

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS
TO
CANADIAN
MICRO-PALÆONTOLOGY.

PART IV.

BY

DR. D. RÜST,
(HANOVER, GERMANY.)

WITH INTRODUCTION BY J. B. TYRRELL.



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NOTE.

The present Report, which constitutes Part IV. of "Contributions to Canadian Micro-Palæontology," was kindly and gratuitously prepared for the Canadian Geological Survey by Dr. D. Rüst, of Hanover, Germany, who has made a life study of fossil Radiolaria.

It consists of descriptions and illustrations of thirteen new and three previously known species of Radiolaria, collected by officers of this Department from the upper Cretaceous rocks of North-Western Manitoba.

To this has been prefixed a short introduction by Mr. Tyrrell, Geologist in charge of the explorations in Manitoba, on the stratigraphical position of the bed from which the fossils were collected.

The pagination of the report, and the numbering of the plates have been made consecutive with those of Parts I., II. and III., by A. H. Foord, E. O. Ulrich and T. Rupert Jones, respectively.

ALFRED R. C. SELWYN,

Director, Geological Survey.

OTTAWA, January, 1892.

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GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA

CONTRIBUTIONS TO CANADIAN MICRO-PALÆONTOLOGY.

PART IV.

By Dr. D. Rüst,

(HANOVER, GERMANY.)

6.—*Radiolaria from the Pierre Formation of North-Western Manitoba.*

INTRODUCTION.

The central portion of the Province of Manitoba is a moderately even plain, at a mean elevation of about 800 feet above the sea, underlain by undisturbed flat-lying limestones and shales, ranging in age from Cambro-Silurian up to Devonian.

On its eastern side this plain is bounded by the high and often steep escarpment of the eastern face of the Second Prairie Steppe, rising from eight to nineteen hundred feet above the level of the country to the east, and ascending from the former elevation in the vicinity of the International Boundary Line to the latter in the Duck Mountain, two hundred miles further north.

This escarpment, beneath its capping of glacial deposits, is composed exclusively of the eroded edges of horizontal, undisturbed and conformable Cretaceous rocks ranging in age upwards from the Dakotah sandstone, about the top of the Middle Cretaceous, to high up in the Pierre shales, towards the top of the Upper Cretaceous. The total thickness of Cretaceous beds seen in the district is approximately 1,400 feet, and, with the exception of the soft Dakotah sandstone at the base of the section, consists entirely of argillaceous shales which vary to some extent in character in different portions of the series.

In the Benton formation, which immediately and conformably overlies the Dakotah sandstone, these shales consist largely of soft dark highly bituminous clays, without much admixture of calcareous material, and also, in Manitoba, with few distinguishable traces of fossils.

The Benton is overlain by a varying thickness of calcareous shales and chalk-marls with phosphatic bands, known as the Niobrara formation. The shales of this terrane are characterized by the presence of a large number of foraminifera, among which *Globigerina cretacea*, d'Orb., and *Textularia globulosa*, Ehr., are particularly abundant, but the following have also been identified for us by C. Davies Sherborn, Esq., F.G.S., of London, England, viz. :—*Globigerina bulloides*, *Globigerina linneana*, *Cristellaria rotulata*, *Planorbulina ammonoides*, *Anomalina rotula*, *Bulimina variabilis*, *Verneuilina triquetra*, *Margulinina variabilis* and *Dentalina pauperata*. With these have also been found the succeeding species of invertebrate and vertebrate fossils, viz. :—*Serpula semicoalita*, *Ostrea congesta*, *Anomia obliqua*, *Inoceramus problematicus* fragments of this shell in great abundance, *Belemnitella Manitobensis*, *Loricula Canadensis*, *Ptychodus parvulus*, *Lamna Manitobensis*, *Enchodus Shumardi* and *Cladocyclus occidentalis*.

Overlying these calcareous deposits of Niobrara age is a thickness of 800 to 1,000 feet of non-calcareous dark or light grey clay shales belonging to the Pierre formation, which contain in their more southern and western extension a large number of beautifully preserved molluscan and other remains, but in the more northern portions of Manitoba, wherever they have been recognized, no large fossils could be found in them, and till the discovery of Radiolaria near the base of the formation, and therefore stratigraphically not far above the zone of the fossils just enumerated from the Niobrara rocks, it was supposed to be locally unfossiliferous.

