



Brachiopoda from the Southern
Indian Ocean (Recent)

G. ARTHUR COOPER

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G. Arthur Cooper



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ABSTRACT

Cooper, G. Arthur. Brachiopoda from the Southern Indian Ocean (Recent). *Smithsonian Contributions to Paleobiology*, number 43, 93 pages, 30 figures, 14 plates, 1 table, 1981.—Specimens collected from 120 stations around and between the subantarctic islands: Marion, Prince Edward, Crozet, Kerguelen, Heard, Amsterdam, and St. Paul by the M/S *Marion Dufresne* with the support of Terres Australes et Antarctiques Francaises, Paris, greatly increase our knowledge of the brachiopoda of the Indian Ocean. Eighteen species are recognized that include 16 genera, 2 of them new: *Pemphixina* and *Xenobrochus*; 11 new species: *Basiliola arnaudi*; *Eucalathis magna*, *E. costellata*, *E. rotundata*, *Xenobrochus australis*, *X. anomalus*; *Dallithyris?* *dubia*; *Dyscolia?* *radiata*, *Platidia marionensis*; *Ecnomiosa inexpectata*, and *Thecidellina minuta*. Seven hitherto described species are recorded: *Pelagodiscus atlanticus* (King); *Pemphixina pyxidata* (Davidson); *Liothyrella moseleyi* (Davidson); *Megerlina davidsoni* (Vélain); *Megerlia gigantea* (Deshayes); *Aerothyris kerguelenensis* (Davidson), and *A. aff. A. macquariensis* (Thomson). Six genera, which could not be identified specifically, were also taken: *Crania*, *Basiliola*, *Tegulorhynchia*, *Eucalathis*, *Liothyrella*, and *Aerothyris*. Genera recognized in the Indian Ocean for the first time are: *Tegulorhynchia*, *Basiliola*, and *Ecnomiosa*, the last hitherto known only from the Gulf of Mexico and Caribbean Sea.

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Brachiopoda from the Southern Indian Ocean (Recent)

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Introduction

The brachiopods forming the subject of this monograph were collected on cruises of the research vessel *M/S Marion Dufresne* on two expeditions supported by Terres Australes et Antarctiques Francaises, Paris: MD.03 (1974) and MD.08 (1976). Included also are specimens from St. Paul and Amsterdam islands collected during a winter stay at the latter island on cruise MD.03.

The southern Indian Ocean between latitudes 35°–55°S and longitudes 35°–75°E is not well known. Beside the objectives of physical oceanography these cruises were designed to collect and study the macro- and meiobenthos.

Cruise MD.03 (1974) was essentially a technological cruise with emphasis on bottom sampling at various depths with different gears (on the shelves and slopes of Kerguelen, Heard, and Crozet islands) to test the vessel and equipment under various conditions.

Cruise MD.08 (1976) was an extension westward of the regional benthic survey to the shelves of Crozet, Marion, Prince Edward islands, and the intervening oceanic areas.

The maps bear the station numbers that should be prefaced by MD.03 (Map 1) and MD.08 (Maps 2–4). Not all the localities appear on the maps and there is no map for Amsterdam and St. Paul islands.

The following abbreviations are used: MNHN (Muséum National D'Histoire Naturelle, Paris); USNM (former United States National Museum, collections now in the National Museum of Natural History, Smithsonian Institution).

ACKNOWLEDGMENTS.—The brachiopods described in this monograph were obtained with the financial and logistical support of Terres Australes et Antarctiques Francaises, Paris. Loan of the specimens was made by Dr. Patrick M. Arnaud, Université D'Aix-Marseille, Station Marine D'Endoume, Centre D'Océanographie, Rue de la Batterie-des-Lions, 13007, Marseille, France, to whom I express my gratitude for his kindness, and for making the study possible. I also thank Dr. Michel Segonzac, Chief of the Centre National de Tri D'Océanographie Biologique at Brest, France for loan of specimens from Cruise MD.08 in his care. I am grateful to Dr. J. C. Hureau, Muséum National D'Histoire Naturelle, Paris, for loan of specimens of *Aerothyris kerguelensis* (Davidson) from Cruise MD.03. I thank Dr. Jean-Loup D'Hondt, of the same institution, who furnished me with the necessary catalogue numbers for the illustrated specimens. These are a series of numbers prefaced by NMHN-BRA-78. I am indebted to Dr. Howard Brunton, British Museum (Natural History), for measurements of Davidson's types of *Aerothyris kerguelensis*. I thank Dr. J. Thomas Dutro Jr. and Dr. Merrill W. Foster for reviewing the manuscript and offering many valuable suggestions.

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All types and illustrated specimens are deposited in the Muséum National D'Histoire Naturelle, Paris. Duplicate specimens have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

Previous Reports of Brachiopods from the Indian Ocean

Prior to 1959 our knowledge of the brachiopods of the Indian Ocean came largely from discoveries by H.M.S. *Challenger* (Davidson, 1878, 1880) and other less prolonged expeditions that dredged off Marion, Heard, and Kerguelen islands. The *Challenger* reports a species of *Terebratulina* from Marion Island, a genus not seen from there in this study and rather rare in the Southern Hemisphere. Jackson (1952:14, 15) expressed some doubt concerning this record. The Transit of Venus Expedition of 1871–1875 visited Kerguelen but the only brachiopod reported is now referred to *Aerothyris kerguelenensis* (Davidson). The *Valdivia* Expedition (Blochmann, 1906) visited

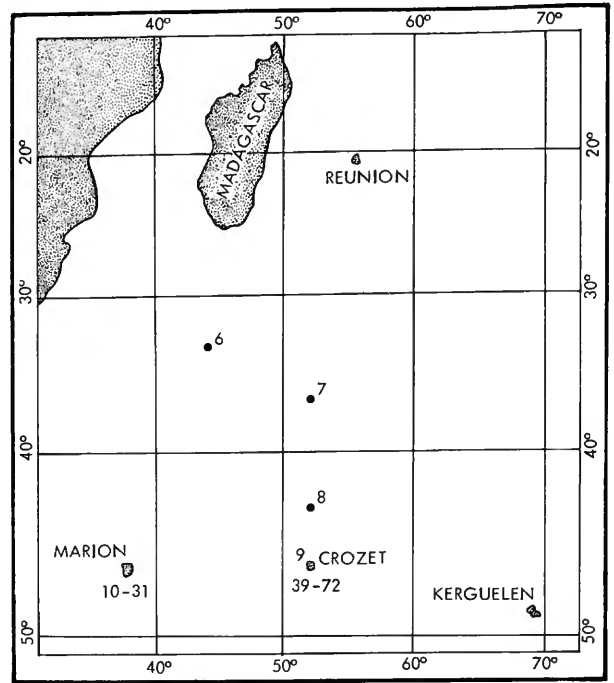


FIGURE 2.—MD.08 stations south of Madagascar (Malagasy Republic).

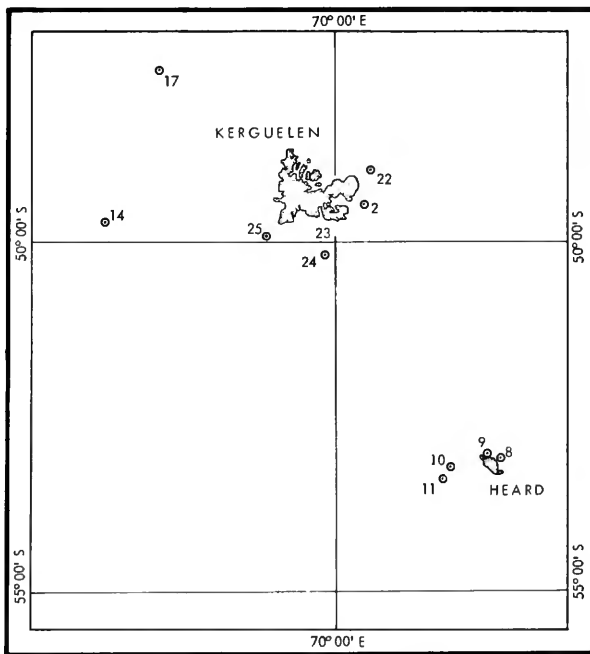


FIGURE 1.—MD.03 stations in vicinity of Kerguelen and Heard islands.

Kerguelen Island and collected the much misunderstood "*Terebratella*" *enzenspergeri* Blochmann. This expedition also collected at Amsterdam Island and reported *Liothyrella winteri* Blochmann. Helmcke (1940) described *Crania valdiviae*, *Valdiviathyris quenstedti*, and "*Rhynchonella*" *valdiviae* (now *Striarina*) from waters off St. Paul Island. These species were not collected by the French expeditions MD.03 and MD.08.

Muir-Wood (1959) described specimens from the John Murray Expedition to the Indian Ocean but none of the species reported by her were taken in the southern part of the Indian Ocean. Cooper (1973a) described specimens from the northern Indian Ocean, along the coast of Africa off the Somali Republic, from the Mozambique Channel between Madagascar and Mozambique, and off the southeast end of South Africa. This last portion of the Indian Ocean has a fauna typified by members of the Kraussinidae. One species of *Kraussina gardineri* Dall was taken south of the Saya de Malha Bank. *Megerlina davidsoni* (Vélain),

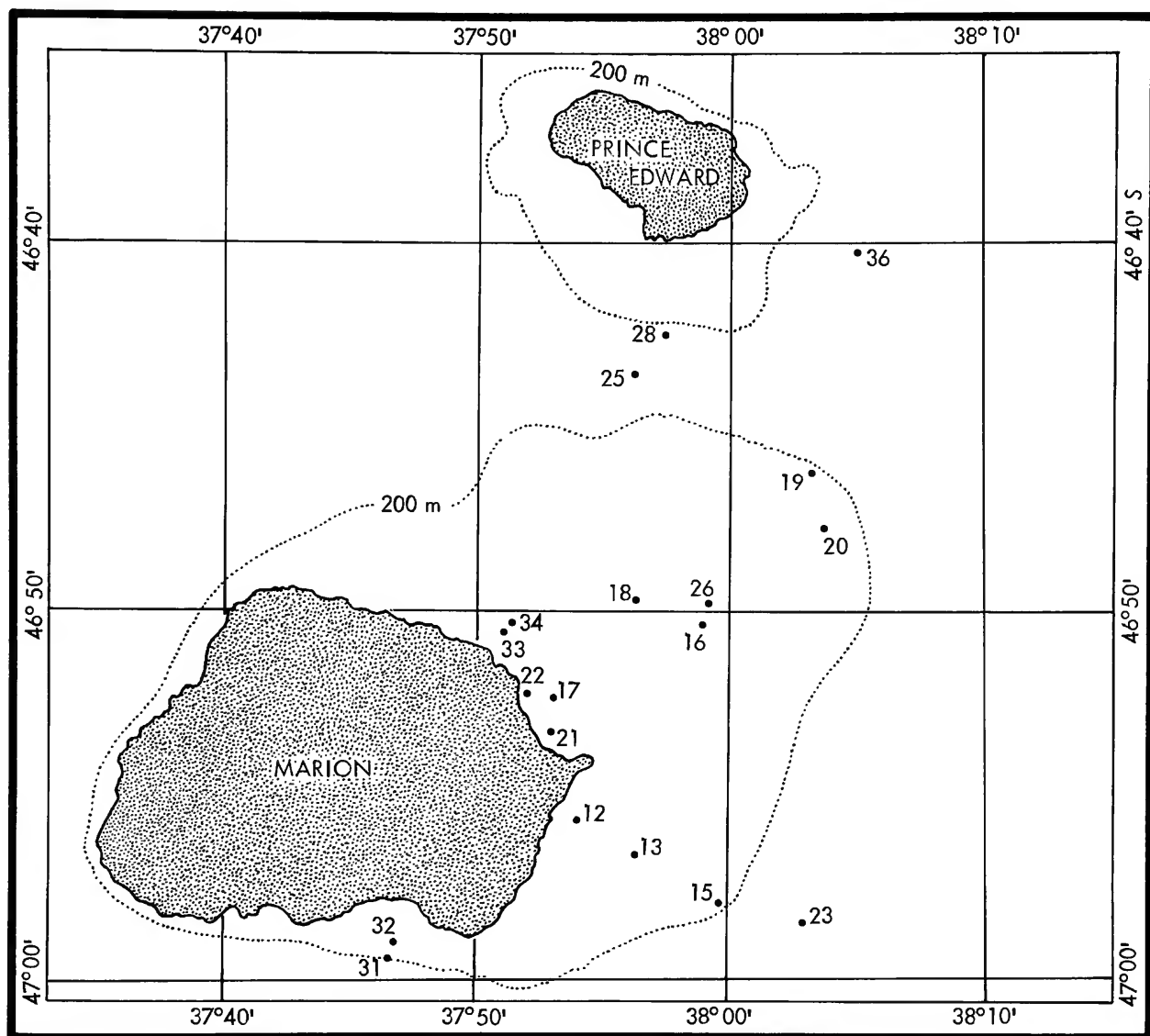


FIGURE 3.—MD.08 stations around Marion and Prince Edward islands.

also reported herein, is a kraussinid genus from St. Paul Island.

Foster (1974) in his extensive work on Antarctic brachiopods redescribed and remarked on some of the Indian Ocean genera and species: *Dyscolia*, *Eucalathis*, *Platidia*, *Liothyrella mosleyi* (Davidson), and *Notosaria?* *pyxidata* (Davidson). He also discussed the problems relating to *Aerothyris kerguelenensis* (Davidson) and *A. enzenspergeri* (Blochmann) and pointed out the similarity of *A. macquariensis* (Thomson) to *A. kerguelenensis*.

SPECIES COLLECTED

- Aerothyris kerguelenensis* (Davidson) – Kerguelen, Crozet, and Marion islands
- Agulhasia davidsoni* (King) – Durban
- Argyrotheca somaliensis* Cooper – Somali Republic
- Chlidonophora chuni* Blochmann – Maldives, Mozambique Channel.
- Compsoria alcocki* (Joubin) – southern India
- C. suffusa* Cooper – Somali Republic
- Crania valdiviae* Helmcke – St. Paul Island
- Cryptopora boettgeri* Helmcke – Dar-es-Salaam
- C. curiosa* Cooper – Andaman Sea

C. maldivensis Muir-Wood – Maldives
Dallithyris? cernica (Crosse) – Mauritius
D. murrayi Muir-Wood – Maldives
Discinisca indica Dall – Ceylon
D. multiradiata Chuang – Somali Republic
Dyscolia johannisdavisi (Alcock) – Maldives
Eucalathis fasciculata Cooper – Mozambique Channel
Frenulina cruenta Cooper – Somali Republic
Gryphus africanus Cooper (= *Xenobrochus*) – Durban, South Africa
G. indianensis Cooper (= *Xenobrochus*) – Somali Republic
Kraussina gardineri Dall – Saya de Malha Bank
K. natalensis (Krauss) – Natal, South Africa
K. rubra (Pallas) – Natal, South Africa
Lacazella mauritiana Dall – Mauritius
Leptothyrella ignota Muir-Wood – Zanzibar
Lingula hians Swainson – Bombay
L. murphiana Reeve – Durban, Karachi
L. translucida Dall – Karachi
Liothyrella moseleyi (Davidson) – Kerguelen Island, Crozet Islands
L. winteri (Blochmann) – St. Paul Island
Megerlia gigantea (Deshayes) – Reunion Island
Megerlina davidsoni (Vélain) – St. Paul Island
M. pisum (Lamarck) – Mauritius, Natal, South Africa
Nipponithyris afra Cooper – Mozambique Channel
Pelagodiscus atlanticus (W. King) – Abyssal, widespread
Platidia anomioides (= *P. marionensis*, new species) – Marion and Prince Edward islands
Rhynchonella nigricans pyxidata Davidson – Kerguelen and Heard islands = *Pemphixina pyxidata* (Davidson)
Rhytirhynchia sladeni (Dall) – Saya de Malha Bank
Striarina valdiviae (Helmcke) – St. Paul Island
Terebratella enzenspergeri Blochmann (= *Aerothyris kerguelenensis* (Davidson)) – Kerguelen Island
Terebratulina abyssicola (Adams and Reeve) – southeast Africa
T. meridionalis Jackson – ?Marion Island
T. valdiviae Blochmann – Sumatra
Thaumatostia anomala Cooper – Andaman Sea
Thecidellina blochmanni Dall – Christmas Island
Valdiviathyris quenstedti Helmcke – St. Paul Island

Brachiopods Collected by M/S Marion Dufresne on Cruises MD.03 and MD.08

The collections made by the M/S *Marion Dufresne* considerably enlarge our knowledge of the brachiopods of the Indian Ocean, adding new species of known genera and two new genera based on already known species: *Xenobrochus* and *Pemphixina*.

The expedition produced only two specimens of inarticulate brachiopods: *Pelagodiscus* and

Crania. Although most of the bottom sampling of the *Marion Dufresne* was in shallow to moderately deep water, one haul from 1500 m produced a single specimen of the ubiquitous brachiopod *Pelagodiscus* known from the deeps of all the oceans (Zezina, 1965). The *Crania* is a young, shallow-water specimen.

Rhynchonellids are rare in all seas except, perhaps, the Arctic. Three genera of rhynchonellids were taken by the *Marion Dufresne*: *Pemphixina*, a new genus related to *Notosaria* of New Zealand waters and Tertiary sediments; *Tegulorhynchia*, a spiny rhynchonellid known from the waters around Japan and the Philippines and the Tertiary of New Zealand; and *Basiliola*, a smooth form hitherto restricted to the Pacific, Japan, and the Philippines. These last two genera are new to the Indian Ocean.

Of the terebratulids collected, one proves to be a new genus, *Xenobrochus*, based on a known species, 2 are doubtfully identified, *Dallithyris* and *Dyscolia*. *Liothyrella*, a common genus in the Antarctic, proved rare in the southern Indian Ocean collections, being represented by one known species and fragments of unidentifiable ones. *Eucalathis* of the Cancellothyridacea is represented by two new species and a third not named. *Terebratulina*, a usually common genus, was not found in the parts of the Indian Ocean sampled by the *Marion Dufresne*.

The terebratellid brachiopods are well represented in the southern Indian Ocean. Abundant specimens of a species each of *Megerlia*, and *Megerlina* were found, the former south of Madagascar and the latter far to the east at St. Paul Island. *Megerlia* may have wandered in from the Mediterranean while *Megerlina* is a kraussinid far from its other localities off South Africa or southeast Australia, where several species are known. *Platidia*, identified by Davidson (1880) with a Mediterranean species, is fairly common in the vicinity of Marion Island. It proves different from the Mediterranean species and is probably another migrant from that region.

Aerothyris is a poorly understood genus with some ambiguous characters. It is abundant around all of the islands from Kerguelen to Mar-

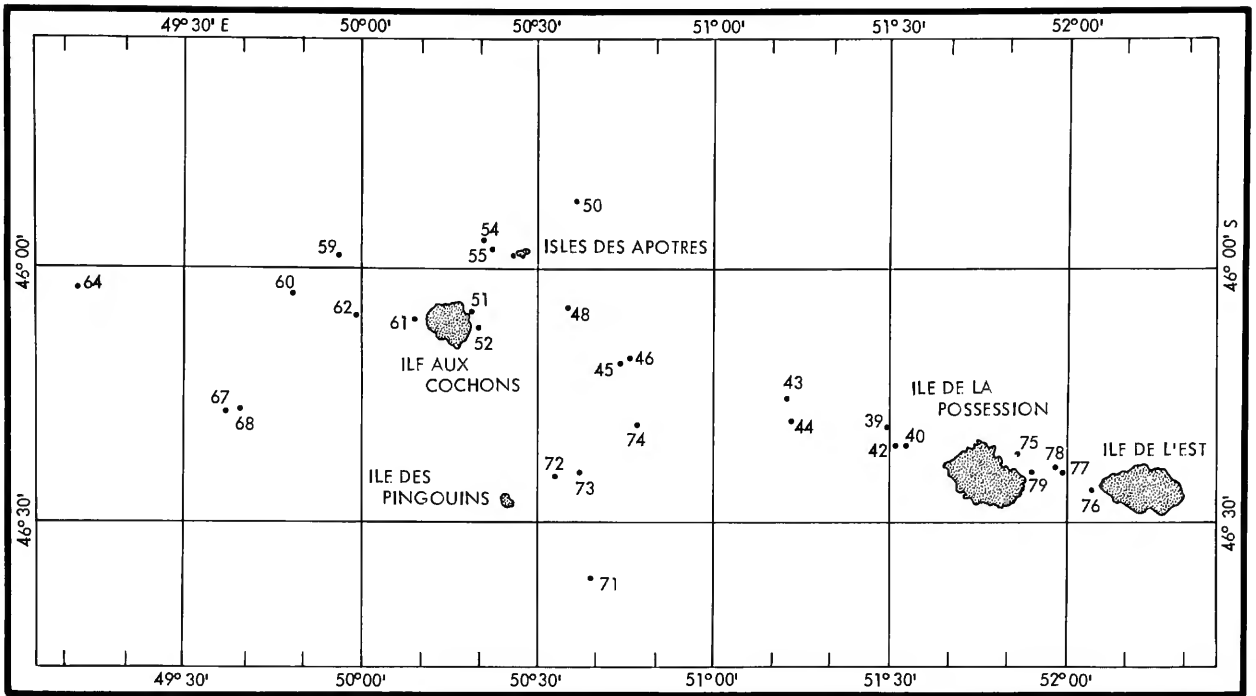


FIGURE 4.—MD.08 stations around the islands from Ile de L'Est to Ile aux Cochons (Crozet Islands).

ion. The extensive collections of this genus made by the *Marion Dufresne* give a better understanding of the species. The collection also confirms a close relationship between *A. kerguelensis* (Davidson) and *A. macquariensis* (Thomson) that occurs far to the east around Macquarie Island southwest of New Zealand.

Perhaps the most surprising and interesting discovery of the *Marion Dufresne* is the occurrence of *Ecnomiosa* in the Indian Ocean. This recently described genus (Cooper, 1977) was first taken from waters of the Caribbean Sea and the Gulf of Mexico. Although this occurrence proved a surprise, it is not the only Caribbean genus to be found in the Indian Ocean. *Chlidonophora*, *Dyscolia*, *Eucalathis*, *Thecidellina*, and *Megerlia* also occur both in the Indian Ocean and the Caribbean Sea.

Thecidellina has a worldwide subtropical to tropical distribution as it occurs in the Caribbean and the Pacific Ocean, as well as the Indian Ocean. It is commonly a shallow water form. Its deepest known occurrence is that reported herein.

The brachiopod fauna of the southern Indian

Ocean proves to be a blend of genera from around Japan, the Philippines, New Zealand, Australia, the Mediterranean, eastern Atlantic, Caribbean Sea, and southeast Africa.

SPECIES COLLECTED

Aerothyris kerguelensis (Davidson)
A. aff. A. macquariensis (Thomson)
Aerothyris species
Basiliola arnaudi, new species
Basiliola species
Crania species
Dallithyris? dubia, new species
Dyscolia? radiata, new species
Ecnomiosa inexpectata, new species
Eucalathis costellata, new species
E. magna, new species
E. rotundata, new species
Eucalathis species
Liothyrella moseleyi (Davidson)
Liothyrella species
Megerlia gigantea (Deshayes)
Megerlina davidsoni (Vélain)
Pelagodiscus atlanticus (King)
Pemphixina pyxidata (Davidson)

Platidia marionensis, new species
Tegulorhynchia species
Thecidellina minuta, new species
Xenobrochus anomalus, new species
X. australis, new species

Brachiopods and Station Records, Cruise MD.03

Abbreviations of sampling gear used:

BB = Okean grab DC = Charcot dredge
 CB = Blake trawl DM = small Charcot dredge
 CL = lithodid trap RK = Reineck corer
 CP = Beam trawl

Station, location, specimens collected (illustrated in parentheses):

- 2, DC 1 Latitude 49°30.7' S, longitude 70°44.7' E, east of Kerguelen Island at 115 meters
Aerothyris kerguelenensis (Davidson), 6
- 2, CB 2 Latitude 49°33.2' S, longitude 70°47.1' E, east of Kerguelen Island at 130 meters
Aerothyris kerguelenensis (Davidson), 5 (1)
- 8, DC 6 Latitude 52°59.4' S, longitude 73°38.0' E, north of Heard Island at 900 meters
Pemphixina pyxidata (Davidson), young, 1
- 9, DM 2 Atlas Cove, Heard Island at 6 meters
Aerothyris kerguelenensis (Davidson), 2 (1)
- 9, DM 4 Atlas Cove, Heard Island at 15 meters
Aerothyris kerguelenensis (Davidson), 1 (1)
- 10, DC 7 Latitude 53°06.7' S, longitude 72°50.1' E, south-southeast of MacDonald Island at 255 meters
 Unidentifiable fragments, 3
Aerothyris kerguelenensis (Davidson), 4
- 11, CP 7 Latitude 53°20.3' S, longitude 72°29.2' E, west of Heard Island at 790 meters
Xenobrochus australis, new species, 2 (1)
Eucalathis magna, new species, 1 (1)
Aerothyris? uncertain, 4
- 14, DC 8 Latitude 49°48.4' S, longitude 64°57.9' E, west of Kerguelen Island at 250 meters
Pemphixina pyxidata (Davidson), 6
Aerothyris kerguelenensis (Davidson), 79 (1)
- 14, CB 3 Latitude 49°45.8' S, longitude 64°50.6' E, west of Kerguelen Island at 262 meters
Pemphixina pyxidata (Davidson), 4
Aerothyris kerguelenensis (Davidson), 68 (3)
- 17, CB 5 Latitude 47°24.9' S, longitude 66°04' E, northwest off Kerguelen Island at 585 meters
Pemphixina pyxidata (Davidson), 1
Aerothyris kerguelenensis (Davidson), young, 22

- 22, CP 15 Latitude 48°58.5' S, longitude 70°51.1' E, northeast off Kerguelen Island at 105–90 meters

- Platidia marionensis*, new species, 1
Aerothyris kerguelenensis (Davidson), 8 (1)
- 23, CP 16 Latitude 49°59.2' S, longitude 70°01.9' E, south off Kerguelen Island at 158 meters
Aerothyris kerguelenensis (Davidson), 8

- 24, CB 6 Latitude 50°10.7' S, longitude 69°48.7' E, south off Kerguelen Island at 195 meters
Pemphixina pyxidata (Davidson), 2
Aerothyris kerguelenensis (Davidson), 6

- 25, CB 7 Latitude 50°01.7' S, longitude 68°27.3' E, southwest of Kerguelen Island at 172 meters
Pemphixina pyxidata (Davidson), 52 (11)
Aerothyris kerguelenensis (Davidson), 3

- 26, CP 17 Latitude 46°24.0' S, longitude 51°59.0' E, Chenal des Orques at 180 meters
Platidia marionensis, new species, 1 (1)
Aerothyris kerguelenensis (Davidson), 82 (5)

- 28, CP 19 Latitude 46°18.1' S, longitude 51°29.0' E, between Possession Island and Cochons Island at 400 meters
Platidia marionensis, new species, 2

- 30, CP 21 Latitude 46°02.3' S, longitude 50°50.2' E, Crozet Islands between Possession and Cochons Island at 187 meters
Aerothyris kerguelenensis (Davidson), 105 (9)

- 31, CP 22 Latitude 45°57.2' S, longitude 50°32.8' E, off Cochons Island at 110 meters
Liothyrella moseleyi (Davidson), 5 (1)
Aerothyris kerguelenensis (Davidson), 25

- Marion III, Station Z63. Marion Island, Transvaal Cove from under surface of stone at 100 cm depth below low water spring level, in a sheltered pool connected to the sea by a subterranean tunnel, A. J. de Villiers collector
Aerothyris kerguelenensis (Davidson), 1

Brachiopods and Station Records, Cruise MD.08

- 6, DC 32 Latitude 33°11.8' S, longitude 43°49.8' E, Walters Bank, south of Madagascar (Malagasy Republic) at 40–43 meters; calcareous algae
 Crania species, 1 (1)

- 6, DC 34 Latitude 33°11.8' S, longitude 43°49.2' E, Walters Bank, south of Madagascar at 105–86 meters
Megerlia gigantea (Deshayes), 2

- 6, DC 35 Latitude 33°09.7' S, longitude 43°49.3' E, Walters Bank, south of Madagascar at 220–185 meters; coarse sand
Eucalathis rotundata, new species, 54 (3)
Megerlia gigantea (Deshayes), 612 (19)

- 6, CP 36 Latitude 33°10.7' S, longitude 43°49.3' E, Walters Bank, south of Madagascar at 120–80 meters; calcareous algae
Thecidellina minuta, new species, 21
- 6, DC 43 Latitude 33°12.0' S, longitude 43°58.2' E, Walters Bank, south of Madagascar at 360–200 meters; coarse sand, some limy concretions
Eucalathis rotundata, new species, 9
Eucalathis species, 1 (1)
Megerlia gigantea (Deshayes), 120 (3)
Thecidellina minuta, new species, 2
- 6, CC 45 Latitude 33°09.5' S, longitude 43°57.2' E, Walters Bank, south of Madagascar at 260–310 meters
Megerlia gigantea (Deshayes), 1
- 6, DC 46 Latitude 33°08.7' S, longitude 43°59.7' E, Walters Bank, south of Madagascar at 600 meters; fine sand
Eucalathis costellata, new species, 16
Megerlia gigantea (Deshayes), 2
- 6, DC 47 Latitude 33°11.4' S, longitude 44°00.4' E, Walters Bank, south of Madagascar at 620–635 meters; scleractinians and dead molluscs
Eucalathis costellata, new species, 1 (1)
Dyscolia? *radiata*, new species, 6 (1)
- 7, DC 57 Latitude 36°48.9' S, longitude 52°07.7' E, Samper Bank, southeast of Madagascar at 380 meters
Basiliola arnaudi, new species, 6 (6)
Basiliola species, 1 (1)
Eucalathis costellata, new species, 108 (4)
Dallithyris? *dubia*, new species, 58 (5)
Megerlia gigantea (Deshayes), 1
Thecidellina minuta, new species, 77 (11)
- 9, CP 64 Latitude 46°10.8' S, longitude 51°49.6' E to 46°23.2' S, 51°53.0' E, American Bay, Possession Island, Crozet Islands at 120–150 meters
Aerothyris kerguelenensis (Davidson), 32 (3)
- 9, CP 65 Latitude 46°22.2' S, longitude 51°51.7' E to 46°23.2' S, 51°53.0' E, American Bay, Possession Island at 112 meters
Aerothyris kerguelenensis (Davidson), 3
- 9, CP 66 Latitude 46°23.1' S, longitude 51°52.8' E to 46°22' S, 51°51.1' E, American Bay, Possession Island at 90–110 meters
Aerothyris kerguelenensis (Davidson), 6
- 9, DC 68 Latitude 46°22.9' S, longitude 51°51.2' E, American Bay, Possession Island at 125 meters; fine sand
Aerothyris kerguelenensis (Davidson), 49 (2)
- 9, BB 69 Latitude 46°22.5' S, longitude 51°51.3' E, American Bay, Possession Island at 105 meters
Aerothyris kerguelenensis (Davidson), 6
- 9, CP 74 Latitude 46°22.4' S, longitude 51°54.3' E to 46°20.3' S, 51°52.2' E, at 150–160 meters, American Bay, Possession Island; sand and gravel
Aerothyris kerguelenensis (Davidson), young, many
- 9, CP 75 Latitude 46°19.8' S, longitude 51°52.3' E to 46°20.9' S, 51°54.7' E, American Bay, Possession Island at 150–340 meters
Platidia marionensis, new species, 1
Aerothyris kerguelenensis (Davidson), 34
- 12, DC 78 Latitude 46°55.7' S, longitude 37°51.1' E, east of Marion Island at 103 meters; muddy sand
Aerothyris kerguelenensis (Davidson), 45 (9)
- 12, BB 79 Latitude 46°55.7' S, longitude 37°54.1' E, off Marion Island at 95 meters; muddy sand
Aerothyris kerguelenensis (Davidson) young, 21
- 13, CP 85 Latitude 46°56.3' S, longitude 37°55.6' E to 46°57.2' S, 37°57.6' E, east of Marion Island at 120 meters
Aerothyris kerguelenensis (Davidson), 11 (2)
- 15, DC 87 Latitude 46°57.7' S, longitude 38°00.0' E, southeast of Marion Island at 185–210 meters; coarse sand
Platidia marionensis, new species (attached), 1 (1)
Aerothyris kerguelenensis (Davidson), 39 (3)
- 15, BB 88 Latitude 46°57.7' S, longitude 37°59.9' E, southeast of Marion Island at 204 meters; coarse sand
Xenobrochus anomalus, new species, 8 (6)
Platidia marionensis, new species, 140 (6)
Aerothyris kerguelenensis (Davidson), 30
- 16, CL 95 Latitude 46°50.2' S, longitude 37°59.1' E, northeast of Marion Island at 138–142 meters
Aerothyris kerguelenensis (Davidson), 1 (1)
- 17, DC 96 Latitude 46°52.1' S, longitude 37°53.8' E, northeast of Marion Island at 112 meters; muddy sand
Aerothyris kerguelenensis (Davidson), 7
- 17, BB 97 Latitude 46°52.5' S, longitude 37°53.5' E, northeast of Marion Island at 110 meters; muddy sand
Aerothyris aff. *A. kerguelenensis* (Davidson), 120 (2)
- 18, DC 107 Latitude 46°49.8' S, longitude 37°56.2' E, northeast of Marion Island at 140 meters; sandy mud with bryozoans.
Aerothyris kerguelenensis (Davidson), 22 (3)
- 18, BB 108 Latitude 46°49.8' S, longitude 37°56.4' E, northeast of Marion Island at 138 meters; sandy mud
Platidia marionensis, new species, 2
Aerothyris kerguelenensis (Davidson), 11
- 18, RK 109 Latitude 46°49.3' S, longitude 37°56.5' E, northeast of Marion Island at 138 meters; sandy mud

- 19, DC 110 *Aerothyris kerguelenensis* (Davidson), 5
Latitude 46°45.9' S, longitude 38°03.7' E, northeast of Marion Island at 190 meters; mud
Platidia marionensis, new species, 1
- 19, BB 111 *Aerothyris kerguelenensis* (Davidson), 6 (1)
Latitude 46°46.2' S, longitude 38°03.2' E, northeast of Marion Island at 190 meters; mud
Platidia marionensis, new species, 6 (1)
Aerothyris kerguelenensis (Davidson), 9 (1 attached *Platidia*)
- 20, CP 116 Latitude 46°47.2' S, longitude 38°03.5' E, to 46°48.0' S, 38°03.5' E, northeast of Marion Island at 180 meters
Platidia marionensis, new species, 1
Aerothyris kerguelenensis (Davidson), 14 (1)
- 21, DC 118 Latitude 46°53.3' S, longitude 37°52.8' E, northeast of Marion Island at 50 meters
Aerothyris kerguelenensis (Davidson), 4
- 22, BB 125 Latitude 46°52.4' S, longitude 37°51.9' E, northeast of Marion Island at 31 meters; sand
Aerothyris aff. *A. macquariensis* (Thomson), 112 (12)
- 23, DC 129 Latitude 46°57.9' S, longitude 38°01.3' E, southeast of Marion Island at 250–460 meters; sand and pebbles
Xenobrochus anomalus, new species, 1
Platidia marionensis, new species, 5
- 25, CP 134 Latitude 46°45.3' S, longitude 37°56.6' E to 46°43.1' S, 37°56.0' E, north of Marion Island at 185–232 meters
Platidia marionensis, new species, 13 (3 attached)
Aerothyris kerguelenensis (Davidson), 54 (1)
- 26, CP 135 Latitude 46°50.6' S, longitude 38°00.6' E to 46°49.8' S, 37°57.7' E, northeast of Marion Island at 135–145 meters
Aerothyris kerguelenensis (Davidson), 41
- 27, DC 136 Latitude 46°45.7' S, longitude 37°54.0' E, north of Marion Island at 185 meters; sandy mud with shells
Platidia marionensis, new species, 1
Aerothyris kerguelenensis (Davidson), 29 (4)
- 28, DC 143 Latitude 46°43.5' S, longitude 37°57.2' E, south of Prince Edward Island at 246–285 meters; sand and gravel
Platidia marionensis, new species, 11 (1)
Aerothyris kerguelenensis (Davidson), 10
- 28, DC 148 Latitude 46°42.6' S, longitude 37°58.4' E, south of Prince Edward Island at 257–280 meters; sand and gravel
Xenobrochus anomalus, new species, 1
Platidia marionensis, new species (7 attached), 42 (1)
Aerothyris kerguelenensis (Davidson), 26
- 31, DC 156 Latitude 46°59.5' S, longitude 37°46.6' E, south of Marion Island at 185 meters; black sand and gravel
Aerothyris kerguelenensis (Davidson), 13
- 32, DC 162 Latitude 46°59.0' S, longitude 37°46.8' E, south of Marion Island at 83–100 meters; sand, gravel, and blocks
Aerothyris kerguelenensis (Davidson), 11
- 33, DC 164 Latitude 46°52.2' S, longitude 37°51.5' E, between Prince Edward and Marion islands at 45 meters
Aerothyris kerguelenensis (Davidson) 1
- 34, DC 167 Latitude 46°50.2' S, longitude 37°51.2' E, between Prince Edward and Marion islands at 115 meters; compact mud
Aerothyris kerguelenensis (Davidson), 6 (2)
Aerothyris species, 1
- 34, BB 168 Latitude 46°50.2' S, longitude 37°51.2' E, between Prince Edward and Marion islands at 110 meters
Aerothyris kerguelenensis (Davidson), 17
- 36, CP 173 Latitude 46°40.7' S, longitude 38°06.7' E to 46°39.2' S, 38°04.0' E, east of Prince Edward Island at 570–315 meters
Platidia marionensis, new species, 18
Aerothyris kerguelenensis (Davidson), 4
- 36, CP 175 Latitude 46°40.9' S, longitude 38°07.2' E, east of Prince Edward Island at 570–375 meters; gravel
Platidia marionensis, new species, 4 (1)
Aerothyris kerguelenensis (Davidson), 1 (1)
- 39, DC 178 Latitude 46°20.5' S, longitude 51°32.5' E, east-west radial, Crozet at 330–600 meters; gravel
Aerothyris kerguelenensis (Davidson), 3
- 39, BB 183 Latitude 46°18.7' S, longitude 51°29.5' E, east west radial, Crozet at 375 meters; black mud
Aerothyris kerguelenensis (Davidson), 3
- 40, DC 185 Latitude 46°21.1' S, longitude 51°33.9' E, east-west radial Crozet at 171 meters
Aerothyris kerguelenensis (Davidson), 6
- 40, DC 186 Latitude 46°21.1' S, longitude 51°33.9' E, east-west radial Crozet at 190 meters; muddy sand
Liothyrella? species juvenile, 2 (1)
Aerothyris kerguelenensis (Davidson) (26 young in slides (14)), 12
- 42, CP 197 Latitude 46°21.4' S, longitude 51°34.9' E, east-west radial between Possession and Cochons islands at 172–220 meters
Aerothyris kerguelenensis (Davidson) (8 measured), 26 (2)
- 44, CP 199 Latitude 46°18.0' S, longitude 51°14.0' E to 46°16.0' S, 51°13.0' E, east-west radial Crozet, between Possession and Cochons islands at 1500 meters; greenish mud

