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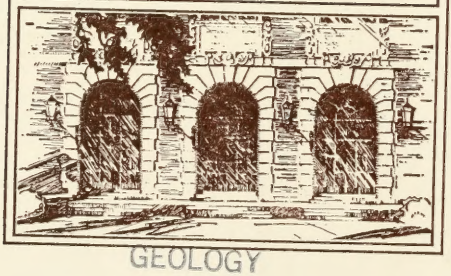

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Geology

ANNOTATED BIBLIOGRAPHY OF LOWER PALEOZOIC SPONGES OF NORTH AMERICA

J. KEITH RIGBY

AND

MATTHEW H. NITECKI

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ANNOTATED BIBLIOGRAPHY OF LOWER PALEOZOIC SPONGES OF NORTH AMERICA

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INTRODUCTION

This paper consists of an annotated bibliography of North American literature on sponges of Cambrian, Ordovician and Silurian ages. It also includes works dealing with organisms which may not be sponges but that have been placed in the phylum Porifera by various authors. Although we do not consider receptaculitids to be related organisms, we have included references dealing with these forms, because they have been traditionally considered as sponges, or as related sponge-like forms. The taxonomic position of receptaculitids, and other problematic organisms will be considered in a later paper.

This work is a part of a larger compilation which will cover all Paleozoic sponges. The next part, synonymy of Lower Paleozoic Sponges of North America is almost completed. Work on an annotated bibliography and synonymy of Upper Paleozoic sponges is in progress.

It is intended to terminate the series with a bibliography and synonymy of Paleozoic sponges other than those of North America.

The authors would welcome any help and suggestions that could insure the completeness of these works. The spelling of taxonomic names is the original citation of individual authors. Many systematic entries have been brought up to date, however, all will be revised and updated in the synonymy list.

The compilation of the bibliography was supported in part by grants GI7988 and GB1303 from the National Science Foundation to the senior author.

BIBLIOGRAPHY

Abbott, George

1914. Is "*Atikokania lawsoni*" a concretion? Nature, **94**, pp. 477–478.

Atikokania lawsoni was described by Walcott from the Steeprock Limestone of Lake Ontario region, but similar structures are also present in the Magnesian Limestone of Fulwell Hill, Sunderland and are considered by Abbott to be inorganic, as is the specimen described by Walcott.

Agnew, A. F.

1963. Geology of the Platteville quadrangle, Wisconsin. Bull. U. S. Geol. Surv., **1123-E**, pp. 245–277, pl. 19, text-figs. 38–42, 1 table.

Receptaculites sp. is used to help subdivide the cherty unit of the Galena Dolomite.

Agnew, A. F., Heyl, A. V. Jr., Behre, C. H. Jr., and Lyons, E. J.

1956. Stratigraphy of Middle Ordovician rocks in the Zinc-Lead districts of Wisconsin, Illinois, and Iowa. U. S. Geol. Surv., Prof. Paper 274-K, pp. 251–312, 24 text-figs.

Receptaculites oweni Hall is abundant in the cherty part of the Galena Dolomite. *Ischadites* sp. occurs, but is less common.

Aitken, J. D. and Norford, B. S.,

1967. Lower Ordovician Survey Peak and Outram Formations, Southern Rocky Mountains of Alberta. Bull. Canad. Petrol. Geol., **15**, no. 2, pp. 150–207, 3 pls., 7 text-figs.

Sponges are mentioned as occurring in the Survey Peak Formation and in a single locality in the Outram Formation on Mount Wilson, the type section of the formation.

Allen, A. T. and Lester, J. G.

1954. Contributions to the paleontology of northwest Georgia. Bull. Georgia Geol. Surv., **62**, 166 pp., 42 pls.

Two specimens of *Hindia parva* Ulrich are illustrated and reported from a locality on U.S. Highway 11, south of Chattanooga, from Upper Ordovician rocks.

1957. Zonation of the Middle and Upper Ordovician strata in northwestern Georgia. Bull. Georgia Geol. Surv., **66**, 110 pp.

Lists *Stromatocerium* sp., *S. pustulosum* Safford, *S. rugosum* Hall, and *Cryptophragmus antiquatus* (Raymond) as sponges in Trentonian rocks. All of these fossils are stromatoporids, or related to stromatoporids, and are not sponges. No undoubted sponges are listed in the paper.

Allingham, J. W.