The locality from which the species herein described were obtained, was examined by Mr. D. B. Dowling in the summer of 1889, while acting as the writer's assistant on the Geological Survey of North-Western Manitoba. It is situated on the south side of the gorge of Bell River, in the eastern face of Porcupine Mountain, and is near the extreme north-western corner of Manitoba, in north latitude 52° 35', west longitude 101° 8'.

The trail followed by Mr. Dowling in exploring Bell River led from Swan Lake to the summit of Porcupine Mountain, and on this course none of the lower divisions of the Cretaceous series were exposed. At

an elevation of 1,450 feet above the sea on the north side of the river a somewhat slidden hillside shows, to a height of thirty feet, a scarped face of dark grey clay shales, representing a horizon very near the base of the Pierre formation. Thirty-five feet higher up the bank, and on the south side of the river, is an outcrop of light grey hard siliceous clay shale, associated with a few dark nodules of ironstone. Specimens of this shale were collected and brought to the Museum of the Geological Survey at Ottawa, and on being submitted to a microscopical examination were found to contain large numbers of well-preserved Radiolaria, preliminary notes of the occurrence of which were published in the American Journal of Science and Arts for September, 1890, page 230, and in the Transactions of the Royal Society of Canada, 1890, Section IV, page 113.

Immediately on learning of the discovery, Dr. D. Rüst, of Hanover, Germany, the most noted living authority on these minute fossil forms, kindly consented to examine and determine any species that he might be able to find in this clay shale, and the following report is the result of his labours.

Above this outcrop of Radiolarian shale no exposures of rock in place were seen, but the position assigned to it, near the base of the Pierre, is believed, from the evidence of numerous other exposures, to be approximately correct.

J. B. TYRRELL.

Sub-class: SPUMELLARIA.

Order: SPHÆROIDEA.

Family: Liosphærida, Haeckel.

Sub-family: Caryosphærida, Haeckel.

Genus: Caryosphæra, Haeckel.

1. CARYOSPHERA ÆQUIDISTANS, n. sp.

Plate XIV., figs. 1a and 1b.

Shell composed of five concentric spheres, two medullary and three cortical, each with about equal radial proportions. All the spheres with regular circular pores, two to four times as wide as the bars, increasing in size from the centre towards the smooth surface.

Dimensions:—Diameter of the first medullary sphere, 0.042 mm.

"	"	second	"	0.063	"
"	"	first cortical sphere,		0.085	"
"	"	second	"	0.105	"
"	"	third	"	0.127	"

Occurrence: very rare.

Order: PRUNOIDEA.

Family: Ellipsida, Haeckel.

Sub-family: Cenellipsida, Haeckel.

Genus: Cenellipsis, Haeckel.

2. CENELLIPSIS HEXAGONALIS, n. sp.

Plate XIV., fig. 2.

Ratio of the longer axis to the shorter 2 : 1. Pores regular, circular, about as wide as the bars, thirteen to fifteen on the half equator. The perimeter of a longitudinal section is roundish hexagonal. Surface smooth.

Dimensions:—Longer axis of the ellipsoid, 0.26 mm.

Shorter	"	"	0.127	"
Pores	"	"	0.05	"

Occurrence: not frequent.

Family : **Druppulida**, Haeckel.

Genus : **Prunulum**, Haeckel.

3. **PRUNULUM CALOCOCCUS**, n. sp.

Plate XIV., fig. 3.

The ellipsoidal cortical shell thin-walled, smooth, with regular, circular, pores about as wide as the bars. Ratio of the major axis of the ellipsoid to the minor, 3 : 2. Both medullary shells large and spherical with large circular pores.

Dimensions : —Major axis of cortical shell,	0.194 mm.
Minor " "	0.117 "
Diameter of the first medullary shell,	0.065 "
" " second (outermost) shell	0.08 "

Occurrence : rare.

Sub-class : **NARSELLARIA**.

Order : **CYRTOIDIA**.

Family : **Cyrtocalpida**.

Sub-family : **Archicorida**.

Genus : **Cyrtocalpis**, Haeckel.

4. **CYRTOCALPIS CRASSITESTATA**, n. sp.

Plate XIV., fig. 4.

Shell infundibuliform, very thick, with regular circular pores of equal size, and about as wide as the bars. Mouth large, simple, wider than the length of the shell. Surface smooth.

Dimensions :—Shell,	0.138 mm. long.
Mouth,	0.174 " wide.

Occurrence : not frequent.

Family : **Sethocyrtida**.

Sub-family : **Sethocorida**, Haeckel.

