

ON THE LOWER SILURIAN (TRENTON) FAUNA OF  
BAFFIN LAND.

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INTRODUCTION.

In the summer of 1897, a number of men took advantage of the Seventh Peary Arctic Expedition to cruise in Arctic seas and to hunt and fish in Baffin Land. The author had the pleasure of meeting these men while on board the steamer *Hope*, and learned that they intended to make a whale-boat trip to the head of Frobisher Bay. As many Lower Silurian fossils had been seen by Hall during his exploration of this bay, the author requested the Baffin Land party to search for fossils. On the subsequent return of the steamer *Hope* from North Greenland, it was a great surprise to find that Messrs. J. N. Carpende, R. W. Porter, A. V. Shaw, A. H. White, and F. G. Goodridge, had made splendid collections of fossils during their stay of but a few hours at Silliman's Fossil Mount, which is at the head of Frobisher Bay.

These fossils are well preserved, and here, as is so often the case in Paleozoic faunas, the brachiopod specimens predominate. However, unlike other Trenton faunas, the Arctic mollusca usually preserve the shell, and this is the more remarkable because all the fossils weather out of a bluish clay. The author's interest in and admiration for these well-preserved fossil forms from a rarely visited region was so great that he could not resist asking the loan of the various collections for the purpose of making them known to paleontologists. Mr. J. N. Carpende, of New Brunswick, New Jersey, who had the most extensive collection, with great liberality allowed the author to make a selection from these fossils for the U. S. National Museum. From him, therefore, this Museum has received 54 species represented by 113 specimens. The next largest lots were gathered by Messrs. A. H. White and A. V. Shaw, and purchased for the Museum. Mr. F. G. Goodridge presented one of the finest trilobites found. Mr. R. W. Porter also made a good collection, which he deposited in the American Museum

of Natural History, and these specimens were kindly placed at the author's disposal for study, by Prof. R. P. Whitfield. To these gentlemen, therefore, paleontology is indebted for rendering it possible to describe one of the best collections of fossils made in Arctic regions.

With the aid of a camera lucida, Mr. E. O. Ulrich, of Newport, Kentucky, made the figures, which are accurate representations of the species. The author is further indebted to him for paleontological assistance, and his various notes are incorporated in this paper in their proper places.

#### DESCRIPTION OF LOCALITIES.

*Frobisher Bay.*—Previous to 1897, all that was known of the geology of Frobisher Bay was included in a few incidental notes by Charles Francis Hall.<sup>1</sup> His collections were partly studied by Mr. R. P. Stevens<sup>2</sup> and Prof. B. K. Emerson.<sup>3</sup>

During the months of August and September, 1861, Hall, in company with Inuit men, women, and children, explored, by means of whale boats, the greater part of Frobisher Bay, which up to that time was believed by civilized man to be a strait. On this trip he was also greatly rejoiced to find unmistakable evidence of Frobisher's visit of 1556-57. The book cited is interesting reading, and from it are taken the following notes regarding the geology of this Bay.

*Jones Cape.*—Hall "ascended a mountain in the rear of our encampment. \* \* \* On my way I observed a considerable quantity of the stone I had noticed upon Iron Island, and I also saw many small pieces of limestone on the very summit about a thousand feet above the level of the sea."<sup>4</sup>

This may be the locality which furnished the fossils from the Utica stage, described by Professor Emerson and listed beyond.

*Cape Stevens.*—This locality is nearly 100 miles farther inland than Cape Jones, and here Hall on the top of a mountain "found numerous shells and fossils, some of which [he] brought away."<sup>5</sup>

This may be the locality furnishing the Trenton fossils described by Professor Emerson and listed beyond.

*Silliman's Fossil Mount.*—At this place fossils were first brought to Hall by the natives.

At my left, across the river, was a ridge of white, which I afterward named Silliman's Fossil Mount (thus named after Benjamin Silliman, jr., of New Haven, Connecticut. This fossil mount is on the west side of the termination of Frobisher Bay. It is in latitude 63° 44', longitude 68° 56'), and behind it the unbroken front of a line

<sup>1</sup>Arctic Researches and Life Among the Esquimaux, New York, 1865.

<sup>2</sup>Amer. Journ. Sci., 2d ser., XXXV, 1863, p. 404.

<sup>3</sup>Narrative of the Second Arctic Expedition made by Charles F. Hall, edited by J. E. Nourse, Washington, 1879. Appendix III, On the Geology of Frobisher Bay, and Field Bay, by B. K. Emerson.

<sup>4</sup>Ibidem, p. 373.

<sup>5</sup>Ibidem, p. 381.

of mountains extending northwesterly to the opening which I have called the Great Gateway.<sup>1</sup> \* \* \*

I visited that phenomenon; I mounted it, and went around it also. It is a mount of marine fossils in limestone, half a mile long, and over a hundred feet high [340 feet aneroid, according to Porter]. \* \* \* The débris of the fossils begins at or near the top of the mount, falling at such an angle as broken stone from a mountain always make, an inclination of about 40°. Above the talus, or heap of broken stones, is a mass of fossils in limestone, strata-like. A smaller mount of the same character is close by, but all in débris. It seems to have been divided from the main mount by the rushing down of waters from the mountains behind. A small stream comes down the mountains, passes along, and finally makes its way out between the two fossil mounts. This is also indicated in the course of this stream, as an acre or more of the plain is covered several feet in depth with the washed-down débris of fossils.

\* \* \* The top of Silliman's Fossil Mount is covered with boulders and grass. Even when close to the small mount it looks like sand, but on examination it is fine broken limestone and fossils.<sup>2</sup>

Mr. R. W. Porter, who visited Silliman's Fossil Mount in August, 1897, described it to the writer as follows:

ON BOARD S. S. HOPE,  
September 18, 1897.

CHARLES SCHUCHERT, Esq.

MY DEAR SIR: In accordance with your request, I take pleasure in handing to you the following notes on Silliman's Fossil Mount (Hall's) of Frobisher Bay, Baffin Land. They are very meager—the results of only a few hours' visit to this formation, as I had intended to give the place a more thorough search next year.

Silliman's Fossil Mount lies at the head of Frobisher Bay, some 3 miles south of the Jordan River and about 1 mile from tide water. It lies close against the mountains of *Meta Incognita* [apparently unconformably], is about 1,000 yards long and 340 feet high (aneroid; not 100 feet, as given by Hall), general direction northwest and southeast. The fossils were taken from the talus slopes, the bed of the brook flowing at the base of the mount, in the limestone near the summit, and on the top itself.

At its northern end there is a smaller mount of lesser height. The mount forms a striking feature of the landscape, and is composed of limestone, disintegrated to such an extent that the talus reaches nearly to the summit, which is very flat and composed of the ledge itself. This limestone ledge of nearly horizontal beds out-



FIG. 1.—A DISTANT VIEW OF SILLIMAN'S FOSSIL MOUNT.  
(Photograph by R. W. Porter.)

<sup>1</sup>Narrative of the Second Arctic Expedition made by Charles F. Hall, edited by J. E. Nourse, Washington, 1879. Appendix III, On the Geology of Frobisher Bay, and Field Bay, by B. K. Emerson, p. 405.

<sup>2</sup>Ibidem, pp. 410-411.

crops all around the summit with vertical sides 10 to 20 feet high. The summit or table top is covered with moss and grass and several large boulders of glacial origin. At its southeastern extremity it is joined to the range of mountains running parallel to the mount and rising to altitudes of from 500 to 800 feet. Between the mount and neighboring mountain side flows a good-sized brook, flowing northwardly and out into the valley between the greater and lesser mounts.

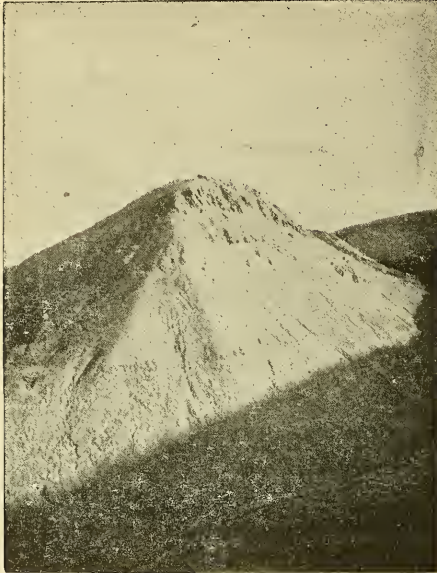


FIG. 2.—A NEAR VIEW OF SILLIMAN'S FOSSIL MOUNT.  
(Photograph by R. W. Porter.)

This brook has probably caused the separation of these two elevations, and has carried a quantity of clay and limestone out into the valley for several hundred yards.

A close scrutiny of the adjacent mountain range revealed no limestone formation on its side. The rock of this range is a dark mica-schist, the dips making an angle of about  $30^{\circ}$  with the horizon. Its surface in many places shows the marks of glaciation (one moraine lying against the northern side of the smaller mount), but for the most part the parent ledge is hidden under a quantity of its own rock broken up by frost action.

I found a great number of limestone boulders, erratics, scattered through the valley of the Jordan River and on the sides and summits of the mountains which border it.

Finally, it may be interesting to know that the natives told me that these same formations containing fossils existed in several localities in the lake region of the interior.

Very truly, yours,

RUSSELL W. PORTER.

*Region west and northwest of Frobisher Bay.*—From Mr. Porter's account of Silliman's Fossil Mount, it is evident that similar Lower Silurian strata occur in the lake region of the interior of Baffin Land.

Mr. E. M. Kindle<sup>1</sup> reports that Missionary Peck obtained from Lake Kennedy, which lies northwest of the head of Cumberland Sound, the following drift fossils:

*Zaphrentis* sp.? [probably *Streptelasma corniculum*].

*Halysites catenulatus* [probably var. *gracilis* Hall].

*Maclurca magna*? [probably *Maclurina manitobensis*].

*Endoceras proteiforme*.

With the fauna of Silliman's Fossil Mount as a guide, it is probable that no horizon other than the Trenton is indicated by the species cited.

Dr. Robert Bell<sup>2</sup> reports that—

On ice pans farther up the coast [from Big Island in Hudson Strait], or to the

<sup>1</sup> Amer. Journ. Sci., 4th ser., II, 1896, p. 456.

<sup>2</sup> Observations on the Geology, etc., of Hudson Strait and Bay, made in 1885. Ann. Rept. Geol. and Nat. Hist. Survey of Canada, new ser., I, 1885, pp. DD. For a summary of North American Arctic geology see the report of the same Survey for 1886, II, 1887, p. R.

northwestward, I found fragments of shaly marl and of gray limestone with fossils, among which *Receptaculites Oweni* was easily distinguished. Shells and bryozoa, belonging to moderately deep-water species, were found on the same pans. The limestone fragments, just mentioned, would point to the occurrence of Silurian rocks on or near the great bays in the western part of the north shore of the straits, where the land is said to be low [see also the description of Akpatok Island]. Dr. Franz Boas of Berlin [now of New York] has recorded the existence of these rocks in the interior of Baffin Land, about 2 degrees of latitude north of this region. He says:<sup>1</sup> "Through the occurrence of the Silurian rocks in the Nettilling (Lake) (= Lake Kennedy), the discovery of the same formation at the upper end of Frobisher Bay increases in value. We must now suppose that the Silurian limestones, which appear at Prince Ruperts Inlet, extend from there to Frobisher Bay, and overlie the granites and gneisses of Baffins Bay and Davis Strait. We will not be far astray if we connect this extensive Silurian district with the limestones which occur to the south of Iglling; and which form the flat eastern half of Melville Peninsula. Southward from Nettilling, these rocks rise in low hill ranges."

