

## The Little Hearts (*Corculum*) of the Pacific and Indian Oceans

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FORM, COLORATION, AND RARITY place the Little Hearts among the most attractive bivalve mollusks of the Pacific and Indian Oceans. They have been prized objects of collectors since the early days of molluscan history.

It was a pleasing surprise to receive for determination recently, from Dr. Asela Franco, 25 specimens of Little Hearts with copious notes on others in her collection. The surprise was justified, for during the cruise of the U. S. Bureau of Fisheries Steamer "Albatross," covering most of the Philippine Archipelago, I took only two specimens, on a reef at Tilig, Lubang Island. Dr. Franco says: "Across from Cebu City separated only by a small channel is the small island of Mactan, where Magellan was killed. East and south of Mactan are several still much smaller islands. During low tide one can walk from one to another of these islands in some places. The heart shells are found west, south, and east of Mactan, or in the waters between Cebu City and Mactan and between Mactan and the neighboring small islands on the south and east sides. Not only heart shells are found in these places, but most of my shells were collected there. It is my favorite collecting locality, as it is near the city. All these smaller islands mentioned belong to Cebu.

"Heart shells are collected during low tide, not beyond about two feet of water. They are usually found among fine broken corals or in sandy places, the dorsal side

being buried a few centimeters deep. Sometimes they are found flat down on the posterior side, perhaps because of the current during high or low tide. Rarely one could see them among seaweeds, and they are never attached to any corals or stones. They are not found in groups or bunches, and both colored and white ones or different types may be seen in the same region. More heart shells are collected during the months of May and June."

Dr. Franco's sending is particularly rich in color markings, a fact which is helpful in interpreting what some of the names bestowed by the early writers embraced. Most of the early specific names were based upon coloration. That coloration was not a constant but a variable feature was then unknown, and this fact was responsible for the list of synonyms here noted.

Dr. Franco's collection, combined with the 42 lots in the National Museum from various localities, enables me to revise the genus and bring the nomenclature up to date.

### *Corculum* Röding

1798. *Corculum* Röding, Mus. Bolt., p. 188.  
1811. *Cardissa* Megerle von Muhlfeidt, Mag. Ges. Naturf. Fr. Berlin 5ter Jahrg., p. 52.  
1870. Type designation by von Martens *Cardium cardissa* L. Zool. Rec. for 1869, p. 586.

Little Hearts are members of the family Cardiidae. They have a thin shell which is anteriorly-posteriorly compressed, the two valves of which when viewed anteriorly or posteriorly present a heart-shaped outline. The lateral edge of the shell, i.e., the middle of the valves, curves forward or back de-

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pending upon the species in question and is so depressed that the anterior and posterior sides almost touch within. The outer edge may be spinose, denticulate, or smooth. The left umbone is always curved behind the right. The anterior surface of the shell bears curved radiating cords which interlock at their ventral margin. They may be smooth or denticulated. These cords may be crossed by lesser concentric cords or threads. The sculpture of the posterior surface is weaker than that of the anterior. Here, too, a heart-shaped escutcheon is present.

#### KEY TO THE SPECIES OF *Corculum*

- Margin of the shell strongly dentate.  
 Anterior side decidedly dished.....*monstrosum*  
 Anterior side not decidedly dished.  
 Anterior and posterior sides about equally convex.  
 Shell large (up to 66 mm. high)....*cardissa*  
 Shell small (less than 25 mm. high).....  
 .....*dionaeum*  
 Anterior side much more convex than posterior side .....*obesum*  
 Margin of the shell not dentate.  
 Anterior side convex.....*humanum*  
 Anterior side concave.  
 Posterior side smoothish.....*levigatum*  
 Posterior side radially ridged.....*asetae*

#### *Corculum monstrosum* (Gmelin)

(Plate 2, Figure 3)

1782. *Cardium monstrosum* Chemnitz, Conch. Cab., vol. 6, pl. 14, figs. 149-150 (non-binomial).  
 1791. *Cardium monstrosum* Gmelin, Linn. Syst. Nat., ed. 13, vol. 1, pt. 6, p. 3253, no. 29.  
 1798. *Corculum dolorosum* Röding, Museum Boltonianum, p. 189.  
 1798. *Corculum inflatum* Röding, *ibid.*, p. 189.  
 1819. *Cardium inversum* Lamarck, Anim. s. Vert., vol. 6, p. 16, no. 46.

