Some Recent Foraminifera from Vestfold Hills, Antarctica

Science Reports, Tohoku University, Sendai, Japan, 2nd Ser. (Geol.), Spec. Vol., No. 4, pp. 19-31, pls. 1-3, 1 text-fig., 1960

Some Recent Foraminifera from Vestfold Hills, Antarctica

Irene Crespin

Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

ABSTRACT

Twenty-three species of Recent foraminifera are described from Vestfold Hills, Antarctica. Six species are new: *Quinqueloculina serra, Stainforthia concisa, S. vestfoldensis, Laryngosigma antarctica, L. liquida,* and *Cassidulina biora.* The assemblage is dominated by *Cassidulina biora.* Arctic species have been identified.

INTRODUCTION

During the spring season of 1957, Mr. B. H. Stinear of the Bureau of Mineral Resources, Geology and Geophysics, was a member of the Australian Antarctic Expedition which visited the Vestfold Hills area, Princess Elizabeth Land. He collected samples of sediments from terraces around the margins of some of the lakes in the area with hope that foraminifera might be present in them. Two samples contained assemblages of well preserved foraminifera, delicate cidaroid spines and thin shelled mollusca, especially Pectens.

Although more than 30 species have been identified from these samples, the present paper is restricted to descriptions of six new species and some rarer forms from the families Miliolidae, Lagenidae, Polymorphinidae, Buliminidae, Rotaliidae and Cassidulinidae. Most of the species have been recorded in different collections examined from Antarctica and have been described by authors mentioned below. Many tests were minute and delicately preserved and were obtained only after floatation. The genera *Stainforthia, Laryngosigma* and *Esosyrinx* are recorded for the first time from Antarctic assemblages and the species *Parafissurina fusuliformis* described by Loeblich and Tappan (1953) from the Arctic, and *Bolivina pseudopunctata* Höglund (1947) from the Gullmar Fjord, Norway, have not previously been noted from the Antarctic.

The age of the foraminiferal assemblage is regarded as Recent. It is most probable that the present lakes were part of a long fiord during the warm period of 8,000 to 5,000 years ago (Gill, 1955) becoming isolated during the subsequent fall in sea level.

All figured specimens are housed in the Commonwealth Palaeontological Collection, Canberra.

Acknowledgment is made to the Director, Bureau of Mineral Resources, Geology and Geophysics, for permission to publish this paper; to D. J. Belford for helpful criticism and for assistance, with P. R. Evans and F. Hadzel, in the preparation of the illustrations;

and to I. R. McLeod, who spent the 1958–1959 season in the area, for his useful comments.

PREVIOUS WORK ON ANTARCTIC FORAMINIFERA

Foraminifera from the Antarctic region have been studied since the early part of the nineteenth century, when A. D. d'Orbigny made his famous voyage to South America and the Falkland Islands area in 1826–1834. He published the results of his work on the foraminifera in 1839. Up to the time Heron-Allen and Earland completed their investigations of the foraminifera from the Falkland Island area collected during the voyage of the "Discovery" (Heron-Allen and Earland, 1932 ; Earland, 1933, 1934), only a few short papers had been published since d'Orbigny's work.

Antarctic foraminifera have been described by Egger (1893), Holland (1910), Chapman (1916a, b) Pearcy (1914), Fauré-Fremiet (1913), Wiesner (1931), Heron-Allan and Earland (1932), Earland (1933, 1934), Macfayden (1933), Chapman and Parr (1937) and Parr (1950).

Arctic foraminifera have received attention for many years, the more recent works being by Cushman (1920, 1933, 1948), Stsehedrina (1946), Phleger (1952) and Loeblich and Tappan (1953). Some species described by Loeblich and Tappan have been found in the assemblages from Vestfold Hills.

TOPOGRAPHY OF THE AREA

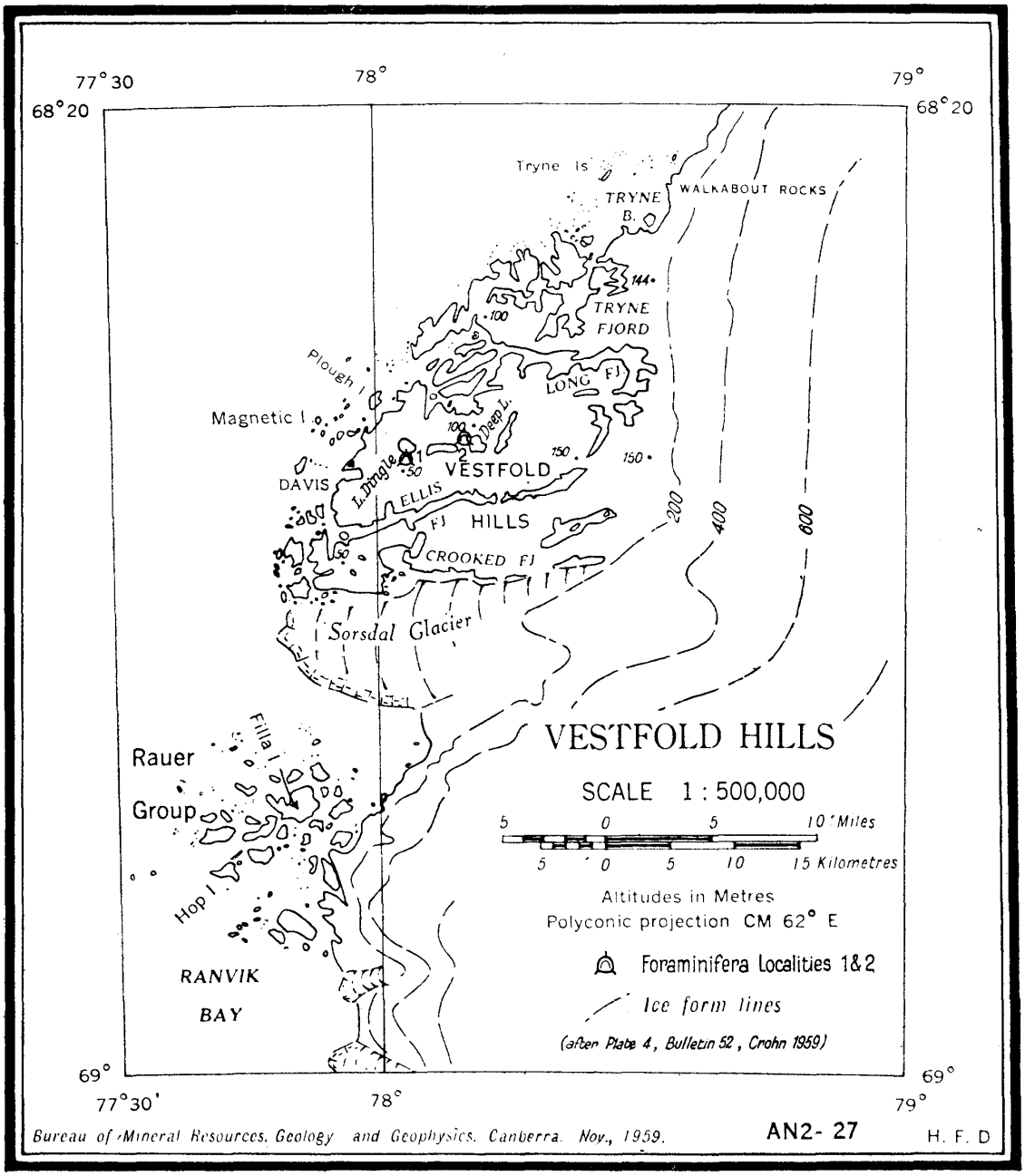
The following notes have been taken from Crohn (1959). A detailed report on investigations in the Vestfold Hills area is in the course of preparation.

