

No. IX.

RESULTS OF THE HUDSON BAY EXPEDITION, 1920.

I. THE FORAMINIFERA

BY

JOSEPH A. CUSHMAN

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The few bottom samples collected by Mr. Frits Johansen in Hudson Bay and James Bay, 1920, were sent to me to examine for foraminifera. While the number of species obtained is not large, they form a very interesting collection from the standpoint of distribution. No foraminifera have previously been known from this region. In all more than thirty species were obtained. These are mostly species which are characteristic of Arctic conditions. A comparison of these with the fauna known from other parts of the Arctic may be interesting.

One of the most interesting things is the lack of certain species which are common elsewhere in the Arctic. Such, for example, is *Hyperammia subnodosa*, which is abundant in the Canadian Arctic Expedition collection, 1913-18, and also north of Newfoundland. It may be noted, however, that Kiaer did not record this species in his paper on the American Arctic. Other species which were abundant in the Canadian Arctic collection are missing in the Hudson Bay collection or are replaced by other species.

A comparison of the Hudson Bay collection with the fauna recorded by Brady from off Nova Zembla, and by Parker and Jones from Baffins Bay and Davis Strait shows that these faunas are both very similar. It is evident, from a comparison of these faunas, that the foraminifera of Hudson Bay are more closely allied to regions to the east than to the regions to the west of this longitude. It is also very evident from a study of both of these collections that there are developed in the Arctic regions very definite species, which are distinct from the warmer water forms often assigned to the same species.

STATIONS FROM WHICH MATERIAL WAS EXAMINED WITH SPECIES OF FORAMINIFERA AT EACH STATION.

(1) Bay at (N. of) S.E. point of South Twin Island, James Bay, 4-5 fathoms. Sand, gravel, and stones. July 27, 1920.

Trochammia rotaliformis, *Verneuilina advena*, *Discorbis wrightii*, *Polystomella striato-punctata*, var. *incerta*, *Quinqueloculina seminulum*.

(2) Bay on south side of Grey Goose Island, east side of James Bay (lat. 54°N.), 10 fathoms. Sandy mud and algae. July 30, 31, 1920.

Ammobaculites cassis, *Trochammia rotaliformis*, *Patellina corrugata*, *Pulvinulina frigida*, *Polystomella striato-punctata*, var. *incerta*, *Quinqueloculina seminulum*, *Quinqueloculina subrotunda*.

(3) Richmond Gulf (about 3 miles from entrance), east coast of Hudson Bay, 15-20 fathoms. Stones, sand, and *Delesseria*-algae. August 23, 1920.

Sorosphaera confusa, *Psammatodendron arborescens*, *Haplophragmoides canariensis*, *Verneuilina advena*, *Lagena globosa*, *Polymorphina lactea*, *Discorbis wrightii*, *Truncatulina lobatula*, *Pulvinulina frigida*, *Nonionina stelligera*, *Polystomella striato-punctata*, var. *incerta*, *Cornuspira foliacea*, *Quinqueloculina seminulum*, *Quinqueloculina subrotunda*.

(4) Bay inside Boat opening, Manitouk Sound, east coast of Hudson Bay, 5-7 fathoms. Clay with sand and stones. August 27, 1920.

Pelosina variabilis, *Pelosina cylindrica*, *Pelosina rotundata*, *Webbinella hemisphaerica*, *Tholosina bulla*, *Reophax curtus*, *Ammobaculites cassis*, *Trochammina rotaliformis*, *Verneuilina advena*, *Polymorphina lactea*?

(5) Bay between Black Whale and Olaska Harbours, E. coast of Hudson Bay (about lat. 55 N.), 10 fathoms. Sandy mud with many loose algae. August 28, 1920.