- Pelagodiscus atlanticus* (King), 1 (1)
Platidia marionensis, new species, 3 (mentioned)
Aerothyris species, 1 (1)
Ennomiosa inexpectata, new species, 13 (11)
- 45, CP 203 Latitude 46°12.2' S, longitude 50°47.0' E to 46°10.8' S, 50°43.5' E, east-west radial, Crozet between Possession and Cochons islands at 535–400 meters
Aerothyris kerguelenensis (Davidson), 2 (1)
- 46, CP 204 Latitude 46°10.6' S, longitude 50°14.7' E to 46°12.0' S, 50°46.6' E, between Possession and Cochons islands at 375–490 meters
Aerothyris kerguelenensis (Davidson), 29 (3)
- 48, CP 209 Latitude 46°05.0' S, longitude 50°37.1' E to 46°01.1' S, 50°33.0' E, between Possession and Cochons islands at 200–140 meters
Aerothyris kerguelenensis (Davidson), 27
- 50, DC 216 Latitude 45°51.5' S, longitude 50°37.8' E north-south radial, northeast of Cochons Island at 150 meters; black mud and gravel
Aerothyris kerguelenensis (Davidson), 53 (5)
- 50, RK 217 Latitude 45°51.9' S, longitude 50°35.2' E, north-south radial at 150 meters; black mud and gravel
Aerothyris kerguelenensis (Davidson), 49
- 50, BB 218 Latitude 45°52.2' S, longitude 50°35.2' E, north-south radial at 145–143 meters; black sand and gravel
Aerothyris kerguelenensis (Davidson), young, 6
- 51, DC 221 Latitude 46°05.0' S, longitude 50°18.4' E, east-west radial between Possession and Cochons islands at 25 meters; black volcanic sand
Aerothyris kerguelenensis (Davidson), 6
- 52, DC 224 Latitude 46°06.4' S, longitude 50°19.7' E, east-west radial between Possession and Cochons islands at 53–50 meters; black volcanic sand
Aerothyris kerguelenensis (Davidson), 1
- 54, DC 234 Latitude 45°55.4' S, longitude 50°20.8' E, northeast of Isles des Apôtres at 145–130 meters; fine sand
Aerothyris kerguelenensis (Davidson), 5
- 55, CP 237 Latitude 45°57.1' S, longitude 50°21.6' E to 45°57.1' S, 50°22.3' E, northwest of Isles des Apôtres at 150 meters
Aerothyris kerguelenensis (Davidson), 6
- 59, DC 252 Latitude 45°59.9' S, longitude 49°59.3' E, east-west radial west of Cochons Island at 210–217 meters; black sandy mud
Aerothyris kerguelenensis (Davidson), 17
- 59, BB 253 Latitude 45°59.8' S, longitude 49°58.3' E, east-west radial west of Cochons Island at 215 meters; black sand mud
Platidia marionensis, new species, 1 (attached)
Aerothyris kerguelenensis (Davidson), 1
- 60, DC 248 Latitude 46°02.7' S, longitude 49°48.2' E, east-west radial west of Cochons Island at 245–250 meters; black compact mud
Aerothyris kerguelenensis (Davidson), 10
- 60, RK 251 Latitude 46°03.5' S, longitude 49°47.6' E, east-west radial west of Cochons Island at 271 meters; gluey mud
Aerothyris kerguelenensis (Davidson), 2
- 61, DC 255 Latitude 46°05.7' S, longitude 50°08.9' E, east-west radial west of Cochons Island at 67 meters; sand and gravel
Aerothyris cf. *A. kerguelenensis* (Davidson), 4
- 62, CP 257 Latitude 46°05.7' S, longitude 50°01.9' E to 46°05.6' S, 49°57.0' E, east-west radial west of Cochons Island at 210 meters
Aerothyris kerguelenensis (Davidson), 15
- 64, DC 268 Latitude 46°02.0' S, longitude 49°08.5' E, east-west radial west of Cochons Island at 930–900 meters; mud
Aerothyris kerguelenensis (Davidson), 13
- 67, DC 271 Latitude 46°16.8' S, longitude 49°37.4' E, south of Cochons Island at 277–280 meters; fluid mud and basalt gravel
Platidia marionensis, new species, 16 (1)
Aerothyris kerguelenensis (Davidson), 13
- 67, BB 273 Latitude 46°17.0' S, longitude 49°37.0' E, south of Cochons Island at 275 meters; mud
Platidia marionensis, new species, 29
Aerothyris kerguelenensis (Davidson), 6
- 68, CP 275 Latitude 46°16.6' S, longitude 49°37.0' E, southwest of Cochons Island at 270–262 meters
Platidia marionensis, new species, 10 (2)
- 70, DC 280 Latitude 46°46.6' S, longitude 50°28.4' E, north-south radial, southeast of Cochons Island at 1350–1440 meters
Platidia marionensis, new species (crushed), 1
- 70, RK 282 Latitude 46°44.9' S, longitude 50°29.0' E, north south radial at 1025–1022 meters; mud
Liothyrella? species, 37
- 71, DC 283 Latitude 46°37.5' S, longitude 50°39.0' E, north-south radial southeast of Cochons Island at 268–270 meters; muddy sand and gravel
Platidia marionensis, new species, 4
Aerothyris kerguelenensis (Davidson), 2
- 71, BB 285–286 Latitude 46°37.5' S, longitude 50°39.0' E, north-south radial at 270 meters
Platidia marionensis, new species (crushed), 5
Aerothyris kerguelenensis (Davidson) young, 1
- 72, DC 289 Latitude 46°23.4' S, longitude 50°32.0' E, east of Ile des Pingouins at 187–155 meters
Aerothyris kerguelenensis (Davidson), 3
- 72, BB 291 Latitude 46°24.5' S, longitude 50°32.0' E, east of Ile des Pingouins at 187–196 meters
Aerothyris kerguelenensis (Davidson), 1

- 72, RK 293 Latitude 46°24.8' S, longitude 50°33.0' E, east of Ile des Pingouins at 187 meters; sand
Aerothyris kerguelenensis (Davidson), 3
- 73, CP 295 Latitude 46°24.3' S, longitude 50°37.8' E to 46°24.4' S, 50°42.0' E, east of Ile des Pingouins at 263–412 meters
Dyscolia? *radiata*, new species, 1
Platidia marionensis, new species, 37
Aerothyris kerguelenensis (Davidson), 8 (1)
- 74, DC 296 Latitude 46°17.8' S, longitude 50°47.8' E, east of Ile des Pingouins at 290 meters; fine sand
Liothyrella? species juvenile (mentioned), 1
Platidia marionensis, new species, 1
Aerothyris kerguelenensis (Davidson), 46 (2)
- 74, BB 297 Latitude 46°18.3' S, longitude 50°48.0' E, east of Ile des Pingouins at 210 meters; muddy sand
Aerothyris kerguelenensis (Davidson), young, 10
- 75, CP 303 Latitude 46°19.9' S, longitude 51°52.9' E to 46°21.1' S, 51°55.0' E, American Bay, Possession Island at 155–257 meters
Aerothyris kerguelenensis (Davidson), 28
- 75, CP 304 Latitude 46°21.8' S, longitude 51°52.1' E to 46°22.5' S, 51°52.4' E, American Bay, Possession Island at 130 meters
Aerothyris kerguelenensis (Davidson), 5
- 75, CP 305 Latitude 46°21.0' S, longitude 51°50.7' E to 46°22.5' S, 51°52.4' E, American Bay, Possession Island at 120 meters
Aerothyris kerguelenensis (Davidson), 8
- 75, CL 306 Latitude 46°20.9' S, longitude 51°53.2' E, American Bay, Possession Island at 145 meters
Aerothyris kerguelenensis (Davidson), 1
- 75, CL 308 Latitude 46°20.6' S, longitude 51°52.5' E, American Bay, Possession Island at 150 meters
Aerothyris kerguelenensis (Davidson), 3
- 76, DC 309 Latitude 46°26.0' S, longitude 52°03.6' E, east-west radial Possession Island to Ile de L'Est at 50 meters; coarse sand
Aerothyris kerguelenensis (Davidson), 4
- 77, DC 314 Latitude 46°25.0' S, longitude 51°59.7' E east-west radial Possession Island to Ile de L'Est at 270–247 meters; coarse sand and gravel
Platidia marionensis, new species, 1
Aerothyris kerguelenensis (Davidson), 42 (1)
- 77, BB 315 Latitude 46°24.5' S, longitude 51°59.8' E, east-west radial from Possession Island to the east at 250 meters; coarse sand and gravel
Aerothyris kerguelenensis (Davidson), young, 12
- 78, CP 319 Latitude 46°23.7' S, longitude 51°58.1' E to 46°24.5' S, 51°55.7' E, east-west radial Possession Island to Ile de L'Est at 142–170 meters.
Aerothyris kerguelenensis (Davidson), 30
- 79, DC 322 Latitude 46°24.2' S, longitude 51°53.9' E, east-west radial Possession Island to Ile de L'Est at 105–95 meters; coarse sand
Aerothyris kerguelenensis (Davidson), 10
- 79, BB 323 Latitude 46°24.6' S, longitude 51°53.8' E, east-west radial from Possession Island to the east at 100 meters
Aerothyris kerguelenensis (Davidson), young, 4
- 79, CP 326 Latitude 46°21.0' S, longitude 51°52.0' E to 46°23.1' S, 51°55.0' E, American Bay, Possession Island at 145–135 meters (Station recorded on register as 75, CP 326)
Aerothyris kerguelenensis (Davidson), 38

Brachiopods from St. Paul and Amsterdam Islands

- St. Paul Island (about latitude 38°43' S, longitude 77°32' E)
- St. Paul 7b Northeastern part of crater, under infralittoral boulders with ascidians, sponges, and calcareous articulate algae
Megerlina davidsoni (Vélain), 22 (1)
- St. Paul 22a Northeastern part of crater, scraping in infralittoral zone, with octocoralla, tubicolous polychaetes, and encrusting bryozoa
Megerlina davidsoni (Vélain), 57 (15)
- St. Paul 35 Northeastern part of crater, 3 meters, on a sandy bottom, with sponges, compound ascidians, and calcareous algae
Megerlina davidsoni (Vélain), 8, (1)
- St. Paul 90 Southern part of crater, scraping under part of infralittoral rocks
Megerlina davidsoni (Vélain), 59 (1)
- St. Paul 91 Southern part of crater with numerous green and calcareous algae; scraping in the infralittoral zone
Megerlina davidsoni (Vélain), 46
- St. Paul 98 Seamount at southeast coast of St. Paul, at 120 meters, lifted up with boulders by a lobster pot
Tegulorhynchia species, 1 (1)
- Amsterdam Island (about latitude 37°50' S, longitude 77°30' E)
- Ams-D8 East coast Amsterdam Island, north to Pointe Novara, about 30 meters; J. Beurois collector
Megerlina davidsoni (Vélain), 1
- Maria Martina* (name of a lobster ship) About 200 meters off Amsterdam Island, no precise locality, bottom of gorgonians
Pemphixina pixidata (Davidson), 1 (1)

Systematics

(hierarchy from class through family)

Class INARTICULATA Huxley, 1869

Order ACROTRETIDA Kuhn, 1949

- Suborder ACROTRETIDINA Kuhn, 1949
 Superfamily DISCINACEA Gray, 1840
 Family DISCINIDAE Gray, 1840
 Order Uncertain
 Suborder CRANIIDINA Waagen, 1883
 Superfamily CRANIACEA Menke, 1828
 Family CRANIIDAE Menke, 1828
 Class ARTICULATA Huxley, 1869
 Order RHYNCHONELLIDA Kuhn, 1949
 Superfamily RHYNCHONELLACEA Gray, 1848
 Family HEMITHYRIDIDAE Rzhonsnitskaya, 1956
 Family BASILIOLIDAE Cooper, 1959
 Order TEREBRATULIDA Waagen, 1883
 Suborder TEREBRATULIDINA Waagen, 1883
 Superfamily CANCELLOTHYRIDACEA Thomson, 1926
 Family CHLIDONOPHORIDAE Muir-Wood, 1959
 Superfamily TEREBRATULACEA Gray, 1840
 Family TEREBRATULIDAE Gray, 1840
 Family DYSCOLIIDAE Fischer and Oehlert, 1891
 Suborder TEREBRATELLIDA Muir-Wood, 1955
 Superfamily TEREBRATELLACEA King, 1850
 Family PLATIDIIDAE Thomson, 1927
 Family KRAUSSINIDAE Dall, 1870
 Family TEREBRATELLIDAE King, 1850
 Superfamily DALLINACEA Beecher, 1893
 Family ECNOMIOSIDAE Cooper, 1977
 Order THECIDEIDA Pajaud, 1970
 Suborder THECIDEIDINA Elliott, 1958
 Superfamily THECIDEACEA Gray, 1840
 Family THECIDELLINIDAE Elliott, 1958

Superfamily DISCINACEA Gray, 1840

Family DISCINIDAE Gray, 1840

Subfamily DISCININAE Gray, 1840

Genus *Pelagodiscus* Dall, 1908

Pelagodiscus atlanticus (King)

PLATE 3: FIGURES 15, 16

Discina atlantica King, 1868:170.—Jeffreys, 1876:252.—Davidson, 1880:62, pl. 4: figs. 17, 18.

?*Discinisca atlantica* (King).—Dall, 1873:261.—Davidson, 1888:200, pl. 26: figs. 18–22.

Pelagodiscus atlanticus (King).—Dall, 1908:440.—Thomson, 1918:38, 40.—Dall, 1920:280.—Thomson, 1927:130.—Helmcke, 1940:230.—Hertlein and Grant, 1944:21.—Zezina, 1965:345–358; 1970:5.—Cooper, 1972:15, pl. 4: figs. 53–56; 1973a:10, pl. 5: fig. 36.—Foster, 1974:38.

DESCRIPTION.—Small, round, about 4 mm in diameter, conical with apex of cone posterior to

center; height of cone about 1.5 mm. Dorsal valve conical, ventral valve concave with large pedicle. Surface of dorsal valve apically smooth, peripherally with fine concentric wrinkles; ventral valve smooth; margin of both valves surrounded by fringe of setae, those of dorsal valve very long, those of ventral valve short, all setae minutely barbed.

STATION.—MD.08: 44, CP 199.

TYPES.—Hypotype NMHN-BRA-78-24.

DISCUSSION.—*Pelagodiscus atlanticus* is worldwide in its distribution as it occurs in the great deeps of all the oceans except the Arctic Ocean. Zezina (1970:5) reports it from 6160 meters in depth. Zezina (1976:68) indicates numerous localities in the Indian Ocean, most of them north of the 30th parallel.

Superfamily CRANIACEA Menke, 1828

Family CRANIIDAE Menke, 1828

Genus *Crania* Retzius, 1781

Crania species

PLATE 13: FIGURES 2–4

DESCRIPTION.—Small, nearly circular, depressed, conical in profile, with low apex, about 1/3 valve length anterior to posterior margin; posterior slope nearly flat, gently sloping; anterior slope gently concave. Surface with smooth apex, remainder covered by short, rounded pustules.

Ventral valve attached to a fragment of calcareous alga on concave surface making for a fairly deep interior; marginal rim strongly thickened, strongly and deeply pitted; posterior margin excavated; posterior adductor scars small, deeply inserted; anterior adductor scars small, separated by a conical thickening; entire surface pierced by large punctae.

Dorsal valve interior with concave marginal rim; posterior adductors small; anterior adductors small, close together on anterior side of a triangular pit bounded by a median thickening. Mid-valve marked by short elevation separating two

lateral bilobed depressions. Surface coarsely punctate.

MEASUREMENTS (mm).—Length 3.2, width 3.5, height ca. 1.6.

STATION.—MD.08: 6, DC 32.

TYPE.—Hypotype MNHN-BRA-78-114.

DISCUSSION.—This is a well-preserved specimen with ventral valve attached to coralline material. Its small size suggests a juvenile except that the interior is well thickened. Helmcke (1940:234) described a species of similar size, *Crania valdiviae*, from 4.3 nautical miles (6.9 km) east of St. Paul Island at 672 meters. His species has small pustules but the interiors do not have the marginal elevated rim and depression of the Walters Bank specimen. The interior of the dorsal valve of *C. valdiviae* according to Helmcke's figures is not significantly thickened.

Superfamily RHYNCHONELLACEA Gray, 1848

Discovery of genera and species of rhynchonellids new to the Indian Ocean brings the total to six genera and eight species. Species of *Cryptopora* Jeffreys, small translucent forms, are usually found in deep water. One species occurs off the Maldive Islands and two off the east coast of Africa (Cooper, 1973a). *Striarina* Cooper is a finely costellate genus found off Amsterdam Island. Two genera and species described below, *Tegulorhynchia* Chapman and Crespín and *Pemphixina*, new genus, occur in the vicinity of Amsterdam Island. Another species of *Pemphixina* occurs off Kerguelen Island. *Basiliola* is described from the Indian Ocean for the first time. It is represented by two species, one described herein, the other, a single valve, is not named. *Rhytirhynchia* is a rare genus related to *Basiliola*, represented by one species.

Rhynchonellids are rare in modern seas compared to the greater abundance of the punctate Terebratulida. Of the 15 living genera of rhynchonellids, 12 occur in the Pacific and six in the Indian Ocean, three of them restricted to the Indian Ocean. Most rhynchonellids occur in water deeper than 200 meters.

Family HEMITHYRIDIDAE Rzhonsnitskaya, 1956

Genus *Tegulorhynchia* Chapman and Crespín, 1923

Tegulorhynchia species

PLATE 2: FIGURES 1-7

DESCRIPTION.—A single small specimen referable to this rare genus was taken at St. Pauls Island. The shell is very thin and unfortunately has been badly damaged in the posterior region of the ventral valve. The sides are well rounded and the maximum width is at midvalve. The valves are subequal in depth, the ventral valve slightly less deep than the dorsal one. The anterior commissure is broadly uniplicate. The beak is nearly straight, the foramen large and margined by disjunct deltidial plates. The surface is costellate and at the intersection of costellae and growth lines a small hollow spine appears, the chief characteristic of the genus. Not much of the interior can be seen but strong dental plates were observed.

MEASUREMENTS (mm).—Length 11.5, dorsal valve length 8.7, width 12.5, thickness 6.3.

LOCALITY.—St. Paul station 98.

TYPE.—Hypotype MNHN-BRA-78-16.

DISCUSSION.—This specimen was unfortunately damaged when it was dredged or in transit. The specimen is small and, when compared with examples of *Tegulorhynchia doederleini* (Davidson), proves to have a somewhat finer ornament and less prominent anterior sulcus. It is also proportionately wider than *T. doederleini*.

Tegulorhynchia is a rare genus in modern seas. It has been found off Japan, in the China Sea, off Borneo, and south of the Celebes. The St. Paul specimen was dredged at 120 meters but the other known occurrences are from depths of 120-400 meters for the Celebes specimen and 324-635 meters for the more northern occurrences.

The specimen from off Borneo identified as *Tegulorhynchia doederleini*, figured by Jackson and Stiasny (1937, pl. 2: figs. 28-33), is more transverse and much more finely ornamented than specimens from Borneo and the China Sea in the

National Museum of Natural History, Smithsonian Institution. It is more like the St. Paul specimen than like those to the north.

Because of the uncertainty regarding many of the details of the species of this genus, I have been unable to link closely the St. Paul specimen to any of those described. The St. Paul form is suggestive of the fossil species *T. squamosa* (Hutton) from the Duntroonian of New Zealand. The two are of similar size but the St. Paul form is wider and has finer ornament. *Tegulorhynchia* is best known from Tertiary sediments of New Zealand.

Pemphixina, new genus

TYPE SPECIES.—*Rhynchonella nigricans* var. *pyxidata* Davidson, 1880:59, pl. 4: fig. 14.

DIAGNOSIS.—Rotund, costellate, uniplicate Hemithyrididae with disjunct deltidial plates, narrowly elongate ventral muscle field, and modified falcifer crura.

DESCRIPTION.—Small to medium, globular in outline and profile. Ventral valve moderately convex, dorsal valve swollen. Sides rounded. Apical angle 75°–100°. Anterior commissure of adult strongly uniplicate. Beak short, erect, foramen hypothyriddid, elongate oval, small. Deltidial plates disjunct. Surface multicostellate, costellae rounded; concentric growth lines numerous, fine. Growth lamellae numerous, anteriorly crowded in the adult.

Ventral valve interior with thick teeth buttressed by short dental plates; fossette deep. Pedicle collar short, excavate. Muscle field well impressed, reaching midvalve or slightly beyond, subrectangular in outline. Diductor scars anterior, small; adductor scar large; ovarian impression deep and narrow. Pallial trunks not impressed. Pedicle short, thin.

Dorsal valve with thick, transverse diductor scars under beak, forming a narrow platform. Socket ridges thick, bounding wide corrugated sockets. Outer hinge plates narrow, often obscured by shell thickening. Crura short, crescentic in cross section, concave surfaces facing anteromedially. Median septum short, thin, buttressed

laterally by shell thickening. Septum rising to a crest at its middle just anterior of the crura, then abruptly diminishing to a mere thread reaching to anterior margin of adductor field, which is large and reaches midvalve. Ovarian patches narrow, crescentic in outline. Pallial trunks not impressed.

COMPARISON.—This genus is so like *Hemithiris* in appearance that it needs only to be compared to members of the Hemithyrididae, which includes *Hemithiris*, *Tegulorhynchia*, *Plicirhynchia*, and *Notosaria*. *Pemphixina* differs from *Hemithiris* in its curved beak, short crura, and stronger costellae. *Pemphixina* lacks the short spines characteristic of *Tegulorhynchia* and is not anteriorly costate with conjunct deltidial plates like *Plicirhynchia*.

Pemphixina is most like *Notosaria* and was originally identified as a subspecies of the common New Zealand *Notosaria nigricans* (Sowerby). Although some resemblances are obvious, so are some of the differences from *Notosaria*. In its shape *Pemphixina* has a globular form when adult ($L/W =$ nearly 1 or slightly greater than 1, Figure 5), whereas adult *Notosaria* is usually transverse ($L/W = 0.80-0.95$, Figure 5). The growth of the two is different: some young *Pemphixina* may be transverse just as some *Notosaria* may approach equality of length and width. Adult *Pemphixina* tend to form round shells with length slightly in excess of width and with maximum growth at the anterior to produce very thick individuals ($T/W = 0.84$). The thickest specimen of *Notosaria* seen (USNM 549929) has $T/W = 0.63$.

The ventral muscle field of *Pemphixina* is rather more rectangular in outline than that of *Notosaria*, which is mostly rounded or somewhat heart-shaped. Inside the dorsal valve the median septum of *Pemphixina* is stronger and higher than that of *Notosaria*. The crura of *Pemphixina* are similar to those of *Notosaria* but are broader, more concave, with a crescentic cross-section, and with the concave surfaces facing medially. These crura suggest those of the falcifer type but are shorter and with only a trace of outer hinge plates. *Notosaria* is commonly black; *Pemphixina* is ash gray.

***Pemphixina pyxidata* (Davidson), new combination**

FIGURES 5, 26; PLATE 1: FIGURES 14-34; PLATE 2: FIGURES 8-13

Rhynchonella nigricans var. *pyxidata* Davidson, 1880:59, pl. 4: fig. 14; 1888:170, pl. 24: fig. 14.

Tegulorhynchia pyxidata (Davidson).—Chapman and Crespin, 1923:188.

Notosaria pyxidata (Davidson).—Cooper, 1959:49.—Foster, 1974:50, pl. 2: figs. 15-18.

DIAGNOSIS.—Large, rounded, strongly costellate *Pemphixina*.

DESCRIPTION.—Of about medium size, thick-shelled, subtriangular to subcircular in outline in young, globular in mature and old specimens. Inequivalve, dorsal valve strongly convex, ventral valve gently convex and shallow. Length and width about equal; maximum width anterior to midvalve. Sides rounded, anterior margin gently rounded; posterolateral margin forming an angle of 75°–105° but usually near 90°. Beak pointed, short, incurved, erect, pierced by a small round hypothryidid foramen; deltidial plates disjunct in adult, lacking in young. Lateral commissure slightly oblique; anterior commissure strongly uniplicate. Surface marked by fine, low, rounded costellae separated by spaces about equal to width of costellae. Costellae crossed by short concentric lamellae that tend to crowd anteriorly. Color ashen gray.

Ventral valve flatly convex in anterior and lateral profiles, maximum convexity in umbonal region, which is moderately swollen; median region somewhat flattened; sulcus shallow, narrow, occupying slightly more than one-third to nearly half the shell width. Sulcus originating at midvalve, shallow, gently concave, bounded by low ridges. Lateral slopes rounded.

Dorsal valve strongly swollen in lateral profile, forming high dome in anterior profile. Umbonal and median regions swollen. Fold originating about midvalve, low, gently rounded, with short lateral slopes. Anterolateral extremities moderately swollen. Posterolateral slopes steep.

Pedicle valve interior with long, thickened, an-

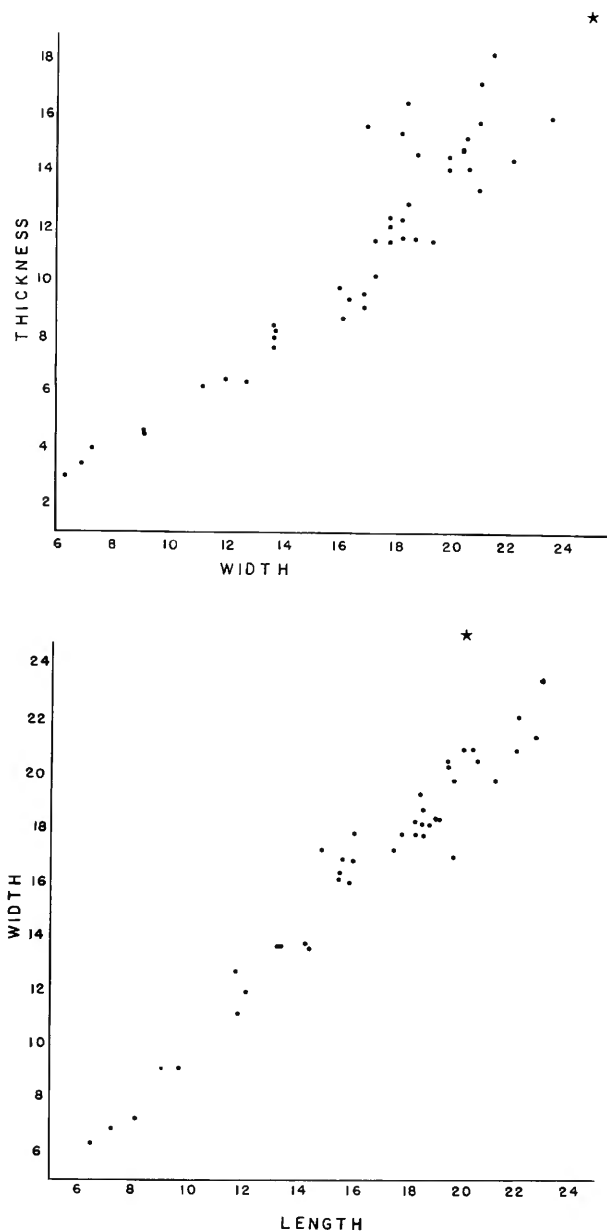


FIGURE 5.—Scattergrams showing length, width, and thickness relationships of *Pemphixina pyxidata* (Davidson) from MD.03: station 25, CB 7, 42 specimens (star = position of large adult *Notosaria nigricans* (Sowerby) for comparison with *P. pyxidata*).

ETYMOLOGY.—The generic epithet, *Pemphixina*, is derived from the Greek *pemphix* (“a bubble”), referring to the shape of the species within the genus.

teriorly excavated pedicle collar; teeth thick, stout, corrugated on their inner face, with deep fossettes; dental plates short, not strongly marked, usually with umbonal chambers well filled with shell tissue. Delthyrial cavity deep; muscle field occupying space anterior to delthyrial cavity, extending to about midvalve or beyond; diductor scars narrowly flabellate, surrounding large adductor scars. Genital areas lateral to muscle field, crescentic in outline.

Dorsal valve interior with strongly accentuated cardinalia; no cardinal process, muscles attached to triangular patches on each side under beak and on hinge plates. Socket ridges thick and erect bounding wide, corrugated sockets. Crura welded to socket ridges, short, convex laterally, truncated distally. Adductor scars large, rounded separated by short septum tapering anteriorly and posteriorly, terminating near midvalve and partly buried in shell tissue posteriorly. Septum rising to pointed crest at its middle, its anterior slope concave, crest bearing two short points. Genital areas narrow, reniform.

MEASUREMENTS (mm).—

<i>Specimen</i>	<i>Length</i>	<i>Dorsal valve length</i>	<i>Width</i>	<i>Thick-ness</i>	<i>Apical angle</i>	<i>L/W</i>
MNHN-BRA-78-15a	6.4	6.0	6.3	3.0	90°	1.02
MNHN-BRA-78-15k	12.0	10.3	12.0	6.5	90°	1.00
MNHN-BRA-78-15b	14.3	13.0	13.7	8.4	91°	1.04
MNHN-BRA-78-15c	15.5	13.7	16.9	9.6	99°	1.09
MNHN-BRA-78-15d	18.2	16.6	18.7	11.6	92°	0.97
MNHN-BRA-78-15f	20.0	17.8	20.1	15.6	90°	0.99
MNHN-BRA-78-15h	22.6	20.0	21.5	18.3	92°	1.05
MNHN-BRA-78-15i	19.6	17.8	19.6	13.8	90°	1.00

BATHYMETRIC RANGE.—90–262 m.

STATIONS.—MD.03: 8, DC 6; 14, DC 8; 14, CB 3; 24, CB 6; 25 CB 7. Marina Martina, 200 meters off Amsterdam Island, no definite locality.

TYPES.—Hypotypes: MNHN-BRA-78-15a–k, -17.

DISCUSSION.—Attachment is by a short pedicle that expands slightly where it is attached but does not have fibers like the pedicle of *Terebratulina*. The specimens are attached to small pebbles and fragments of shell of their own species and *Aerothyris kerguelensis*. Some of the pebbles are so small they must have acted as counter weights to

keep the anterior end up and functional, but able to be moved by currents. Some of the specimens are liberally coated by bryozoans, sponges, and other encrusting forms. Some have bevel-sided borings.

The species is variable, particularly in the relation of its thickness to other shell dimensions. The ratio of length to width is about 1.1 and the average of the specimens from station 25 is 0.99. This relationship is maintained from the very young to obese adults. As with many other rhychonellid genera, old adults tend to grow more rapidly at the anterior margin, exaggerating the shell thickness. The result is a fair number of globular specimens. No deformity of specimens was noted.

With growth, changes take place inside the shells. The dental plates that show clearly in the young, with marked umbonal cavities between them and the shell wall, tend to become obsolescent but are not completely obliterated by deposition of shell material in the umbonal cavities. Inside the young dorsal valve the septum is only

slightly developed and is more a myophragm than a septum. With age, the septum may become a fairly strongly elevated wall tapering anteriorly and posteriorly. In old specimens that show the dorsal interior, the septum is again reduced, partly by burial and partly by resorption. In the largest and oldest specimens, the crest has been removed and the septum, with thickening on each side, has become a rounded ridge.

The crura in the young are similar to those of the adult and obese individuals. The crura are short, crescent-shaped in section, and lie obliquely so that the concave surfaces face medially. There

is a trace of outer hinge plates making a narrow separation of the crura from the socket ridge.

This species was originally described as a variety (subspecies) of *Rhynchonella* (now *Notosaria*) *nigricans* Sowerby from the waters around New Zealand. Although there is some resemblance of the one for the other, the Kerguelen forms are light colored, not black like *Notosaria*, and have an entirely different growth form, globular in the adult, with extreme thickness. *Notosaria* on the other hand tends to be more or less strongly transverse, and is only moderately thick shelled. The crura of *Pemphixina* tend to be hollow on the face toward midvalve and are crescentic in cross-section. *Pemphixina* is separated from *Notosaria* by approximately 90° of longitude (Figure 26).

Family BASILIOLIDAE Cooper, 1959

Genus *Basiliola* Dall, 1908

Basiliola arnaudi, new species

PLATE 3: FIGURES 1-14

DIAGNOSIS.—Small nearly round *Basiliola*.

DESCRIPTION.—small, subcircular in outline with well rounded sides and truncated anterior margin; maximum width at midvalve; valves unequally convex, ventral valve gently convex, dorsal valve swollen. Lateral commissure slightly oblique; anterior commissure strongly and narrowly uniplicate to incipiently sulcinate. Beak short, forming an apical angle of 90°–105°; foramen small, oval, mesothyridid to submesothyridid; deltidial plates conjunct and flared distally to form an anterior lip to foramen. Surface marked only by concentric lines of growth, some very fine, some strong.

Ventral valve flatly convex in lateral profile, shallowly concave in anterior profile. Umbonal region somewhat narrowly swollen, median region flattened; sulcus broad and shallow, originating somewhat anterior of midvalve and forming a long flattened to gently concave tongue. Flanks slightly swollen; posterolateral slopes steep.

Dorsal valve fairly evenly and strongly convex

in lateral profile, strongly domed in anterior view; umbonal and median regions swollen, forming a poorly defined fold best seen at the anterior commissure; slopes very steep.

Ventral valve interior with sessile pedicle collar; teeth small and corrugated, muscle region small, almost circular, located anterior of delthyrial cavity and posterior of midvalve; dental plates short, receding and nearly obsolete by deposition of shell substance in umbonal chambers. Vascula media strong.

Dorsal valve interior with low narrow socket ridges, bounding finely corrugated sockets; outer hinge plates fairly wide, slightly concave; crura short, falcifer. Adductor field located slightly posterior of midvalve, narrowly U-shaped. Vascula media well impressed.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve		Thick-ness	Apical angle
		length	Width		
MNHN-BRA-78-23a	15.4	14.0	15.2	8.9	103°
MNHN-BRA-78-23b	14.0	12.5	13.3	9.3	90°
MNHN-BRA-78-23c	15.0	13.2	14.6	9.6	100°
MNHN-BRA-78-23d	15.0	13.2	14.5	9.1	101°
MNHN-BRA-78-23e	13.0	11.8	12.6	8.2	95°
MNHN-BRA-78-23f	14.4	13.0	12.9	9.0	86°

STATION.—MD.08: 7, DC 57.

TYPES.—Holotype: MNHN-BRA-78-23a; paratypes MNHN-BRA-78-23b-f.

DISCUSSION.—Several species of *Basiliola* are known from Pacific waters around the Hawaiian Islands, Japanese Islands, and Philippine Islands. *Basiliola arnaudi*, the first of this genus to be found in the Indian Ocean, is much larger and rounder than the small and delicate *B. lucida* (Gould) from Japan and is much smaller than the larger *B. pompholyx* (Dall) from the Philippine Islands. It is also rounder and more swollen than *B. elongata* (Cooper) from the Philippines. *Basiliola beecheri* Dall, type of the genus, is much larger and more elongate than *B. arnaudi*. *Basiliola* species described below represents another species.

Rhytirhynchia sladeni (Dall) is one of eight rhynchonellid species known from the Indian Ocean. It is like *Basiliola* in internal characters but exhibits anterior costation by having a strong costa

in the sulcus of the ventral valve. One specimen of *B. arnaudi* (MNHN-BRA-78-23f) has an incipient costa in the ventral sulcus suggesting a tendency toward *Rhytirhynchia* but all of the other specimens in the collection show no such tendency. *Rhytirhynchia sladeni* is a larger and stouter species than *B. arnaudi* and has much longer crura in the dorsal valve.

***Basiliola* species**

PLATE 13: FIGURE 1

DESCRIPTION.—A single dorsal valve of another species of *Basiliola* was taken at MD.08: station 7, DC 57. Although a fragment, it is not strongly convex like that of *B. arnaudi* but is gently convex in both profiles. The fragment is also larger than any of the specimens of *B. arnaudi*.

FIGURED SPECIMEN.—MNHN-BRA-78-113.

Superfamily CANCELLOTHYRIDACEA Thomson, 1926

Family CHLIDONOPHORIDAE Muir-Wood, 1959

Subfamily EUCALATHINAE Fischer and Oehlert, 1890

All known species of *Eucalathis*, except *E. magna*, new species, described below, are small and usually all ribbed and strongly resemble young *Terebratulina*. *Eucalathis* is known from the eastern Atlantic, Caribbean, southern Pacific, Antarctic, and Indian oceans. It is often found in deep water.

Genus *Eucalathis* Fischer and Oehlert, 1890

***Eucalathis magna*, new species**

PLATE 1: FIGURES 1-6

DIAGNOSIS.—Large, elongate *Eucalathis*.

DESCRIPTION.—Large for the genus, almond-shaped with rounded sides and narrowly rounded anterior margin. Posterolateral margins forming angle of 67°. Valves of unequal depth, ventral valve having greater depth. Lateral commissure

strongly and subangularly uniplicate. Beak straight; foramen large, subtriangular. Interarea narrow. Deltidial plates lacking. Surface marked by crowded costellae of different size, intercalated in three generations; about 3 costellae of all sizes in one millimeter at anterior. Color white.

Ventral valve gently convex in lateral profile with greater convexity in posterior half, anterior half flattened. Anterior profile very gently convex. Umbonal and beak regions swollen; anterior half broadly flattened with narrow, shallow, sulcus extending from umbonal region to anterior margin. Posterolateral slopes rounded.

Dorsal valve nearly flat in lateral profile but subcarinate in anterior view. Umbonal and median regions somewhat narrowly swollen to produce an ill-defined fold that plicates the anterior margin. Flanks flattened and sloping steeply to the lateral margins.

Interior with long crural process and short, anteriorly pointed loop.

MEASUREMENTS (mm).—Length 11.1, dorsal valve length 9.7, width 8.7, thickness 4.9, apical angle 67°.

TYPE.—Holotype: MNHN-BRA-78-12.

STATION.—MD.03: 11, CP7.

DISCUSSION.—This species strongly resembles various species of *Terebratulina* in its outline, profile, and ornament, but its loop is entirely unlike that of any known *Terebratulina*. Instead of having a loop in which the crural processes join with the transverse band to form a narrow ring as in *Terebratulina*, the loop of this Heard Island species is exactly like that of *Eucalathis*, which has the transverse band projecting anteriorly to form a rounded angle. Most species of *Eucalathis* are small, perhaps a third less long than *E. magna*. They are, however, somewhat similar in shape and some of them have fairly strongly beaded costellae like those of *E. magna*. There is no known *Eucalathis* like this one. *Eucalathis macrorhynchus* Foster from the Pacific-Antarctic Ridge, southeast Pacific is barely half the size of *E. magna* and has subdued costellae. *Eucalathis murrayi* (Davidson), another species from the South Pacific, is also very small.

Eucalathis costellata, new species

PLATE 5: FIGURES 1-14

DIAGNOSIS.—*Eucalathis* of medium size with slight ventral sulcus, strong posterior costellation, and anterior fasciculation.

DESCRIPTION.—Small, but moderately large for genus, subtriangular in outline, maximum width anterior to midvalve; valves unequally deep, ventral valve deeper than dorsal valve. Posterolateral margins straight, forming apical angle of 70°. Lateral margins rounded; anterior margin gently rounded. Lateral commissure nearly straight; anterior commissure rectimarginate to broadly uniplicate. Beak short; foramen wide and subtriangular; deltidial plates obsolete. Surface multicostellate, costellae often beaded; with six or eight more prominent costellae.

Ventral valve moderately convex in lateral profile, maximum convexity anterior to beak, flattening anteriorly. Anterior profile, moderately domed. Five strong subangular costellae on umbo, expanding anteriorly, median two slightly depressed anteriorly to form shallow sulcus. Costellae added by intercalation from near beak to anterior in 3 generations, intercalation variable, producing some anterior fasciculation.

Dorsal valve moderately convex in lateral profile, most convex at swollen umbo, lessening in convexity anteriorly; anterior profile moderately domed but more so than that of ventral valve. Umbo smooth. Costellae numbering seven at umbo increasing anteriorly in width, with intercalations appearing in 3 generations to anterior margin. Median fold poorly defined.

Ventral valve interior with strong, excavated, short, pedicle collar. Teeth small.

Dorsal valve interior with variable loop, from broad, smooth curve anteriorly (Plate 5: figure 13) to subangular at the anterior (Plate 5: figure 12). Loop wide, narrowed and slightly folded at the anterior in adult specimens.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness	Apical angle
MNHN-78-30a	5.8	4.8	5.2	2.9	70°
MNHN-78-64a	6.6	5.4	5.0	3.4	66°

STATIONS.—MD.08: 6, DC 47; 6, DC 46; 7, DC 57.

TYPES.—Holotype: MNHN-BRA-76-64a; paratypes MNHN-BRA-78-30a-d.

DISCUSSION.—The contrast in costellation of *E. costellata* and *E. macrorhynchus* Foster from the Antarctic distinguishes these two species. *Eucalathis costellata* has strong costellae while Foster's species has only faint costellation. The specimen attributed to *E. murrayi* (Davidson) by Foster (1974, pl. 7: figs. 10-12) is strongly costellate but with a different pattern of costellae than that of *E. costellata* and the shell is wider than long. This specimen does not conform well to Davidson's description of *E. murrayi* nor do the external features of *E. costellata*. The latter is longer than wide and much larger than *E. murrayi*. Unfortunately there is no good illustration of Davidson's species. It is figured by Muir-Wood (1959, pl. 5: fig. 10) but details of the ribbing are uncertain. The species of *Eucalathis* occurring in the Atlantic are smaller and have different ribbing than that of *E. costellata*.

Eucalathis rotundata, new species

PLATE 13: FIGURES 5-15

DIAGNOSIS.—Nearly circular, strongly costate *Eucalathis*.

DESCRIPTION.—Small, rounded in outline, with length and width nearly equal; hinge wide, slightly narrower than midwidth, which is widest part; sides rounded; anterior margin broadly rounded; posterolateral margins forming an apical angle of about 90°. Beak erect; foramen large; deltidial plates obliquely elevated. Surface costae crossed by strong concentric elevated growth lines.

Ventral valve gently convex in lateral profile, moderately rounded in anterior view. Beak marked centrally by two strong costae, slightly elevated, flanked by three lateral costae of lesser strength than median two; Median costae forming poorly defined fold. Flanks gently convex.

Dorsal valve nearly circular with fairly strongly convex lateral profile, anterior view more strongly

convex than ventral valve in same view; umbo smooth; six strong costae mark body of shell, flanks with three of lesser strength. Median one slightly depressed.

Ventral valve with strong, short, excavated pedicle collar; teeth large. Dorsal valve with variable loop angulated to broad medially; cardinal process small.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Mid-width	Thickness	Hinge width	Apical angle
MNHN-BRA-78-115a	3.5	2.8	3.2	1.9	1.4	84°
MNHN-BRA-78-115b	3.1	2.5	3.2	1.6	2.0	91°

STATIONS.—MD.08: 6, DC 35; 6, DC 43.

Types.—Holotype: MNHN-BRA-78-115a; paratypes: MNHN-BRA-78-115b,c.

COMPARISON.—This species differs from *E. costellata*, new species, in its much rounder outline and stronger costation. It differs from *E. murrayi* (Davidson) in its slightly smaller size, rounder form, and less number of costae. There is no resemblance to *E. macrorhynchus* Foster, which is strongly triangular with numerous subdued costellae.

There is some variation in the species because some specimens are slightly more elongate than others but the elongate ones are, nevertheless, costate.

Eucalathis species

PLATE 12: FIGURES 1-4

DESCRIPTION.—A single specimen from station MD.08: 6, DC 43 is so unlike other individuals of *Eucalathis* that it is treated separately. The specimen measures (in mm): length 4.6; dorsal valve length 4.6; dorsal valve length 3.8; width 4.2; and thickness 2.2. It differs from *E. costellata*, new species, in its smaller size, strong median sulcus, and evenness of the size of the costellae. It differs from *E. rotundata*, new species, in its more triangular shape, strong dorsal sulcus, and fine, even costellae. The specimen is mudfilled and may have drifted into the population of *E. rotundata*.

TYPE.—Figured specimen: MNH-BRA-78-105.