The Vestfold Hills lies between latitude 68°25′S and 68°40′S, and longitude 77°50′E and 78°30′E. The headquarters of the Vestfold Hills survey was based at Davis (see Map).

The area is rocky, largely ice-free, and deeply indented by fiords ; the rocks project from the edge of the continental ice cap. Including the outlying islands, rock is exposed for about 150 square miles. The country rock consists of acid gneisses, commonly charnockitic, with irregular bodies of granite pegmatite, amphibole and pyroxene rich layers, and quartz-garnet and quartz-epidote rocks. Numerous basic dykes cut these rocks.

The relief of the area is of the order of 400 feet, and is characterized by numerous hummocky hills, with the intervening valleys filled to various depths by moraine. Many large and small lakes are scattered through these valleys. They appear to have no surface outlets.

Several highly saline lakes with a water surface below that of sea level are present in the central part of the Vestfold Hills. Lake Dingle is 35 feet below sea level and Deep Lake 170 feet. During the summer, numerous streams of melted snow drain these lakes. The larger streams have built up a sandy floor to their valleys ; the sample examined from Deep Lake was collected from this sand. Steep rocky slopes rise from the water or from a boulder beach. Narrow but well-defined terraces approximately at sea level are present on the slopes around Deep Lake and Lake Stinear and a less obvious one around Lake Dingle. The sample examined from Lake Dingle was collected from this terrace.



NOTES ON THE SAMPLES

The foraminifera-bearing samples were collected at two localities:

1. South Terrace, Lake Dingle (Broad Lake)
2. Terrace about 120 feet above water level near the northwest corner of Deep Lake.

The material submitted for examination consisted of unconsolidated fossiliferous sand with a small amount of silt. The residue after washing of the sample from Lake Dingle consisted of clear angular, quartz grains, foraminifera with *Cassidulina* the dominating genus, abundant delicate cidaroid spines and shell fragments. The washings

from the Deep Lake sediment consisted of clear quartz grains, fragments of igneous rocks, carbonaceous particles, a few cidaroid spines, shell fragments, and numerous small delicately preserved foraminifera, the dominating genus again being *Cassidulina*. Heron-Allen and Earland (1932) reported their richest assemblage, in which *Cassidulina* was very common, in a coarse sand from dredgings taken at 118–137 metres. Minute forms like *Lingulina translucida*, which is present in the Deep Lake sample, were present in this coarse sand.

SYSTEMATIC DESCRIPTIONS

Family Miliolidae

Genus *Quinqueloculina* d'Orbigny, 1826

Quinqueloculina serra sp. nov.

Pl. 2, figs. 1–3.

Diagnosis: A species of *Quinqueloculina* with elongate test, almost triangular in end view. Sharp serrations along peripheral margin of chambers. Wall imperforate and highly polished.

Description: Test elongate, with greatest width in central portion of test; almost triangular in end view. Periphery subacute. Three chambers, rapidly increasing in size visible on dorsal surface, earlier ones obscured. Sharp, well-defined serrations along peripheral edge of three last-formed chambers all pointing away from apertural end of each succeeding chamber. Sutures flush with surface and rather indistinct. Wall smooth, imperforate, highly polished. Aperture rounded with a strong tooth.

Dimensions: Length–holotype, 0.77 mm.; paratype A, 0.37 mm. Max. width–holotype, 0.49 mm.; paratype A, 0.20 mm.

Occurrence: Holotype (C. P. C. 590) and paratypes A and B (C. P. C. 591, 592) from Lake Dingle.

Observations: One adult and several juvenile tests of *Q. serra* were found at Lake Dingle. The juvenile forms (Paratypes A and B) show at least four chambers with a thickened ridge along the sutural margin. The peripheral edges of the last-formed chambers are strongly serrated, with the serrations pointing away from the apertural end of each succeeding chamber. The species shows some resemblance to *Q. cristata* (Millett, 1898), from the Malay Archipelago, in the serrated periphery, but in that species the serrations are only noticeable on the last-formed chamber, and the test is more circular.

Genus *Pyrgo* Defrance, 1824

Pyrgo patagonica (d'Orbigny), 1839

Pl. 1, fig. 1.

Biloculina patagonica d'Orbigny, 1839, p. 65, pl. 3, figs. 15–17. Heron-Allen and Earland, 1932, p. 311, pl. 6, figs. 4–6.

Pyrgo patagonica, Parr, 1950, p. 296

Observations: A few specimens of *P. patagonica* including the figured specimen (Hypotype C. P. C. 593) were found at Lake Dingle. D'Orbigny figured the type from off the coast of Patagonia. Heron-Allen and Earland (1932) and Parr (1950) suggested that

this species may be synonymous with *P. elongata* (d'Orb.).

Pyrgo peruviana (d'Orbigny), 1839

Pl. 1, figs. 2, 3.

Biloculina peruviana d'Orbigny, 1839, p. 68, pl. 9, figs. 1–3. Heron-Allen and Earland, 1932, p. 312, pl. 6, figs. 7–9.

Observations: The figured specimens (Hypotypes C. P. C. 594, 595) are two of many found at Lake Dingle; the species is also found at Deep Lake where it is scarce. Heron-Allen and Earland (1932) stated that *P. peruviana* was common at certain localities in the Falkland Islands region.

Family Lagenidae

Genus *Lingulina* d'Orbigny, 1829

Lingulina translucida Heron-Allen and Earland, 1932

Pl. 1, fig. 13.

Observations: Three specimens only were found of this small form; the figured specimen (Hypotype C. P. C. 596) comes from Deep Lake.

Genus *Lagena* Walker and Jacob, 1798

Lagena gracillima (Seguenza), 1862

Pl. 1, fig. 14.

Amphorina gracillima Seguenza, 1862, p. 51, pl. 1, fig. 37.

Lagena gracillima, Brady, 1884, p. 456, pl. 56, figs. 19–28. Loeblich and Tappan, 1953, p. 60, pl. 11, figs. 1–4.