1963. Geology of the Dodgeville and Mineral Point quadrangles, Wisconsin. Bull. U. S. Geol. Surv., 1123-D, pp. 169–244, pls. 12–18, text-figs. 25–27, 3 tables.

Receptaculites oweni Hall is reported as a characteristic fossil in the cherty part of the Galena Dolomite.

Ami, H. M.

1894. Notes on fossils from Quebec City, Quebec. Ottawa Nat., **8**, pp. 82–90.

Notes the first occurrence of *Nidulites favus* Salter in Canada as an imperfect specimen collected from the Ordovician Quebec Group. Lists and briefly describes in addition several corals, bryozoans, brachiopods, gastropods, trilobites, and other arthropods.

1896. Note on some of the fossil organic remains comprised in the geological formations and outliers of the Ottawa Paleozoic basin. Proc. Trans. Roy. Soc. Canad., ser. 2, **2**, sec. 4: pp. 151–158.

Notes the occurrence of *Receptaculites occidentalis* Salter from the Black River Limestone; *Astylospongia* (now *Caryomanon*) *parvula* Billings, *Steliella billingsi* Hinde, *S. crassa* Hinde, *Pasceolus globosus* Billings, and *Receptaculites* (now *Ischadites*) *iowensis* Billings from the Trenton Limestone, all from the Ottawa Valley.

1899. Appendix II. On some Cambro-Silurian and Silurian fossils from Lake Temiscaming, Lake Nipissing and Mattawa outliers.

Ann. Rept. Geol. Surv. Canad., new ser., **10**, Rept. I, 1897, pp. 289-I–302-I.

Receptaculites occidentalis Salter is listed from the Black River Mattawa outlier, and *Pasceolus globosus* Billings is listed from the Black River beds at Lake Nipissing.

1902. Appendix. Lists of fossils to accompany report by R. W. Ells on the city of Ottawa Map. Geol. Surv. Canad., Ann. Rept. 1899, new ser., **12**, pp. 51G–77G.

Brachiospongia digitata (Owen) is listed from the Trenton Formation from Wright's new quarries in Hull, and *Pasceolus globosus* Billings is listed from the shore of Ottawa River in Ottawa City.

Amsden, T. W.

1949. Stratigraphy and paleontology of the Brownsport Formation (Silurian) of Western Tennessee. Peabody Mus. Nat. Hist., Yale Univ., Bull. 5, 138 pp., 34 pls., 30 text-figs.

Stratigraphy of the beds in which the famous western Tennessee sponge accumulations occur is described. *Astraeospongia meniscus* (Roemer) is listed from the Brownsport and Lowville Formations of Tennessee.

1957. Catalog of fossils from the Middle and Upper Ordovician of Oklahoma. Okla. Geol. Surv., Circ. 43, 41 pp.

Ischadites iowensis (Owen) is listed as occuring in the Bromide Formation, as mentioned by Decker and Merritt (1931).

Ardley, Edmond

1916. A list of type fossils in the Peter Redpath Museum (McGill University). Canad. Rec. Sci., **9**, pp. 464–482

The type specimens of Dawson's Gaspe Ordovician (?) sponges are housed in the museum. These include: *Acanthodictya hispida* Dawson, *Cyathophycus quebecense* Dawson, *Halichondrites confusus* Dawson and Hinde, *Hyalostelia* (now *Kiwetinokia*) *metissica* Dawson, *Lasiothrix curvicosata* Dawson and Hinde, *Palaeosaccus dawsoni* Hinde, *Protospongia delicatula* Dawson and Hinde, *P. mononema* Dawson and Hinde, *P. polynema* Dawson and Hinde, *P. tetranema* Dawson and Hinde, *P.* (now *Diagonella*) *coronata* Dawson and Hinde, and *P.* (now *Diagonella*) *cyathiformis*, as well as *Stephanella hindii* Dawson and *Trachyum vestatus* Dawson from other localities.

Ball, J. R. and Greacen, K. F.

1946. Catalog of the Egan collection of Silurian invertebrate fossils at the Chicago Academy of Sciences. Chicago Acad. Sci., Spec. Pub. no. 7, 55 pp.