Chemnitz, while giving a good description and figures of this species in 1782, was a non-binomialist and does not figure in nomenclature. Gmelin based his name upon Chemnitz's statements and figures, and established the specific name *C. monstrosum*.

Röding, when he created the generic name *Corculum*, cited both Gmelin's and Chemnitz's *Cardium monstrosum* as the basis for his *Corculum dolorosum*. This, therefore, is an absolute synonym of *C. monstrosum* Gmelin. Röding also lists *Corculum inflatum*, a new name, which he bases upon *Cardium monstrosum* Gmelin and Favannes Conchyliologie, pl. 51, f. E1. I am unable to recognize anything in our collection that corresponds completely with Favannes' drawing, which I am inclined to believe places the escutcheon on the wrong side. To dispose of the name *Corculum inflatum* Röding, I am here designating his first citation "Gmel. *Cardium monstrosum*" as type of *Corculum inflatum* Röding, which adds this name to the list of synonyms of *C. monstrosum*.

To this list must also be added the *Cardium inversum* Lamarck, which was likewise based on Chemnitz's figures 149-150.

This species is differentiated from the rest by its extremely convex, comparatively smooth posterior side and denticulated outer margin.

Shell soiled or yellowish white. The anterior surface is convex along its ventral margin excepting at the outer edge, which is very strongly upturned, lending this surface a deeply dished aspect. It is marked by radiating cords which are separated by spaces a little wider than the cords. The cords are sharply spinose, the spines becoming weakened on the outer cords. The margin is strongly dentate. In addition, the surface is marked by fine threads paralleling the cords and stronger, very regularly disposed incremental lines. The posterior surface is very convex. It bears three poorly developed, widely separated, finely nodulose, radiating cords adjacent to the escutcheon. Outward from these, merely indicated radiating cords are present. Lines of growth and radiating finer threads are scarcely indicated.

*U.S.N.M. 543544* (Franco 1f). The specimen figured measures: height, 36.7 mm.; length, 20 mm.; diameter, 35.3 mm. Dr. Franco states that she has one measuring: height, 49 mm.; length, 47 mm.; diameter, 28 mm.

In addition to the figured specimen, the U. S. National Museum has:

*U.S.N.M. 7673*, 2 specimens from the U. S. Exploring Expedition, with no locality.

*U.S.N.M. 543545* (Franco 2a), 1 specimen.

*U.S.N.M. 543546* (Franco 1e), 1 specimen.

*U.S.N.M. 543547* (Franco 1d), 1 specimen.

*U.S.N.M. 344829a* (Hirase 2813), 2 specimens from Osima, Osumi, Japan.

### *Corculum cardissa* (Linnaeus) (Plate 1, Figure 3)

1705. *Cartissae*, Hertjes, etc. Rumphius *Amboinsche Rareteitkamer*, pl. 42, fig. E, p. 132, in part.

1758. *Cardium cardissa* L., *Syst. Nat.*, p. 678, no. 59.

Linnaeus adopted Rumphius' name, placing it in his genus *Cardium* as *Cardium cardissa*. He cites Rumphius' plate 42, figure E. Rumphius states that the most and best are found on Nussalaut (now called Noesa-laoet Island) and a few on Hitoe Island.

Rumphius, in addition to the one figured, recognized two other forms which he described in his text and which have subsequently received names, as will be stated in the following pages.

The striking features of this species are its large size and the strong, slender, almost spinose denticles of the outer edge of the valves. The two sides are about equally convex on the early shell. In adult shells the outer edge curves anteriorly, leaving the valves between the outer edge and the middle concave, or dished. The anterior surface is marked by rather broad, depressed radiating cords which are about as wide as the spaces that separate them. These cords bear nodules which are quite regularly distributed in vertical as well as horizontal series. They are best developed in the early part of the shell. In the spaces separating the radiating cords fine threads are present, which are crossed by closely spaced transverse threads. The

posterior valve bears the horn-colored, heart-shaped escutcheon near the umbones which is followed usually by four or more broadly triangular ridges bearing regularly distributed cusps on their crests. Between these cords and the denticulated outer edge, weakly developed and more closely spaced cords are present. The spaces between the cords show fine threads paralleling the cords, while regularly, closely spaced, stronger threads cross them.