Superfamily TEREBRATULACEA Gray, 1840

Family TEREBRATULIDAE Gray, 1840

Xenobrochus, new genus

DIAGNOSIS.—Small terebratulaceans with recrimarginate anterior commissure, erect socket ridges, large symphytium, and loop with trans-

verse band, convex anteriorly without lateral terminal points on loop.

TYPE SPECIES.—*Gryphus africanus* Cooper 1973a: 8, pl. 4: figs. 31-38.

DESCRIPTION.—Small, elongate oval in outline, inequivalve, ventral valve having greater depth than dorsal one. Sides moderately rounded; anterior margin narrowly rounded. Beak moderately long, erect, labiate, truncated by a fairly large submesothyridid to permesothyridid foramen. Symphytium wholly or partially visible. Lateral commissure straight; anterior commissure rectimarginate. Surface marked by concentric growth lines only.

Ventral valve interior with large teeth, and short pedicle collar. Dorsal valve with wide, half-elliptical cardinal process. Socket ridges erect, bounding wide sockets floored by stout fulcral plates. Outer hinge plates narrow, not clearly separable from the socket ridges, tapering anteriorly to join a narrow crus, and extending anteriorly to the crural processes, which are low, broadly pointed, with large acute angle. Descending lamellae formed by anterior slope of crural processes. Transverse band convex anteriorly, somewhat angulated medially or rounded; median fold of transverse band slight.

ETYMOLOGY.—The generic epithet, *Xenobrochus*, is derived from the Greek *xenos* ("strange") plus *brochos* ("noose" or "loop"), referring to the loop with transverse band that is characteristic of species within the genus.

DISCUSSION.—This genus is especially charac-

terized by having its transverse band directed anteriorly rather than ventrally, as is usual in most terebratulaceans. In this respect it is unlike all other genera of terebratulidae except *Abyssothyris elongata* Cooper, which is readily separable because of its sulcate anterior margin.

In addition to the type species, the genus includes *Gryphus?* *translucidus* Dall, *G.?* *indianensis* Cooper and, possibly, *Liothyris?* *agulhasensis* Helmcke, and the two new species from off Marion Island, described below.

Xenobrochus africanus (Cooper), new combination

PLATE 4: FIGURES 30-35

Gryphus africanus Cooper 1973a; 8, plate 4: figs. 31-38.

Figures of this small brachiopod are introduced to illustrate the unusual loop with its anterodorsally directed transverse band. Compare with the loop of *X. anomalus* described below.

TYPES.—Holotype: USNM 550375a; paratype: USNM 550375b.

OCCURRENCE.—Durban Bay, off Indian Ocean, South Africa.

Xenobrochus anomalus, new species

PLATE 4: FIGURES 11-20

DIAGNOSIS.—Very small, elongate oval *Xenobrochus* with tubular pedicle collar and extended, erect, socket ridges.

DESCRIPTION.—Very small, elongate oval in outline, with gently rounded sides and narrowly rounded anterior margin. Posterolateral margins nearly straight, forming an apical angle of 50°–70°. Lateral commissure straight; anterior commissure rectimarginate. Beak moderately long and narrow, suberect to erect; foramen large, mesothyridid. Deltidial plates conjunct or disjunct. Symphytium visible. Surface smooth. Densely punctate, about 320/mm².

Ventral valve deeper, more convex than dorsal valve; moderately convex in lateral profile, slightly domed in anterior profile; umbonal region broadly swollen; flanks steep. Pedicle long and slender.

Dorsal valve evenly and moderately convex in lateral profile, moderately domed in anterior profile, slightly less so than ventral valve. Umbonal and median regions swollen; flanks steep.

Ventral interior with extravagant development of pedicle collar, which is tubular; teeth large, narrow. Muscle scars not discernible.

Dorsal valve interior with a broad transverse cardinal process; myophore a narrow elliptical scar, cardinal process myophore on posterolateral extension of socket ridge that forms cover to proximal part of socket; socket ridges thin and erect; fulcral plates thick; outer hinge plates attached to dorsal edge of socket ridge, narrow crural bases not elevated along inner edge of outer hinge plates. Crural processes low, blunt points located at anterior limit of outer hinge plates. Descending lamellae short; transverse band not seen, but median curve of distal ends of descending lamellae suggesting a transverse band directed anteriorly. Adductor scars not visible.

MEASUREMENTS (mm).—

Specimen	Dorsal valve		Width	Thick-ness	Apical angle
	Length	length			
MNHN-BRA-78-28a	7.0	6.1	5.1	3.7	50°
MNHN-BRA-78-28b	7.3	6.4	4.6	3.8	50°
MNHN-BRA-78-28c	7.1	6.3	5.0	4.1	52°

STATIONS.—MD.08: 15, BB 88; 23, DC 129.

TYPES.—Holotype: MNHN-BRA-78-28a; paratypes: MNHN-BRA-78-28b-f.

DISCUSSION.—This little species extends the range of *Xenobrochus* from southern African waters to those around Marion Island. *X. anomalus* is smaller than *X. indianensis* and is more narrowly oval with maximum width near midvalve, not anterior of the middle as in the Indian Ocean form. *X. africanus* (Cooper) from off South Africa is most like *X. anomalus* but is somewhat smaller, less tapered posteriorly, with smaller foramen, and without a tubular pedicle collar, which is a strong feature of *X. anomalus*.

Xenobrochus australis, new species

PLATE 1: FIGURES 11-13

DIAGNOSIS.—Large *Xenobrochus* with width 60% of length.

DESCRIPTION.—Small, longer than wide, biconvex, inequivalve, the ventral valve having the greater depth. Sides gently rounded; anterior margin narrowly rounded. Lateral commissures straight; anterior commissure rectimarginate. Beak fairly long, narrow, erect, truncated by a large foramen with labiate anterior lip; foramen permesothyridid. Symphytium concave, wholly visible. Color white, surface smooth. Punctuation dense, 200 per square mm at middle of ventral valve.

Ventral valve fairly strongly convex in lateral view, maximum convexity in posterior half; anterior half gently convex; anterior view narrowly rounded and strongly convex. Median region swollen; lateral slope steep.

Dorsal valve moderately and evenly convex in lateral view; anterior view narrowly but moderately convex; umbonal region somewhat swollen. Sides with short, steep slopes.

Ventral valve with long, distally frayed pedicle; pedicle collar moderately long, excavate.

Dorsal valve with thin socket plates and narrow, shallowly concave outer hinge plates. Crura very long, thin, and rounded, not extended as a ridge along the inside edge of the outer hinge plate. Crura supporting obtusely angular crural bases that are joined by a narrow, angularly arched, transverse band that gives the loop the appearance of a short-handled scoop. Transverse band directed anteriorly and with a median angulation.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve		Thick-ness	Apical angle
		length	Width		
MNHN-BRA-78-14a	14.7	12.8	9.8	8.0?	55°
MNHN-BRA-78-14b	15.0	13.6	10.0	8.7	58°

TYPES.—Holotype: MNHN-BRA-78-14a; paratype: MNHN-BRA-78-14b (in alcohol).

DISCUSSION.—This species resembles *X. africanus* (Cooper) in the form of its loop. A number of terebratulids have the transverse band of the loop directed dorsoventrally or anteriorly, not horizontally or ventrally as is more usual in true *Gryphus*. The loop of *X. australis* is unlike that of *Liothyrella*, which is

usually triangular in shape and widened at the anterior with the transverse band more or less strongly elevated ventrally. This Heard Island species externally resembles *Liothyrella multiporosa* Foster but differs in having a less deep ventral valve, a more elongate outline with less narrowed anterior, a larger foramen as well as completely different loop.

Genus *Dallithyris* Muir-Wood, 1959

***Dallithyris? dubia*, new species**

PLATE 4: FIGURES 21-29

DIAGNOSIS.—Small, narrowly oval *Dallithyris?*

DESCRIPTION.—Small, thin-shelled, elongate oval, wider than long, with maximum width at midvalve. Valves unequally convex and deep, ventral valve strongly convex and deep; dorsal valve gently convex and shallow. Sides broadly rounded; anterior margin narrowly rounded. Posterolateral extremities forming apical angle of 77°-90°, lateral commissure straight; anterior commissure rectimarginate. Beak short, suberect, not labiate; foramen fairly large, round, mesothyridid. Symphytium short, concave, partially visible. Surface marked only by concentric lines of growth.

Ventral valve evenly and moderately convex in lateral profile, fairly strongly domed in anterior view. Umbonal and median regions swollen, sides steep.

Dorsal valve evenly and gently convex in lateral view, forming a broad low dome in anterior profile. Umbonal region swollen, median and anterior convex; flanks sloping gently.

Ventral valve interior with small, narrow teeth; pedicle collar short, excavate. Ventral muscle area narrow; vascula median slightly divergent.

Dorsal valve interior with slender socket ridges; outer hinge plates fairly long, narrow concave; crura nonexistant; crural processes small, angular, located at distal end of outer hinge plates. Loop short, narrowing anteriorly, and with fairly broad transverse band angularly folded at its middle.

MEASUREMENT (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness	Apical angle
MNHN-BRA-78-29 a	16.7	15.2	13.7	9.2	90°
MNHN-BRA-78-29 b	15.5	14.4	12.0	8.2	77°

STATION.—MD.08: 6, DC 57.

TYPES.—Holotype: MNHN/BRA-78-29b; paratypes: MNHN-BRA-78-29a,c,d.

DISCUSSION.—*Dallithyris murrayi* Muir-Wood, the type species of *Dallithyris*, is a large somewhat triangular brachiopod having a short, narrow loop. As figured by Muir-Wood (1959, pl. 3: figs. 1, 2b, 4a) the loop is variable, its anterolateral extremities angular or rounded, occasionally tapering. The specimen from off Samper Bank is much narrower and smaller than *D. murrayi* and the loop has a definite taper anteriorly. In view of the uncertainty as to the average loop character of *Dallithyris*, the generic designation of *D.?* *dubia* is queried. Muir-Wood assigned *Terebratula?* *cubensis* Pourtales to *Dallithyris*, but the loops of the two are so different that the Caribbean shell was reassigned by Cooper (1977:67) to *Tichosina*. *Dallithyris?* *dubia* is similar to *Gryphus sphenoides* Jeffreys (not Philippi). Although the shape of the two is similar, the latter species has not yet been assigned correctly to a genus, and is doubtfully referred to *Dallithyris*.

Genus *Liothyrella* Thomson, 1916

Liothyrella is a genus widely identified in southern hemisphere waters, especially in the Antarctic where it is represented by numerous species (Foster, 1974; Cooper, 1973b). It is also known abundantly in the Tertiary of New Zealand and Australia and is less abundant in New Zealand waters. So numerous are the species and so variable the loop, that more than one stock may be represented in the genus. Unfortunately the specimens taken by the *Marion Dufresne* are mostly broken shells without loops.

Liothyrella moseleyi (Davidson)

PLATE 1: FIGURES 7-10

Terebratula moseleyi Davidson, 1878:436; 1880:30, pl. 2: figs. 12-14.

Liothyris moseleyi (Davidson).—Davidson, 1886:11, pl. 2: figs. 1-4.

Liothyris moseleyi (Davidson).—Blochmann, 1908:618.

Liothyrella moseleyi (Davidson).—Hertlein and Grant, 1944: 97, pl. 7: figs. 3-7, 12.—Foster, 1974:69, pl. 4: figs. 23-25.

Not *Gryphus moseleyi* Dall, 1920:318.

DESCRIPTION.—Small, subcircular in outline, valves subequal in convexity, ventral valve usually slightly deeper than dorsal valve; sides and anterior margin rounded; posterolateral margins forming angle of 74°-86°. Lateral commissures straight; anterior commissure rectimarginate. Beak short, suberect, labiate; foramen small, submesothyridid to mesothyridid. Deltidial plates conjunct forming a concave symphytium. Color dull white; surface smooth.

Ventral valve moderately convex in anterior and lateral profiles, with umbonal region most convex. Median region swollen, swelling continuing to anterior margin. Dorsal valve evenly and moderately swollen in anterior and lateral profiles, slightly less so than ventral valve. Median region swollen.

Ventral valve interior with short excavate pedicle collar; small but rounded teeth; muscle scars lightly impressed. Dorsal valve interior with thin, erect, socket ridges; narrow outer hinge plates and crural processes located at junction of outer hinge plates and crura.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness	Apical angle
MNHN-BRA-78-13a	18.9	16.6	16.0	10.4	77°
MNHN-BRA-78-13b	16.5	14.4	15.7	9.6	86°
MNHN-BRA-78-13c	16.1	14.4	13.5	8.7	78°

STATION.—MD.03: 31, CP 22.

TYPES.—Hypotype: MNHN-BRA-78-13a-c.

DISCUSSION.—None of the specimens in the collection preserves a complete loop. Foster (1974: 69) discussed details of this species that separate it from other species of *Liothyrella* and, indeed, that may separate it generically. Foster (1974, pl. 4: fig. 25) illustrates the loop of a paratype that is distinct from the loop of *Liothyrella wa* (Broderip), the type species of *Liothyrella*. The loop of *L. moseleyi* is equal to 1/3 the length of the dorsal valve, is almost parallel-sided, and has a broad

transverse band. The loop does not expand anteriorly as is characteristic of the loop of *Liothyrella* and the crural processes are farther anterior than those characteristic of *Liothyrella*. Foster also points out that the density of the punctae is less than that of *L. uva*.

Another species having a narrow loop like that of *L. moseleyi* is *L. blochmanni* (Jackson). This leads to the suspicion that there is another terebratulid stock in the Antarctic different from *Liothyrella*.

Liothyrella? species

PLATE 3: FIGURE 31

DESCRIPTION.—Thirty-seven valves in various stages of abrasion are referred tentatively to *Liothyrella*. Diagnostic generic characters are difficult to detect but the general aspect of the specimens conforms to that of *Liothyrella*. The specimens are large, elongate oval, variable, longer than wide, with maximum width slightly anterior to midvalve. The ventral valves have a large symphytium and a slightly labiate beak, but in most examples the beak is damaged. The teeth are large and the diductor field squarish. No dorsal valve has a complete loop and the outer hinge plates are too badly damaged to be useful. They are wide, gently concave, nearly horizontal, and margined by a slight elevation of the crural base. The exterior surfaces are much abraded but faint traces of radial capillae may be detected.

STATION.—MD.08: 70, RK 282.

TYPES.—Described specimens: MNHN-BRA-78-123.

DISCUSSION.—The oval outline and interior characters of these specimens are most like *Liothyrella*. Although they show traces of capillae, a trait present in some liothyrellas, the presence of well-formed outer hinge plates eliminates them from assignment to *Dyscolia*.

Three juveniles from MD.08: station 40, DC 186 (MNHN-BRA-78-122a-c) are also placed under this heading. The loop is incomplete as is usual with young *Liothyrella* and incipient outer hinge plates are visible. Another juvenile from MD.08: station 74, CP 296 is also referred here (MNHN-BRA-78-125).

Family DYSCOLIIDAE Fischer and Oehlert, 1891

Genus *Dyscolia* Fischer and Oehlert, 1890

Dyscolia? *radiata*, new species

PLATE 3: FIGURES 17-30

DIAGNOSIS.—Subtriangular, loop narrow, crural processes obtuse, surface covered by fine irregular capillae.

DESCRIPTION.—Of about medium size, subtriangular in outline, unequally convex, ventral valve having greater convexity and depth; posterolateral margins straight, forming apical angle of 80°-92°. Sides rounded; anterior margin broadly rounded. Lateral commissure straight, anterior commissure rectimarginate. Beak short, strongly labiate; foramen small, rounded, mesothyridid to permesothyridid. Symphytium concave, completely visible. Surface marked by fine irregular radial threads, growth lines, and growth lamellae.

Ventral valve moderately and regularly convex in lateral view, fairly strongly domed, with steep sides in anterior profile. Umbonal region swollen, swelling dissipating on the swollen midvalve; anterior slope steep and swollen.

Dorsal valve moderately and evenly convex in lateral profile; broadly and gently domed in anterior view. Umbonal and median regions moderately swollen; flanks gently convex. Pallial impressions poorly recorded; vascula media extending directly anteriorly. Ovarian impressions narrow.

Dorsal valve interior with stout socket ridges, bounding narrow sockets; outer hinge plates obsolete; no inner hinge plates. Loop about 1/3 the length and about 1/7 the width of the dorsal valve; somewhat tapered anteriorly, crura long, narrow in section; crural processes obtusely angular, anterior to midloop (60% of length); descending branches broad, short; transverse band narrow and gently arched medially; anterolateral extremities bluntly rounded.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness	Apical angle
MNHN-BRA-78-25 a	29.5	26.4	27.5	18.2	81°
MNHN-BRA-78-25 b	27.3	24.2	26.3	16.0	92°

STATIONS.—MD.08: 6, CP 47; 73, CP 295.

TYPES.—Holotype: MNHN-BRA-78-25b; paratypes: MNHN-BRA-78-25a,c-f.

DISCUSSION.—*Dyscolia?* *radiata* most resembles *Dyscolia ewingi* Cooper from off South America in south Atlantic waters. Although the two are externally similar, the loop of the South American species is wide and nearly rectangular, and its shell is larger. There is also resemblance to *Liothyrella?* *neozelanica* Thomson, which is a larger, indistinctly radially capillate shell. The loop of the New Zealand species is rather more triangular than that of *D?* *radiata*.

A single fragmentary ventral valve (MNHN-BRA-78-97) from station 73, CP 295 is assigned here because of its strongly labiate beak and widely triangular form. The shell is quite worn but shows patches of capillae.

Superfamily TEREBRATELLACEA King, 1850

Family PLATIDIIDAE Thomson, 1927

Genus *Platidia* Costa, 1852

Platidia marionensis, new species

PLATE 2: FIGURES 37–39; PLATE 5: FIGURES 15–34

Platidia anomioides (Scacchi).—Davidson, 1880:55, pl. 4: figs. 10, 11.

Platidia anomioides (Scacchi) Philippi species.—Davidson, 1887:152, pl. 21: fig. 16.

Platidia anomioides (Scacchi and Philippi).—Foster, 1974:85, pl. 7: figs. 17–19.

DIAGNOSIS.—Small circular *Platidia*.

DESCRIPTION.—Small, circular; color cream to yellowish white; valves unequally convex, ventral valve strongly swollen; dorsal valve variable, usually flat to concave in posterior half, moderately swollen, flat to concave in anterior; foramen large, occupying nearly 1/4 length of dorsal valve and fully half its width. Anterior commissure rectimarginate. Surface marked by concentric growth undulations. Punctae count about 300 per square millimeter.

Ventral valve strongly convex in lateral profile, more convex in posterior half, anterior half fla-

tened; anterior profile strongly domed; beak short bluntly rounded, forming large obtuse angle; flanks convex.

Dorsal valve moderately convex in lateral and anterior profiles except at umbonal region which is excavated; foramen forming a semiellipse with smooth margins.

Ventral valve interior with short interarea, large teeth without buttress, low median ridge at apex.

Dorsal valve interior with compact lophophore having small lateral branches, occupying about middle half of valve. Median septum short, reaching to about midvalve. Loop with delicate descending lamellae and needle-pointed, short crural processes. Ascending element at end of septum forming a wide-pronged fork.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness
MNHN-BRA-78-68	3.3	2.7	3.6	?
MNHN-BRA-78-69a	3.4	3.0	4.0	?
MNHN-BRA-78-70a	3.6	3.2	3.5	1.7
MNHN-BRA-78-70b	3.6	3.3	3.6	1.7

STATIONS.—MD.03: 22, CD 15; 26, CP 17; 28, CP 19. MD.08: 6, DC 34; 9, CP 75; 15, DC 87; 15, BB 88; 18, BB 108; 19, DC 110; 19, BB 111; 20, CP 116; 23, DC 129; 25, DC 134; 27, DC 136; 28, DC 143; 28, DC 148; 36, DC 173; 44, CP 199; 59, BB 253; 67, DC 271; 67, DC 273; 68, CP 275; 70, DC 280; 71, DC 283; 71, BB 285–286; 73, CP 295; 74, DC 296; 77, DC 314.

TYPES.—Holotype: MNHN-BRA-78-70a; paratypes: MNHN-BRA-78-22, -78-65; -78-66a,b; -78-67; -78-68; -78-69a,b; -78-70b-d.

DISCUSSION.—*Platidia* is a small brachiopod that lives closely attached to its host, which may be a pebble, other shells, its own king, or bryozoans. Close appression to the host often distorts these small shells, creating flat or concave dorsal valves rather than convex ones when the shell has more freedom to grow. Because all of the species of *Platidia* are variable, identification based on exterior details only is difficult.

The specimens from Marion Island and vicinity were early identified as *P. anomioides* (Scacchi

and Philippi), which was first described from the Mediterranean. The same name has been used for specimens from the Atlantic, Caribbean, Antarctic, South Africa, and the Gulf of Mexico. In this enormous expanse of sea, this species is naturally quite variable. In the Mediterranean and northeastern Atlantic, specimens are often distorted and become fairly large, upward of 7.0 mm in width (Fischer and Oehlert, 1891:95) and as adults are usually wider than long. Punctae counts are variable, a specimen (USNM 173465) of 3 mm width had a count of 268/m² and another (USNM 173462) of 5.4 mm width had 266–275 punctate per square mm. A specimen, from the Caribbean (USNM 550528) of 3 mm width had a count of only 200 punctae per square mm.

The specimens of *Platidia* from northeast of Marion Island and elsewhere in the southern Indian Ocean are regarded as a new species because they are nearly circular, attain a width of barely 4 millimeters, and have a lophophore in which the lobes extend directly laterally and do not flare toward the posterolateral margins. The lophophore generally occupies somewhat less of the interior than those of *P. anomioides*. The socket ridges are long and thin in the Marion specimens. The Mediterranean form is commonly brown or yellow whereas the specimens from Marion Island vicinity are yellowish white or cream colored. Furthermore, the punctae count of the Marion specimens is about 336, a figure in accordance with *Platidia* figured by Foster from Antarctica (Foster, 1974:85). Specimens like the Marion species occur on the Agulhas Bank off the Southern tip of Africa (Cooper, 1973b:21).

Family KRAUSSINIDAE Dall, 1870

Genus *Megerlina* Deslongchamps, 1884

Megerlina davidsoni (Vélain)

PLATE 2: FIGURES 14–36

Kraussina pisum Vélain [not Lamarck].—Frauenfeld, 1865: 894; Vélain, 1876:285.

Kraussina davidsoni Vélain, 1877:72, 139, pl. 5: figs. 23, 24; 1878:139, pl. 5: figs. 24–26.—Davidson, 1880:21; 1886–

1888:126, pl. 21: figs. 12–14.—Deslongchamps, 1884:160, pl. 19: figs. 6, 9, 10.

DESCRIPTION.—This species was well described by Vélain (1877) and later by Davidson (1886–1888) and Deslongchamps (1884). Vélain also described the conditions under which the species lived in the narrow environment of the volcanic crater that is St. Paul Island in the Indian Ocean. This is a small brachiopod, brownish in color, with length and width subequal. The foramen is large, the anterior margin is sulcate, and the interior is reminiscent of that of *Kraussina*. According to Vélain, the animal lived on the underside of stones, often crowded in crevices and subject to deformation. It lives from tide level down to 30 meters depth.

Although the interior of the shell of this species is well known and has been illustrated by Deslongchamps (1884) some details of the musculature and the development of the lophophore support have not been described. The interior of both valves and especially that of the dorsal valve is marked by prominent, large, and long tubercles. These form a subperipheral rim in both valves. When the shell is slightly agape, these form a sort of sieve or screen that may have been effective for this purpose when feeding. The older tubercles in the rear of an adult are partly buried in shell tissue and are not as prominent as the younger marginal ones.

The deltidial plates are widely disjunct and the foramen is a large triangular opening that is covered by an integument bearing the pedicle, to which some of the muscles are attached. The teeth are thick and solid but are not supported by dental plates. The muscle scars are lightly impressed. The scars of the large pedicle muscles can be discerned but it is difficult to distinguish the traces of the smaller diductors. The pedicle is in the midst of the integument, is short, and adhered so strongly to the substrate that particles of the rock still cling to it. In many specimens, the pedicle appears as a black solid circle surrounded by the integument.

The muscle arrangement of the pedicle valve is like that of *Megerlia* and *Argyrotheca* with large,

prominent, spreading pedicle muscles that are attached on the underside of the posterior side of the pedicle, which in turn is essentially part of the integument. The diductor muscles are posterior of the pedicle muscles near the center of the delthyrial cavity and are attached to the pedicle and integument at the same place as the pedicle muscles. They then spread out on the integument and attach with the integument to the posterior shell margin, which is narrowly roughened and serves as a cardinal process. Dorsal pedicle muscles are very small and are attached to the integument at the pedicle and to the socket ridge of the dorsal valve. The shell of this animal is so tightly pressed to the object of attachment that movement of the shell corrodes the beaks of both valves and often parts of the hinge. To open the shell, the valves must be lifted and the large pedicle muscles can effect this on contraction by stretching the pedicle. At the same time contraction of the small diductors opens the valves.

MEASUREMENTS (mm).—

<i>Specimen</i>	<i>Length</i>	<i>Dorsal valve length</i>	<i>Hinge width</i>	<i>Mid- width</i>	<i>Thick- ness</i>
MNHN-BRA-78-18a	7.9	6.0	5.6	7.3	4.1
MNHN-BRA-78-19a	6.4	5.5	5.6	7.4	3.0
MNHN-BRA-78-21a	8.3	6.2	5.6	7.7	4.4

CARDINALIA AND LOPHOPHORE SUPPORTS.—The cardinalia consist of stout oblique socket ridges and a fulcral plate. The cardinal process is a roughened strip along the posterior margin of the notothyrial cavity. The short and slender dorsal pedicle muscles are attached to the socket ridges, and in some specimens leave a transversely oval scar. Thickening on the anterior side of the socket ridges simulates an outer hinge plate but it never reaches the valve floor or it is likely to be misidentified as a hinge plate.

The lophophore support consists of a Y-shaped apparatus located at the crest and anterior end of a thick median septum that reaches nearly to the posterior. The development of the internal structures is of considerable interest. The smallest specimen (MNHN-BRA-78-19e) exhibiting the interior is 1.6 mm wide. The socket ridges and

pedicle muscle scars are discernible. At midvalve a low ridge has appeared that extends from midvalve nearly to the anterior margin. At the posterior terminus of the ridge a slight depressed area appears that is the site of the development of the Y. The next specimen in development (MNHN-BRA-78-19h) is much larger, 3 mm wide. Its median ridge consists of three large tubercles anterior to a ridge that extends slightly beyond midvalve. At the middle and on each side of this ridge is a tiny divergent flattened blade, the beginning of the Y. Another specimen of 3 mm (MNHN-BRA-78-19i) is still more advanced showing the septum extending posteriorly beyond midvalve. It is furrowed along the midline. The anterior tubercles have been reduced to one large one and a smaller one anterior to it. The blades of the Y are concave on the inner face and rounded distally. A specimen 4 mm wide (MNHN-BRA-78-19-1) has widened blades and the septum, still grooved, extends nearly to the notothyrial cavity. The tubercles anterior to the septum are three but reduced in size. At the posterior side of the distal end of the Y there is a slight bending toward the inside of the Y. This is better shown in a specimen 4.5 mm wide (MNHN-BRA-78-19m) and has been interpreted as representing the beginning of the transverse band of the normal loop. In a specimen 8 mm wide, a well-developed adult, the Y is wide, the limbs slightly curved and concave inward. The median septum is grooved for about half its posterior length, then extends to the notothyrial cavity where it expands to a small platform. The posterior margin of the limbs of the Y are curved inward toward each other. An additional feature appears in the form of a small blade attached to the under or dorsal side of each blade near the septum, suggesting an incipient development of the descending branch of a normal loop. This small blade never grows dorsally and no corresponding crus or trace of one appears from the socket ridge.

BATHYMETRIC RANGE.—Shallow water, 3–30m.

STATIONS.—AMS-D8; St. Paul: 7b, 22a, 35, 90, 91.

TYPES.—Hypotypes: MNHN-BRA-78-18; 19a-m; 78-2aa; 78-21a.

Genus *Megerlia* King, 1850

Megerlia gigantea (Deshayes)

PLATE 6: FIGURES 1-26

Morrisia gigantea Deshayes, 1863:37, pl. 5 (32): figs. 9-11.
? *Mühlfeldtia truncata paucistriata* Jackson, 1921:42 [not illustrated].

DESCRIPTION.—Small, rounded, subrectangular to subpentagonal; valves unequal in depth; dorsal valve varying from slightly concave to gently convex, ventral valve fairly strongly convex. Hinge narrower than midwidth, which is widest part; sides and anterior margin rounded; lateral

pressed to form a faint sulcus. Flanks gently sloping. Interarea short and laterally narrow; beak usually slightly eroded.

Ventral valve interior with a broad, slightly excavate, pedicle collar; teeth strong, oblique, moderately long, and parallel to the delthyrial margin. Ventral pedicle muscles large, diductors reduced. Pedicle short.

Dorsal valve interior with narrow plectolophus lophophore; no cardinal process, diductors located on thickening at apex; socket ridges short, elevated; crura moderately long, stout; crural processes long, narrow, and approximate; descending and ascending lamellae united to form laterally directed expansions joined dorsoventrally by a narrow, arched, transverse band. Lateral branches united with anterior end of a low, thick, median ridge.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve length	Width	Hinge width	Thickness	L/W
MNHN-BRA-78-71a	8.2	6.8	9.1	6.7	4.1	0.91°
MNHN-BRA-78-71b	7.7	5.8	8.7	6.5	3.7	0.89°
MNHN-BRA-78-71c	7.4	6.1	8.7	7.0	3.8	0.85°
MNHN-BRA-78-71d	8.8	7.3	10.1	7.0	4.6	0.87°
MNHN-BRA-78-71e	8.2	7.5	10.0	7.6	4.3	0.82°

commissure straight, anterior commissure slightly and narrowly sulcate. Beak widely obtuse, foramen hypothyriddid, margined by narrow elevated (deltidial?) plates. Interarea curved, gently aspascline to anacline. Surface of ventral valve costellate and spinose, that of dorsal valve faintly costellate but not spinose; both valves with strong concentric lamellae. Finely punctate.

Ventral valve unevenly convex in lateral profile, most convex in umbonal region, flattening anteriorly. Anterior profile forming a broad dome. Middle and umbonal regions swollen; flanks flattened.

Dorsal valve usually flatly convex in lateral profile but varying from slightly concave to gently convex. Anterior profile flat or gently convex. Anteromedian region narrowly and gently de-

STATION.—MD.08: 6, DC 35; 6, DC 43; 6, CC 45; 6, DC 46; 7, DC 57.

TYPES.—Hypotypes: MNHN-BRA-78-71a-i; 78-72a-j; 78-73a-c.

DISCUSSION.—This species has not been known since its early publication. It is a misnomer because it is small compared to other species of *Megerlia*. Deshayes was comparing his species with those of *Morrisia* (*Platidia*), all of which are much smaller than *M. gigantea*. Deshayes (1863:37) commented on his specific name *gigantea* for such a small shell but justifies it in showing that it is the largest species of what he thought to be *Morrisia* = *Platidia*. Although *Megerlia* does not have the foramen shared conspicuously by the dorsal valve, nevertheless some specimens are abraded on the dorsal beak area. *Megerlia gigantea* has a strong

reentrant at the dorsal beak and no cardinal process and thus suggests the condition in *Platidia* and *Megerlia*. Dall (1920:336) suggested that Deshayes species belonged to *Pantellaria*, which is a *Megerlia* having the dorsal beak excavated and the dorsal valve without costellae or granules. Following Dall's lead Thomson (1927:229) placed Deshayes species in *Pantellaria*. *Megerlia gigantea* cannot be regarded as *Pantellaria* because its beak characters and ornament are not in accordance with those characters of that genus. The dorsal beak of *M. gigantea* is not strongly excavated and the dorsal valve is ornamented but not to the same degree as its ventral valve. The loop of *M. gigantea*, as figured by Deshayes (1863, pl. 5: fig. 10), is an accurate depiction of the loop of *Megerlia*.

Jackson (1921:44) thought that *M. gigantea* resembled his *Mühlfeldtia* = *Megerlia truncata paucistriata* because of the "scanty nature of the striae [= costellae]." Deshayes' name misled Fischer and Oehlert (1891:84) into thinking that *M. gigantea* was larger than *M. truncata* (Linné). Davidson (1887:105) believed that Deshayes species was the same as the Mediterranean *M. truncata* and was suspicious of its locality.

Specimens of *Megerlia* identified as *M. echinata*, or similar to that species, have been found in several widely scattered areas off the coast of Florida, in the Caribbean, off the Cape of Good Hope, Africa, and off New South Wales. Unfortunately, these occurrences are rare and few specimens are known. A specimen from off the Cape of Good Hope was figured by Cooper (1973a, pl. 1: figs. 1-3). It differs from *M. gigantea* in having a much more strongly convex ventral valve, a concave dorsal valve, and a more excavated dorsal valve beak than *M. gigantea*. The single specimen from off New South Wales is larger, more strongly costellate, and has a more convex dorsal valve than *M. gigantea*. In absence of good populations for study and comparison, it is not possible adequately or accurately to evaluate single isolated specimens.

Megerlia echinata (Fischer and Oehlert) from *Talisman* station 74, off the coast of northwest

Africa, is somewhat larger than *M. gigantea*, has a fairly strongly excavated dorsal valve beak, and dorsal valve generally concave and nearly without ornament.

LOOP DEVELOPMENT.—A dorsal valve 1.6 mm long (MNHN-BRA-78-72a) has a minute median cone open on its anterior side and cemented to the floor of the valve without any trace of a median ridge. The peripheral margins of this specimen are armed with fairly high nodes. The specimen of the next size, 2 mm long (MNHN-BRA-78-72b), shows the cone still open anteriorly, expanded laterally and ventrally. The cone is supported by a short stout pillar that extends posteriorly for a short distance. The next stage, 3.3 mm long, (MNHN-BRA-78-72d) has a much more ventrally elongated and widened cone. The median ridge extends to the notothyrial cavity, the floor of which is thickened. The socket ridges are expanded, thickened, and cuplike. An incipient crus extends from their anterior side. A specimen 3.5 mm long (MNHN-BRA-72e) shows the crus and crural process attached to the side of the septum and an essentially adult loop. Succeeding stages to old age show a widening loop with elongating anterolateral extensions, a thickening of the median ridge and of the floor of the notothyrial cavity.

Family TEREBRATELLIDAE King, 1850

Subfamily TEREBRATELLINAE King, 1850

Genus *Aerothyris* Allan, 1939

In the southern Indian and Antarctic oceans there are numerous species of terebratellids, all in the *Magellania* stage of loop development. The proper generic name to apply to these is as difficult a problem as establishment of their correct specific names. Foster (1974) preferred to call certain of them *Magellania*, especially those that concern us here: *M. kerguelenensis* (Davidson) and *M. macquariensis* Thomson. These two conform to *Magellania* in having dorsally convergent inner hinge plates and a well-developed cardinal pro-

cess, as well as the magellaniform loop. They do not conform to *Magellania* when compared to *M. flavescens* (Lamarck), the type species of *Magellania*. Typical *Magellania* is an elongate, rather narrowly oval brachiopod having strong costae around its margins and for some distance toward the smooth beak. Its beak is strongly protuberant, straight, narrow with a large foramen and large, completely visible symphytium. Allan (1939:246) proposed the name *Aerothyris* for *M. macquariensis* and considered the important generic characters its smooth shell and disjunct deltidial plates. To confuse the definition, some specimens of *Aerothyris* have conjunct deltidial plates (see below) although they are usually a small minority in any population.

To use the name *Magellania* for the several smooth but variable species with magellaniform loop in the Southern Hemisphere is confusing in the extreme. Nevertheless, it must be admitted that, although some smooth species obviously are not *Magellania* or *Aerothyris*, yet to define them in rigid terms as separate genera has still to be accomplished. *Magellania? venosa* (Solander), the large brachiopod from both sides of the south end of South America, is an example. More exploration and more collections of fossil as well as recent specimens are needed before the various lines of evolution of the Terebratellidae will be separated and properly defined.

The numerous specimens of brachiopods with magellaniform loop collected by the cruises of M/S *Marion Dufresne*, offer a difficult problem because they are very variable with unlike end members and with complete intergradation between the extremes. At one end of the series are smooth nearly circular shells while at the other end they are elongate oval, large or small.

Two species have been described from the vicinity of Kerguelen Island: *Waldheimia kerguelenensis* Davidson and *Terebratella enzenspergeri* Blochmann. The former was taken by the *Challenger* expedition (Davidson, 1878) and was reported as abundant in the vicinity of Kerguelen and Marion Islands. To illustrate his species, Davidson selected elongate oval specimens having a narrow,

often slit-like (keyhole) foramen. He noted (1880: 40) that, "It varies in dimensions from 2 to 44 mm. Some examples were nearly circular, and as broad as long, but the majority were of an elongated oval shape, becoming ventricose with age." It is evident therefore that Davidson was dealing with a variable species. Some of the variation and at least one of the populations taken by M/S *Marion Dufresne* (MD.08) proves very similar to *Magellania macquariensis* Thomson, from Macquarie and Antipodes islands, southwest of New Zealand. In discussing *M. macquariensis* and its affinities with *W? kerguelenensis*, Foster (1974:141) remarks: "This species appears slightly closer to *Magellania* [*Aerothyris*] *kerguelenensis* than to any other terebratellid species. Rare individuals of this species [*M. macquariensis*] have the same type of foramen [keyhole type] as *M. kerguelenensis*. Some specimens of *M. kerguelenensis* have cardinalia that differ little from those of *M. macquariensis*." The interior of *A. kerguelenensis* is usually more heavily calcified than that of *M. macquariensis*.

Terebratella enzenspergeri Blochmann, a round brachiopod, is the other species close to *kerguelenensis* from Kerguelen Island. It is poorly known and there are problems concerning its true specific identity. These two species, *kerguelenensis* and *enzenspergeri*, and their relation to one another, are described and discussed below.

Summary of Measurable Populations of *Aerothyris*

CRUISE MD.03

Station 14, DC 8. *Aerothyris kerguelenensis* (Davidson): Thirty-six specimens ranging from 14.4 to 36.0 mm in length and 14.6 to 34.0 mm in width. L/W ranges from 0.96 to 1.15, with an average of 1.10 (22 specimens 1.10 or below); T/W ranges from 0.51 to 0.74 with an average of 0.61. Of all Specimens, 94% have foramen width 2.0 mm or below (Figures 8, 23, 26).

Station 14, CB 3. *Aerothyris kerguelenensis* (Davidson): Twenty-one specimens measured with

range in length of 19.1 to 33.7 mm and in width of 18.2 to 28.0 mm. L/W ranges from 1.01 to 1.24 (11 at 1.10 or below), average 1.10; T/W ranges from 0.53 to 0.76 with 0.61 average. All pedicle openings that could be measured are 2.0 mm (one specimen) or below (Figures 8, 23, 26).

Station 26, CP 17. *Aerothyris kerguelensis* (Davidson): Fifty-five measurable specimens ranging from 5.4 to 39.9 mm in length and 4.6 to 34.5 mm in width. L/W ranges from 0.95 to 1.30, (31 at 1.10 or below), average 1.11; T/W ranges from 0.44 to 0.80 with average of 0.55. Forty-eight percent of the specimens in which the foramen could be measured have the foramen 2.5 mm or above (Figures 12, 23, 26).

Station 30, CP 21. *Aerothyris kerguelensis* (Davidson): Ninety-eight measurable specimens ranging in length from 22.8 to 43.5 mm and in width from 21.0 to 40.7 mm. L/W ranges from 0.98 to 1.24 (56 specimens at 1.10 or below), average 1.09; T/W ranges from 0.48 to 0.80, average 0.58. Of all specimens with measurable foramen, 83% are 2 mm or below (Figures 6, 7, 23, 26).

CRUISE MD.08

Station 9, CP 64. *Aerothyris kerguelensis* (Davidson): Seven measurable specimens with range of length 18.0–41.0 mm, and width 16.0–32.4 mm. The range of L/W=1.05–1.27, with an average of 1.17. The width of the foramen varies between 4.0 and 1.5 mm. Range of T/W=0.51–0.73. Most of the specimens are young adults (Figure 26).

Station 9, CP 65. *Aerothyris kerguelensis* (Davidson): Two measurable specimens respectively length 32.6 mm and 20.3 mm, width 31.0 mm and 18.0 mm. L/W is 1.05 for the larger one, 1.13 for the smaller and with foramen respectively 3 and 2 mm in width. Depth 112 mm.

Station 9, DC 68. *Aerothyris kerguelensis* (Davidson): Nineteen measurable specimens with length range 9.6–35.8 mm and width range 8.7–31.4 mm. Range of L/W=0.97–1.15, with

an average of 1.06 (only 4 specimens 1.10 and over). The range of T/W=0.46–0.58, average 0.50. The diameter of the foramen ranges from 1.0 to 3.5 with 14 measuring two mm or lower. Most of the specimens are young adults, mostly nearly as wide as long. The loop is freed between 11 and 13 mm of the dorsal valve length (Figures 21, 24).

Station 9, CP 75. *Aerothyris kerguelensis* (Davidson): Eighteen measurable specimens ranging in length from 17.6–40.8 mm, and in width from 15.8–35.8 mm. Range of L/W=1.04–1.24, with average of 1.14. Range of T/W=0.51–0.66, average 0.57. Only one specimen L/W=1.04, the remainder above 1.11. The foramen is variable 41% at 3.0 mm, 47% at 2.5 and below, only 12% 2.0 mm and below. Most specimens strongly sulcate (Figures 15, 24).