Farther to the north, great areas of Upper Silurian rocks occur, yielding characteristic fossils of this age. In association with this fauna also occur species of Lower Silurian age. Two of these are *Receptaculites arcticus* Etheridge, and *R. occidentalis* Salter. The latter may be the same as *R. oweni* of this paper, a species closely related to *R. occidentalis*. One or both of these species are found associated with a typical Upper Silurian fauna at Cape Louis Napoleon (latitude  $79^{\circ} 38'$  north), and Cape Frazer (latitude  $79^{\circ} 45'$  north). *Maclurea arctica* Haughton, *M. logani* Salter, and *M. magna* Lesueur, are also identified as occurring in this region in Upper Silurian faunas. Such localities are Fury Point (latitude  $72^{\circ} 50'$  north, longitude  $92^{\circ}$  west), Depot Bay (latitude  $72^{\circ}$  north, longitude  $94^{\circ}$  west), Cape Hilgard (latitude  $79^{\circ} 41'$  north), and Bessels Bay (latitude  $81^{\circ} 6'$ ). *Maclurea arctica* with *Actinoceras crebriseptum* Hall and *Receptaculites neptuni* Defrance (probably = *R. oweni*) are found with Upper Silurian fossils on the west coast of King Williams Island. *Maclurea*, or *Maclurina*, is a genus restricted to the Lower Silurian, and the same is true of *Actinoceras crebriseptum*. On the other hand, Etheridge has described as *Helicotoma naresii*, a similar shell from the Upper Silurian of Offley Island (latitude  $81^{\circ} 16'$  north) and with this the author has identified a specimen in the U. S. National Museum collected by Dr. E. Bessels at Polaris Bay (latitude  $81^{\circ} 33'$  north). The preservation of these shells, however, is such that any identification will have little value.

The foregoing facts can be interpreted in various ways:

First, Arctic collections of fossils are usually made by explorers who pick up loose fossils, some of which may have been carried by the ice considerable distances. In this way, specimens from several horizons become mixed. The author, however, does not believe that this is generally the case here, since the apparant mixtures occur in seven localities distributed between latitudes  $72^{\circ}$  to  $81^{\circ} 6'$  north.

Secondly, the identifications are not uniform, and this is particularly true of the specimens of *Maclurea*. For the present, therefore, it will

<sup>1</sup> Petermann's Mittheilungen, November, 1885.

be necessary to eliminate such identifications as horizon markers from the Upper Silurian local faunæ.

Thirdly, *Receptaculites arcticus*,<sup>1</sup> *R. occidentalis*, and *R. oweni* are good Lower Silurian horizon markers and are easily identified. Therefore the writer accepts the presence of these forms as indicative of Lower Silurian rocks. Such localities are Cape Louis Napoleon, Cape Frazer, and the west coast of King Williams Island.

From this evidence, it appears that to the north of Baffin Land other areas of Trenton strata occur, and likewise that at Cape Louis Napoleon, Cape Frazer, and on the west coast of King Williams Island, they underlie the Upper Silurian beds. Probably, it is this occurrence rather than the transportation by ice, which has led to the mixing of the faunas.

*Akpatok Island.*—The Trenton of Frobisher Bay and Lake Kennedy apparently continues southward to Hudson Strait, where, in the vicinity of Big Island, *Receptaculites oweni* was found by Dr. Bell on pan ice, as described above. Another Trenton limestone area occurs more to the east, and near the south shore of Hudson Strait, on Akpatok Island, in Ungava Bay. Here Dr. Bell<sup>2</sup> obtained 90 fossils of Trenton age. He writes:

The portion of the island which I saw [northern end to middle of east side] consists of unaltered gray limestone in horizontal beds, and it presents a perpendicular wall 400 to 500 feet high all along. This sea wall is clear cut and the beds appear thick and solid, but wherever their edges have been long exposed to the weather or in the hillsides and ravines of the interior, they split up into thinner layers. Some fragments observed in one place had the appearance of lithographic stone. \* \* \* This formation must here have a thickness of 900 feet above sea level, and there is possibly a great additional thickness of Cambro-Silurian rocks beneath the sea level.

#### EXTENT OF THE ARCTIC TRENTON.

From the foregoing description of localities, it appears that Middle Lower Silurian horizons are very extensive in eastern Arctic America. Such are known in places on either side of Hudson Strait, Frobisher Bay, the interior of Baffin Land, and to the north of this land at various localities between latitudes 79° and 80° north. As far as known, these strata unconformably overlie very ancient crystalline rocks and are in turn overlain by Upper Silurian beds of Niagara or Wenlock age. Lower Cambrian rocks are found in southern Labrador, but in the region of Baffin Land such are not known to be present. Here, then, there seems to be a complete break from the Laurentian to the Trenton, followed by another break paleontologically, in the absence of the Cincinnati beds, and probably the lower horizons of the Upper Silurian. The Lower Silurian fossils of this area indicate nothing older than the typical Trenton of New York and the Galena of Wisconsin and

<sup>1</sup>The types of this species are in the British Museum, and Dr. Hinde in his work on the Receptaculitide (Quart. Jour. Geol. Soc., London, November, 1884, p. 845) gives the horizon as Lower Silurian.

<sup>2</sup>Summary Rept. of Geol. Surv. Dept. for the year 1897-98, pp. 82, 83.

Minnesota, and nothing younger than the Utica stage of the United States. The thickness of these beds is not less than 900 feet and probably exceeds this.

This summary is based on information known to the author, and, while the evidence is meager, the essential geological age and the sequence of the rocks of Baffin Land seem to be established.

#### PALEONTOLOGY.

*Hall's collections.*—The few fossils collected at Silliman's Fossil Mount and brought to America by Mr. Hall were identified by R. P. Stevens<sup>1</sup> for the New York Lyceum of Natural History, as follows:

*Maclurea magna* Leseuer [probably *Maclurina manitobensis*].

*Endoceras proteiforme* Hall? [= *Cameroceeras proteiforme*].

*Orthoceras* (badly worn specimens).

*Heliolites* (new species).

*Heliolites* (new species).

*Halysites catenulata*.

*Receptaculites* (new species) [= ?*R. oweni* of this paper].

There is apparently nothing in this list but what was again discovered in 1897. Mr. Stevens writes that "the fossils, without doubt, are all Lower Silurian," and on the basis of the *Maclurea magna* "would place the limestone containing it on the horizon of the Chazy limestone of New York." However, it does not appear that this writer announced any particular age beyond Lower Silurian for the rocks comprised in Silliman's Fossil Mount.<sup>2</sup>

Another lot of fossils collected by Hall on his first expedition to Frobisher Bay was given to Amherst College, and forms the basis of Prof. B. K. Emerson's report "On the Geology of Frobisher Bay and Field Bay." In this lot, there is apparently nothing from Silliman's Fossil Mount, but Utica and Trenton fossils are present from localities more to the eastward and from the north shore of Frobisher Bay. These are:

#### TRENTON SPECIES.

["Gray argillaceous limestone." ?Cape Stevens.]

*Buthotrephis* cfr. *gracilis* Hall.

*Stictopora ramosa* Hall?

*Rhynchonella*.

*Tellinomya levata* Hall.

*Murchisonia gracilis*?

*Conularia trentonensis* Hall.

#### UTICA SPECIES.

["Flinty bituminous limestone." ?Jones Cape.]

*Diplograptus dentatus* (Brongniart).

*Lingula curta* Conrad.

*Endoceras proteiforme* Hall.

*Orthoceras laqueatum* Hall?

*Triarthrus beeki* Green.

*Calymmenc senaria* Conrad.

<sup>1</sup> Amer. Journ. Sci., 2d ser., XXXV, 1863, pp. 293, 294.

<sup>2</sup> Prof. B. K. Emerson says: "We made inquiry, but can find no traces of this or the other fossils reported upon in Mr. Stevens's article quoted." See "On the Geology of Frobisher Bay and Field Bay." Appendix III to "Narrative of the Second Arctic Expedition made by Charles F. Hall," edited by Prof. J. E. Nourse, Washington, 1879, p. 576.

## TRENTON SPECIES—continued.

["Gray argillaceous limestone." ?Cape Stevens.]

*Tentaculites.**Leperditia alta* Conrad.*Leperditia canadensis* Jones.*Primitia muta* Jones.*Primitia frobisherii* Emerson.*Beyrichia symmetricus* Emerson.*Asaphus* sp.

## UTICA SPECIES—continued.

["Flinty bituminous limestone." ?Jones Cape.]

*Cyphaspis frobisherii* Emerson.

The Trenton horizon may be the same as that of Silliman's Fossil Mount. In any event, the foregoing lists indicate horizons intimately connected, and it is probable that all the fossiliferous strata at the head of Frobisher Bay are of Trenton and Utica age.

*Akpatok Island.*—The fossils collected by Dr. Bell on Akpatok Island have been studied by Professor Whiteaves,<sup>1</sup> with the following results:

The species indicate the Trenton limestone, and "are remarkably similar to the fossils of the Trenton formation of the Red River Valley in Manitoba." "Eleven had previously been found in the Manitoba Trenton, and nine are species that are common at East Selkirk and Lower Fort Garry." This fauna also connects directly with that of Silliman's Fossil Mount.

The following is a list of the species:

*Receptaculites oweni* Hall.*Streptelasma robustum* Whiteaves.*Calapæcia canadensis* Billings.*Rafinesquina lata* Whiteaves.*Leptæna unicostata* (Meek and Worthen).*Plectambonites sericea* (Sowerby).*Orthis tricenaria* Conrad.*Orthis (Dinorthis) meedsi arctica* Schuchert.*Orthis (Hebertella) bellirugosa* (Conrad).*Orthis (Dalmanella) testudinaria* (Dalman).*Platystrophia biforata* (Schlotheim).? *Rhynchotrema inæquivalvis* (Castelnau).*Cyrtoceras manitobense* Whiteaves.

<sup>1</sup> Amer. Journ. Sci., 4th ser., VII, 1899, pp. 433, 434.



List of fossils from Silliman's Fossil Mount and their distribution.

Species.	Horizons.				Regions.	
	Birdseye or Lowville.	Black River.	Trenton or Galena.	Cincinnati.	Minnesota, Manitoba.	New York, Ottawa.
<i>Receptaculites oweni</i> Hall.....			×		×	
<i>Ischadites iowaensis</i> (Owen).....			×		×	
<i>Halsites catenulatus gracilis</i> (Hall).....			×		×	
<i>Lyellia affinis</i> (Billings).....				×		
<i>Plasmopora lambi</i> , new species.....						
<i>Calapocia canadensis</i> Billings.....	×	×		×	×	×
<i>Streptelasma corniculum</i> Hall.....			×		×	×
<i>Porocrinus shawi</i> , new species.....						
<i>Lichenocrinus affinis</i> Miller.....				×		
<i>Crepipora</i> , species undetermined.....						
<i>Orthis tricenaria</i> Conrad.....	×	×	×		×	×
<i>Orthis (Dalmanella) testudinaria</i> (Dalman).....	×	×	×	×	×	×
<i>Orthis (Plectrothis) plicatella</i> Hall.....			×	×	×	×
<i>Orthis (Hebertella) borealis</i> (Billings).....			×	×	×	×
<i>Orthis (Hebertella) bellirugosa</i> (Conrad).....	×	×	×	×	×	×
<i>Orthis (Dinorthis) meedsi</i> Winchell and Schuchert.....			×	×	×	×
<i>Orthis (Dinorthis) meedsi arctica</i> , new variety.....			×	×	×	×
<i>Platystrophia bifurcata</i> (Schlotheim).....	×	×	×	×	×	×
<i>Parastrophia hemiplicata</i> Hall.....			×	×	×	×
<i>Rhynchotrema inequivalvis</i> (Castelman).....			×	×	×	×
<i>Ctenodonta subnasuta</i> Ulrich?.....			×		×	
<i>Ctenodonta frobisherensis</i> , new species.....						
<i>Ctenodonta carpenteri</i> , new species.....						
<i>Ctenodonta baffinensis</i> , new species.....						
<i>Modiolodon arctica</i> , new species.....						
<i>Whiteavesia symmetricus</i> , new species.....						
<i>Cyrtodonta sillimanensis</i> , new species.....						
<i>Cyrtodonta gibbera</i> , Ulrich variety.....						
<i>Vanuxemia abrupta</i> Ulrich.....			×		×	
<i>Vanuxemia baffinensis</i> , new species.....						
<i>Whitella arcticus</i> , new species.....						
<i>Saffordia modesta</i> Ulrich.....			×		×	
<i>Protowartha percolutus</i> Ulrich and Scofield.....		×	×		×	×
<i>Tetranota obsoleta</i> Ulrich and Scofield.....	×	×	×	×	×	×
<i>Kokenia costalis</i> Ulrich and Scofield.....			×		×	×
<i>Eclerophon similis</i> Ulrich and Scofield.....			×		×	×
<i>Lophospira spironema</i> Ulrich and Scofield.....		×	×		×	×
<i>Liospira americana</i> (Billings).....	×	×	×		×	×
<i>Claustrospira conica</i> Ulrich and Scofield.....		×	×	×	×	×
<i>Selya (?) ulrichi</i> , new species.....						
<i>Helicotoma (?) larvata</i> Salter.....		×				×
<i>Maclurina manitobensis</i> (Whiteaves).....			×		×	×
<i>Maclurina cuneata</i> (Whitfield).....			×		×	×
<i>Maclurca crassa</i> Ulrich and Scofield.....			×		×	×
<i>Trochonema umbilicatum</i> (Hall).....	×	×	×	?	×	×
<i>Trochonema (Eunema) robbinsi</i> Ulrich and Scofield.....			×		×	×
<i>Holopea arctica</i> , new species.....						
<i>Trochus (?)</i> , species undetermined.....						
<i>Fusispira inflata</i> (Meek and Worthen).....			×		×	×
<i>Fusispira nobilis</i> Ulrich and Schofield.....			×		×	×
<i>Cameroceus proteiforme</i> (Hall).....	×	×	×		×	×
<i>Orthoceras olorus baffinensis</i> , new variety.....					×	
<i>Orthoceras bilineatum</i> Hall.....		×	×		×	
<i>Orthoceras porteri</i> , new species.....						
<i>Orthoceras scalariformis</i> , new species.....						
<i>Cyrtoceras manitobense</i> Whiteaves.....			×		×	
<i>Cyrtoceras cornubum</i> , new species.....						
<i>Cyrtoceras baffinensis</i> , new species.....						
<i>Olinoceras exiguum</i> (Billings).....			×		×	×
<i>Oncoceras arcticum</i> , new species.....						
<i>Potrioceras</i> , species undetermined.....						
<i>Eurytomites plicatus</i> Whiteaves.....			×		×	
<i>Bythocypris granti</i> Ulrich.....		×			×	
<i>Pramia</i> or <i>Kladenia</i> .....						
<i>Krausella</i> , 2 new species.....						
<i>Nileus vigilans</i> (Meek and Worthen).....		×	×	×	×	
<i>Illeenus crassicauda americanus</i> (Billings).....			×	×	×	
<i>Isotelus gigas</i> De Kay.....			×	×	×	×
<i>Dalmanites (Pterygomotopus) goodrighi</i> , new species.....			×	×	×	×
<i>Ceraurus pleurexanthemus</i> Green.....	×	×	×	×	×	×
Total.....	10	17	38	11	41	17