Genus : **Dictyocephalus**, Ehrenberg.

5. **DICTYOCEPHALUS MICROSTOMA**, n. sp.

Plate XIV., fig. 5.

Shell, thin-walled, smooth, collar stricture not apparent. Cephalis sub-spherical, hyaline, without pores. Thorax inflated sub-spherical, with regular circular pores, about as wide as the bars, in twenty oblique rows. Mouth constricted, only one-third as wide as the thorax, without peristome.

Dimensions :—Cephalis, 0.053 mm. long.
 " 0.045 " broad.
 Thorax, 0.151 " long.
 " 0.147 " broad.
 Mouth, 0.051 " in diameter.

Occurrence : frequent.

6. *DICTYOCEPHALUS MACROSTOMA*, n. sp.

Plate XV., fig. 1.

Shell thin-walled, smooth, without collar stricture. Cephalis subspherical, hyaline, without pores. Thorax, roundish urceolated with regular circular pores about as wide as the bars, in fifteen to sixteen oblique rows. Mouth less constricted than in the former species; two-thirds as wide as the thorax, without peristome.

Dimensions :—Cephalis, 0.051 mm. long.
 " 0.042 " broad.
 Thorax, 0.153 " long.
 " 0.127 " broad.
 Mouth, 0.083 " in diameter.

Occurrence : very frequent.

Family : **Theocyrtida.**

Sub-family : **Theocorida.**

Genus : **Theocampe**, Haeckel.

7. *THEOCAMPE SPHÆROCEPHALA*, n. sp.

Plate XV., fig. 2.

Shell wide bottle shaped, thin-walled, with two distinct strictures. Cephalis spherical, hyaline, without pores. Thorax campanulate, with three transverse rows of circular pores. Abdomen inflated with from eight to nine obliquely descending rows of circular pores. Mouth but little constricted, two-thirds as wide as the abdomen. Ratio of the three joints to each other : length, 1 : 2 : 4 ; breadth, 1 : 3 : 6.

Dimensions :—Cephalis,	0·027 mm. long and broad.
Thorax,	0·039 " long.
" "	0·031 " broad.
All three joints,	0·190 " long.
Abdomen,	0·147 " broad.

Occurrence : not frequent.

Family : **Theocyrtida.**

Sub-family : **Theocapsida.**

Genus : **Tricolocapsa**, Haeckel.

8. **TRICOLOCAPSA SALVA**, Rüst.

Plate XV., fig. 3.

Theocapsa salva, Rüst, 1885. Palæontographica, Bd. xxxiv, p. 210, Taf. 28, fig. 5. Beiträge zur Kenntniss der fossilen Radiolarien in der Gesteinen der Kreide, von Dr. Rüst.

Shell slenderly ovate, with two slight strictures. Thorax of about the same size as the abdomen. Relative lengths of the three joints 1:3·5:4, relative breadth 1 : 3 : 3·5. Cephalis flat hemispherical, hyaline, without pores. Thorax spherical with subregular circular unequal pores. Abdomen broad ovate, with larger, regular, circular pores, in from nine to ten transverse rows. Surface smooth.

Dimensions :—Length of shell,	0·23 mm.
Breadth of abdomen,	0·127 "

Occurrence : frequent.

This species was first discovered in the Coprolites of the Gault near Zilli in Saxony, and described in Palæontographica, vol. xxxiv. The form there found is a little smaller, but is of very common occurrence.

9. **TRICOLOCAPSA THORACICA**, n. sp.

Plate XV., fig. 4.

Shell ovate, smooth, with two distinct strictures. Relative lengths of the three joints 2 : 5 : 3. Relative breadths 2 : 5 : 5. Cephalis hemispherical, with from three to four transverse rows of small circular pores. Thorax subspherical, with from nine to ten transverse rows of larger regular circular pores. Abdomen broad, hemispherical, with from four to five transverse rows of pores of the same size.

Dimensions :—Length of shell,	0·204 mm.
Breadth " "	0·157 "

Occurrence : not frequent.

10. TRICOLOCAPSA DOWLINGI, n. sp.

Plate XV., fig. 5.

Shell ovate, smooth, with upper slight, and lower deep stricture. Relative lengths of the three joints, 1 : 4 : 6 ; relative breadths, 1 : 3 : 5. Cephalis hemispherical, hyaline, without pores. Thorax quite spherical with from seven to eight oblique rows of large circular pores, twice as wide as the bars. Abdomen subspherical, compressed, with from ten to twelve transverse rows of distant smaller circular pores.

