JOHNSONIA

Published by
THE DEPARTMENT OF MOLLUSKS
Museum of Comparative Zoölogy, Harvard University
Cambridge, Massachusetts

DECEMBER 31, 1943 *TROCHIDAE* NUMBER 12

THE GENERA GAZA AND LIVONA IN THE WESTERN ATLANTIC

BY
W. J. CLENCH AND R. T. ABBOTT

Both of these genera are important members of the Western Atlantic fauna: *Gaza*, as possessing four of the six known forms and *Livona*, as a genus peculiar to this region. The family Trochidae to which they both belong, is large and extensively distributed all over the world. In addition, it is a family that is exceedingly rich in deep sea species. Possessing nacreous shells which are frequently polished for ornaments, the smaller species strung for necklaces and others are cut up for art work. *Trochus niloticus* has considerable use in button manufacturing and a large trade was established by the Japanese in the Western Pacific for this purpose. The collecting of this species with small boats enabled them to reach most if not all of the Western Pacific Islands and the islands comprising the East Indies. Such a procedure enabled them to gain an incredible amount of data, not by any means limited to this reef-loving mollusk.

We are indebted to Paul Bartsch of the United States National Museum for the generous loan of their material on *Gaza*. This collection has added much to the value of our data. Credit is given in the records as USNM.

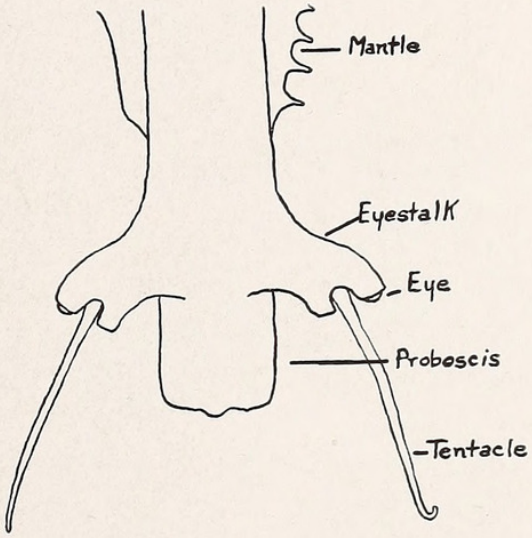

Plate 1. *Livona pica* Linné

Shell with animal extended.
Cable Beach, Guantánamo, Cuba.
(Reduced about one-third)

Outline of head
(Enlarged about 3×). Both
drawn by R. T. Abbott.

Gaza *Watson*

Gaza Watson 1879, Jour. Linn. Soc. **14**, p. 601; Watson 1886, Report on the Voyage of H.M.S. Challenger, Zoology, **15**, p. 93.

Shell turbinate to depressed turbinate, rather thin, generally highly opalescent. Umbilicus deep, rather wide and partially or completely covered by a columellar pad or callus. Operculum corneous, multispiral, thin and colored a pale amber.

Genotype (monotypic) *Gaza daedala* Watson

Gaza is one of the most beautiful of our deep-sea mollusks. It possesses a thin and delicate structure which differs quite sharply from most other trochoids. It is highly opalescent, even on the main portion of the whorls which is covered with a very thin periostracum. A few of the species are finely sculptured and the early whorls are rather deeply pigmented with opalescent purple. Though still exceedingly rare, future dredgings, particularly off Florida and in the West Indies, should bring to light many more specimens.

Gaza superba *Dall*, Plate 2, fig. 1–2

Callogaza superba Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 49 (off Montserrat, West Indies).
Gaza (*Callogaza*) *superba* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 354, pl. 22, fig. 4–4a.
Gaza superba Dall, Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 380.