*Age of Silliman's Fossil Mount.*—From Mr. Porter's description, it will be seen that the fossils recently collected at Silliman's Fossil Mount are from various horizons, and yet there is nothing to indicate the presence of more than one fauna. The foregoing list shows that at present there are 72 species known from this locality, and of these 28 are restricted to it. There are, therefore, 54 species which are common to other localities, a goodly number with which to make safe correlations. Of these 54 species, 41, or 57 per cent of the known fauna, are also found in the region of Minnesota, Wisconsin, and Iowa, while 17 are known to occur in New York and Ottawa.

On comparing the 54 widely distributed species with those from definite stages in Minnesota, it is seen that 10 are also found in Birds-eye (= Lowville), 17 in the Black River, 38, or about 70 per cent, in the Galena, the direct equivalent of the New York Trenton, and 11 in the Cincinnati group.

From these figures it is evident that the stage of Silliman's Fossil Mount belongs in the Galena, and that the fauna is more intimately related to that of the Minnesota region than to the Trenton of New York. When the New York Trenton fauna is restudied in the light of recent researches in Minnesota,<sup>1</sup> however, it will be shown that the two faunas have more in common than now appears. On the other hand, the lithological similarities of the Minnesota Galena and Silliman's Fossil Mount—light-colored shales predominating in both areas—may explain in large measure the close identity of these widely separated faunas.

This little fauna likewise brings out the fact that the corals, brachiopods, gastropods, and the trilobites are slow in their evolutionary change, and the species can therefore spread over very great areas, while the cephalopods, and particularly the pelecypods, are more sensitive to change, and are thus restricted to localities.

#### DESCRIPTION OF SPECIES.

### Uncertain Class.

#### Family RECEPTACULITIDÆ Roemer.

#### RECEPTACULITES OWENI Hall.

*Receptaculites oweni* HALL, Geol. Rept. Wis., 1862, p. 46, fig. 2; p. 429.—WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 57, pl. F, figs. 1-4.

In the present collection, this species is represented by a large disk-shaped specimen which measures 6 inches from the central apex to the

<sup>1</sup> See the two magnificent volumes on the paleontology of the Lower Silurian fossils of Minnesota, entitled *Geology of Minnesota*, III, Pts. 1, 2, published by the Geological and Natural History Survey of Minnesota, N. H. Winchell, State Geologist.

circumference, making the species originally not less than 12 inches over all. This is about the usual size for the larger specimens of *R. oweni* in Minnesota, although examples have been seen 20 inches in diameter.

Etheridge has described *R. arcticus* from Cape Frazer and Cape Louis Napoleon in Grinnell Land. This is also a large disk-shaped species, similar in growth to *R. oweni*, but the walls are usually twice as thick, and the transverse tubes are much larger and fewer in a given space than in the species last named.

*Collectors.*—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28143, U.S.N.M.

#### ISCHADITES IOWAENSIS (Owen).

*Selenoides iowensis* OWEN, Geol. Surv. Wis., Iowa, Minn., 1852, p. 587, pl. 2B, fig. 13.  
*Ischadites iowensis* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 64, pl. F, figs. 5, 6.

A well-preserved fragment of this species is identical with specimens from Goodhue County, Minnesota.

*Collector.*—J. N. Carpender. Cat. No. 28144, U.S.N.M.

### Class CŒLEENTERATA.

#### Order ALCYONARIA Edwards and Haime.

##### Family HALYSITIDÆ.

##### HALYSITES CATENULATUS, var. GRACILIS Hall.

*Halysites catenularia* var. *gracilis* LAMBE, Geol. Surv. Canada, Cont. to Canadian Pal., V, 1899, p. 69, pl. III, figs. 5-7.

Of this widely distributed species, which begins in the Trenton and dies out in the Lower Helderberg, there are several excellent specimens present. These Arctic Trenton specimens are in harmony with the variety *gracilis*, which is restricted to the Trenton and Lorraine stages.

*Collectors.*—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28138, U.S.N.M.

##### Family HELIOPORIDÆ Moseley.

##### LYELLIA AFFINIS (Billings).

For synonymy see Lambe, Geol. Surv. Canada, Cont. to Canadian Pal., IV, 1899, p. 84.

This species, of which there are in the present collection three well-preserved examples, Mr. Lambe says occurs in the "Hudson River and Niagara formations, in the four divisions of the Anticosti group, and in the Lower Helderberg group." To this range is now added the Trenton stage.

*Collectors.*—J. N. Carpender and A. V. Shaw. Cat. No. 28139, U.S.N.M.

## PLASMOPORA LAMBII, new species.

This species begins growth on some small foreign object, and expands to a diameter exceeding 12 cm. by 7 cm. in height. Beyond the place of attachment the lower surface is irregularly concave and covered by a thin epitheca. The upper surface is in form depressed hemispheric to conical. Corallites from 1 to 1.75 mm. in diameter, commonly about 1.25 mm., circular, and separated from one another from 0.5 to 1.25 mm. Septa not prominent, and where the original surface is well preserved not easily distinguishable from the radial striations, or granular surface, of the tubular area. Corallites with very closely adjoining tabulæ, which are generally decidedly vesicular, but in places they are flat. In longitudinal sections there are from two to five tubules between neighboring corallites; the tabulæ are convex, generally giving the inter-corallite space a decided vesicular structure.

The general vesicular condition of the tabulæ in both the tubules and corallites distinguishes *P. lambii*. This feature was pointed out by Mr. Lawrence M. Lambe of the Canadian Geological Survey, and the writer takes pleasure in connecting his name with this new species in appreciation of his excellent work on the corals of Canada.

*Collectors*.—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28140, U.S.N.M.

## CALAPŒCIA CANADENSIS Billings.

For synonymy see Lambe, Geol. Surv. Canada, Cont. to Canadian Pal., IV, 1899, p. 43.

Of this species, there is a small, depressed, hemispheric specimen in which the corallites are in contact, and therefore there is little inter-zooecial vesicular tissue. The hexagonal, nearly uniform corallites are from 3 to 4 mm. in width, and each has from 18 to 20 septa.

The above identification is confirmed by Mr. Lawrence M. Lambe.

*Collector*.—J. N. Carpender. Cat. No. 28142, U.S.N.M.

## Order MADREPORARIA Edwards and Haime

## Suborder TETRACORALLA Haeckel.

## Family STREPTELASMIDÆ Nicholson.

## STREPTELASMA CORNICULUM Hall.

*Streptelasma corniculum* HALL, Pal. N. Y., I, 1847, p. 69, pl. XXV, figs. 1a-1e.—WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 90, pl. G, figs. 20, 21.

This characteristic Trenton cup coral is common in the strata of Silliman's Fossil Mount, and agrees well with specimens from the Galena horizon of Minnesota.

*Collectors*.—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28141, U.S.N.M. The American Museum of Natural History has a number of specimens collected by Mr. R. W. Porter.

## CYSTOIDEA.

## Family CRYPTOCRINIDÆ Zittel.

## POROCRINUS SHAWI, new species.

(Plate XII, figs. 1-3.)

This species is most nearly related to *P. smithi* Grant,<sup>1</sup> as far as the shape of the dorsal cup, elevation of the costæ, and form of the plates are concerned. It differs, however, from all American species in that the circular pore-rhomb spaces are larger. This is particularly true of the lowest series, which occupy nearly the entire basal plates besides portions of two adjoining subradials. The rhombs are also very large in the interradial areas on each side of the arm bases.

The ambulacral grooves are narrow and short, and within the shallow vestibule terminate abruptly below into the body cavity. The margin bordering the large, central, circular opening is somewhat notched at each ambulacral groove, giving the impression that there may have been communication between the oral opening and each ambulacral groove. The smaller ventral plates are not preserved in this specimen, which is the only one known.

Named for Mr. A. V. Shaw, of Boston, Massachusetts, who was one of the Frobisher Bay party of 1897.

Collector.—A. H. White. Cat. No. 28145, U.S.N.M.

## Family LICHENOCRINIDÆ.

## LICHENOCRINUS AFFINIS Miller.

*Lichenocrinus affinis* MILLER, Journ. Cinn. Soc. Nat. Hist., V, 1882, p. 229, pl. IX, figs. 7, 7a.

But a single specimen of this species has been noted, and this was attached to an Orthoceras. It has the general aspects of *L. affinis* in the pentagonal column, form of body, slight convexity, number of plates, and the general irregularity of these, both in form and arrangement.

The genus *Lichenocrinus* has not been previously recorded from rocks below the Utica. In the Cincinnati group specimens are often abundant where *L. affinis* occurs in the upper third or Richmond stage.

Collector.—J. N. Carpender. Cat. No. 28146, U.S.N.M.

<sup>1</sup>Ottawa Field Nat. Club, Trans. No. 2, 1881, p. 42, plate, figs. 1-8.

## BRYOZOA.

## Family CERAMOPORIIDÆ Ulrich.

## CREPIPORA, species undetermined.

Specimens of this species were sent to Mr. E. O. Ulrich, who identified them as belonging to *Crepidora*. The minute structure, however, is poorly preserved, and no thin sections were made.

*Collectors*.—A. H. White, J. N. Carpender, and A. V. Shaw. Cat. No. 28147, U.S.N.M.

## Class BRACHIOPODA.

## Order PROTREMATA Beecher.

## Family ORTHIDÆ Woodward.

## ORTHIS TRICENARIA Conrad.

*Orthis tricenaria* CONRAD, Proc. Acad. Nat. Sci. Phila., 1843, p. 333.—WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 418, pl. XXXII, fig. 18-23.

This well-known and characteristic Trenton species is represented by two specimens, which are small for this form, but otherwise closely resemble those from the Galena shale of Minnesota. On Akpatok Island the species attained the largest growth known, being more than three times as large as those found in Baffin Land.

*Collector*.—J. N. Carpender. Cat. No. 28149, U.S.N.M. One specimen was also found by Mr. R. W. Porter and is now in the American Museum of Natural History.

## ORTHIS (DALMANELLA) TESTUDINARIA (Dalman).

*Orthis (Dalmanella) testudinaria* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 2, 1893, p. 441, pl. XXXIII, figs. 17-22.

This ubiquitous Lower Silurian species is very abundant at Silliman's Fossil Mount, and at this locality is quite constant in its characters. The specimens belong to the variety with fine striæ, in which the dorsal valve is often slightly convex, recalling the subgenus *Rhipidomella* rather than *Dalmanella*. However, other examples have the typical flat dorsal valve, with a well-defined median sinus.