Observations: Only two specimens of this elongate, delicate species were found, including Hypotype C. P. C. 617, from Deep Lake. Parr (1950) recorded it from the Kerguelen area, and Loeblich and Tappan (1953) from off North Alaska.

Lagena ? *protea* Chaster, 1892

Pl. 1, figs. 9–11.

Lagena protea Chaster, 1892, p. 62, pl. 1, fig. 14. Heron-Allen and Earland, 1913, p. 73, pl. 7, figs. 19, 20.

Observations: This unusual adherent lagenid-like form is here tentatively referred to the genus *Lagena*, to which all previous references have been made; but such forms should probably be referred to a new genus. Chaster (1892) in his original description of *L. protea* said it lacked the usual essential character of the genus which is "symmetry of form". He commented that similar setose conditions are found in *Polymorphina* and *Ramulina*. Three different shapes (Hypotypes C. P. C. 597, 598, 599) are figured here from Lake Dingle. The aperture is in all specimens a tubular ectosolenian neck projecting abruptly from the apical end of the test, and does not project from the flattened surface which is the area of attachment.

Lagena hispidipholus (Pearcy, 1914) from the Burwood Bank, South Atlantic, is possibly synonymous with *L.* ? *protea*.

Genus *Fissurina* Reuss, 1850

Fissurina revertens (Heron-Allen and Earland), 1932

Pl. 1, figs. 5, 6.

Lagena revertens Heron-Allen and Earland, 1932, p. 380, pl. 11, figs. 23–28.
Fissurina revertens, Parr, 1950, p. 308

Observations: Five specimens were found at Deep Lake, including the figured specimen (Hypotype C. P. C. 600). All tests show the characteristic keels and centrally placed entosolenian tube. The species was described from the Falkland Island region where it is common. Parr (1950) recorded one specimen from Kerguelen Station 64.

Genus *Parafissurina* Parr, 1947

Parafissurina fusuliformis Loeblich and Tappan, 1953

Pl. 1, fig. 12.

Parafissurina fusuliformis Loeblich and Tappan, 1953, p. 79, pl. 14, figs. 18, 19.

Observations: Three specimens of this usual form were found the figured specimen (Hypotype C. P. C. 601) coming from Deep Lake. All show the typical, narrow, slightly curved test, acute to subrounded at the base and tapering to an acutely angled extremity. The eccentric aperture consists of a small rounded opening partially covered by a flap from the aboral side. Loeblich and Tappan described the species from Frobisher Bay, Baffin Land.

Parafissurina subovata Parr, 1950

Pl. 1, fig. 4.

Parafissurina subovata Parr, 1950, p. 319, pl. 10, figs. 12–14.

Observations: Four well preserved tests were found at Lake Dingle, including the Hypotype C. P. C. 602. The shell wall is translucent, showing the back part of the long entosolenian tube by the rear of the wall of the test; the tube extends nearly to the base of the chamber and flares at the lower end. Parr described the species from Kerguelen Island and recorded it from one Antarctic station.

Family Polymorphinidae

Genus *Laryngosigma* Loebich and Tappan, 1953

Laryngosigma antarctica sp. nov.

Pl. 1, figs. 15, 16.

Diagnosis: This species of *Laryngosigma* has an elongate, slightly compressed test, the chambers being arranged biserially but not in a plane; the last two chambers occupy about two-thirds of length of test. The wall is calcareous and the aperture radiate with a short narrow straight entosolenian tube.

Description: Test free, elongate, slightly compressed, ovate in side view, with greatest width in lower middle third. Periphery rounded. Chambers arranged biserially but not in a plane, gradually increasing in size, a line through the chambers forming a sigmoid curve. Last two chambers slightly inflated, large, attenuated, and occupying more than two thirds of length of test. Sutures distinct, depressed, oblique, last-formed sharply oblique extending from central portion of lower third to margin of test a short distance below aperture. Wall calcareous, finely perforate, translucent; surface smooth. Aperture

terminal, radiate, with a short, narrow, straight, entosolenian tube.

Dimensions: Length-holotype, 0.45 mm.; paratype, 0.39 mm. Thickness-holotype, 0.20 mm.; paratype, 0.19 mm.

Occurrence: Holotype (C. P. C. 603) and paratype (C. P. C. 604) from South Terrace, Lake Dingle.

Observations: Loeblich and Tappan (1953) created the genus *Laryngosigma* for the polymorphine-like tests with an entosolenian tube, which they found in the Arctic. *L. antarctica* differs from the Arctic form *L. hyalascidea,* in its greatest width in the lower middle third, in the large, attenuated last two chambers and in the sharply oblique sutures dividing these two chambers. Several specimens of *L. antarctica* were found in the material from Lake Dingle but because of the fragile wall of the tests, most of them were broken during examination.

Laryngosigma hyalascidea Loeblich and Tappan, 1953
Pl. 1, fig. 17.

Laryngosigma hyalascidea Loeblich and Tappan, 1953, p. 83, pl. 15, figs. 6–8.

Observations: One specimen only (Hypotype C. P. C. 605) was found at Deep Lake. Loeblich and Tappan, who described the species from the Arctic, illustrate the variation within the species. The figure of *Polymorphina inflata* Pearcy (1914) from the Burwood Bank, South Atlantic, shows a short entosolenian tube extending into the cavity of the last chamber and should probably be included in the genus *Laryngosigma.*

Laryngosigma liquida sp. nov.
Pl. 1, figs. 18, 19.

Diagnosis: This species of *Laryngosigma* has an elongate, ovate, translucent test with maximum width about centre of test. The early chambers are small, the later chambers large, each gradually increasing in size. A narrow short, straight entosolenian tube passes into a radiate aperture.

Description: Test elongate, ovate, slightly depressed, with maximum width in about centre of test. Periphery rounded. Chambers arranged biserially but not in a plane, a line through them forming a sigmoid curve. Early chambers small, slightly inflated, the last three chambers large, each one gradually increasing in size as added and each one becoming more inflated. Sutures distinct, depressed, oblique; the later ones gently wavy. Wall calcareous, finely perforate, delicately translucent; surface smooth. Aperture terminal, radiate, with a short, narrow straight entosolenian tube.

Dimensions: Length–holotype, 0.43 mm.; paratype, 0.66 mm. Max. width–holotype, 0.18 mm.; paratype, 0.24 mm.

Occurrence: Holotype (C. P. C. 606) and paratype (C. P. C. 607) from South Terrace, Lake Dingle.

Observations: *L. liquida* differs from *L. antarctica* in its greater number of chambers, which are more regularly added. Perfect specimens are few because of the delicate wall structure.

The specific name is taken from the Latin *liquidus,* clear.

Genus *Esosyrinx* Loeblich and Tappan, 1953

Esosyrinx curta (Cushman and Ozawa), 1930

Pl. 1, figs. 7, 8.

