coasts. Under this name it has been



Photographs by F. P. Orchard

Plate 34. *Thais trinitatensis* Guppy. Fig. 1-2. Claxton Bay, Trinidad (Fig. 1. Neoholotype). Fig. 3-4. Brujas Point, Canal Zone, Panama (Atlantic). (All natural size.)

recorded from the Western Atlantic. It differs from *coronata* by being far more attenuated and having finer sculpture. This species is not to be confused with *T. coronata* A. Adams (= *adamsi* Dall) a Western Pacific species which is the subgenotype of *Pinaxia* A. Adams.

The Pacific analogue of this form at Panama is *Thais* (*Thaisella*) *kiosquiformis* Duclou. In this species the spire has become very much attenuated and the whorl shoulder angled and tuberculated. The strongly imbricated scales of the previous anal canal growth stages are well developed (Plate 34, fig. 3-4).

The recently described subspecies (of *coronata*), *T. c. brujensis* Smith, is an absolute synonym of *T. trinitatensis*. Specimens submitted by W. D. Clark from Punta Brujas, Panama are slightly more attenuated than specimens of *trinitatensis* from Trinidad, the type locality, but in all other respects they are similar.

*Thais trinitatensis* appears to be a rather rare species and perhaps only locally abundant. From the limited series we have seen, this species becomes smaller and the spire more attenuated at the northern end of its range.

*Thais santodomingensis* Pilsbry and Johnson 1917 (Proc. Acad. Nat. Sci., Philadelphia 69, p. 169; Pilsbry 1922, *ibid.* 73, p. 354, pl. 28, fig. 8-9) from the Oligocene of Hispaniola, belongs in the subgenus *Thaisella*. It is possibly an ancestral form of *T. trinitatensis*.

*Range.* Guatemala and south to Brasil.

*Records.* GUATEMALA: Puerto Barrios (H. Vander Schalie). PANAMA: Punta Brujas; west shore of Limón Bay, Canal Zone (both W. D. Clark). TRINIDAD: Claxton Bay (H. G. Kugler). BRITISH GUIANA: Georgetown (S. T. Brooks). SURINAM: Courantyne River (H. G. Kugler). BRASIL: Río Mucury, Espirito Santo (Thayer Expedition); São Luiz do Marantão (both MCZ).

### ***Thais* (*Thaisella*) *coronata* Lamarck, Plate 35, fig. 1-2**

*Purpura coronata* Lamarck 1822, Animaux sans Vertèbres 7, p. 241 (Seas of Sénégal); Kiener 1836, Icon. Coquilles Vivantes 8, p. 70, pl. 18, fig. 53-53a.

*Purpura callifera* Lamarck 1822, Animaux sans Vertèbres 7, p. 240 (locality unknown).

*Purpura guinensis* Schubert and Wagner 1829, Conchy.-Cab. (1) 12, p. 144, pl. 232, fig. 4083-4084 (Guinea [Africa]).

*Cuma coronata* Lamarck, Tryon 1880, Manual of Conchology (1) 2, p. 201, pl. 62, fig. 326.

*Description.* Shell 36 to 44 mm. (about 1½ to 1¾ inches) in length, very heavy, solid and coarsely sculptured. Whorls six, strongly convex and generally with a strongly angled shoulder. Color old ivory to dull white, occasionally mottled with light reddish brown. Interior of aperture yellowish salmon. Spire depressed with the base sometimes sunken below the shoulder of the body whorl. Spire produced at an angle of 75° which does not include the shoulder on the body whorl. Aperture subcircular with the inner edge of the outer or palatal lip finely crenulated. Posterior or anal canal greatly developed and margined within by an inconspicuous anal ridge. Previous growth stages of the canal occasionally form a series of closely packed scales at the union of the whorls thus forming the very high and sharply angled shoulder. This is particularly true of certain adult specimens. In others, however, these scales are not so large nor so closely

packed and as a consequence leave rather deep depressions between the scales. Siphonal canal rather deep and recurved, previous growth stages leaving a broad ridge around the shallow umbilicus. Columella nearly straight and thickened. Parietal area glazed and somewhat thickened. Sculpture consisting of a strongly marked anal canal ridge and in addition a series of two or more spiral rows of nodules; there are also numerous and rather fine, imbricated, spiral cords. Axial sculpture consists of fine and irregular growth lines.

	length	width	aperture	
(large)	44	35	23 × 14 mm.	Curuçá, Brasil
(average)	35	31	20 × 10	Curuçá, Brasil

*Types.* The type figures and the specimens upon which they were based are here selected to be those in Kiener's *Icon. Coquilles Vivantes* 8, pl. 18, fig. 53-53a. These figures are based upon specimens of Lamarck. The type locality is Sénégal, West Africa.

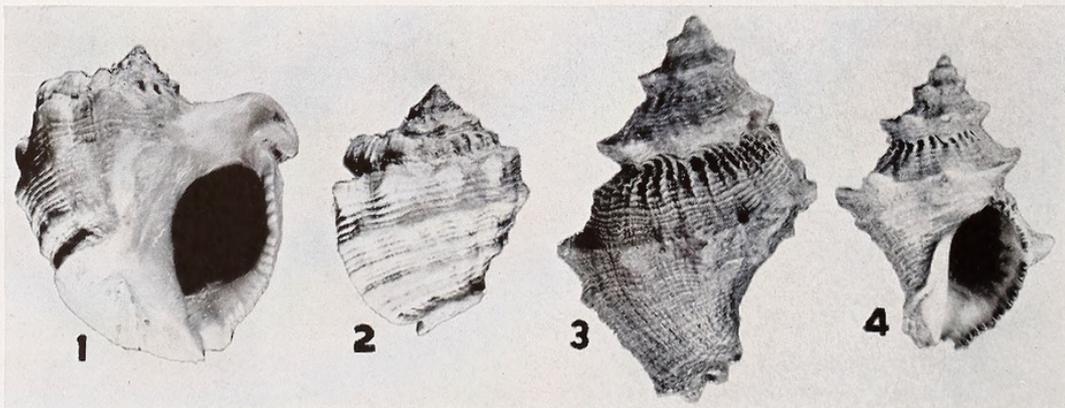
*Common name.* Crown Rock Shell.

*Remarks.* We possess but a single lot of this species from the Western Atlantic collected by L. Agassiz during the Thayer expedition to Brasil at Curuçá in the state of Pará. These specimens all possess the closely packed imbricated scales that form the past growth stages of the anal canal.

This record of Agassiz appears to be authentic, particularly as the specimens were associated with the characteristic printed labels of the Thayer Expedition. However, the species should be searched for along the Brazilian coast to establish definitely its occurrence in the Western Atlantic.

We owe to Kiener the indication of the relationships of *Thais callifera* Lamarck. Kiener states that it is but a "variety" of *T. coronata* Lamarck, and also that it is the same as *T. guinensis* S. and W. This latter is well figured and is certainly the same species as *T. coronata*.

*Range.* EASTERN ATLANTIC: Cape Verde Islands south to the Belgian Congo. WESTERN ATLANTIC: Brasil.



Photographs by F. P. Orchard

Plate 35. Fig. 1-2. *Thais coronata* Lamarck, Curuçá, Pará, Brasil. Fig. 3-4. *Thais kiosquiformis* Duclos, Panama City, Panama.

*Records.* WESTERN ATLANTIC: BRASIL: Curuçá, Pará. EASTERN ATLANTIC: CAPE VERDE ISLANDS (MCZ). SENEGAL: (MCZ). LIBERIA: Monrovia; Cape Mount, Fisherman's Lake (both MCZ); Marshal (M. Brisco). CAMEROON: Kribi (G. Schwab). RIO MUNI: Benito; Adjé (both S. T. Brooks). GABOON: (MCZ). BELGIAN CONGO: Malela, near Banana (MCZ).

### Subgenus **Stramonita** *Schumacher*

*Stramonita* Schumacher 1817, Essai Nouveau Système, Copenhagen, p. 226.

Subgenotype, *Buccinum haemastoma* Linné (subsequent designation, Gray 1847).

Shells moderate to large in size, rather strong, smooth to moderately nodulose and generally having the spire extended. Anal canal generally indicated with a rather strongly developed anal ridge.

### **Thais (Stramonita) haemastoma** *Linné*, Plate 36, fig. 1-6

*Buccinum haemastoma* Linné 1767, Systema Naturae, ed. 12, p. 1202 (European Ocean) [Refers to Gualtieri 1742, pl. 51, fig. A].

*Thais grisea* Röding 1798, Museum Boltenianum (2), p. 54 [Refers to Martini 1777, Conchy.-Cab. (1) 3, pl. 101, fig. 964. This figure is here selected as the type figure].

*Thais metallica* Röding 1798, Museum Boltenianum (2), p. 54 [Refers to Martini 1777, Conchy.-Cab. (1) 3, pl. 101, fig. 965-966. Figure 965 is here selected as the type figure. This is the apertural view of the same specimen which Röding called *grisea* above].

*Thais nebulosa* Röding 1798, Museum Boltenianum (2), p. 54 [Refers only to *Buccinum haemastoma* Linné]; non Conrad 1867.

*Thais panama* Röding 1798, Museum Boltenianum (2) p. 54 [Refers to *Buccinum haemastoma* Gmelin, Chemnitz 1788, Conchy.-Cab. (1) 10, pl. 154, fig. 1467-1468].

*Thais stellata* Röding 1798, Museum Boltenianum (2), p. 54 [Refers to D. D'Argenville 1757, La Conchyliologie, pl. 17, fig. H. This is an unrecognizable figure. It could be any of several species of *Thais*, even species in other genera. However, as Röding associated *stellata* with *haemastoma*, it can be considered an absolute synonym of *haemastoma*].