Station 12, DC 78. *Aerothyris kerguelensis* (Davidson): Twenty-two measurable specimens ranging in length from 10.9–46.7 mm and in width from 9.9–43.5 mm. Range of L/W=1.00–1.34, with average of 1.11, about 87% are below 1.15. Range of T/W=0.42–0.75, with average of 0.55. The foramen is mostly small and keyhole-shaped, 83% being below 1.0 mm. Many of the specimens are large and strongly sulcate (Figures 13, 21, 24).

Station 13, CP 85. *Aerothyris kerguelensis* (Davidson): Six measurable specimens ranging in length from 10.0–44.4 mm and in width from 8.8 to 38.2 mm. The range of L/W=0.99–1.27, with average 1.16; range of T/W=0.43–0.66, with average of 0.59. Two with keyhole aperture, 2 at 2.5–3.0 mm of foramen. Moderately sulcate.

Station 15, DC 87. *Aerothyris kerguelensis* (Davidson): Thirteen specimens measured ranging in length from 18.0 to 31.4 mm and in width from 15.0 to 23.7 mm. The range of L/W=1.10–1.38, with average of 1.19; T/W=0.52–0.83, with average of 0.61. Only one specimen with foramen above 1.5 mm. Very variable lot with unusually narrow specimens with ones wider than long (Figures 21, 24).

- Station 18, DC 107. *Aerothyris kerguelenensis* (Davidson): Four specimens measured ranging 25.6 mm to 34.8 mm in length and from 20.3–28.6 mm in width. L/W ranges from 1.06–1.26, with average of 1.15, and T/W=0.54–0.72, with average of 0.61. Foramen 1.5 or below, three with keyhole form. Adults of middle age. Seven separated ventral valves with conjunct deltidial plates.
- Station 19, DC 110. *Aerothyris kerguelenensis* (Davidson): Four shells ranged in length from 18.0 to 29.4 mm and width 15.7–24.3 mm. L/W range=1.09–1.21 and T/W range=0.48–0.63, with respective averages 1.21 and 0.58. Foramen small, all 1 mm.
- Station 20, CP 116. *Aerothyris kerguelenensis* (Davidson): Seven specimens range in length from 21.3 to 29.8 mm and in width from 18.0 to 27.8 mm. The L/W range=1.06–1.18, averaging 1.11; the T/W range=0.51–0.60, with average of 0.58. Foramen all below 2.0 with most at 1.5 mm. Chiefly young adults.
- Station 22, BB 125. *Aerothyris* aff. *A. macquariensis* (Thomson): Fifty-seven measurable specimens ranging in length from 9.8 mm to 34.9 mm and varying in width from 8.9 mm to 30.5 mm. L/W range=1.03–1.27, with an average of 1.11 (with 37 specimens at 1.10 or below). T/W range=0.40–0.77, with average of 0.61. Of 45 specimens with measurable foramen (those unattached) 33% are 2 mm in diameter or less; the remainder above 2 with three specimens having a foramen of 4 mm diameter (Figures 21, 24, 28, 29).
- Station 25, CP 134. *Aerothyris kerguelenensis* (Davidson): Thirty-five specimens with length from 19.5 to 35.0 mm and width from 16.8 to 26.6 mm. L/W range=1.06–1.30, with average of 1.18; T/W range=0.51–0.79, with average of 0.61. Twenty-nine specimens have L/W=1.11–1.34, showing most specimens to be narrowly oval. The foramen is variable with 54% of the specimens measuring 2.0 mm in diameter or below (Figures 17, 21, 24).
- Station 26, CP 135. *Aerothyris kerguelenensis* (Davidson): Eleven specimens with length ranging from 27.4 to 36.4 and width from 23.7 to 32.8. L/W=1.09–1.18, and averages 1.12 (3 specimens only 1.10 and below); T/W range=0.55–0.62, and averages 0.59. All measurements of the foramen are 2.0 mm or below. Mostly middle age adults (Figures 14, 21).
- Station 27, DC 136. *Aerothyris kerguelenensis* (Davidson): Eight specimens ranging in length from 22.5 to 29.9 mm and in width from 20.0 to 25.7 mm. L/W range=1.05–1.35, with average of 1.17 (all above 1.10); T/W range=0.54–0.82, with average of 0.64. The foramen is 2.0 mm (one specimen) or below. Several specimens with keyhole foramen (Figure 26).
- Station 28, DC 143. *Aerothyris kerguelenensis* (Davidson): Six specimens, narrowly oval, with length ranging from 20.7 to 24.6 and width from 17.3 to 21.5 mm. L/W range=1.14–1.30, with average of 1.19 (none below 1.14). T/W range=0.60–0.65, with average of 0.62. All specimens with foramen below 2.0 mm. Small, elongate forms that occur with *Platidia*.
- Station 28, DC 148. *Aerothyris kerguelenensis* (Davidson): Eighteen specimens with length ranging from 11.4 to 24.6 and width from 10.1 to 21.0. L/W range=1.06–1.24, with average of 1.16 (all but two specimens above 1.12); T/W range=0.54–0.69, average 0.60. All specimens with measurable foramen 2 mm or below. Mostly small and elongate shells, with *Platidia* occasionally attached. (Figures 16, 21, 24.)
- Station 31, DC 156. *Aerothyris kerguelenensis* (Davidson): Two specimens only, length range=25.8–29.5, width 21.8–26.4 mm. L/W=1.12–1.18 and T/W=0.57–0.60. Foramen 3.0 mm and 1.5 mm (keyhole).
- Station 32, DC 162. *Aerothyris kerguelenensis* (Davidson): Five specimens ranging in length from 22.3 to 43.2 mm and in width from 22.3 to 45.5 mm. L/W range=0.95–1.24, and averages 1.09. T/W range=0.50–0.68, and averages 0.56. The foramen is large varying from 3.5 to 4.0 mm. These are mostly large variable forms.
- Station 34, DC 167. *Aerothyris kerguelenensis* (Davidson): Four specimens ranging in length from

- 15.0 to 41.8 mm and in width from 14.6 to 33.3. L/W range=1.03–1.26, average 1.12; T/W range=0.45–0.65, average 0.54. All specimens with foramen at 1.5 mm or below, two with keyhole type.
- Station 40, DC 186. *Aerothyris kerguelenensis* (Davidson): Seven large specimens ranging in length from 31.9 to 36.0 mm and width from 29.6 to 34.6 mm. L/W range=1.03–1.15, averages 1.08; T/W range=0.51–0.59, averages 0.55. Foramen: one at 3.0 mm, two at 1.0 mm, remainder 2.0–2.5 mm. Three specimens with keyhole type foramen. Large wide specimens.
- Station 42, CP 197. *Aerothyris kerguelenensis* (Davidson): Nineteen specimens ranging in length from 21.6 to 42.8 mm and in width from 21.9 to 39.0 mm. L/W range=0.99–1.19, with average of 1.08 (14 specimens 1.10 or below); T/W range=0.46–0.66, with average of 0.56. The diameter of the foramen varies between 1.5 and 3.0 mm, with 89% 2.0 mm or above. Specimens wide and with large foramen (Figures 22, 25).
- Station 45, CP 203. *Aerothyris kerguelenensis* (Davidson): Three specimens, adults with average L/W of 1.03 and T/W of 0.55. The foramen measures 2.0 or below for all three.
- Station 46, CP 204. *Aerothyris kerguelenensis* (Davidson): Twenty-four specimens ranging in length from 19.0 to 33.2 and in width from 16.4 to 31.1 mm. L/W range=0.98–1.10, and averages 1.04 (only 2 specimens 1.10 and above); T/W range=0.50–0.67, and averages 0.56. Most specimens, (82%) have a foramen of 2.0 mm or less. The specimens are mostly wide and rounded, modestly sulcate (Figures 9, 22, 26).
- Station 48, CP 209. *Aerothyris kerguelenensis* (Davidson): Twenty-four specimens ranging in length from 18.7 to 44.6 mm and in width from 18.0 to 38.7 mm. L/W range=1.04–1.48, with an average of 1.19 (21 specimens are 1.10 or above). Many specimens are unusually narrow. T/W range=0.52–0.80, and averages 0.63. Forty percent of the specimens have a foramen 2.5 mm or above; the remainder are 2.0 mm or below; one with keyhole type. These are thick, elongate forms (Figures 18, 22, 25).
- Station 50, DC 216. *Aerothyris kerguelenensis* (Davidson): Twenty-six (average L=13.0 mm), mostly small shells varying in length from 7.0 to 21.5 mm and in width from 6.5 mm to 18 mm. The L/W range=0.99–1.29, with average of 1.13; T/W range=0.44–0.62, with average of 0.52. Fifty-nine percent of the L/W is over 1.10, thus indicating a tendency toward the typical form of *A. kerguelenensis*. Specimens prepared to show the loop indicate a shorter growth period to free the loop from the median septum. A specimen of 12.0 mm has a free loop but the descending branches show projections of the lateral branches not yet resorbed. The largest specimen in this lot has a L/W of 1.19 and is almost a miniature of type *A. kerguelenensis*. (Figure 22.)
- Station 59, DC 252. *Aerothyris kerguelenensis* (Davidson): Four large specimens with average L/W of 1.12 and T/W of 0.56. Foramen 2 mm.
- Station 60, DC 248. *Aerothyris kerguelenensis* (Davidson): Three specimens with average L/W of 1.11 and T/W of 0.60. Foramen 2.0 or below, one with keyhole type.
- Station 60, RK 251. *Aerothyris kerguelenensis* (Davidson): A single specimen of length 29.3 mm and width 26.8 mm and L/W=1.09 and T/W=0.58; foramen 2.0 mm. Strong narrow sulcus.
- Station 62, CP 257. *Aerothyris kerguelenensis* (Davidson): Thirteen specimens ranging in length from 21.6 to 37.7 mm and in width from 20.8 to 33.7. L/W range=1.03–1.30, and averages 1.13 (six specimens only under 1.12); T/W range=0.52–0.73, and averages 0.62. Eighty percent of the specimens have the foramen at 2.0 mm or above (Figures 14, 22, 25).
- Station 73 CP 295. *Aerothyris kerguelenensis* (Davidson): Six specimens with length range 22.8–32.7 and width range 23.7–29.5. L/W range=0.96–1.13 (three specimens below 1.00), and average of 1.02; T/W range=0.48–0.59, average 0.52. Foramen: 5 specimens 2.5 mm or below, one at 3.0 mm. Some specimens round,

nearly circular. No radial striae seen.

Station 74, DC 296. *Aerothyris kerguelenensis* (Davidson): Twenty-three specimens ranging in length from 21.0 to 35.0 mm and in width from 20.3–32.3 mm. L/W range=0.99–1.16, average 1.06 (only 5 specimens above 1.09); T/W range=0.45–0.59, with average 0.54. Foramen: 12% at 3.0 mm or above; 38% at 2.5 mm and the remainder 2.0 mm or below. Mostly rounded oval shells (Figures 10, 22, 25).

Station 75, CP 303. *Aerothyris kerguelenensis* (Davidson): Twenty specimens ranging in length from 23.2 to 39.7 mm and in width from 22.0 to 34.6 mm. L/W range=1.02–1.16 (14 specimens 1.10 or below), average 1.09; T/W range=0.45–0.61, average 0.54. Foramen mostly large, all specimens above 2.0 mm (Figures 11, 22, 25).

Station 75, CP 304. *Aerothyris kerguelenensis* (Davidson): A single specimen 37.8 mm long and 32.3 mm wide with L/W=1.17 and T/W=0.58. Foramen of 3.0 mm.

Station 75, CP 305. *Aerothyris kerguelenensis* (Davidson): Four specimens varying in length from 22.8 mm to 38.2 mm. L/W range=1.08–1.20 (2 specimens at 1.20, average 1.16); T/W range=0.50–0.59. Foramen all 2.0 mm or above.

Station 75, CL 308. *Aerothyris kerguelenensis* (Davidson): Three large specimens with length from 30.5 to 37.0 mm and width 28.7 to 32.3 mm. Average L/W=1.15 (with two at 1.17 and 1.21, the third at 1.06); average T/W=0.57. Size of foramen uncertain because of attachment.

Station 77, DC 314. *Aerothyris kerguelenensis* (Davidson): Seventeen specimens ranging from 19.8 to 33.0 mm in length and 19.6 to 28.0 mm in width. L/W range=1.01–1.27 (only 4 specimens are 1.10 or below), average 1.16; T/W range=0.52–0.69 (all but two above 0.60), average 0.63. Foramen: mostly 2.0 or above, only one at 1.5 (Figures 16, 22, 25).

Station 78, CP 319. *Aerothyris kerguelenensis* (Davidson): Eight specimens ranging in length from 16.4 to 42.0 mm and in width from 16.0

to 32.0 mm. L/W range=1.03–1.31, with average of 1.13 (5 specimens 1.10 or below); T/W range=0.51–0.79, and averages 0.59. Foramen: all 2.0 mm or below.

Station 79, CP 326. *Aerothyris kerguelenensis* (Davidson): Twenty-four specimens ranging from 13.8 to 40.0 in length and 13.8 to 35.5 in width. L/W range=1.00–1.35, with average of 1.09 (10 specimens are 1.10 or below). One specimen with L/W=1.00. T/W range=0.51–0.67, average 0.57. Foramen 85% 2 mm or more (Figures 11, 23, 25).

Aerothyris macquariensis (Thomson) (for comparison with *A. kerguelenensis*): 100 adult specimens ranging in length from 19.2 to 44.7 mm and in width from 16.4 to 42.0 mm. L/W ratio range=0.99–1.36, and averaging 1.13. Thickness range=10.0–25.6 mm. T/W range=0.52–0.74, with average of 0.62. The foramen averages 80% above 2 mm in width (Figures 23, 26; specimens from Harvard station 27–36, Foster 1974:158).

Aerothyris kerguelenensis (Davidson)

FIGURES 6–26; PLATE 4: FIGURES 1–3, 7–9; PLATE 7: FIGURES 1–30; PLATE 8: FIGURES 1–10; PLATES 9–11; PLATE 12: FIGURES 5–27; PLATE 13: FIGURES 16–23.

Waldheimia kerguelensis Davidson, 1878:431; 1880:40, pl. 3: figs. 1–9; 1886:53, pl. 10: figs. 7–17.

W. dilatata Smith, 1879:192.—Studer, et al., 1889:155.

Terebratella dorsata Davidson [not Gmelin] 1880:44, pl. 4: fig. 4.

?*Magellania kerguelensis* [sic] (Davidson).—Eichler, 1911:390, pl. 42: fig. 7; pl. 43: fig. 16.

Magellania kerguelenensis (Davidson) Jackson, 1918:179.—Foster, 1974:137, fig. 3, part 33; 31K,L; pl. 20: figs. 2–4, pl. 24: figs 5–7.

Terebratella enzenspergeri Blochmann, 1906:697.—Eichler, 1911:12, pl. 42: figs. 10a,b; 11a–d.

Terebratella? *enzenspergeri* Blochmann.—Foster, 1974:109, fig. 3, part 18; 30I, J; pl. 18: figs. 10–12; pl. 22: fig. 10;

?*Aerothyris eichleri* Allan, 1939:245.

DESCRIPTION.—Medium to large, approaching 2 inches (51 mm) in length, valves subequal in

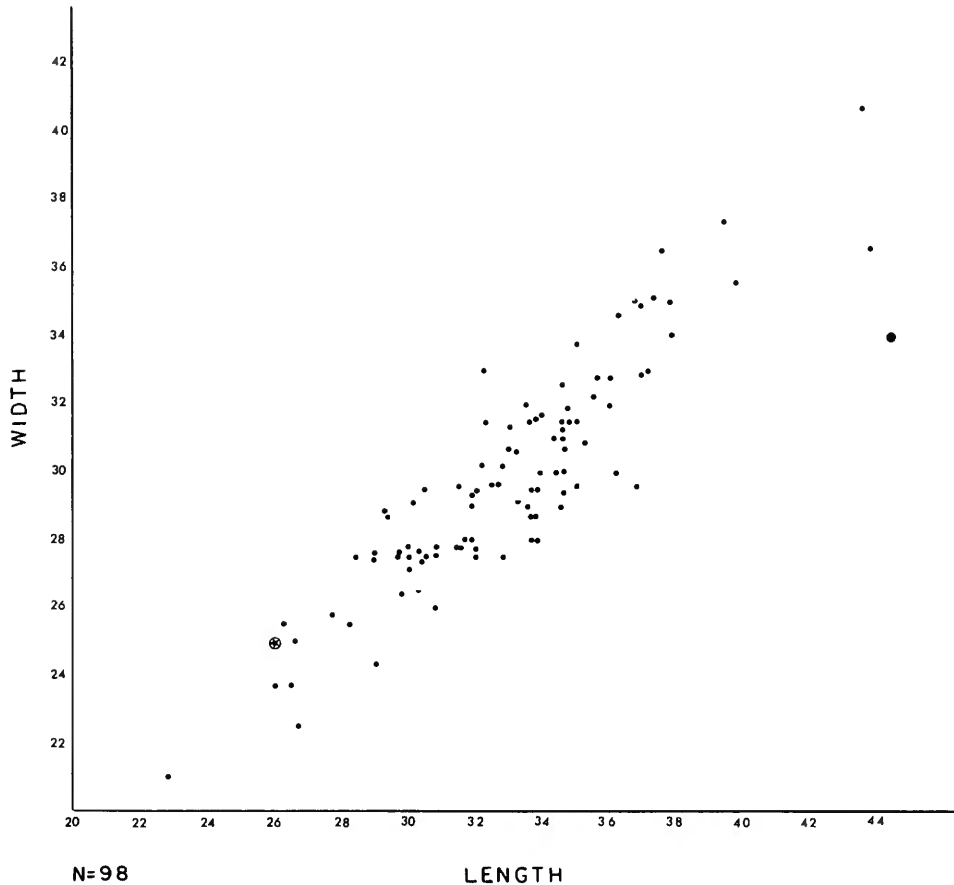


FIGURE 6.—Scattergram showing length/width relationship of *Aerothyris kerguelensis* (Davidson) of 98 specimens from MD.03: station 30, CP 21 (circled star = position of *A. enzenspergeri* (Blochmann); large dot = position of type specimen of *A. kerguelensis*).

depth, ventral valve usually deeper than dorsal one. Outline variable, usually longer than wide with maximum width at midvalve, subcircular, subrhomboidal to elongate oval. Sides rounded, anterior margin broadly to narrowly rounded to subnasute. Posterolateral margins forming an apical angle of 80° – 105° . Lateral commissure straight or faintly sigmoidal; anterior commissure sulcate from faint to fairly strong. Beak variable, often posteriorly abraded, usually short, suberect to strongly incurved (erect); beak ridges subangular and strongly marked in the young, setting off a narrow interarea, more rounded in old shells. Foramen variable from widely circular (4 mm diameter) to narrowly elliptical (less than 1 mm

in diameter) taking the form of a keyhole. Deltoidal plates usually disjunct, occasionally conjunct, often partially or wholly eliminated by pedicle pressure. Pedicle usually short, with short “rootlets” at its distal end. Color yellowish white, surface smooth except for incremental lines of growth more or less strongly developed and often concentrated anteriorly and marginally. Punctae varying from about 80 to slightly over 100 per square mm. counted near midvalve.

Ventral valve gently and fairly evenly convex in lateral profile with maximum convexity in umbonal region; anterior profile strongly convex with a rounded, posteriorly narrow, median keel extending from beak to anterior margin as a more

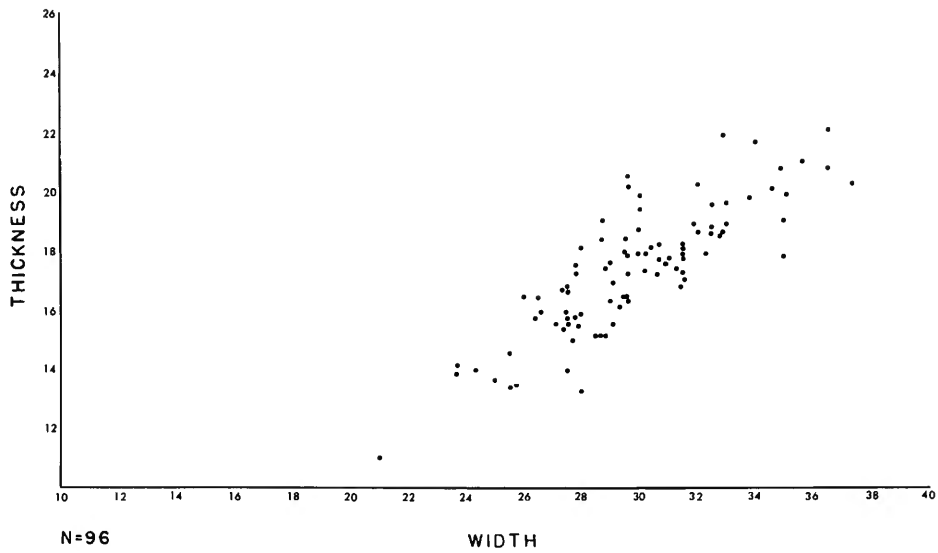


FIGURE 7.—Scattergram showing thickness/width of 96 specimens of *A. kerguelensis* (Davidson) from MD.03: station 30, CP 21.

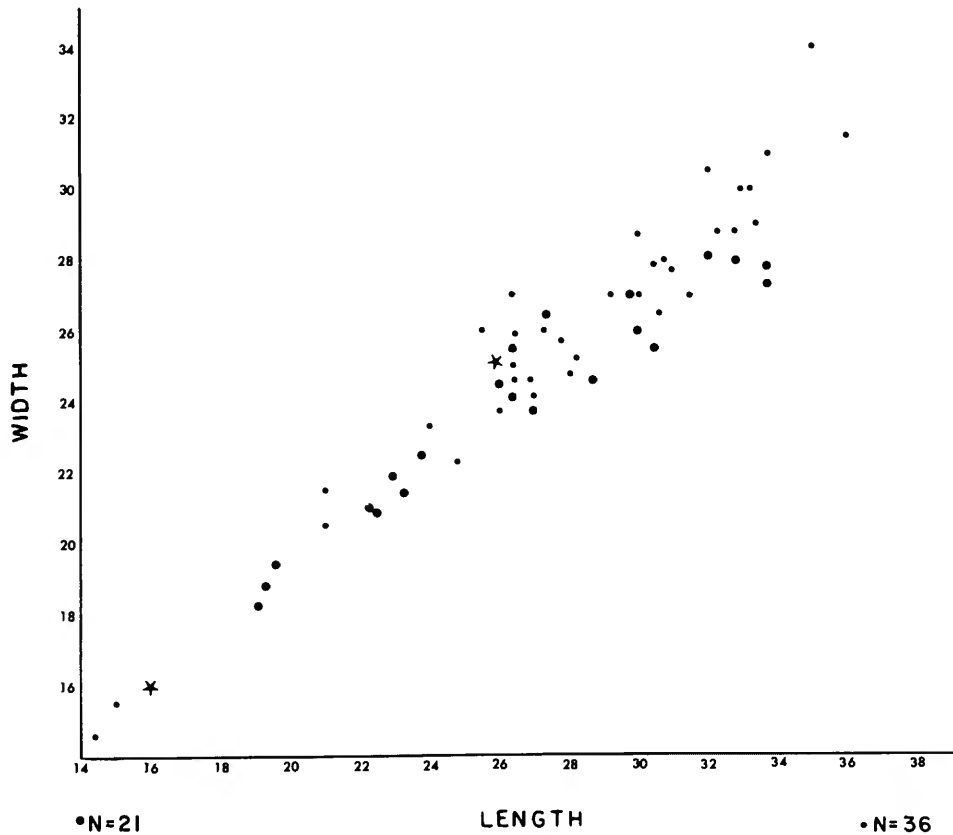


FIGURE 8.—Scattergram of length/width *A. kerguelensis* (Davidson) from MD.03: stations 14, DC 8 and 14, CB 3 (large dots = 14, CB 3, 21 specimens; small dots = 14, DC 8, 36 specimens; stars = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson)).

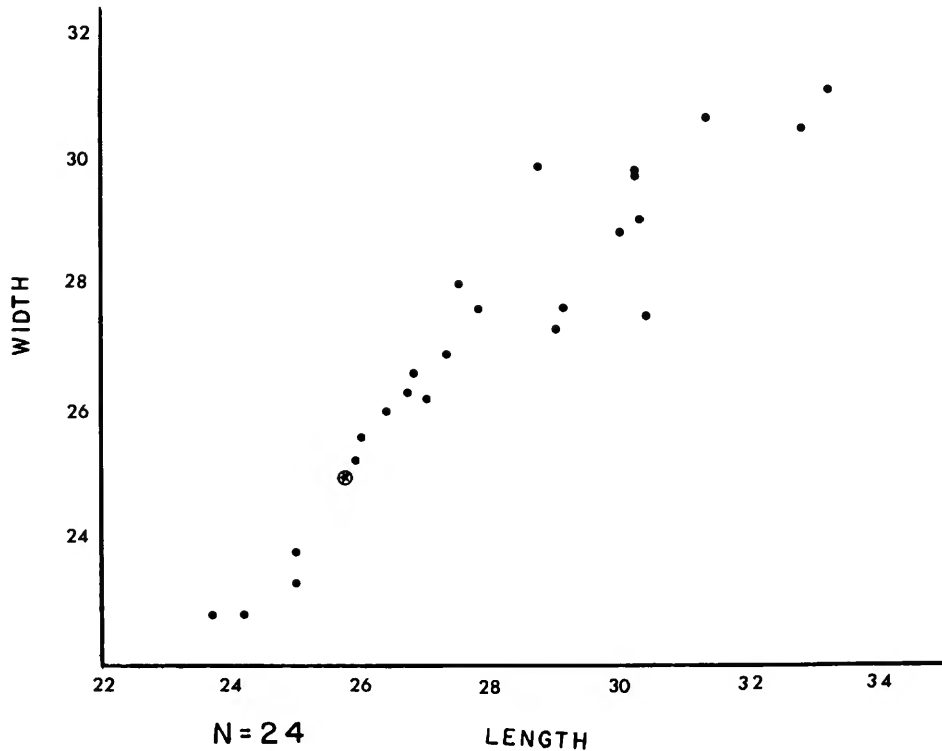


FIGURE 9.—Scattergram of 24 specimens of *A. kerguelensis* (Davidson) from MD.08: station 46, CP 204 showing length/width relationship ($L/W=1.04$ of 24 specimens; circled star = position of *A. enzanspergeri* (Blochmann) = *A. kerguelensis* (Davidson)).

or less well-marked fold, occasionally produced into a subnasute extension; lateral slopes flattened, moderately steep.

Dorsal valve slightly more convex than ventral one with maximum swelling in posterior half; anterior half somewhat flattened. Umbonal region swollen; sulcus obscure in young, beginning near midvalve, shallow and only slightly depressed, forming a channel with slightly convex to flat bottom. Sulcus when pronounced forming a short anterior tongue. Flanks bounding sulcus narrow, steeply sloping.

Ventral valve interior with variable, sessile, pedicle collar. Teeth moderately large, obliquely elongated, tapering medially and supported by callus thickening. Delthyrial cavity deep; muscle field reaching $1/3$ to $1/4$ the valve length from the beak. Diductors large, forming an elongate patch; accessory diductors small, the two sets attached to a strap-like tendon that in turn at-

taches to the cardinal process (Plate 8: figure 10). Muscle scars usually well impressed and divided by a low median ridge. Pallial trunks (vascula myaria) broad, extending from each side of the diductors directly to the anterior margin, with 3 lateral branches, (Plate 9: figure 5).

Dorsal valve interior, variable with age. Cardinal process of young broadly elliptical, bilobed, with concave roughened myophore, in old age thickened anteriorly to form a stout bulbous shaft with myophore enclosed by elevated rim. Socket ridges of young thin and erect, bounding narrow sockets, becoming greatly thickened with age; inner hinge plates* of young well defined, meeting the median septum to form umbonal cham-

* Dagis (1974:15-17) suggests use of septal plates rather than inner hinge plates for these struts because they are different from the horizontal, often secondary, inner hinge plates of the terebratulaceans.

bers, in old age becoming obsolete by filling of lateral umbonal chambers. Median septum in young forming a thin wall tapering to about midvalve, greatly thickened and partially buried in old specimens. Loop magellaniform in shells from 16 or 17 mm to full adulthood. Crura very short, flat in section. Crural processes long and needlelike. Pallial trunks forming pinnate (apocopate) pattern consisting of two unbranched direct vascula media extending from anterior end of adductors to anterior margin and lateral vascula myaria extending from sides of adductors to anterior margin as two broad channels with six lateral branches. (Plate 9: figure 4).

MEASUREMENTS (mm) OF SPECIMENS FROM MD:
03, STATION 30, CP 21 (Plate 7).—

<i>Specimen</i>	<i>Length</i>	<i>Dorsal valve length</i>	<i>Width</i>	<i>Thick- ness</i>	<i>Apical angle</i>	<i>L/W</i>	<i>T/W</i>	<i>Foramen diam.</i>
MNHN-BRA-78-75a	43.7	37.8	40.7	26.0	98°	1.05	0.59	1.3
MNHN-BRA-78-75b	37.9	34.6	32.4	19.7	98°	1.17	0.61	2.0
MNHN-BRA-78-75c	32.8	29.4	27.5	16.7	88°	1.15	0.61	2.5
MNHN-BRA-78-75d	26.5	24.0	22.7	13.8	97°	1.17	0.61	1.5
MNHN-BRA-78-75e	22.8	20.1	20.9	11.0	97°	1.09	0.52	1.5
MNHN-BRA-78-75f	19.2	16.8	16.7	9.3	94°	1.15	0.56	1.5
MNHN-BRA-78-75g	24.7	21.9	21.9	11.6	93°	1.13	0.53	2.0
MNHN-BRA-78-75h	14.1	12.5	13.0	7.0	81°	1.08	0.54	1.0

MEASUREMENTS (mm) OF SPECIMENS FROM MD:
08, STATION 12, DC 78 (Plate 9).—

<i>Specimen</i>	<i>Length</i>	<i>Dorsal valve length</i>	<i>Width</i>	<i>Thick- ness</i>	<i>Apical angle</i>	<i>L/W</i>	<i>T/W</i>	<i>Foramen diam.</i>
MNHN-BRA-78-83g	44.0	38.2	39.0	22.0	104°	1.13	0.56	1.3
MNHN-BRA-78-83h	40.8	36.4	38.6	21.3	113°	1.06	0.55	3.5
MNHN-BRA-78-83i	38.4	34.0	34.5	19.3	100°	1.11	0.56	1.0
MNHN-BRA-78-83a	36.0	30.5	30.0	20.6	92°	1.20	0.69	1.5
MNHN-BRA-78-83e	19.9	18.0	20.0	10.5	95°	1.00	0.53	1.25
MNHN-BRA-78-83f	44.3	38.6	36.9	27.8	97°	1.20	0.75	3.0

MEASUREMENTS (mm) OF SPECIMENS FROM MD:
08, STATION 42, CP 197. —

<i>Specimen</i>	<i>Length</i>	<i>Dorsal valve length</i>	<i>Width</i>	<i>Thick- ness</i>	<i>Apical angle</i>	<i>L/W</i>	<i>Foramen width</i>
MNHN-BRA-78-120a	35.7	36.2	33.7	20.3	102°	1.06	2.0
MNHN-BRA-78-120b	37.7	32.8	35.5	19.5	94°	1.06	2.5
MNHN-BRA-78-120c	39.3	35.0	33.8	21.6	101°	1.16	3.0
MNHN-BRA-78-120d	36.4	32.3	33.2	10.8	102°	1.09	4.0
MNHN-BRA-78-120e	34.0	29.7	31.6	17.5	102°	1.08	3.0
MNHN-BRA-78-120f	36.2	30.9	32.8	17.8	91°	1.11	3.0
MNHN-BRA-78-120g	42.8	37.6	36.8	24.3	105°	1.16	3.5
MNHN-BRA-78-120h	32.0	28.7	27.0	18.0?	88°	1.18	2.5

I am grateful to Dr. Howard Brunton, British Museum (Natural History) for the above measurements. These clearly indicate the specimens used by Davidson in creating *A. kerguelensis*. It will be noted that the pedicle foramen is variable and that all specimens have disjunct deltidial plates. The L/W is very variable; all but one specimen is over 1.03 and one is 1.41. These show that Davidson selected mainly oval specimens to illustrate the species, because all of the figured specimens except one, have L/W in excess of 1.10.

BATHYMETRIC RANGE.—6–930 m.

STATIONS (underlined stations have measured populations represented by scattergrams).—

MEASUREMENTS (mm) OF TYPE SPECIMENS IN
THE BRITISH MUSEUM (NATURAL HISTORY) (Figure
19).—

BMNH Cat. No.	Plates and figures*	Length	Width	Thick- ness	Foramen width	Deltidial plates	L/W	T/W
ZB 1007		10.5	10.2	ca. 6.0	1.0	disjunct	1.03	0.59
ZB 1078	10:16 (3:8)	28.5	25.0	?	?	?	1.14	?
ZB 1080	10:7 (3:1)	43.5	35.0	28.2	1.5	disjunct	1.24	0.81
ZB 1081	10:8 (3:2)	39.5	35.4	24.7	1.6	disjunct	1.12	0.70
ZB 1082	10:9 (3:5)	33.6	28.0	ca. 19.5	1.3	disjunct	1.20	0.70
ZB 1083	10:10 (3:4)	30.5	25.2	17.0	2.0	disjunct	1.21	0.67
					(eroded)			
ZB 1084		26.6	24.4	15.5	2.6	disjunct	1.11	0.65
					(eroded)			
ZB 1085		24.5	18.5	?	1.8	disjunct	1.32	?
					(eroded)			
ZB 1086	10:12	21.0	16.5	11.2	1.5	disjunct	1.27	0.68
					(eroded)			
B 12436a		28.9	ca. 23.0	ca. 17.0	1.6	disjunct	1.26	0.74
					(eroded)			
B 12436b		26.0	ca. 18.5	13.2	1.9	disjunct	1.41	0.71
					(eroded)			
B 12436c		38.2	34.4	23.0	1.7	disjunct	1.11	0.67

* Plate 10 is in Davidson, 1886; the figures in parentheses refer to the same figures on plate 3 in the *Challenger* report (Davidson 1880).

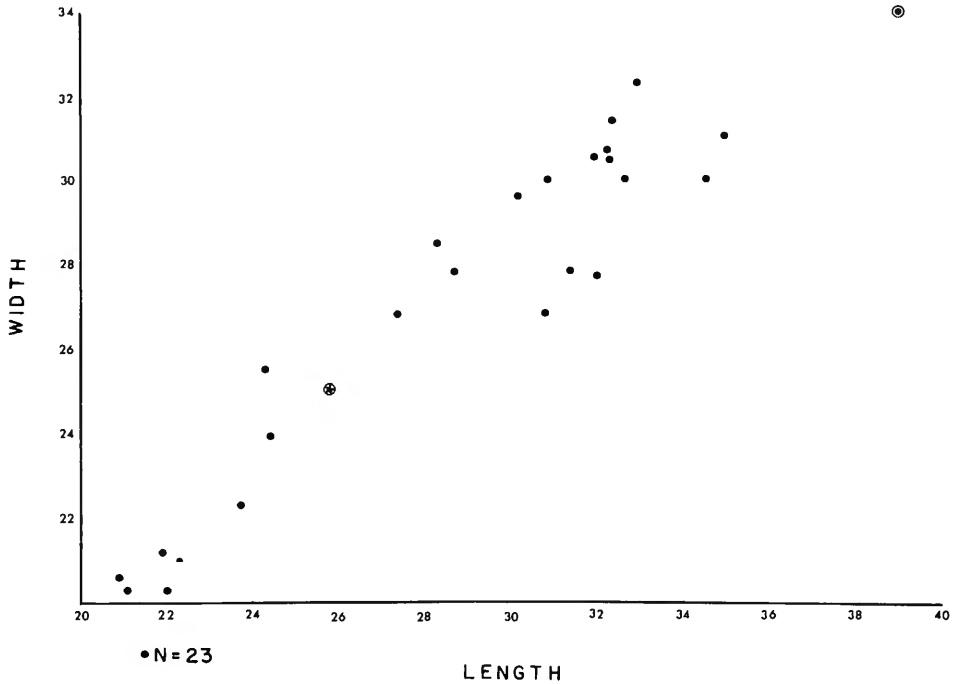


FIGURE 10.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08; station 74, DC 296, 23 specimens ($L/W = 1.06$; circled star = position of *A. enzenspergeri* (Blochmann)); circled dot = position of type *A. kerguelensis*).

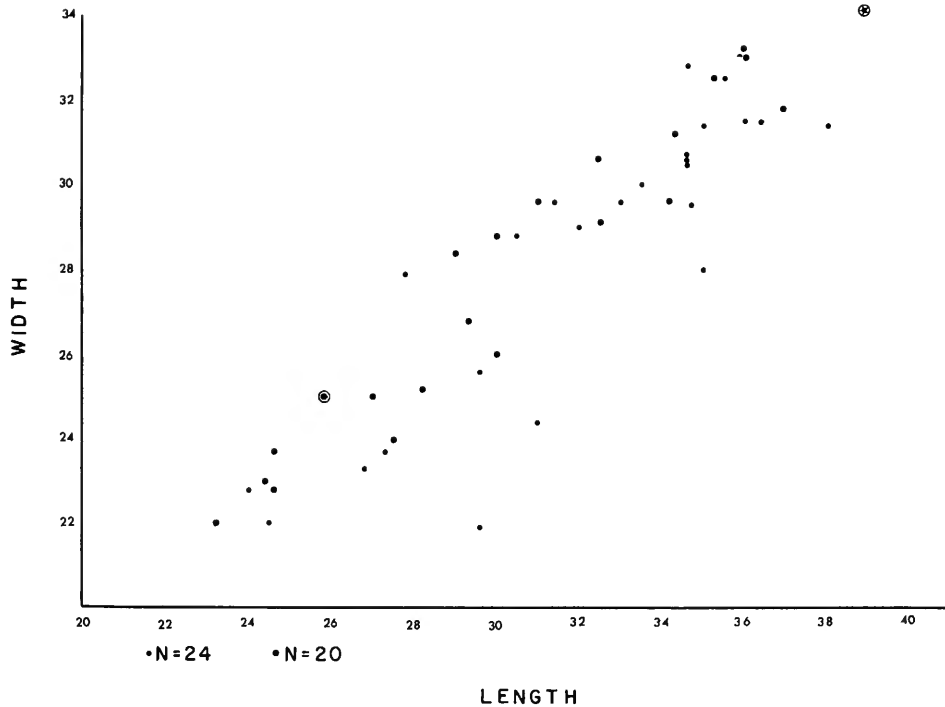


FIGURE 11.—Scattergrams of length/width of 2 lots of *A. kerguelensis* (Davidson) from MD.08: station 75, CP 303, 20 specimens (large dots) and 79, CP 326, 24 specimens (small dots) (both $L/W=1.09$; circled dot = position of *A. enzenspergeri* (Blochmann); circled star = place of type *A. kerguelensis*).

MD.03: 2, DC 1; 2, CB 2; 9, DM 2; 9, DM 4; 10, DC 7; 11, CP 7; 14, DC 8; 14, CB 3; 23, CP 16; 24, CB 6; 25, CB 7; 26, CP 17; 30, CP 21; 31, CP 22.

MD.08: 9, CP 64; 9, CP 65; 9, CP 66; 9, DC 68; 9, BB 69; 9, CP 74; 9, CP 75; 12, DC 78; 12, BB 79; 15, DC 87; 15, BB 88; 16, CL 95; 17, DC 96; 17, BB 97; 18, DC 107; 18, BB 108; 18, RK 109; 20, DC 116; 21, DC 118; 25, CP 134; 26, CP 135; 27, DC 136; 28, DC 143; 28, DC 148; 31, DC 156; 32, DC 162; 33, DC 164; 34, DC 167; 34, BB 168; 36, DC 173; 36, CP 175; 39, DC 178; 39, BB 183; 40, DC 185; 40, DC 186; 42, CP 197; 45, CP 203; 46, CP 204; 48, CP 209; 50, RK 217; 50, DC 216; 50, BB 218; 51, DC 221; 52, DC 224; 54, DC 234; 55, CP 237; 59, DC 252; 59, BB 253; 60, DC 248; 60, RK 251; 61, DC 255; 62, CP 257; 64, DC 286; 67, DC 271; 67, BB 273; 71, DC 283; 71, BB 285-286; 72, DC 289; 72, BB 291; 73, CP 295; 74, DC 296;

74, BB 297; 75, CP 303; 75, CP 305; 75, CL 306; 75 CL 308; 76, DC 309; 77, DC 314; 77, BB 315; 78, CP 319; 79, DC 322; 79, BB 323; 79, CP 326; Marion Island III, Z63.

TYPES.—Hypotypes: MNHN-BRA-78-27a,b; 75a-i; -76a-e; -77a-c; -78; -79; -80; -81; -83a-e; 84; -85; -86; -87; -90a-d; -92; -93; -94a-d; -95; 96; -98; -99a-c; -100; -101; -102; -103; -104; -106; -107; -108; -109; -110; -111; -116; -117; -118; 120; -121.