The coloration of the anterior surface may be soiled white, or yellowish white, or yellow unicolor, or slightly rayed.

One specimen, *U.S.N.M. 543548* (Franco's 3e), has a dark brown umbonal pit. The posterior side usually shows a watered-silk effect, the pattern being arranged in both radiating and concentric series.

One specimen, *U.S.N.M. 543549* (Franco's 3a), has a series of bright red spots arranged in radiating series.

*U.S.N.M. 543550* (Franco's 3) has the outer edge of the basal part rose-red on both sides.

The specimen figured, *U.S.N.M. 543551* (Franco's 1a), measures: height, 56.2 mm.; length, 27.8 mm.; diameter, 52.7 mm. Our largest specimen, *U.S.N.M. 7673*, one of a series of 14 obtained by the U. S. Exploring Expedition bearing the label "Pacific Islands," measures: height, 66.5 mm.; length, 31.2 mm.; diameter, 63.2 mm.

*U.S.N.M. 131464*, 1 specimen from India.<sup>2</sup>

*U.S.N.M. 321687*, 5 specimens from Nicobar Islands.<sup>2</sup>

*U.S.N.M. 7673*, 14 specimens from the Pacific Islands (Exploring Expedition).

*U.S.N.M. 75908*, 1 specimen from the Indo-Pacific.

*U.S.N.M. 2544*, 2 specimens (no locality).

*U.S.N.M. 75396*, 2 specimens from the Indo-Pacific.

*U.S.N.M. 120183*, 1 specimen from the Indo-Pacific.

*U.S.N.M. 17465*, 1 specimen from the East Indies.

<sup>2</sup> The Indian Ocean specimen measures: height, 42 mm.; length, 17.2 mm.; diameter, 38.8 mm. The largest Nicobar specimen measures: height, 38 mm.; length, 15.7 mm.; diameter, 34.1 mm. It is quite possible that the specimens from the Indian Ocean may represent a smaller race that may require a name in the future.

- U.S.N.M.* 32046, 1 specimen from the Indo-Pacific.  
*U.S.N.M.* 543552 (Franco 1*b*), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543553 (Franco 1*g*), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543554 (Franco 3*f*), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543555 (Franco 1), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543556 (Franco 4), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543557 (Franco 4*a*), 1 specimen from Cebu, P. I.  
*U.S.N.M.* 543558 (Quadras Coll.), 1 specimen from Balagnan Island, Surigao District, Mindanao, P. I.  
*U.S.N.M.* 248248, 2 specimens from Tilig (reef), Lubang Island.  
*U.S.N.M.* 1074, 1 specimen from Loochoo Island.  
*U.S.N.M.* 344827, (Hirase Coll. 2811), 3 specimens from Riukiu Islands, Japan.

***Corculum dionaeum* (Broderip and Sowerby)**  
 (Plate 2, Figure 2)

1828. *Cardium dionaeum* Broderip and Sowerby, Zool. Jour., vol. 4, p. 367.  
 1836. *Cardium unimaculatum* Broderip and Sowerby, Proc. Zool. Soc. London, pp. 84, 85.  
 1845. *Cardium dionaeum* Reeve, Conch. Icon., pl. 21, fig. 122.

The small size of this species is its most characteristic feature. Its range, too, is far from that of the other forms here noted. The presence of a color mark or marking noted for *C. unimaculatum*, which appears to be its only difference from *C. dionaeum*, does not seem to warrant separating the two. They appear from the literature to have the same distribution. Broderip and Sowerby in describing the species state that it was collected by Lieut. Belcher during Beechey's voyage on some island in the south Pacific. Reeve cites Anaa as its habitat. Broderip and Sowerby also cite Anaa as the place in which Cuming collected *unimaculatum*.

Shell small, usually white, sometimes with red about the escutcheon or various other marking. The anterior surface is marked with radiatingly curved, rather heavy cords which become broader and flatter toward the outer margin. They are nodulose, the

nodules being gradually reduced in strength as the cords widen. Microscopic radiating lines are present on the cords and in the spaces that separate them. The entire surface is also marked by closely spaced, wavy incremental lines. The posterior side bears the rather long escutcheon below which are three nodulose cords and beyond this is a series of low, flattened, broad, radiating ridges separated by mere impressed lines. These ridges are of about the same strength as those in the equivalent part of the anterior surface. Here, too, the fine radial and incremental sculpture is present.