*Buccinum lineatum* Lamarck 1822, Animaux sans Vertèbres 7, p. 268 (locality unknown); non *P. lineata* 'Lamarck' de St. Vincent 1827.

*Buccinum cingulatum* Lamarck 1822, Animaux sans Vertèbres 7, p. 268. [Listed as a synonym of *B. lineatum* by Lamarck with reference to pl. 400, fig. 6a-b, Tableau Encyclopédique et Méthodique 3, 1816]; non *Buccinum cingulatum* Linné 1771; Röding 1798; Reeve 1846.

*Purpura unifascialis* Lamarck 1822, Animaux sans Vertèbres 7, p. 247 (locality unknown); B. de St. Vincent 1827, in Lamarck's Tableau Encyclopédique et Méthodique 3, pl. 397, fig. 6.

*Purpura biserialis* de Blainville 1832, Nouvelles Annales du Muséum d'Histoire Naturelle (Paris) (3) 1, p. 238, pl. 11, fig. 11 (Mazatlan [Mexico]).

*Purpura callaoensis* Kiener 1836, Icon. Coquilles Vivantes 8, p. 99, pl. 26, fig. 71 (Coast of Callao [Peru]); non Gray 1828.

*Purpura lineata* Kiener 1836, Icon. Coquilles Vivantes 8, p. 115, pl. 33, fig. 80 (locality unknown); non *lineata* 'Lamarck' de St. Vincent 1827 [Kiener's reference is to fig. 6a-b in the Tableau Encyclopédique et Méthodique, the same figures named *Buccinum cingulatum* by Lamarck in 1822 and de St. Vincent in 1827. Kiener's figures were based apparently on the same specimens in the collection of Lamarck].

*Purpura nuttalli* Conrad 1837, Journal Academy Natural Sciences Philadelphia 7, p. 265, pl. 20, fig. 19 (Fayal [Azores]).

*Purpura gigantea* Calcara 1840, Monografiede dei generi Clausilia e Bulimo, p. 53, Palermo, Sicily; non de Blainville 1832. [We have not seen this paper, but Dautzenberg reports it to be the same as *gigantea* Reeve.]

*Purpura blainvillei* Deshayes 1844, Animaux sans Vertèbres (2) **10**, pl. 93 (Coast of Peru); new name for *P. callaoensis* Kiener 1836, non Gray 1828.

*Purpura cornuta* 'Menke' Reeve 1846, Conchologia Iconica **3**, **Purpura**, under species 21 [Listed as a synonym of *T. haemastoma* Linné. This is probably a manuscript name of Menke].

*Purpura gigantea* Reeve 1846, Conchologia Iconica **3**, **Purpura**, pl. 4, fig. 17 (locality unknown); non de Blainville 1832.

*Purpura fasciata* Dunker 1857, Proc. Zoological Society London 1856 [1857], p. 357 (locality unknown); non Reeve 1846.

*Purpura floridana* Conrad 1867, American Journal of Conchology **3**, p. 270 [Refers to Dunker 1853, Index Molluscorum, supplement 2, Novitates Conchologicae, pl. 3, fig. 14; non Conrad 1837].

*Purpura nebulosa* Conrad 1867, American Journal of Conchology **3**, p. 270 [Refers to figure 15, in Dunker, cited above, which, however, is the obverse view of the specimen he called *floridana!*]; non *nebulosa* Röding 1798.

*Purpura barcinonensis* Hidalgo 1867, Journ. de Conchy. **15**, p. 357, pl. 12, fig. 1 (Barcelona, Spain).

*Purpura oceanica* Locard 1886, Prodrome de Malacologie Française, Paris, p. 145 and 555 (Atlantic coast of France [Cap Breton]. The types of Locard are in the Paris Museum). [This is the same as *gigantea* Reeve.]

*Purpura haemastoma minima* Pallary 1900, Journ. de Conchy. **48**, p. 291 (Oran, Algeria).

*Purpura haemastoma costellata* Pallary 1900, Journ. de Conchy. **48**, p. 292 (Oran, Algeria).

*Purpura haemastoma striata* Pallary 1900, Journ. de Conchy. **48**, p. 292 (Oran, Algeria); non Quoy and Gaimard 1832.

*Description.* Adult shell reaching about 80 mm. in length ( $3\frac{1}{4}$  inches), solid, occasionally smooth, but generally nodulose. Whorls 6 to 7, slightly convex and occasionally angled. Color dirty gray to dark brown, occasional specimens showing darker color areas generally arranged in an axial pattern. Interior of aperture usually colored a salmon pink, though many specimens are found in which the color is yellowish and even approaching white. Aperture sub-ovate to sub-oval. Outer lip moderately thickened and generally strongly crenulated, the crenulations formed by the ends of low and small ridges which generally run back well within the aperture. Inner lip glazed, smooth and thickened by the callus. At its upper margin there is a strong ridge which runs back within the aperture. This is opposite the small anal canal. Some specimens have a few faint plicae on the base of the columella. Umbilicus generally closed, occasionally very slightly rimate. Columella nearly straight and moderately thickened. Siphonal canal oblique and short. Previous growth stages of the canal leave behind a small ridge which surrounds the umbilical area. Anal canal short and margined within by a narrow ridge on the parietal wall. There is a small subsutural depression occasionally present on the outer whorl. Spire moderately extended. Suture fine and irregular. Sculpture is exceedingly variable, consisting of very fine incised spiral lines, and frequently with two or more rows of nodules which are arranged in spiral pattern. Axial striae consisting mainly of fine growth lines. Periostracum deciduous and rarely present.

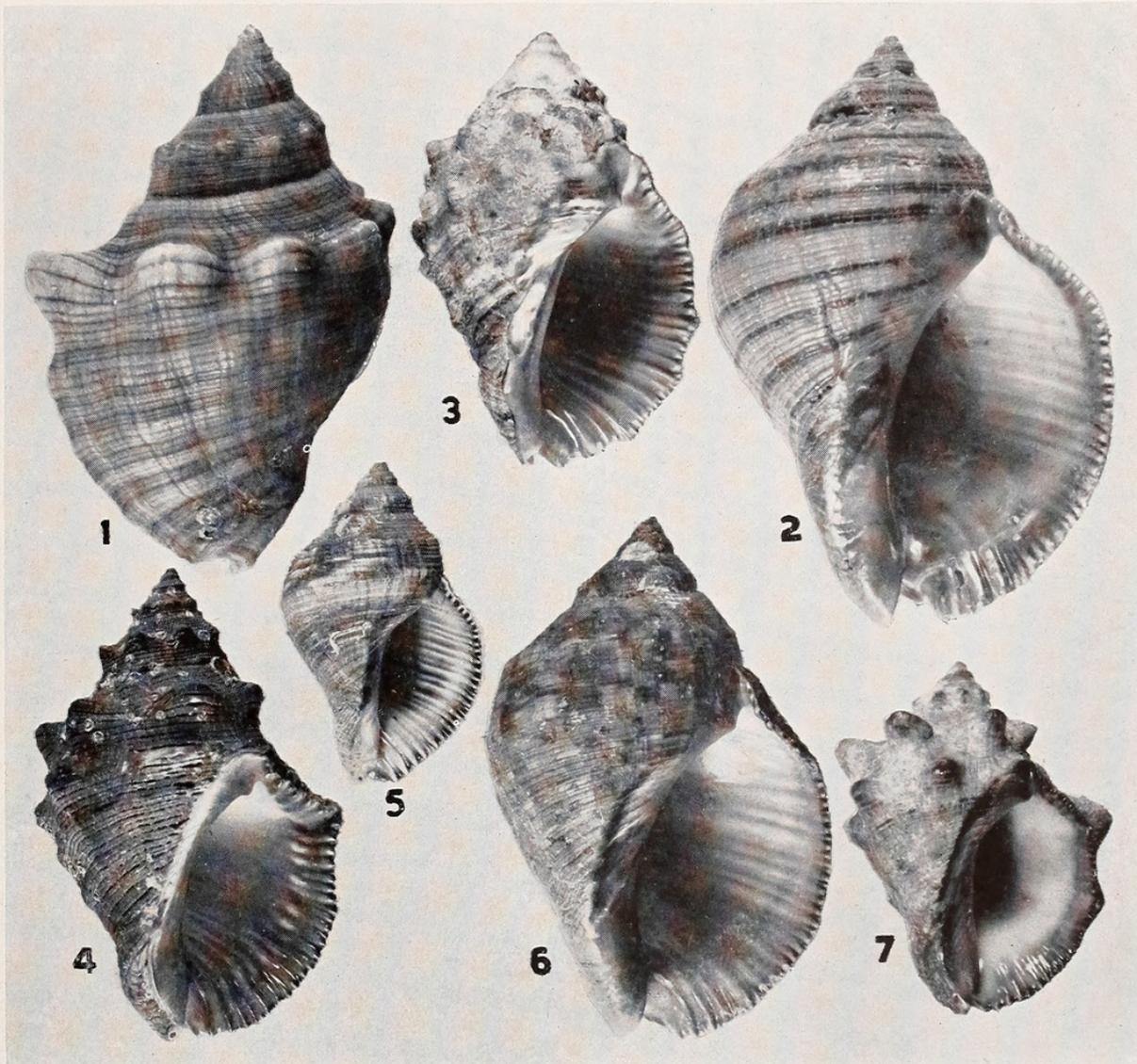
	length	width	aperture	
(large)	121	77	80 × 40 mm.	(from figure of Reeve's <i>gigantea</i> )
(large)	80	47	51 × 35	Rio de Janeiro, Brasil
(average)	60	36	38 × 36	Galicia, Spain
(average)	62	38	40 × 20	Taboga Island, Panama

*Types.* The type figure of this species is that published by Gualtieri 1742, pl. 51, fig. A. This is the only reference given by Linné. We here select the type locality to be Teneriffe, Canary Islands, as the specimens which we have seen from this place agree very well with Gualtieri's figure.

