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THE NEVADA EARLY ORDOVICIAN (POGONIP) SPONGE
FAUNA

By R. S. BASSLER

THE discovery in 1927 by H. G. Clinton and Percy Train, of Manhattan, Nev., of a new fossil sponge fauna in Upper Pogonip (Chazyan) strata of that State, characterized by the trilobite *Pliomerops barrandei* Billings, was of such interest that I was prevailed upon to describe it immediately without illustration, so that the many duplicate specimens belonging to their collections could be sent out with definite specific names to interested students. It is regretted that the illustration of these new genera and species has been delayed until the present time, but the literature upon Paleozoic fossil sponges grows so slowly that apparently there has been no conflict in the matter of synonymy. Uncertainty as to the exact location of these sponge-bearing beds, which was quoted as McMonnigal Canyon, Monitor Range, 10 miles west of Devils Punch Bowl in Monitor Valley, Nev., had also to be removed.

Dr. Edwin Kirk, in the course of his stratigraphic studies of the western Paleozoic for the United States Geological Survey in 1928, visited the type locality for these sponges. This proved to be the hillside slope above the cabin half a mile south of Ikes Canyon, 4 miles west of Dianas Punch Bowl as registered in 1929 on the Roberts Mountain quadrangle, Nev., these being the modern names for McMonnigal Canyon and Devils Punch Bowl, the latter occurring only 4 miles east of the canyon. Furthermore, the mountain range in question is now the Toquima Range in the Toiyabe National

Forest. Then, in the summer of 1939, Drs. Josiah Bridge and G. A. Cooper had the opportunity of studying the area and obtaining additional collections besides confirming Dr. Kirk's location. They report that outcrops in the canyon itself afford good collections of the sponges particularly on the north side about two-fifths of a mile inside the entrance. Here the best fossils are found on a talus slope 50 to 70 feet above the valley floor below the big cliff, although some may be collected from outcrops in the several ravines.

Associated with these sponges and the trilobite *Pliomerops* is an undescribed fauna of Ostracoda, a few stony Bryozoa, crinoid and cystid remains, trilobites, cephalopods, gastropods, and brachiopods. Of the last, the following species were described as new by Ulrich and Cooper in 1936¹: *Aporthophyla typa*, *Toquimia kirki*, *Goniotrema perplexa*, *Rhysostrophia nevadensis*, and *R. occidentalis*. This part of the Pogonip limestone seems to be represented elsewhere in North America in the Table Head formation of Newfoundland and the Oil Creek formation of Oklahoma.

These Nevada fossil sponges are preserved in a thin-bedded, dense, clayey limestone composed largely of organic remains and often weathered enough at the surface to show silicification of the contained fossils. With further etching by acid the minute spicular structure of the sponges can be seen to better advantage at their surface, but farther within where water has not penetrated the spicules have the same calcareous structure as the rest of the material. In practically all publications on the order Tetractinellida of the Silicispongiae, authors describe the spicules as originally siliceous but explain that when found calcareous the silica has been replaced by lime. Should that be true, all these early as well as later Paleozoic sponges have without exception been so replaced, a phenomenon that certainly has not occurred so uniformly. These sponges undoubtedly follow the rule of all other Paleozoic fossils that whenever they are buried in a calcareous siliceous shale or certain clayey limestones the organic calcite is replaced at the surface by silica, but the original structure on the interior remains calcium carbonate just as it does in most other fossils. Associated with these sponges are great numbers of long, needle-shaped structures, which may be dermal spicules. These are here illustrated (pl. 21, fig. 7) as a doubtful species of *Hyalostelia*, but their relationship, if any, to the associated sponges has not been discovered.

The original abbreviated descriptions of the following species, with the exception of one new form, appeared in the Journal of the Washington Academy of Sciences, volume 17, No. 15, pages 391-394,

¹ Journ. Pal., vol. 10, pp. 616-631, 1936.

1927. Bibliographic references to this paper are omitted in the present one since all descriptions previous to *Patellispongia* are printed on page 392, while that genus and *Hesperocoelia* are described on page 393, and the Anthaspidellidae on page 394. Again, the horizon and locality are not mentioned each time because for all the species it is, as stated before, the Upper Pogonip (Chazyan) limestone, one-half mile south of Ikes Canyon, 4 miles west of Dianas Punch Bowl on the eastern front of the Toquima Range, Roberts Mountain quadrangle, Nev. The same assemblage of species occurs in Ikes Canyon itself, as mentioned before.

All the illustrations of this paper are unretouched photographs, except that the pore structure has been emphasized enough to make it visible. The photography of the thin sections proved difficult, since on enlargement the definite structure of the spicules loses much of its clearness.

Subclass SILICISPONGIAE: Order TETRACTINELLIDA

Family ARCHAEOSCYPHIDAE Rauff

Archaeoscyphidae RAUFF, *Paleontographica*, vol. 40, p. 238, 1894.

Sponge attached, simple or branching, ranging from narrow cylindrical to saucer or funnel shaped, turbinate and frondescent forms with simple or branched cloaca usually of considerable diameter; oscula represented by numerous often closely spaced, small pores penetrating the spicular tissue of the wall as definite canals and opening on the outer surface at regular intervals.

With the recognition of five genera in the Nevada Pogonip fauna, this family, formerly based upon a single species of the genus *Archaeoscyphia*, assumes some importance in the early Ordovician rocks.

Genus ARCHAEOSCYPHIA Hinde, 1889

Archaeocyathus (part) BILLINGS, *Paleozoic fossils*, Geol. Surv. Canada, vol. 1, p. 354, 1865.

Archaeoscyphia HINDE, *Quart. Journ. Geol. Soc. London*, vol. 45, p. 142, 1889.—
RAUFF, *Palaeontographica*, vol. 40, p. 238, 1894.

Sponge simple, attached, short but rapidly expanding funnel-shaped, 6 cm. or more high and about 4 cm. wide, with a broad cloaca 3 cm. in maximum diameter and the outer surface bearing strongly marked, angular, parallel, transverse ridges. Wall 5 mm. thick, lined on both the inside and outside by longitudinal rows of closely spaced pores traversing the spicular skeleton, which consists of minute siliceous spicules of the tetractinellid type with the rays slightly branched at their extremities and interlocking without forming prominent nodes.