The specimen figured, *U.S.N.M.* 75955, was collected by Pease in the Paumotu Islands. It measures: height, 21.8 mm.; length, 9.5 mm.; diameter, 18.2 mm.

In addition I have seen the following specimens:

- U.S.N.M.* 128480, 5 specimens from Anaa Island.  
*U.S.N.M.* 76814, 4 specimens from Paumotu Islands.  
*U.S.N.M.* 76120, 2 specimens from Paumotu Islands.  
*U.S.N.M.* 42325, 4 specimens from Paumotu Islands.  
*U.S.N.M.* 363437, 1 specimen from Mangaia Island, Cook Islands.  
*U.S.N.M.* 423441, 1 specimen from Lifu.  
*U.S.N.M.* 32046*a*, 2 specimens from the Indo-Pacific.  
*U.S.N.M.* 17468, 1 specimen from the Pacific islands.

***Corculum obesum*, new species**  
 (Plate 1, Figure 2)

The distinctive characters of this species are the extreme obesity of the anterior surface combined with the concave ventral side, the margin being denticulated as in *C. cardissa*.

This species appears to be less in size than *C. cardissa*. The anterior surface is very greatly elevated, whereas the posterior is only slightly elevated near the escutcheon and concave from there to the outer margin. The anterior surface is marked by radiating nodu-

lose spiral cords separated by spaces as wide as the cords bearing fine threads. Slender, closely spaced, incremental threads cross the radiating sculpture. The posterior surface has the heart-shaped escutcheon which is bordered by three low, broad, strongly nodulose ridges which extend over the elevated part of the shell. The concave part is marked by low flat cords separated by slight depressions, which grow wider from within outward. Wavy incremental lines render the cords feebly nodulose. The outer margin of the shell is strongly denticulated. The color of the specimens before me is white anteriorly, with a water-silk effect posteriorly.

The type, *U.S.N.M. 543559* (Franco 1*b*), comes from Cebu. It measures: height, 36.1 mm.; length, 18 mm.; diameter, 29.9 mm.

*U.S.N.M. 152449* contains 2 specimens from Yokohama, Japan. *U.S.N.M. 127623* contains 1 from Okinawa Island. *U.S.N.M. 74469* contains a young specimen referable here, obtained by the U. S. Exploring Expedition; it bears the locality "East Indies." Another young specimen, *U.S.N.M. 128487*, has no locality data.

### *Corculum humanum* Röding (Plate 2, Figure 4)

1782. *Cardium humanum* Chemnitz, *Conch. Cab.*, vol. 6, pp. 153–154, pl. 14, figs. 145–146 (non-binomial).

1782. *Cardium roseum* Chemnitz, *Conch. Cab.*, vol. 6, pp. 154–155, pl. 14, figs. 147–148.

1798. *Corculum humanum* Röding, *Museum Boltianum*, p. 189.

1819. *Cardium junoniae* Lamarck, *Anim. s. Vert.*, vol. 6, p. 17.

Röding based his name upon *Cardium humanum* Chemnitz. Chemnitz, being a non-binomialist, has no status in nomenclature; the species therefore dates from Röding. Chemnitz states that his specimen came from the Nicobar Islands. He also says that it is present in the Greater and Lesser Moluccas.

Lamarck included *C. humanum* in his *Cardium junoniae*, in which he also placed *Cardium roseum* Chemnitz; I agree with

him. His *C. junoniae* therefore is a pure and simple synonym of *C. humanum*.

In this species the shells attain a large size. The margin is not spinose or denticulate. The anterior side is convex and the posterior is dished with the margin bent inward (not outward as in *C. aselae*).