*Common name.* Red-mouthed Rock Shell; Red-lipped Scoop.

*Remarks.* This species is probably as variable as any in the genus. European writers have proposed a host of names for the many forms as the above synonymy indicates. According to our present understanding of this species most of the names do not appear at all necessary as they are applied mainly to individual variations, in many cases to groups of individuals of unit ecologic populations (Pallary 1900, Journ. de Conchy. 48, p. 290). One Eastern Atlantic subspecies seems to be fairly well differentiated, *T. haemastoma forbesi* Dunker, from the West African coast, but even this subspecies merges into the typical form (Plate 36, fig. 7).

On the southern end of its range in Brasil and Uruguay individuals become quite large and somewhat strongly nodulose.



*Photographs by F. P. Orchard*

Plate 36. *Thais haemastoma haemastoma* Linné. Fig. 1-2. Jura Juba Bay, Rio de Janeiro, Brasil. Fig. 3. Teneriffe, Canary Islands. Fig. 4. Taboga Island, off Panama. Fig. 5. Panama. Fig. 6. Rio de Janeiro, Brasil. Fig. 7. *Thais haemastoma forbesii* Dunker, Benito, Spanish Guinea, West Africa. (All natural size.)

Reeve's *T. gigantea* is but an exceedingly large example of *haemastoma*. Pallary (*l.c.* above) cites examples of equal size that occur at Oran, Algeria.

In a large series it seems to be impossible to differentiate specimens from the Eastern Atlantic, Western Atlantic and Eastern Pacific. Certain extreme individual variations do appear to be somewhat different but the majority of specimens from these geographic regions are quite similar. In common with many intertidal species it is capable of mechanical transport, even in the adult stage. We possess a specimen collected by the United States Exploring Expedition on a floating log (North Latitude 36°, West Longitude 22°). This is some 300 miles northwest of the Madeira Islands. Drift of this sort could certainly carry specimens a considerable distance under favorable conditions. This may indicate a possible origin of the species in the Western Atlantic. A westward distribution may have occurred early enough to have reached the Eastern Pacific at the time when passage was possible through the region of Central America. The strong South Equatorial Current (westward) is probably a factor of considerable import in such mechanical dispersal. There are many cases of similar or very closely related forms that occur in the Western Atlantic and the Eastern Atlantic regions, particularly in the tropical portions of both areas that may have had advantage of such transport.

*Range.* EASTERN ATLANTIC: France, Western Mediterranean and south along the African coast to Sénégal. (*T. h. Forbesi* Dunker continues south along the African coast at least to the French Congo.) WESTERN ATLANTIC: from Trinidad south to Uruguay. EASTERN PACIFIC: from Mexico south to central Chile.

*Records.* EASTERN ATLANTIC: SPAIN: Asturias; Galicia (both MCZ). ALGERIA: Mers-el-Kebir, Oran; Algiers (both MCZ). MADEIRA ISLANDS: Fayal (MCZ). CANARY ISLANDS: Teneriffe (MCZ). CAPE VERDE ISLANDS: (MCZ). SENEGAL: Gorée Id. (MCZ).

WESTERN ATLANTIC: TRINIDAD: Otaheite Bay (MCZ); Magueripe Bay (H.G. Kugler). BRASIL: Praia de Camocim, Estado do Ceará; Praia do Chega Negro, Bahía; Río Mucury, Estado Espirito Santo; Praia de Itaipú, São Gonçalo, Río de Janeiro; Praia das Conchas, Itanhaen, Estado de São Paulo (all M. J. de Oliveira). URUGUAY: Cabo Santa María (A. Carcelles).

EASTERN PACIFIC: MEXICO: Acapulco; Magdalena Bay; Lower California; Mazatlan; Loreto; Cabo San Lucas; Guaymas (all MCZ). COSTA RICA: Golfo de Nicoya (MCZ). PANAMA: near Panama City (J. Zetek); Taboga Id.; Venado Beach (both C. M. Dumbauld). ECUADOR: Santa Elena (MCZ). PERU: Payta; Callao; Bahía de Paracas (all MCZ). CHILE: Valparaiso (MCZ). EASTERN PACIFIC ISLANDS: Cedros Id.: Juan Fernandez (both MCZ).

### **Thais haemastoma floridana** Conrad, Plate 37, fig. 1-4

*Purpura floridana* Conrad 1837, Journal Academy of Natural Sciences, Philadelphia 7, p. 265, pl. 20, fig. 21 (Florida and Mobile Point, Alabama); *non floridana* Conrad 1867.

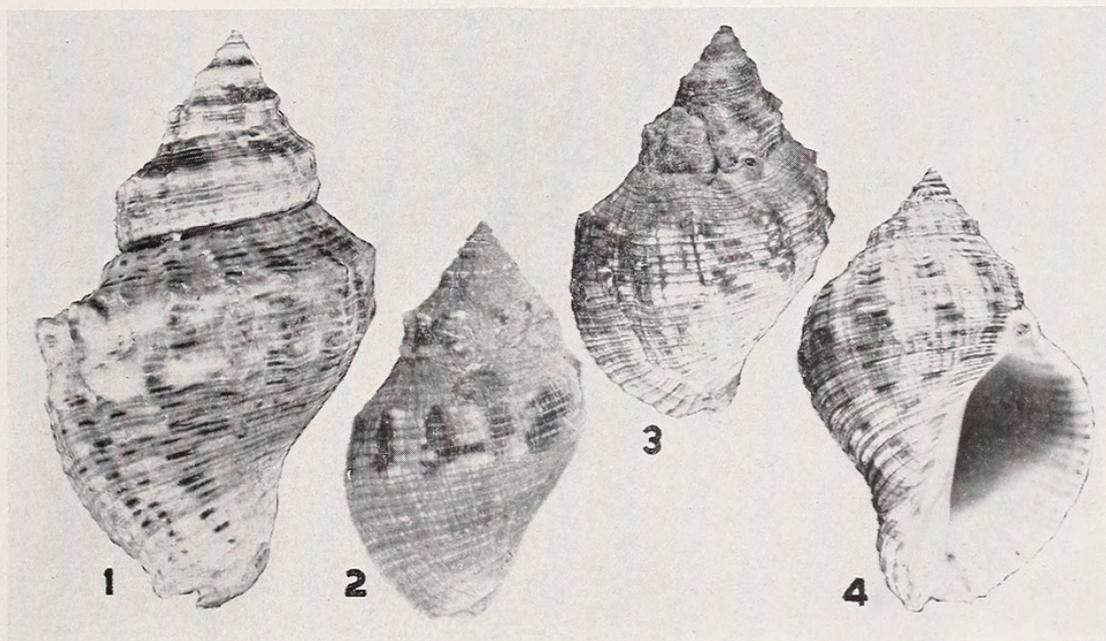
*Purpura haemastoma* 'Linné' Dall 1889, Bull. United States National Museum no. 37, p. 122, pl. 46, fig. 1a-2b.

*Purpura gundlachi* 'Dunker' Arango 1880, Fauna Malacologia Cubana, Habana, p. 202 (Habana, Cuba); [nude name]. This name so far as we can trace was never published until it appeared as a synonym under *P. floridana* Conrad by Arango.

*Description.* Adult shell reaching about 75 mm. in length (3 inches), solid, smooth to generally and finely nodulose. Whorls 6 to 7, slightly convex and occasionally angled. Color light gray to yellowish with a mottling of a darker color which generally appears in an axial pattern. Interior of aperture with a well diffused color of salmon pink, many specimens showing brown between the denticulations of the outer lip. Aperture sub-ovate to sub-oval. Outer lip moderately thickened and generally strongly crenulated, the crenulations formed by the ends of low and small ridges which generally run back well within the aperture. Inner lip glazed, smooth and thickened by a callus. At its upper margin there is a strong ridge which runs back within the aperture. Some specimens have a faint plica on the base of the columella. Umbilicus generally closed, occasionally very slightly rimate. Columella nearly straight and moderately thickened. Siphonal canal oblique and short. Previous growth stages of the canal leave behind a small ridge which surrounds the umbilical area. Anal canal short and margined within by a narrow ridge on the parietal wall. There is a small subsutural depression occasionally present on the outer whorl. Spire moderately extended. Suture irregular and generally fine, occasionally indented. Sculpture is exceedingly variable, consisting of very fine incised spiral lines and frequently with two or more rows of small nodules which are in spiral pattern. Axial striae consist mainly of fine growth lines.

	length	width	aperture	
(large)	75	44	41 × 19 mm.	Charleston, South Carolina
(average)	56	33	32 × 15	Galveston, Texas
(average)	67	39	38 × 18	Hypoluxo Island, Lantana, Florida

*Types.* Neoholotype, Museum of Comparative Zoölogy, no. 125382, Hypoluxo Island, Lantana, Florida. F. Lyman, collector. Dr. Pilsbry reports that Conrad's original



Photographs by F. P. Orchard

Plate 37. *Thais haemastoma floridana* Conrad. Fig. 1. Hypoluxo Island, Lantana, Florida (Neoholotype). Fig. 2-3. Daytona Beach, Florida. Fig. 4. Fernandina, Florida. (All natural size.)

type is not at the Academy of Natural Sciences, Philadelphia and is presumably lost. We have selected a new specimen to represent this subspecies.

*Common name.* Florida Rock Shell.