The genotype and only species, *A. minganensis*, is not any too well known, but judged from the description and illustrations by Billings and Hinde the type specimens, although not well preserved, appear to have the characters mentioned above.

ARCHAEOSCYPHIA MINGANENSIS (Billings)

PLATE 23, FIGURES 3-6

- Petraia minganensis* BILLINGS, Can. Nat. and Geol., vol. 4, p. 346, 1859.
Archaeocyathus minganensis BILLINGS, Paleozoic fossils, Geol. Surv. Canada, vol. 1, p. 354, figs. 342, 343, 1865.
Ethmophyllum minganense WALCOTT, U. S. Geol. Surv. Bull. 30, p. 77, figs. 6-8, 1886.
Archeoscyphia minganensis HINDE, Quart. Journ. Geol. Soc. London, vol. 45, p. 143, pl. 5, figs. 12-14, 1889.—RAUFF, Paleontographica, vol. 40, p. 240, pl. 1, figs. 1-10, 1894 (see for complete bibliography).—TWENHOFFEL, Geol. Soc. Amer. Special Pap. 11, p. 34, 1938.

In spite of the various researches upon this species and its references to several divisions of the animal kingdom, its exact structure has not yet been confirmed because of a lack of good study material. However, the several figures on plate 23 copied from Billings and practically the same as given in all the references, show that *Archeoscyphia* is a sponge possessing the same general type of structure as the other genera here referred to the family.

Chazyan (Romaine formation): Montagne (Big Romaine) Island (Mingan Islands), St. Lawrence River, Quebec.

Genus NEVADOCOELIA Bassler, 1927

Simple, erect, obconical to oval, pedunculate sponges pierced throughout their length by a cloaca about one-third the width and marked on the outer surface by transverse parallel ridges or rows of nodes. Pores (oscula) of sponge wall small, appearing at the surface in more or less closely spaced parallel rows and on the interior as canals arising from the cloaca and bending gradually to the surface with the intervening spaces composed of the usual spicular structure characteristic of the family.

Genotype.—*Nevadocoelia wistae* Bassler.

NEVADOCOELIA WISTAE Bassler

PLATE 19, FIGURES 6, 7; PLATE 24, FIGURES 6, 7

Sponge elongate, cylindrical to oval, arising gradually from a narrow base to a length of 12 cm. or more and a width of 4 cm., with the cloaca about 13 mm. in diameter. Surface marked by un-

dulating, more or less parallel, transverse ridges 1 to $1\frac{1}{2}$ mm. wide and $2\frac{1}{2}$ mm. apart, with 7 occurring in 3 cm. Sponge pores averaging 0.35 mm. in width, separated by about their own diameter and opening on outer surface in more or less regular longitudinal rows. In longitudinal section the pores arise at the cloaca and bend gradually upward at an angle of about 30° to the surface.

Cotypes.—U.S.N.M. No. 79632.

NEVADOCOELIA TRAINI Bassler

PLATE 19, FIGURES 1-5

General characters as in the preceding species, but the growth occurs in shorter, broader sponge bodies, averaging 8 cm. long and 4 cm. wide, with the cloaca about 12 mm. in diameter and the surface marked by sharp nodes instead of parallel transverse ridges. Six nodes occur on an average in 2 cm., measured transversely. Pore structure very similar to the preceding species. In the several hundred specimens of this and the preceding species no intermediate forms were noted, so that the surface ridges and nodes seem to be good specific characters.

Cotypes.—U.S.N.M. No. 79633.

NEVADOCOELIA GRANDIS Bassler

PLATE 19, FIGURE 8

Sponge not unlike *N. wistae* in growth and external structure but much larger and with more separated and broader transverse ridges, 4 of which occur in 3 cm. The cloaca is about 3 cm. wide, but the pores piercing the outer surface have the same size and arrangement as in the genotype. The type specimen, 15 cm. long and 9 cm. wide, represents only the upper third of the entire sponge, so it might be only a giant form of *N. wistae*, but a smaller complete example (15 cm. long and 7 cm. wide, with cloaca also 3 cm. in width) shows the transverse ridges equally large and distant from each other.

Holotype.—U.S.N.M. No. 79634.

NEVADOCOELIA PULCHRA Bassler

PLATE 20, FIGURES 1-4

Sponge oval, 7 cm. in greatest diameter and more than 11 cm. high, with the cloaca 1.5 to 3 cm. wide. Outer surface marked by unusually strong ridges, which grow into wide, ascending, flangelike expansions 5 mm. wide and distant at least 1 cm. from each other. Pore arrangement and size as in other species of the genus, with 6

pores in 4 mm. measured lengthwise and 8 rows in the same space transversely.

Holotype.—U.S.N.M. No. 79635.

Genus LISSOCOELIA Bassler

Smooth, cylindrical, hollow stems, branching dichotomously usually in the same plane but at irregular intervals, constitute the growth in this genus. The smooth surface under the lens shows minute rounded pores penetrating the spicular tissue as in other members of the family. These are the openings of the oscula, which in thin sections are seen to be closely arranged tubes arising from the basal wall and gently bending to the surface at a low angle. The cloaca is narrow and extends the full length of the sponge.

Genotype.—*Lissocoelia ramosa* Bassler.

LISSOCOELIA RAMOSA Bassler

PLATE 19, FIGURES 9-11; PLATE 24, FIGURES 4, 5

Sponge body of smooth hollow stems, usually about 1½ cm. wide although increasing to 2 cm. at the place of branching, which occurs at intervals of 3 cm. or more, often but not always in the same plane, a complete growth being 10 cm. in diameter. The cloaca throughout averages 0.5 cm. in width. Surface smooth, marked by minute rounded pores about 0.20 mm. in diameter, distributed equally throughout the spicular tissue at distances of 2 to 3 times their own width. Spicules exceedingly minute but apparently with the same structure as in the family. Sections show the cloaca varying from 3 to 5 mm. in diameter, with the oscula arising from the basal sponge wall as narrow parallel tubes bending in a gentle curve to the surface.