*Collectors*.—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28148, U.S.N.M. The American Museum of Natural History also has a number of specimens collected by Mr. R. W. Porter.

## ORTHIS (PLECTORTHIS) PLICATELLA Hall.

*Orthis (Plectorthis) plicatella* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 436, pl. XXXIII, figs. 5-7.

As a rule, this species is not abundant in the Trenton either in New York or in Minnesota, but at Silliman's Fossil Mount it is a common shell.

The Arctic examples are large and robust, and agree rather with specimens from Watertown, New York, than with those from Minnesota, which are somewhat smaller. The species is often confounded with *Orthis* (*Hebertella*) *borealis*, but can be easily distinguished by the almost entire absence of fold and sinus. When these are present, however, they are found to occupy a position the reverse of that seen in the latter species.

*Collectors*.—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28150, U.S.N.M. A number of specimens collected by Mr. R. W. Porter are in the American Museum of Natural History.

ORTHIS (HEBERTELLA) BOREALIS (Billings).

*Orthis* (*Hebertella*) *borealis* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 433, figs. 33a-33c.

This well-developed species is represented by six typical specimens. They much resemble *O. (P.) plicatella* externally except in the position of the fold and sinus, which is the reverse of that seen in Hall's species.

*Collector*.—J. N. Carpender. In the American Museum of Natural History there are three specimens collected by R. W. Porter. Cat. No. 28151, U.S.N.M.

ORTHIS (HEBERTELLA?) BELLIRUGOSA (Conrad).

*Orthis* (*Hebertella*?) *bellarugosa* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 434, pl. XXXIII, figs. 1-4.

This species is never abundant in the Trenton, and the same is true in Baffin Land. Mr. Russell W. Porter found a single specimen, which is now in the American Museum of Natural History. This form also occurs on Akpatok Island, Ungava Bay, Labrador.

ORTHIS (DINORTHIS) MEEDSI Winchell and Schuchert, var. ARCTICA,  
new variety.

(Plate XII, figs. 7, 8.)

*Orthis* (*Dinorthis*) *meeysi* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 427, pl. XXII, figs. 39-45.

This species, which is common in the Galena or Trenton stage of Minnesota, is also abundant at the Frobisher Bay locality. As in Minnesota, it is here also a very variable species. However, among the Arctic specimens this variation tends toward the equalization and increase of the number of plications, while in Minnesota, bundling of the plications accompanied by the development of a conspicuous dorsal sinus, is the chief trend of variation. The specimens having the last-named characters were given the varietal name *germana*. On the same ground it may be advisable to name the Arctic variation—those with the more numerous and equal plications, and an obsolete or nearly obsolete dorsal-sinus variety—*arctica*.

*O. (D.) meedsi* of Silliman's Fossil Mount also recalls *O. (D.) proavita* and *O. (D.) subquadrata*, showing that the three probably belong to one stock.

*Collectors*.—J. N. Carpender and A. H. White. Cat. Nos. 28152,3, U.S.N.M. A number of specimens are in the American Museum of Natural History, which were collected by Mr. R. W. Porter.

#### PLATYSTROPHIA BIFORATA (Schlotheim).

*Platystrophia biforata* WINCHELL and SCHUCHERT, Geol. Minn., III, Pt. 1, 1893, p. 455, pl. XXXIII, figs. 51-54.

This ubiquitous Silurian species appears to be rare at the Frobisher Bay locality, since but three specimens are present. These are small, a condition in harmony with their Trenton age, and have short hinge lines devoid of hinge extensions. The latter feature is best developed in the upper or Richmond stage of the Cincinnati group.

*Collectors*.—J. N. Carpender and A. H. White. Cat. No. 28154, U.S.N.M. A single specimen is in the collection of the American Museum of Natural History.

#### Family PORAMBONITIDÆ Davidson.

##### PARASTROPHIA HEMIPLICATA Hall.

*Parastrophia hemiplicata* SCHUCHERT, Bull. U. S. Geol. Surv., No. 87, 1897, p. 300.

These small early pentameroids are under size in the Arctic locality, but otherwise are more in harmony with examples from New York than with those from Minnesota.

*Collector*.—A. H. White. Cat. No. 28156, U.S.N.M.

#### Order TELOTREMATA Beecher.

##### Family RHYNCHONELLIDÆ Gray.

##### RHYNCHOTREMA MINNESOTENSIS (Sardeson).

*Rhynchotrema inaequalvis* WINCHELL and SCHUCHERT (part), Geol. Minn., III, Pt. 1, 1893, p. 459, pl. XXXIV, figs. 9-11, 15-23 (not figs. 12-14, 24, 25).

*Rhynchonella minnesotensis* SARDESON, Bull. Minn. Acad. Nat. Sci., III, 1892, p. 333, pl. IV, figs. 21-23; Amer. Geol., XVIII, 1896, p. 184.

The common *Rhynchonella* from the Birdseye or Lowville and Black River stages, which is usually identified as *R. increbescens* Hall, is always devoid of the concentric lamellæ so characteristic of *R. increbescens*=*R. inaequalvis* of the Trenton stage. Occasional specimens occur with a few of the lamellæ near the anterior margin, but generally the shell is devoid of these, their places being occupied by very fine, wavy, concentric lines. In higher beds, these fine lines develop into stronger and more extended lamellæ, which find their greatest development in *Rhynchotrema perlamellosum* of the upper or Richmond stage of the Cincinnati group.



The form of *R. minnesotensis* is quite variable and can not be of much aid in distinguishing this shell from *R. inaequalvis*. The two are often found associated in the same beds, and it is then difficult to identify them correctly. This fact led Winchell and Schuchert, in 1893, to regard both as belonging to one species, *R. inaequalvis*.

*Locality and formation.*—In the Lowville and particularly in the Black River stages of the Trenton in Minnesota and Wisconsin, Lexington, Kentucky, and in the Cincinnati group at Savannah, Illinois. This species and *R. inaequalvis subtrigonalis* are unknown at Silliman's Fossil Mount.

#### RHYNCHOTREMA INÆQUALVIS (Castelnau).

*Spirifer inaequalvis* CASTELNAU, Essai Système Sil. l'Amérique Septentrionale, 1843, p. 40, pl. XIV, fig. 8.

*Atrypa increbescens* HALL, Pal. N. Y., I, 1847, p. 146, pl. XXXIII, figs. 13a-13h (probably not p. 289, pl. LXXIX, fig. 6).

*Rhynchotrema inaequalvis* WINCHELL and SCHUCHERT (part), Geol. Minn., III, Pt. 1, 1893, p. 459, pl. XXXIV, figs. 12-14, 24, 25 (not figs. 9-11, 15-23=*R. minnesotensis*).

This species was first described by Castelnau, who obtained his specimens from the "magnesian limestone" of Drummonds Island. His figures show the characteristic concentric lamellæ which are almost always present on these shells coming from the Trenton, and this feature distinguishes them from those found in the Lowville and Black River stages. Hall subsequently described this shell as *Atrypa increbescens*, but it is now generally known as *Rhynchonella increbescens*. The species is a characteristic form of the Trenton, while in the Cincinnati group its descendant *R. capax* attains large size, often great rotundity, with marked concentric lamellæ. The lamellar development finds its extreme in *R. perlamellosum*.

*R. inaequalvis* is abundant at Silliman's Fossil Mount, the concentric lamellæ being also strongly developed in the specimens found.

*Collectors.*—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28155, U.S.N.M. A number of specimens collected by Mr. R. W. Porter are in the American Museum of Natural History.

#### RHYNCHOTREMA INÆQUALVIS SUBTRIGONALIS (Hall).

*Atrypa subtrigonalis* HALL, Pal. N. Y., I, 1847, p. 145, pl. XXXIII, fig. 12.

This shell is only an elongate variety of *R. inaequalvis* and appears to be a rare form in the Trenton of New York, yet at Curdsville, Kentucky, it is abundant. As in *R. inaequalvis*, the lamellæ are well developed.

## Class PELECYPODA.

## Family NUCULIDÆ Gray.

## CTENODONTA SUBNASUTA Ulrich?

(Plate XIII, figs. 4-6.)

*Ctenodonta subnasuta* ULRICH, Geol. Minn., III, Pt. 2, 1894, p. 585, pl. XLII, figs. 34-36.

There are two examples of this species, and these appear to agree best with Minnesota specimens of *C. subnasuta*. They were sent to Mr. E. O. Ulrich for direct comparison with his types. He writes:

You can not be far wrong if you identify these specimens with *C. subnasuta*. Still, there is some doubt as to their identity. The Arctic specimens are larger than the types, and relatively a little more elongate, while the basal outline is scarcely as convex, and the umbones not so full and evenly rounded. Finally, the smaller end, which I am now somewhat inclined to regard as the anterior, is relatively wider in your shells. I may add that the larger specimen indicates a thinner hinge plate than in the types, so that, after all, these specimens may belong to a distinct species. Typical *C. subnasuta* occur in the Trenton of Manitoba.

Collectors.—J. N. Carpender and A. H. White. Cat. No. 28163, U.S.N.M.

## CTENODONTA CARPENDERI, new species.

(Plate XIII, figs. 1-3.)

This is the most abundant pelecypod from Silliman's Fossil Mount and appears to be closely related to *C. cuneiformis* Ulrich.<sup>1</sup> It differs, however, in various details, particularly in always being considerably larger. *C. carpenderi* has also the general aspect of small specimens of *C. nasuta*, but differs in the straight hinge line, especially that of the posterior end, which terminates abruptly into the regularly convex outline of this portion of the shell.

Mr. E. O. Ulrich, to whom several examples were sent, wrote as follows:

These specimens are closely related to *C. cuneiformis* Ulrich. The types of that species are much smaller, with the narrower end relatively shorter and the constriction more distinct. Good specific differences are found in the postcardinal region (i. e., assuming that the wider end is posterior). Here the Arctic species is more impressed, causing the umbonal ridge to be much more prominent, the postcardinal slopes wider and concave instead of flat. Just behind the beaks there is a triangular shaped area (ligamental probably) which is wanting in *C. cuneiformis*.

Named after Mr. J. N. Carpender, of New Brunswick, New Jersey, who made the most extensive collection of fossils at the head of Frobisher Bay.

Collectors.—J. N. Carpender, A. H. White, and A. V. Shaw. Cat. No. 28164, U.S.N.M. Other specimens collected by Mr. R. W. Porter are now in the American Museum of Natural History.

<sup>1</sup>Geol. Minn., III, Pt. 2, 1894, p. 597, pl. XLII, figs. 31-33.

## CTENODONTA BAFFINENSIS, new species (Ulrich).

(Plate XIII, figs. 7-10.)

There is but a single example of this species present, and this was provisionally identified as *C. scofieldi* Ulrich.<sup>1</sup> The author of the species writes that, while it has the general aspect of *C. scofieldi*, it is nevertheless sufficiently distinct to be recognized as new. Mr. Ulrich has made the following comparisons:

At first sight this is extremely like *C. scofieldi*, but on closer inspection, and particularly when compared with the types of that species, certain peculiarities become so prominent that I wonder that they were not observed at once. The first of these is a depression, or rather widening furrow, extending vertically from the beaks across the valves. This is sufficient to cause a straightening, even a slight concavity, in the ventral outline. The outline of the valves differs further in the postventral (wider) region being more prominent and more narrowly rounded here. In a cardinal view the species agrees best with *C. scofieldi*, but in a lateral view the outline corresponds better with *C. medialis* and *C. nitida* Ulrich. The contour of the valves, however, shows it to be a distinct form, the mesial depression possibly indicating relations to species of the type *C. carinata* Ulrich. *C. scofieldi* also has no radiating lines; the concentric lines are equally as delicate.

*Collector.*—R. W. Porter. The type is in the American Museum of Natural History.

## CTENODONTA FROBISHERENSIS, new species.

(Plate XIII, figs. 11-14.)

Of this little shell there are two well-preserved specimens, which appear to be distinct from all other Ordovician Ctenodontas. Probably the species most nearly related is *C. albertina* Ulrich,<sup>2</sup> from which it differs in having the beaks more centrally situated, the valves shallower, and in being less drawn out anteriorly. At first this form was thought to be most closely related to *C. oviformis* Ulrich,<sup>3</sup> but the author of the latter species writes that the Arctic shell "has different proportions" and that it represents a new species. *C. oviformis* is less high, has narrowly rounded ends, and the beaks are situated nearer the mid-length. Its rounded-ovate form distinguishes it from the other Frobisher Bay species, all of which are nasute forms.