*Remarks.* This subspecies is exceedingly close in its relationships to the typical form. Segregated geographically, specimens do appear to be a little different. They are not as nodulose as *haemastoma*, are generally lighter in color and possess more pinkish rather than salmon-brown color within the aperture. Many examples of both forms are difficult and sometimes impossible to separate. In the main, however, West Indian specimens bear a closer relationship to *floridana* than they do to *haemastoma*. Krebs (1864, p. 26) reports only *floridana* from the West Indies though he states that *haemastoma* is "often found at the bottom of vessels which arrive from the coast of Africa at the port of St. Thomas." I have seen but a single example from the west coast of Florida south of the Cedar Keys, found by Mr. S. L. Porter on the outer coast of Sanibel Island on a small patch of rocks.

*Range.* North Carolina, south through the West Indies and along the Central American coast to Trinidad.

*Records.* NORTH CAROLINA: Roanoke Id.; Beaufort (both MCZ). SOUTH CAROLINA: Sullivan's Id., Charleston (Charleston Museum). FLORIDA: Fernandina; Fort Walton; Tortugas (all L. A. Burry); Lantana (F. Lyman); Daytona Beach (G. Quelch); Cutler Point (R. Humes); Lake Worth; Lower Matecumbe Key; Plantation Key; Conch Key (all B. R. Bales); St. Augustine; Cape Canaveral; West Palm Beach; Fort Lauderdale; Miami Beach; Key Largo; Key West; Cedar Keys; Pensacola (all MCZ); Sanibel Id. (S. L. Porter); Panama City (A. B. Koto). TEXAS: Galveston (MCZ); Port O'Connor (Charleston Museum). BAHAMAS: North Bimini Id., Bimini Ids. (MCZ). CUBA: Varadero, Matanzas (C. J. Finley); off Cayo Conuco, Caibarién (R. Humes); Punta de la Sabanilla, Cienfuegos (MCZ). HISPANIOLA: Monte Cristi; Puerto Plata; Santa Bárbara de Samaná; Jérémie (all MCZ). JAMAICA: (MCZ). VIRGIN ISLANDS: Tortola (M. W. Dewey); St. John; St. Thomas (both MCZ). LESSER ANTILLES: Antigua (M. L. Howland); Guadeloupe (MCZ); Soldado Rock, Trinidad (H. G. Kugler). MEXICO: Veracruz; Isla del Carmen, Campeche (both M. E. Bourgeois). NICARAGUA: Waunta Haulover (W. H. Fluck). VENEZUELA: Cubagua Id. (MCZ).

### **Thais haemastoma haysae** *Clench*, Plate 38, fig. 1-3

*Thais floridana haysae* Clench 1927, *Nautilus* **41**, p. 6; 1930, *Nautilus* **44**, p. 68, pl. 2, fig. 11 (Grand Bayou, Mississippi delta, Louisiana).

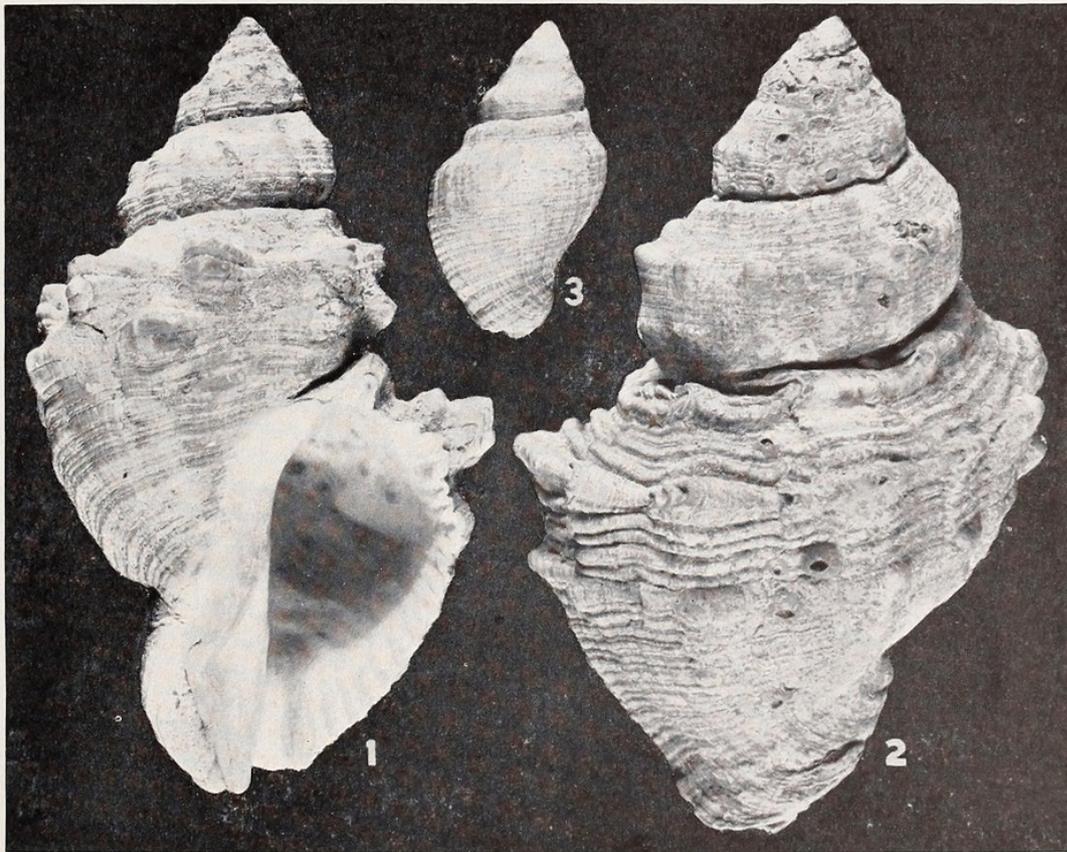
*Thais haemastoma* 'Linné' Burkenroad 1931, *Ecology* **12**, pp. 656-664, fig. 1.

*Description.* Adult shell reaching about 105 mm. in length ( $4\frac{1}{2}$  inches), solid and possessing a double row of strong nodules at the shoulder. Whorls 7 to 8, convex, the last whorl strongly angled. Color dull gray with occasional specimens showing an irregular mottling of a darker color which may be in a spiral or axial pattern. Interior of aperture a light brownish to pinkish orange. Aperture sub-ovate to sub-oval. The outer lip moderately thickened and generally strongly crenulated; the crenulations generally run well

back within the aperture. Inner or parietal lip glazed, smooth and thickened by the callosity. At its upper margin there is a strong ridge which runs back within the aperture. Occasional specimens will have a few faint plicae on the base of the columella. Umbilicus generally closed, occasionally very slightly rimate. Columella nearly straight and moderately thickened. Siphonal canal oblique and short. Previous growth stages of the canal leave behind a small ridge which surrounds the umbilical area. Anal canal short and margined within by a narrow ridge on the parietal wall. There is a small to pronounced subsutural depression generally present on the outer whorl. Spire moderately to well extended, occasionally equaling the length of the aperture. Suture usually indented. Sculpture generally quite constant, consisting of numerous, rather coarse, spiral incised lines with two rows of very large nodules in spiral arrangement at the whorl shoulder. Young specimens under 5 or 6 whorls show only traces of tubercles. Periostracum deciduous and rarely present.

	length	width	aperture	
(large)	90	50	51 × 22 mm.	Holotype
(large)	103	53	56 × 21	Grand Bayou, Louisiana
(average)	80	42	44 × 18	25 miles south of Port Arthur, Texas

*Types.* Holotype, Museum of Comparative Zoölogy no. 52203, Grand Bayou, Mississippi delta, Louisiana. M. L. Hays collector, 1926.



Photographs by F. P. Orchard

Plate 38. *Thais haemastoma haysae* Clench. Fig. 1. Grand Bayou, Louisiana (Holotype). Fig. 2. Bastian Bay, Louisiana. Fig. 3. Horn Island, Louisiana. (All natural size.)

*Common name.* Hays' Rock Shell; Louisiana Conch; Louisiana Drill.

*Remarks.* This subspecies, in common with other members of the *haemastoma* complex, possesses specimens that are rather difficult to separate under a given name. In general, however, *haysae* appears to be a well marked subspecies. Specimens occur that are much larger than *floridana*, the subspecies with which it is most closely allied. In addition, it is differentiated by the two large rows of nodules, much coarser spiral, incised lines and the deeply channeled suture.

M. D. Burkenroad (*l.c.* above) in an able report has given considerable data on the biology of this subspecies. It is a serious pest, destroying large numbers of oysters in Louisiana waters and elsewhere along the northern Gulf Coast. The eggs are imbedded in a gelatinous matrix and enclosed in horny capsules about 10 mm. in length. Each capsule contains about 100 eggs; each female is capable of producing more than 100 capsules. The larvae are liberated as veligers and escape from the capsule after the small cap has been broken open. In this free swimming stage they are widely dispersed by currents over new territory. This is in direct contrast to the condition existing in *T. lapillus*; here the veliger or free swimming stage must be passed over very rapidly while the young are in the capsule, as these emerge as minute snails with the shells well formed.

*Range.* Gulf of Mexico from Florida west to Texas and possibly along the northern Mexican coast.

*Records.* FLORIDA: Pensacola (L. A. Burry). LOUISIANA: Grand Bayou, Bastian Bay; Horn Island (all MCZ). TEXAS: 25 miles south of Port Arthur; 10 miles S.W. of Sabine; Carancahua Bay, Calhoun Co. (all MCZ).

### **Thais (Stramonita) rustica** Lamarck, Plate 39, fig. 4-6, 8, 10

*Thais undata* of authors, not of Lamarck 1822.

*Purpura rustica* Lamarck 1822, Animaux sans Vertèbres 7, p. 246 (locality unknown). [Kiener has figured these specimens of Lamarck under *Purpura undata* (1836, Icon. Coquilles Vivantes 8, pl. 34, fig. 81c)].