Psammosphaera fusca, *Reophax curtus*?, *Ammobaculites cassis*, *Trochammina rotaliformis*, *Verneuilina advena*, *Nodosaria calomorpha*, *Polymorphina lactea*, *Polymorphina lanceolata*, *Polymorphina ovata*, *Polymorphina oblonga*, *Discorbis wrightii*, *Pulvinulina frigida*, *Nonionina orbicularis*, *Nonionina scapha*, *Polystomella striato-punctata*, var. *incerta*, *Polystomella arctica*, *Cornuspira foliacea*, *Quinqueloculina seminulum*, *Quinqueloculina subrotunda*, *Triloculina oblonga*, *Quinqueloculina sp.*

(6) Sound between Paint Hills Islands, east coast of James Bay, 10 fathoms. Sept. 10, 1920. Sandy mud with stones.

Trochammina rotaliformis, *Nonionina orbicularis*, *Polystomella striato-punctata*, var. *incerta*, *Quinqueloculina sp.*

FAMILY ASTRORHIZIDAE.

GENUS PSAMMOSPHERA F. E. SCHULZE, 1875.

Psammosphaera fusca F. E. Schulze.

Psammosphaera fusca F. E. Schulze, II. Jahr. Comm. Wiss. Unt. deutsch. Meer in Kiel, 1875, p. 113, pl. 2, figs. 8 a-f.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 249, pl. 18, figs. 1, 5-8 (not 2-4).

Rare specimens occur only at station 5. They are composed of small, angular quartz grains, with a whitish cement, and no visible apertures. The species is recorded from a very wide range, but there are entirely different forms which should be carefully studied. I have recorded a large form from the western Atlantic (Bull. 104, U.S. Nat. Mus., pt. 1, 1918, pl. 13, fig. 6; pl. 14, figs. 1-3) which may not be this species. It is certainly not like this northern form which seems to be typical. The type station is Houguesund, Norway, 120 fathoms.

GENUS SOROSPHERA H. B. BRADY, 1879.

Sorosphaera confusa H. B. Brady?

Sorosphaera confusa H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 28, pl. 4, figs. 18, 19; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 251, pl. 18, figs. 9, 10.

There are a very few specimens from station 3 which may be referred to this species with some doubt. They are composed of fine white amorphous material for the most part, of several chambers irregularly arranged, but with definite apertures. In one of the specimens these are irregularly grouped near where the chambers intersect, in another they are remote from one another. In the usual form of the species the apertures are not apparent, according to the description, but the figures in the *Challenger* Report show rather definite areas which appear to be apertures closed by amorphous material. Most of the other records are from deep water.

GENUS PELOSINA H. B. BRADY, 1879.

Pelosina variabilis H. B. Brady.

Pelosina variabilis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 30, pl. 3, figs. 1-3; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 235, pl. 26, figs. 7-9—Flint, Rep. U.S. Nat. Mus., 1897 (1899), p. 266, pl. 4, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 74 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 1, 1910, p. 47, fig. 52 (in text).—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 218.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 53, pl. 22, figs. 1-4.

At station 4 this and the two following species occur. One of the specimens of *P. variabilis* has a double aperture. The test is composed of fine-grained, light-coloured, amorphous material. Most of the records for the species are in cold or deep water.

Pelosina cylindrica H. B. Brady.

Pelosina cylindrica H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 236, pl. 26, figs. 1-6.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 253, pl. 4, figs. 1, 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 72 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 1, 1910, p. 46, figs. 50, 51 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 54, pl. 22, fig. 5.

Rhizammina indivisa Goës (part), Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 20.

Like the preceding, this species is known mostly from deep, cold waters. It is recorded from the Antarctic as well as from northern regions. The Hudson Bay specimens are tubular with thick walls of amorphous material which carry sand grains imbedded in the surface.

Pelosina rotundata H. B. Brady.

Pelosina rotundata H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 31, pl. 3, figs. 4, 5; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 236, pl. 25, figs. 18-20.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 254, pl. 11, fig. 60.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 71 (in text).

Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 1, 1910, p. 45, figs. 47-49 (in text); Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 55, pl. 21, figs. 4-6.

A few specimens were found which seemed to belong to this genus. They had apertures, but were without necks. Later a single specimen with the tapering tubular neck was found, showing that the whole are probably *P. rotundata*. Records for typical specimens are rare and much scattered.

GENUS WEBBINELLA RHUMBLER, 1903.

Webbinella hemisphaerica (Jones, Parker and H. B. Brady).

Webbina hemisphaerica Jones, Parker and H. B. Brady, Pal. Soc. Mon., 1865, p. 27, pl. 4, fig. 5.—Robertson, Rep. Brit. Ass., 1875, p. 189.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 350, pl. 41, fig. 11.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 266, pl. 14, figs. 1-3. Cushman, Proc. Boston Soc. Nat. Hist., vol. 34, 1908, p. 24.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 53.

Webbinella hemisphaerica Rhumbler, Arch. Prot., vol. 3, 1903, p. 228, fig. 54 (in text).—Cushman, Bull. 71, U.S. Nat. Mus., pt. 1, 1910, p. 51, figs. 56*a*, *b* (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003. Cushman, Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 62, pl. 25, figs. 1-3.

At station 4 this species is evidently common as numerous small stones sent me had numerous specimens on their surfaces. The specimens are not as high as that of the *Challenger* Report figure, nor are they of the same texture or shape. The same is true of a comparison of those I have figured from off the Carolinas, and there is a considerable difference from either of the others.

The specimens which are common in Hudson Bay give the appearance of being the result of selection in position of the material. If it may be supposed that the original animal was free and able to ingest various sorts of material, it is easy to see how the test might be formed. The whole is somewhat convex in the central portion, with a thinning toward the periphery which is in general circular, but often somewhat irregular. The central cavity in broken specimens is comparatively small. It is bordered with the largest sand grains of the whole test, and the outside gradually becoming finer, until the final outer coating is very fine and smooth. There is no apparent aperture. All the specimens examined are very uniform in structure and in appearance. This would lead one to the belief that in this region there is a definite species, probably not the same as that described by Jones, Parker and H. B. Brady, nor the same as that figured in the *Challenger* Report, nor the same as that I have figured and referred to above.

GENUS THOLOSINA RHUMBLER, 1895.

Tholosina bulla (H. B. Brady)?

This species which was so abundant in the Canadian Arctic Expedition collection seems to be almost wanting in Hudson Bay, unless a single detached

specimen represents it. The specimen is of the usual convex form and white colour, and shows the central cavity. *T. vesicularis* was also entirely lacking in the collection.

GENUS PSAMMATODENDRON NORMAN, 1881.

Psammatodendron arborescens Norman.

Psammatodendron arborescens Norman, MSS. in H. B. Brady, Denkschr. k. Akad. Wiss. Wien, vol. 43, 1881, p. 98; Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 404.—Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 670.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 79, pl. 30, figs. 1, 2.

Hyperammia arborescens H. B. Brady, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 262, pl. 28, figs. 12, 13.—Wright, Proc. Belfast Nat. Field Club, 1884-85, App. IX., 1886, p. 319, pl. 26, fig. 1.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1884, p. 18, pl. 4, figs. 63, 64.—Schaudinn, Bergens Mus. Aarbok, 1894-95, No. 9, p. 5.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 260, fig. 102 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 11.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 1, 1918, p. 79, pl. 30, figs. 1, 2.

This species seems to be characteristic of the colder regions of the North Atlantic and Arctic Oceans. It is recorded by Awerinzew from the Siberian Arctic. In the North Atlantic it is known from off the coast of Norway and Great Britain as well as further north off Greenland, Iceland, Nova Zembla, and Franz Joseph Land.

Only small branching portions were found in the Hudson Bay collection at station 3.

FAMILY LITUOLIDAE.

GENUS REOPHAX MONTFORT, 1808.