Description. Shell 30 to 40 mm. in width, thin, turbinate and opalescent. Whorls 8 to $8\frac{1}{2}$, strongly convex. Color old ivory with an opalescent sheen on all portions of the shell. Early whorls faintly wine-colored. Aperture subelliptical. Umbilicus deep and fairly wide; the whorls within visible and slightly inset. Columellar callus or pad nearly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat

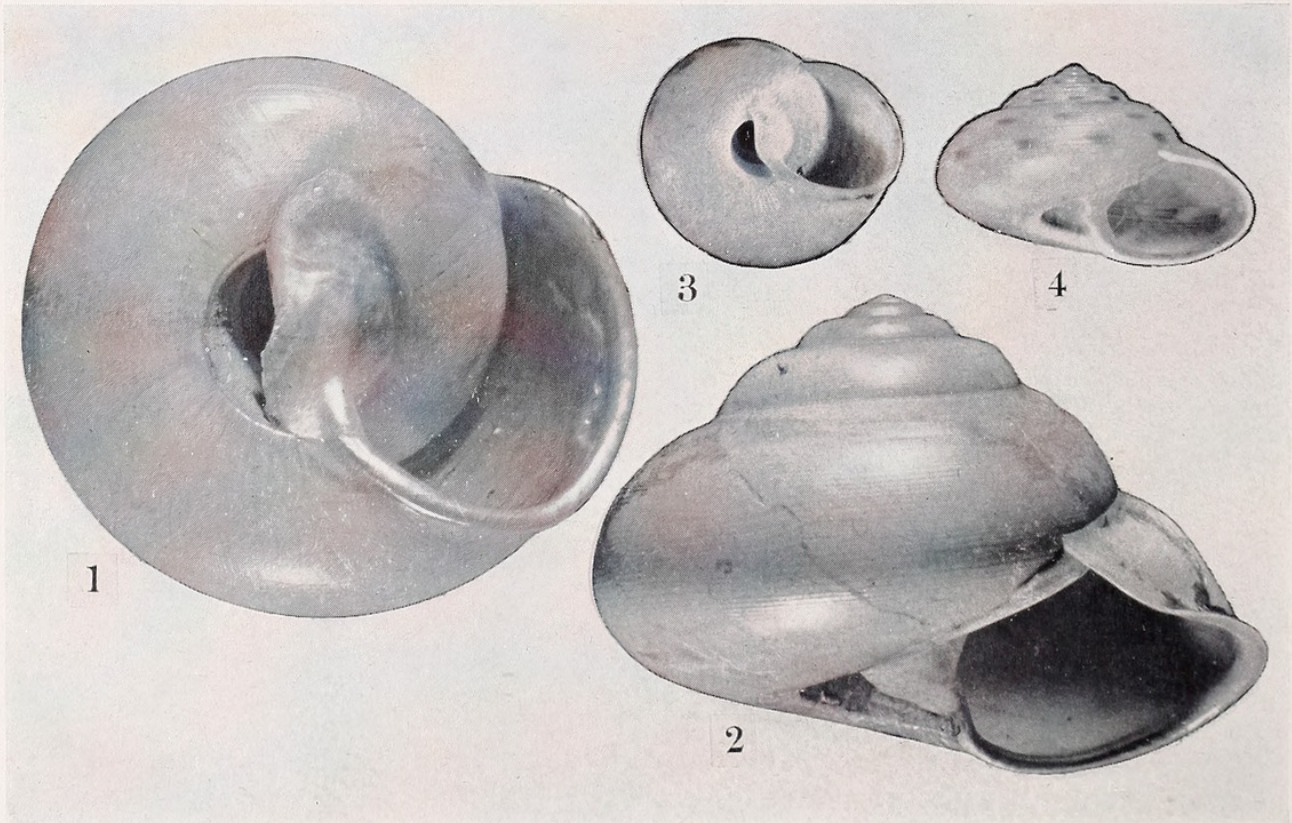

Plate 2. Fig. 1. *Gaza superba* Dall, off Habana, Cuba. Holotype (2×). Fig. 2. *Gaza superba* Dall, off Mobile Bay, Alabama (2×). Fig. 3. *Gaza watsoni* Dall, off Habana, Cuba. Holotype ($2\frac{1}{2}$×). Fig. 4. *Gaza watsoni* Dall, off Matanzas, Cuba ($2\frac{1}{2}$×).