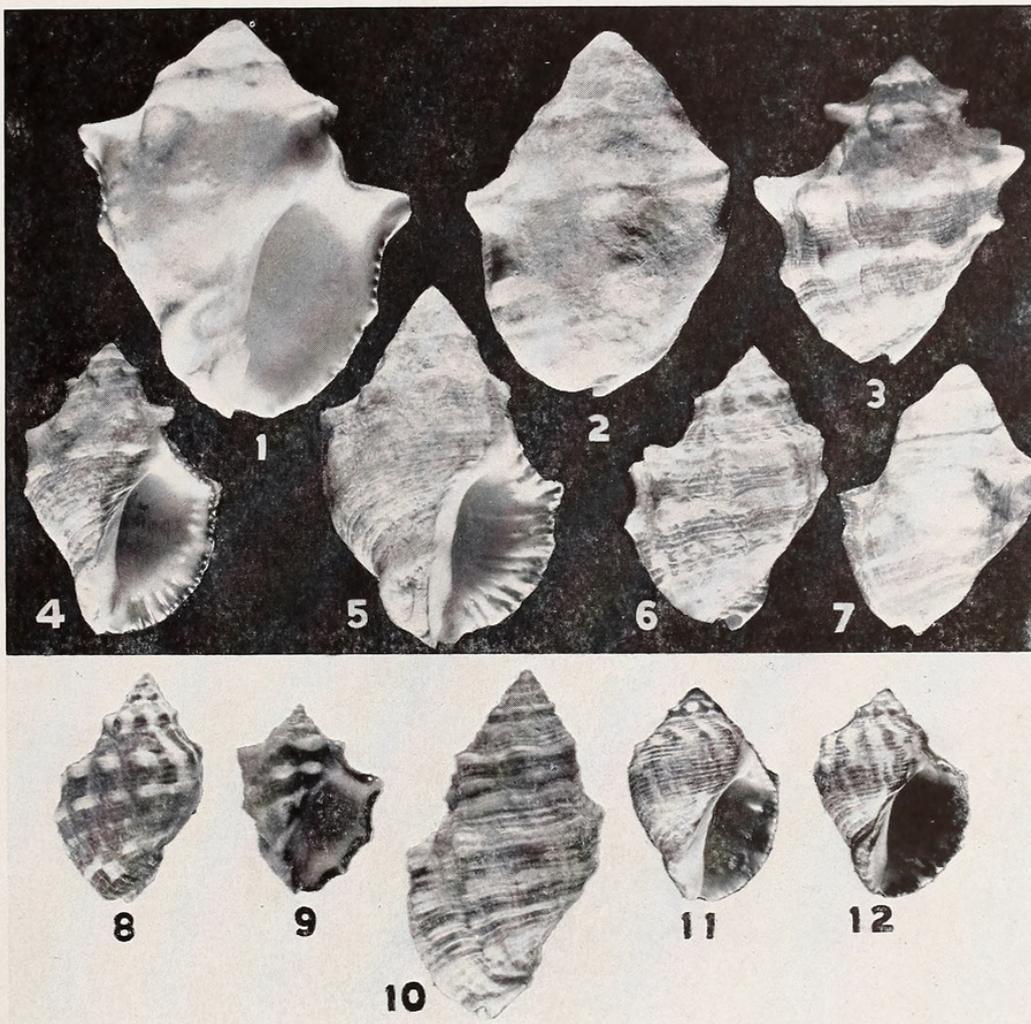
*Purpura bicostalis* 'Lamarck' de St. Vincent 1827, Tableau Encyclopédique et Méthodique 3, pl. 398, fig. 5 a-b (locality not given).

*Purpura kienerii* Deshayes 1844, Animaux sans Vertèbres ed. 2. 10, p. 64, 101 (Martinique). [Based on the figures of *P. bitubercularis* Kiener, non Lamarck (Kiener 1836, Icon. Coquilles Vivantes 8, pl. 11, fig. 32)].

*Purpura fasciata* Reeve 1846, Conchologia Iconica 3, **Purpura**, species no. 45, pl. 9 (locality unknown); non *P. fasciata* Dunker 1857.

*Description.* Adult shell reaching about 50 mm. (2 inches) in length, solid and generally sculptured. Whorls five to six, slightly convex and angled at the shoulder. Color a dirty gray to a dull mottled brown, particularly in old specimens. Young specimens are mottled dark chocolate brown and cream with occasional specimens showing reddish, particularly on the nodules and along the spiral line of their development. Interior of aperture white, but generally margined with dark brown along the outer lip. The dark coloration generally confined to the ends of the small ridges and these usually grouped into bands. This is particularly pronounced in young specimens before the thicker white overlay limits this color to near the margin. Parietal wall usually glazed and showing fine threads of color in spiral pattern. Aperture sub-ovate to sub-oval. Outer lip moder-

ately thickened and generally strongly crenulated, the crenulations formed by the ends of the low, small ridges which generally run back well into the aperture. In addition to the marginal ridges there is usually a second series below. These lower ridges are few in number and generally white in color and are usually stronger than the marginal series. Rarely these secondary ridges form little knobs on their outer extremities. Inner lip glazed and smooth. At its upper margin there is a strong ridge, the anal ridge, which runs back into the aperture. This is opposite the small and relatively inconspicuous anal canal. Some specimens have a few faint plicae on the base of the columella. Umbilicus closed. Columella nearly straight and moderately thickened. Siphonal canal oblique and short. Previous growth stages of the canal leave behind a small ridge which surrounds the umbilical area. Anal canal short and inconspicuous. There is a small subsutural depression occasionally present on the outer whorl. Spire generally extended. Suture fine and irregular and usually difficult to observe, particularly in older specimens. Sculpture varia-



Photographs by F. P. Orchard

Plate 39. *Thais deltoidea* Lamarck. Fig. 1. Channel Rocks, Miami, Florida. Fig. 2-3. Eight Mile Rock, Grand Bahama Island, Bahamas. Fig. 9. Arthurs-town, Cat Island, Bahamas. *Thais rustica* Lamarck. Fig. 4 and 6. Guana Island, Tortola, Virgin Islands. Fig. 5. Puerto Plata, Santo Domingo. Fig. 8. Gambia, New Providence, Bahamas. Fig. 10. Monte Cristi, Santo Domingo. *Thais rustica bicarinata* de Blainville, Fig. 7, 11 and 12. Ascension Island, South Atlantic Ocean. (All natural size.)

ble but generally with one or more rows of rather well developed nodules on the shoulder and mid area of the whorl. In addition there are many small spiral threads. Axial sculpture consisting of very fine growth lines. Periostracum deciduous and rarely present.

	length	width	aperture	
(large)	48	37	27.5 × 11 mm.	Puerto Plata, Hispaniola
(average)	34	19	21.5 × 9.5	Key West, Florida

*Types.* Lamarck's types were figured by Kiener 1836, Icon. Coquilles Vivantes 8, pl. 34, fig. 81c. As the locality was unknown to Lamarck we here limit the type locality to Puerto Plata, Hispaniola.

*Common name.* The Rustic Rock Shell.

*Remarks.* This species has long been known under the name of *T. undata* Lamarck. However, a re-examination of the monographs of both de Blainville and Kiener who have figured specimens from Lamarck's collection, indicates that Lamarck's *undata* is an Indo-Pacific species and not a member of our Western Atlantic fauna.

*Thais rustica* is a well defined species though closely related to the *T. haemastoma* complex. It differs from *T. haemastoma* by having the mouth of the aperture white, not yellow or orange, and by possessing, with few exceptions, a secondary series of ridges within the aperture. It is more nodulose and generally a smaller shell.

This species occurs on the rocks exposed to the open sea. It is intertidal and though not rare it never occurs in any great numbers. It produces a small amount of purple dye.

*Range.* Southern Florida, the West Indies and south to Brasil.

*Records.* FLORIDA: Palm Beach; Soldiers Key, Miami; Key West (all MCZ); Hillsboro Reef; Looe Key (both L. A. Burry); Boca Chica Bay (B. R. Bales); Miami (R. Humes); Boca Raton (P. P. McGinty); Tortugas (J. Miller); Missouri Key (A. B. Koto). BERMUDA: Hamilton; Coney Id. (both MCZ). BAHAMA ISLANDS: West End, Grand Bahama Id.; Bimini Ids.; East Point, New Providence; Savannah Sound, Eleuthera; Millerton, Long Island; Arthurstown, Cat Id.; Abraham's Bay, Mariguana; Mathewtown, Great Inagua (all MCZ). CUBA: Habana (MCZ); Kawama Beach, Matanzas (C. J. Finley); Cayo Francés Caibarién (P. J. Bermúdez); Levisa Bay, Mayarí (A. Queñones). Guantánamo Naval Base; Punta de los Colorados, Cienfuegos (both MCZ). HISPANIOLA: Cap Haitien (W. J. Eyerdam); Monte Cristi; Puerto Plata; Santa Bárbara de Samaná; Jérémie (all MCZ). JAMAICA: Port Antonio; mouth of Dunn's River (both MCZ). MONA ISLAND: (H. A. Beatty). PUERTO RICO: Miramar, San Juan (MCZ). VIRGIN ISLANDS: Tortola; Virgin Gorda (both M. W. Dewey); Saint Thomas (MCZ). LESSER ANTILLES: Dominica (Yale Univ.); Antigua; St. Pierre, Martinique; Barbados; Toco and Salybia, Trinidad (all MCZ). CARIBBEAN ISLANDS: Navassa Id. (MCZ). PANAMA: Colón (MCZ); Isla de Pinos, San Blas (J. Zetek). COLOMBIA: Santa Marta; Cartagena (both MCZ). BRASIL: Natal (MCZ); Praia do Chega Negro, Bahía (M. de Oliveira).