Reophax curtus Cushman.

Reophax scorpiurus Goës (part) (not *R. scorpiurus* Montfort), Königl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 24, pl. 5, figs. 160-163.

Reophax curtus Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 8, pl. 2, figs. 2, 3.

Test short and thick, composed typically of three chambers, increasing rapidly in size as added, last-formed chamber making up a large proportion of the test, fusiform or elliptic, axis of the test straight or more often slightly curved; wall composed of angular quartz sand grains, with a considerable amount of grey cement between; apertural end slightly tapering, without a definite neck, the aperture being an opening between three or more sand grains at the end of the chamber.

Length up to 2 mm.

The type station for this species is *Albatross* D2458 in 89 fathoms, north of the Grand Banks, in very cold water (29.5°F.). Fine, large, typical specimens

are common at station 4, and a single specimen from station 5 may be referred here. The species occurs off Greenland and off the north coast of Europe in cold water.

The species is shorter, thicker, and fewer-chambered than *R. scorpiurus*, the chambers fewer and longer than in *R. pilulifer*, and different in the material of the wall and in the number and shape of the chambers from *R. bilocularis*.

It seems to be a species of cold waters and moderate depths.

Goës figures this species under the name of *R. scorpiurus* in the reference noted above. The specimens were from the Greenland Sea in 35-215 meters, and from the Skagerack in 250 meters.

GENUS HAPLOPHRAGMOIDES CUSHMAN, 1910.

Haplophragmoides canariensis (d'Orbigny).

A single specimen only from station 3 gives the only record for this species in the collection. It has been already recorded from the Canadian Arctic Expedition and from other Arctic areas, as well as in temperate regions. It is evidently not the same as that found in shallow, tropical waters.

GENUS AMMOBACULITES CUSHMAN, 1910.

Ammobaculites cassis (Parker).

Lituola cassis Parker, in Dawson, *Canad. Nat.*, vol. 5, 1870, pp. 117, 180, fig. 3.
Haplophragmium cassis H. B. Brady, *Rep. Voy. Challenger, Zoology*, vol. 9, 1884, p. 304, pl. 33, figs. 17-19.—Goës, *Köngl. Svensk. Vet. Akad. Handl.*, vol. 25, No 9, 1894, p. 24, pl. 5, figs. 152-157.—Flint, *Rep. U.S. Nat. Mus.*, 1897 (1899), p. 275, pl. 19, fig. 4.—Awerinzew, *Mem. Acad. Imp. Sci. St. Petersburg*, ser. 8, vol. 29, No. 3, 1911, p. 20.

Ammobaculites cassis Cushman, *Rep. Canadian Arctic Exped.*, vol. 9, pt. M, 1920, p. 6m, pl. 1, fig. 3; *Bull. 104, U.S. Nat. Mus.*, pt. 2, 1920, p. 63, pl. 12, fig. 5.

At one station (4), specimens were fairly common. The specimens are mostly fairly broad, but some more slender ones also occur, but as a rule, these seem to be young. There are a few specimens also from stations 2 and 5.

A. cassis is one of the species characteristic of cold waters. It ranges southward as far as Cape Cod on the Atlantic coast, thence northward along the New England coast, into the mouth of the St. Lawrence, Gaspé Bay, thence westward into Hudson Bay, and is known from off Greenland, Spitzbergen, Nova Zembla, the Siberian Arctic, and from the Canadian Arctic. It also apparently is in cold waters in the North Pacific. The records are all in comparatively shallow waters.

GENUS TROCHAMMINA PARKER AND JONES, 1860.

Trochammina rotaliformis J. Wright.

Trochammina inflata (Montagu), var., Balkwill and Wright, *Trans. Roy. Irish Acad.*, vol. 28 (Science), 1885, p. 331, pl. 13, figs. 11, 12.