*Collectors.*—J. N. Carpender and A. V. Shaw. Cat. No. 28165, U.S.N.M.

## Family MODIOLOPSIDÆ Ulrich.

## MODIOLODON ARCTICUS, new species.

(Plate XIII, figs. 18, 19.)

There is a good cast of the interior of the valves of this shell in the present collection. The species is very much like *M. patulus* Ulrich,<sup>4</sup>

<sup>1</sup> Geol. Minn., III, Pt. 2, 1894, p. 593, pl. XLII, figs. 53-58.<sup>2</sup> Ibidem, p. 598, pl. XLII, figs. 76-82.<sup>3</sup> Ibidem, p. 586, pl. XLII, fig. 29.<sup>4</sup> Ibidem, p. 521, pl. XXXVII, figs. 20-24.

and was at first regarded by the writer as a variety of that form. *M. arcticus* is, however, nearer subquadrate than ovate, shorter and more erect, the post-cardinal portion more alate, and the beaks smaller and more pointed than in *M. patulus* Ulrich.

Collector.—J. N. Carpender. Cat. No. 28166, U.S.N.M.

WHITEAVESIA SYMMETRICUS, new species (Ulrich).

(Plate XIII, figs. 15-17.)

This little shell was thought by the writer to be probably identical with *Cyrtodonta affinis* var. *fillmorensis* Ulrich,<sup>1</sup> and for confirmation of this opinion sent the specimen to Mr. Ulrich. He, however, refers it to the genus *Whiteavesia* of the family Modiolopsidæ. As his notes are detailed, they are given at length.

Remains of the black ornament-bearing epidermis prove the specimen to belong to the Modiolopsidæ. It is a new species, with an anterior end reminding of *Modiolopsis arguta*, while the rest of the outline and general aspect is more nearly like *M. similis*. It is also like *M. obsoleta*, but it is too high posteriorly. It is, however, not a true *Modiolopsis*, the umbones being too prominent and full, the ventral outline convex, and the anterior muscular scars scarcely distinguishable in the cast. These characters make it a *Whiteavesia*, and it does not seem to be closely related to any of the described species of that genus. The rather uniform convexity of the valves is peculiar to this species.

Collector.—J. N. Carpender. Cat. No. 28162, U.S.N.M.

Family CYRTODONTIDÆ Ulrich.

CYRTODONTA SILLIMANENSIS, new species (Ulrich).

(Plate XIII, figs. 31-33.)

Mr. Ulrich has kindly made the following notes on this species:

Have compared this with every *Cyrtodonta* known to me without finding one with which it is identical. In a general way it reminds of *C. affinis*, *C. parva*, and *C. halli*,<sup>2</sup> but am satisfied it is not closely related with any of that group of species. Its true affinities seem to be with *C. subcarinata* Billings, but is readily distinguished by its shorter form and much broader posterior. From *C. huronensis* Billings,<sup>3</sup> which I regard as another close ally (also *C. billingsi* Ulrich<sup>2</sup>), it differs not only in size but in its greater convexity and much better defined antero-median sulcus. The specimen is preserved in part as a cast of the interior, and I am therefore inclined to doubt that the sulcus is as strongly defined on the exterior of the shell as shown on the specimen.

Collector.—J. N. Carpender. Cat. No. 28159, U.S.N.M.

CYRTODONTA (?) GIBBERA Ulrich, variety.

(Plate XIII, figs. 34-36.)

*Cyrtodonta gibbera* ULRICH, Geol. Minn., III, Pt. 2, 1894, p. 542, pl. XXXIX, figs. 13-15.

The only example of this species was sent by the writer to Mr. Ulrich, who made the following comparisons:

<sup>1</sup> Geol. Minn., III, Pt. 2, 1894, p. 540, pl. XXXIX, fig. 23.

<sup>2</sup> Ibidem.

<sup>3</sup> Canadian Nat. and Geol., III, 1858, p. 432.

It differs from my type specimen, which is a cast of the exterior, in being somewhat less gibbous, particularly in the umbones, the beaks also coming closer, i. e., they are almost in contact, while they are rather widely separated and less incurved in the type.

In the absence of evidence concerning the hinge, the generic position of the shell is necessarily doubtful. Therefore, although admitting provisionally that it is closely allied to *Cyrtodonta gibbera*, I am not at all satisfied that it will not turn out to be a *Vanuxemia* near *V. abrupta*.

Collector.—J. N. Carpender. Cat. No. 28161, U.S.N.M.

#### VANUXEMIA ABRUPTA Ulrich.

*Vanuxemia abrupta* ULRICH, Geol. Minn., III, Pt. 2, 1894, p. 560, pl. XXXVIII, figs. 39-44.

Of this species there are two examples, which Mr. Ulrich has compared with the types. In Minnesota this form is found in the Middle Galena of Fillmore and Goodhue counties.

Collector.—J. N. Carpender. Cat. Nos. 28157, 8, U.S.N.M.

#### VANUXEMIA BAFFINENSIS, new species.

(Plate XIII, figs. 26-28.)

This species finds its nearest relatives in *V. hayniana* Safford and *V. niota* (Whitfield<sup>1</sup>). It differs from these species in the greater obliquity of the shell. The largest specimen figured (figs. 29 and 30) is a worn example, and is provisionally referred to *V. baffinensis* as a variety. When additional material is secured, it may prove to be a distinct species. (Another specimen just received from Mr. A.V. Shaw shows that the variety is probably a distinct species.)

Collector.—J. N. Carpender. Cat. No. 28160, U.S.N.M.

#### WHITELLA ARCTICUS, new species.

(Plate XIII, figs. 23-25.)

Ulrich writes that this species of *Whitella* is nearest his *W. rugatina*,<sup>2</sup> from which it differs in being much more erect. In fact, *W. arcticus* is more erect than any other species of the genus. The escutcheon is very narrow.

Collector.—J. N. Carpender. Cat. No. 33059, U.S.N.M.

#### Family GRAMMYSIIDÆ Hall.

##### SAFFORDIA MODESTA Ulrich.

*Saffordia modesta* ULRICH, Geol. Minn., III, Pt. 2, 1894, p. 627, pl. XLI, figs. 29-31.

Of this form there are two specimens in the American Museum of Natural History, collected by Mr. R. W. Porter. Externally they agree with the Minnesota species.

<sup>1</sup> See Geol. Minn., III, Pt. 2, 1894, p. 560.

<sup>2</sup> Ibidem, p. 569, pl. XLI, fig. 1.

## Class GASTROPODA.

### Family PROTOWARTHIDÆ Ulrich.

#### PROTOWARTHIA PERVOLUTA Ulrich and Scofield.

*Protowarthia pervoluta* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 871, pl. LXIII, figs. 21-27.

This species is fairly common at Silliman's Fossil Mount, and in some specimens the shell is preserved. Testiferous examples of *P. pervoluta* are distinguished from other species of the genus by the columella-like development of the inner lip. The specimens were sent to Mr. Ulrich, who has compared them with his types. He writes that the Arctic examples are somewhat more angular on the back of the volutions than the type specimens.

*Collectors.*—J. N. Carpender and A. H. White. Cat. No. 28173, U.S.N.M.

### Family BUCANIDÆ Ulrich.

#### TETRANOTA OBSOLETA Ulrich and Scofield.

*Tetranota obsoleta* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 880, pl. LXV, figs. 19-23.

Of this widely distributed shell there are eight examples in the present collection. Three were sent to Mr. Ulrich, who pronounced them typical examples of his *T. obsoleta*.

In the United States, this shell ranges from the Lowville stage into the Utica, and is found in Minnesota, Wisconsin, Kentucky, and at Cincinnati, Ohio.

*Collectors.*—J. N. Carpender and A. H. White. Cat. No. 28175, U.S.N.M. Three specimens collected by Mr. R. W. Porter are in the American Museum of Natural History.

#### KOKENIA COSTALIS Ulrich and Scofield.

*Kokenia costalis* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 882, pl. LXIV, figs. 46-49.

Two specimens of this interesting species, from the Galena shales of Goodhue County, Minnesota, the type locality for this species, are in the United States National Museum. The two specimens from Frobisher Bay agree with the present examples in every way excepting in the number of revolving lines. Of these there are seven in the Minnesota specimens, while in the Arctic individuals there are from eleven to twelve, of which the fourth, sixth, and eighth are the most prominent. The first, second, fourth, sixth, and eighth revolving lines are continuous into the aperture, the others being interpolated on the last volution. Extremely fine transverse lines of growth and a few varices indicating stages of growth are also present.

*Collector.*—J. N. Carpender. Cat. No. 28176, U.S.N.M.

## Family BELLEROPHONTIDÆ.

## BELLEROPHON SIMILIS Ulrich and Scofield.

*Bellerophon similis* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 919, pl. LXIV, figs. 31-39.

Of this species there are two examples, one of which is identical with Ulrich's figures thirty-two and thirty-three of the work cited. It is one of the characteristic fossils of the Trenton or Galena stage of Minnesota.

*Collector*.—A. H. White. Cat. No. 28174, U.S.N.M.

## Family PLEUROTOMARIIDÆ d'Orbigny.

## LOPHOSPIRA SPIRONEMA Ulrich and Scofield.

*Lophospira spironema* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 983, pl. LXXII, figs. 44-47.

This is the most abundant gastropod found at Silliman's Fossil Mount. The species was at first thought by the writer to be *L. fillmorensis* Ulrich and Scofield, but Mr. Ulrich, to whom three examples were sent, pronounced it *L. spironema*. The Arctic examples attained a far larger size than the Black River specimens of Minnesota.

*Collectors*.—A. H. White and J. N. Carpender. Cat. No. 28177, U.S.N.M. Other specimens collected by R. W. Porter are in the American Museum of Natural History.

## LIOSPIRA AMERICANA (Billings).

*Liospira americana* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 996.

This very widely distributed and common species is abundant at Silliman's Fossil Mount. The large umbilicus is completely filled with shell matter, but above in the earlier whorls it is open.

*Collectors*.—A. H. White, A. V. Shaw, J. N. Carpender, and R. W. Porter. Cat. No. 28180, U.S.N.M.

## CLATHROSPIRA CONICA Ulrich and Scofield.

*Clathrospira conica* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1008, pl. LXX, figs. 1-4.

This is one of the abundant species at Silliman's Fossil Mount, and in the United States ranges from the Black River group into the middle of the Cincinnati group. The Arctic examples attained a larger size than elsewhere, but otherwise are considered by Mr. Ulrich to be in harmony with his species.

*Collectors*.—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28178, U.S.N.M. The American Museum of Natural History also has specimens collected by Mr. R. W. Porter.

## SEELYA (?) (PLETHOSPIRA?) ULRICH, new species.

(Plate XII, figs. 9, 10.)

This interesting little shell has many of the characteristics of *S. ventricosa* Ulrich,<sup>1</sup> from the Calciferous (Beekmantown) stage. It is, however, a much smaller shell, and differs from all known species of *Seelya* in having the revolving bands nearly obsolete.

There are four of these shells, which were sent to Mr. Ulrich for identification. He writes:

The specimens are casts of the interior, and the revolving peripheral furrows probably have nothing to do with the revolving sculpture of the true *Seelya*. Similar furrows occur in good casts of *Lophospira bowdeni* and other Pleurotomariidæ. The band, I believe, was of the flat or concave type, as in *Seelya*, *Plethospira*, and *Hormotoma*, but, as it was evidently close to the suture and partly covered by same, it is too low on the whorls to be in strict accordance with these genera.

*Collector*.—A. H. White. Cat. No. 28187, U.S.N.M. The American Museum of Natural History has two specimens collected by Mr. R. W. Porter. The species is named for Mr. E. O. Ulrich, who has accomplished much in bringing about a better understanding of the fossils of the American Lower Silurian.

## Family EUOMPHALIDÆ.

## HELICOTOMA (?) (LIOSPIRA?) LARVATA Salter.

*Helicotoma larvata* BILLINGS, Canadian Organic Remains, Decade I, 1859, p. 15, pl. II, figs. 11-14.

Of this species there is a single excellent specimen, which the writer at first labeled *Liospira angulata* Ulrich, variety. However, when Ulrich compared the Arctic example with the type species he concluded it to be *Helicotoma larvata* Salter. He has kindly made the following notes on this specimen:

This species resembles *Liospira mundula*, *L. angulata*, and other species of that section of this genus very greatly, and it may be, as I once thought, truly referable to *Liospira*. Excepting that the Arctic specimen is small, it is the best preserved yet seen by me. Still I am unable to settle the difficulty. Whatever light it casts upon the problem is in favor of retaining the species under *Helicotoma*.