DISCUSSION.—The above measurements show some of the variability in samples of 3 populations of *A. kerguelensis*. Davidson in describing his species mentioned the variability in passing, but figured specimens that seem to be rather extremes in the general population of this species. The specimen figured (Davidson, 1880, plate 3: figures 1a,b) is unlike any in the collections available to me in the prominence of the lateral folds bounding the dorsal valve sulcus. His figure 2 on the

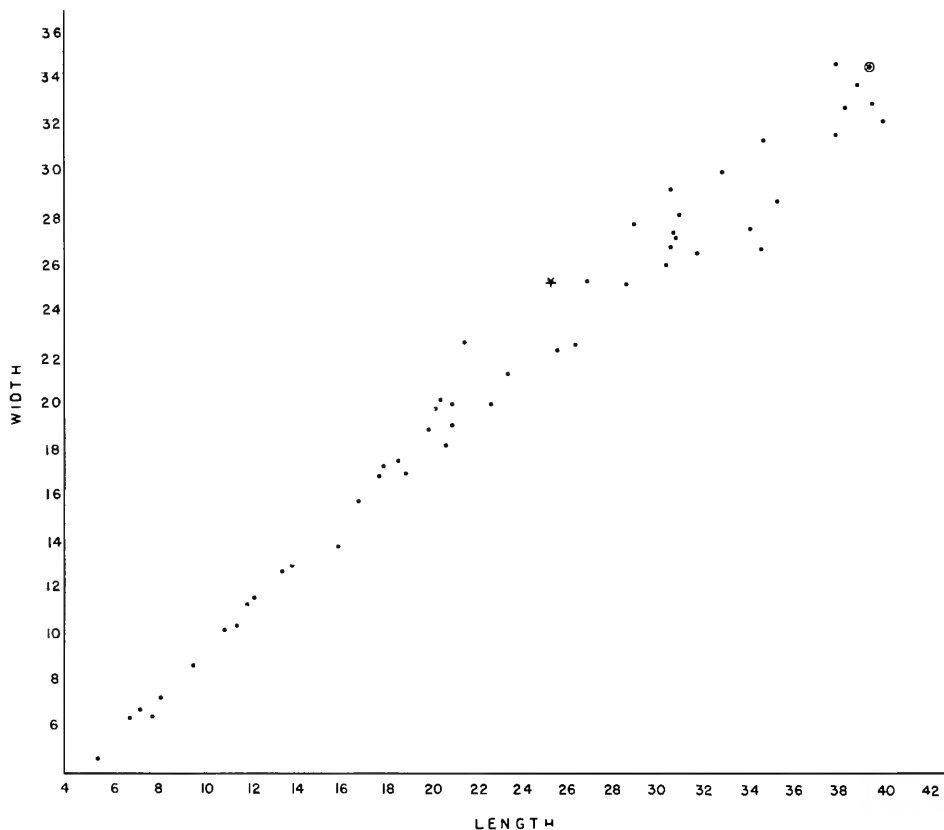


FIGURE 12.—Scattergram of length/width of *A. kerguelenensis* (Davidson) from MD.03: station 26, CP 17, 50 specimens ($L/W=1.11$; circled star = position of type *A. kerguelenensis*; solid star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelenensis* (Davidson)).

same plate shows a rounder and less folded specimen such as that measured above MNHN-BRA-78-75b.

VARIATION.—The samples of various populations taken by cruises MD.03 and MD.08 show extreme variability from predominantly round specimens suggestive of *Aerothyris macquariensis* to elongate narrow ones. The L/W of the average populations studied in this report vary from 1.02 to 1.19. The specimens figured by Davidson and specimens from the *Challenger* collection in the National Collection appear in the higher part of the range with L/W averaging 1.21. These specimens are narrowly elliptical and have a fairly strongly curved beak. They are not however typical of the species. Specimens ranging in L/W between 1.15 and 1.20 are predominantly small and elongate oval. Davidson selected prominent

but uncommon specimens to illustrate his species. Many of these small specimens agree in proportions with topotypes of *A. kerguelenensis* in all particulars but size. One of the distinctions between *A. macquariensis* (Thomson) and *A. kerguelenensis* is the greater calcification of the interior of the latter. Adults of all the populations considered in this paper, save one, are in general more heavily calcified than is usual in the Macquarie Island species. The exception is the collection from MD.08: station 22, BB 125, which is discussed below, the specimens being referred to *Aerothyris* aff. *A. macquariensis* (Thomson).

DELTAIDIAL PLATES.—The deltidial plates are variable in all *Aerothyris* populations that concern us. In a population from MD.03: station 14, DC 8 an unusual 12 specimens out of 45 proved to have conjunct deltidial plates, just over 25%. Of

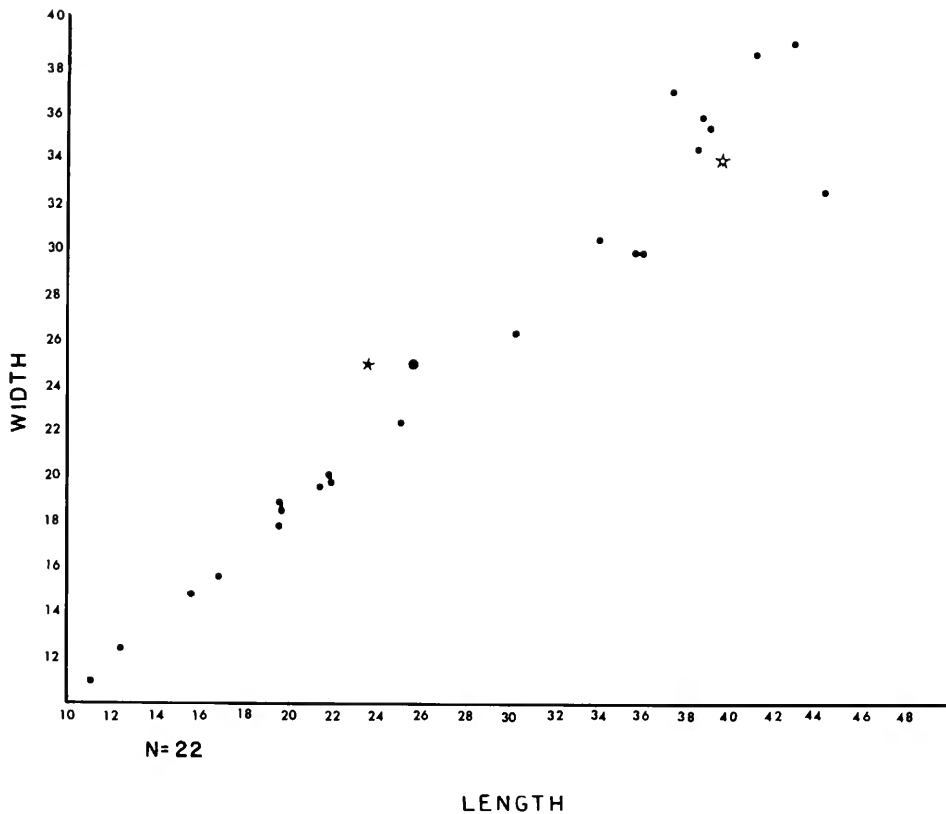


FIGURE 13.—Scattergram of length/width of *A. kerguelenensis* (Davidson) from MD.08: station 12, DC 78, 22 specimens ($L/W=1.11$; solid star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelenensis* (Davidson); open star = position of type *A. kerguelenensis*)

the 12 specimens all except one are large adults. The conjunct deltidial plates or deltidium is usually short with the foramen elongate, oval, and submesothyridd in position. At MD.03: station 30, CP 21, only 2 specimens out of 65 had conjunct deltidial plates. A number of isolated and broken ventral valves from MD.08: station 18, DC 107 have conjunct deltidial plates. The plates are united at their anterior extremity as a thin line and the joined edges bend ventrally and are marked externally by a depressed line of junction (Plate 12: figures 13–16). The development of conjunct deltidial plates may be a reaction to reduction in the size of the pedicle, possibly signalling its atrophy. It is known that some terebratulid brachiopods, *Neothyris lenticularis* (De-shayes), lie loose on the seabottom weighted down by the great thickening of the ventral umbonal

region (Allan, 1937:160; Lee, 1978:402; Foster, 1974:100) after reduction of the pedicle.

FORAMEN.—Features of *A. kerguelenensis* emphasized by Davidson and Foster are the size and shape of the foramen. In some specimens the foramen is large, measuring as much as 4 mm in diameter, but in others it is extremely narrow, often somewhat oval, and measuring one mm or slightly less at its widest part. These narrow openings often have an accompanying near conjunction of the deltidial plates that leave a narrow slit under or anterior to the foramen, producing the “keyhole” type of foramen that is said to be a distinguishing mark of the species (Plate 9: figures 9, 12, 21, 24, 25). This type of foramen may occur in wide or narrow shells and is known also to occur spasmodically in *Aerothyris macquariensis* (Thomson) (Foster, 1974). Specimens with wide

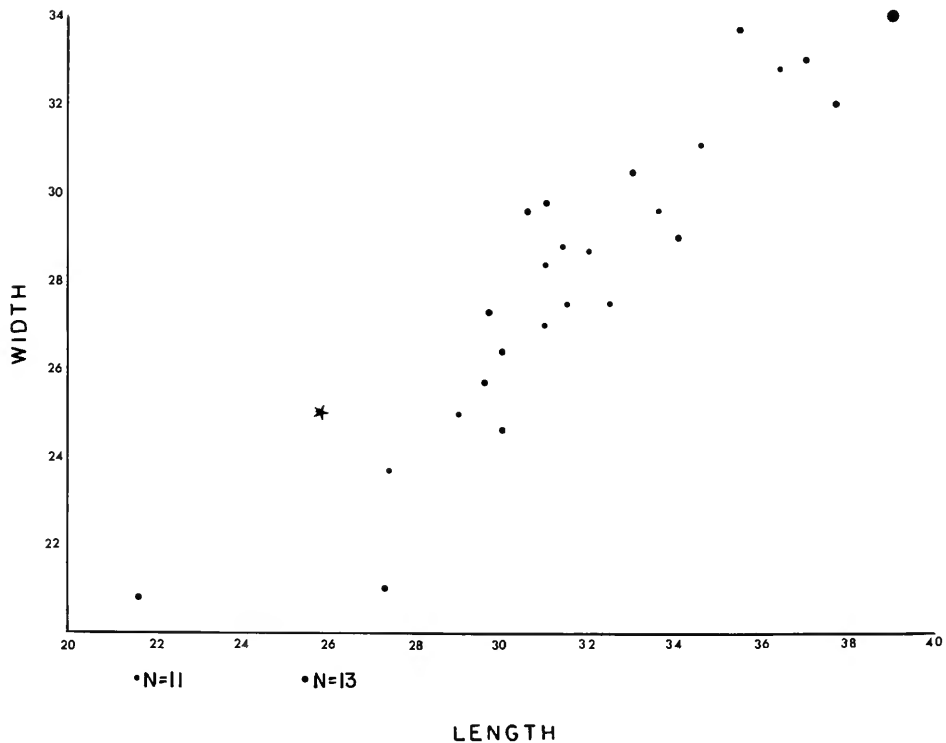


FIGURE 14.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08: station 26, CP 135, 11 specimens (small dots); $L/W=1.12$ and station 62, CP 257, 13 specimens (large dots; $L/W=1.13$; very large dot = position of type *A. kerguelensis*; star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson).

foramen usually have the beak short and nearly straight, often with some sign of abrasion. These shells were undoubtedly fixed close to the substrate by a short, stout pedicle. The keyhole foramen usually occurs in specimens having a suberect or incurved beak signifying a long slender pedicle. It is possible that the keyhole is a development toward, or as a consequence of, atrophy of the pedicle and development of free living on the bottom. No sure correlation was found between type of bottom and size of the pedicle. Specimens from MD.08: station 75, CP 303 have a high percentage of specimens with large foramen and live on sand and gravel. Specimens from MD.08: station 28, DC 148 live on coarse sand and gravel but have a predominantly small foramen. Specimens from all of the stations having muddy bottom had predominantly small pedicle openings. No correlation between depth and size of pedicle opening was found.

In considering the taxonomic value of the pedicle opening, it was decided arbitrarily to regard lots with a pedicle predominantly above 2 mm in diameter as having a large foramen; from 2 mm and below the foramen is regarded as small. It will be noted that the lots usually contain both types, one usually predominant over the other.

LOOP DEVELOPMENT.—No complete series from a single population occurs in the collection but tiny specimens 2.5–6 mm in length are present in the collection from MD.08: station 40, DC 186, together with a well-preserved loop in a specimen of 13 mm. The specimens at this station are fairly round, average $L/W=1.08$. A fair idea of the complete story of the loop development can be obtained from specimens from MD.03: station 26, CP 17 ranging in length from 7.5 mm to 17 mm. Specimens from this station are somewhat longer than those of the preceding series (average $L/W=1.12$).

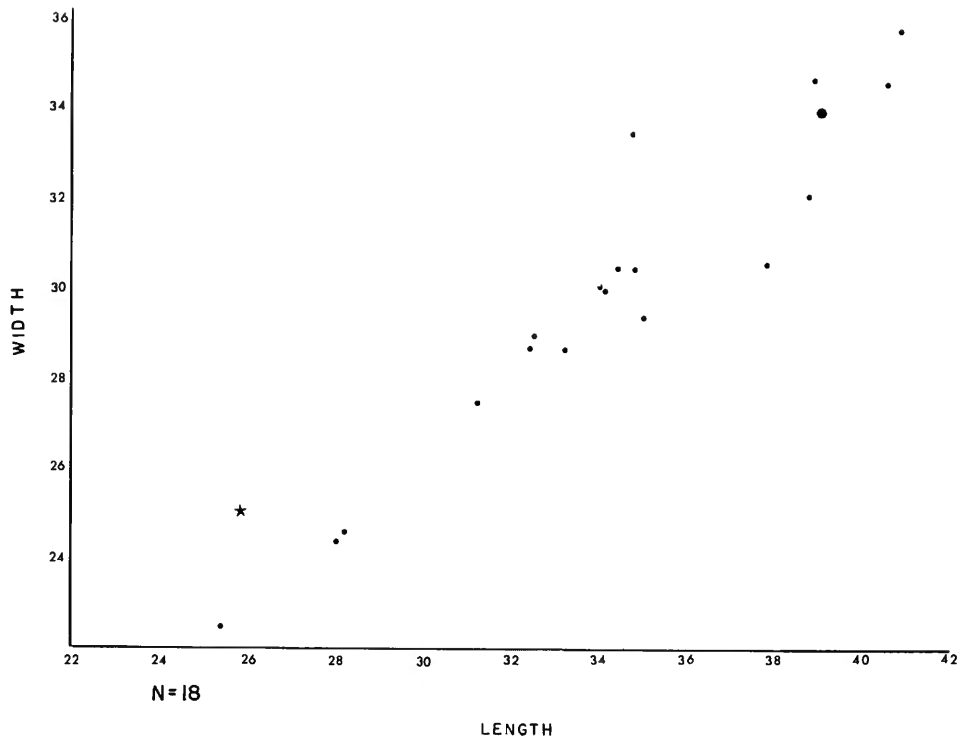


FIGURE 15.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08: station 9, CP 75, 18 specimens ($L/W=1.14$; large dot = position of type *A. kerguelensis*; star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson).

Specimens from MD.08: Station 40, DC 186 (Plate 11: figures 13–17): Three specimens (MNHN-BRA-78-104a–c), measuring 2.5–3.0 in length of ventral valve show the dorsal median pillar in incipient stage, the younger two without any trace of crura. The specimen measuring 3 mm shows a trace of the crura and more prominent socket ridges. In this specimen the pillar is extended posteriorly to about midvalve, the beginning of the median septum.

The next specimen (MNHN-BRA-78-104d) is 4 mm long, has an elongated pillar with septum extending nearly to the notothyrial chamber. There is a slight excavation and widening of the distal end of the pillar, the incipient cone. The crura are minute nubs.

The next specimen (MNHN-BRA-78-104e), 4.5 mm long, shows the pillar with a small but well-developed cone open toward the posterior, the crura short, with slight development of the crural processes. The descending lamellae ante-

rior to the crural processes extend to midway of the distance to the cone.

A sixth specimen (MNHN-BRA-78-104f), not quite 5 mm long, has a slightly more advanced cone than the preceding and with incipient development of the anterior part of the descending branch on the side of the pillar. The cone is irregular with anterior elongated and posterior cover recessed. The crural processes are well developed, but the descending branch anterior to them is not advanced over the preceding stage. The descending inner hinge plates are slightly excavated anteriorly and meet the floor; the septum is continued to meet their anterior junction.

A specimen of 5 mm length (MNHN-BRA-78-104g) has a well-developed, posteriorly open cone, well-formed septum, and inner hinge plates joined with the septum. The crural processes are well formed and the two elements of the descending lamellae are joined. A slightly larger specimen (MNHN-BRA-78-104h) is essentially the same

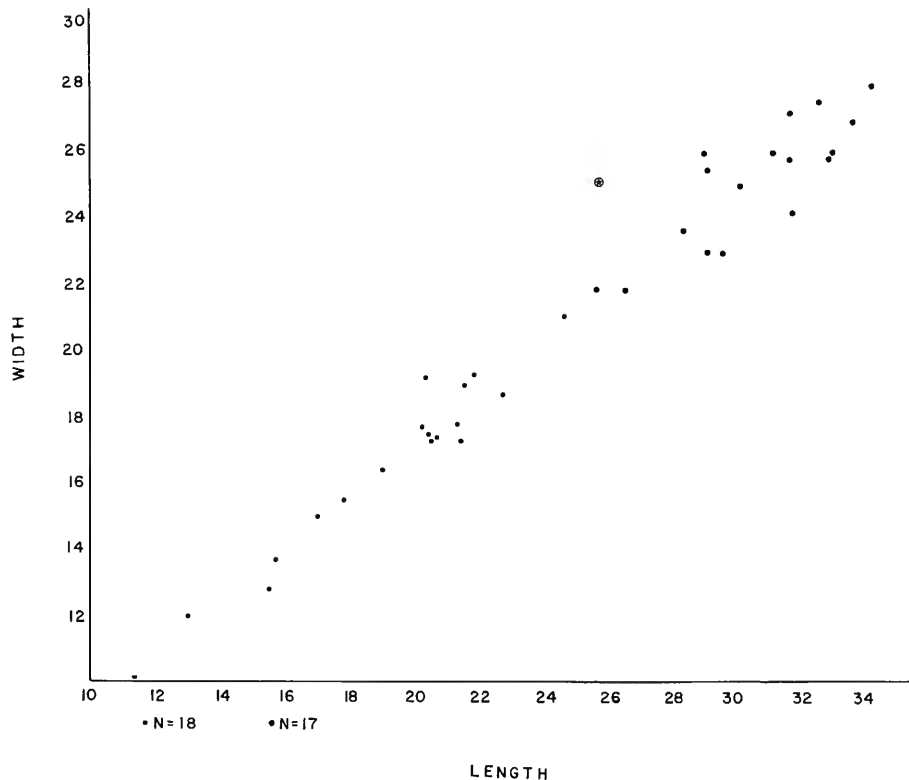


FIGURE 16.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08: station 28, DC 148, 18 specimens (small dot) and 77, DC 314, 17 specimens (medium dot), both $L/W=1.16$ (circled star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson); largest dot = place of *A. kerguelensis*).

except that the descending lamellae are not complete.

A specimen 13 mm in length (MNHN-BRA-78-104i) has the loop transformed from the cone with median septum, descending branches, and part of the septum just being resorbed. Other features are like those of the adult.

Specimens from MD.03: Station 26, CP 17 (Plate 7, figure 25; Plate 11, figures 1, 2): The smallest specimen (MNHN-BRA-78-76b) is 6 mm long with expanded cone, the anterior part attached to the pillar undergoing resorption as shown by a deep reentrant. The posterior base of the cone is strongly attached to the pillar now expanded into a high septum joined to the inner hinge plates. The ventrad part of the cone forms a fairly wide loop.

A specimen 13 mm long (MNHN-BRA-78-76c)

shows a fairly well-advanced loop with narrow, curved, lateral ribbons joining the descending lamellae united, but just freed from the septum. The crural processes are now needle sharp points. Compared to the 13 mm long specimen described above, this one differs in still retaining the transverse ties of the descending branches, although the septum has been resorbed from under the lateral tying bands, leaving the loop free.

The next specimen (MNHN-BRA-78-76f), 14 mm long is in essentially the same condition as the preceding, but with the loop still fixed to the median septum.

A specimen 17 mm long (MNHN-BRA-78-76g) is near adulthood because the bands tying the descending branches to the median septum are wholly free but remnants of the tying bands are still attached to the descending lamellae.

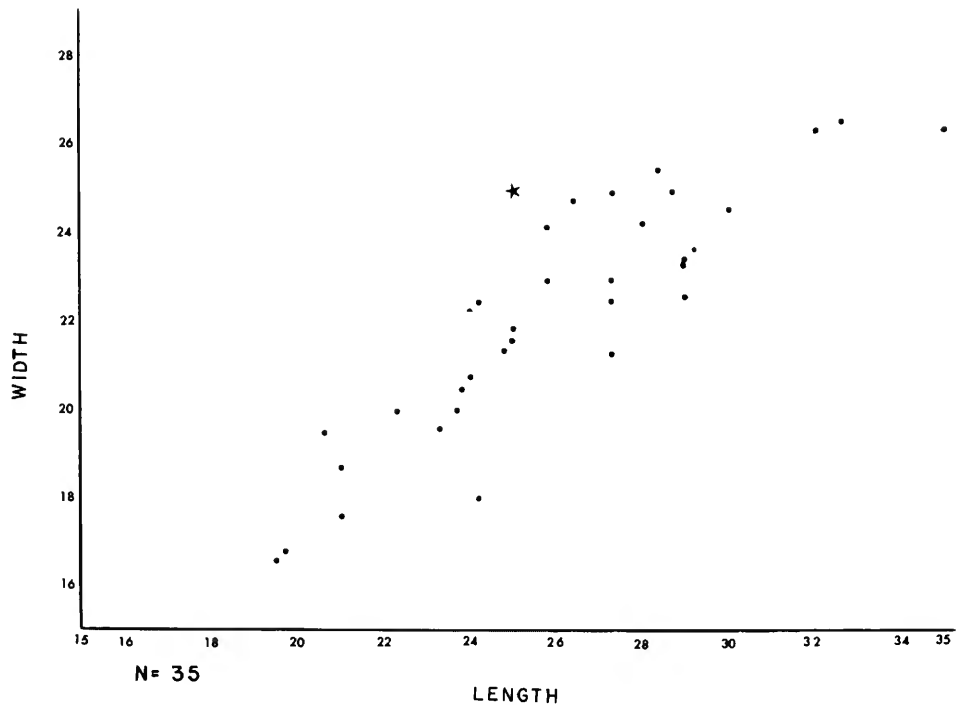


FIGURE 17.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08: station 25, CP 134, 35 specimens ($L/W=1.18$; star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson).

Some specimens of a size larger than 17 mm exhibit traces of the tying bands on the descending lamellae as more or less prominent irregularities.

The development of the loop does not conform in all instances to definite stages. The condition at 6 mm may show variation in the development of the cone and the progress of the completion of the descending branches of the loop. Evidently, freeing the loop from the septum may take place before or after 15 mm of length has been obtained.

A feature worth noting, in the specimens from 13 mm to 17 mm long, is the freeing of the distal end of the median septum before the lateral bands joining the descending lamellae have been resorbed. Five specimens show this. The loop is in the terebratelliform stage, but free of the tip end of the septum or pillar remnant. It is possible that, in clearing the flesh with Chlorox the end of the thin and delicate septum was attacked. However, parts of the loop are as delicate as the

septum and have not been injured. At any rate, the development is essentially the same as that seen in *Aerothyris macquariensis*.

The loop development shown here is like that depicted by Foster (1974:140–141, fig. 38) for *Magellania macquariensis* (Thomson). He mentions that some specimens at 13.6 mm have a magellaniform loop. He (page 140) also mentions “One specimen at 13.9 mm has the descending branches joined, but these branches do not join to the septum.” This is a rare condition like that mentioned above.

In order fully to understand *Aerothyris kerguelensis* and its variation, a discussion of *Terebratella enzenspergeri* Blochmann is needed to explain why this “species” is herein regarded as a synonym of *A. kerguelensis*.

Terebratella enzenspergeri is a species from Kerguelen Island described by Blochmann, who includes in his species a specimen collected by the *Challenger* expedition described and illustrated by Davidson (1880:44, pl. 4: fig. 4) under the name

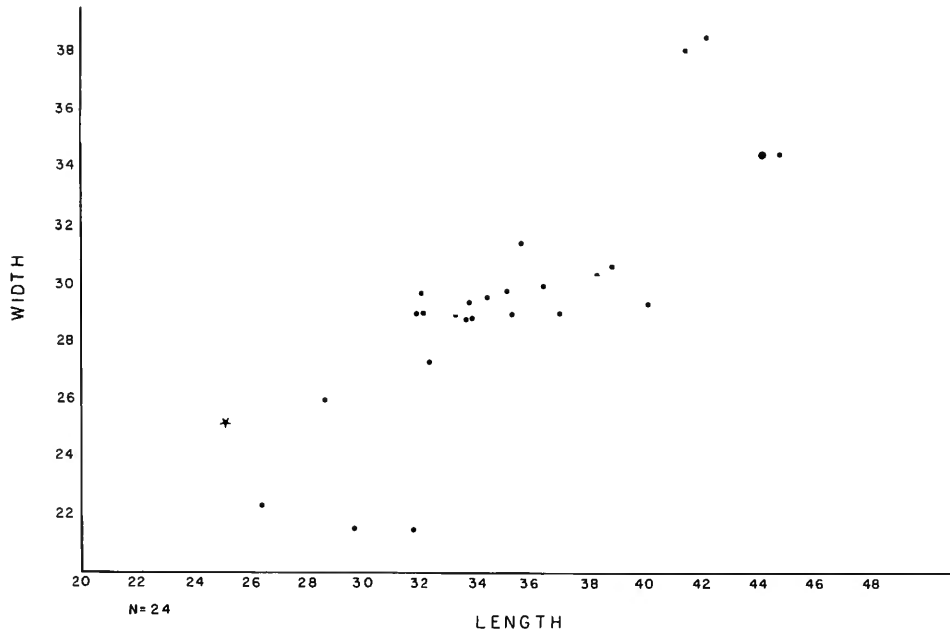


FIGURE 18.—Scattergram of length/width of *A. kerguelensis* (Davidson) from MD.08: station 48, CP 209, 24 specimens ($L/W=1.19$; large dot = position of large *A. kerguelensis*; star = position of *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson)).

Terebratella dorsata (Gmelin). The specimen comes from Royal Sound, latitude $49^{\circ}40'$ S, longitude $70^{\circ}20'$ E, off Kerguelen Island. Davidson noted that the loop of his specimen was “doubly attached.” Blochmann (1906:697) obtained an additional specimen from Kerguelen Island that he identified with Davidson’s specimen and named the two specimens as a new species, *Terebratella enzenspergeri*.

The Davidson and Blochmann specimens were further studied by Eichler (1911:392) and Foster (1974:109), both of whom refer the species to *Terebratella*, but Foster queries the name. Blochmann (1906) early showed that Davidson’s *Terebratella dorsata* (1880, pl. 4: fig. 4) was not to be referred to the South American species because there were many obvious differences, among them lack of strong costation and a lesser number of punctae per square mm in the Kerguelen form. *Terebratella enzenspergeri* is marked by scattered irregular striae (grooves not costellae). Eichler also pointed out differences between *T. dorsata* from South America and *T. enzenspergeri*.

Foster (1974:111) notes that Davidson mentioned the doubly attached loop. This British Museum (Natural History) specimen does not preserve the loop and Foster found no remnants indicating attachment. He examined other specimens said to be of *T. enzenspergeri*, all without loop, and failed to find evidence of double attachment. He therefore queried the use of the name *Terebratella* for this species.

The figures of *T. enzenspergeri* published by Eichler include Davidson’s figured specimen, another from the *Challenger* Expedition, and one collected by the *Gauss* Expedition at Kerguelen Island. Davidson’s figured specimens (the type?) is 25.8 mm long, 25.0 mm wide, and 6.5 mm thick; the second is 16 mm long and wide; the *Gauss* specimen is 15 mm long, 15 mm wide, and 6.5 mm thick. It will be noted that these specimens are nearly equal in length and width. The dorsal interior of the larger *Challenger* specimen (Eichler, 1911, pl. 42: fig. 11d) shows no trace of lateral bands on the unthickened, low, median septum, and the hinge plate is well excavated.

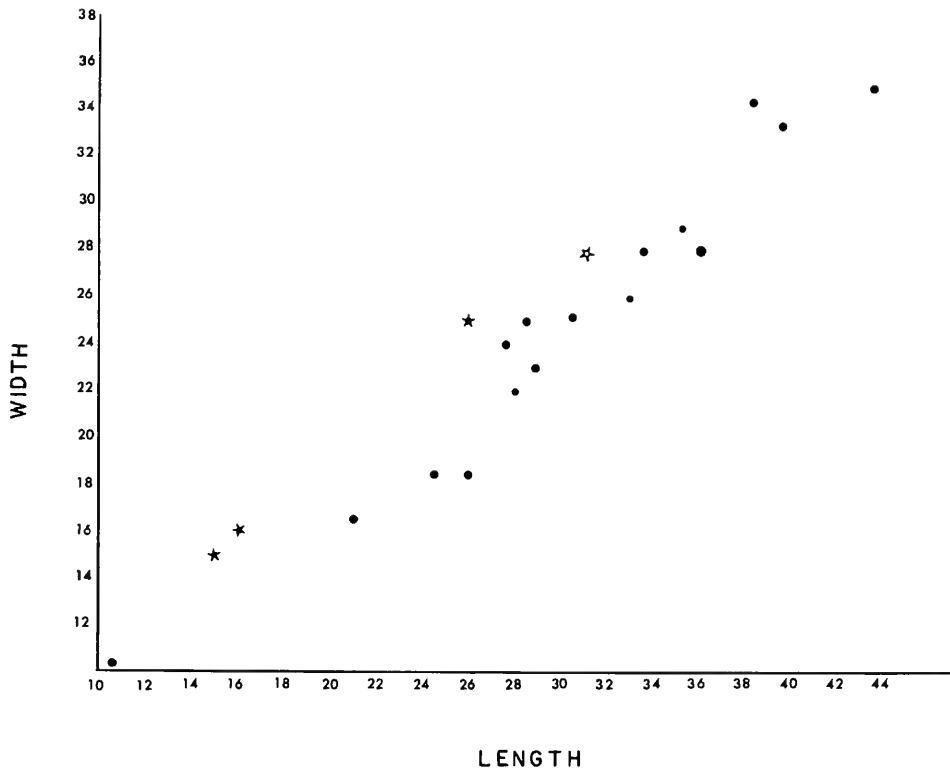


FIGURE 19.—Scattergram of length/width for 18 specimens of *A. kerguelensis* (Davidson) (solid stars = *A. enzenspergeri* (Blochmann) = *A. kerguelensis* (Davidson); small dots = *Challenger* specimens in National Museum of Natural History; large dots type specimens in British Museum (Natural History); very large dot = Harvard University, Museum of Comparative Zoology 9520A (Foster, 1974, pl. 20, fig. 2); open star average *Aerothyris macquariensis* Thomson (Plate 8: figures 11–13).

Foster (1974:111) notes: "The cardinalia and median septa in *T. enzenspergeri* are similar to those in *Magellania macquariensis* Thomson, but *M. macquariensis* is essentially smooth, is deeper and narrower, and is without a straight hinge line." He notes also that *Magellania kerguelensis* has a heavier, narrower, and deeper shell than *enzenspergeri* and an essentially sessile hinge plate."

Foster (1974, pl. 18: fig. 10) illustrates a specimen labelled as *T. enzenspergeri* much larger and quite unlike the British Museum and *Gauss* specimens, taken from the Gulf of Morbihan, Kerguelen Island. It is wide-hinged, with large foramen. No trace of radial striae is evident in the picture. The specimen is similar to large, wide forms of *A. kerguelensis*. The striae of *T. enzenspergeri* appear to be the result of marginal injuries

and not a normal feature of the shell (Plate 13). Sporadic specimens of *A. kerguelensis* in the present collection and also *A. macquariensis* (Thomson), show this type of striation to a minor degree (Plate 13: figure 24). The British Museum specimens figured by Eichler are striated to an exaggerated degree and suggest pathological shells. Many of the striae can be traced to irregularities in the shell margin at successive stages of growth (see Plate 13: figures 20–24). Consultation of the scattergrams (Table 1; Figures 6–20, 27–29) will show a continuum of populations from $L/W=1.02$ to 1.19. The former end of the series is mostly of nearly round shells while the opposite end is of elongate oval specimens. However, oval specimens occur in predominately round populations while circular specimens appear in popu-

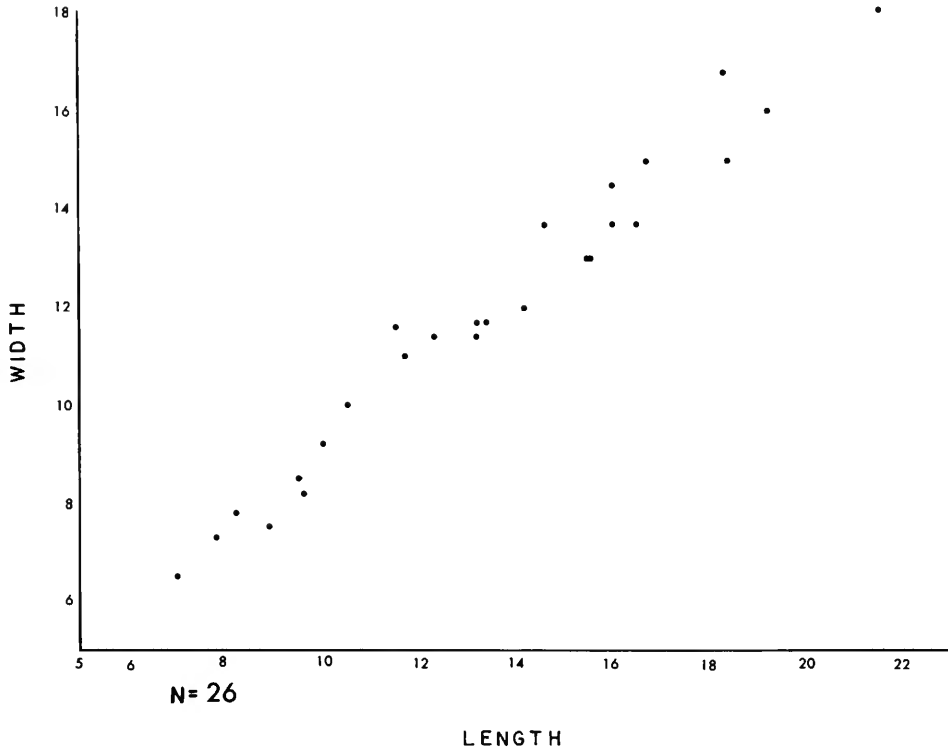


FIGURE 20.—Scattergram showing L/W ratio of small *Aerothyris kerguelensis* (Davidson) from MD.08: station 50, DC 216.

lations of oval specimens ($L/W=1.16-1.19$). At station 46, CP 204, a population with average L/W of 1.04 contains one oval specimen with $L/W=1.16$ along with 6 specimens very close to the dimensions of *enzenspergeri*. A population at station 77, DC 314, with $L/W=1.16$, contains one specimen that is almost circular. There is little uniformity in the foramen in any of the populations.

So little is known of the variation of outline of *enzenspergeri* that the name cannot be intelligently applied for a species. It is not known whether or not it produces specimens with a keyhole foramen. The figured specimens all have a large, round foramen.

It is possible that all of the illustrated specimens of *A. enzenspergeri*, two of which are 15 and 16 mm in length and width and the third 25 mm, are merely young, round individuals of a population of *A. kerguelensis*. As noted elsewhere, the illustrated shells of *A. enzenspergeri* may be pathologic.

Inasmuch as the size and form of the foramen

are probably controlled by bottom conditions and by the niche in which any individual lived, it will be fashioned by these conditions and not be a reliable specific or generic character. Not one of the populations studied has a uniform development of the foramen, although some have a pre-dominance of one kind.

The collection described herein contains 37 samples of populations from as many localities. The average L/W of these populations ranges from 1.02 to 1.19. Fifteen of them contain one or more specimens answering to the proportional dimensions of the type specimens of *T. enzenspergeri* as described by Eichler. None of these has the radial "striae" seen on the types. The average L/W of the samples containing these specimens ranges from 1.02 to 1.16. Specimens of the proportional dimensions of *T. enzenspergeri* may appear in any population of *A. kerguelensis*.

The types of *T. enzenspergeri* consist of three specimens, two of which are 16 mm long, and one only 25.8 mm long. The two smaller ones are at

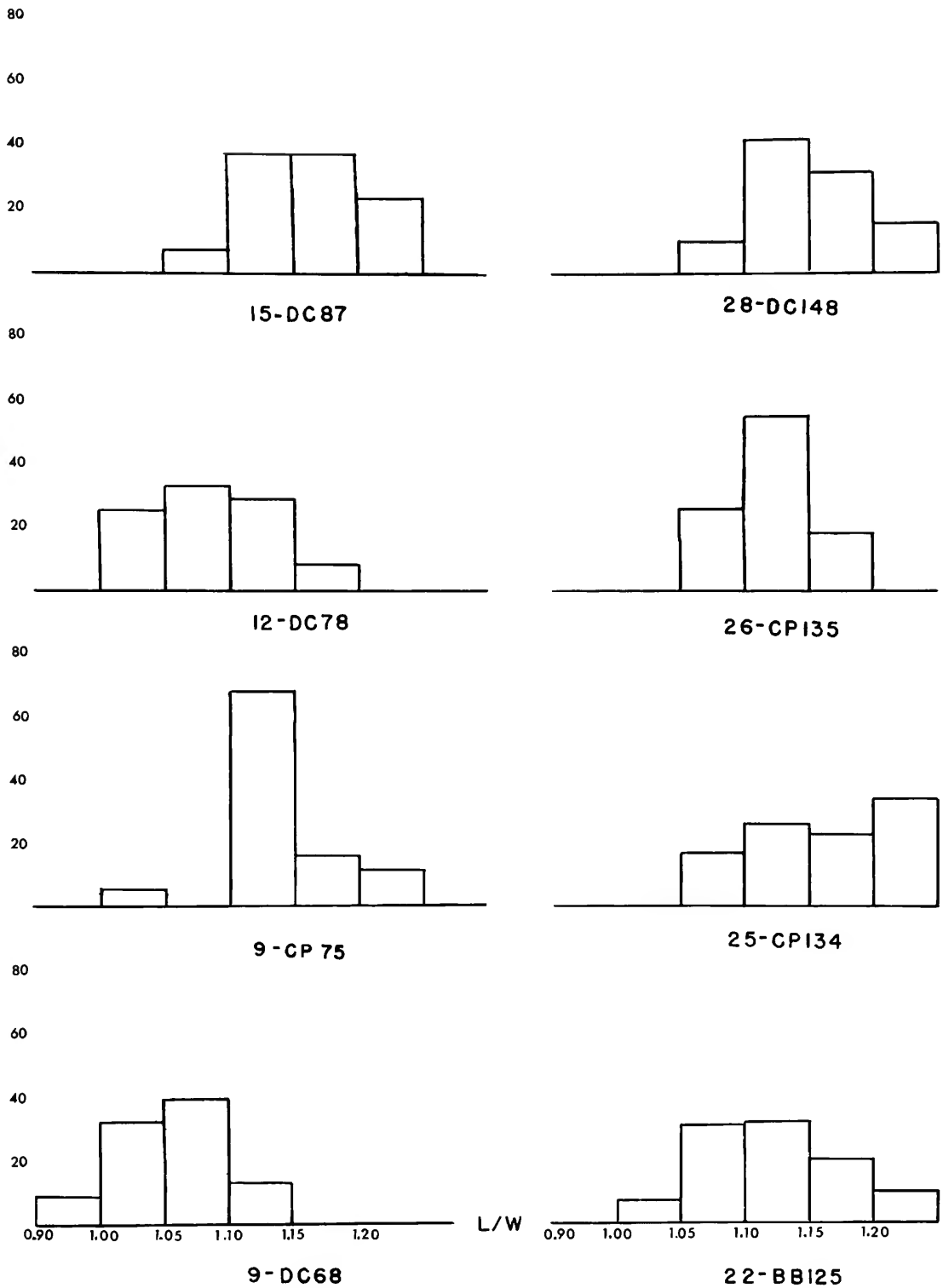


FIGURE 21.—Histograms showing percentage of L/W index in *Aerothyris kerguelensis* (Davidson) in various stations of MD.08. (Station 22, BB 125 represents *Aerothyris* aff. *A. macquariensis* (Thomson).)