Pseudopolymorphina curta Cushman and Ozawa, 1930, p. 105, pl. 27, figs. 3a, b.
Esosyrinx curta, Loeblich and Tappan, 1953, p. 85, pl. 15, figs. 1–5.

Observations: One specimen (Hypotype C. P. C. 608) was found at Lake Dingle. It showed a short entosolenian tube running into the last-formed chamber, and the biserially arranged chambers characteristic of the genus. Loeblich and Tappan recorded *E. curta* from off Akpakok Island, Ungava Bay, Arctic region.

Family Nonionidae

Genus *Astrononion* Cushman and Edwards, 1937

Astrononion antarcticum Parr, 1950

Pl. 2, fig. 9.

Astrononion antarcticus Parr, 1950, p. 371, pl. 15, figs. 13, 14.

Observations: Three specimens including Hyptoype C. P. C. 609, were found at Lake Dingle. Each specimen has the typical seven chambers in the adult coil, the secondary chambers being confined to the central portion of the test.

Genus *Nonionella* Cushman, 1926

Nonionella iridea Heron-Allen and Earland, 1932

Pl. 3, fig. 16.

Nonionella iridea Heron-Allen and Earland, 1932, p. 438, pl. 16, figs. 14–16. Cushman, 1939, p. 34, pl. 9, fig. 5.

Observations: Several specimens of this minute species were found at both localities; the figured specimen (Hypotype, C. P. C. 610) came from Deep Lake. Heron-Allen and Earland recorded it from the Falkland Islands area and South Georgia, where it was abundant.

Family Buliminidae

Genus *Pseudobulimina* Earland, 1934

Pseudobulimina chapmani (Heron-Allen and Earland), 1922

Pl. 3, figs. 14, 15.

Bulimina chapmani Heron-Allen and Earland, 1922, p. 130, pl. 4, figs. 18–20.
Robertina chapmani, Wiesner, 1931, p. 124, pl. 20, figs. 239a-c.
Pseudobulimina chapmani, Earland, 1934, p. 134, pl. 6, figs. 11–14. Cushman and Parker, 1947, p. 76, pl. 18, fig. 20.

Observations: A single specimen (Hypotype C. P. C. 610) was found at Lake Dingle. The test is more flattened than other figured specimens, with the result that the early coiled chambers on the dorsal surface are more distinct, the suture lines showing as bands of clear shell structure. The apertural opening appears on the ventral surface as a well-marked cleft on the broad face of the final chamber.

Genus *Stainforthia* Hofker, 1956

Stainforthia vestfoldensis sp. nov.

Pl. 2, figs. 4, 5, 6.

Diagnosis: This species of *Stainforthia* has a tapering, sometimes slightly twisted test of six to seven chambers, triserial in initial portion, later becoming biserial. The wall is thin and hyaline; the aperture elongate, inverted V-shaped with a narrow border formed by attachment of upper edge of tooth plate.

Description: Test elongate, tapering, slender, slightly twisted and compressed, triserial in initial portion, becoming biserial in adult portion; four times as long as broad with greatest width in the upper third of test, ovate in side view. Proloculus a small, globular chamber, followed by three small gently inflated chambers, gradually increasing in size and giving a bunched appearance. These followed by four chambers arranged biserially, each one rapidly increasing in size with length greater than width; last-formed one slightly inflated. Chambers slightly overlapping. Periphery subrounded, slightly lobulate. Sutures distinct, depressed. Wall thin, radiate, hyaline, smooth, covered entirely with very fine perforations. Aperture subterminal, very narrow, elongate inverted V-shaped opening towards one side of last-formed chamber and extending from suture between last-formed chamber and preceding one to apex of test. Aperture with narrow incurved border throughout, formed by attachment of upper edge of tooth plate. Each chamber with well developed tooth plate.

Dimensions: Length–holotype, 0.66 mm.; paratype A, 0.47 mm.; paratype B, 0.54 mm. Max. width–holotype, 0.20 mm.; paratype A, 0.16 mm.; paratype B, 0.18 mm.

Occurrence: Holotype (C. P. C. 612) from South Terrace, Lake Dingle. Paratypes A and B (C. P. C. 613, 164) from Terrace at northwest corner of Deep Lake.

Observations: Hofker (1956, 1956a) introduced the generic name *Stainforthia*, with the genotype *Virgulina concava* Höglund (1947), for the *Virgulina*-like forms in which the walls are hyaline and thin and covered with very fine but distinct pores, and the aperture loop-shaped with a tooth plate. All specimens of the genus from the Antarctic show the triserial arrangement of the initial portion, a feature which Hofker suggests is indicative of the microspheric generation.

S. vestfoldensis differs from *S. concava* (Höglund) in its much less lobulate periphery, its less inflated chambers, the absence of an apical spine and the narrow inverted V-shaped aperture.

Stainforthia concisa sp. nov.

Pl. 2, figs. 7, 8.

Diagnosis: This species of *Stainforthia* has a short, stout, tapering test; a globular proloculus, four minute triserially arranged chambers, followed by four inflated biserial chambers, which are large and inflated. The aperture is inverted U-shaped and has a distinct incurved border formed by attachment of upper edge of tooth plate.

Description: Test elongate, tapering, short, stout, with greatest width at base of lower third, where test in edge view is broadly ovate. Proloculus minute, globular chamber, followed by four small triserially arranged chambers which, in turn, are followed by four inflated biserially arranged chambers, the last two being large, inflpate and

somewhat attenuated, all chambers overlapping slightly. Periphery lobulate. Sutures distinct, depressed. Wall thin, radiate, hyaline, smooth, covered almost entirely with very fine pores. Aperture elongate, inverted U-shaped, extending from suture between last-formed chamber and preceding one and extending almost to apex of test. Aperture with a distinct incurved border throughout, formed by attached upper edge of tooth plate.

Dimensions: Length–holotype, 0.34 mm.; paratype, 0.35 mm. Max. width–holotype, 0.17 mm.; paratype, 0.17 mm.

Occurrence: Holotype (C. P. C. 615) and paratype (C. P. C. 616) from Terrace at northwest corner of Deep Lake.

Observations: *S. concisa* differs from *S. vestfoldensis* in its short, stout test and the broad U-shaped apertural area. All available specimens of the species have triserial arranged chambers, which, according to Hofker (1956), suggest the microspheric generation.

The specific name is derived from the Latin *concisus*, short.

Genus *Bolivina* d'Orbigny, 1839

Bolivina pseudopunctata Höglund, 1947

Pl. 2, figs. 10, 11.

Bolivina pseudopunctata Höglund, 1947, p. 273, pl. 24, fig. 5; pl. 32, figs. 2, 3; text-figs. 280, 281, 287.
Phleger, 1952, p. 83, pl. 14, fig. 19. Loeblich and Tappan, 1953, p. 111, p. 20, figs. 13, 14.