In Canada this is a Black River species.

*Collector*.—A. H. White. Cat. No. 28179, U.S.N.M.

## Family MACLURIIDÆ Woodward.

## MACLURINA MANITOBENSIS (Whiteaves).

*Maclurina manitobensis* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1041, pl. LXXVI, figs. 4, 5; pl. LXXXII, fig. 45.

This species is common at Silliman's Fossil Mount and attains a large size, one specimen measuring nearly 5 inches in diameter. In

<sup>1</sup> Geol. Minn. III, Pt. 2, 1897, p. 1009, figs. 7, *b*, *c*, *d*, in text.



Manitoba, it attains a diameter of  $8\frac{1}{2}$  inches. It is a characteristic species of the Trenton.

*Collectors.*—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28183, U.S.N.M.

MACLURINA CUNEATA (Whitfield).

*Maclurina cuneata* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1042, pl. LXXVI, figs. 1-3; pl. LXXXII, fig. 46.

Of this species there are two typical specimens with the characteristic, small umbilical perforation.

*Collector.*—J. N. Carpender. Cat. No. 28184, U.S.N.M.

MACLUREA CRASSA Ulrich and Scofield.

*Maclurea crassa* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1040, pl. LXXV, figs. 12-14.

One example of this species measures nearly 3 inches in diameter, which is larger than the Minnesota specimens, but this is in keeping with the greater size attained by the Maclureas and Maclurinas in the far north.

*Collectors.*—J. N. Carpender and A. V. Shaw. Cat. No. 28182, U.S.N.M.

Family TROCHONEMATIDÆ Ulrich.

TROCHONEMA UMBILICATUM (Hall).

*Trochonema umbilicatum* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1047, pl. LXXVII, figs. 1-3.

Of this widely distributed Lower Silurian shell, six specimens are present. They preserve most of the shell, and show considerable surface detail.

*Collectors.*—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28186, U.S.N.M. Other specimens collected by Mr. R. W. Porter are in the American Museum of Natural History.

TROCHONEMA (EUNEMA) ROBBINSI Ulrich and Scofield.

*Trochonema (Eunema) robbinsi* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1053, pl. LXXVI, figs. 11-15.

Three examples of this species are present, only one of which is well preserved. These were sent to Mr. Ulrich for comparison with *T. robbinsi* and *T. salteri*. He writes as follows:

These specimens possibly indicate a form intermediate between *T. (E.) similis* and *T. (E.) robbinsi* Ulrich and Scofield. The upper whorls of the best specimen agree rather closely with the former, while the last whorl, with its relatively narrow peripheral band, is more in accordance with the latter species. It is to be borne in mind, however, that it is only the shell-less portion of the specimen that agree with *T. (E.) similis*, the opposite side of the same whorls showing no trace of the ridge near the suture, which is strongly developed and is characteristic of *T. similis*.

*Collector*.—J. N. Carpender. Cat. No. 28185, U.S.N.M. The best specimen was found by Mr. R. W. Porter, and is now in the American Museum of Natural History.

**HOLOPEA ARCTICA**, new species.

(Plate XII, figs. 14-16.)

This little *Holopea* has its nearest relation in *H. ampla* and *H. similis* Ulrich and Scofield.<sup>1</sup> It differs from the latter in having the upper sides of the whorls less flat, the sutures deeper, and the lines of growth more regular than in any other species of *Holopea*. From *H. ampla*, the Arctic species differs in having the whorls expand less rapidly.

*Collector*.—A. H. White. Cat. No. 28190, U.S.N.M.

? Family TROCHIDÆ.

**TROCHUS** (?), species undetermined.

(Plate XII, figs. 11-13.)

Of this form there is only one good specimen, and this has none of the ornamental surface preserved. The specimen was sent to Mr. Ulrich, and he kindly made the following notes:

I regard it as related to some of the Gotland shells referred to *Trochus* by Lindström, but as the specimen retains no trace of the sculpture-bearing layer of the shell it can not be compared satisfactorily with described species. Lindström's *T. densistriatus*, *T. kolmodini*, and *T. wisbyensis* seem not far removed.

The specimen is in the American Museum of Natural History.

Family SUBULITIDÆ.

**FUSISPIRA INFLATA** Meek and Worthen.

*Fusispira inflata* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1075, pl. LXXX, figs. 17, 18.

The only example of this species is an imperfect shell with most of the smaller part of the spire missing. So far as comparison can be made, the species is in harmony with *F. inflata*. Mr. Ulrich agrees that the specimen belongs to this species.

*Collector*.—J. N. Carpender. Cat. No. 28189, U.S.N.M.

**FUSISPIRA NOBILIS** Ulrich and Scofield.

*Fusispira nobilis* ULRICH and SCOFIELD, Geol. Minn., III, Pt. 2, 1897, p. 1078, pl. LXXX, figs. 2-4.

The two Arctic specimens of this form are imperfect, and the largest fragment indicates that the species here attained as large a growth as in Minnesota, being about 4 inches in length. Mr. Ulrich has seen the fragments and agrees that they represent his species.

<sup>1</sup> Geol. Minn., III, Pt. 2, 1897, pp. 1065, 1066.

## Class CEPHALOPODA.

## Order TETRABRANCHIATA.

## Family ENDOCERATIDÆ.

## CAMEROCERAS PROTEIFORME (Hall).

*Cameroceeras proteiforme* CLARKE, Geol. Minn., III, Pt. 2, 1897, p. 777, pls. XLVIII-LI, LIII.

Of this common species there is one small but well-preserved fragment showing the submarginal siphon. In a length of 2 inches, there are seven chambers and eight septa.

*Collector.*—J. N. Carpender. Cat. No. 28191, U.S.N.M.

## Family ORTHOCERATIDÆ.

## ORTHO CERAS OLORUS Hall, var. BAFFINENSIS, new variety.

(Plate XII, figs. 19-22.)

*Orthoceras vertebrale* HALL, Pal. N. Y., I, 1847, p. 201, pl. XLIII, figs. 5-5c (not Schlotheim, 1820).

*Orthoceras olorus* HALL, Miller's Amer. Pal. Foss., 1st ed., 1877, p. 245.

The Arctic examples of this form, of which there are three, do not appear to attain the large size of the New York specimens. Hall describes the species with "strong longitudinal striæ," while the Arctic specimens have very fine equidistant lines, between each of which are from 3 to 6 exceedingly delicate ones. This difference in the ornamentation, together with the smaller size, is regarded of sufficient importance for varietal distinction. There is no other American Lower Silurian annulated species with which it can be compared.

*Collectors.*—J. N. Carpender and A. H. White. Cat. No. 28192, U.S.N.M.

## ORTHO CERAS BILINEATUM Hall.

*Orthoceras bilineatum* CLARKE, Geol. Minn., III, Pt. 2, 1897, p. 786, pl. XLVII, figs. 20, 21; pl. LIV, figs. 6, 7.

Of this species there is one small specimen annulated throughout. The characteristic, regularly alternating, larger and smaller lines of ornamentation are preserved.

*Collector.*—A. H. White. Cat. No. 28193, U.S.N.M.

## ORTHO CERAS PORTERI, new species.

(Plate XII, figs. 23-25.)

This annulated species of *Orthoceras* appears to be related to *O. bilineatum*. The apical angle in both is about the same, but in *O. porteri* the annulations and septa are farther apart, the siphuncle is more eccentric, and the ornamentation is entirely different. The longitudinal lines are double throughout, and consist of prominent primary ones,

between which there are always three equally strong secondary lines. Transverse, or growth, lines are fine and numerous, and in crossing the longitudinal lines they cause these to be slightly nodose.

*Collector.*—J. N. Carpender. Cat. No. 28194, U.S.N.M.

This name is given as a mark of appreciation to Mr. Russell W. Porter, of Boston, Massachusetts, who, with his associates, made it possible to revisit Frobisher Bay and to make a most complete collection of Arctic Trenton fossils.<sup>1</sup>

#### ORTHOCERAS SCALARIFORMIS, new species.

(Plate XII, figs. 17, 18.)

Shell small, not annulated, tapering slowly, with an apical angle of about 7°, section originally circular, septa 9 in the length of 1 inch; siphuncle large, and apparently in contact with the outer wall. Surface with 13 widely separated prominent longitudinal costæ, which are crossed somewhat irregularly by concentric lamellæ, anteriorly directed, and 1 to each septum. Here and there two or three intermediate vertical lines occur between the longitudinal costæ.

*Collector.*—J. N. Carpender. Cat. No. 28195, U.S.N.M.

#### Family CYRTOCERATIDÆ.

##### CYRTOCERAS MANITOBENSE Whiteaves.

*Cyrtoceras manitobense* WHITEAVES, Trans. Royal Soc. of Canada, Sec. 4, VII, 1889, p. 80, pl. XIII, figs. 3, 4; pl. XV, fig. 4; Geol. Surv., Canada, Pal. Foss., III, 1897, p. 223.

*Oncoceras manitobense* CLARKE, Geol. Minn., III, Pt. 2, 1897, p. 799.

This species is the most abundant of the Cephalopoda at Silliman's Fossil Mount. The writer sent the specimens to Professor Whiteaves, who compared them with the types, and subsequently reported that they are "apparently exactly the same species as *C. manitobense* Whiteaves from Lake Winnepeg, Manitoba. We have very similar specimens from Akpatok Island, Hudson Strait." The Baffin Land specimens are smaller than those from Manitoba.

*Collectors.*—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28119, U.S.N.M.

##### CYRTOCERAS CORNULUM, new species.

(Plate XIV, figs. 8-10.)

This little shell is clearly related to the previous species, having many of its characters. It differs, however, in its smaller growth, greater curvature, and most decidedly in the very rapid increase of the cone. The greater curvature is due to the rapid increase in depth of the air chamber toward the ventral side, where near the living chamber it is

<sup>1</sup> A description of this trip is given by Mr. Porter in Bull. Amer. Geog. Soc., XXX, May, 1898, pp. 97-110, the paper being entitled "Frobisher Bay Revisited."

often three times the depth on the dorsal side. The siphuncle is very small, almost in contact with the ventral wall, and swells but little between the septa.

Professor Whiteaves, who saw the type, states that among the fragments of *Cyrtoceras* from Manitoba "are some apparently like *C. cornutum* in section, curvature, and much in the position of siphuncle."

*Collectors.*—A. V. Shaw and A. H. White. Cat. No. 28121, U.S.N.M.

#### CYRTOCERAS BAFFINENSIS, new species.

(Plate XIV, figs. 11–13.)

This small species of *Cyrtoceras* has the general aspect of *C. manitobense*, and for a time was regarded as the young of that species, yet a comparison shows that *C. baffinensis* has a somewhat smaller apical angle. The diagnostic feature, however, is in the depth of the air chambers. These are much more shallow and do not increase in depth with growth nearly as rapidly as in *C. manitobense*, there being twenty-two of these in 25 mm., while in the latter species at a similar stage of growth there are about sixteen.

*Collector.*—A. H. White. Cat. No. 28198, U.S.N.M.

### Family ONCOCERATIDÆ.

#### CLINOCERAS EXIGUUM (Billings).

*Cyrtoceras exiguum* BILLINGS, Can. Nat. and Geol., V, 1860, p. 172, figs. 17, 18.

*Oncoceras exiguum* CLARKE, Geol. Minn., III, Pt. 2, 1897, p. 798, pl. LVIII, figs. 10, 11.

In this collection there are five specimens of this species, three of which preserve more or less of the body chamber, and permit a reconstruction of the form of the shell. The body chamber was not less than 15 mm. in length and the entire shell not less than 58 mm. Billings gives the probable length as about 50 mm., which is very close to the protraction based on Arctic material. Clarke writes that the Minnesota specimens probably did not exceed 30 mm., but as his specimens are very small fragments, this estimate is probably short of the actual length. The first twelve septa back of the living chamber occupy 22 mm., and in another specimen there are nine in 19 mm. The depth of the air chambers decreases very little toward the apex, the average being a little less than 2 mm. down to where the shell has a diameter of 3.5 mm.

Specimens from shale are usually compressed, and this is the condition of the Arctic material, but the shell was circular in outline, with a very small central siphuncle.