Astylospongia praemorsa (Goldfuss) is reported from the Silurian of Indiana, Tennessee, and from a drift boulder in Illinois. *Caryospongia juglans nuxmoschata* (Hall) is reported from Silurian rocks of Illinois Indiana, Tennessee, and Ontario, and *Palaeomanon cratera* Roemer and *Astraeospongia meniscus* (Roemer) are reported from Silurian rocks of Tennessee. *Receptaculites hemisphericus* Hall is reported from Wisconsin, and *R. tessellatus* Winchell and Marcy (now *Ischadites infundibulum* (Hall)) and *Ischadites iowensis* Owen from Illinois. *Cerionites dactyloides* (Owen) is reported from Iowa.

Barlow, A. E.

1899. Report on the geology and natural resources of the area included by the Nipissing and Temascaming map sheets, comprising portions of the district of Nipissing, Ontario, and the county of Pontiac, Quebec. Ann. Rept. 1897, Geol. Surv.Canad., n. ser., **10**, Rept. I, 287 pp.

Receptaculites occidentalis Salter is reported from the Lower Trenton Ordovician rocks of the district. *Coscinopora* (?) sp. is also reported. This reference is probably to *Receptaculites*, as now understood. *Coscinopora*, as the genus in now used, is included within the bryozoans.

Bass, N. W. and Northrop, S. A.

1955. Lower Paleozoic rocks of the White River Uplift, Colorado. *In* Guidebook to the geology of Northwest Colorado. 6th Ann. Field Conf. Intermtn. Assoc. Petrol. Geol., and Rocky Mtn. Assoc. Geol., pp. 3–9, 2 text-figs.

Sponge spicules are mentioned, along with other faunal elements, in collections of fossils from the Manitou Formation near Glenwood Canyon.

Bassler, R. S.

1909. The cement resources of Virginia west of the Blue Ridge. Bull. Virginia Geol. Surv., 2-A, 309 pp., 30 pls., 30 text-figs.

Describes and figures the new species *Receptaculites biconstrictus* and notes its occurrence in the Ordovician Holston Marble, where it

is abundant and characteristic. *Nidulites* cf. *favus* Salter occurs in northwestern Virginia and the genus is prominent in the Chambersburg Formation. The problematic genus *Strepochetus*, probably an alga, is noted in the Chambersburg Formation as well.

1915. Bibliographic index of American Ordovician and Silurian fossils. Bull. U. S. Nat. Mus. 92, **1** and **2**, 1521 pp.

Most of the publication is a bibliographic list of genera and species, with synonymies up to 1914, in alphabetical order. The remainder is an index of specific names, a biological classification, an alphabetical list of genera, and an alphabetical list of American Ordovician and Silurian geological formations, with correlation tables.

Many sponges are treated throughout the work, and their taxonomy updated. The publication is an important reference. The new species *Nidulites pyriformis* is named.

1919. Maryland Geological Survey Cambrian and Ordovician. 424 pp., 58 pls., 27 text-figs., tables.

Nidulites pyriformis Bassler and *Receptaculites occidentalis* Salter are described, illustrated, and placed with doubt in calcareous algae. Both are from Chambersburg Limestone. In addition, *N. pyriformis* Bassler is listed from Virginia, Maryland and Pennsylvania, and *R. occidentalis* Salter is listed from Maryland, New Jersey, Kentucky, Canada, Arctic America and southern Pennsylvania.

Rhabdopora fragilis (Billings) is described from the Beekmantown Limestone of Maryland and is also reported from Pennsylvania.

Camarocladia rugosa Ulrich is described and illustrated from the Chambersburg Limestone of Maryland and is reported from Pennsylvania, Minnesota, and Kentucky.

Hindia parva Ulrich is described and illustrated from the Martinsburg Shale of Maryland, and reported from Pennsylvania, Virginia, Minnesota, Wisconsin, Kentucky, Tennessee, and New Jersey.

1927. A new Early Ordovician sponge fauna. Jour. Wash. Acad. Sci., **17**, no. 15: pp. 390–394.

Chazyan sponges from the Pogonip Group are described from collections taken from McMonigal Canyon in the Toquima Range of central Nevada. The new genera proposed include: *Nevadocoelia, Lissocoelia, Calycocoelia, Patellispongia, Hesperocoelia,* and the new species proposed are: *N. wistae, N. traini, N. grandis, N. pulchra, C. typicalis, P. oculata, P. clintoni, P. minutipora, H. typicalis,* and *H. undulata.* In addition, *Anthaspidella clintoni* n. sp., *Anthaspidella*

traini n. sp., and *Streptosolen occidentalis* n. sp. were proposed. None of the above was figured. These species were better described and all were figured in a later paper by Bassler (1941).