elevated. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of very fine growth lines. Periostracum absent. Operculum thin, light brown in color and multispiral.

	height	width	
(large)	32	40 mm.	(Dall 1889, p. 354)
(average)	25.5	35.5	off Montserrat, Lesser Antilles
(small)	20	27.5	off Barbados, Lesser Antilles

Types. Lectotype, Museum Comparative Zoölogy, no. 7541, *Blake*, station 153, from off Montserrat, Lesser Antilles in 303 fathoms. Cotype, Mus. Comp. Zoöl. no. 7542, *Blake*, station 274, from off Barbados in 209 fathoms.

Remarks. Much more material is needed before a complete understanding can be had of all these species. The records would indicate that all are pretty well distributed throughout the West Indies, though at this writing these records are fairly well scattered. The subspecies, *G. superba cubana* Cl. and Ag. may eventually prove to be a distinct species. There appears to be no overlap in the size of the two forms.

Range. Deep water (155 to 324 fathoms) northern Gulf of Mexico and probably throughout the West Indies south to northern South America.

Records. Alabama: *Albatross*, station 2376 (N. Lat. 29°03′; W. Long. 88°16′) off Mobile Bay in 324 fathoms (USNM). Florida: *Albatross*, 2397 (N. Lat. 28°42′; W. Long. 86°36′) northern Gulf of Mexico in 280 fathoms (USNM). Virgin Islands: *Blake*, station 129, off St. Croix in 314 fathoms (USNM). Lesser Antilles: *Blake*, station 153, off Montserrat in 303 fathoms (MCZ); *Blake*, station 274, off Barbados in 209 fathoms (MCZ); *Blake*, station 275, off Barbados in 218 fathoms and station 281 in 288 fathoms (both USNM). Colombia: *Albatross*, station 2143 (N. Lat. 9°30′45″; W. Long. 76°25′30″) off Morrosquillo in 155 fathoms (USNM).

Gaza superba cubana *Clench and Aguayo*, Plate 3, fig. 1–2

Gaza superba cubana Clench and Aguayo 1940, Mem. Soc. Cubana Hist. Nat. **14**, p. 81, pl. 15, fig. 3 (off Sagua la Grande, Santa Clara, Cuba).

Description. Shell 23 mm. in width, thin, depressed turbinate and opalescent. Whorls 7, strongly convex. Color old ivory with an opalescent sheen on all portions of the shell. Early whorls often a vivid wine-color. Aperture subelliptical. Umbilicus deep and fairly wide, the whorls within visible and slightly inset. Columellar callus or pad nearly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of very fine growth lines. Periostracum absent. Operculum unknown.

height	width	
13	23 mm.	Holotype. Off Sagua la Grande, Santa Clara Prov., Cuba
13.5	22.5	Paratype. Off Punta Alegre, Camagüey Prov., Cuba

Types. Holotype, Museum Comparative Zoölogy, no. 135151, *Atlantis*, station no. 3448 (N. Lat. 23°21′; W. Long. 79°56′) off Sagua la Grande, Santa Clara Prov., Cuba in 380 fathoms. The following paratypes are all from the *Atlantis* dredgings and all are off the northern coast of Cuba: station 3419 (N. Lat. 22°46′; W. Long. 79°00′) off Punta Alegre in 180 fathoms; station 3469 (N. Lat. 23°12′; W. Long. 81°22′) off Ma-

tanzas in 425 fathoms; station 3475 (N. Lat. 23°18′; W. Long. 80°48′) off Cárdenas in 400 fathoms; station 3476 (N. Lat. 23°18′30″; W. Long. 80°52′) off Cárdenas in 360 fathoms; station 3485 (N. Lat. 23°13′; W. Long. 81°22′) off Matanzas in 385 fathoms (all MCZ and Museo Poey, Habana).

Remarks. See under *G. superba* Dall.