This species is related to *Oncoceras mumiaformis* Whitfield, which Clarke referred to *Clinoceras*. The Arctic material shows the shell to be gently arcuate and to possess the other generic characters of *Clinoceras*. Billings's species should be referred to Maschke's genus.

*Collectors.*—J. N. Carpender and A. H. White. Cat. No. 28199, U.S.N.M.

## ONCOCERAS ARCTICUM, new species.

(Plate XIV, figs. 4-7.)

As shown by the figures, this species differs from all other American *Oncoceras* in the great antero-posterior curvature of the ventral side of the shell. This is caused by the rapidly increasing depth of the air chambers toward the ventral side, where they are about twice the depth of the dorsum. Siphuncle small, slightly constricted at each septum, and closely adjoining the ventral wall except immediately beneath the living chamber, where it is slightly deflected dorsally. Venter more broadly rounded than the dorsum. Living chamber large, with the sides slightly constricted, not less than 24 mm. deep, 33 mm. dorso-ventrally, and 24 mm. transversely. The cast is smooth and preserves no markings of the exterior.

*Cyrtoceras cornulum* was first thought to be the young stage of *Oncoceras arcticum*, but its section is more elongate-oval, with the dorsal side more rounded, the reverse being true in the latter species. The chambers also are deeper on the ventral side, the ventral curvature is less strong, and the shell thicker, with longitudinal plications.

Collector.—J. N. Carpenter. Cat. No. 28196, U.S.N.M.

## ONCOCERAS TUMIDUM, new species.

(Plate XIV, figs. 1-3.)

This species is much larger than any other in the Trenton of the United States, although much smaller than *O. magnum*, the giant of the genus, which is found at East Selkirk, in Manitoba. The present form seems to be most closely related to *O. gibbosum* Whiteaves<sup>1</sup> (= *O. whiteavesi* Miller), but has not the numuloidal siphuncle of that species, nor the sigmoid outline of the septa on the dorsum. The living chamber, also, is shallower, being about 28 mm. deep. The constriction of *O. tumidum* recalls that seen in *Potrioceras* or *Gomphoceras*, but unlike these shells is not bilaterally symmetrical. The specimen preserves but 6 septa and the living chamber, and throughout all there is a rapid regular convergence toward the anterior end. Dorsal end of shell broadly rounded, with the ventral side somewhat acutely rounded. The 5 air chambers are dorsally 13 mm. deep and ventrally 25 mm. The siphuncle is small and situated about 6 mm. inside the ventral wall. Septa regularly but deeply concave.

The type specimen was sent to Professor Whiteaves for comparison with *O. whiteavesi* Miller. He reports that *Oncoceras tumidum* is "very much like *O. whiteavesi* Miller (= *O. gibbosum* Whiteaves, not Hall) in lateral contour, but in your specimen the body chamber does not seem to narrow so abruptly as it always does in *O. whiteavesi*, and shows no sign of any constriction at the aperture."

Collector.—J. N. Carpenter. Cat. No. 28190, U.S.N.M.

<sup>1</sup>Trans. Royal Soc. Canada, Sec. 4, IV, 1889, p. 80, pl. xv, fig. 43.

## POTERIOCERAS, species undetermined.

There is a poor specimen of this genus from the Frobisher Bay locality. It was thought to be a small specimen of *P. nobile*, and was therefore sent to Professor Whiteaves<sup>1</sup> for comparison. He, however, writes:

We have nothing exactly like this. It is very similar in shape to *P. nobile*, except that the latter is somewhat compressed and yours is not. The difference in size between your specimen and ours is, of course, enormous. Your shell also is not very unlike the so-called *Gomphoceras eximium* Billings, but that species is ovate in transverse section, possibly from lateral pressure. Your specimen is, I should think, most likely a *Poterioceras*, but too imperfect to show its specific characters or affinities.

Collector.—J. N. Carpender. Cat. No. 28122, U.S.N.M.

## Family TARPHYCERATIDÆ Hyatt.

## EURYSTOMITES PLICATUS Whiteaves?

*Eurystomites plicatus* WHITEAVES, Can. Rec. Sci., VI, 1896, p. 395; Geol. Surv. Canada, Pal. Foss., III, Pt. 3, 1897, p. 225, figs. 15, 16; pl. XXVII, fig. 2.

The only specimen of this species present is not well preserved, but has parts of one and one-half whorls. Professor Whiteaves, who saw the specimen, writes that it is "probably *Eurystomites plicatus* Whiteaves. At any rate, it has the same outline in transverse section, with the dorsum impressed by a shallow and rather narrow furrow of contact, and the same amount of involution." The specimen, however, shows no surface markings nor any siphuncle.

Collector.—J. N. Carpender. Cat. No. 28123, U.S.N.M.

## Class ARTHROPODA.

## Subclass CRUSTACEA.

## Order OSTRACODA.

Ostracoda are abundant at Silliman's Fossil Mount, 10 specimens having been found attached to the larger fossils. These were sent to Mr. E. O. Ulrich for determination. He has identified them as follows:

*Bythocypris granti* Ulrich.<sup>2</sup>

*Primitia* or *Klædenia*.

*Krausella*, two new species.

## Order TRILOBITA.

## NILEUS VIGILANS (Meek and Worthen).

*Nileus vigilans* CLARKE, Geol. Minn., III, Pt. 2, 1894, p. 712, figs. 17-19.

Of this widely distributed species there is one very fine enrolled but small specimen and fragments of three other individuals. These agree exactly with Mr. Clarke's description and figures.

<sup>1</sup>Trans. Royal Soc. Canada, Sec. 4, VII, 1889, p. 77, pl. XIV, fig. 1.

<sup>2</sup>Geol. Minn., III, Pt. 2, 1894, p. 689, pl. XLIV, figs. 39-42.

*Collectors.*—J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28168, U.S.N.M. The American Museum of Natural History has two specimens collected by Mr. R. W. Porter.

**ILLÆNUS CRASSICAUDA AMERICANUS** (Billings).

*Illænus americanus* CLARKE, Geol. Minn., III, Pt. 2, 1894, p. 714, figs. 20-23.

One fine enrolled specimen of this well-known species was found by Mr. F. G. Goodridge, of New York City, and was very kindly given to the U. S. National Museum. Mr. R. W. Porter also collected two fine specimens, which are now in the American Museum of Natural History. These agree excellently with this species, the best examples of which are from Trenton Falls, New York.

*Collectors.*—F. G. Goodridge, J. N. Carpender, A. V. Shaw, and A. H. White. Cat. No. 28167, U.S.N.M.

**ISOTELUS GIGAS** De Kay.

*Isotelus gigas* CLARKE, Geol. Minn., III, Pt. 2, 1894, pp. 701-706, with text figures.

Of this species several fragments were found by J. N. Carpender and A. V. Shaw.

**DALMANITES (PTERYGOMETOPUS) GOODRIDGII**, new species.

(Plate XII, figs. 5, 6.)

The cephalon of this species recalls that of *D. (P.) eboraceus* Clarke in the characters of the glabella and in the great prominence of the eyes. However, in *D. (P.) goodridgii*, the eyes are even more elevated, the cephalon is smooth and devoid of all granulation, while the most marked difference is seen in the posterior outline of the head, which is broadly rounded or subquadrate, with a central, short projection. The occipital ring is also much wider, and is strongly elevated medio-posteriorly into an obtuse apex. Of thoracic segments, nine are preserved in these specimens.

The pygidium is likewise less triangular than in *D. (P.) eboraceus*, and while there are ten or eleven annulations on the axis, there are not more than five pleuræ. These are well developed anteriorly, becoming rapidly more and more obsolete.

Named for Mr. F. G. Goodridge, of New York City, one of the collectors of fossils on the Peary expedition of 1897.

*Collectors.*—J. N. Carpender and A. H. White. Cat. No. 28170, U.S.N.M.

**CERAURUS PLEUREXANTHEMUS** Green.

*Ceraurus pleurexanthemus* GREEN, Pal. N. Y., I, 1847, p. 242, pl. LXV, figs. 1a-1n; pl. LXVI, figs. 1, 1e-1h.—CLARKE, Geol. Minn., III, Pt. 2, 1894, p. 734.

There are three examples of this species in the collection, none of which are entire, but all agree well with New York specimens. The species did not here attain quite the large size of New York specimens, but one glabella shows a growth about two-thirds of the largest from the latter locality.

*Collector.*—A. H. White. Cat. No. 28169, U.S.N.M.



## SUMMARY.

The only Lower Silurian horizons known in northeastern Arctic America are of Trenton and Utica age. The latter zone appears only on the north shore of Frobisher Bay, but the Trenton is found in various places from the north shore of Hudson Strait to latitude 81° north. The Lower Silurian is thickest on Akpatok Island, where it is from 400 to 500 feet in depth. Dr. Bell, however, estimates the entire thickness of these strata in this region to be not less than 900 feet.

In Baffin Land, and apparently elsewhere in Arctic America, the Lower Silurian strata rests unconformably on old crystalline rocks. To the north of Baffin Land, the former are overlain by beds of Niagara or Wenlock age.

The Trenton faunas, occurring in various places around the insular Archaean nucleus of North America, have much in common, and this indicates that the conditions at that time were very similar, while the sea was in communication throughout. As yet, however, the distribution of the strata, together with their faunas, are well known only to the south and southeast of the Archaean nucleus, yet that of the west (Manitoba) and of the northeast (Baffin Land) show direct communication.

The Baffin Land fauna had an early introduction of Upper Silurian genera in the corals *Halysites*, *Lyellia*, and *Plasmopora*. In Manitoba similar conditions occur in the presence of *Halysites*, *Favosites*, and *Diphyphyllum*. Other Upper Silurian types do not appear to be present.

The Trenton fauna of Silliman's Fossil Mount, at the head of Frobisher Bay, has seventy-two species, of which twenty-eight are restricted to it. This fauna shows an intimate relationship with that of the Galena of Minnesota, Iowa, and Wisconsin. Fifty-seven per cent of the species of Baffin Land also occur in the Galena of the regions just mentioned.

The Trenton fauna of Baffin Land shows that the corals, brachiopods, gastropods, and trilobites have wide distribution, and are therefore less sensitive to differing habitats apt to occur in widely separated regions. On the other hand, the cephalopods, and particularly the pelecypods, indicate a shorter geographical range. The almost complete absence of Bryozoa in the Baffin Land Trenton contrasts strongly with the great development of these animals in Minnesota and elsewhere in the United States.

## EXPLANATION OF PLATES.

[From drawings by Mr. E. O. ULRICH.]

## PLATE XII.

*Porocrinus shawi*, p. 155.

- Fig. 1. Posterior view of the calyx; enlarged.  
 2. Anterior view; natural size.  
 3. Ventral view; enlarged.

*Dalmanites (Pterygometopus) goodridgii*, p. 174.

4. The pygidium supposed to be of this species.  
 5, 6. Two views of the cephalon.

*Orthis (Dinorthis) mēēsi arctica*, p. 157.

- 7, 8. Dorsal and profile views.

*Seelya (?) (Plethospira ?) ulrichi*, p. 166.

- 9, 10. Two views showing the nearly obsolete revolving bands.

*Trochus ?*, species undetermined, p. 168.

- 11-13. Three views of the only specimen of this genus.

*Holopea arctica*, p. 168.

- 14, 15. Two views of the best specimen.  
 16. Surface ornamentation; x5.

*Orthoceras scalariformis*, p. 170.

17. The ornamentation.  
 18. Sectional view, with the position of the siphon.

*Orthoceras olorus baffinensis*, p. 169.

- 19, 21, 22. Views of three specimens.  
 20. Surface ornamentation; x10.

*Orthoceras porteri*, p. 169.

23. View of the exterior.  
 24. Surface ornamentation; x5.  
 25. Sectional view, with the position of the siphon.

## PLATE XIII.

*Ctenodonta carpenteri*, p. 160.

- FIGS. 1-3. Three views of the largest specimen.

*Ctenodonta subnasuta* Ulrich?, p. 160.

- 4-6. Three views of the best specimen.

*Ctenodonta baffinensis*, p. 161.

- 7-9. Three views of the type specimen.  
 10. Surface ornamentation; x10.

*Ctenodonta frobisherensis*, p. 161.

- 11-13. Three views of the best specimen.  
 14. Left valve of another specimen.

*Whiteavesia symmetricus*, p. 162.

- 15-17. Three views of the type specimen.

*Modiolodon arcticus*, p. 161.

18, 19. Views of the cast of the interior.

*Allodesma* (?) species undetermined.

20-22. Three views of the only specimen. This species is for the present not described.