This, one of the commonest of the Nevada sponges, is easily recognized by its cylindrical branching stems with the markedly smooth surface and very minute pore structure.

Cotypes.—U.S.N.M. No. 79636.

Genus CALYCOCOELIA Bassler

Sponge arising from a blunt broad peduncle into a goblet-shaped body, which increases rapidly in width from below upward and then opens at the upper surface in a deep excavation representing the cloaca. Surface smooth but marked by minute, rounded pores, the oscula arranged closely in rows parallel to the sponge length, these representing openings of internal regularly arranged canals separated by a spicular meshwork as in related genera but with the spicules exceptionally long and narrow rayed.

Genotype and only species.—*Calycoelia typicalis* Bassler.

CALYCOCOELIA TYPICALIS Bassler

PLATE 21, FIGURES 3-5; PLATE 24, FIGURE 3

The goblet-shaped form deeply excavated by the wide cloaca of about 15 mm. diameter and the smooth, minutely porous surface characterize this species. The type specimen is nearly 7 cm. in diameter at the top, decreasing to 4 cm. at the pedunculate base. The pores, arranged in regular, longitudinal, parallel series, measure about 10 rows in 10 mm.

Holotype.—U.S.N.M. No. 79637.

Genus PATELLISPONGIA Bassler

Sponge as usually found consisting of unilamellar fragments, sometimes of considerable dimensions, but originally probably broad saucer-shaped expansions attached by a short stem. Under surface comparatively smooth, covered by a thick dermal tissue pierced by minute, closely spaced pores, which when weathered usually show a regular arrangement in rows parallel to the direction of growth.

Passing through the spicular tissue and opening at right angles at the upper surface these pores reappear as more or less evenly spaced rounded canals representing the oscula, surrounded by the usual spicular tissue of the family.

Genotype.—*Patellispongia oculata* Bassler.

PATELLISPONGIA OCULATA Bassler

PLATE 22, FIGURES 1, 2; PLATE 24, FIGURES 1, 2

This species forms broad lamellar expansions 12 cm. or more in diameter and 1 cm. thick attached by a short peduncle. Upper surface exhibiting numerous rather regularly spaced pores, the openings of the oscula nearly 1 mm. in diameter with nearly 6 in 10 mm. and separated by about their own diameter. Under surface smooth marked by pores 0.4 mm. wide, with 9 in 5 mm. but without any special arrangement.

Holotype.—U.S.N.M. No. 79638.

PATELLISPONGIA CLINTONI Bassler

PLATE 20, FIGURES 5-7

Sponge similar to the preceding in growth and other characters, but the pores on the upper surface are somewhat larger, open on slight elevations, and (more important from a specific standpoint) from 4 to 5 mm. apart. The under side of the lamella, as in other species of the genus, is smooth and shows minute closely spaced pores in the spicular

tissue, these in the present case being about 0.35 mm. wide and separated by their own diameter.

Cotypes.—U.S.N.M. No. 79639.

PATELLISPONGIA MINUTIPORA Bassler

PLATE 21, FIGURES 1, 2

Sponge consisting of a thin, expanded, smooth lamella, 12 cm. or more wide and 4 mm. thick, differing particularly from other members of the genus in the minuteness and close spacing of the pores on both sides. At least 15 pores can be counted in 10 mm. on the upper surface, where they occur at regular intervals and average 0.5 mm. in width. The basal surface shows pores of about the same dimensions as the upper but arranged in longitudinal parallel series.

Holotype.—U.S.N.M. No. 79640.

PATELLISPONGIA MAGNIPORA, new species

PLATE 21, FIGURE 6

Sponge a unilamellar expansion 10 cm. or more broad, 3 to 8 mm. thick, with a smooth but minutely porous base and an upper surface marked by wide, open canals 2 to 2.5 mm. in diameter, irregularly arranged and spaced at distances several times their width in the usual spicular tissue. The minute pores of the basal side are closely spaced in equally closely arranged parallel longitudinal rows with 7 pores in 5 mm. measured longitudinally, each pore about 0.6 mm. wide.

The surface pores or canal openings in the species, represented by four specimens, are the largest so far noted in the genus, which fact in addition to their irregular arrangement causes easy recognition.

Holotype.—U.S.N.M. No. 99602.

Genus HESPEROCOELIA Bassler

General structure as in *Patellispongia* except that the broad, thin, saucer-shaped lamella of that genus is here represented by a flat, undulated frond or convoluted sponge body with pore openings of similar size and arrangement on each face but penetrated lengthwise by a cloaca in the form of a narrow to broad, flattened tube or series of tubes, opening along the upper edge in a row of rounded or oval apertures.

Genotype.—*Hesperocoelia typicalis* Bassler.

HESPEROCOELIA TYPICALIS Bassler

PLATE 22, FIGURES 6-8; PLATE 24, FIGURE 9

Sponge a smooth, flattened, flabellate frond, 5 cm. or more in diameter and about 6 mm. in thickness, traversed by longitudinal canals of vary-

ing width representing the cloaca, emerging at the surface along the upper thin edge in a row of narrow openings, each about 3 mm. long and 1 mm. wide, spaced so that 4 or 5 occur in 20 mm. The usual openings or oscula in the spicular tissue show on both sides of the sponge, with an average of 4 pores in 3 mm. measuring longitudinally.

Cotypes.—U.S.N.M. No. 79641.

HESPEROCOELIA UNDULATA Bassler

PLATE 22, FIGURES 3-5; PLATE 24, FIGURE 8

This species differs from the preceding in forming undulated, often convoluted bodies 8 cm. or more high and 1 cm. thick and in the fact that the cloacal openings along the upper edge of the sponge are round, 3.5 to 4 mm. in diameter with 4 or 5 in 20 mm. Moreover, the small pores penetrating the spicular tissue are more delicate and closely spaced.

Cotypes.—U.S.N.M. No. 79642.

Family ANTHASPIDELLIDAE Ulrich and Everett, 1890

Sponges attached, saucer to funnel shaped, often turbinate with canal system usually consisting of two sets, one radial and one vertical, crossing each other at right angles. Skeleton of 4-rayed spicules consisting of a rodlike central part and rapidly diverging bifurcations at each end, uniting to form radial columns, which when connected by the horizontal central rods form a minutely tubular meshwork.