Shell large, white, yellowish, unicolor or variously spotted or streaked with bright red or suffused or washed with paler shades of red, yellow, or orange. The anterior side is well elevated and marked by strong, rather broad nodulose radiating cords between and upon which moderately strong parallel threads are present. The strong cords widen and weaken gradually edgeward. The incremental sculpture consists of very regular, somewhat flattened threads which are separated by spaces almost as wide as the threads. The posterior side is deeply concavely dished for the outer two thirds of its surface. The convex area adjoining the escutcheon bears 4 spinose cords; between these and the outer edge low flattened cords are present, which gradually grow wider from within outward. Fine threads and incremental lines reticulate the entire surface.

The specimen figured, *U.S.N.M. 543560* (Franco 2), measures: height, 43 mm.; length, 18 mm.; diameter, 38.9 mm.

In addition, I have seen the following specimens referable here:

*U.S.N.M. 168710*, 2 specimens from the Indian Ocean.

*U.S.N.M. 488017*, 1 specimen from the U. S. Exploring Expedition with Pacific islands as locality.

*U.S.N.M. 17466*, 1 specimen from the East Indies.

*U.S.N.M. 168709*, 2 specimens from the China Seas.

*U.S.N.M. 543561* (Franco 3*g*), 1 specimen from Cebu.

*U.S.N.M. 543562* (Franco 3*b*), 1 specimen from Cebu.

*U.S.N.M. 543563* (Franco 3*j*), 1 specimen from Cebu.

*U.S.N.M. 543564* (Franco 3*k*), 1 specimen from Cebu.

*U.S.N.M. 90301*, 1 specimen from the Philippines.

*U.S.N.M. 304240*, 1 specimen from Japan.

*U.S.N.M. 344828* (Hirase 2812), 3 specimens from Osima, Osumi, Japan.

#### *Corculum levigatum*, new species

(Plate 1, Figure 1)

This species resembles *C. monstrosum*, but differs from it in being flatter, with the margin not denticulate. The anterior side is moderately elevated at the ventral edge. The outer margin is decidedly upturned, a shape which lends the side of the shell a dishd appearance. The surface is marked by strong radiating cords, the inner of which are weakly nodulose, while the outer are devoid of them. These cords are separated by spaces equaling the cords. Both the cords and the spaces between them are marked by fine threads that parallel them, and by very regular transverse incremental lines which are closely spaced and only a trifle stronger than the threads. The posterior surface is marked by low, broad radiating cords separated by shallow spaces a little narrower than the cords. Of these cords, those near the escutcheon show only traces of denticles. The finer radial sculpture is almost absent, while the incremental markings are very regularly spaced threads separated by spaces as wide as the threads.

The type, *U.S.N.M. 543565*, was obtained by the U. S. Exploring Expedition and bears no specific locality label. It measures: height, 47.5 mm.; length, 20.1 mm.; diameter, 43.4 mm.

In addition to the type I have seen the following specimens:

*U.S.N.M. 7673*, 2 additional specimens from the same source.

*U.S.N.M. 17467*, 1 specimen from the East Indies.

*U.S.N.M. 2544*, 1 specimen obtained by the U. S. Exploring Expedition in the East Indies.

*U.S.N.M. 168709a*, 1 specimen from China.

*U.S.N.M. 344829* (Hirase 2813), 1 specimen from Osima, Osumi, Japan.

#### *Corculum aselae*, new species

(Plate 2, Figure 1)

This species has the anterior side moderately dishd, but the extreme edge in mature shells is bent posteriorly; the posterior side is also rather strongly ridged radiately. In some features it recalls *C. levigatum*, but the latter has the posterior side uniformly dishd and much smoother.

The color of this species is extremely variable, ranging from white through yellow and orange to rose. These shades may appear in more or less solid tints or in interrupted or continuous rays or bands.

The anterior side is convex on the inner half, then gradually becomes concave on the rest of its surface. It is marked by strong radiating ridges which are about as wide as the spaces that separate them. The inner of these cords are strongly nodulose, but the nodules gradually become weaker outwardly until they are scarcely perceptible on the outer cords. Fine threads paralleling the ridges are present in the spaces between the cords, while weak incremental lines cross them. The posterior side is well elevated adjacent to the escutcheon and here bears four low, rather broad, weakly nodulose radiating ridges. Outside this area the shell is less convex, with the outer edge slightly upturned. This surface is marked by depressed radiating ridges separated by mere impressed lines, and by very regular slender, closely spaced incremental threads.