Dimensions :—Length of the shell, 0·214 mm.

Breadth of the abdomen, 0·147 "

Occurrence : not frequent.

11. TRICOLOCAPSA SELWYNI, n. sp.

Plate XV., fig. 6.

Shell wide, bottle-shaped, smooth, with two distinct strictures. Relative lengths of the three joints, 1 : 2 : 4. Relative breadths, 1 : 2·5 : 6. Cephalis small, ovate, hyaline, without pores. Thorax hemispherical, with four transverse rows of circular regular pores. Abdomen large, inflated, spherical, with from ten to twelve transverse rows of pores of equal size.

Dimensions :—Length of the shell 0·174 mm.

Breadth of the abdomen, 0·137 "

Occurrence : not rare.

Family : **Lithocampida.**

Sub-family : **Stichocorida**, Haeckel.

Genus : **Dictyomitra**, Ehrenberg.

12. DICTYOMITRA CANADENSIS, n. sp.

Plate XVI., fig. 1.

Shell short, conical, campanulate, smooth, with three distinct strictures. Cephalis small, spherical. Thorax small, hemispherical, with three transverse rows of circular pores. Abdomen with two joints ; the upper large, inflated, with eleven transverse rows of circular, regular pores ; the lower joint ring-shaped with four transverse rows of pores of the same size. The wide open mouth without peristome. Relative lengths of the four joints, 1 : 1 : 5 : 2. Relative breadths, 1 : 1·5 : 5 : 5·5.

Dimensions :—Length of the shell, 0·23 mm.

Greatest breadth, 0·147 "

Occurrence : not frequent.

13. DICTYOMITRA POLYPORA, Zittel

Plate XVI., fig. 2

Dictyomitra polypora, Zittel, 1876. Zeitschrift der deutsch, geol. Gesellsch., Band 28, p. 80, Taf. II., fig. 1.

Shell slender, conical, rough, with six to nine deep strictures. Length and breadth of the joints gradually increasing, so that the eighth joint is twice as long and broad as the third. Pores regular, circular, in transverse rows in each joint, the last joint having from five to six rows.

Dimensions:—Length of the shell (with eight joints),	0·24 mm.
Length of the eighth joint,	0·04 "
Breadth " " "	0·1 "
Length of third joint,	0·02 "
Breadth " " "	0·05 "

Occurrence: frequent.

This species is likewise found in Secondary rocks of Northern Germany (Cretaceous chalk of Brunswick), Zittel; in the Neocomian chalk of Gardenazza (St. Cassian), and the Gault Coprolites of Zilli (Saxony), Rüst.

14. DICTYOMITRA MULTICOSTATA, Zittel,

Plate XVI., fig. 3.

Dictyomitra multicostata, Zittel, 1876. Zeitschrift der deutsch. geol. Gesellsch., Band 28, p. 81, Taf. II., fig. 2-4.

Shell slender conical with prominent longitudinal ribs, and from eight to ten deep strictures. Length and breadth of the joints gradually increasing, the eighth joint being twice as long and broad as the fourth joint. Pores regular, circular, one series in each longitudinal furrow, three to four pores in each joint.

Dimensions:—Length of the shell (with eight joints),	0·2 mm.
" " fourth joint,	0·02 "
" " eighth "	0·04 "
Breadth " fourth "	0·04 "
" " eighth "	0·08 "

Occurrence: frequent.

This species is likewise found in Secondary rocks of North Germany (Chalk of Brunswick, &c.), Zittel.

Family : **Lithocampida.**

Sub-family : **Stichocapsida.**

Genus : **Stichocapsa**, Haeckel.

15. **STICHOCAPSA TYRRELLI**, n. sp.

Plate XVI, fig. 4.

Shell smooth, slender, pear shaped, twice as long as broad, with three deep strictures. Relative lengths of the four joints 1 : 1.3 : 4 : 3. Relative breadths 1 : 2 : 5 : 5.5. Cephalis spherical, hyaline, without pores. Thorax hemispherical, with four transverse rows of regular circular pores. The fourth joint is the broadest, but is shorter than the large campanulate third joint. Pores in the second, third and fourth joints of equal size, and all about as wide as the bars.

Dimensions :—Length of the shell, 0.296 mm.

Breadth of the fourth joint, 0.194 "

Occurrence : not rare.