Genus ANTHASPIDELLA Ulrich and Everett

Anthaspidella ULRICH and EVERETT, Geological Survey of Illinois, vol. 8, pp. 255, 256, 1890.

Flat to saucer or funnel shaped sponges supported by a short sub-cylindrical stem with the upper surface showing oscula, each provided with its own system of radiating channels, all of which, however, merge into the prevailing structure. Depressed part of each osculum occupied by a few rather large, thin-walled, vertical tubes. Lower surface of sponge occupied by rounded canal openings in spicular meshwork, arranged in more or less radiating rows.

Genotype.—*Anthaspidella mammulata* Ulrich and Everett.

ANTHASPIDELLA CLINTONI Bassler

PLATE 23, FIGURE 9

Sponge of large flattened disks, the type specimen a fragment 9 by 11 cm., indicating a diameter of at least 20 cm. for the entire body and a maximum thickness of 1 cm. Although similar to *Anthaspidella*

scutula Ulrich and Everett, from the Black River (Platteville) limestone at Dixon, Ill., in the small size and comparatively close arrangement of the clusters consisting of the oscula and radiating canals, the present species differs in that the clusters measuring from center to center are closer (15 mm.) and coarser, and the canals are shorter, broader, and less regularly arranged.

Holotype.—U.S.N.M. No. 79643.

ANTHASPIDELLA TRAINI Bassler

PLATE 23, FIGURES 7, 8

Sponge suggesting *Anthaspidella florifera* Ulrich and Everett, a small saucer-shaped species from the Black River (Platteville) limestone at Dixon, Ill., but differing in that the body is flat, at least 20 cm. in diameter, 1 cm. thick, and the clusters are coarser and farther apart, ranging from 25 to 35 mm. distant from center to center. The canals in each cluster are also fewer, broader, and radiately arranged.

Holotype.—U.S.N.M. No. 79644.

Genus STREPTOSOLEN Ulrich and Everett

Streptosolen ULRICH and EVERETT, in Miller, North American geology and paleontology * * *, pp. 153, 165, 1889.

The very irregular arrangement of the canals that pass through the sponge mass in every direction is the chief character separating this genus from *Anthaspidella* and other members of the family. The canals in *Streptosolen* intertwine to such a degree that it is difficult to separate the two sets.

Genotype.—*Streptosolen obconicus* Ulrich and Everett.

STREPTOSOLEN OCCIDENTALIS Bassler

PLATE 23, FIGURES 1, 2

Sponge with the form and general structure of the genotype from the Black River (Platteville) limestone at Dixon, Ill., but differing in that the canals do not intertwine so much and the central osculum is much wider and has larger tubes.

Cotypes.—U.S.N.M. No. 79645.

EXPLANATION OF PLATES

[All the specimens figured are from the Upper Pogonip (Chazyan) limestone, half a mile south of Ikes Canyon, 4 miles west of Dianas Punch Bowl, Roberts Mountain quadrangle, Nev. Unless otherwise stated, the figures are natural size.]

PLATE 19

- 1-5. *Nevadocoelia traini* Bassler: (1) View of upper two-thirds of type, showing the characteristic sharp nodes of the surface; (2) surface, $\times 6$, with nodes and pores (oscula); (3) cross section of top showing width of cloaca; (4, 5) two views of three illustrating canals. $\times 6$, their opening at the surface in definite rows, and spicular tissue.
- 6, 7. *Nevadocoelia vistae* Bassler: The type specimen, illustrating the somewhat closely spaced, narrow, more or less parallel transverse ridges and view of the surface. $\times 6$, showing pores and spicular structure. (See also pl. 24, figs. 6, 7.)
8. *Nevadocoelia grandis* Bassler: Portion of the type illustrating the large dimensions and the strong, widely-spaced surface ridges.
- 9-11. *Lissocoelia ramosa* Bassler: The type (9) a smooth cylindrical branching stem, with end view (10) showing its hollow nature, and surface, $\times 6$ (11) illustrating spicular structure and minute rounded pores. (See also pl. 24, figs. 4, 5.)

PLATE 20

- 1-4. *Nevadocoelia pulchra* Bassler: Side and top views of the type (1, 2) illustrating the wide, flangelike, ascending expansions and the central cloaca, with enlarged views (3, $\times 6$; 4, $\times 20$) exhibiting the rows of minute pores and spicular structure.
- 5-7. *Patellispongia clintoni* Bassler: The type specimens, parts of saucer-shaped unilamellate expansions (5, 6) and surface, $\times 6$ (7) showing the pores widely separated by spicular tissue.

PLATE 21

- 1, 2. *Patellispongia minutipora* Bassler: Upper surface of type, a fragment of a thin lamella, and surface, $\times 6$, illustrating the minute closely spaced pores with intervening spicular tissue.
- 3-5. *Calycoecocelia typicalis* Bassler: (3, 4) Side and top views of this goblet-shaped sponge with several areas of oscula darkened to show arrangement; (5) surface view, $\times 20$, showing the oscular pores and the spicular structure. (See also pl. 24, fig. 3.)
6. *Patellispongia magnipora*, new species: Portion of the type, a unilamellate expansion, and a small portion. $\times 6$, illustrating large, widely spaced pores in broad areas of spicules.
7. *Hyalostelia* ? species: View of needle-like rods, some 50 mm. long, occurring in thick layers, accompanying the various species of sponges herein described.

PLATE 22

- 1, 2. *Patellispongia oculata* Bassler: Portion of the type, a broad lamellar expansion showing upper surface with regularly but widely spaced pores about 1 mm. in diameter and enlarged view ($\times 6$) with spicular structure between pores more visible. (See also pl. 24, figs. 1, 2.)
- 3-5. *Hesperocoelia undulata* Bassler: Side and edge views of the flat, undulated frond (3, 4) pierced by a row of oval openings representing the cloaca, and surface of same, $\times 6$, exhibiting size and distribution of the minute pores and the intermediate spicular tissue (5). (See also pl. 24, fig. 8.)
- 6-8. *Hesperocoelia typicalis* Bassler: The flattened flabellate type specimen (6) traversed by longitudinal canals representing the cloaca emerging at the upper thin end (7) and view of surface $\times 6$ (8) exhibiting pores and intermediate tissue. (See also pl. 24, fig. 9.)