The type, *U.S.N.M. 543566* (Franco 3*d*), measures: height, 44.2 mm.; length, 17.8 mm.; diameter, 38.3 mm. (Near Cebu City, Cebu.)

In addition to the type, we have the following specimens:

*U.S.N.M. 543567* (Franco 3*c*).

*U.S.N.M. 543568* (Franco 3*b*).

*U.S.N.M. 543569* (Franco 3*m*).

*U.S.N.M. 543570* (Franco 1*c*).

*U.S.N.M. 344829* (Hirase 2813), 1 specimen collected at Osima, Osumi, Japan.

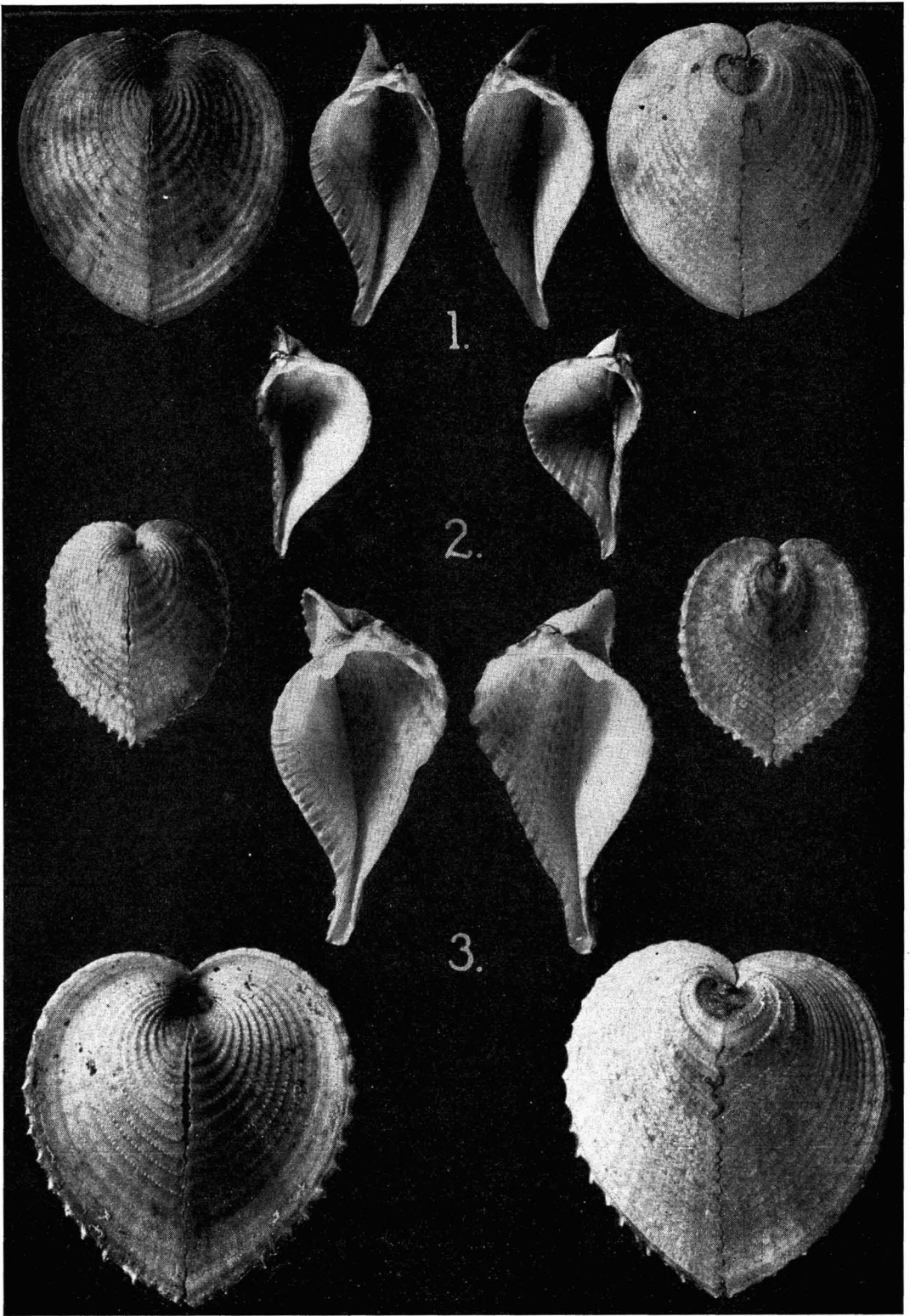


PLATE I. Corculum of the Pacific and Indian Oceans. (natural size)