16. **STICHOCAPSA DAWSONI**, n. sp.

Plate XVI, fig. 5.

Shell smooth, irregular ovate, with three internal septal rings, with out external strictures. The third joint is the largest, being more than half as long as the shell. Relative lengths of the four joints 1 : 1 : 5 : 1. Relative breadths 1 : 2 : 4 : 3. Cephalis hemispherical, hyaline, without pores. The second and fourth joints small, with three transverse rows of regular circular pores. The third joint ovate, with truncated poles, and from twelve to thirteen transverse rows of sub-regular circular pores.

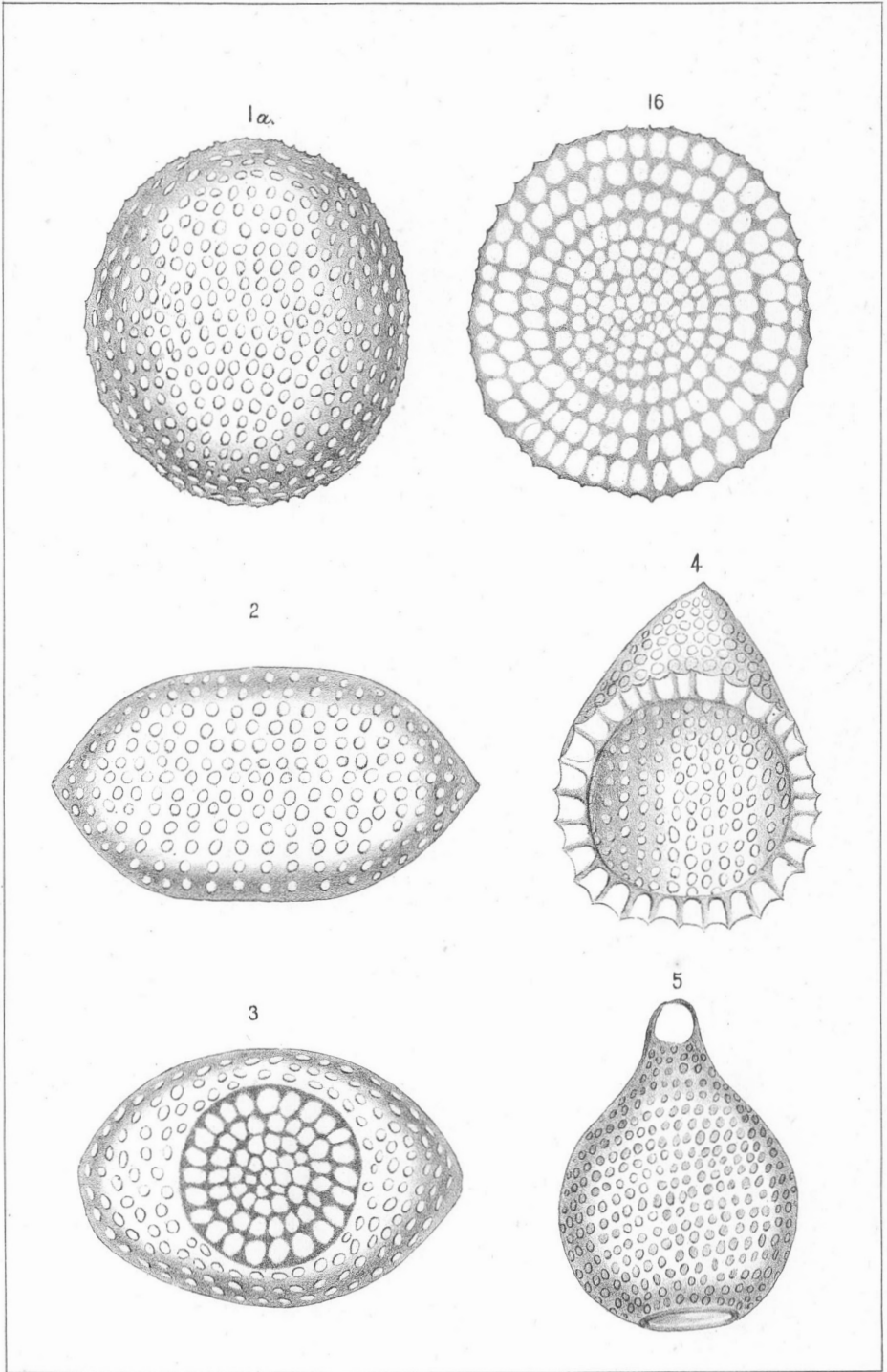
Dimensions :—Length of the shell, 0.174 mm.