**Thais rustica bicarinata** de Blainville, Plate 39, fig. 7, 11-12

*Purpura bicarinata* de Blainville 1832, Nouvelles Annales du Muséum d'Histoire Naturelle (Paris) (3) 1, p.

215 (St. Helena) [See also under *P. helena* Quoy and Gaimard]; Lamy 1918, Bull. Muséum d'Histoire Naturelle **24**, p. 354.

*Purpura helena* Quoy and Gaimard 1833, Voyage L'Astrolabe **2**, p. 573, pl. 39, fig. 7-10 (St. Helena). [According to Fischer-Piette and Beigbeder 1943, p. 429 and 430, the type specimens of this species were also the type specimens selected by de Blainville for his *P. bicarinata*].

*Purpura undata* 'Lamarck' Kiener 1836, Icon. Coquilles Vivantes **8**, p. 116, pl. 34, fig. 81 a-b [not fig. 81] (The South Seas [South Atlantic?] and St. Helena). [Figures 81 a-b are those collected by Quoy and Gaimard and described by deBlainville as *P. bicarinata*].

*Purpura fasciata minor* Hidalgo 1893, Mem. Real Academia Ciencias, Madrid **19**, p. 336; *non minor* Jeffreys 1867. [Hidalgo refers only to Kiener's figures (Icon. Coquilles Vivantes **8**, pl. 34, fig. 81 a-b, 1836); see notes under *Purpura undata* 'Lamarck' Kiener above]. Hidalgo's records of Bahía and Pernambuco, Brasil no doubt refer to specimens of *Thais rustica* Lamarck.

**Description.** Adult shell reaching about 33 mm. ( $1\frac{1}{4}$  inches) in length, solid and with five to six sculptured whorls, convex and angled at the shoulder. Color a dirty gray to dull mottled brown. In young specimens the color is more pronounced. Interior of aperture white with brownish color marks showing near the margin. Parietal wall glazed. Aperture ovate. Outer lip thickened and finely crenulated. Within there are four low ridges which may be discontinuous, their outer ends terminating in nodules. Sculpture consisting of two or more spiral ridges on which there are numerous nodules in young specimens. In adult specimens these nodules become much fewer and much larger.

	length	width	aperture	
(large)	33	21	20 × 9.5 mm.	Ascension Id., South Atlantic
(young)	24	16.5	18.5 × 9	Ascension Id., South Atlantic

**Types.** The type specimens of *bicarinata* de Blainville, *helena* Quoy and Gaimard, and *undata* 'Lamarck' Kiener are in the Paris Museum. The type locality is the Island of St. Helena in the South Atlantic [see notes after these names in the synonymy].

**Common name.** St. Helena Rock Shell.

**Remarks.** This subspecies is close in most of its characters to the typical form. It differs in possessing much stronger nodules, being broader in proportion to its length, and in having the apertural ridges more strongly developed.

**Range and Records.** Known only from the islands of St. Helena and Ascension in the South Atlantic. We are indebted to Mr. A. H. Patterson for specimens from Ascension Island.

### Subgenus **Mancinella** Link

*Mancinella* Link 1807, Beschreibung der Naturalien-Sammlung zu Universität zu Rostock, p. 115.

*Thalessa* H. and A. Adams 1853, Genera of Recent Mollusca, London **1**, p. 127.

Subgenotype, *Murex mancinella* of authors, not of Linné or Gmelin = *Purpura gemmulata* Lamarck (subsequent designation, Iredale 1915). See E. A. Smith 1913, Proc. Malac. Society, London **10**, pp. 287-289.

Shells are moderate in size, generally strong and solid usually strongly nodulose with most species having a rather short spire. Anal canal rather short and sometimes hardly indicated at all. Anal ridge small and relatively inconspicuous.

**Thais (Mancinella) deltoidea** Lamarck, Plate 39, fig. 1-3, 9

*Purpura deltoidea* Lamarck 1822, Animaux sans Vertèbres 7, p. 247 (locality unknown); Kiener 1836, Icon. Coquilles Vivantes 8, p. 54, pl. 13, fig. 37 (Seas of Martinique); Deshayes and Edwards 1844, Animaux sans Vertèbres (2) 10, p. 85.

*Purpura subdeltoidea* de Blainville 1832, Nouvelles Annales du Muséum d'Histoire Naturelle (2) 1, p. 214, pl. 9, fig. 11 (Martinique).

*Purpura albocincta* Küster 1860, Conchy.-Cab. (2) 3, pt. 1a, p. 180, pl. 30, fig. 8-9 (locality unknown).

*Purpura trapa* 'Röding' Guppy 1877, Proc. Scientific Association of Trinidad 2, p. 144; *non* Röding 1798.

*Description.* Shell 30 to 50 mm. (about 1 to 2 inches) in length, heavy, solid and coarsely nodulous. Whorls convex, 6 to 8. Color generally grayish white, irregularly mottled with dull brown to black in young specimens and occasionally with dark purple to black color patches near outer lip on old specimens. Parietal wall tinted with lavender to rose. Spire moderately extended, produced at an angle from 85° to 90°. Suture indistinct. Aperture rather elongate and nearly semicircular, its interior a porcelaneous white. At the union of the outer lip and the parietal wall there is a moderately deep groove which corresponds to the anal notch. At this point, however, the outer lip is not cut back to form a sinus. Outer lip thickened within and its edge finely crenulated below the shoulder spine. Parietal lip reflected over the body whorl in the form of a broad callus, highly polished and colored irregularly with pink, salmon and brown. Siphonal canal short, but cut back deeply under the columella, its apex terminating in a ridge. This ridge follows back and disappears under the smooth parietal shield. Columella nearly straight and rounded, with a small but distinct ridge at the base which forms the margin of the siphonal canal, its upper end following back within the whorl as a small plication. Slightly above this ridge there are from 1 to 3 very indistinct teeth. Sculpture consisting of a series of large and blunt nodules at the shoulder of the whorl, occasionally producing a second row of nodules below the shoulder series. In young specimens a third row may be moderately developed. In addition to the nodules there are numerous and fine spiral incised lines each ending in one of the crenulations at the margin of the aperture. In old specimens these are obsolete except on the last half of the body whorl. No axial sculpture apparent. Periostracum absent. Operculum semicircular, corneous, rough, with strong axial growth lines, inner surface with a strong and thickened marginal callus, central scar area with small irregular ridges with the areas in between minutely scarred with incised lines.

	length	width	aperture	
(large)	51.5	39	35 × 14.5 mm.	Miami Beach, Florida
(average)	41	36.5	32 × 12	Eleuthera Id., Bahamas

*Types.* As Lamarck did not figure a specimen with his original description we here select as typical illustrations the two figures of Kiener which may possibly have been based upon Lamarck's material. Martinique, Lesser Antilles is here selected as the type locality.

*Common name.* The Deltoid Rock Shell.

*Remarks.* This is an abundant species, occurring throughout the West Indian region. It lives on rocky shores in both exposed and partially protected places though it seems to prefer situations where a fair amount of surf occurs. It can grip the rocks with considerable strength and it takes quite a pull to dislodge them.

Variation in the shell characters is considerable and young specimens appear to be very different from adults, particularly in their coloration and fine, distinct sculpture. Mature specimens, especially those found in exposed situations, are usually worn smooth except the large nodules and the color is usually an ashen gray while young examples obtained in more sheltered spots are darker in color, almost black, with the nodules tipped with dark red or rose. In addition this species appears to be particularly susceptible to the lodgment of coralline algae.

This species is not closely related to any other in the Western Atlantic though it is fairly close to *T. crassa* de Blainville of the Panamic province of the Eastern Pacific region.

*Range.* Jupiter Inlet, Florida, Bermuda, the Bahamas and south through the West Indies to Brasil.

*Records.* FLORIDA: St. Lucie Inlet (J. M. Cannon); Lake Worth (L. A. Burry); Boynton Beach (P. McGinty); Pompano (MCZ); Channel Rocks, Biscayne Bay (Ralph Humes); Molasses Reef, Key Largo (L. A. Burry); Lower Matecumbe Key; Pelican Shoals (both B. R. Bales); Key West (A. B. Koto); Tortugas (MCZ). BERMUDA: (Yale Univ.; MCZ). BAHAMAS: Eight Mile Rock, Grand Bahama Id.; Joe Cays, Little Abaco Id.; Sweetings Village, Great Abaco; Cat Cay, Bimini Ids.; Gambia, New Providence; Governors Harbour, Eleuthera Id.; Arthurstown, Cat Id.; Cape St. Maria, Long Id.; Watlings Id.; Fortune Id.; Matthewtown, Great Inagua (all MCZ); Cay Sal Bank (R. Humes). CUBA: Habana (MCZ); Punta Sabanilla, Matanzas; Cayo Francés, Caibarién (both P. J. Bermúdez); Cayo Santa Maria, Camagüey (R. Humes); Guantánamo Naval Base; Castillo de Jagua, Cienfuegos (both MCZ). HISPANIOLA: Gonave Id.; Miragoane; Cap Haitien (all W. J. Eyerdam); Monte Cristi; Puerto Plata; Santa Bárbara de Samaná (all MCZ). PUERTO RICO: San Juan (MCZ). VIRGIN ISLANDS: Guana Id., Tortola; Virgin Gorda (both M. W. Dewey); St. Thomas (MCZ). JAMAICA: Montego Bay (MCZ). LESSER ANTILLES: St. Lucia (Charleston Museum); Dominica (Yale Univ.); Guadeloupe; Barbados (both MCZ); Grenada (H. G. Kugler). CARIBBEAN ISLANDS: Roatan Id. (MCZ). MEXICO: Isla Mujeres, Yucatan (C. G. Aguayo). PANAMA: Colón (MCZ); Porto Bello (J. Zetek). BRASIL: Porto Seguro (MCZ); Praia de Chega Negro, Cidade de Bahía and Manguinhos, Ilha de Itaparica, Estado de Bahía (both Paulo de Oliveira).