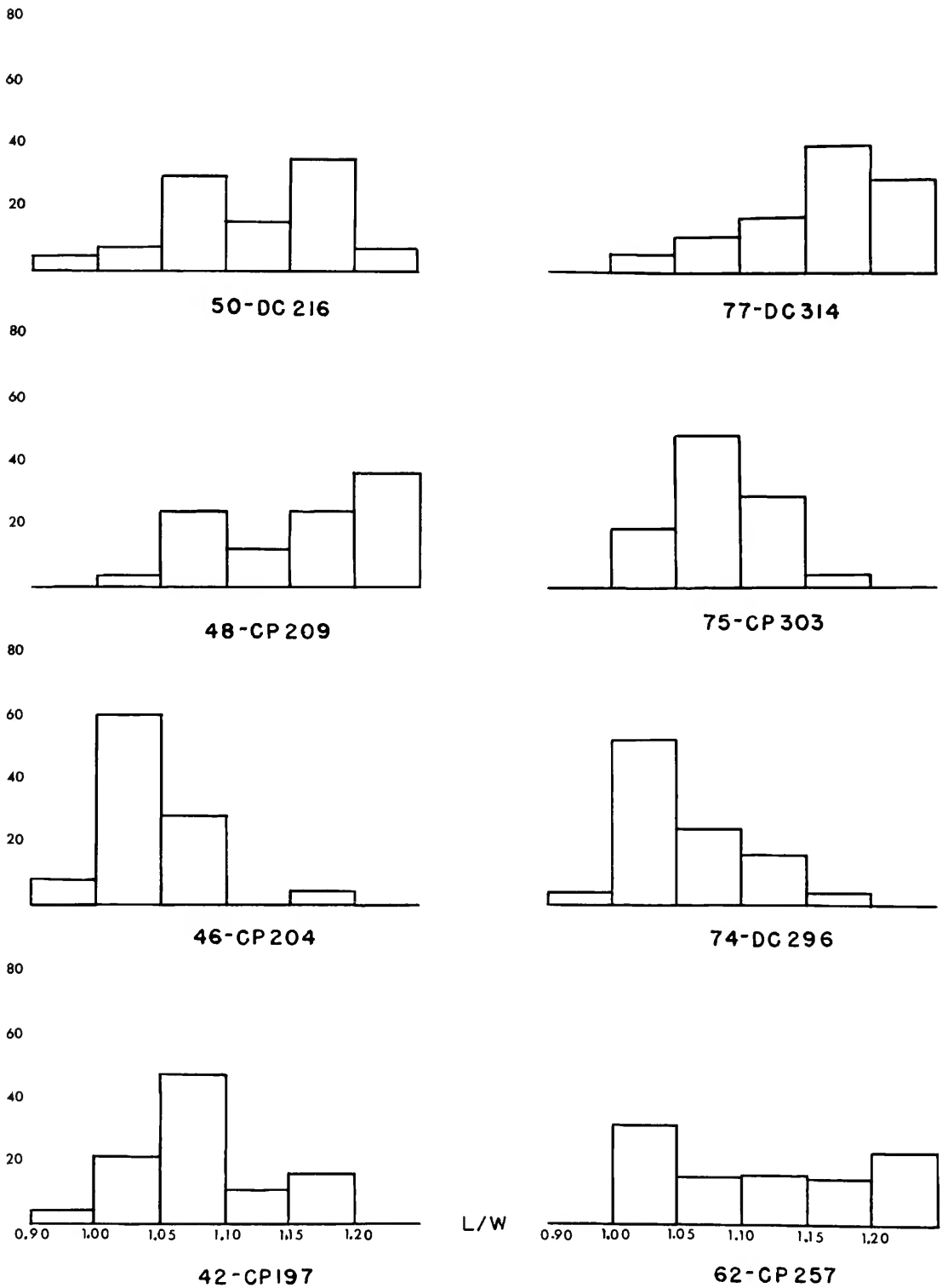


FIGURE 22.—Histograms showing percentage of L/W index in *Aerothyris kerguelenensis* (Davidson) in various stations of MD.08.

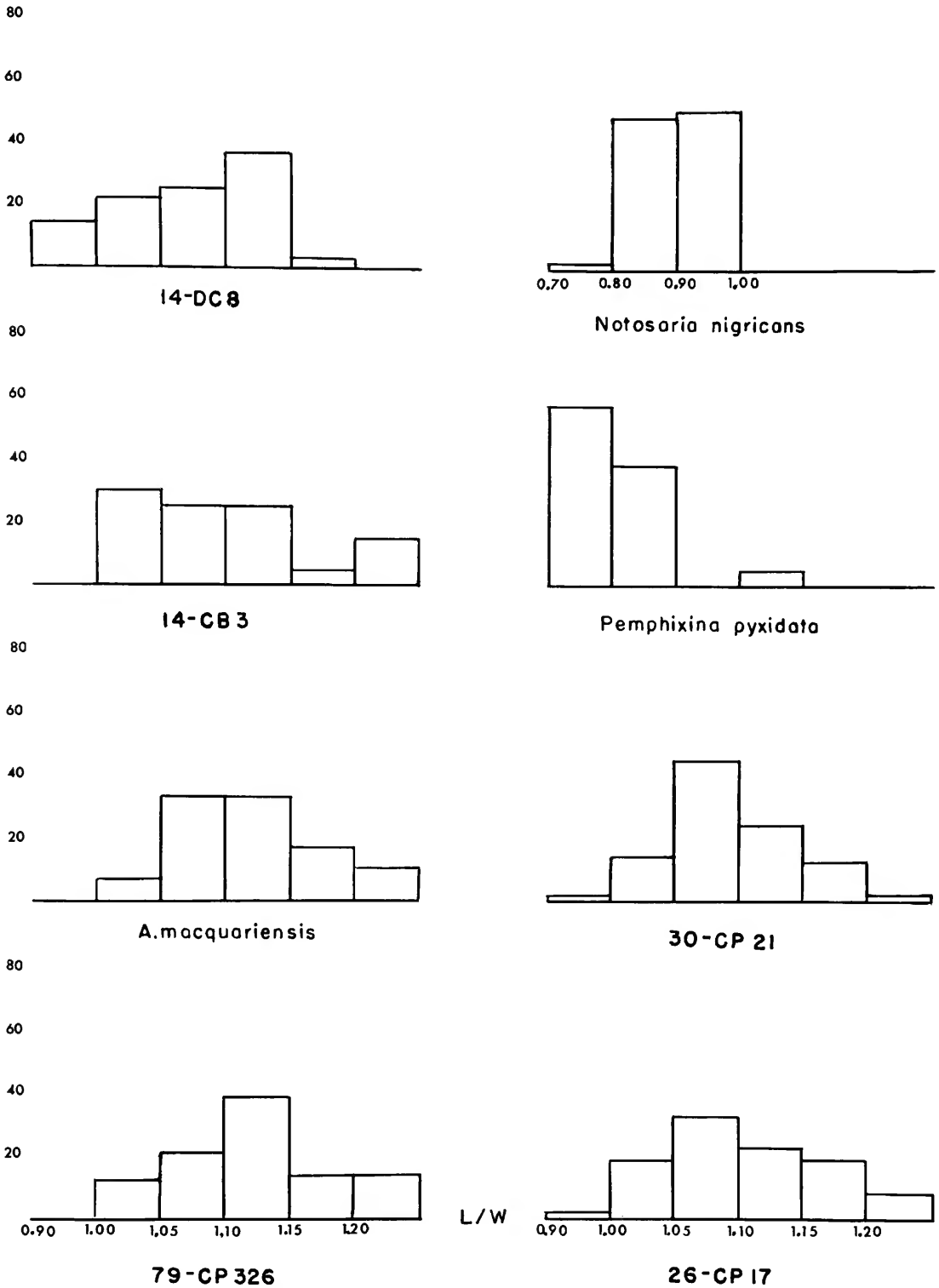


FIGURE 23.—Histograms showing percentage of L/W index in *Aerothyris kerguelensis* (Davidson) in MD.08: station 79, CP 326, and 4 stations of MD.03, and for comparison, percentage of L/W in *Pemphixina pyxidata*, *Notosaria nigricans*, and *Aerothyris macquariensis* (from Harvard station 27-36).

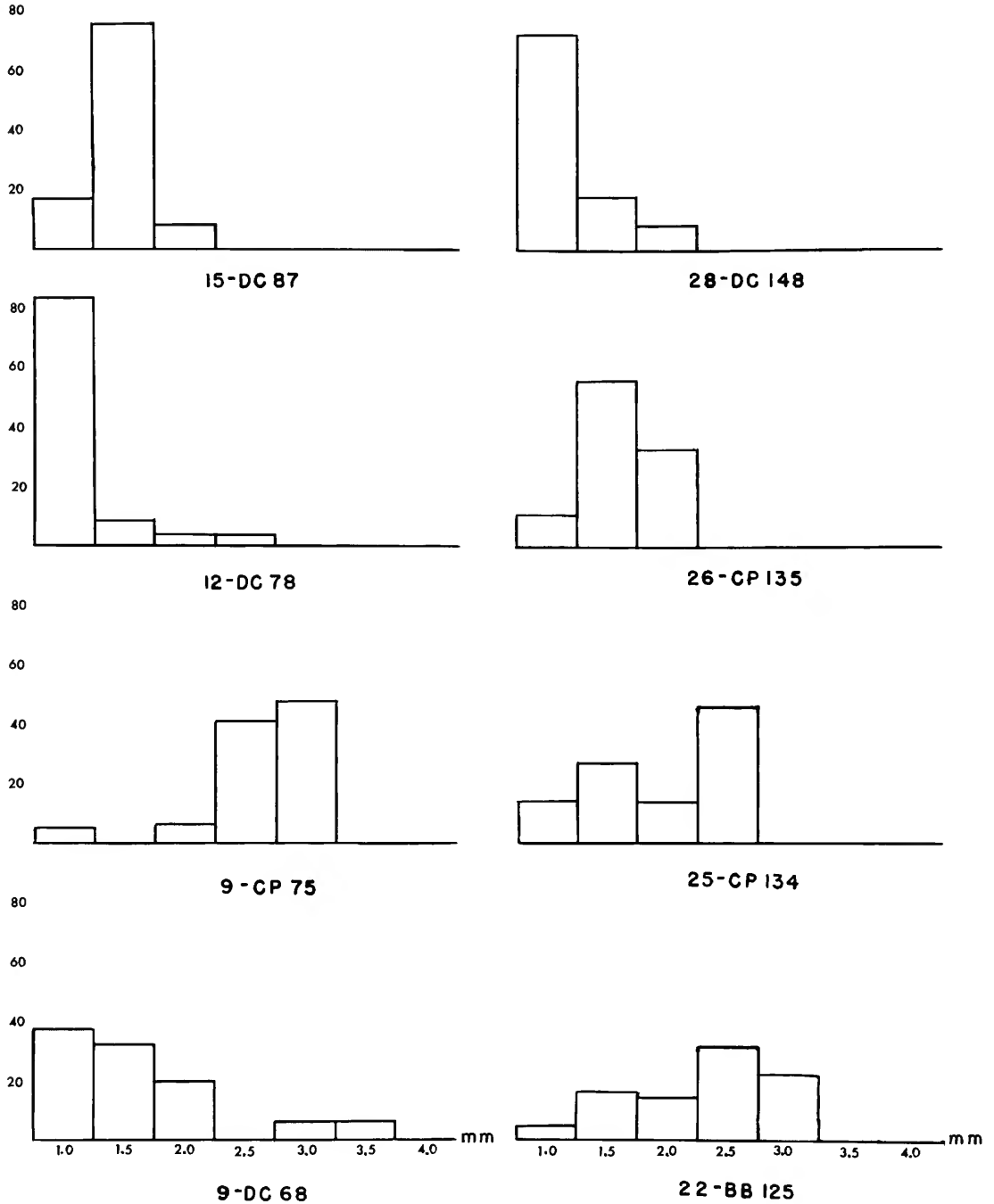


FIGURE 24.—Histograms showing percentage of foramen diameter measurements in *Aerothyris kerguelenensis* (Davidson) from 8 stations of MD.08. (Station 22, BB 125 represents *Aerothyris* aff. *A. macquariensis* (Thomson).)

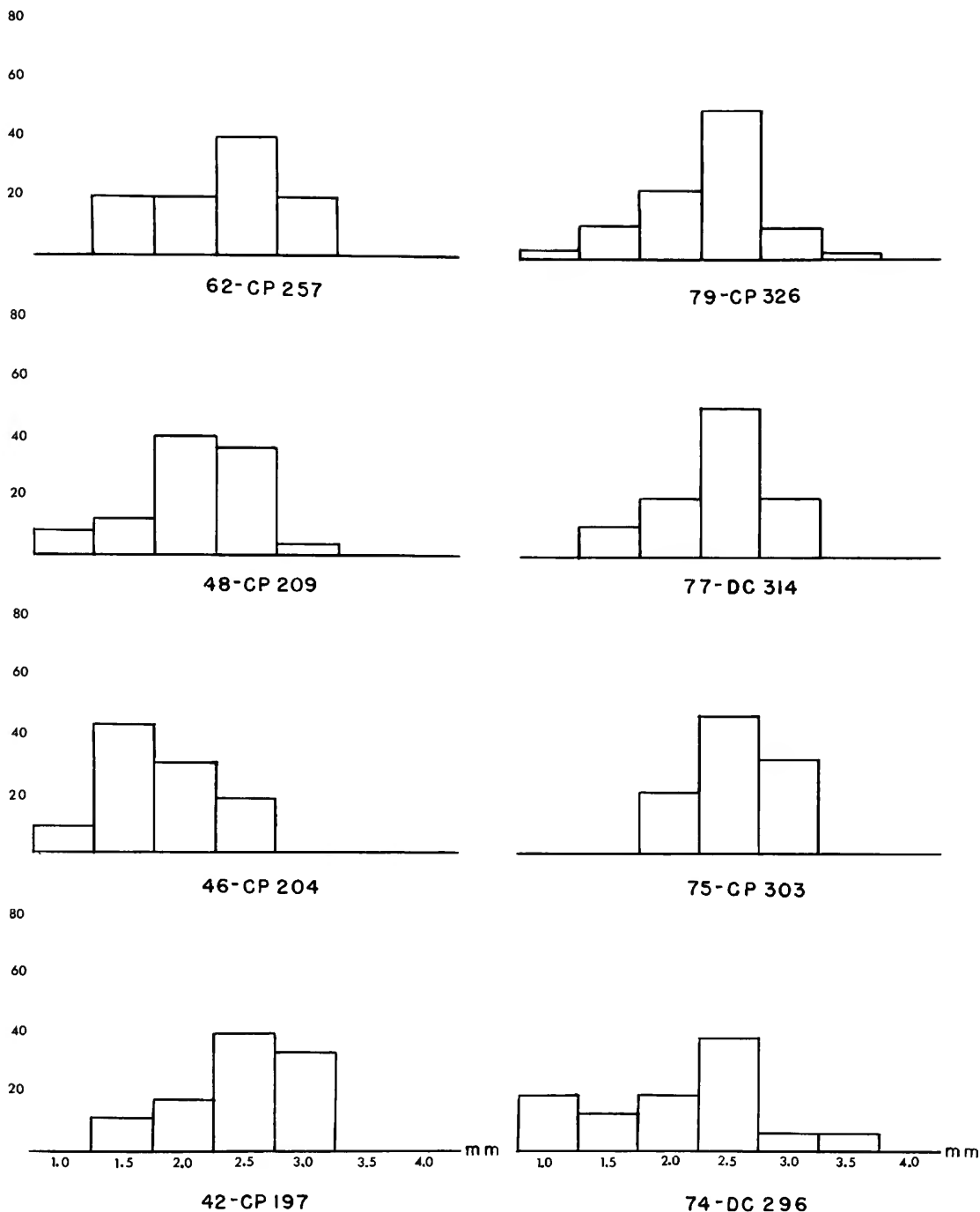


FIGURE 25.—Histograms showing percentage of foramen diameter measurements in *Aerothyris kerguelenensis* (Davidson) from 8 stations of MD.08.

the critical time of resorption of the septal pillar and freeing of the loop (ca. 17 mm, see below). Well-preserved specimens of this size might give the impression of having a terebratelliform loop.

Eichler's largest specimen of the three he described probably had a free loop.

The cardinalia of the dorsal interior of *T. enzenspergeri* figured by Eichler are not strongly

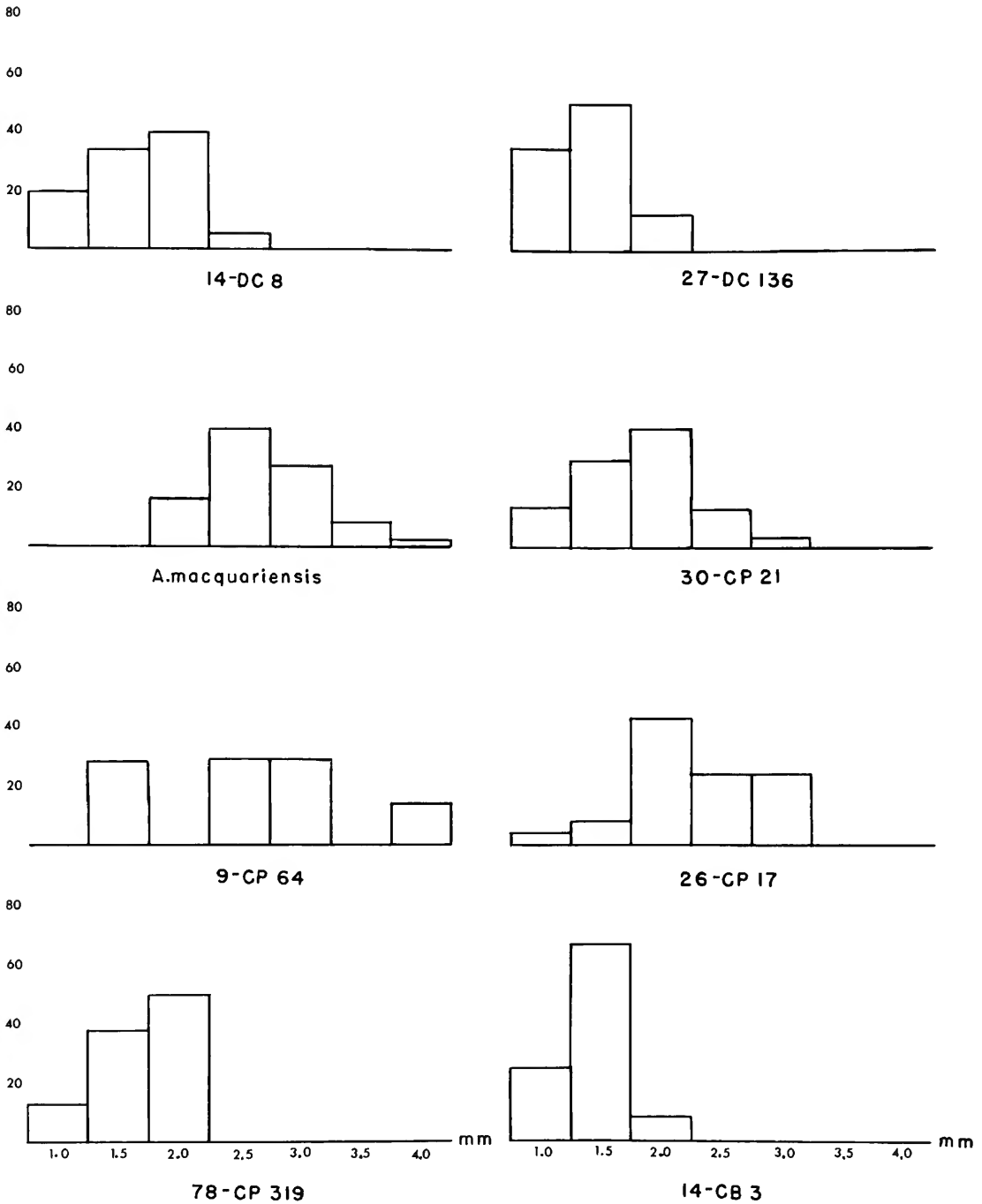


FIGURE 26.—Histograms showing percentage of foramen diameter in *Aerothyris kerguelensis* (Davidson) in 3 stations of MD.08, 4 stations of MD.03, and *Aerothyris macquariensis* (Thomson).

calcified because the illustrated shell is a young individual. Calcification of the cardinalia in *A. kerguelensis*, like its other characters, is variable, some young shells thickening early in life, others

not until more maturity is reached.

I conclude from the above that *T. enzenspergeri* is probably a young form representing a wide or nearly circular outline of *Aerothyris kerguelensis*.

***Aerothyris macquariensis* (Thomson)**

FIGURES 23, 26, 27; PLATE 8: FIGURES 11-13;
PLATE 13: FIGURE 24

Magellania macquariensis Thomson, 1918:30, 31, pl. 15: figs. 13-17; pl. 16: fig. 40.—Foster, 1974:139, figs. 31G, 38; pl. 19: figs. 17-27; pl. 20: fig. 1; pl. 21; figs. 17, 18; pl. 24: figs. 8-12; pl. 25: fig. 12,
Aerothyris macquariensis (Thomson).—Allan, 1939:245.—Bowen 1968:146: fig. 10.

DESCRIPTION.—One hundred specimens from 112-124 meters off the northeast side of Macquarie Island were studied (Harvard Station 27-36). These have a length range of 19.2-44.7 mm and width range of 16.4-42mm. The range of

$L/W=0.99-1.36$ with an average of 1.13. The range of $T/W=0.52-0.73$, with average of 0.62. The foramen varied in diameter from 1.5 to 4.0 mm. Eighty percent of the specimens have the foramen above 2.0 mm in diameter. One specimen is provided with a keyhole foramen like that of *A. kerguelenensis*. Two specimens have conjunct deltidial plates.

That *A. macquariensis* is very close to *A. kerguelenensis* was suggested by Foster (1974) and is apparent. It has an exterior form identical to many specimens of the Kerguelen species, variable anterior sulcation, the same type of cardinalia, and similar aberrations of size and form of the foramen. Its average L/W of 1.13 places it in

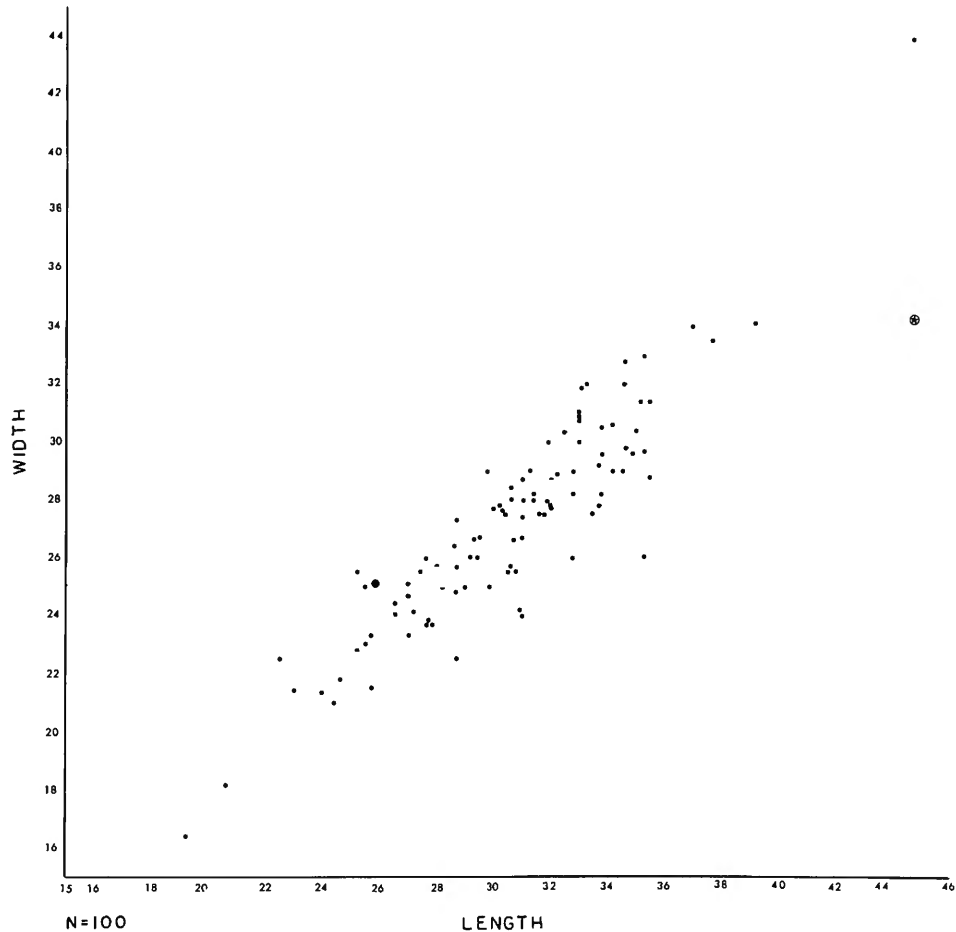


FIGURE 27.—Scattergram of length/width for 100 specimens of *Aerothyris macquariensis* (Thomson) from Harvard station 27-36 off Macquarie Island ($L/W=1.13$; large dot = *A. enzenspergeri* (Blochmann) = *A. kerguelenensis* (Davidson); circled star = *A. kerguelenensis* type).

the middle range of L/W of *A. kerguelensis*. The keyhole type of foramen occurs sporadically. The chief differences between the species is the usually predominately larger foramen (80% above 2 mm diameter) in a usually massive, only slightly curved beak and the lesser calcification of the interior in adult or old specimens. Most examples of *A. kerguelensis* thicken their cardinalia early in their development and often create bizarre aberrations in old age (see Plates 12, 13). The loop development of *A. macquariensis* closely matches that of *A. kerguelensis* from some localities. *A. macquariensis* occupies a medial position in the series of *A. kerguelensis* when its external form is considered, but its foramen is constantly larger than that of most populations of *A. kerguelensis*.

As noted, a population from station 22, BB 125 has affinities with *A. macquariensis*, the Marion Island form, varying only in being collectively

slightly less elongate. The range of *A. macquariensis* is larger than hitherto known because Bowen (1968:146) reports empty shells of this species off Otago Peninsula, South Island, New Zealand, at 180–220 fathoms (329–402 meters), fairly deep water for the species. The Marion Island specimens extend the range of the species to the west. Possibly their similarity to *A. macquariensis* is rather a matter of local conditions affecting a stock of *A. kerguelensis* than the wider geographic extension of a species. The specimens, however, are too different from average *A. kerguelensis* to be identified with it.

TYPES.—Hypotype: Figured specimen USNM 550251–61.

Aerothyris aff. *A. macquariensis* (Thomson)

FIGURES 28, 29; PLATE 8: FIGURES 14–29

Magellania macquariensis Thomson, 1918:30, 24, 27; pl. 15: figs. 13–17; pl. 14: fig. 40.

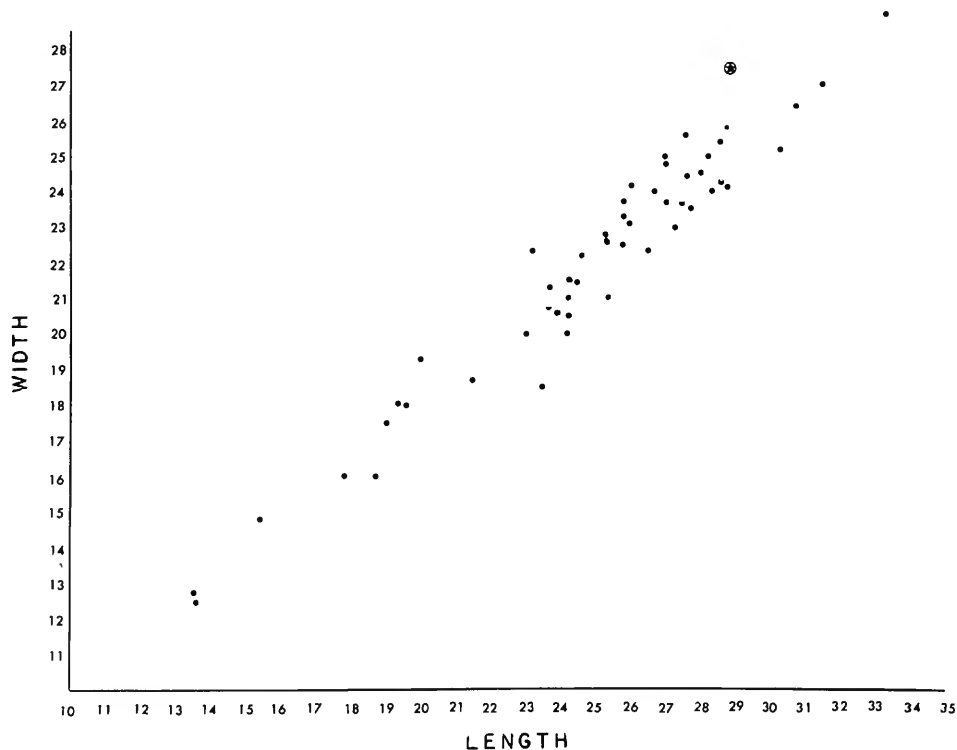


FIGURE 28.—Scattergram of length/width of *Aerothyris* aff. *A. macquariensis* (Thomson) from MD.08: station 22, BB 125, 52 specimens (L/W=1.10; circled star = position of specimen with keyhole foramen).

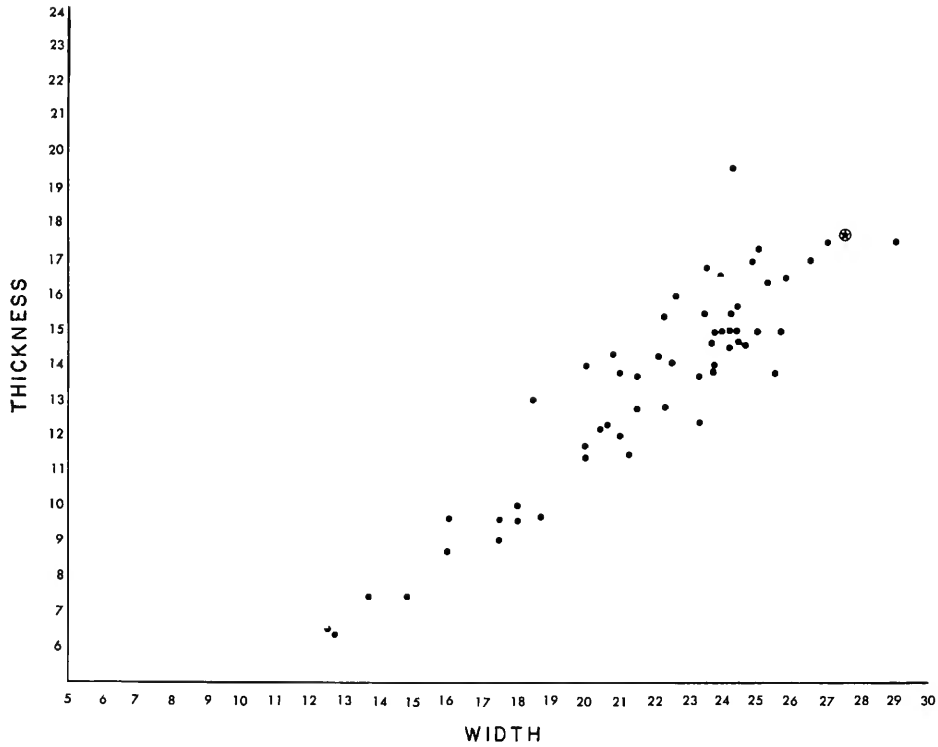


FIGURE 29.—Scattergram (top) of *Aerothyris* aff. *A. macquariensis* (Thomson) from MD.08: station 22, BB 125, 58 specimens, showing thickness-width relationship.

DESCRIPTION.—Specimens from MD.08: station 22, BB 125 deviate strongly from other lots here assigned to *A. kerguelenensis*. The specimens are yellowish white, rather thin-shelled, and of about medium size when compared to the extremes of *A. kerguelenensis*. The L/W averages 1.11 and the T/W averages 0.61. Most specimens have a large foramen, 66% over 2 mm in diameter. The foramen is bounded by small deltidial plates or none at all, but one specimen in the lot has a keyhole

foramen and another has conjunct deltidial plates. The cardinalia of the dorsal valve are not thickened and have well-excavated inner hinge plates and a modest development of the cardinal process. The median septum is short and low, reaches to midvalve or posterior thereto. The muscle scars are not deeply impressed. One small precocious specimen preserves the pallial marks in the dorsal valve that conform to the pattern seen in *A. kerguelenensis* (Plate 10: figure 4).

MEASUREMENT (mm).—

Specimen	Length	Dorsal valve length	Width	Thickness	Apical angle	Foramen width	L/W
MNHN-BRA-78-82a	33.3	28.5	29.0	17.4	84°	2.8	1.15
MNHN-BRA-78-82b	28.8	24.7	26.0	16.4	92°	2.8	1.11
MNHN-BRA-78-82c	30.0	25.7	25.2	16.4	78°	3.7	1.19
MNHN-BRA-78-82d	27.3	23.7	23.7	17.0	82°	2.7	1.15
MNHN-BRA-78-82e	18.6	16.6	15.7	13.7	87°	2.0	1.18
MNHN-BRA-78-82f	28.2	23.7	24.6	17.3	90°	3.0	1.15
MNHN-BRA-78-82g	34.1	30.0	30.7	18.8	89°	2.5	1.14
MNHN-BRA-78-82h	28.7	24.1	27.6	17.3	98°	1.5	1.04

TABLE 1.—Percentage of length/width ratios and percentage of foramen widths in populations of *Aerothyris kerguelensis* (Davidson) and one lot of *A. macquariensis* (Thomson)

Station	Depth (in m)	Ave. L/W	Range of length/width ratio						Range of foramen width (in mm)						
			0.90- 1.00	1.01- 1.05	1.06- 1.10	1.11- 1.15	1.16- 1.20	1.21 plus	<1.0	<1.5	<2.0	<2.5	<3.0	<3.5	<4.0
73, CP 295	263- 412	1.02	50	33	0	17	0	0	17	17	17	32	17	0	0
46, CP 204	375- 490	1.04	8	60	28	0	4	0	9	43	30	18	0	0	0
74, DC 296	290	1.06	4	52	24	16	4	0	19	13	19	37	6	6	0
9, DC 68	125	1.06	10	32	42	16	0	0	36	32	20	0	6	6	0
42, CP 197	172- 220	1.08	5	21	47	11	16	0	0	11	17	39	33	0	0
75, CP 303	155- 257	1.09	0	19	48	29	4	0	0	0	21	47	32	0	0
79, CP 326	81	1.09	0	13	21	38	14	14	3	11	22	50	11	3	0
14, DC 8	250	1.10	14	22	25	36	3	0	20	34	40	6	0	0	0
14, CB 3	262	1.10	0	30	25	25	5	15	25	67	8	0	0	0	0
30, CP 21	187	1.10	2	14	45	24	13	2	14	30	39	13	4	0	0
12, DC 78	103	1.11	0	25	33	29	8	5	83	9	4	0	4	0	0
22, BB 125	31	1.11	0	7	31	32	20	10	4	16	14	33	22	4	7
26, CP 17	165	1.12	2	18	32	22	18	8	4	8	40	24	24	0	0
26, CP 135	145	1.12	0	0	27	55	18	0	12	55	33	0	0	0	0
50, DC 216	150	1.13	4	7	30	15	37	7	?	?	?	?	?	?	?
<i>macquariensis</i>	124	1.13	1	7	33	33	17	9	0	3	17	40	28	9	3
62, CP 257	210	1.13	0	31	15	16	15	23	0	20	20	40	20	0	0
9, CP 75	150- 340	1.14	0	5	0	68	16	11	6	0	6	41	47	0	0
77, DC 314	270	1.16	0	5	11	17	39	28	0	10	20	50	20	0	0
28, DC 148	280	1.16	0	0	10	42	32	16	73	18	9	0	0	0	0
25, CP 134	232	1.18	0	0	17	26	23	34	13	27	14	46	0	0	0
48, CP 209	200	1.19	0	4	24	12	24	36	8	12	40	36	4	0	0

TYPES.—Hypotypes: MNHN-BRA-82a-m.

STATION.—MD.08: 22, BB 125.

DISCUSSION.—Davidson (1880:40) reported *A. kerguelensis* in great numbers off Marion Island. The specimens he illustrated in the *Challenger* report and in his later work on Recent brachiopods (1886-1888:53, pl. 10) show a fair range of sizes and variation, but most of the pictures show specimens with a narrow keyhole foramen. Several specimens from Marion Island are illustrated (1880, pl. 3: figs. 3-9) and each has a narrow foramen. The National collection has 3 specimens (USNM 110883 and 550374a,b) collected by the *Challenger* expedition, the former from Kerguelen Island and latter two from Marion Island. All are elongate oval, have incurved beaks, are provided

with a keyhole foramen, and all have thickened cardinalia and a high L/W (all but one 1.10 or above). They are typical *A. kerguelensis kerguelensis*.

The specimens from northeast of Marion Island (MD.08: station 22, BB 125) cannot be identified as *M. kerguelensis* because of their poorly calcified cardinalia, and predominance of a large foramen. The sea bottom from which they were taken was sand. These specimens are very close to *A. macquariensis* (Thomson) in all details, especially to specimens from Antipodes Island. The chief difference between the Marion Island form and that from Macquarie Island is the predominantly greater thickness and a slight difference in L/W ratio.

***Aerothyris?* species 1**

PLATE 4: FIGURES 4-6

DESCRIPTION.—Small, roundly pentagonal, slightly longer than wide, unequally convex, ventral valve deeper than dorsal valve; sides rounded; anterior margin broadly rounded; posterolateral margins forming an angle of 90° . Lateral commissure straight, anterior commissure slightly sulcate. Beak short, suberect; beak ridges rounded; foramen large, submesothyridd; deltidial plates narrowly conjunct. Surface smooth.

Ventral valve with short, sessile, pedicle valve; teeth narrow, elongate.

Dorsal valve circular, gently convex; hinge region narrow; beak incurved; cardinal process unformed; socket ridges short, thin, bounding narrow sockets; inner hinge plate short, concave, and attached to median septum, which is deeply excavated; median septum high, long, extending nearly to anterior margin. Crural processes short, acute, defining very short crura. Descending lamellae thin, expanding anteriorly and supporting broad ascending branches and a broad transverse band. Loop narrow and long, occupying 60% of length and 28% of valve width.

MEASUREMENTS (mm).—length 15, dorsal valve length 14.7, width 14.7, thickness ?; apical angle 90° .

STATION.—MD.08 44, CP 199.

TYPE.—Figured specimen: MNHN-BRA-78-26.

DISCUSSION.—The single specimen described and figured is unlike any other in the collection, differing strongly in its conjunct deltidial plates, exceptionally long median septum; narrow, short, notothyrial cavity bounded by concave hinge plates attached to a high median septum with deep umbonal chambers. The specimen is from much deeper water (1500 m) than any other specimens of *Aerothyris* recorded herein.

Superfamily DALLINACEA Becher, 1893**Family ECNOMIOSIDAE Cooper, 1977****Genus *Ecnomiosa* Cooper, 1977*****Ecnomiosa inexpectata*, new species**

Figure 30; PLATE 14: FIGURES 1-20

DIAGNOSIS.—Medium size, faintly sulcate *Ecnomiosa*.

DESCRIPTION.—About medium size, subcircular in outline, slightly longer than wide; valves unequal in depth and convexity, ventral valve having greater convexity and depth. *Terebratalia*-like in appearance. Sides rounded, anterior margin slightly nasute; posterolateral extremities forming an obtuse apical angle of 96° – 106° . Lateral commissure straight, anterior commissure with a slight ventrad wave. Beak moderately long, wide, foramen large, occupying entire pedicle opening; no deltidial plates. Surface marked by very fine, regular lines of growth. Periostracum rich light brown to dark brown; shells white.

Ventral valve moderately and evenly convex in lateral profile, fairly strongly domed in anterior view with steeply sloping sides. Umbonal region somewhat narrowly swollen, swelling continuing to anterior margin to form a perceptible median fold that produces the anterior sinuation of the anterior commissure. Flanks gently convex and steep.

Dorsal valve gently and unevenly convex in later view, most convex in posterior, becoming

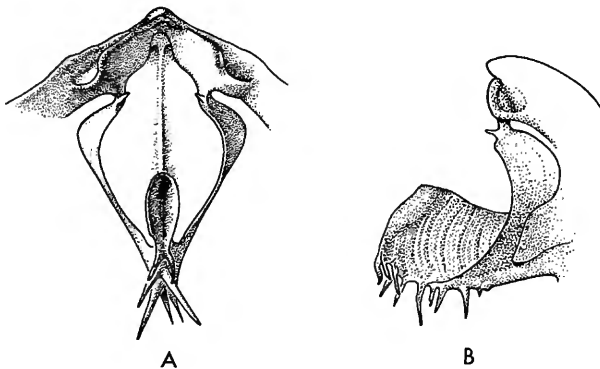


FIGURE 30.—Young specimen of *Ecnomiosa inexpectata*, new species, showing early campagiform stage of loop with anteriorly spiny cone, (ca. $\times 11.5$; A = ventral view; B = side view).

less so anteriorly. Anterior view a low dome somewhat flattened medially. Beak small, umbo gently swollen; poorly visible sulcus originating at midvalve and extending to anterior margin where it forms a slight tongue.

Ventral valve interior with large, thick, nearly horizontal teeth separated from the shell margin by a groove; pedicle collar broad, sessile; dental plates short, separated from valve wall by short, shallow, delthyrial cavities. Ventral muscle field located posterior to midvalve, subrectangular in outline. Vascula media slightly oblique.

Dorsal valve interior with stout socket ridges, small outer hinge plates, and short crura. Crural processes short and angular; median septum not reaching midvalve. Loop long, transverse band with medial vertical ring attached to distal end of median septum; descending branches of loop also attached to distal end of median septum.

MEASUREMENTS (mm).—Length 25.6, dorsal valve length 22.8, width 23.7, thickness 14.1, apical angle 96° .

STATION.—MD.08: 44, CP 199.

TYPES.—Holotype: MNHN-BRA-78-119a; paratypes: MNHN-BRA-78-119b-1.

DISCUSSION.—This Indian Ocean species of *Ecnomiosa* is much smaller than that from the Gulf of Mexico, has a shallow dorsal sulcus, and is anteriorly slightly sulcate. *Ecnomiosa gerda* Cooper from the Gulf of Mexico, although somewhat nasute, has a rectimarginate anterior commissure in the adult.

LOOP DEVELOPMENT.—The collection of *Ecnomiosa* from the Indian Ocean is small, consisting of two adults, a broken adult ventral valve, a young complete adult with loop, and several immature specimens showing details of the loop development.

The smallest specimen (MNHN-BRA-78-119e) 3 mm wide, has well-defined dental plates in the ventral valve. In the dorsal valve, the socket ridges are strong. The crura are short, the crural processes low. The descending lamellae flare widely and attach to the floor of the valve at about midlength. The area surrounded by the loop is greatly thickened and divided medially by a low ridge, the incipient pillar.