Range. Known only from deep water (180 to 425 fathoms) off northern Cuba.

Records. (See also under Types). FLORIDA: off Tortugas in 197 and 249–358 fathoms (USNM).

Gaza fischeri *Dall*, Plate 3, fig. 3–5

Gaza fischeri Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 355, pl. 37, fig. 6 (off St. Lucia, West Indies); Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 380.

Description. Shell 27 mm. in width, thin, depressed turbinate and opalescent. Whorls 6 to 6½, strongly convex. Color old ivory with a brilliant opalescent sheen on all portions of the shell. Early whorls rarely wine-colored. Aperture subelliptical. Umbilicus deep and fairly wide but whorls within not visible. Columellar callus or pad completely covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of numerous fine comma-shaped ridges on the upper portion of the whorls, strongly developed on the early whorls, but usually absent on the body whorl. Periostracum absent. Operculum thin, corneous, light amber in color and multispiral.

height	width	
17.5	27.5 mm.	Off Sagua la Grande, Santa Clara Prov., Cuba
17	24	Off St. Lucia, Lesser Antilles

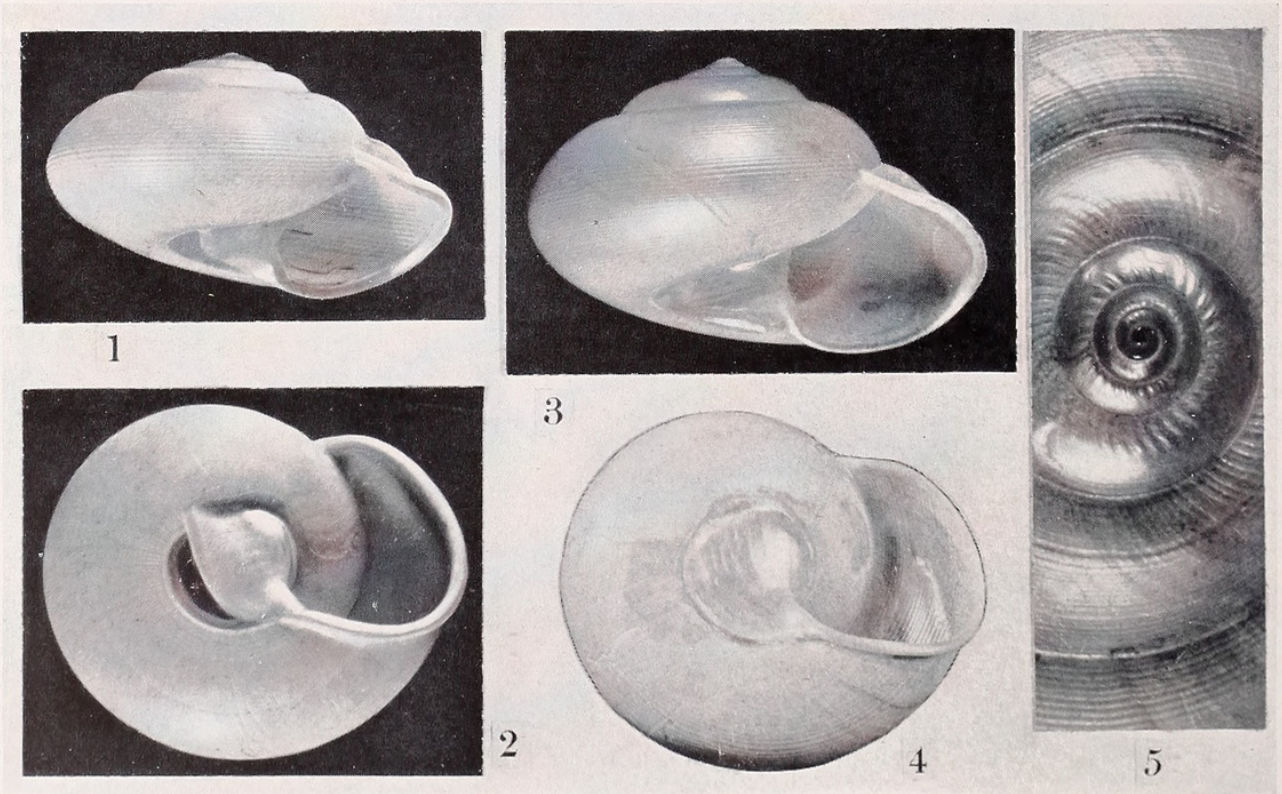

Plate 3. Fig. 1–2. *Gaza superba cubana* Cl. and Ag., off Sagua la Grande, Cuba. Holotype (2×). Fig. 3. *Gaza fischeri* Dall, off Sagua la Grande, Cuba (2×). Fig. 4. *Gaza fischeri* Dall, off St. Lucia, Lesser Antilles. Lectotype (2×). Fig. 5. *Gaza fischeri* Dall, off Cárdenas, Cuba (6×).

Types. Lectotype, Museum Comparative Zoölogy, no. 7543, *Blake*, station 221, off St. Lucia, Lesser Antilles, in 423 fathoms.

Remarks. See under *G. superba* Dall.

Range. Known only from deep water (423 to 500 fathoms) off northern Cuba and south to St. Lucia, Lesser Antilles.

Records. Cuba: *Atlantis*, station 2991 (N. Lat. 23°21′; W. Long. 80°23′) off Sagua la Grande in 475 fathoms; *Atlantis*, station 3471 (N. Lat. 23°21′; W. Long. 80°56′) off Cárdenas in 500 fathoms (both MCZ); *Albatross*, station 2351 (N. Lat. 22°41′; W. Long. 84°16′30″) off Cayo Jutias, north coast of Pinar del Rio in 426 fathoms (USNM). Lesser Antilles: *Blake*, station 221, off St. Lucia in 423 fathoms (MCZ).