1932. The stratigraphy of the Central Basin of Tennessee. Bull. Tenn. Div. Geol., **38**, 268 pp., 49 pls., 4 text-figs., 4 geol. maps.

Figures, but does not describe the following new forms: *Camarocladia implicatum*, *C. gracilis*, *Saccospongia laxata*, and *S. massalis* from Upper Ordovician rocks. In addition, *Brachiospongia digitata* (Owen), *Dystactospongia minor* Ulrich and Everett, *Hindia sphaeroidalis* Duncan, and *Saccospongia danvillensis* Ulrich are figured. Figured, but not described, species above were later described (Bassler, 1935).

Zittelella varians (Billings) is listed from the Murfreesboro Limestone and the Ridley Limestone; and *Zittelella* sp. from the Catheys Formation. *Camarocladia implicatum* Bassler occurs in the Lebanon Limestone and *C. gracilis* Bassler in the Tyrone Limestone. *Hindia sphaeroidalis* Duncan occurs in the Hermitage Formation, Bigby Limestone, Catheys Formation, Leipers Formation, and in the Arnheim Formation. *Dystactospongia* sp. is reported from the Hermitage Formation, and *Dystactospongia insolens* Miller is reported from the Leipers Formation. Several species of *Dystactospongia* are reported from the Arnheim Formation, along with *Heterospongia subramosa* Ulrich. *Hindia parva* Ulrich is reported from the Cannon Limestone, along with *Saccospongia laxata* Bassler, *S. massalis* Bassler, and *S. danvillensis* Ulrich.

1935. Descriptions of Paleozoic fossils from the Central Basin of Tennessee. Jour. Wash. Acad. Sci., **25**, no. 9: pp. 403–409.

Camarocladia gracilis Bassler, *C. implicatum* Bassler, *Saccospongia massalis* Bassler, and *S. laxata* Bassler are described from the Ordovician Black Riveran and Trentonian rocks of Tennessee. These forms were illustrated earlier in a paper on the stratigraphy of the region, but were not described then (Bassler, 1932). There is some question about the sponge nature of *Camarocladia*. Both species of *Saccospongia* occur in the Cannon Limestone. *Camarocladia gracilis* occurs in the Tyrone Limestone and *C. implicatum* in the Lebanon Limestone.

1941. The Nevada Early Ordovician (Pogonip) sponge fauna. Proc. U. S. Nat. Mus., **91**, no. 3126: pp. 91–102, pls. 19–24.

A sponge fauna, preliminarily reported by Bassler (1927), from the Pogonip Group of the Toquima Range is described and illus-

trated. All the species were earlier partially described and this is an expansion of those descriptions, along with figured specimens.

Nevadocoelia wistae, N. traini, N. grandis, N. pulchra, Lissocoelia ramosa, Calycocoelia typicalis, Patellispongia oculata, P. clintoni, P. minutipora, P. magnipora, Hesperocoelia typicalis, H. undulata, Anthaspidella clintoni, A. traini, and *Streptosolen occidentalis* were proposed by Bassler and are described and figured. *Archaeoscyphia minganensis* (Billings) is also described and figured, but from eastern North American material.

This fauna is now known to come from Zone N of Hintze (1951, 1952), high in the Pogonip Group, and is one of the better described Ordovician faunas of North America.

Bayer, T. N.

1967. Repetitive benthonic community in the Maquoketa Formation (Ordovician) of Minnesota. Jour. Paleontol., **41,** no. 2, pp. 417–422, pl. 51, 2 text-figs.

Microspongia fibrosa (Roemer), *Astylospongia* cf. *A. praemorsa* (Goldfuss), and *Caryospongia* sp. are reported from the Elgin Member of the formation in southern Minnesota, as part of an extensive benthonic fauna.

Beecher, C. E.

1889. Brachiospongidae: a memoir on a group of Silurian sponges; with six plates. Mem. Peabody Mus. Nat. Hist., Yale Univ., **2,** pt. 1: 28 pp., 6 pls., 4 text-figs.