Trochammina rotaliformis J. Wright, in Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1911, p. 309.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 52, pl. 3, figs. 11-13.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 2, 1920, p. 77, pl. 16, figs. 1, 2.

This is one of the commonest species in the collection. It occurs at all but one of the stations, and at station 5 in great numbers. The specimens are very similar to the original figures given by Balkwill and Wright, much more so than those given by Heron-Allen and Earland from the Clare Island region.

It has not previously been recorded from the western Atlantic and I failed to find it in the *Albatross* dredgings from Newfoundland southward. It may be a species of shallow water. Its occurrence in Hudson Bay is an interesting one.

FAMILY TEXTULARIIDAE

GENUS VERNEUILINA D'ORBIGNY, 1840.

Verneuilina advena Cushman, new species.

Test minute, elongate, triserial, tapering, broadest near the apertural end, composed of as many as twenty-five chambers, inflated; sutures distinct and depressed; wall arenaceous, but very smoothly finished on the exterior, the amount of cement and fine material being proportionately large; aperture in a deep depression at the junction of the last of the three series of chambers; colour reddish-brown, the last-formed chamber often white.

Length usually not over 0.3 mm.

At four of the stations this minute species has occurred, and at station 3 in some considerable numbers. It is known from the Canadian Arctic Expedition where I recorded it as *V. polystropha* (Rep. Canadian Arctic Exped., vol. 9, pt. M, 1920, p. 8m, pl. 1, fig. 5). I have also found it off our eastern Atlantic coast, and it is known from other regions to the north. It is probably recorded under *V. polystropha* from various localities. *Verneuilina scabra* (Williamson) (*V. polystropha* in part) does not so far as I have seen, occur in the western Atlantic.

Heron-Allen and Earland have recently published a paper (Proc. Roy. Irish Acad., vol. 35, No. 8, 1920) in which they note and figure this species, referring it to *V. polystropha*, and speaking of it as a dwarf form as a result of "nanism." Inasmuch as the larger typical form does not seem to occur on the American coast, and this smaller species is widely distributed here, it would seem that the two are distinct. Beside the difference in distribution there are very definite characters in the size, and especially the characters of the wall which distinguish the two.

FAMILY LAGENIDAE.

GENUS LAGENA WALKER AND BOYS, 1784.

Lagena globosa (Montagu).

"*Serpula* (*Lagena*) *laevis globosa*" Walker and Boys, Test. Min., 1784, p. 3, pl. 1, fig. 8.

Vermiculum globosum Montagu, Test. Brit., 1803, p. 523.

Lagena globosa Brown, Illus. Rec. Conch. Great Britain and Ireland, ed. 1, 1827, pl. 1, fig. 37.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 3, 1913, p. 3, pl. 4, fig. 2.

At station 3 there were taken several specimens that evidently belong to this species as usually known. They are of the elongate form figured by Brady in the *Challenger* Report (pl. 56, fig. 1). It is recorded from Baffins Bay by Parker and Jones, and there are other records from various parts of the Arctic.

GENUS NODOSARIA LAMARCK, 1812.

Nodosaria calomorpha Reuss.

Nodosaria calomorpha Reuss, Denkschr. Akad. Wiss. Wien, vol. 25, 1865, p. 129, pl. 1, figs. 15-19.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 497, pl. 61, figs. 23-27.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 3, 1913, p. 48, pl. 25, fig. 6.

A single, two-chambered specimen was found in the bottom material from station 5. It is similar to the specimens figured by Brady, the test translucent and thin-walled.

Awerinzew records this species from the Siberian Arctic.

GENUS POLYMORPHINA D'ORBIGNY, 1826.

Polymorphina lactea (Walker and Jacob).

"*Serpula tenuis ovalis laevis*" Walker and Boys, Test. Min., 1784, p. 2, pl. 1, fig. 5.

"*Polymorpha Subcordiformia vel Oviformia*" Soldani, Testaceographia, vol. 1, pt. 2, 1791, p. 114, pl. 112, figs. 11, nn, etc.