Subgenus **Callogaza** *Dall*

Callogaza Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 50; Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 356.

This subgenus differs from *Gaza* s.s. in possessing minor color blotches or patches and having strongly shouldered whorls.

Subgenotype (subsequent designation 1889) *Callogaza watsoni* Dall

Gaza (Callogaza) watsoni *Dall*, Plate 2, fig. 3–4

Callogaza watsoni Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 50 (off Habana, Cuba).

Margarita filogyra Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 42, (off Bahía Honda, Cuba).

Gaza (*Callogaza*) *watsoni* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 356, pl. 22, fig. 7–7a; pl. 23, fig. 1–1a; pl. 24, fig. 2–2a.

Gaza watsoni Dall, Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 381.

Description. Shell 15 mm. in width, thin, depressed turbinate and opalescent. Whorls 6 to 7, strongly convex and shouldered. Color old ivory with an opalescent sheen on all portions of the shell. First whorl dark amber. In addition, there is a series of small irregular patches of light brown disposed along the whorls. Aperture subcircular. Umbilicus deep and fairly wide, the whorls within visible and slightly inset. Columellar callus or pad slightly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of numerous comma-shaped ridges on the upper portion of each whorl, strongly developed on the early whorls and much finer on the body whorl. Periostracum absent. Operculum thin, corneous, light amber in color and multispiral.

	height	width	
(large)	10.5	14.5 mm.	Off Barbados, Lesser Antilles
(average)	8	11	Holotype. Off Habana, Cuba

Types. Holotype, Museum Comparative Zoölogy, no. 7544, *Blake*, station 12, off Habana, Cuba in 177 fathoms.

Remarks. This species is smaller than all other West Indian forms of *Gaza*, has a proportionately heavier shell, much stronger spiral sculpture, far less opalescence and rather strongly shouldered whorls.

Range. Known only from deep water (117 to 500 fathoms) from northern Cuba south to Brasil.