Work of earlier workers is summarized and the genus *Strobilospongia* (now *Pattersonia* Miller, 1882) and the new species *S.* (now *Pattersonia*) *tuberosa* Beecher and *S.* (now *Pattersonia*) *aurita* Beecher are described and illustrated. *Brachiospongia digitata* (Owen) is also well described and illustrated. A summary of geologic occurrences of Paleozoic hexactinellids, to 1889, is also given, listing 23 genera. Described specimens of *Brachiospongia* and *Pattersonia* are from Trentonian and Maysvillian rocks of Tennessee and Kentucky.

Beerbower, J. R.

1960. Search for the past, an introduction to paleontology. Prentice-Hall Inc., New York. 562 pp., 225 text-figs.

Treats the morphology and evolution of sponges in a light manner and figures *Hydnoceras, Astylospongia, Palaeomanon, Astraeospongia,* and *Microspongia* (now *Hindia*) from the Paleozoic.

Bell, Robert

1886. Observations on the Geology, Zoology and Botany of Hudson's Strait and Bay, made in 1885. Geol. Nat. Hist. Surv. Canad. *In* Geol. Surv. Canad. Ann. Rept. (new ser.),v. 1 for 1884–5, p. 27-DD.

Receptaculites oweni Hall is reported from limestone fragments on ice-pans of field ice off Big Island.

Billings, Elkanah

1857. Report for the year 1856. *In* Geol. Surv. Canad., Report of Progress for the years 1853–54–55–56, pp. 247–345.

Under Class Uncertain the new genus *Pasceolus* is described. It is compared with *Ischadites koenigi* Hinde and with tunicates. Two new species are proposed but not illustrated, *P. halli*, from White Cliff, Gamache Bay: and *P. globosus* from the Trenton Limestone, at Ottawa.

1859. Fossils of the Calciferous sandrock, including some of the deposit of white limestone at Mingan, supposed to belong to the formation. Canad. Nat. Geol. and Proc. Nat. Hist. Soc. Montreal, **4**, Art. 27, pp. 345–346

Described *Petraia minganensis* (now *Archaeoscyphia minganensis*) from the Mingan Islands in the Gulf of St. Lawrence from the "Calciferous sandrock" (the Romaine Formation), of Ordovician age.

1861. New species of Lower Silurian fossils; Geol. Surv. Canad. Pamphlet, **21**, 24 pp.

This pamphlet forms the first 24 pages of the "Palaeozoic Fossils," 1865, therefore it is the date of publication of the following new genera and species: *Archaeocyathus* (now *Archaeoscyphia*) *minganensis; Eospongia roemeri; Eospongia* (now *Zittelella*) *varians;* and *Astylospongia* (now *Caryomanon*) *parvula.*

See also Billings 1861, "Appendix" to the *Geology of Vermont.*

1861. On some new or little known species of Lower Silurian fossils from the Potsdam Group "Primordial Zone." Rept. Geol. Vermont, **2**, pp. 942–945.

This paper contains descriptions covered by the first 18 pages of the pamphlet published by the Geological Survey of Canada, 1861, and is also included as the first 18 pages in "Palaeozoic Fossils" published by the Survey in 1865.

1861. On some new species of fossils from the Calciferous, Chazy, Black River, and Trenton Formations. Rept. Geol. Vermont, **2**, pp. 955–960.

This paper contains descriptions covered by pages 18–24 of a pamphlet published by Geological Survey of Canada, 1861, and later as part of "Palaeozoic Fossils,"published in 1865 by the Survey.

1863. Catalogue of Lower Silurian fossils. *In* Rept. of Progress from Commencement to 1863, Geol. Surv. Canad., pp. 936–954.

Under Amorphozoa, *Eospongia roemeri* Billings and *Eospongia* (now *Zittelella*) *varians* Billings are reported from Chazyan rocks. *Astylospongia* (now *Caryomanon*) *parvula* Billings is listed from the Trentonian. Under Protozoa, *Receptaculites occidentalis* Salter is reported from Trentonian rocks. *R.* (now *Ischadites*) *iowensis* Owen is listed from Utica age rocks, and *R. calciferus* Billings from the Calciferous beds.

1865. New species of Lower Silurian fossils. Geol. Surv. Canad. Pamphlet, pp. 169–344.

This is the fourth part of "Palaeozoic Fossils" as it was ultimately bound. In this pamphlet the following new genera and species of fossils are described: *Calathium formosum, C. affine, C. anstedi, C. fittoni, C.* (?) *pannosum, C. anstedi* (?), *Trachyum cyathiforme,* and *T. rugosum.*

1865. Notes on some of the more remarkable genera of Silurian and Devonian fossils. Canad. Nat., ser. 2, **2**, pp. 184–198, text-figs. 1–14.