Serpula lactea Walker and Jacob, Adams' Essays, ed. 2, 1798, p. 634, pl. 24, fig. 4.

Polymorphina lactea Magillivray, Moll. Aberd., 1843, p. 320.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 559, pl. 71, fig. 11.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 3, 1913, p. 84, pl. 34, fig. 8.

A few specimens, somewhat compressed, resemble the figures given of this species. The specimens are translucent and thin-walled. They occurred at stations 3, 4, and 5. The species of *Polymorphina*, as recorded in the literature of this genus, are in a state of great confusion. From studies I have made of tropical material and that from cooler regions it seems that careful discrimination will result in definite distributions of a considerable number of species.

Polymorphina lanceolata Reuss.

Polymorphina lanceolata Reuss, Zeitschr. Deutsch. Geol. Gesell., vol. 3, 1851, p. 83, pl. 6, fig. 50.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 492, pl. 61, fig. 32.—Cushman, Rep. Canadian Arctic Exped., vol. 9, pt. M, 1920, p. 9m.

Forms referred to this species, as figured by Brady, are rare at station 5. The surface is smooth and polished and the sutures hardly depressed.

Polymorphina ovata d'Orbigny.

Polymorphina ovata d'Orbigny, For. Foss. Vienne, 1846, p. 233, pl. 13, figs. 1-3.
—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 564, pl. 72, figs. 7, 8.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 3, 1913, p. 87, pl. 30, fig. 2.

Rare specimens which show an alternating of chambers somewhat similar to those figured by Brady occur at station 5.

Polymorphina oblonga d'Orbigny.

Polymorphina oblonga d'Orbigny, For. Foss. Vienne, 1846, p. 232, pl. 12, figs. 29-31.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 569, pl. 73, figs. 2-4.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 3, 1913, p. 88, pl. 37, fig. 6.

Specimens very similar to the figures given by Brady occur at station 5. The sutures are depressed and the chambers stand out from the general surface.

FAMILY ROTALIIDAE.

GENUS PATELLINA WILLIAMSON, 1858.

Patellina corrugata Williamson.

Patellina corrugata Williamson, Rec. Foram. Great Britain, 1858, p. 46, pl. 3, figs. 86-89.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 634, pl. 86, figs. 1-7.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 5, 1915, p. 9, pl. 7, fig. 1.

A single specimen of this interesting species was obtained in the material from station 3. It is typical of the cold water form of this species. Records of its distribution range as far north as 83°19'N., at a depth of 72 fathoms. It is also known from off Nova Zembla and the coasts of Europe. I have recorded it on the Atlantic coast from the Woods Hole region. This is probably different from the species so common in shallow water of the South Pacific which has been assigned to this of Williamson.

GENUS DISCORBIS LAMARCK, 1804.

Discordis wrightii (H. B. Brady).

Discorbina parisiensis J. Wright (in part) (not d'Orbigny), Proc. Belfast Nat. Field Club, 1876-1877 (1877), Appendix, p. 105, pl. 4, figs. 2 *a-c*.

Discorbina wrightii H. B. Brady, Denkschr. Akad. Wiss. Wien, vol. 43, pt. 2, 1881, p. 104, pl. 2, figs. 6*a, b*.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 223.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 131, pl. 12, fig. 4.

A small specimen very similar to Brady's original figure with the beading of the ventral side extending about half way from the periphery to the umbilicus occurred at station 3. From station 5 there is a better developed specimen which has become somewhat flatter on the ventral side, and has the beading

extending to the periphery. From station 1 is a specimen, or rather two specimens in a plastogamic condition, which are evidently this same species.

Brady's original specimens were from off Nova Zembla and the species has been recorded by Heron-Allen and Earland from the coasts of the British Isles.

GENUS TRUNCATULINA D'ORBIGNY, 1826.