### Subgenus *Polytropa* Swainson

*Nucella* of authors, not of Röding 1798.

*Polytropa* Swainson 1840, A Treatise on Malacology, London, pp. 81 and 305.

*Polytropicalicus* Rovereto 1899, Atti Soc. Ligustica **10**, p. 105, new name for *Polytropa* Swainson *non* De-france 1826. [De-france instituted the name *Polytropes*. Under our present rules this name is not a homonym of *Polytropa* Swainson as stated by Rovereto and therefore this latter name is valid].

Subgenotype, *Buccinum lapillus* Linné (subsequent designation, J. E. Gray 1847).

The shells generally possess a sculpture of spiral ridges which may be crossed by axial imbrications or foliations. Anal canal generally not indicated though occasionally specimens show a slight groove within the aperture at its upper end. Siphonal canal moderately long, oblique, with the previous growth stages leaving behind a rather strongly developed umbilical ridge. Umbilical area depressed and may possess a small rimation.

Röding introduced the name *Nucella* listing several species, one of these being *Nucella lapillus* Röding. Iredale subsequently (1915) made this species the genotype of *Nucella* assuming that this was the species of Linné and Lamarck. Unfortunately this is not so. Röding refers his *Nucella lapillus* to *Buccinum rusticum* Gmelin and in addition gives a reference to Martini 1777, Conchy.-Cab. (1) 3, plate 120, fig. 1104–1105. As this reference is included also by Gmelin, these are here selected to be the type figures. They do not refer to any species of *Thais* as now understood but probably to a true buccinoid, some member of the genus *Cantharus*, possibly *undosa* Linné.

However, if the above statement is not accepted, it can be ruled that Iredale's type designation of 1915 was invalid as his type reference was to *Thais* [*Purpura*] *lapillus* Lamarck 1803, a name published five years after Röding's genus *Nucella* was introduced. The next type designation was that of Winckworth (1945, p. 141) who gives *N. theobroma* Röding = *Buccinum lapillus* Linné. Winckworth was in error, however, in giving credit to Dall for this type designation as Dall did not use the word "type" nor did he use the name *theobroma* Röding. I cannot, however, accept Winckworth's statement that *N. theobroma* Röding = *Buccinum lapillus* Linné. Röding refers his *theobroma* to *Buccinum filosum* Gmelin, and they both in turn refer to Martini 1777, Conchy.-Cab. (1) 3, pl. 121, figures 1113–1114, figures which appear to me to be unrecognizable. On the same plate in Martini (121) there are two excellent figures of *Buccinum lapillus* (fig. 1111, 1112) which Röding renamed *Nassa rudis* with a reference to *Buccinum lapillus* Gmelin. It is clear that Röding did not intend the species which is now commonly known as *Thais lapillus* to be included in his subgenus *Nucella*. This latter name should be either abandoned or else associated with *Cantharus* as indicated above.

*Polytropa* in all probability should be raised to a full genus. Though differences in shell characters appear to be somewhat minor, dissimilarity in operculum characters is evident as between *Polytropa* and the other species of *Thais* that we have examined. In this respect mention may be made of the ovate growth ridges and the lack of very fine sculpture as characteristic of *Polytropa*. Also, as mentioned in the introduction to this report, young *T. lapillus* Linné emerging as shelled snails from the egg capsule, differ quite sharply from the shell-less veligers of *T. haemastoma haysae* Clench in the subgenus *Stramonita*. However, far more knowledge of the biology for most of the species is needed before any significant conclusions can be drawn.

### **Thais (Polytropa) lapillus Linné, Plate 40, fig. 1–8**

*Buccinum lapillus* Linné 1758, Systema Naturae ed. 10, p. 739 (European Ocean) [Among several references Linné gives Lister's *Historiae Animalium Angliae*, London, 1678, pl. 3, fig. 5–6]; *non Nucella lapillus* Röding 1798.

*Nassa rudis* Röding 1798, Museum Boltenianum (2) p. 132 [Refers to Gmelin 1790, Systema Naturae, ed. 13, p. 3484 (*Buccinum lapillus* Linné), and to Martini 1777, Conchy.-Cab. (1) 3, pl. 121, fig. 1111–1112].

*Purpura imbricata* Lamarck 1822, Animaux sans Vertèbres 7, p. 244 (Seas of Europe).

*Purpura bizonalis* Lamarck 1822, Animaux sans Vertèbres 7, p. 249 (locality unknown).

*Purpura filosa* Menke 1830, Synopsis Methodica Molluscorum, Pymont, p. 62 [Refers to *Buccinum filosum* Gmelin].

*Purpura buccinoidea* de Blainville 1829, Faune Française p. 148.

*Purpura rugosa* 'Lamarck' Kiener 1836, Icon. Coquilles Vivantes 8, p. 103, pl. 29, fig. 77a; *non P. rugosa* Lamarck 1822; Quoy and Gaimard 1833.

*Purpura lapillus* Linné varieties *major* and *minor* both of Jeffreys 1867, British Conchology 4, p. 277; *non minor* Hidalgo 1893.

*Purpura lapillus* Linné var. *ponderosa* Verkrüzen 1881, Jahrb. Deut. Malakozoologischen Gesell. 8, p. 95 (Notre Dame Bay, Newfoundland).

*Purpura celtica* Locard 1886, Prodrome de Malacologie Française, p. 147 (several localities along the Atlantic coast of France) [Locard based his *celtica* on the same figure which Kiener had given for *P. rugosa* 'Lamarek.' The original *rugosa* of Lamarek is a species from New Zealand, and only superficially like *T. lapillus* or any of its several forms. Kiener apparently had selected a strongly spirally sculptured specimen of *lapillus* which he figured as *rugosa* 'Lamarek'].

*Purpura lapillus* Linné, varieties *crassissima*, *lactea*, *aurantia*, *castanea*, *lineolata*, *fauce-violaceo* all of Dautzenberg 1887, Bull. Soc. d'études scientifiques de Paris 9, pt. 2, p. 24.

*Purpura lapillus* Linné varieties *citrina*, *caeruleuscens*, *monozonalis*, *mixta* all of Dautzenberg 1920, Journal de Conchyliologie 65, p. 47.

*Purpura lapillus fusco-apicata* Dautzenberg and Fischer 1925, Travaux Station Biologique Roscoff, Part 3, p. 44.

Several fossil forms of *Thais lapillus* Linné are considered by F. W. Harmer in The Pliocene Mollusca of Great Britain 1, pp. 117 (1914) and 334 (1918), Palaeontographical Society, London. Many references are given to earlier works on this subject.

*Description.* Adult shell reaching about 40 mm. (1½ inches) in length in the Western Atlantic, and 65 mm. (2½ inches) in the Eastern Atlantic solid, occasionally smooth but generally sculptured. Whorls five, rather convex. Color a dull yellowish white with variations of yellow, orange or brown, diffused or in the form of bands on a white background. Aperture elliptical and colored white to brown. Outer lip generally smooth, rather thick and occasionally crenulated. Occasionally there are a few small, short ridges within the aperture that appear in one or more axial rows. Inner or parietal lip glazed, usually with a well defined callus. Anal canal hardly defined, siphonal canal rather narrow and slightly oblique, the older shell growth extending backward as a basal ridge. Suture moderately impressed and poorly defined. Columella arched and slightly angled at the beginning of the siphonal canal. Sculpture exceedingly variable, sometimes smooth but generally with numerous rounded spiral ridges. Frequently specimens exhibit a series of imbricated scales which are arranged in an axial pattern. These may appear over the entire surface of the shell or only over certain portions. Operculum small and thin. Periostracum absent.

Both the description and measurements for this species have been based upon material from the Western Atlantic. Certain European specimens are much larger than anything known to occur on our coast, and there is in addition a much wider range in form and sculpture.

	length	width	aperture	
(large)	40	22	28 × 12 mm.	Digby, Nova Scotia
(average)	36	21.5	22 × 10.5	Port Clyde, Knox County, Maine
(average)	27	17.5	20 × 8.5	Kennebunkport, Maine

*Types.* The type figure, here selected, is plate 3, fig. 5 in Lister's *Historiae Animalium Angliae*, London, 1678. If Linné's types are not in existence, a neoholotype should be chosen from some locality in southern England that approximates this figure in Lister.

*Common names.* Dog Whelk; Dog Periwinkle; Common Whelk.