Records. Cuba: *Blake*, station 12, off Habana in 117 fathoms. (MCZ); *Atlantis*, station 2999, off Matanzas in 190 fathoms and station 3463 in 230 fathoms (both MCZ);

Atlantis, station 2963, Bahía de Cochinos in 190 fathoms (MCZ). Virgin Islands: *Caroline*, station 100, off Tortola in 100 to 300 fathoms (USNM). Lesser Antilles: *Caroline*, station 102, off Anegada in 90 to 500 fathoms (USNM); *Blake*, station 299, off Barbados in 140 fathoms (MCZ). South America: *Albatross*, station 2756, off Para River, Brasil in 391 fathoms (USNM).

Key to the Western Atlantic *Gaza*

1.	Shell with small, brown color patches; whorls shouldered	*watsoni*
2.	Shell without brown color patches; whorls usually rounded	3
3.	Columellar pad completely covering the umbilicus	*fischeri*
4.	Columellar pad partially covering the umbilicus	5
5.	Shell less than 30 mm. in width; spire depressed	*cubana*
6.	Shell greater than 30 mm. in width; spire elevated	*superba*

Livona *Gray*

Livona Gray 1842, Syn. Cont. of British Museum, ed. 44, p. 57; Gray 1847 (November) Proc. Zool. Soc. London, p. 145. [*Meleagris* Denys de Montfort 1810, *non* Linné 1758, *non* Fischer von Waldheim 1835; *Cittarium* Philippi 1847 (February); *Livonia* of authors, not of Gray 1855, are synonyms.]

Genotype (monotypic) *Turbo pica* Linné

Shell turbiniform, large and elevated with strongly rounded whorls. Aperture nearly circular. Umbilicus deep with a tooth-like extension of the callus projecting over the umbilical opening. The radula possesses a large number of lateral teeth. Operculum circular, chitinous and multispiral. This genus contains but a single species.

The status of the name *Livona* is still uncertain. Gray instituted the name first in 1841 (Synopses of the Contents of the British Museum, ed. 42, 1840 [1841]) without any definition. He defined it in 1842 (44th. ed.) but did not cite any species. As their title would indicate, these were but guidebooks to the exhibition cases of shells in the British Museum. Gray, in 1847 (citation above) published a list of genera with synonymies and included type designations. However, if the 1842 publication is eventually ruled out, the name of this genus will change to *Cittarium* Philippi, which appeared in February 1847, as Gray's generic list did not appear until November of the same year. *Turbo pica* Linné is monotypic for *Meleagris* Mont., *Livona* Gray, and *Cittarium* Phil.

An excellent review of this situation covering Gray's use of *Livona* and other genera first introduced in the British Museum Guides, has been published by Iredale (1913, Proc. Malac. Soc. **10**, pp. 294–309).

Livona pica *Linné*, Plate 1 and Plate 4

Turbo pica Linné 1758, Syst. Nat. ed. 10, p. 763 (M. Sardinico).

Meleagris picus Linné, Denys de Montfort 1810, Conchyliologie Systématique, Paris, p. 207, figured p. 206 (Martinique).

Cittarium pica Linné, Philippi 1847, Zeit. f. Malak. **4**, p. 20.

Livona pica Linné, Gray 1847, Proc. Zool. Soc. London, p. 145.

Trochus picoides Gould 1853, Boston Jour. Nat. Hist. **6**, p. 381 (Santa Barbara [California]).

Trochus (*Livona*) *picoides* Gould 1862, Otia, p. 185.

Livona picoides Gould, Carpenter 1864, Supp. Report British Asso. Ad. Sci. for 1863, pp. 535, 537, 652 (Santa Barbara [California]).

Description. Adult shell 50 to 100 mm. (2 to 4 inches) in size, heavy and moderately sculptured. Whorls 8 to 9. Mottlings of blue black streaks over a white base. Frequently,

the white is tinged with green algal stain and in large specimens the mottlings are often deep brownish purple on the last whorl. Columella and interior of aperture glazed with an iridescent white. Inner edge of lip possesses rich cobalt mottlings. Aperture subcircular. Outer lip simple and slightly thickened just within the aperture. Edge of the lip is sharp and strong. Umbilicus round, narrow and very deep, with a white single toothed callus slightly protruding over one side. The rough, wavy suture between whorls is slightly indented. A slight, flat depression runs parallel to and a little below the suture. Entire outer shell is corrugated with small irregular bumps. Occasional young specimens show very fine spiral incised lines under a 10x hand lens. Axial sculpture consists of fine and somewhat oblique growth lines. In corroded but living specimens, the first five whorls are worn rough and white. Periostracum not present.