Truncatulina lobatula (Walker and Jacob).

Truncatulina lobatula Cushman, Rep. Canadian Arctic Exped., vol. 9, pt. M, 1920, p. 9m.

This species, which has already been recorded in the Canadian Arctic Expedition occurs at station 3 in Hudson Bay. It is not as common, however, as might be expected.

GENUS PULVINULINA PARKER AND JONES, 1862.

Pulvinulina frigida Cushman, new species.

Pulvinulina karsteni H. B. Brady (not Reuss), Trans. Linn. Soc. London, vol. 29, 1864, p. 470.

Pulvinulina repanda (Fichtel and Moll), var. *karsteni* Parker and Jones, Phil. Trans., vol. 155, 1865, p. 396, pl. 14, figs. 14, 15, 17.

Test small, biconvex, rotaliform, composed of about two and one-half coils; chambers distinct, usually six in the last-formed coil; sutures distinct but not depressed on the dorsal side, on the ventral side slightly depressed and filled with an amorphous material radiating out from the umbilical region; wall clear and translucent on the dorsal side, usually showing all the chambers back to the proloculum distinctly, on the ventral side less clear.

Diameter up to 0.4 mm.

This Arctic, or at least cold water species, was obtained at stations 2, 3, and 5. It is not the same as *P. karsteni* Reuss, as a reference to the original figures will show, especially the ventral side. The figures given by Parker and Jones of Arctic specimens are very excellent for this species as it occurs in Hudson Bay. There is little or no trace of any carina on the ventral side except that the material filling the sutural depressions sometimes becomes confluent along the periphery. The species was referred by Brady to *P. karsteni* in 1864, and he has been followed since. Brady's notes in 1864 are interesting in this connection.

"Three or four small starved specimens of this species have been pointed out amongst my mountings by Mr. Parker. . . . As I have never met with mature specimens, I can only refer to Professor Reuss's memoir on the Chalk of Mecklenburg (Zeitsch. Deutsch. Geol. Gesellsch., vol. vii., p. 273, pl. 9, fig. 6), and in this instance I have preferred copying his figures of the shell to drawing direct from immature specimens."

The following quotation is from Parker and Jones in 1865:

"This is a neat, many-chambered, moderately conical variety of *P. repanda*, with some degree of limbation bordering the chambers, especially beneath, where a wheel-like system of exogenous shell-matter characterizes the shell."

They also note differences between the Arctic and North Atlantic specimens referred to this species and also that Reuss's figure is not exactly like either.

P. frigida is evidently an Arctic species of definite distribution and definitely characterized.

FAMILY NUMMULITIDAE.

GENUS NONIONINA D'ORBIGNY, 1826.

Nonionina orbicularis H. B. Brady.

Nonionina orbicularis H. B. Brady, Denkschr. Akad. Wiss. Wien, vol., 43, 1881, p. 105, pl. 2, figs. 5a, b; Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 415, pl. 21, figs. 5a, b; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 727, pl. 109, figs. 20, 21.—Heron-Allen and Earland, Trans. Linn. Soc. London, Zoology, ser. 2, vol. 11, 1916, p. 280.

In the Hudson Bay collection this species is fairly common, especially at station 5, with fewer specimens at station 6. They are very similar in all respects to the specimen figured by Brady from off Nova Zembla. The species is evidently an Arctic one of wide distribution in cold waters. The figures of specimens from warm waters referred to this species are evidently not identical with it. In general form, and especially in the condition of the umbilicus and sutures, the specimens are exactly like the Nova Zembla specimens.

Nonionina stelligera d'Orbigny.

This species I have already recorded from the collection of the Canadian Arctic Expedition. It is known from many Arctic and Subarctic localities. The only specimen from Hudson Bay was from station 3.

D'Orbigny's original specimens were from shore sands from the Canaries at Teneriffe, and it would be interesting to obtain specimens of this from this locality to see if in reality it is the same as this widely distributed Arctic species

Nonionina scapha (Fichtel and Moll).