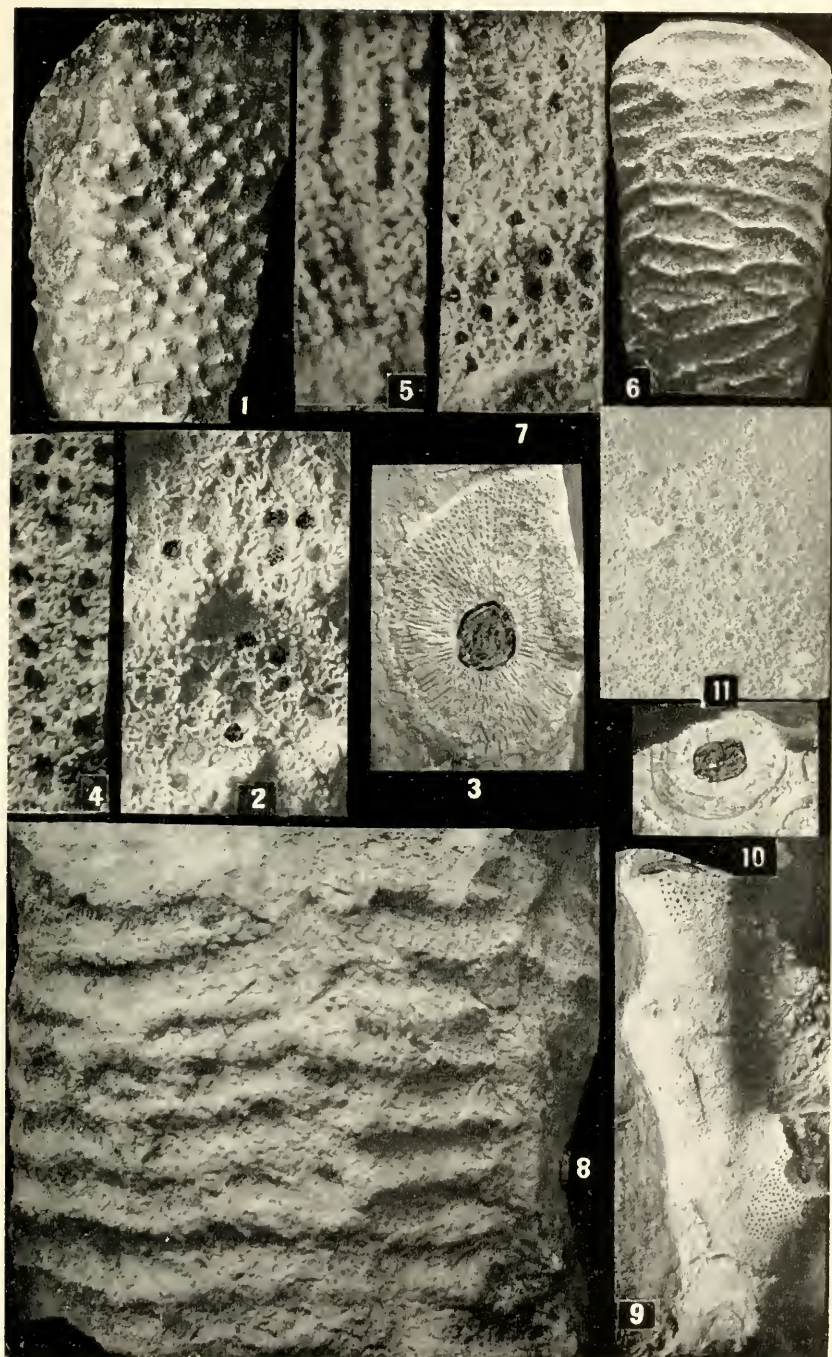
PLATE 23

- 1, 2. *Streptosolen occidentalis* Bassler: Side of one of the types exhibiting irregularly spaced canal openings and top of larger example showing wider central osculum and tubes larger than in the type species.
- 3-6. *Archacoscyphia minganensis* (Billings): Drawing of a restored specimen about one-half natural size (3) and sketches of three forms of spicules, $\times 80$ (4-6). Chazyan (Mingan): Mingan Islands (after Billings, 1865).
- 7, 8. *Anthaspidella traini* Bassler: The type, an incomplete specimen showing the large, coarse, rather widely spaced clusters (7) and spicular structure exhibited on etched surface, $\times 20$ (8).
9. *Anthaspidella clintoni* Bassler: Part of surface of type exhibiting comparatively small size and close arrangement of the clusters consisting of oscula and radiating canals.