Breadth of the third joint, 0.137 "

Occurrence : not frequent.

PLATE XIV.

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This figure is drawn from a specimen with the apex pointing obliquely downwards to show the wide mouth.	
“ 5 <i>Dictyocephalus microstoma</i>	105

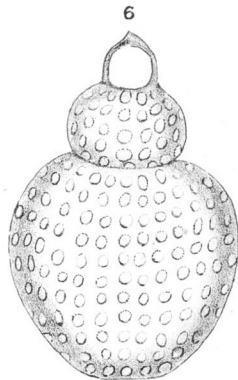
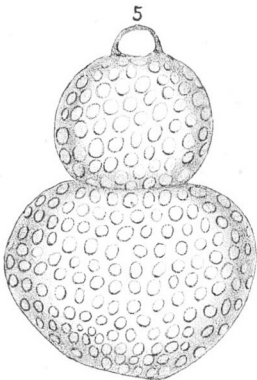
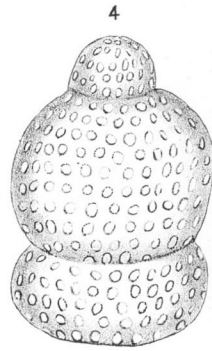
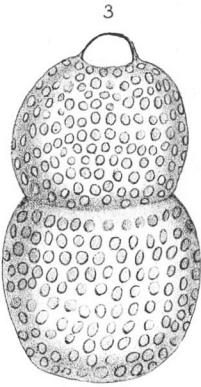
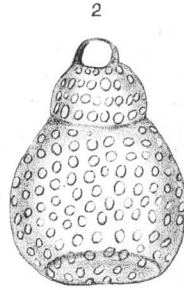
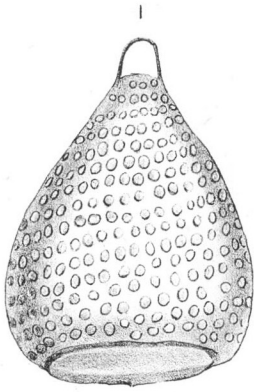


D. Rüst, delt.

RADIOLARIA.

PLATE XV.

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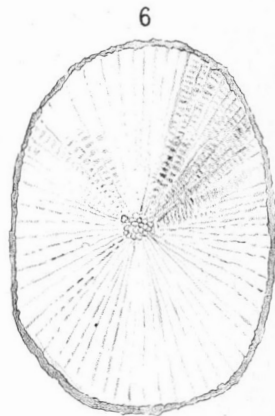
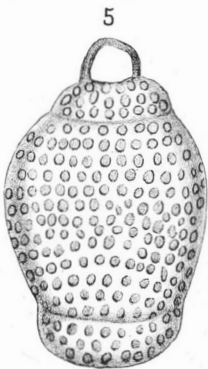
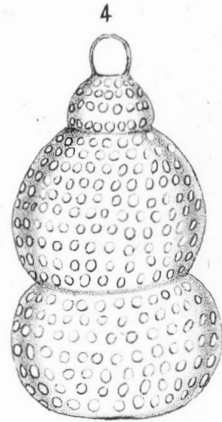
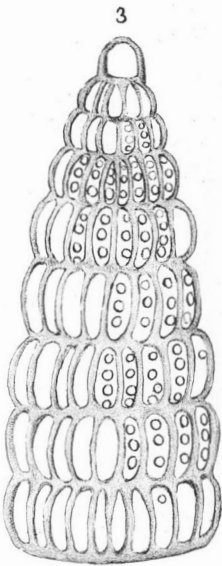
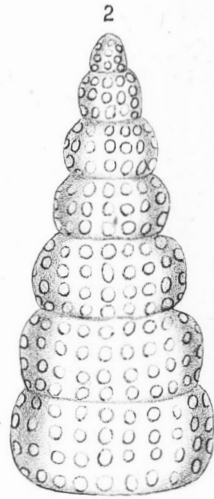
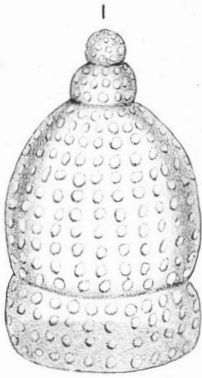


D. Rüst, del.

RADIOLARIA.

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D. Rüst., delt.

RADIOLARIA