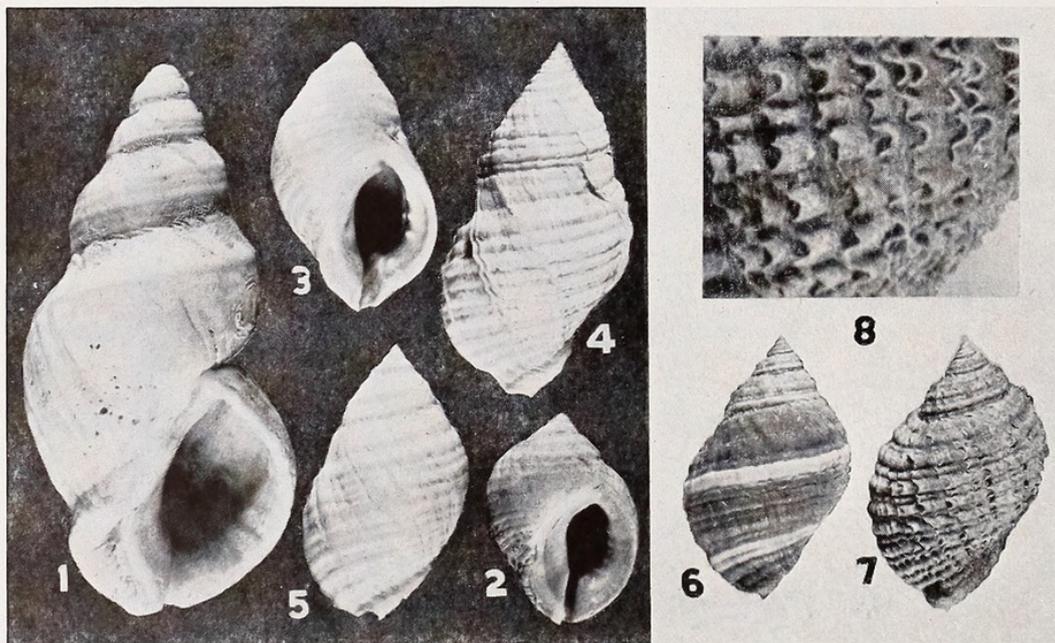
*Remarks.* I have made no attempt to complete the list of synonyms or accepted subspecies of all of the European forms in this variable species. Variation of this species in

European waters appears to be far more extensive than that existing anywhere along our Atlantic shores. Reference should be made to A. H. Cooke (1895, p. 91, fig. 35) where 19 figures are given, showing the many types of variation that are exhibited by this species. On our plate 40, fig. 1-2 are two extreme forms from England.

It is considered here that *T. imbricata* Lamarek is an absolute synonym of *T. lapillus* Linné. This is a name generally employed for specimens of *lapillus* that possess imbrications. These imbricated forms intergrade completely with the smooth forms of this species and many examples exist that possess both smooth and imbricated areas on the same specimen. From our own field observations it would appear that the imbricated specimens develop in protected areas. A protected spot can exist even on an exposed rocky coast. When this species is exposed at low tide it becomes quiescent, generally remaining fixed until the return of the tide. New shell growth is made when the animal is submerged and such a delicate structure as a thin scale or blade of shell material would be difficult and perhaps impossible to construct in water severely agitated.

Colton (1916, p. 453) claims that the various color patterns are hereditary and that natural selection has played an important part in their survival. That is, light colored forms are more numerous on the barnacle-covered (light colored) rocks and that the dark colored forms are more numerous on the darker colored rocks where *Mytilus* occurs. The data he submits on the imbricated forms to show that they are non-environmental, are anything but conclusive. The same can be said of the facts given in a later paper by Colton (1922, pp. 146-157) in which the evidence can certainly be interpreted as favoring environmental causes.

Moore (1936, p. 79) on the other hand presents considerable evidence that certain coloration is due to food; that is, *T. lapillus* feeding on *Mytilus* are dark colored while



Photographs by F. P. Orchard

Plate 40. *Thais lapillus* Linné. Fig. 1. Cornwall, England. Fig. 2. Teignmouth, England. Fig. 3. Kennebunkport, Maine. Fig. 4. Cushing, Maine. Fig. 5. Fishers Island off Stonington, Connecticut. Fig. 6. Casco Bay, Maine. Fig. 7-8. Grand Manan, New Brunswick. (Fig. 1-7, natural size; Fig. 8, 4 $\times$ .)

those feeding on *Balanus* are white. When *Mytilus*-fed *Thais* were transferred to a diet of *Balanus*, a pigmentation change took place in the shells and when put back on a *Mytilus* diet the dark coloration reappeared. The orange pigmentation, however, did not seem to be influenced by diet. Moore (p. 83) also found that imbricated forms occurred mainly below low water mark which would again bear out our own contention that these forms are produced when there is protection from physical forces of the environment. In the same paper Moore reports that large examples of *T. lapillus* reach 63 mm. in length in England, though these giant forms exist mainly in the sub-littoral zone. We possess a single example from Cornwall, England that measures 65 mm. in length. *T. lapillus* is known to occur in depths as low as 10 fathoms. Additional biological data on *T. lapillus* is given by Moore in his 1936 paper and again in 1938 (see bibliography).

According to A. Labbé (1926, Bull. Biologique de France et Belgique 60, pp. 30-41, 2 text figures) shelled embryos of *T. lapillus* are imbricated in the egg capsule and retain or lose these imbrications after their escape from the capsule. That is, the development of imbrications is a normal condition for this species, and this sculpture is continuously developed only when the specimens occupy a protected situation after they have left the egg capsule.

*Range.* WESTERN ATLANTIC: Jacobshaven, eastern Greenland and southern Labrador south to central Connecticut and the eastern end of Long Island, New York. EASTERN ATLANTIC: Mathew Strait, Novaya Zemlya south to Villanova de Portimao, Algarve, Portugal.

The distribution of this species has been very carefully studied by A. H. Cooke (1915, pp. 192-209) who cites numerous localities in both Eastern and Western Atlantic waters and includes an extensive bibliography.

All records for *T. lapillus* in the Pacific from both the northern Asiatic and North American coasts are referable to other, though closely allied, species of *Thais*.

*Records.* NEWFOUNDLAND: Fogo Id.; mouth of Serpentine River, Bay of Islands. PRINCE EDWARD ISLAND: Carleton Head. NOVA SCOTIA: Digby; Halifax; Harborville; Mitchell Bay; South Joggins; White Island; Bird Island. NEW BRUNSWICK: Grand Harbor, Grand Manan. MAINE: Eastport; Jonesport; Seal Harbor, Mt. Desert Id.; Castine; Isle au Haut; Rockland; Tenants Harbor; Bremen; Brunswick; Portland; Biddeford Pool; Kennebunkport; Kittery. NEW HAMPSHIRE: Hampton Beach. MASSACHUSETTS: Plum Island; Rockport; Gloucester; Beverly Farms; Salem; Swampscott; Nahant; Castle Island and Squantum, Boston Harbor; Nantasket; Cohasset; Scituate; Duxbury; Plymouth; Provincetown; Falmouth. RHODE ISLAND: Newport; Newcastle; Quonochantaug. CONNECTICUT: Napa Tree Pt., New London County. NEW YORK: Fishers Island (all of the above localities are based on the collections in the MCZ); Orient and Montauk Point, Long Island (both R. Latham).

## Notes

The following notes are based on names that have been referred to *Thais* and *Purpura* of the Western Atlantic that were misidentified or are now known to be in other genera. Of course, this list is not complete, but it does include most of the names that had to be considered for our studies on the Western Atlantic mollusks.

### **Coralliophila abbreviata** Lamarck

*Purpura abbreviata* Lamarck 1822, Animaux sans Vertèbres **7**, p. 146 (locality unknown).

This species has been referred to *Purpura* frequently. It is, however, in the genus *Coralliophila* in the family Magilidae. This same species has been called "*Purpura galea* Chemnitz," a name now considered invalid.

### **Tritonalia aberrans** C. B. Adams

*Purpura aberrans* C. B. Adams 1850, Contributions to Conchology, New York, no. 4, p. 58 (Jamaica) [Holotype MCZ 177956].

Though described as a *Purpura* this species belongs in the genus *Tritonalia*.

### **Thais bitubercularis** Lamarck

*Purpura bitubercularis* Lamarck 1822, Animaux sans Vertèbres **7**, p. 237 (locality unknown) [Lamarck refers to A. Seba 1758, Lecupletissimi Rerum Naturalium **3**, pl. 52, fig. 22-23]; H. de Blainville 1832, Nouvelles Annales du Muséum d'Histoire Naturelle (Paris) (3) **1**, p. 215 (Martinique); L. C. Kiener 1836, Icon. Coquilles Vivantes **8**, p. 49, pl. 11, fig. 32 (Martinique).

In a very large series of *Thais* at hand, there is nothing that closely approximates this species of Lamarck from the Western Atlantic. Both de Blainville and Kiener refer this species to Martinique, certainly in error. We possess specimens referable to *bitubercularis* from Bombay, India and from near Broome, Western Australia.

### **Thais (Mancinella) consul** Gmelin

*Murex consul* Gmelin 1790, Systema Naturae 13 ed., **6**, p. 3540, no. 159 (Indian Ocean) [This name is based on Chemnitz 1788, Conchylien-Cabinet **10**, p. 160, fig. 1516-1517].

*Purpura consul* Gmelin, Lamarck 1822, Animaux sans Vertèbres **7**, p. 237 (Indian Ocean) [Based upon the same figure noted above in Chemnitz].

*Purpura chocolatum* Duclos 1832, Annales des Sciences Naturelles **26**, p. 108, pl. 2, fig. 7 (Peru).

It appears to me that *Thais consul* and *T. chocolata* are synonymous. The original figure of *consul* by Chemnitz is based upon a very old specimen. We have a few examples that approximate the figure of Chemnitz. The "chocolate" color is not always exhibited, many specimens being a rather dull gray.

### **Purpura dubia** 'Stimpson' Kurtz

*Purpura dubia* 'Stimpson' Kurtz 1860, Catalogue of Recent Marine Shells Found on the Coasts of North and South Carolina, (Portland, Maine), p. 8 [nude name].

### **Buccinum filosum** Gmelin

*Buccinum filosum* Gmelin 1790, Systema Naturae ed. 13, **1**, pt. 6 (locality unknown) [Refers to Martini 1777, Conchy.-Cab. (1), **3**, pl. 121, fig. 1113-1114].

This figure in Martini has been referred to as *Thais lapillus* Linné, but in my opinion it is unrecognizable.



Clench, William James. 1947. "The Genera *Purpura* and *Thais* in the Western Atlantic." *Johnsonia* 2(23), 61–91.

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