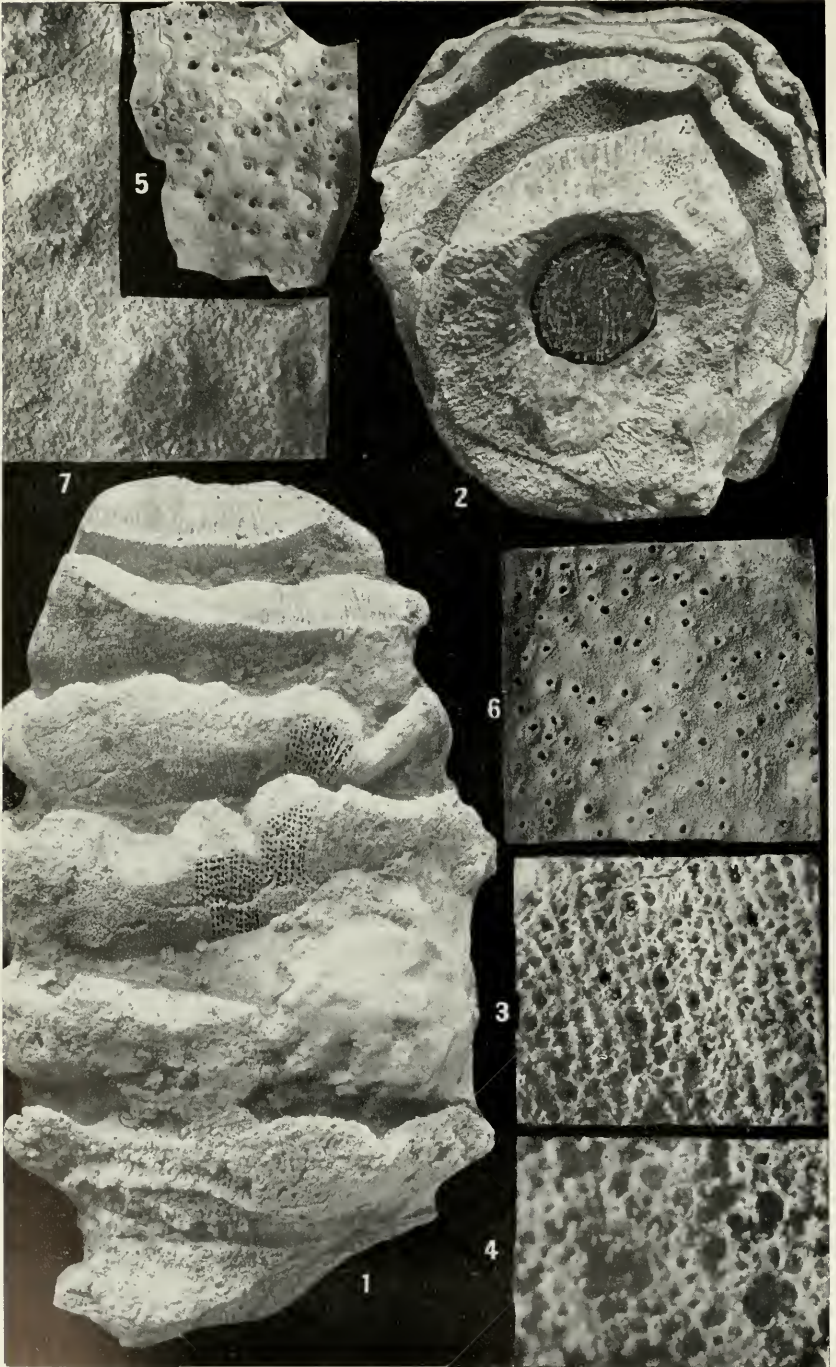
PLATE 24

(Thin sections, all $\times 9$, with structure emphasized by shading in some cases.)

- 1, 2. *Patellispongia oculata* Bassler: Vertical and tangential sections showing arrangement of canals and spicular meshwork. (See also pl. 22, figs. 1, 2.)
3. *Calycocoelia typicalis* Bassler: Section crossing canals and spicular meshwork, illustrating size and length of spicules. (See also pl. 21, figs. 3-5.)
- 4, 5. *Lissocoelia ramosa* Bassler: Tangential section near surface where minute pores and fine spicular structure are best shown and vertical section through wall with canals and meshwork. (See also pl. 19, figs. 9-11.)
- 6, 7. *Nevadocoelia wistae* Bassler: Part of vertical section with several canals. Most of the spicules are cut so as to show in white points (6). Tangential section (7) through pores and spicular mesh, with a sketch $\times 15$. (See also pl. 19, figs. 6, 7.)
8. *Hesperocoelia undulata* Bassler: Transverse section through cloaca with canals and usual tissue, with a small sketch of spicular structure, $\times 20$. (See also pl. 22, figs. 3-5.)
9. *Hesperocoelia typicalis* Bassler: Cross section through cloaca with canals and spicular structure; and small portion of the latter $\times 20$. (See also pl. 22, figs. 6-8.)