Observations: Specimens of *B. pseudopunctata* were found at both localities, hypotypes A and B (C. P. C. 618, 619) coming from Deep Lake. The number of biserial chambers ranged from seven to ten. The wall of all specimens is thin and transluscent, the lower part of each chamber being covered with numerous minute punctae which in Figure 11, completely cover some of the chambers. Parr's figure (1950) of *B. seminuda* Cushman (1910) from the Antarctic region seems more closely related to *B. pseudopunctata* than to that species, as shown by Cushman (1937). Höglund (1947) states that his species is not so stout or as coarsely perforated as Cushman's species. *B. pseudopunctata* is common in the Arctic (Loeblich and Tappan, 1933).

Family Rotaliidae

Genus *Epistominella* Husezima and Maruhasi, 1944

Epistominella patagonica (d'Orbigny), 1839

Pl. 2, figs. 12, 13.

Rotalina patagonica d'Orbigny, 1839, p. 36, pl. 11, figs. 6–8.
Eponides patagonica, Cushman, 1927, p. 162, pl. 5, figs. 1, 2.
Pulvinulina patagonica, Heron-Allen and Earland, 1932, p. 430, pl. 15, figs. 20–22.

Observations: Several tests of this small species were found at both localities, the figured specimen (Hypotype C. P. C. 620) coming from Deep Lake.

Family Cassidulinidae

Genus *Cassidulina* d'Orbigny, 1826

Cassidulina biora sp. nov.

Pl. 3, figs. 1–10.

Diagnosis: This species of *Cassidulina* is almost circular in side view; ovate and

slightly concave in central portion in end view, with a broadly rounded periphery. The chambers range from four to six. The walls are polished and opaque. The aperture is large and partly obscured by a broad thin plate which has an opening along both the lower and upper edges, the inner one being parallel to the basal suture, and the more elongate of the two.

Description: Test free, size large for genus, biconvex, almost circular in side view, ovate on end view, slightly concave in central portion. Periphery broadly rounded, at times lobulate. Chambers distinct, somewhat inflated, alternating, five in last-formed whorl on dorsal side, four on ventral side, completely covering preceding whorl. Last-formed chamber large, broadly curved on peripheral margin and overlapping chambers on ventral surface. Sutures distinct, depressed, straight. Wall thin, polished, opaque, very finely perforate. Aperture on ventral side; large, oval, partly obscured by broad thin plate, which has an elongate opening along both the lower and upper edges; the inner opening is parallel to the basal suture and is more elongate than the upper one.

Dimensions: Length–holotype, 0.93 mm.; paratype A, 0.95 mm.; paratype B, 0.93 mm.; paratype C, 0.95 mm.; paratype D, 0.63 mm. Max. width–holotype, 0.78 mm.; paratype A, 0.82 mm.; paratype B, 0.78 mm.; paratype C, 0.75 mm.; paratype D, 0.45 mm.

Occurrence: Holotype (C.P.C. 621) and paratypes A,B,C, (C.P.C. 622, 623, 624) from Terrace at northwest corner of Deep Lake. Paratype D (C.P.C. 625) from South Terrace, Lake Dingle.

Observations: No reference has been found to any species of *Cassidulina* which has similar apertural characters to those of *Cassidulina biora*. The plate is not a tooth in the sense referred to by Hofker, as it is confined to the aperture of each chamber. The last-formed chambers on paratypes C and D have been etched away to show this characteristic feature, which is present in all specimens examined from Vestfold Hills, where *C. biora* dominates the foraminiferal asemblages. Most specimens are large and both dextral and sinistral shells have been noted. The tests vary only slightly in size and shape.

The name *biora* has been derived from the Latin *bi*–two, *ora*–an opening.

Cassidulina crassa d'Orbigny, 1839
Pl. 3, figs. 12, 13.

Cassidulina crassa d'Orbigny, 1839, p. 56, pl. 7, figs. 18–20. Brady, 1884, p. 429, pl. 54, figs. 4, 5. Fauré-Fremiet, 1913, p. 263, fig. 6 (c). Heron-Allen and Earland, 1932, p. 357, pl. 9, figs. 26–33. Hofker, 1956, p. 931, text-fig. 60.

Observations: Two specimens (Hypotypes A,B, C.P.C. 626, 627) are figured here from Deep Lake. The typical elongate, loop shaped aperture is present. Most specimens of *Cassidulina* from Antarctica have been referred to *C. crassa*; the form is well illustrated by Heron-Allen and Earland (1932).

Cassidulina sp.
Pl. 3, fig. 11.

Observations: The figured specimen (C.P.C. 628) from Deep Lake, shows some

resemblance to *C. islandica*, described by Nφrvang (1945) from Iceland. The aperture is triangular and has a triangular tooth. The test is not as inflated nor has it as many chambers as *C. islandica*, but it may be a juvenile specimen.

REFERENCES

Brady, H.B. (1884) : Report on the Foraminifera Dredged by H.M.S. "Challenger" During the Years 1873–1876. Challenger Exped., Rept. Zool. 9.

Chapman, F. (1916a): Report on the Foraminifera and Ostracoda from Elevated Deposits on the Shores of the Ross Sea. British. Ant. Exped. 1907–9, Geol. 2, 27–51.

————, (1916b) : Report on the Foraminifera and Ostracoda out of marine muds from soundings in the Ross Sea. *Ibid.* 55–80.

————, and Parr, W.J. (1937) : Foraminifera. Aust. Ant. Exped., 1911–1914. Sci. Rept., ser. C. Zool. Bot. 1 (2), 1–190.

Chaster, G. W. (1892) : Report upon the Foraminifera of the Southport Society of Natural Science District. 1st Rept. Southport Soc. Nat. Sci., 1890–1 (Southport, 1892), 54–72.

Crohn, P.W. (1959) : A Contribution to the Geology and Glaciology of the Western Part of Australian Antarctic Territory. Bur. Min. Resourc. Aust., Bull. 52.

Cushman, J.A. (1920) : Foraminifera of the Canadian-Arctic Expedition, 1913–18. Rept. Comm. Arctic Exped. 1913–18, pt. M, 3–13.

————, (1927) : Recent Foraminifera from off the West Coast of America. Bull. Scripps Inst. Ocean., 119–188.

————, (1933) : New Arctic Foraminifera Collected by Capt. R. A. Bartlett from Fox Base and off the Northeast Coast of Greenland. Smith. Mus. Coll., 89 (9), 1–8.

————, (1939) : A Monograph of the Foraminiferal Family Nonionidae. U. S. Geol. Surv., Prof. Pap. 191.

————, (1948) : Arctic Foraminifera. Cush. Lab. Foram. Res., Spec. Publ. 23.

————, and Ozawa, Y. (1930) : A Monograph of the Foraminiferal Family Polymorphinidae Recent and Fossil. Proc. U. S. Nat. Mus., 77 (6).