Operculum circular, multispiral, slightly concave, and of a thick, translucent chitin. When dried the color is a rich, chestnut brown; in living specimens it is an opalescent blue-green. It fits snugly well within the aperture. Muscular attachment scar is one-third the area of the operculum and is roughly kidney-shaped.

The foot of the animal is thick, oval in outline, the length of the shell when extended, with a simple smooth border. Head large, bearing a large blunt snout or proboscis and two large eye-stalks. Each eye-stalk or peduncle is split into two blunt lobes, the outer one carrying a single eye. Between the lobes, a thin, slightly tapering tentacle projects forward. Covering the dorsal side of the animal is a mantle whose border may be seen when the animal is extended. The left epipodial lobe running back from the head carries a series of about twenty saw-tooth lobes. The right lobe is smooth. At the posterior half of the foot the operculum is set in a cup-like skin fold, or epipodium whose border possesses a number of dainty filaments or epipodial tentacles. Color of ventral side of foot a solid cream. Dorsal side is light yellow with a heavy dusting of purplish brown horizontal streaks. Mantle and its lobes a dull greyish white. Head and its appendages jet black. Tentacles black at the base and fading to a light grey towards the tip. Underneath the operculum the cup depression of the foot and its filaments are a cream yellow.

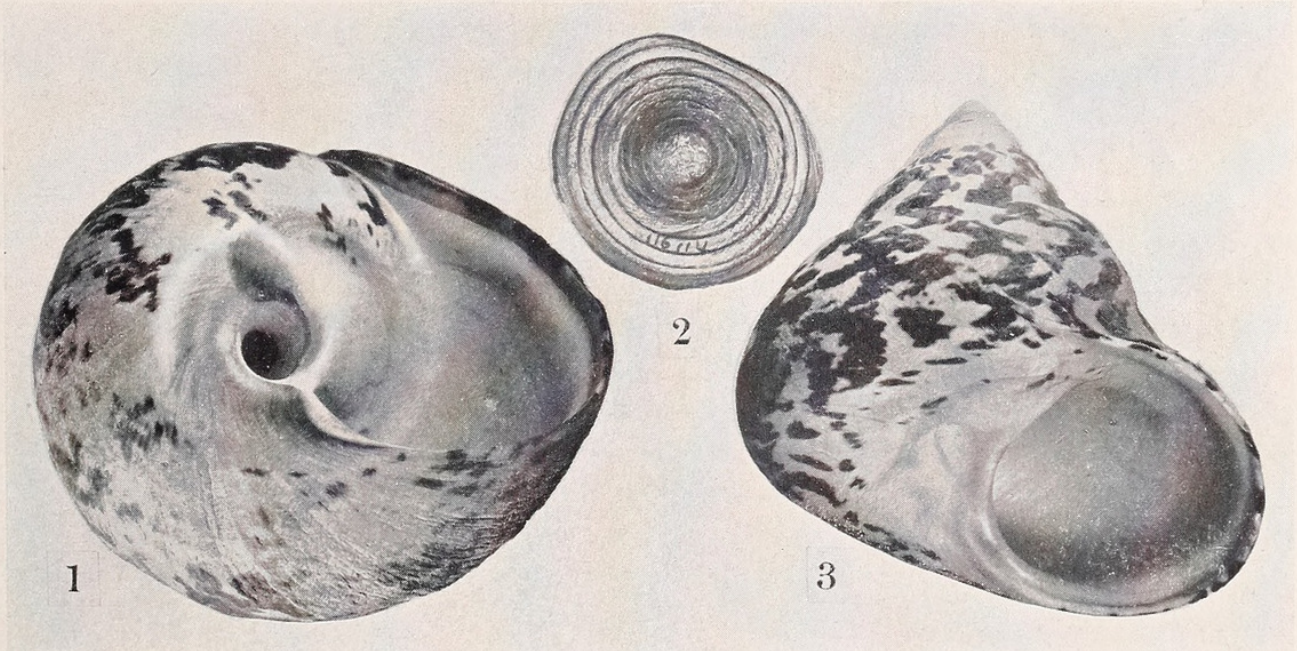

Plate 4. *Livona pica* Linné

Fig. 1. Alicetown, North Bimini Id., Bahamas. (Reduced about one-third). Fig. 2. Operculum. Fig. 3. Governors Harbour, Eleuthera Id., Bahamas. (Reduced about one-third).

This species has been figured beautifully by Kiener (1875, Coquilles Vivantes, **11,** p. 64, pl. 1) under the name of *Trochus pica*, showing both the shell and the animal.

	height	width	
(large)	100	105 mm.	Carriacou, Grenadines, Lesser Antilles
(average)	65	68	Arthurstown, Cat. Id., Bahamas

Types. We select Linné's reference to Gaultieri (1742, pl. 68, fig. B) to be the type figure. As Linné's reference to the "Sea of Sardinia" is obviously an error, we designate that of Martinique Id., Lesser Antilles, cited by Denys de Montfort, to be the type locality.

Common name. West Indian Top-Shell.

Remarks. This is a rather abundant species throughout the West Indies. It is found along rocky coasts, in exposed places as well as in tide pools and under loose slabs of rock. It is partially inter-tidal though it exists more abundantly below low water line. We have found as many as twenty large specimens under a single slab of rock (Cienfuegos, Cuba).