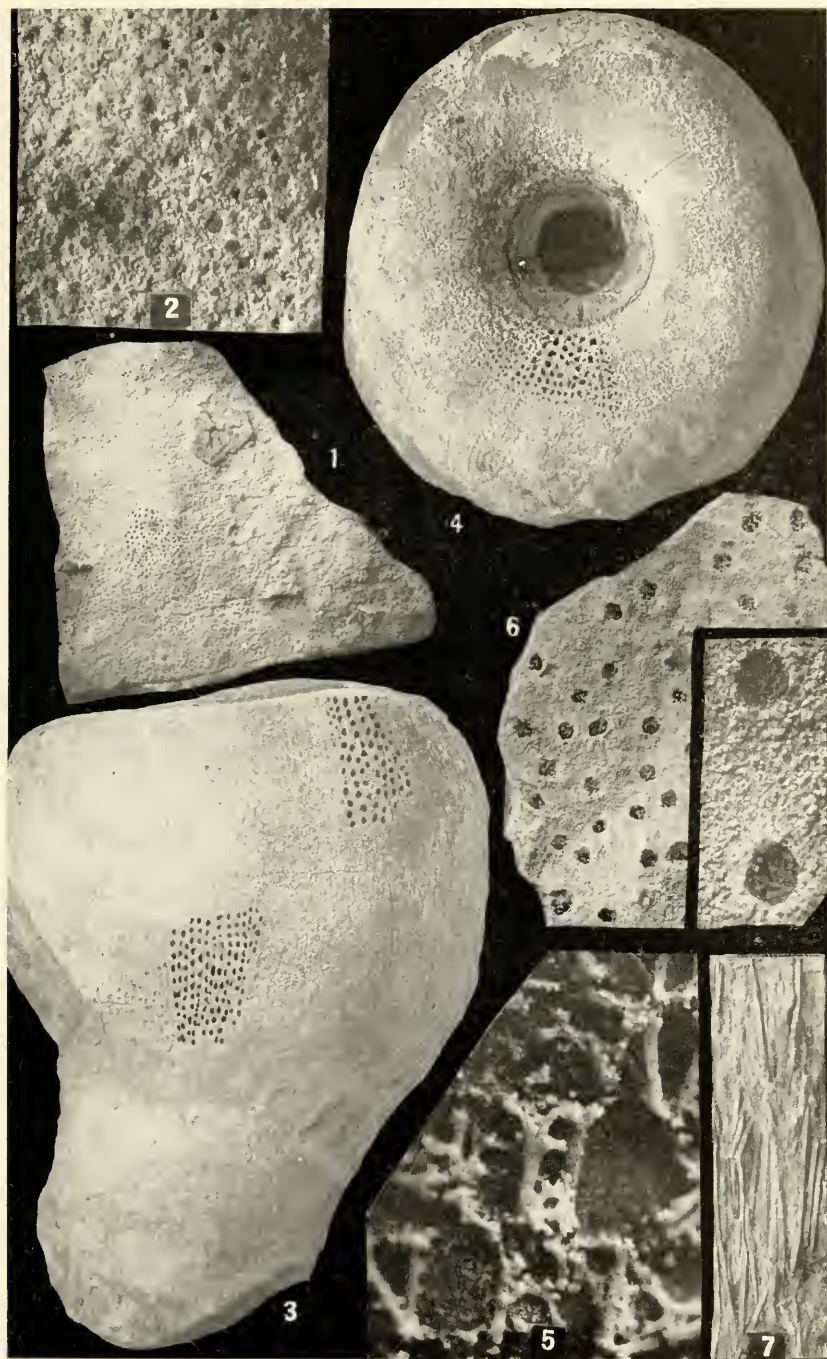


EARLY ORDOVICIAN SPONGES.
FOR EXPLANATION OF PLATE SEE PAGE 101.