————, and Parker, F.L. (1947) : *Bulimina* and Related Foraminiferal Genera. U. S. Geol. Surv., Prof. Pap. 210–D, 55–176.

Earland, A. (1933) : Foraminifera, Part II. South Georgia. Discovery Rept. 7, 27–138. (Cambridge Univ. Press.)

————, (1934) : Foraminifera, Part III. The Falklands Sector of the Antarctic (excluding S. Georgia). Ibid. 10, 1–208.

Egger, J.G. (1893) : Foraminiferen aus Meeresgrundproben gelothet von 1874 bis 1876 von S. M. Sch. "Gazelle". Abh. bayerisch Akad. Wiss. 2, Cl. 18, (2), 195–458.

Fauré-Fremiet, E. (1913) : Les Foraminiféres de la Seconde Mission Antarctique Francaise II^{e} Campagne du "Pourquoi Pas" (Note Préliminaire). Soc. géol. France, Bull. 38, 260–271.

Gill, E.D. (1955) : Radiocarbon Dates for Australian Archaeological and Geological Samples. Aust. J. Sci., 18 (2), 49–52.

Heron-Allen, E., and Earland, A. (1922) : Protozoa. Part III-Foraminifera. Brit. Ant. (Terra Nova) Exped. 1910, Nat. Hist. Rept. Zool., 6 (2), 25–268.

————, and ———— (1913) : Clare Island Survey, Part 64. Foraminifera. Proc. Roy. Irish Acad., 31, 1–188.

————, and ———— (1932) : Foraminifera. Part I. The Ice-Free Area of the Falkland Islands and Adjacent Seas. Discovery Rept., 4, 291–460.

Hofker, J. (1956) : Tertiary Foraminifera of Coastal Ecuador. Part II. Additional Notes on Eocene species. J. Paleont., 30 (4), 891–958.

————, (1956a) : Foraminifera Dentata. Foraminifera of Santa Cruz and Thalch-Island, Virginia-Archipelago, West Indies. Spolia Zool. Mus. Hauniensis XV. Copenhagen, 9–237.

Höglund, H. (1947) : Foraminifera in the Gullmar Fjord and the Skagerak. Zool. Bidrag. Uppsala, 26, 1–328.

Loeblich, A.R., and Tappan, H. (1953) : Studies of Arctic Foraminifera. Smith. Mus. Coll., 121 (7), 1–142.

Macfadyen, W.A. (1933) : Fossil Foraminifera from the Burwood Bank and their Geological Significance. Discovery Rept., 7, 1–16.

Millett, F.W. (1898) : Report on the Recent Foraminifera of the Malay Archipelago Collected by Mr. A. Durrand F.R.M.S. (contained in Anchor Mud). J. Roy. Micro. Soc., art. 14, 499–513.

Nφrvang, A. (1945) : Foraminifera. Zoology of Iceland, 2 (2)m 1–79. Copenhagen and Reyljavik.

d'Orbigny, A.D. (1839) : Foraminifères. Voyage dans l'Amérique méridionale, 5 (5). Strasburg.

Parr, W.J. (1947) : The Lagenid Foraminifera and their Relationship. Proc. Roy. Soc. Vict., 58 (n.s.) 1–2, 116–130.

————, (1950) : Foraminifera. B.A.N.Z. Antarctic Research Expedition, 1929–1931. Rept. ser. B (Zool. & Bot.), 5 (6), 235–392.

Pearcey, F.G. (1914) : Foraminifera of the Scottish National Antarctic Expedition. Roy. Soc. Edinburgh, 49 (4), 991–1044.

Phleger, F.B. (1952) : Foraminifera Distribution in Some Sediment Samples from the Canadian and Greenland Arctic. Cush. Found. Foram. Res., 3 (2), 80–89.

Stsehedrina, Z.S. (1946) : New Species of Foraminifera from the Arctic Ocean (Russian with English summary). Trans. Arctic Sci. Res. Inst. Northern Sea route, Board Drifting Expedition on the Icebreaker, "G. Sedov" in 1937–1940, Moscow, 3 (Biology), 139–148.

Wiesner, H. (1913) : Die Foraminiferen der Deutschen Südpolar-Expedition, 1901–1903. Deutsche Südpolar Exped., 20 (Zool. 12), 53–165.

PLATE 1

Fig. 1. *Pyrgo patagonica* (d'Orbigny). Hypotype. × 68

Figs. 2,3. *Pyrgo peruviana* (d'Orbigny). 2, Hypotype A, × 23; 3, Hypotype B, showing denticle-like projections around aperture. × 21

Fig. 4. *Parafissurina subovata* Parr. Hyptotype. × 197

Figs. 4,5. *Fissurina revertens* (Heron-Allen and Earland). Hypotype. 5, side view. 6, edge view showing groove between two ridges extending almost for length of test. × 204

Figs. 7,8. *Esosyrinx curta* (Cushman and Ozawa). Hypotype. 7, side view, showing radiate aperture and short entosolenian tube. 8, other side of test. × 103

Figs. 9–11. *Lagena* ? *protea* Chaster. Hypotypes A,B,C. Showing variation in shape of adherent tests. 9, × 54; 10, × 42; 11, × 32

Fig. 12. *Parafissurina fusuliformis* Loeblich and Tappan. Hypotype. Showing entosolenian tube and hooded aperture. × 92

Fig. 13. *Lingulina translucida* Heron-Allen and Earland. Hypotype. Side view showing typical two-chambered test. × 84

Fig. 14. *Lagena gracillima* (Sequenza). Hypotype. Side view showing asymmetrical test. × 66

Figs. 15,16. *Laryngosigma antarctica* sp. nov. 15, Holotype. Side view showing entosolenian tube and characteristic arrangement of chambers. × 88 ; 16, Paratype. Side view. × 88

Fig. 17. *Laryngosigma hyalascidea* Loeblich and Tappan. Hypotype. Side view showing entosolenian tube and irregular chamber arrangement. × 95

Figs. 18,19. *Laryngosigma liquida* sp. nov. 18, Holotype. Side view showing entosolenian tube, typical arrangement of chambers and elongate-ovate outline of test. × 98; 19, Paratype. Side view of slightly twisted test, showing entosolenian tube. × 56