It is an excellent food and makes a really fine chowder to which we can testify, though the greenish color of the chowder, imparted by the liver, is not particularly appealing. In the immediate vicinity of populated areas, this mollusk may be quite rare, owing to its use as food. This is particularly true of the Bahamas and, we believe, of Jamaica also. Fluck has reported (Nautilus **19,** p. 78, 1905) its use as a food by the natives of Nicaragua.

Young chitons and more particularly *Acmaea cubensis simplex* Pils. are frequently attached to the lower columellar area. This latter may possibly be a commensal though nothing, so far as we are aware, is known about its relationships with *Livona.* This peculiar association with *Livona* should have a meaning other than a mere and casual place of attachment.

Livona pica is found as a fossil in Bermuda and hermit crabs are responsible mainly for the specimens that are to be found on the beaches. According to Verrill (1902, Trans. Connecticut Academy **11,** p. 708) *L. pica* existed alive in post Columbian times, but has apparently since died out. He further states that in 1901 a large number of the species were brought alive from the Bahamas and liberated in Hamilton Harbor. A.J.Peile (1926, Proc. Malac. Soc. **17,** p. 73) makes note of this introduction but states that they have not survived.

Its occurrence alive in Florida still needs confirmation. Dall's record (1889, p. 160) from Charlotte Harbor (West Florida) was based apparently on the specimens obtained by Bartlett during the cruise of the "Blake." This record is certainly open to question and we suspect that a mixture of material took place or else a wrong assignment of locality. It is not listed in Perry's report (Bull. American Paleon. No. 95, 1940) on our southwestern Florida shells, a report based almost entirely on the shells of Sanibel and Captiva Islands. These islands form the southwestern limits of Charlotte Harbor. Its occurrence only on rocky shores precludes its living along the sand and mangrove margin of Charlotte Harbor.

Mr. Van Hyning has loaned us a specimen of this species which had been collected alive by a sponge fisherman from a "Rock reef, 40 miles N.W. of Tarpon Springs, Florida," Economos collector. Again we strongly suspect an error. This is well beyond its expected range and any West Indian species occurring this far to the north should occur alive on the lower Florida Keys.