Nautilus scapha Fichtel and Moll, Test. Micr., 1803, p. 105, pl. 19, figs. d-f.

Nonionina scapha Parker and Jones, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 102, No. 4.

Polystomella crispa Linné, var. (*Nonionina*) *scapha* Parker and Jones, Phil. Trans., vol. 155, 1865, p. 404, pl. 14, figs. 37, 38; pl. 17, figs. 55, 56.

A very few specimens were obtained from station 5. They are of the very broad, triangular form, in apertural view similar to the Arctic and North Atlantic specimens figured by Parker and Jones in the above reference. This form is very striking and different from many of the figures assigned to this species from other regions by many authors.

GENUS POLYSTOMELLA LAMARCK, 1822.

Polystomella striato-punctata (Fichtel and Moll), var. *incerta* (Williamson).

This variety I have already recorded from the collection of the Canadian Arctic Expedition. It has occurred in the Hudson Bay collection at all but one

station, 1, 2, 3, 5, and 6. From the records it seems to be widely distributed in the Arctic and Subarctic regions.

Polystomella arctica Parker and Jones.

This circumpolar species occurs in the collection from Hudson Bay from station 5. I have already recorded it from the Canadian Arctic Expedition. There are numerous other specimens which have a form similar to this but have a single row of openings, but with a broad band of exogenous shell material above each suture.

FAMILY MILIOLIDAE.

GENUS CORNUSPIRA SCHULTZE, 1854.

Cornuspira foliacea (Philippi).

In the Report of the Canadian Arctic Expedition I have given notes on this species. It has again been found in very similar form in these collections from Hudson Bay, occurring at stations 3 and 5.

GENUS QUINQUELOCULINA D'ORBIGNY, 1826.

Quinqueloculina seminulum (Linné)?

This species was recorded from the collection of the Canadian Arctic Expedition. It is recorded in most of the Arctic collections. Our specimens, however, are all of a stout, squarish shape, with a very highly polished, smooth surface. They were from stations 1, 2, 3, and 5, not common at any of the stations.

In shape these specimens are nearest to the figure given by Parker and Jones (Phil. Trans., vol. 155, 1865, pl. 15, fig. 34) as *Miliolina* (*Quinqueloculina*) *oblonga* (Montagu) from the Arctic.

Quinqueloculina subrotunda (Montagu).

Most of the lists from the Arctic include this species. It has occurred in the Hudson Bay collection at stations 2, 3, and 5. It was previously found in the collection of the Canadian Arctic Expedition.

Quinqueloculina sp.

There is a single specimen of an arenaceous *Quinqueloculina* from station 5. It is dark red in colour and of different form from *Q. agglutinans* d'Orbigny. Parker and Jones record this arenaceous reddish form from the Arctic.

Quinqueloculina sp.

From station 6 there is a single large specimen very similar to that figured by Parker and Jones (Phil. Trans., vol. 155, 1865, pl. 15, figs. 36 *a-c*), and referred by them to *Quinqueloculina ferussacii* d'Orbigny. It is not the same as d'Orbigny's species and may possibly represent a distinct Arctic form.

GENUS TRILOCULINA D'ORBIGNY, 1826.

Triloculina oblonga (Montagu).

Vermiculum oblongum Montagu, Test. Brit., 1903, p. 522, pl. 14, fig. 9.

Triloculina oblonga d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 300, No. 16; Modèles, No. 95; in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 155, pl. 10, figs. 3-5.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 6, 1917, p. 69, pl. 26, fig. 3; figs. 35, 36 (in text).

Miliolina oblonga H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 160, pl. 5, figs. 4a, b.

There are numerous specimens from station 5 which may be referred to this species. They are not as elongate as tropical specimens such as are usually assigned to *T. oblonga*. The surface of the test is smooth and polished.

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