*Whitella arcticus*, p. 163.

23-25. Three views of the type specimen.

*Tanuxemia baffinensis*, p. 163.

26-28. Three views of the type specimen.

29, 30. Two views of a large specimen which probably is a distinct form.

*Cyrtodonta sillimanensis*, p. 162.

31-33. Views of the type specimens.

*Cyrtodonta* (?) *gibbera* Ulrich, var., p. 162.

34-36. View of the only example.

#### PLATE XIV.

*Oncoceras tumidum*, p. 172.

Fig. 1. Ventral side.

2. Side view.

3. Sectional view of the larger end.

*Oncoceras arcticum*, p. 172.

4. View of the dorsum.

5. Side view.

6. Sectional view, with the position of the siphon.

7. Ventral side.

*Cyrtoceras cornulum*, p. 170.

8. Side view, showing the radiating furrows of the inner side of the shell.

9. Ventral view.

10. Outline of the shell transversely.

*Cyrtoceras baffinensis*, p. 171.

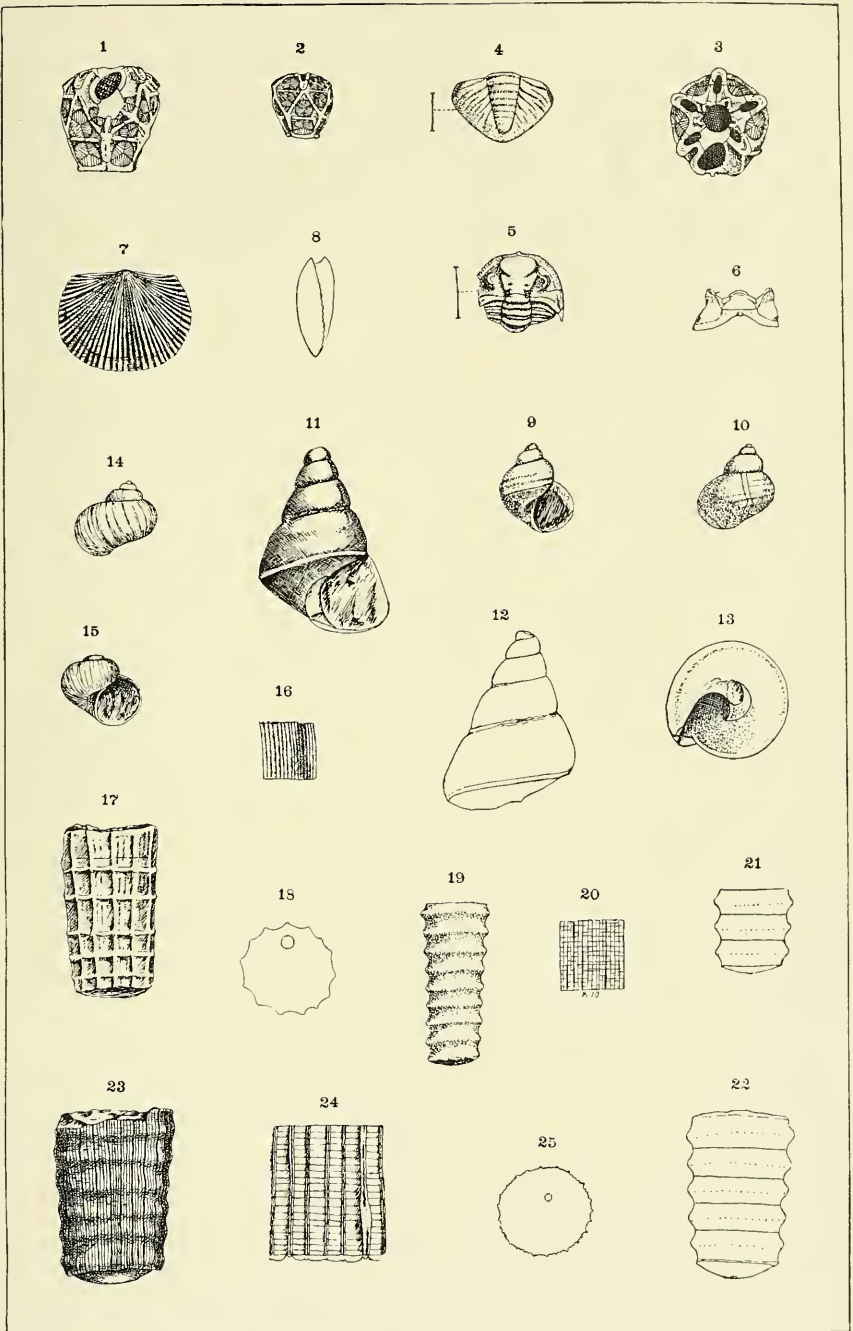
11. Side view.

12. Ventral view.

13. End view with about half the length of the shell drawn in.

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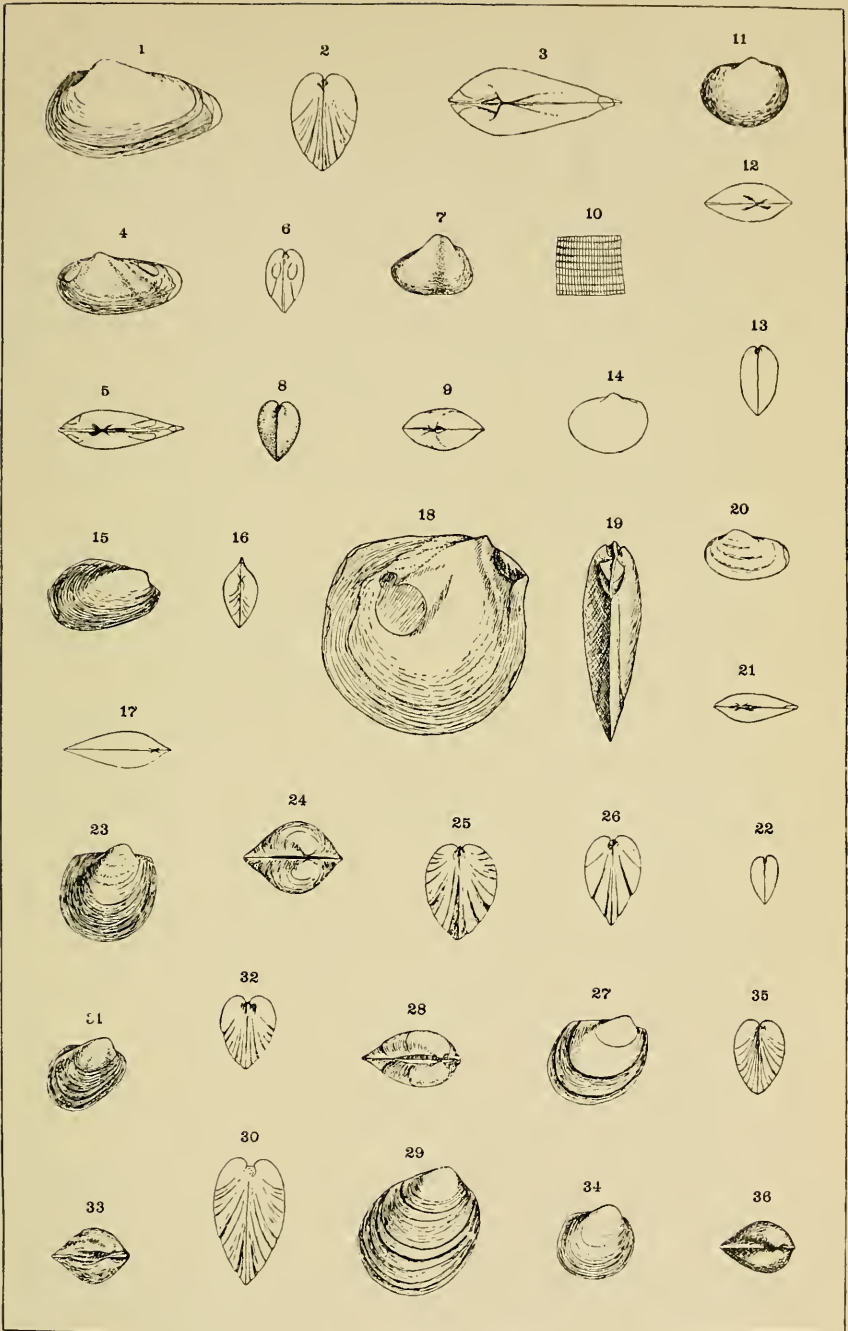




FOSSILS FROM SILLIMAN'S MOUNT.

FOR EXPLANATION OF PLATE SEE PAGE 176.



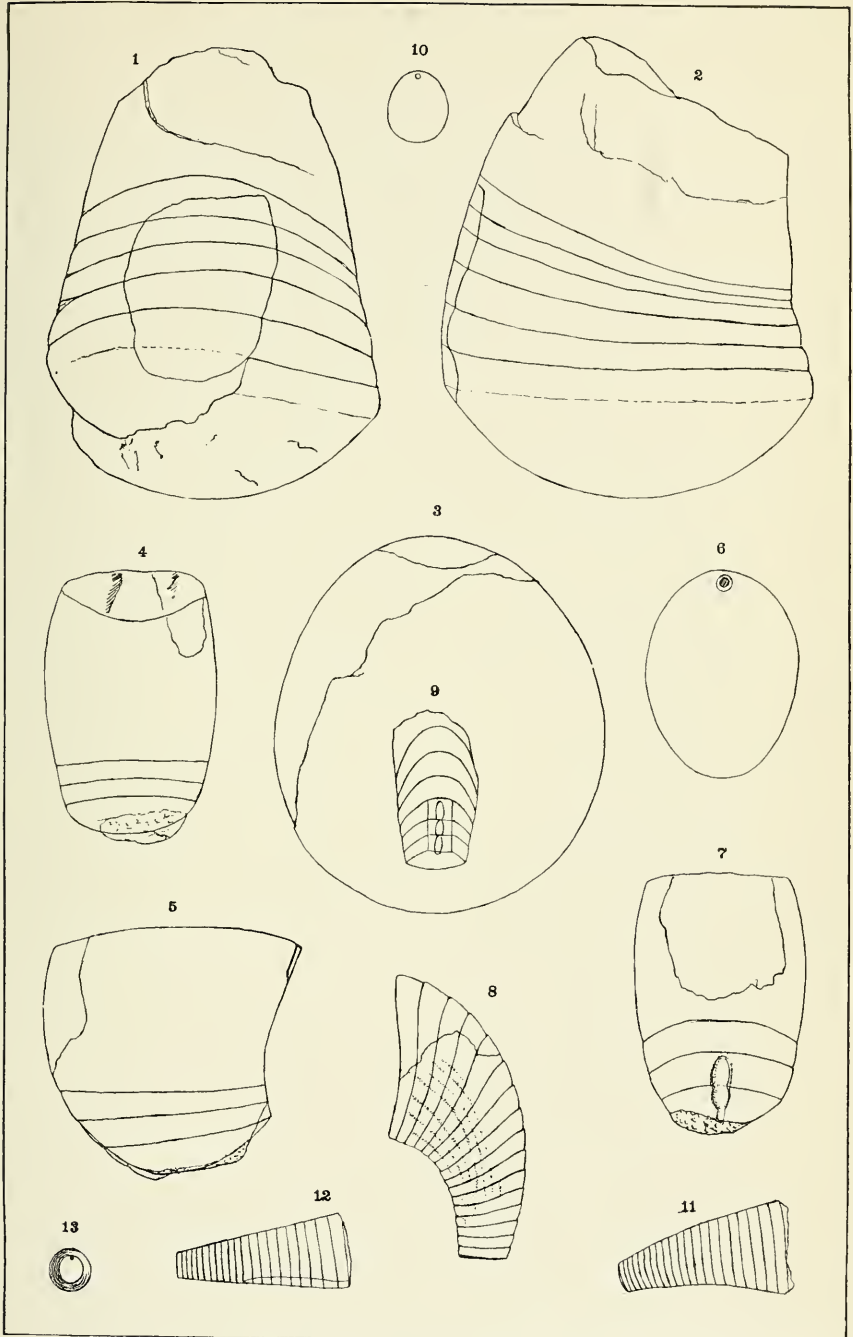


PELECYPODS FROM SILLIMAN'S MOUNT.

FOR EXPLANATION OF PLATE SEE PAGES 176, 177.







CEPHALOPODS FROM SILLIMAN'S MOUNT.

FOR EXPLANATION OF PLATE SEE PAGE 177.