A specimen 4.5 mm long and 4.0 mm wide (MNHN-BRA-78-119g) exhibits the interior of both valves. In the ventral valve the dental plates are short but well developed. In the dorsal valve, prominent socket ridges support short crura that extend posteriorly along the base of the socket plate as a narrow ridge. Crural processes are short and blunt. The descending branches of the loop meet the valve floor at about midvalve and form two curved ridges extending medially to meet at the median pillar. The pillar is a low, triangular plate with a low ridge extending posteriorly from it that does not reach the notothyrial cavity.

Another specimen with dorsal valve of 5.5 mm width (MNHN-BRA-78-119h) has cardinalia similar to the preceding but with a more elevated pillar, now with a somewhat rectangular outline and the median ridge from its posterior more elevated but not reaching the notothyrial chamber. The anterior edge of the median pillar is provided with small spines. The descending branches of the loop are broken anteriorly but there is a trace of inner loops on the valve floor.

A specimen with dorsal valve 5.5 mm in width (MNHN-BRA-78-119i) has the socket ridges meeting the valve floor. The pillar is elevated, wide longitudinally, and spinose along its dorsal edge. It is expanded distally to form a narrow cone, the point of which passes into the posterior edge of the pillar. The crura are very short and the descending branches are very broad proximally and just clear of the valve floor for slightly more than half their length, at which point more slender extensions attach to the sides of the pillar. This arrangement forms an intermediate step between the young in which the pillar has not formed a cone, and those young in which the descending branch is wholly attached to the valve floor.

A specimen with dorsal valve 6 mm (MNHN-BRA-78-119j) wide shows a considerable and sudden advance over the preceding. The descending branches are less flaring and their anterior ends are attached to the lower part of the median pillar, with no part attached to the valve floor. This pillar has widened to form a narrow cone open toward the ventral valve. The dorsal side of

the cone is provided with small spines. The pillar descends rapidly in the posterior direction and becomes a low septum that extends to the notothyrial chamber. The ridges on the dorsad edges of the socket ridges extend medially as incipient inner hinge plates. There is no cardinal process.

A specimen with dorsal valve 8.5 mm wide (MNHN-BRA-78-119k) shows a widening and lengthening cone, spiny along its dorsad surface, and open at both ends. The descending lamellae are wider ribbons but less flared laterally. The inner hinge plates approach the low median septum. The median ridge has become a high septum and the inner hinge plates are excavated beneath and attach to the floor on the sides of the median septum. The pillar attaching the cone is narrow at its base and widens ventrally in the long direction of the shell, and attaches along the entire length of the cone to its narrowly open apex. The apex of the cone coincides with the posterior edge of the pillar.

A specimen of 11 mm width of dorsal valve (MNHN-BRA-78-119-l) was broken in transit or collecting but the remainder of the loop is quite revealing. The pillar at its base is now very narrow and the descending branches of the loop attached to the pillar at the base of the cone are broad and concave. The anterior of the cone is deeply cleft but other details have been lost. The inner hinge plates are thickened and attach to the valve floor on each side of the median septum.

At 12 mm of width of the dorsal valve (MNHN-BRA-78-119d) the loop is essentially adult except for the stoutness of its parts. The inner hinge plates are welded to the median septum. The pillar is greatly reduced and the cone has been deeply cleft. The proximal end of the cone now breached forms the ring that attaches the median part of the transverse band, the distal part of the cone, to the pillar, now the septum. The descending branches are attached to the median septum by lateral extensions. The loop is essentially adult.

Genus? species?

DESCRIPTION.—Four specimens from MD.03: 11, CP 7 differ markedly from *Aerothyris*. They all

have short, truncated beaks with a large foramen set off by conjunct deltidial plates. The pedicle collar is short and rimmed in one specimen. The other ventral valves have no pedicle collar and their umbonal regions are subcarinate, suggesting that they are different from the one with pedicle collar. A fragment of dorsal valve has a long, low, median septum. Without dorsal cardinalia it is impossible to assign these specimens correctly.

Superfamily THECIDACEA Gray, 1840

Family THECIDELLINIDAE Elliott, 1958

Genus *Thecidellina* Thomson, 1915

Thecidellina minuta, new species

PLATE 6: FIGURES 27-40

DIAGNOSIS.—Minute, peripheral papillose bands narrow; lacy skeleton over interbrachial sac.

DESCRIPTION.—Very small, length about 2 mm, variable in outline, usually subpentagonal, either elongate or transverse; cicatrix of attachment variable from apical to about 2/3 the ventral valve. Interarea usually narrow, flat, in length about equal to 1/3-1/6 valve length depending on ventral notch for cardinal process. Hinge usually fairly wide but variable; depth of ventral valve variable. Dorsal valve subcircular, with straight hinge; flatly convex in lateral profile, with low median elevation from interarea to mid-valve and short interarea. Color white.

Ventral valve interior with thick, narrow teeth; hemispondylium narrow, with thin plates that attach to valve floor. Inner surface of old specimens granulose. Granulose border confined to anterior and lateral edge of shell.

Dorsal valve interior with very narrow granulose border; median ascending element or septum extending dorsally for about 2/3 valve length obliquely in posteroventral direction. Cardinal process short and squarish as usual in the family. Bridge or transversarium broad, strongly curved, with short septum at its middle that extends to cardinal process. Interbrachia covered in part or wholly by lacy framework of interbrachial sac

over which the schizolophus lophore is laid. Lophophore groove narrow.

MEASUREMENTS (mm).—

Specimen	Length	Dorsal valve		Thick-ness	Apical angle
		length	Width		
MNHN-BRA-78-74a	2.1	1.6	2.0	1.3	80°
MNHN-BRA-78-74d	1.9	1.5	1.9	1.2	80°

STATION.—MD.08: 7, DC 57.

TYPES.—Holotype: MNHN-BRA-78-74c; paratypes MNHN-BRA-78-74a,b, d-k.

DISCUSSION.—This is the smallest living species of *Thecidellina*. In the Indian Ocean *Thecidellina blochmanni* Dall occurs at Christmas Island south of Java and Europe Island off Madagascar (Madagascar Republic). This species is much larger than *T. minuta* and is shaped differently. *Thecidellina minuta* differs from *T. blochmanni* also by lacking a broad, interior, peripheral margin. *Thecidellina minuta* is also unusual in inhabiting deeper water (380 m) than is customary for *Thecidellina*, which is commonly found in water less than 200 meters deep.

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PLATE 1

FIGURES 1-6.—*Eucalathis magna*, new species: 1-4, Anterior, ventral, side, and dorsal views of holotype, MNHN-BRA-78-12, $\times 3$; 5, interior of holotype showing eucalathid loop, $\times 3$; 6, part of spicular skeleton of lophophore, $\times 3$ (all from MD.03: station 11, CP 7, at 790 meters).

FIGURES 7-10.—*Liothyrella moseleyi* (Davidson): 7-9, Anterior, side, and dorsal views, $\times 1$, of complete specimen, hypotype MNHN-BRA-78-13a; 10, dorsal view of preceding, $\times 2$, showing foramen and symphytium (from MD.03: station 31, CP 22, at 110 meters).

FIGURES 11-13.—*Xenobrochus australis*, new species: 11, 12, Dorsal and side views of holotype, $\times 2$, MNHN-BRA-78-14a; 13, side view of holotype showing loop with its long, slender crura and spatula-like anterior, $\times 2.5$ (from MD.03: station 11, CP 7, at 790 meters).

FIGURES 14-34.—*Pemphixina pyxidata* (Davidson): 14, Immature specimen, $\times 2$, hypotype MNHN-BRA-78-15a; 15, dorsal view of more mature specimen, $\times 1$, hypotype MNHN-BRA-78-15b; 16-18, side, anterior, and dorsal views, $\times 1$, of still more mature individual, hypotype MNHN-BRA-78-15c; 19-21, dorsal, anterior, and side views, $\times 1$, of mature specimen, hypotype MNHN-BRA-78-15d; 22, dorsal view of preceding specimen showing ornament, $\times 2$; 23, 24, side and anterior views of old, rotund, obese specimen, $\times 1$, hypotype MNHN-BRA-78-15h; 25, interior of dorsal valve of young individual, $\times 2$, hypotype MNHN-BRA-78-15e; 26, rubber impression of posterior of ventral valve interior showing muscle scars, $\times 2$, hypotype MNHN-BRA-78-15j; 27, 28, dorsal valve interior, $\times 2$, showing the crura in posterior and partial lateral views, hypotype MNHN-BRA-78-15f; 29, interior of posterior part of specimen, $\times 3$, showing crura and parts of mantle with ovarian region, hypotype MNHN-BRA-78-15g; 30, same specimen with parts of mantle removed to show muscles and crura, $\times 3$; 31, 32, dorsal and ventral views, respectively of ventral and dorsal valves of another individual showing muscle scars and cardinalia, hypotype MNHN-BRA-78-15i; 33, 34, same dorsal valve tilted posteriorly to show short median septum and tilted laterally to show wide corrugated socket, $\times 2$ (MD.03: station 25, CB 7, at 172 meters).

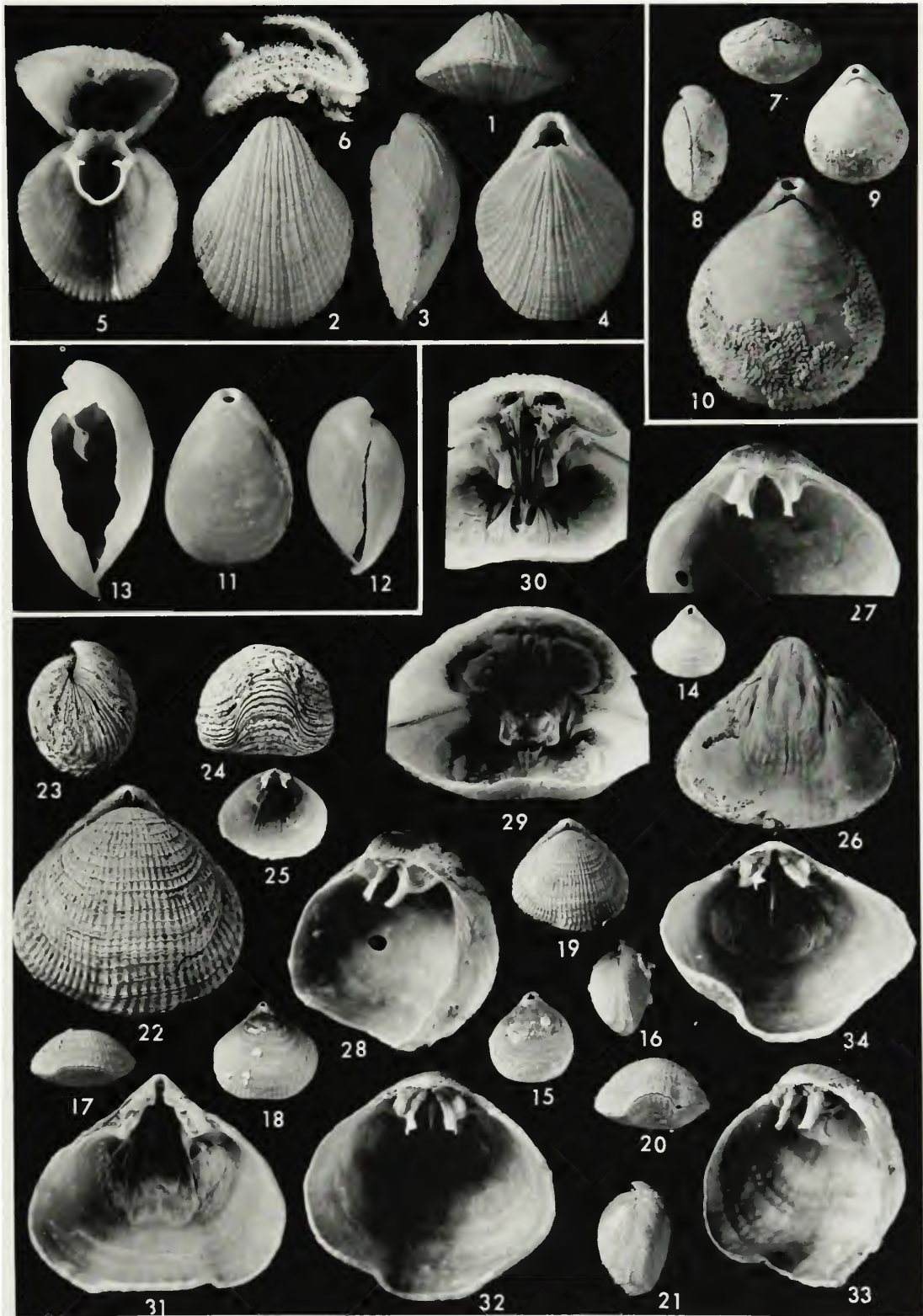


PLATE 2

FIGURES 1–7.—*Tegulohynchia* species: 1, Dorsal view, $\times 1$, MNHN-BRA-78-16; 2–6, anterior, posterior, ventral, side, and dorsal views of preceding specimen, $\times 2$; 7, dorsal view, $\times 3$, of preceding showing spiny exterior and long, slender pedicle (St. Paul, station 98).

FIGURES 8–13.—*Pemphixina pyxidata* (Davidson): 8, Dorsal view of complete specimen, $\times 1$, hypotype MNHN-BRA-78-17 with posterior of ventral valve $\times 2$; 9, side and ventral views of dorsal valve showing crura, $\times 3$; 10–13, dorsal, posterior, side, and anterior views, $\times 2$, of preceding specimen (Amsterdam Island).

FIGURES 14–36.—*Megerlina davidsoni* (Vélain): 14–17, Dorsal, side, ventral, and anterior views of large individual, $\times 4$, showing abraded foramen, hypotype MNHN-BRA-78-18a (St. Paul, 35).

18–21, Dorsal, ventral, anterior, and side views of smaller specimen, $\times 4$, hypotype MNHN-BRA-78-19a; 22, 31, ventral and dorsal interiors, of young specimen, $\times 6$, hypotype MNHN-BRA-78-19j; 23, 29, ventral and dorsal interiors of a somewhat larger specimen than preceding, $\times 6$, hypotype MNHN-BRA-78-19m; 30, interior of another immature dorsal valve, $\times 6$, hypotype MNHN-BRA-78-19-1; 32, 33, two immature, dorsal valve interiors, $\times 6$, hypotypes MNHN-BRA-78-19i,e; 34, 35, interior of dorsal and ventral valve of same individual showing lophophore and pedicle muscles, $\times 10$, hypotype MNHN-BRA-78-19d; 36, interior of adult dorsal valve, $\times 6$, showing well-preserved lophophore, hypotype MNHN-BRA-78-19b (St. Paul, 22a).

24, 26, 27, Ventral valve interior and dorsal and side views of dorsal valve of same individual, $\times 4$, hypotype MNHN-BRA-78-20a (St. Paul, 7b).

25, 28, Interior of ventral and dorsal valves of same individual showing teeth, deltidial plates, and cardinalia, $\times 4$, hypotype MNHN-BRA-78-21a (St. Paul, 90).

FIGURES 37–39.—*Platidia marionensis*, new species: Ventral, anterior, and dorsal views, $\times 6$, of a complete specimen paratype MNHN-BRA-78-22 (MD.03: station 26, CP 17).

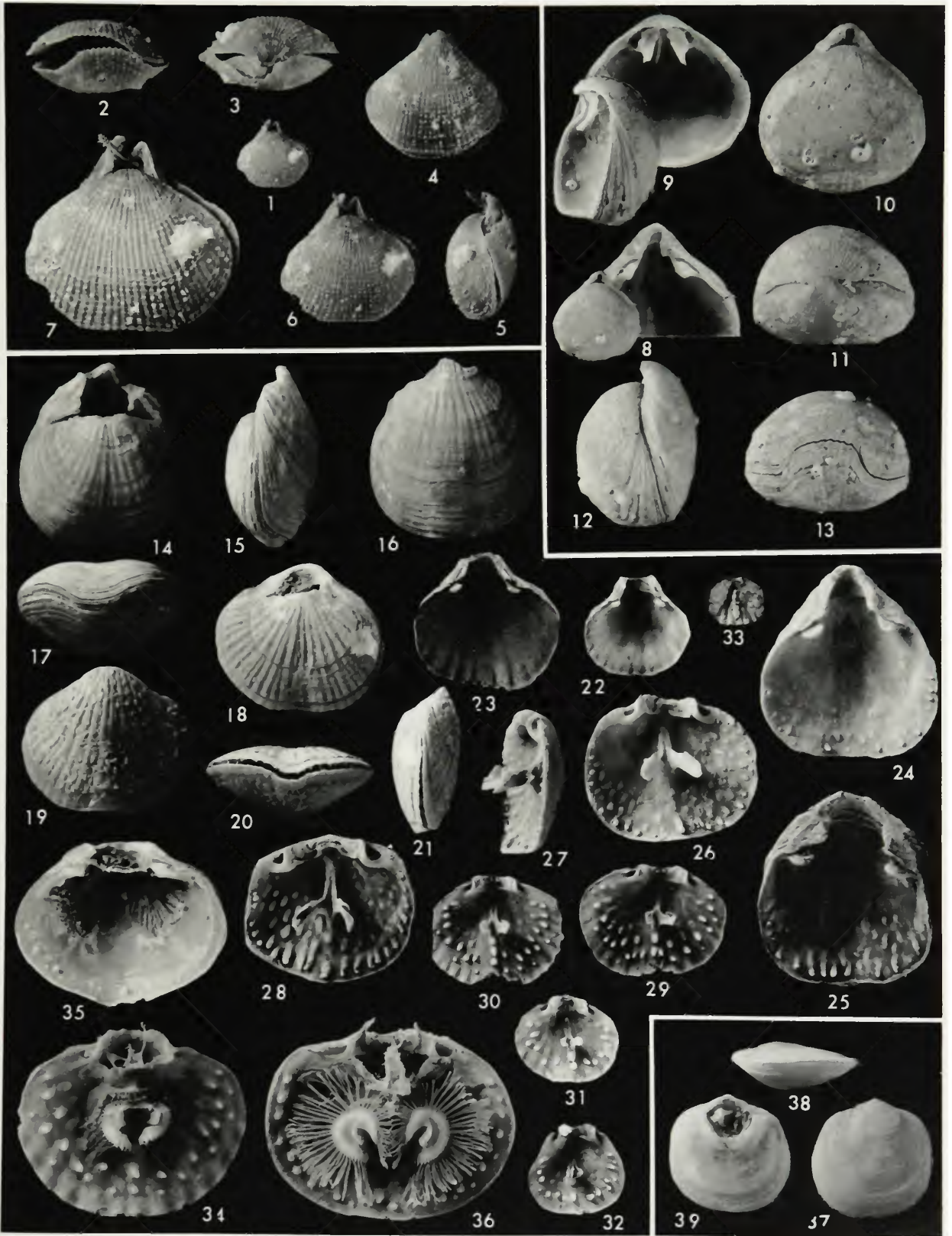


PLATE 3

FIGURES 1–14.—*Basiliola arnaudi*, new species: 1, Dorsal view $\times 1$ of complete specimen, paratype MNHN-BRA-78-23c; 2–5, anterior, side, ventral, and dorsal views, $\times 2$, of preceding paratype, with attached *Thecidellina minuta*, new species; 6, dorsal view of holotype, $\times 1$, MNHN-BRA-78-23a; 7–10, side, dorsal, ventral, and anterior views, $\times 2$, of holotype showing strong uniplicate anterior commissure; 11, interior of the ventral valve, $\times 2$ and $\times 4$, showing upturned margin of deltidial plates, paratype MNHN-BRA-78-23d; 12, interior of dorsal valve of same specimen, $\times 2$, $\times 4$, showing details of hinge plates, crura, and corrugated socket, counterpart to ventral valve above; 13, 14, partial side view and anterior view of the cardinalia of dorsal valve of paratype, $\times 2$, MNHN-BRA-78-23d (MD.08: station 7, DC 57).

FIGURES 15,16.—*Pelagodiscus atlanticus* (King): Ventral and dorsal views of small specimen, $\times 5$, MNHN-BRA-78-24 (MD.08: station 44, CP 199).

FIGURES 17–30.—*Dyscolia? radiata*, new species: 17–19, Side, anterior, and dorsal views of paratype, MNHN-BRA-78-25a; 20, enlargement of exterior of preceding showing radial lines, $\times 4$; 21–23, anterior, dorsal, and side views, $\times 1$, of another complete specimen, holotype MNHN-BRA-78-25b; 24, interior of ventral valve, $\times 2$, paratype MNHN-BRA-78-25c; 25, posterior of ventral valve of holotype, $\times 3$, showing symphytium, teeth, and labiate beak; 26, interior of dorsal valve of holotype, $\times 1$; 27, 28, ventral and side views, $\times 2$, of preceding dorsal valve of holotype showing spatulate loop; 29, same, $\times 3$, showing loop in detail; 30 rubber impression of ventral valve, $\times 1$, showing muscle scars prepared from paratype MNHN-BRA-78-75c (MD.08: station 6, CP 47).

FIGURE 31.—*Liothyrella?* species: Ventral view of interior of juvenile dorsal valve showing incomplete loop, paratype MNHN-BRA-78-122b (MD.08: station 40, DC 186).

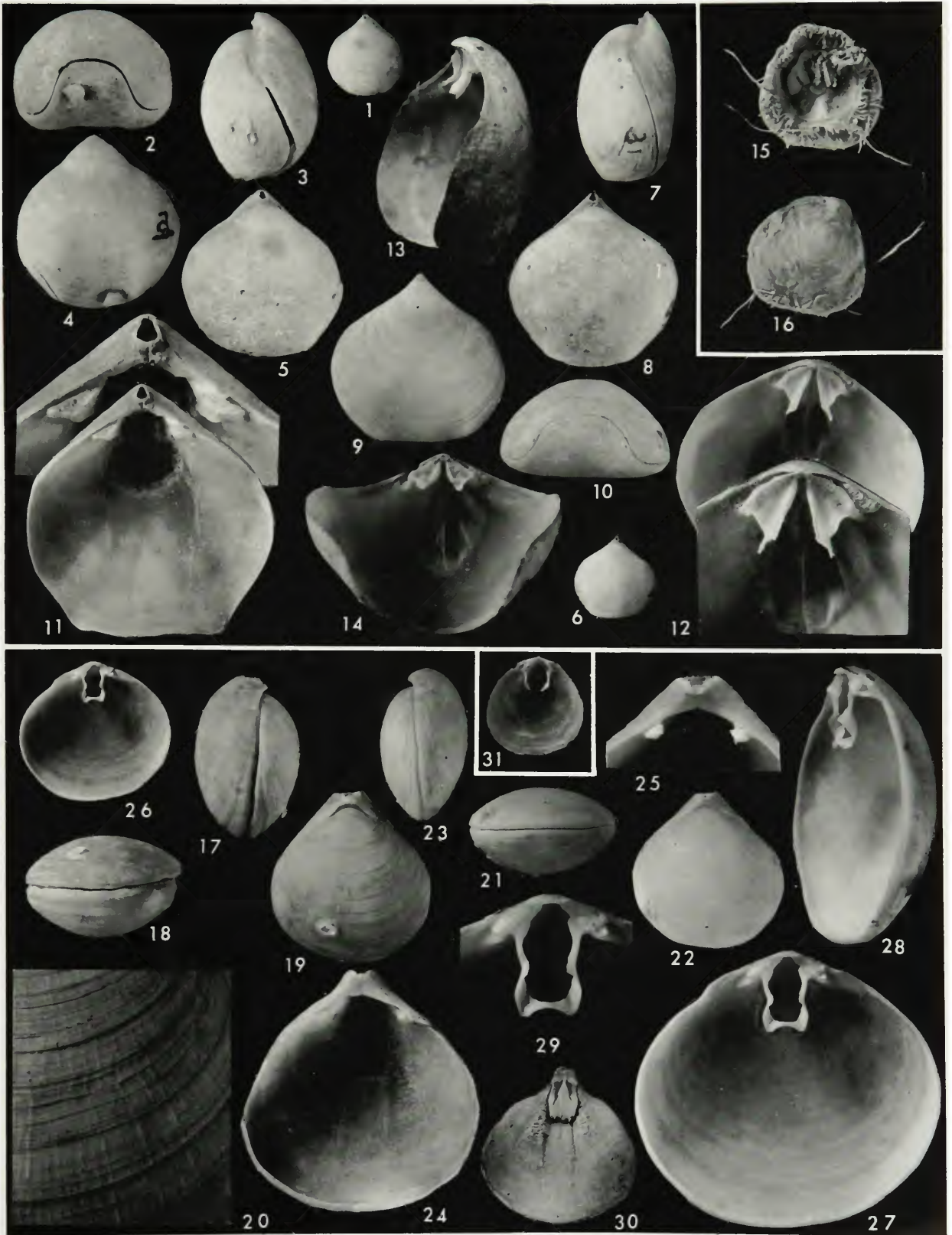


PLATE 4

- FIGURES 1–3.—*Aerothyris kerguelenensis* (Davidson): Anterior, side, and dorsal views of topotype, × 1, USNM 110883, at 150 fathoms (275 meters) (off Kerguelen Island, Indian Ocean, *Challenger* Expedition specimen).
- FIGURES 4–6.—*Aerothyris?* species 1: 4, 5, Side and ventral views of dorsal valve showing loop, × 3; 6, posterior of ventral valve showing conjunct deltidial plates and teeth, × 3, MNHN-BRA-78-26 (MD.08: station 44, CP 199).
- FIGURES 7–10.—*Aerothyris kerguelenensis* (Davidson): 7–9, Anterior, side, and dorsal views, × 1, of round specimen with large foramen suggesting affinities with *A. macquariensis* (Thomson), hypotype MNHN-BRA-78-27a; 10, interior of dorsal valve, × 1.5, hypotype MNHN-BRA-78-27b (MD.08: station 46, CP 204).
- FIGURES 11–20.—*Xenobrochus anomalus*, new species: 11–13, Anterior, dorsal, and side views, × 4, of holotype, MNHN-BRA-78-28a; 14–16, dorsal, anterior, and side views, × 4, of another complete specimen, paratype MNHN-BRA-78-28b; 17, 18, posterior of ventral valve showing symphytium and teeth, and same ventral valve tilted to show pedicle collar × 4, paratype MNHN-BRA-78-28e; 19, 20, posterior of dorsal valve and complete dorsal valve interiors showing hinge plates, × 4, respectively, paratypes MNHN-BRA-78-28d, f (MD.08: station 15, BB 88).
- FIGURES 21–29.—*Dallithyris? dubia*, new species: 21, 22, Dorsal view, × 1, × 2, of small complete specimen, paratype MNHN-BRA-78-29a; 23–26, dorsal view, × 1, and side, anterior, and dorsal views, × 2, of holotype MNHN-BRA-78-29b; 27, posterior of ventral valve and dorsal valve interior, × 3, showing symphytium, teeth, and spatulate loop, hypotype MNHN-BRA-78-29c; 29, side view of same loop, × 4; 28, ventral view of same loop, × 6 (MD.08: station 7, DC 57).
- FIGURES 30–35.—*Xenobrochus africanus* (Cooper): 30–32, Dorsal, side, and anterior views, × 4, of holotype, USNM 550375a; 33, interior of dorsal valve of holotype, × 6, showing loop with transverse band directed anteroventrally; 34, another dorsal valve showing anteriorly directed transverse band, × 6, paratype USNM 550375b; 35 posterior of ventral valve interior of holotype, showing foramen, large symphytium, and teeth, × 6 (*Anton Brunn* Station 358A, latitude 29° 19'S, longitude 32° 00' E, at 366 meters off north Natal, vicinity of Durban Bay, South Africa).

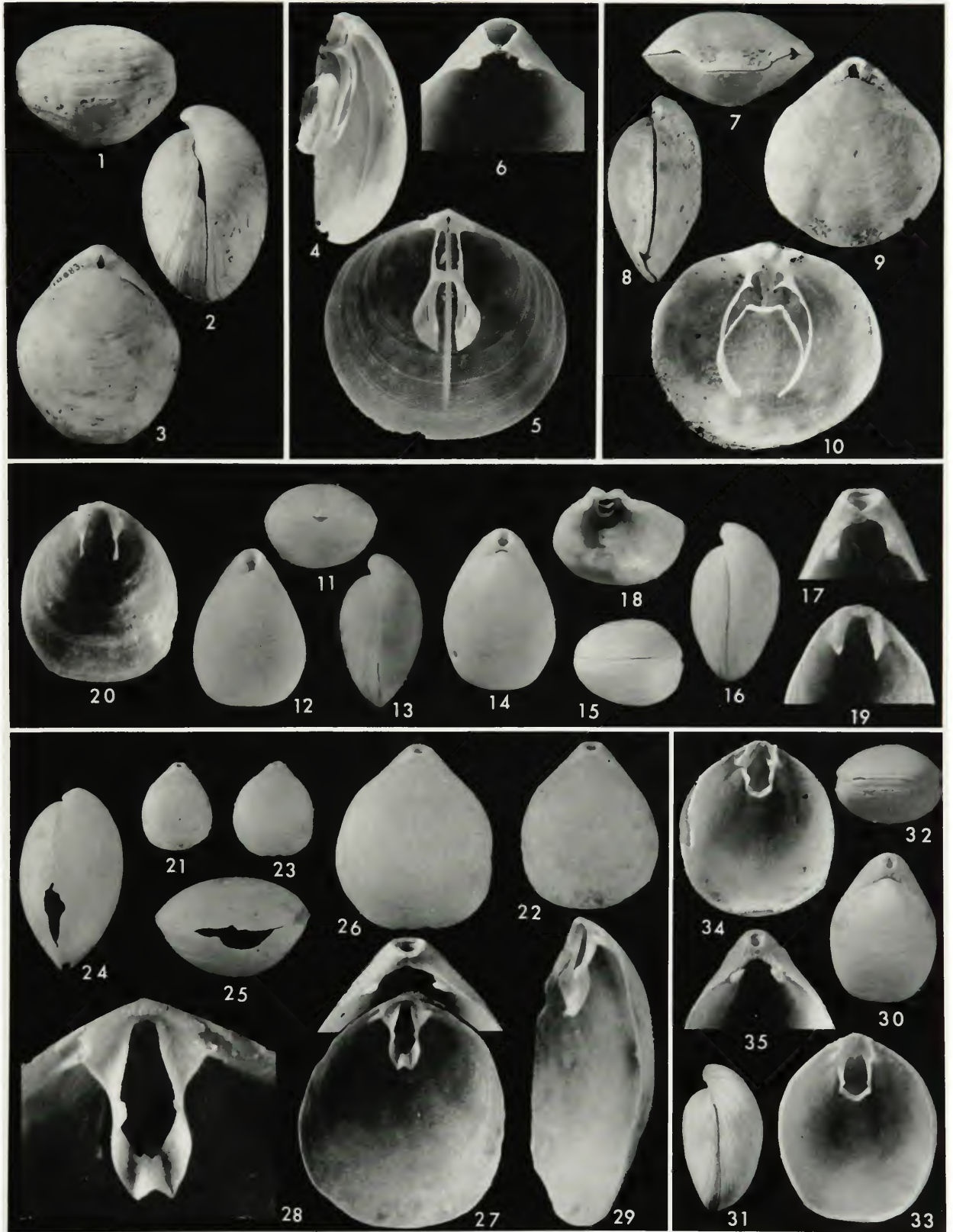


PLATE 5

FIGURES 1-14.—*Eucalathis costellata*, new species: 1-4, Dorsal, side, ventral, and anterior views, $\times 5$, holotype MNHN-BRA-78-64a; 5, interior of holotype showing anteriorly rounded loop, $\times 5$, station 6, DC 47.

7-10, Anterior, ventral, side, and dorsal views of wider specimen than preceding with gastropod? boring, $\times 5$, paratype MNHN-BRA-78-30a; 11, 12, interior of preceding specimen, $\times 5$, $\times 10$, showing loop in detail; 13, 14, interior of two dorsal valves, $\times 10$, showing variation in loop, paratypes MNHN-BRA-78-30c,d; 6, dorsal interior showing loop $\times 5$, paratype MNHN-BRA-78-30b (MD.08: station 7, DC 57).

FIGURES 15-34.—*Platidia marionensis*, new species: Fragment of volcanic rock with several attached specimens, $\times 3$, paratype MNHN-BRA-78-65 (MD.08: station 26, CP 175).

16, 17, Three attached *Platidia marionensis*, respectively $\times 1$, $\times 2$, on *Aerothyris kerguelenensis* (Davidson), paratype MNHN-BRA-78-67 (MD.08: station 28, DC 148).

18, 19, Dorsal and ventral views of round specimen, $\times 4$, paratype MNHN-BRA-78-68 (MD.08: station 67, DC 271).

20, 21, Ventral and dorsal views of specimen somewhat wider than preceding, $\times 4$, paratype MNHN-BRA-78-69a; 34, side view, $\times 10$, of dorsal valve showing loop, paratype MNHN-BRA-78-69b (MD.08: station 68, CP 275).

22, 23, Specimens attached to fragments of old *Aerothyris* shells, $\times 3$, showing close attachment to host, paratypes MNHN-BRA-78-66a,b; 24-26, ventral, dorsal, and side views $\times 6$, holotype, MNHN-BRA-78-70a; 27-30, anterior, side, dorsal, and ventral views of specimen with slightly distorted beak, $\times 6$ paratype MNHN-BRA-78-70b; 31, interior of dorsal valve $\times 20$, showing lophophore, MNHN-BRA-78-70c; 32, interior of ventral valve showing knoblike teeth, interarea, and low median ridge, $\times 10$, paratype MNHN-BRA-78-70d; 33, 34, ventral and posterior views, ca. $\times 14$, of dorsal valve of preceding specimen showing loop (MD.08: station 15, BB 88).

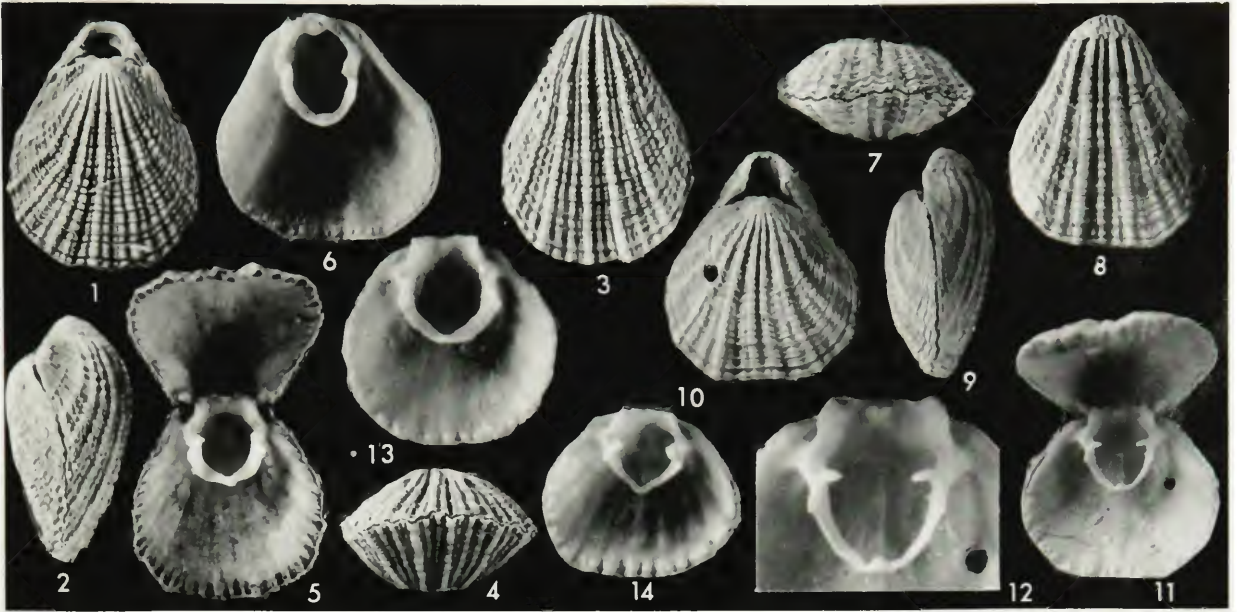


PLATE 6

FIGURES 1–26.—*Megerlia gigantea* (Deshayes): 1–3, Anterior, side, and dorsal views of an average specimen, $\times 2$, hypotype MNHN-BRA-78-71a; 4, exterior of ventral valve of same specimen showing short spines on costellae, $\times 5$; 5, exterior of ventral valve of small specimen, $\times 5$, showing spiny surface, hypotype MNHN-BRA-78-71i; 6, interior of ventral valve showing interarea and teeth, $\times 2$, paratype MNHN-BRA-78-71g; 7–9, posterior and side views $\times 2$ and ventral view, $\times 3$, showing loop, hypotype MNHN-BRA-78-71h; 10–12, side, dorsal, and anterior views of large worn specimen, $\times 2$, hypotype MNHN-BRA-78-71f; 13, posterior of preceding hypotype, $\times 3$, showing upturned edges of deltidial plates; 21–26, series of dorsal valve interiors showing development of the loop, hypotypes 21, = $\times 3$, MNHN-BRA-78-72g; 22 = $\times 4$, MNHN-BRA-78-72i; 23 = $\times 4$, MNHN-BRA-78-72f; 24 = $\times 4$, MNHN-BRA-78-72d; 25 = $\times 4$, MNHN-BRA-78-72c; 26 = $\times 4$, MNHN-BRA-78-72b (MD.08: station 6, DC 35).

14–16, Side and posterior views, $\times 2$ and ventral view, $\times 3$ of dorsal valve interior showing loop, hypotype MNHN-BRA-78-73a; 17, 18, dorsal and ventral views of interior of ventral and dorsal valves, $\times 3$, showing lophophore of dorsal valve and body wall and major pallial trunks of ventral valve, hypotype MNHN-BRA-78-73b; 19, 20, ventral view of dorsal valve interior and dorsal view of ventral valve interior showing same features as preceding, hypotype MNHN-BRA-78-73c (MD.08: station 6, DC 43).

FIGURES 27–40.—*Thecidellina minuta*, new species: 27, Dorsal view of two specimens attached to piece of shell, $\times 9$, paratype MNHN-BRA-78-74a; 28, another complete attached specimen, $\times 10$, in posterior view, paratype MNHN-BRA-78-74b; 29, dorsal view of complete specimen, $\times 10$, paratype MNHN-BRA-78-74d; 30–32, dorsal, ventral, and side views of holotype, $\times 10$, MNHN-BRA-78-74c; 33, 34, interior of ventral and dorsal valves, $\times 18$, showing hemispondylium and median pillar, paratype MNHN-BRA-78-74e; 35, 36, ventral views of two dorsal valves, respectively $\times 18$, $\times 20$, showing lophophore, paratypes MNHN-BRA-78-74f, g; 37, 38 ventral view of two dorsal valves showing median pillar, respectively $\times 20$, $\times 18$, paratypes MNHN-BRA-78-74h, i; 39, 40, ventral views of two dorsal valves showing inner network that lies under the lophophore, $\times 2$, paratypes MNHN-BRA-78-74k, l (MD.08: station 7, DC 57).

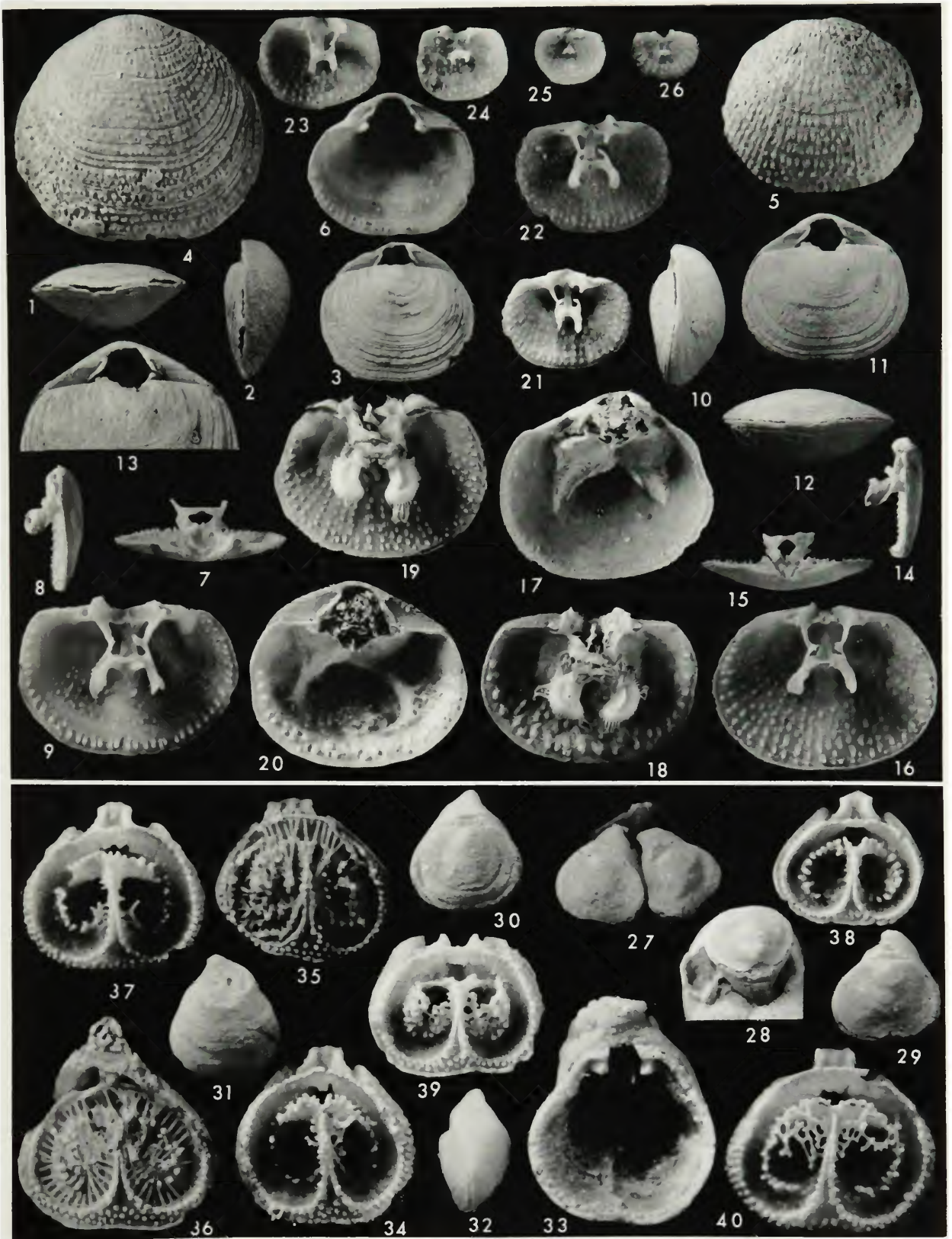


PLATE 7

FIGURES 1–30.—*Aerothyris kerguelensis* (Davidson): 1, Dorsal view, $\times 1$, of young adult with “keyhole” foramen collected by *Challenger*, topotype USNM 110883 for comparison with more variable specimens (off Kerguelen Island at 150 fathoms (=275 meters); for comparison with figures below and for additional views, see Plate 4: figures 1–3).