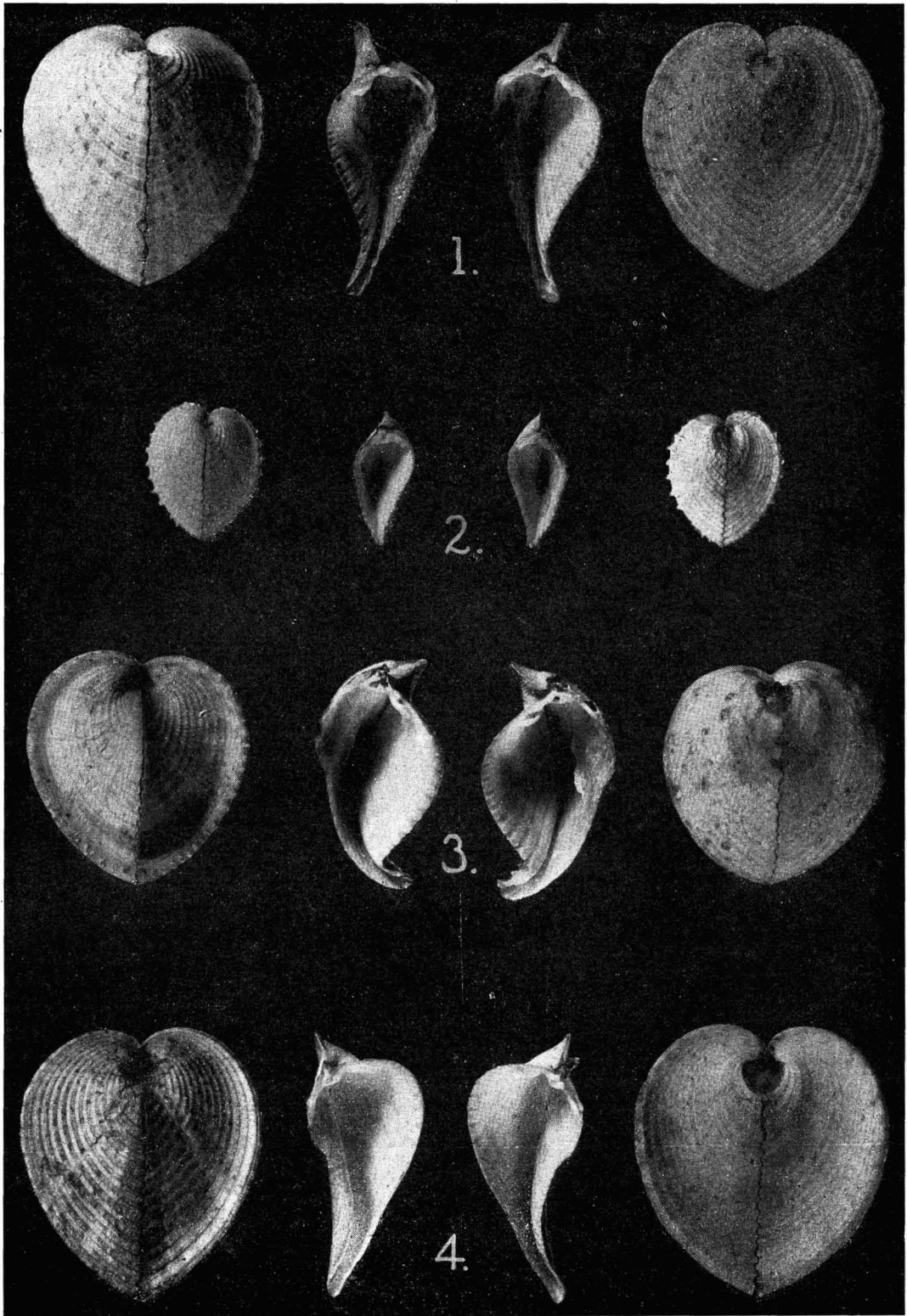


PLATE II. Corculum of the Pacific and Indian Oceans. (natural size)