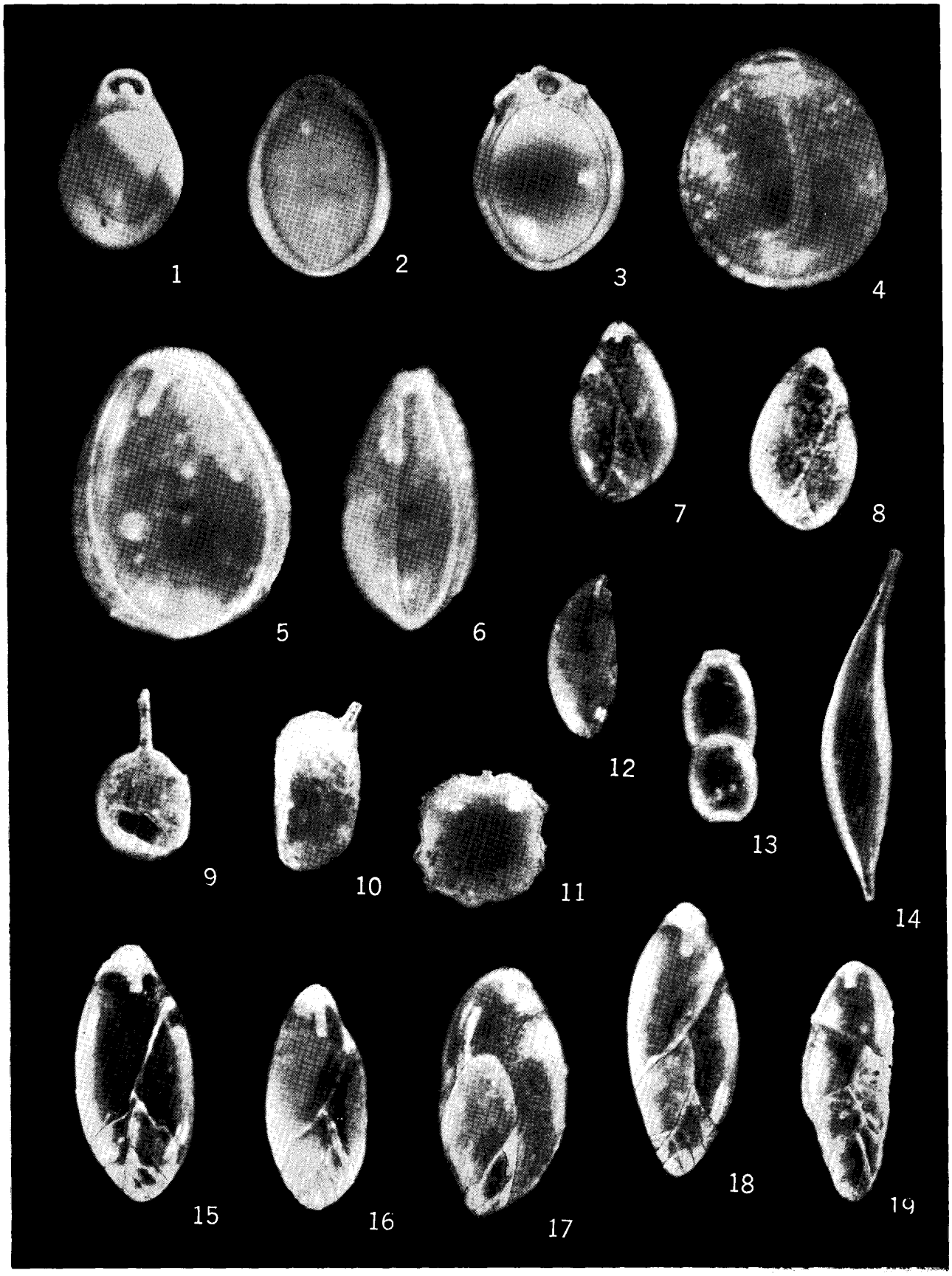

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

PLATE 2

Figs. 1–3. *Quinqueloculina serra* sp. nov. 1, Holotype. Side view, showing sharp serrations along peripheral margin of chambers and smooth polished surface. × 52; 2, Paratype A. Juvenile test. × 54; 3, Paratype B. End view showing shape of aperture with tooth. × 54

Figs. 4–6. *Stainforthia vestfoldensis* sp. nov. 4, Holotype. Side view showing triserial initial chambers followed by biserially arranged ones. × 96; 5, Paratype A. Side view showing inverted V-shaped aperture. × 86; 6, Paratype B. Side view, showing arrangement of chambers. × 93

Figs. 7,8. *Stainforthia concisa* sp. nov. 8, Holotype. Side view showing arrangement of chambers. × 98; 7, Paratype. Side view showing inverted U-shaped aperture. × 100

Fig. 9. *Astrononion antarcticum* Parr. Hypotype. Side view showing characteristic arrangement of supplementary chambers. × 51

Figs. 10,11. *Bolivina pseduopunctata* Höglund. Hypotypes. Side view showing transparent upper portion of chamber and lower portion covered with strong punctae. × 100

Figs. 12,13. *Epistominella patagonica* (d'Orbigny). Hypotype. Dorsal and ventral surfaces. × 100