2–4, Dorsal, side, and anterior views of young specimen, $\times 1$, hypotype MNHN-BRA-78-75h; 5–7, dorsal, side, and anterior views of young, slightly sulcate adult, $\times 1$, hypotype MNHN-BRA-78-75e; 8–10, anterior, side, and dorsal views of young sulcate adult, $\times 1$, hypotype MNHN-BRA-78-75d; 11–13, side, dorsal, and anterior views of nearly full-grown specimen, $\times 1$, hypotype MNHN-BRA-78-75c; 14–16, anterior, side, and dorsal views, $\times 1$, of adult, gently sulcate individual, hypotype MNHN-BRA-78-75b; 17–19, dorsal, anterior, and side views, $\times 1$, of very large specimen with well-defined sulcation, moderately elevated fold, and “keyhole” foramen, hypotype MNHN-BRA-78-75a; 28, ventral view of interior of dorsal valve, $\times 1$, showing free loop and enormous cardinal process, hypotype MNHN-BRA-78-75i; 29, side view of preceding dorsal valve, $\times 1.5$ (all from MD.03: station 30, CP 21, at 187 meters).

20, Interior of fragmentary, old ventral valve, $\times 1.5$ showing muscle scars, hypotype MNHN-BRA-78-76a; 25, specimen 6 mm long with loop attached to septum, 5 hypotype MNHN-BRA-78-76b; 27, specimen 14 mm long with loop nearly free but showing remnants of attachment to septum on descending branches, $\times 3$, hypotype MNHN-BRA-78-76d; 30, specimen 22 mm long with loop completely free and septum reduced, $\times 2$, hypotype MNHN-BRA-78-76e (all from MD.03: station 26, CP 17, at 180 meters).

21, Interior of fragmentary old dorsal valve showing huge cardinal process, hypotype MNHN-BRA-78-77c; 22, interior of posterior of specimen with both valves attached and showing all muscles of ventral valve except adductors, $\times 3$, hypotype MNHN-BRA-78-77a; 23, same view of another specimen showing all muscles, $\times 3$, hypotype MNHN-BRA-78-77b (from MD.03: station 14, CB 3, at 262 meters; for enlarged view of figure 22, see Plate 8: figure 10).

24, Specimen 5 mm long having well-developed ring and with descending lamellae attached to septum, $\times 5$, hypotype MNHN-BRA-78-121 (MD.03: station 9, DM 2, at 15 meters).

26, Dorsal valve interior showing well-developed pallial trunks, $\times 1.5$, hypotype MNHN-BRA-78-78 (MD.08: station 15, DC 87).

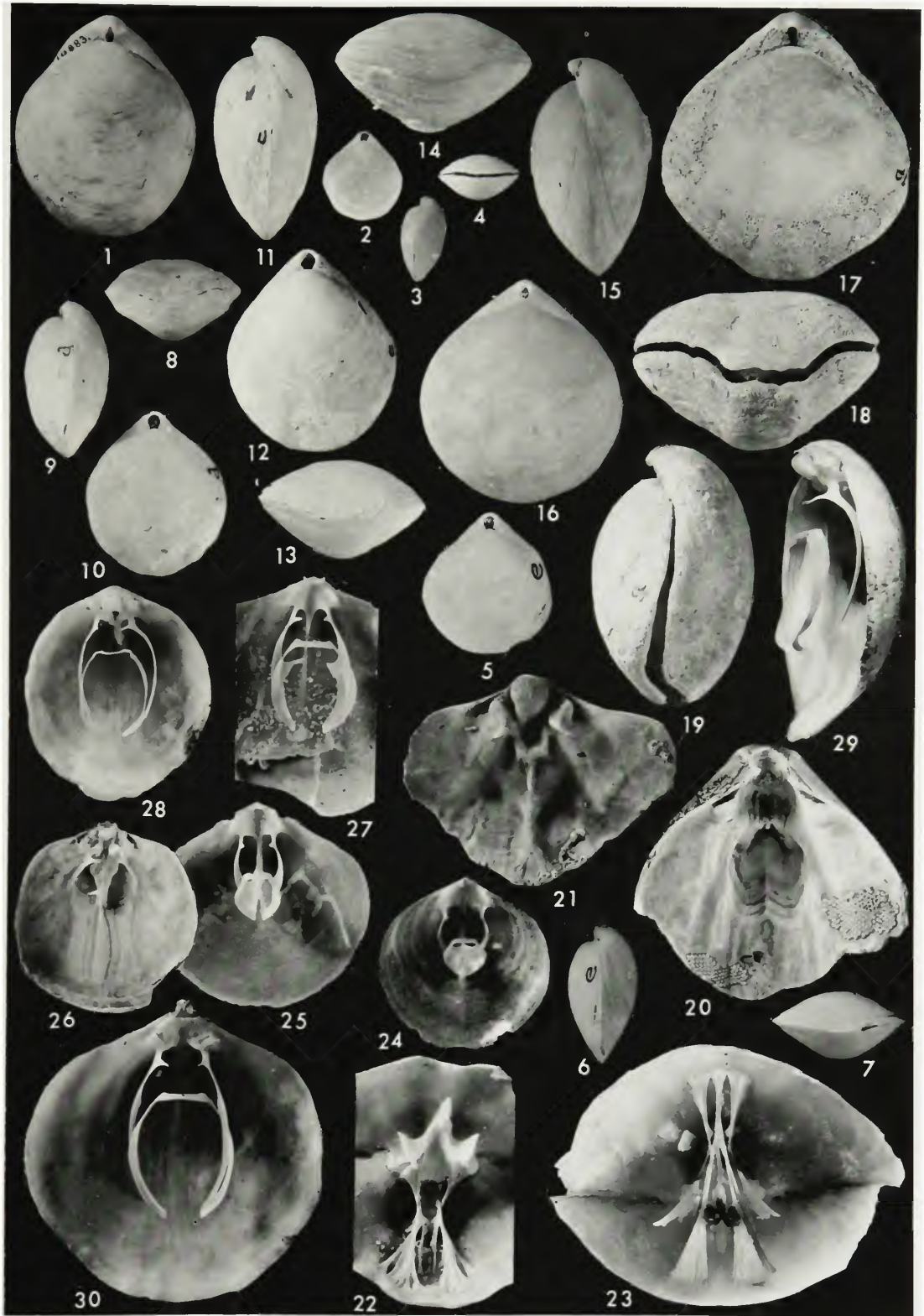


PLATE 8

FIGURES 1–3.—*Aerothyris kerguelenensis* (Davidson): Side, anterior, and dorsal views, $\times 1$, of large rounded individual with keyhole foramen, hypotype MNHN-BRA-78-79 (MD.03: station 14, DC 8).

FIGURES 4–7.—*Aerothyris* aff. *A. kerguelenensis* (Davidson): 4, 5, Dorsal and anterior views, $\times 1$, of wide and circular form with conjunct deltidial plates and small foramen, MNHN-BRA-78-80a; 6, 7, ventral and side views of young specimen with loop, $\times 5$, in terebratelliform stage, MNHN-BRA-78-80b (MD.08: station 17, BB 97).

FIGURES 8, 9.—*Aerothyris kerguelenensis* (Davidson): 8, Interior of dorsal valve, $\times 1.5$, showing adult loop, hypotype MNHN-BRA-78-81 (MD.08: station 74, DC 296).

9, Another elongate oval specimen from *Challenger* Expedition, $\times 1$, showing narrow form and narrow foramen, hypotype USNM 550374 (off Marion Island at 100 fathoms (= 183 m)).

FIGURE 10.—Interior of adult specimen showing arrangement of diductors and dorsal adjustor muscles, $\times 6$ (large diductors in foreground and between them short accessory diductors, both sets attached to straplike integument fixed to cardinal process; pedicle attached to strap; dorsal adjustors visible, attached to hinge plates and to pedicle strap. Hypotype MNHN-BRA-78-77a, MD.03: station 14, CB3).

FIGURES 11–13.—*Aerothyris macquariensis* (Thomson): Anterior, side, and dorsal views of an average specimen, $\times 1$, hypotype USNM 550251-61 (Recent at 112–124 meters, off northeast side of Macquarie Island, Introduced for comparison with specimens (figures 14–28) from Marion Island).

FIGURES 14–29.—*Aerothyris* aff. *A. macquariensis* (Thomson): 14–16, Side, dorsal, and anterior views of specimen with large foramen and vestigial deltidial plates, $\times 1$, hypotype MNHN-BRA-78-82c; 17–19, side, dorsal, and anterior views of slightly smaller specimen with large foramen, $\times 1$, hypotype MNHN-BRA-78-82f; 20, dorsal view of fully grown specimen with foramen approaching the “keyhole” type characteristic of *A. kerguelenensis*, $\times 1$, hypotype MNHN-BRA-78-82h; 21, dorsal view of another adult with large foramen and conjunct deltidial plates, $\times 1$, hypotype MNHN-BRA-78-82a; 22, rubber impression of interior of ventral valve, $\times 1.5$ showing muscle scars and vestiges of pallial marks, hypotype MNHN-BRA-78-82i; 23, 24, interior of dorsal valve showing cardinalia and pallial trunks and rubber impression of interior to show pallial trunks in relief, $\times 2$, hypotype MNHN-BRA-78-82j; 25, posterior of a dorsal valve, $\times 2$, showing socket, ridges, hinge plates, and poorly developed cardinal process, hypotype MNHN-BRA-78-82k; 26, posterior of ventral valve showing teeth and small deltidial plates, MNHN-BRA-78-82i; 27, interior of dorsal valve $\times 1.5$ showing loop, hypotype MNHN-BRA-78-82-1; 28, 29, ventral and side views of young specimen with loop in terebratellid stage, $\times 5$, hypotype MNHN-BRA-78-82m (MD.08: station 22, BB 125).



PLATE 9

FIGURES 1–28.—*Aerothyris kerguelenensis* (Davidson): 1–3, Dorsal, anterior, and side views, $\times 1$, of compact, sulcate, rather wide individual, with “keyhole” foramen, hypotype MNHN-BRA-78-83a; 4, 5, rubber impressions of interior of dorsal and ventral valve, $\times 1$, showing pallial trunks and muscle scars, and vascula media and myaria hypotype MNHN-BRA-78-83f; 6, dorsal view of specimen from which preceding rubber impressions were taken, $\times 1$; 7, interior of elongate dorsal valve, $\times 1$, showing pallial trunks (vascula media and myaria), hypotype MNHN-BRA-78-83b; 8, young round specimen in dorsal view, $\times 1$, hypotype MNHN-BRA-78-83d; 9–11, dorsal, side, and anterior views, $\times 1$, of large, rounded specimen with narrow, small foramen and conjunct deltidial plates, hypotype MNHN-BRA-78-83i; 12, posterior of preceding specimen, $\times 2$, showing small foramen and conjunct deltidial plates; 13, interior of adult dorsal valve $\times 1$, showing loop hypotype MNHN-BRA-78-83c; 14–16, dorsal, side, and anterior views, $\times 1$, of exceptionally large, wide, sulcate specimen, with small “keyhole” foramen, hypotype MNHN-BRA-78-83g; 17–19, anterior, side, and dorsal views, $\times 1$, of another large, round individual having a large foramen, hypotype MNHN-BRA-78-83h; 20, dorsal view of young specimen, hypotype MNHN-BRA-78-83e (MD.08: station 12, DC 78). 21–23, Dorsal, side, and anterior views of elongate, narrow specimen, $\times 1$, having a small “keyhole” foramen and almost conjunct deltidial plates, hypotype MNHN-BRA-78-84; 24, posterior of previous specimen, enlarged $\times 2$, to show details of foramen and deltidial plates (MD.08: station 13, CP 85). 25–27, Dorsal, side, and anterior views, $\times 1$, of large oval specimen with “keyhole” foramen, hypotype MNHN-BRA-78-85 (MD.08: station 34, DC 167). 28, Dorsal interior of large elongate individual, $\times 2$, showing loop, hypotype MNHN-BRA-78-86 (MD.08: station 28, DC 143).

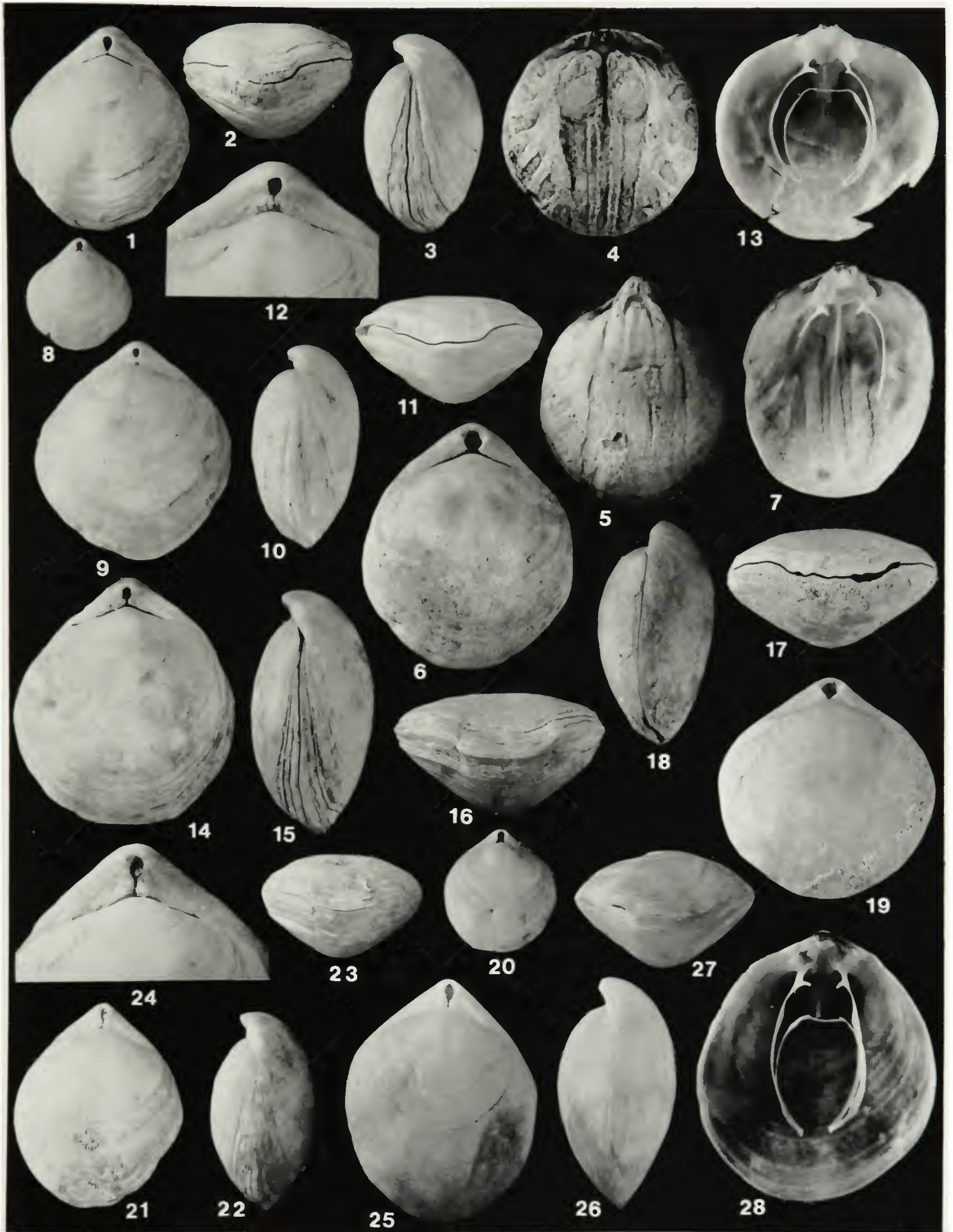


PLATE 10

FIGURES 1-37.—*Aerothyris kerguelenensis* (Davidson): 1-3, Dorsal, anterior, and side views of young, round individual, $\times 1$, hypotype NMHN-BRA-78-87; 4, interior of dorsal valve of same specimen showing loop, $\times 1.5$ (MD.08: station 45, CP 203).

5-7, Side, dorsal, and anterior views of small, elongate, oval specimen with keyhole foramen $\times 1$, hypotype NMHN-BRA-78-88a; 8-10, dorsal, side, and anterior views of smaller, oval specimen, $\times 1$, with attached *Platidia marionensis*, new species, hypotype NMHN-BRA-78-88b (MD.08: station 15, DC 87).

11-13, Small elongate specimen in side, dorsal, and anterior views, having large foramen, $\times 1$, hypotype NMHN-BRA-78-89 (MD.08: station 77, DC 314).

14-16, Dorsal, anterior, and side views, $\times 1$, of small elongate specimen with narrow foramen and widely disjunct, deltidial plates, hypotype NMHN-BRA-89-90a; 33, interior of dorsal valve showing loop, $\times 2$, hypotype NMHN-BRA-78-90d (MD.08: station 27, DC 136).

17-19, Anterior, dorsal, and side views, $\times 1$, of stout, rounded specimen with wide foramen, hypotype NMHN-BRA-78-91 (this is a variant in small sample of population with L/W = 1.02; MD.08: station 73, CP 295).

20-22, Dorsal, anterior, and side views, $\times 1$, of wide, rounded specimen, hypotype NMHN-BRA-78-92 (MD.08: station 9, CP 64).

23-25, Side, anterior, and dorsal views, $\times 1$, of large, wide specimen with large foramen, hypotype NMHN-BRA-78-93; 26, interior of dorsal valve of same specimen, $\times 1$, showing adult loop (MD.08: station 40, DC 186).

27, Dorsal view of small, round specimen, $\times 1$, from population predominately oval, hypotype NMHN-BRA-78-81 (for the interior showing its loop, see Plate 8, figure 8; MD.08: station 74, DC 296).

28, Fairly large, elongate specimen in dorsal view, $\times 1$, hypotype NMHN-BRA-78-94a; 29-31, anterior, dorsal, and side views, $\times 1$, of specimen rounder than preceding with large foramen, hypotype NMHN-BRA-78-94c; 32, interior of dorsal valve of another elongate specimen, $\times 1.5$, hypotype NMHN-BRA-78-94b (MD.08: station 25, CP 134)

34-36, Anterior, side, and dorsal views, $\times 1$, of exceptionally large individual with elongate, large foramen, hypotype NMHN-BRA-78-95 (MD.08: station 42, CP 197).

37, Interior of large dorsal valve showing free loop, $\times 1.5$, hypotype NMHN-BRA-78-96 (MD.08: station 9, DC 68).



PLATE 11

FIGURES 1-17.—*Aerothyris kerguelenensis* (Davidson): 1, 2, Ventral and posterior views, $\times 3$, of specimen with loop well preserved and lateral branches united but free of septum, hypotype MNHN-BRA-78-76c (MD.03: station 26, CP 17).

3, Incomplete specimen of ventral valve showing conjunct deltidial plates, $\times 1$, hypotype MNHN-BRA-78-98; 4, same specimen as preceding enlarged, $\times 2$, showing conjunct deltidial plates and tilted to show inner junction of plates (MD.08: station 13, CP 85).

5, 6, Posterior of ventral valve with conjunct deltidial plates, $\times 2$, and tilted to show inner junction of plates with curled edges, $\times 2$, hypotype MNHN-BRA-78-99a (MD.08: station 18, DC 107).

7, Ventral view of dorsal valve interior, $\times 2$, showing inner hinge plates straddling median septum, hypotype MNHN-BRA-78-100 (MD.08: station 19, BB 111).

8, Interior of dorsal valve showing extravagantly thickened cardinalia, $\times 2$, hypotype MNHN-BRA-78-101; 9, same in dorsal view, $\times 2$, to show ponderous cardinal process (MD.08: station 74, DC 296).

10, Another dorsal valve interior, $\times 2$, showing bizarre thickening of cardinalia and pallial trunks, hypotype MNHN-BRA-78-102 (MD.08: station 40, DC 186).

11, 12, Dorsal and ventral views of greatly thickened dorsal valve, $\times 2$, showing pallial trunks and overgrown median septum, hypotype MNHN-BRA-78-103 (MD.08: station 9, CP 64).

13-17, Series of 5 specimens showing loop development, all \times ca. 7.5: 13, dorsal valve of a specimen with ventral valve about 2.8 mm in length showing early pillar and initial development of septum; 14, specimen with ventral valve 3.2 mm in length showing expanded pillar and septum and nubs of beginning crura; distal end of pillar expanding to form a cone; 15, specimen with ventral valve 4.6 mm in length and showing expanded cone, beginnings of crural processes and descending lamellae, anterior edge of pillar with spines; 16, specimen with ventral valve about 5 mm long showing expanded and posteriorly open cone with narrow cover destined to become transverse band; crural processes well established and descending branches complete; 17, specimen with ventral valve 5.5 mm in length, more retarded than previous specimen because descending branches are not united; respectively hypotypes MNHN-BRA-78-104c,d, f-h (MD.08: station 40, DC 186).

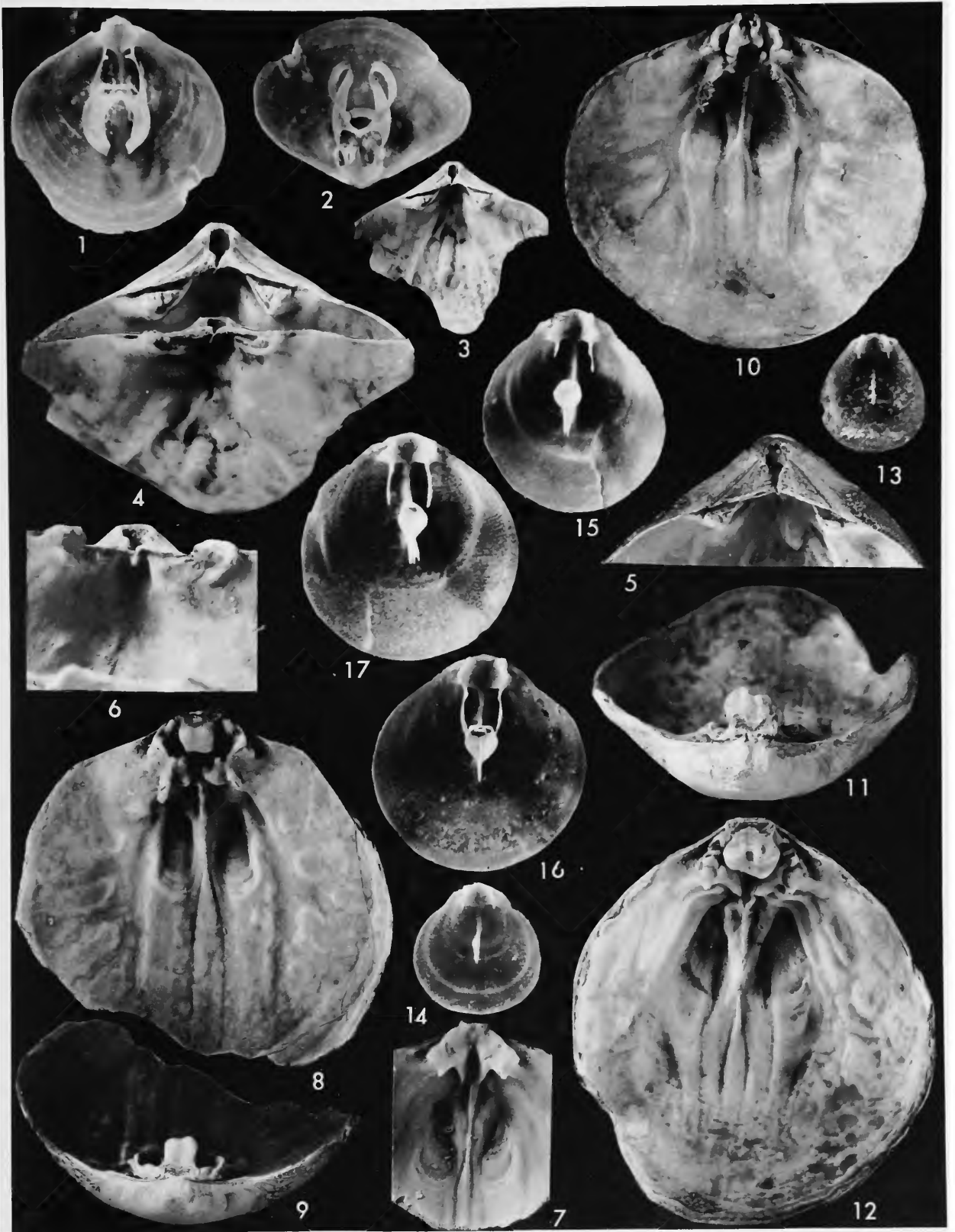


PLATE 12

FIGURES 1-4.—*Eucalathis* species: Dorsal, side, anterior, and ventral views, $\times 5$, of fairly evenly costate specimen, MNHN-BRA-78-105 (MD.08: station 6, DC 43).

FIGURES 5-27.—*Aerothyris kerguelensis* (Davidson): 5, 6, Ventral and posterior views, $\times 1.5$, of dorsal valve showing bizarre thickening of cardinal process and associated structures, hypotype MNHN-BRA-78-106 (MD.08: station 42, CP 197).

7, Ventral view of another dorsal valve with extravagantly thickened cardinal process, $\times 1.5$, hypotype MNHN-BRA-78-107 (MD.08: station 9, DC 68).

8, Interior of dorsal valve, $\times 1.5$ showing unusual development of inner hinge (septal) plates and septum, hypotype MNHN-BRA-78-108 (MD.08: station 46, CP 204).

9, 10, Dorsal valve, $\times 1.5$, with septum rising to crest at midvalve, hypotype MNHN-BRA-78-109 (MD.08: station 20, CP 116).

11, Dorsal valve interior, $\times 1.5$, showing extravagant anterior thickening of cardinal process and inner hinge plates, hypotype MNHN-BRA-78-110 (MD.08: station 9, CP 64).

12, Interior of dorsal valve, $\times 1.5$, showing thickened cardinalia and one resorbed lateral attachment of descending branch to median septum; although precocious in its thickening of shell, this specimen was retarded in its loop development, hypotype MNHN-BRA-78-111 (MD.08: station 16, CL 95).

13-16, Interior of ventral valve, $\times 1$, $\times 1.5$, showing conjunct deltidial plates and great thickening of shell in muscle field, hypotypes MNHN-BRA-78-99b,c; note inwardly depressed ends of deltidial plates in figures 14, 16 (MD.08: station 18, DC 107).

17, Dorsal view, $\times 1$, of largest specimen in population sample, hypotype MNHN-BRA-78-112a; 18-20, dorsal, side, and anterior views of preceding specimen, $\times 1.5$; 21, small, somewhat rounded specimen, $\times 1$, hypotype MNHN-BRA-78-112b; 22, 23, same specimen, $\times 1.5$, showing growth lamellae; 24, early development stage of loop, ca. $\times 9$, showing early ring and incipient descending and ascending branches, hypotype MNHN-BRA-78-112d; 25, interior of dorsal valve, ca. $\times 9$, of another young specimen showing elaborated ring with descending lamellae complete and attached to septum hypotype MNHN-BRA-78-112e; 26, 27, interior of dorsal valve of specimen with ventral valve 14 mm long showing complete magellaniform loop, hypotype MNHN-BRA-78-112c, $\times 3$ (MD.08: station 50, DC 216).

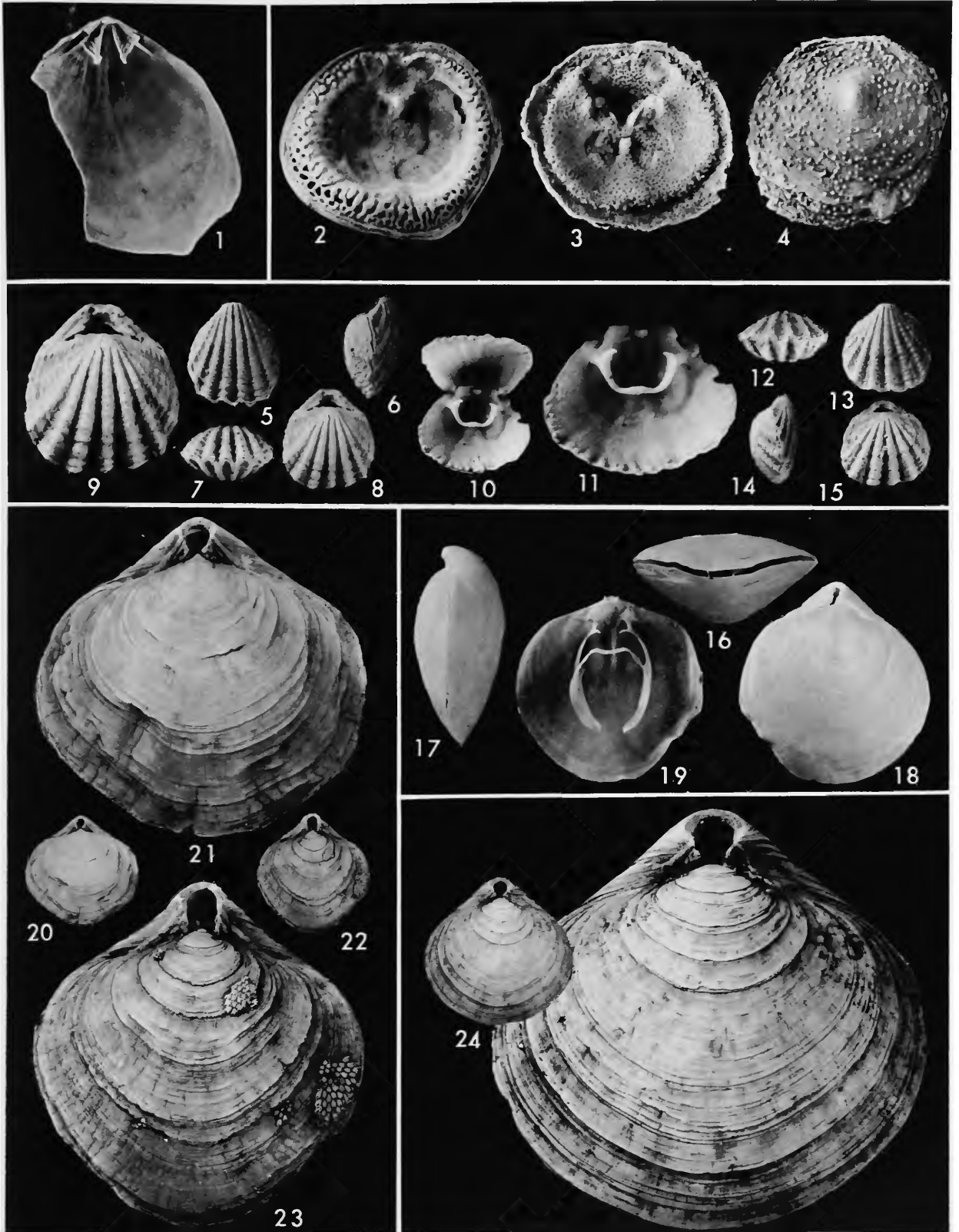


PLATE 13

FIGURE 1.—*Basiliola* species: Interior of large, flattish dorsal valve, $\times 3$, showing cardinalia, MNHN-BRA-78-113 (MD.08: station 7, DC 57).

FIGURES 2–4.—*Crania* species: Interior of ventral valve, interior of dorsal valve, and exterior of dorsal valve, ca. $\times 10$, showing pitted anterior rim of ventral valve and concave rim of dorsal valve and pustulose exterior, MNHN-BRA-78-114 (MD.08: station 6, DC 32).

FIGURES 5–15.—*Eucalathis rotundata*, new species: 5–8, Ventral, side, anterior, and dorsal views, $\times 5$, of strongly costate specimen, holotype MNHN-BRA-78-115a; 9, dorsal view of same specimen, $\times 9$; 10, 11, interior of preceding specimen, $\times 5$, $\times 9$, showing rounded loop; 12–15, anterior, ventral, side, and dorsal views, $\times 5$, of paratype MNHN-BRA-78-115b (MD.08: station 6, DC 35).

FIGURES 16–23.—*Aerothyris kerguelenensis* (Davidson): 16–18, Anterior, side, and dorsal views, $\times 1$, of round specimen, hypotype MNHN-BRA-78-116; 19, interior of dorsal valve of preceding specimen, $\times 1$, showing loop (MD.08: station 34, DC 167).

20, Dorsal view of specimen with length and width nearly equal, $\times 1$, hypotype MNHN-BRA-78-117; 21, dorsal view of same specimen, $\times 3$, showing irregular radial striae (MD.03: station 22, CP 15).

22, Dorsal view of another but more elongate specimen, $\times 1$, hypotype MNHN-BRA-78-118; 23, Same specimen, $\times 3$, showing numerous radial striae, many of which can be related to shell irregularities (MD.03: station 2, CB 2).

24. *Aerothyris macquariensis* (Thomson): Dorsal view, $\times 1$, $\times 3$, of specimen showing radial striae similar to those shown above and often linked to shell imperfections, hypotype USNM 550251-58 (Harvard Station 27–36).

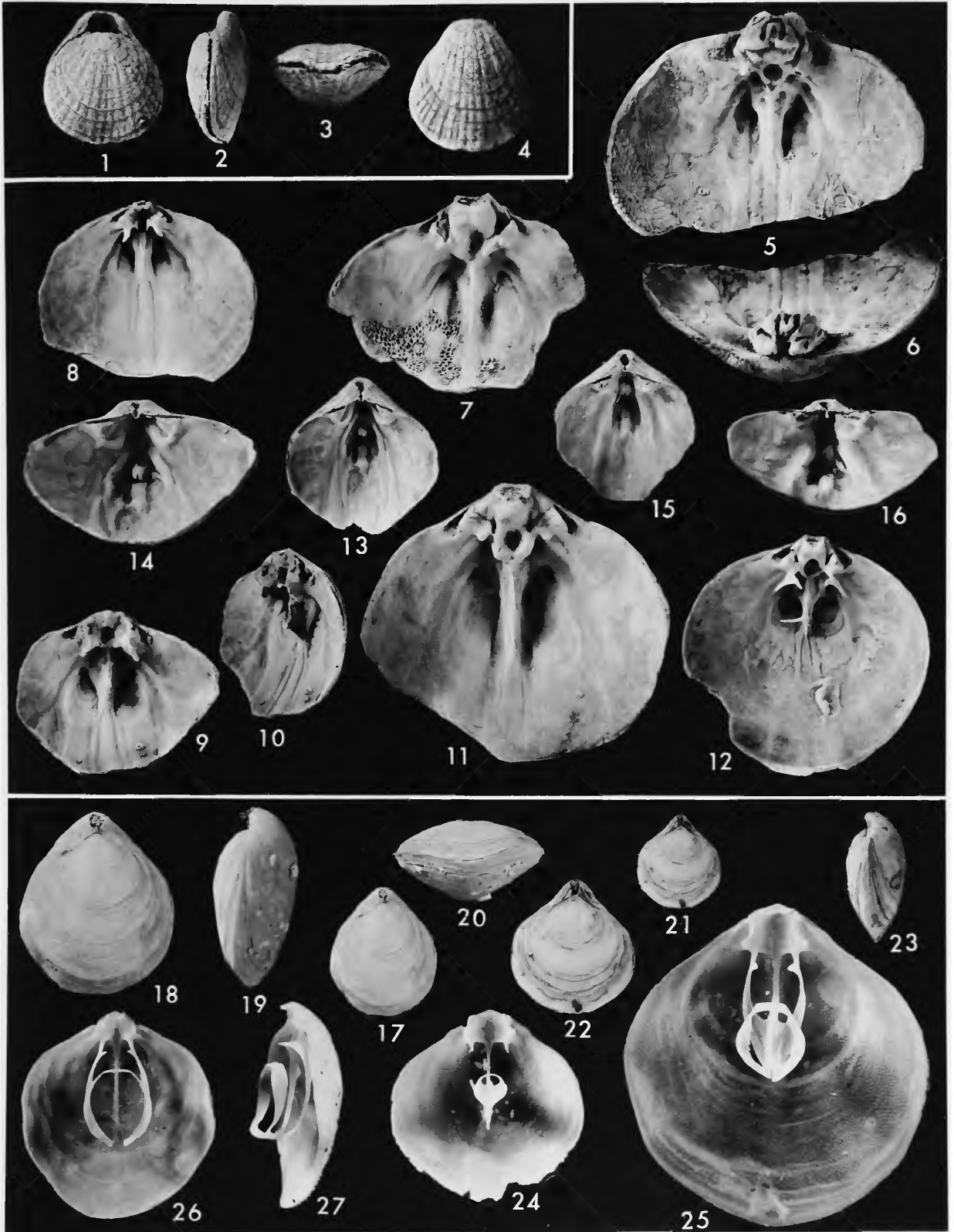


PLATE 14

FIGURES 1-20.—*Ecnomiosa inexpectata*, new species: 1-3, Anterior, dorsal, and side views, $\times 1$, holotype MNHN-BRA-78-119a; 4, dorsal view of holotype, $\times 2$; 5, interior of fragmentary pedicle valve, $\times 1.5$, showing muscle scars and dental plates, paratype MNHN-BRA-78-119b; 6, rubber impression of ventral valve interior of preceding showing muscle scars, $\times 1$; 7-11, dorsal valve in direct ventral view, posterior, anterior, side, and partially tilted ventral views, $\times 2$, of nearly adult dorsal valve showing posterior ring attaching transverse band to median septum, paratype MNHN-BRA-78-119c; 12-14, posterior, anterior, and ventral views, $\times 2$, of complete loop of young but adult individual, paratype MNHN-BRA-78-119d; 15, ventral view of dorsal valve about 4.3 mm wide, at $\times 12$, showing incipient pillar and early loop welded to valve floor, paratype MNHN-BRA-78-119g; 16, dorsal valve interior at $\times 10$, showing broken loop with descending lamellae not attached to valve floor and pillar in its early stages of elongation, paratype MNHN-BRA-78-119h; 17, interior of dorsal valve nearly 6 mm wide, $\times 5$, $\times 9$, showing early development of cone expanding at distal end of pillar, its spiny anterior edge and descending lamellae just released from attachment to valve floor in their proximal half, paratype MNHN-BRA-78-119i; 18, same specimen in ventral view, and side view, $\times 11$, $\times 10$, showing somewhat more expanded cone on pillar, descending lamellae less expanded laterally and free of valve floor; 19, another dorsal valve nearly 9 mm wide, at $\times 4$, showing much expanded cone, still spiny anteriorly, much narrowed descending lamellae, inner hinge plates attached to low but elongated median septum, paratype MNHN-BRA-78-119k; 20, same specimen as preceding, $\times 8$ showing cone open posteriorly, its spiny anterior and inner hinge plates joined to septum, including 2 views of same specimen in partial side ($\times 6$) and side ($\times 8$) views showing anteriorly spiny cone, descending lamellae free of valve floor, and beginning of lateral lacunae (MD.08: station 44, CP 199).



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Review of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of the manuscripts and art.

Copy must be typewritten, double-spaced, on one side of standard white bond paper, with 1 $\frac{1}{4}$ " margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: title page with only title and author and no other information, abstract page with author/title/series/etc., following the established format, table of contents with indents reflecting the heads and structure of the paper.

First page of text should carry the title and author at the top of the page and an unnumbered footnote at the bottom consisting of author's name and professional mailing address.

Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but with no other preparation (such as all caps or underline). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or formal, numbered table heads.

Formal tables (numbered, with table heads, boxheads, stubs, rules) should be submitted as camera copy, but the author must contact the series section of the Press for editorial attention and preparation assistance before final typing of this matter.

Taxonomic keys in natural history papers should use the alined-couplet form in the zoology and paleobiology series and the multi-level indent form in the botany series. If cross-referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa with their corresponding heads in the text.

Synonymy in the zoology and paleobiology series must use the short form (taxon, author, year:page), with a full reference at the end of the paper under "Literature Cited." For the botany series, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in the "Literature Cited") is optional.

Footnotes, when few in number, whether annotative or bibliographic, should be typed at the bottom of the text page on which the reference occurs. Extensive notes must appear at the end of the text in a notes section. If bibliographic footnotes are required, use the short form (author/brief title/page) with the full reference in the bibliography.

Text-reference system (author/year/page within the text, with the full reference in a "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all scientific series and is strongly recommended in the history and technology series: "(Jones, 1910:122)" or "... Jones (1910:122)."

Bibliography, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5-9." For alinement and arrangement of elements, follow the format of the series for which the manuscript is intended.

Legends for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

Illustrations must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9 \underline{b} ." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9 \underline{b} ." Keys to any symbols within an illustration should appear on the art and not in the legend.

A few points of style: (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.