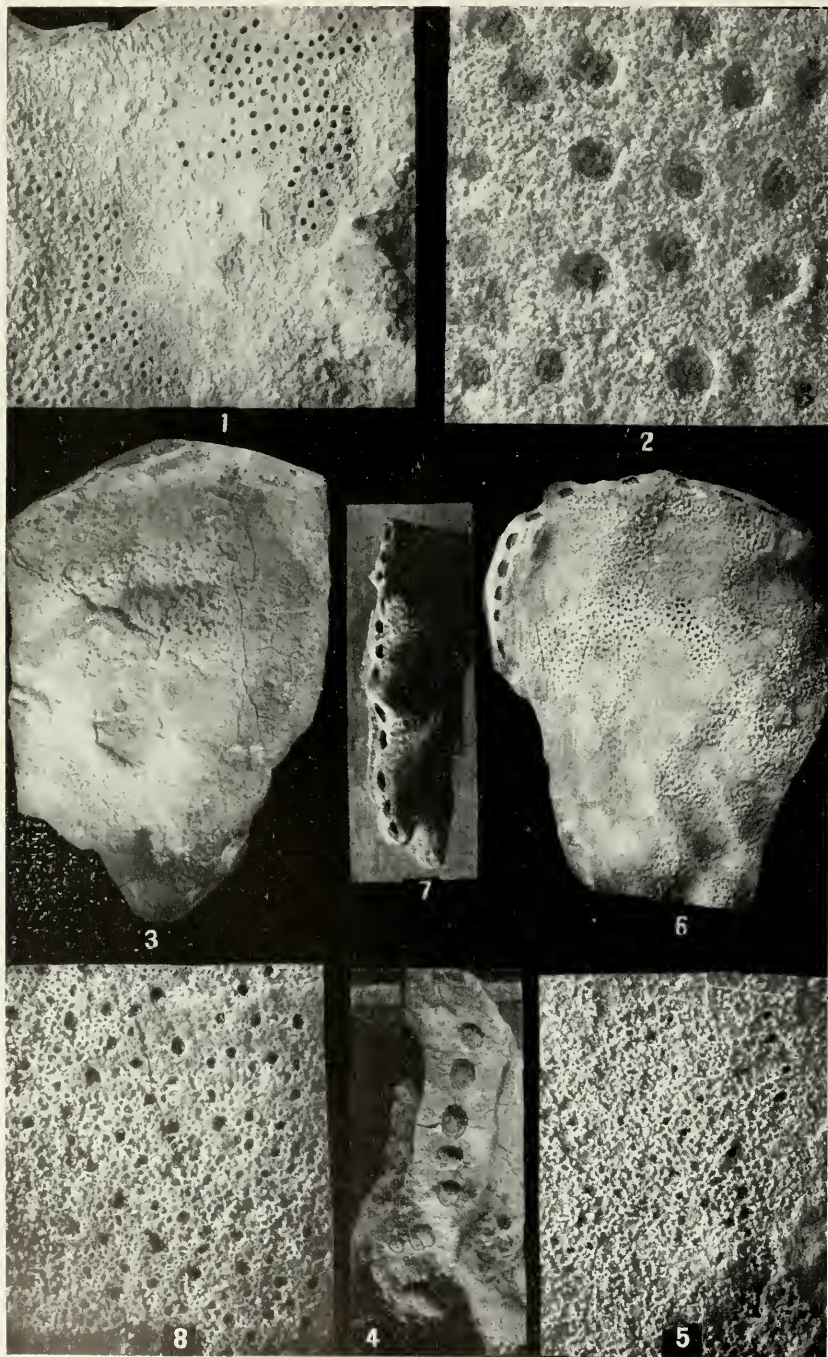


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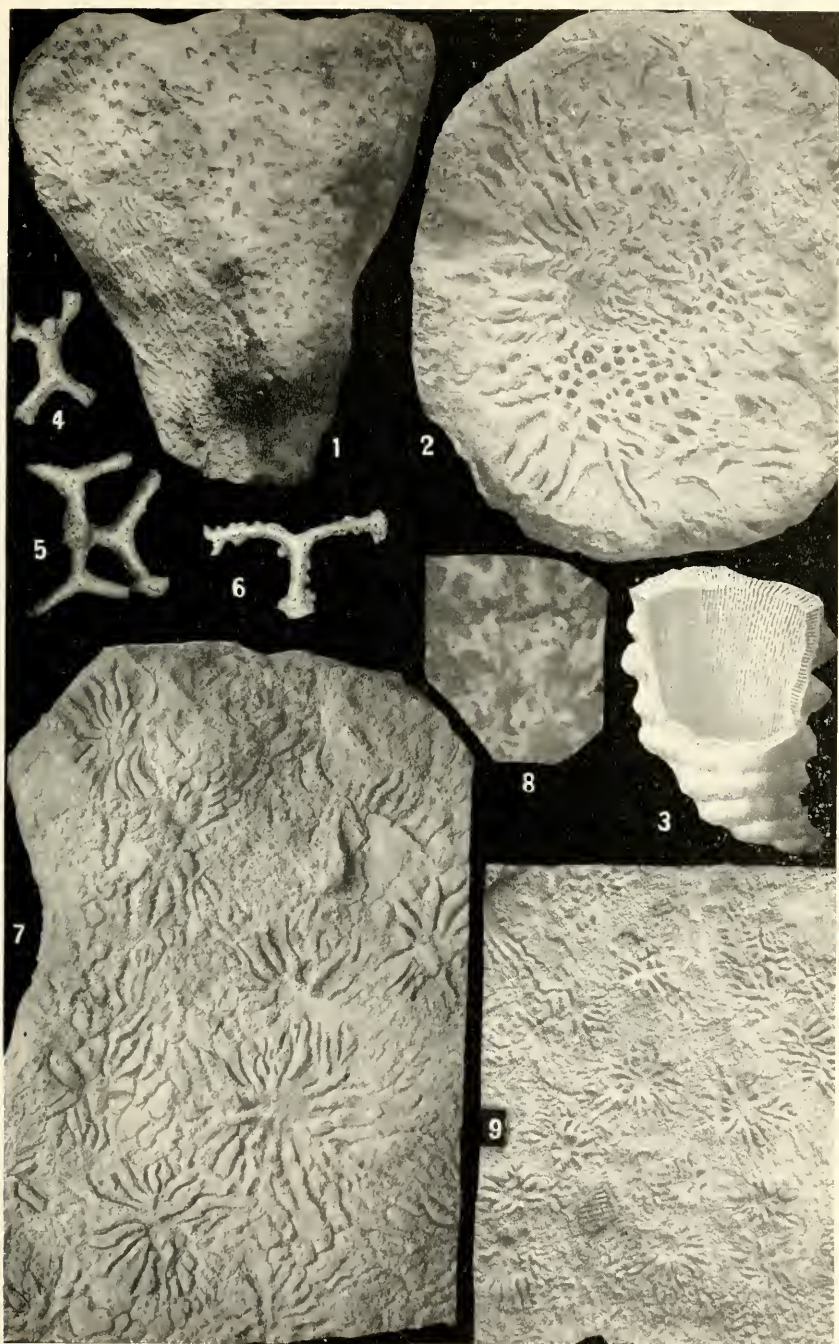
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EARLY ORDOVICIAN SPONGES.
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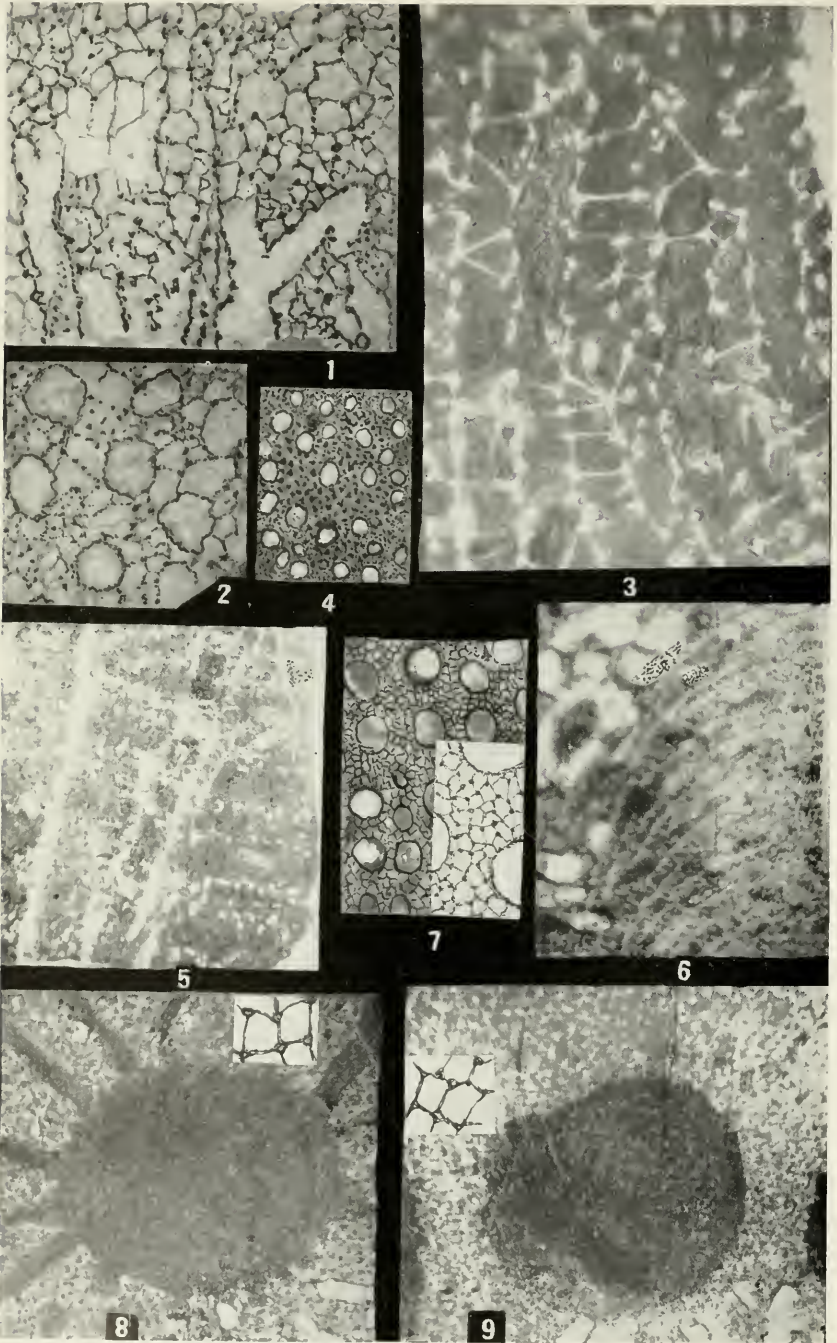


EARLY ORDOVICIAN SPONGES.
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