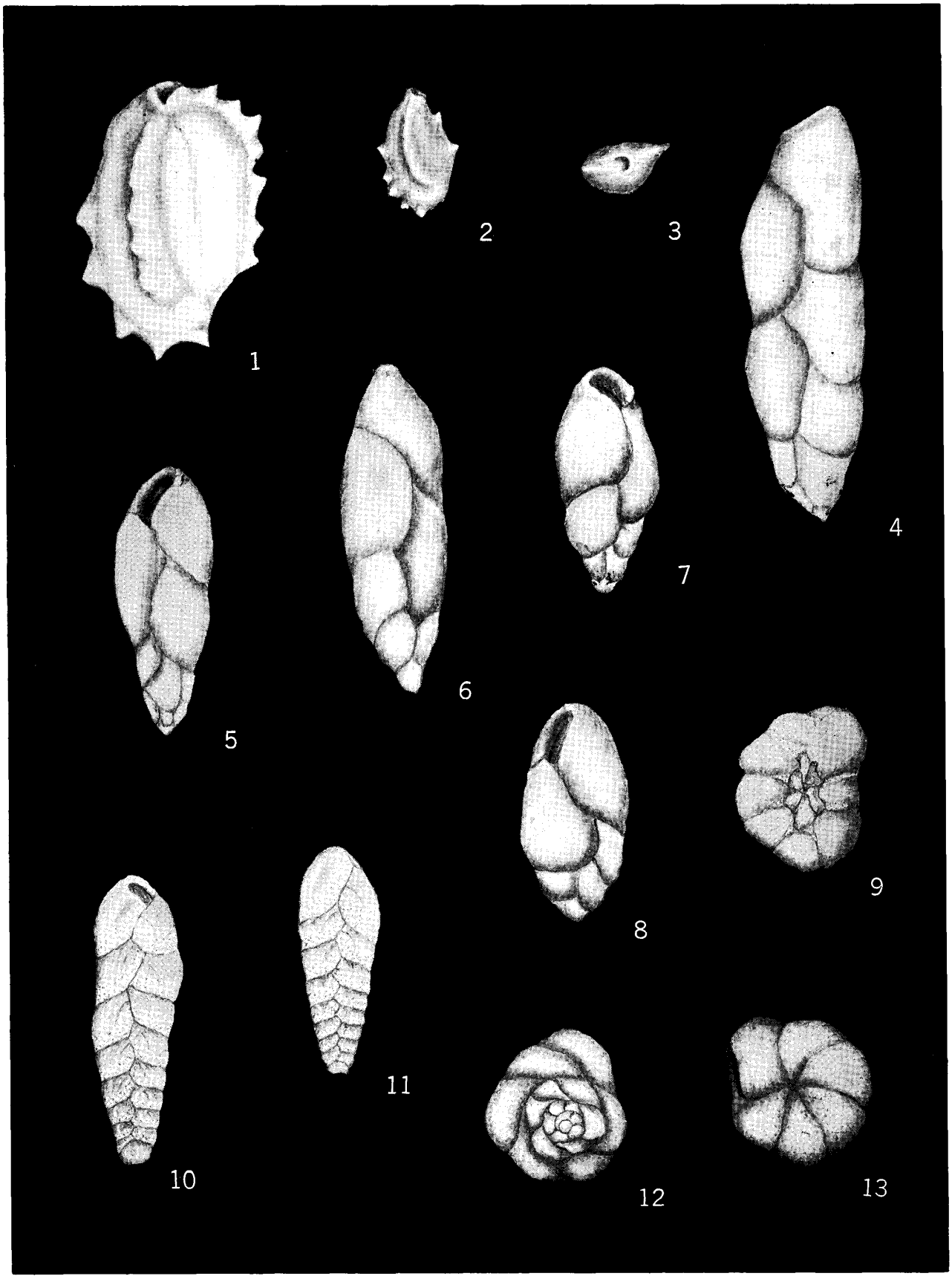

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE 3

Figs. 1–4. *Cassidulina biora* sp. nov. Holotype. 1, ventral side showing apertural depression. × 28; 2, dorsal side with biserial arrangement of chambers. × 28. 3, end view showing rounded periphery. × 28; 4, enlargement of apertural area showing two openings. × 40

Figs. 5–7. *Cassidulina biora* sp. nov. Paratype A. 5, ventral of sinistral test. 6, apertural view. 7, dorsal view. × 25

Fig. 8. *Cassidulina biora* sp. nov. Paratype B. ventral view of dextral test, showing characteristic arrangement of apertural area. × 42

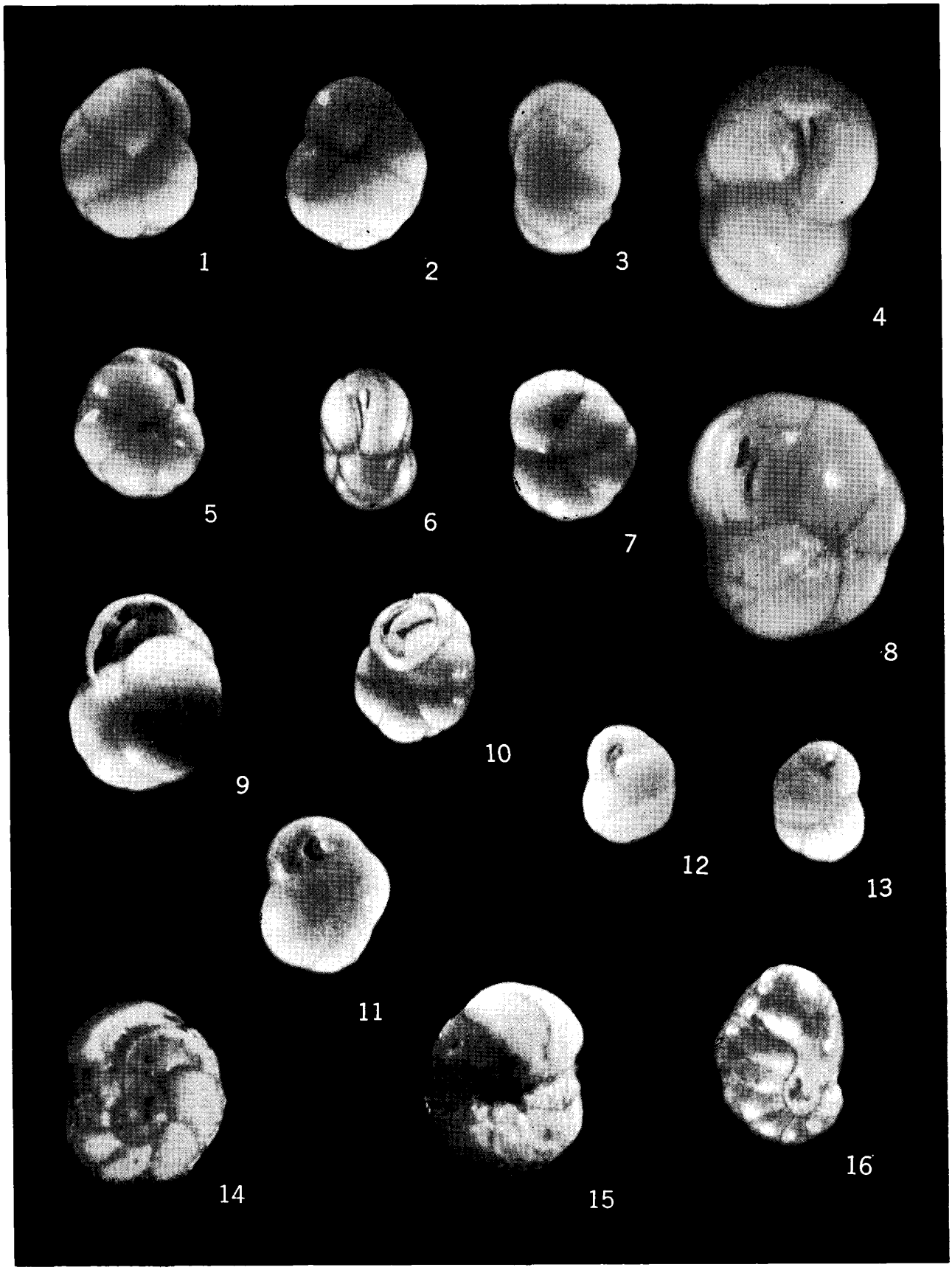
Figs. 9,10. *Cassidulina biora* sp. nov. 9, Paratype C. 10, Paratype D. View of ventral side showing etching away of last chamber to expose apertural arrangement. 9, × 32; 10, × 38

Fig. 11. *Cassidulina* sp. Side view showing inflated test and triangular tooth. × 92

Figs. 12,13. *Cassidulina crassa* d'Orbigny. Hypotypes. Dextral and sinistral tests with typical elongate apertural opening. 12, × 44; 13, × 57

Figs. 14,15. *Pseudobulimina chapmani* Heron-Allen and Earland. Hypotype. 14, dorsal veiw. 15, ventral view showing deep cleft-like slit of aperture. × 56

Fig. 16. *Nonionella iridea* Heron-Allen and Earland. Hypotype. × 93


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16