See Billings, 1865, Palaeozoic Fossils, Geol. Surv. Canad., **1.**

1865. Palaeozoic fossils, containing descriptions and figures of new or little known species of organic remains from the Silurian rocks, 1861–1865. Geol. Surv. Canad., **1**, 426 pp.

I. On some new or little-known species of Lower Silurian fossils from Potsdam Group (Primordial Zone).

These fossils were collected from two main localities, both of the age of the Potsdam Group. The first is on the north shore of the Straits of Belle Isle, and the other is about three miles east of Phillipsburgh in the County of Missisquoi, and extends south into Vermont.

Genera described:

Archeocyathus n. gen.

A. atlanticus n. sp., Potsdam, Anse au Loup, on the north shore of the Straits of Belle Isle.

A. profundus n. sp., Potsdam, Anse au Loup, on the north shore of the Straits of Belle Isle. (In a later work he says he separated *A. minganensis* from *A. profundus*).

II. On some new species of fossils from the Calciferous Chazy, Black River, and Trenton formations.

Eospongia n. gen., this genus was separated from the similar genus *Astylospongia* Roemer.

E. roemeri n. sp., Mingan Islands, Chazy limestone.

E. varians n. sp., Mingan Islands, Chazy limestone.

Astylospongia parvula n. sp., similar to *A. inciso-lobota* Roemer, City of Ottawa, Trenton limestone.

III. On some new species of fossils from the Quebec Group.

Collected in the limestones of the Quebec Group in the northern part of Newfoundland.

Calathium n. gen.

C. formosum n. sp., Quebec Group, G, Cape Norman, Newfoundland.

C. affine n. sp., Quebec Group, G, Cape Norman, Newfoundland.

C. anstedi n. sp., Quebec Group, H, Pistolet Bay on Schooner Island, Newfoundland.

C. fittoni, Quebec Group, K, Point Rich, Newfoundland.

Trachyum n. gen.

T. cyathiforme n. sp., Quebec Group, G, Cape Norman, Newfoundland.

T. rugosum n. sp., similar to *T. cyathiforme*, provisional name.

IV. New species of fossils from different parts of the Lower, Middle, and Upper Silurian rocks of Canada.

Calathium? *pannosum* n. sp., Quebec Group, Point Lévis, in the upper part of limestone number 2.

C. anstedi?, Quebec Group, H, Pistolet Bay, Newfoundland. (If it turns out to be a distinct species he will call it *C. crassum*.)

V. New species of fossils from the limestones of the Quebec Group from Point Lévis and other localities in Canada East.

Archeocyathus (ante, p. 3)

A. minganensis, Potsdam, Anse au Loup, Straits of Belle Isle.

Trichospongia n. gen.

T. sericea n. sp., Calciferous formation, Mingan Islands, Quebec.

Rhabdaria n. gen.

R. fragilis,Mingan Islands, Quebec.

R. furcata, Mingan Islands, Quebec.

Calathium? *paradoxicum* n. sp., Calciferous formation, Mingan Islands. Quebec.

Receptaculites calciferous n. sp., Calciferous formation, Mingan Islands, Quebec.

Also mentions *R. occidentalis* (Salter), Black River limestone. *Receptaculites*? *elegantulus* n. sp., Calciferous formation, Mingan Islands, Quebec.

VI. New species of fossils from the Quebec Group in the northern part of Newfoundland.

Fossils from various formations in the Silurian Devonian systems.

Calathium canadense, Chazy limestone, Mingan Islands, Quebec.

Astylospongia praemorsa, Chazy limestone, Mingan Islands, Quebec.

Receptaculites DeFrance

R. occidentalis see *R. neptuni*.

R. calciferous, Calciferous formation, Mingan Islands, Quebec.

R. oweni (Hall), Lower Silurian, Illinois.

Tetragonis murchisonii (Eichwald) cf. *Ischadites koenigii* Murchison and *R. canadensis*.

R. canadensis (Billings)

R. jonesi

R. iowensis (Owen)

R. jonesi n. sp., upper part of the Lower Helderberg Group, Cape Gasp?.

VII. New species of fossils from the Quebec Group in eastern Canada with some others previously described and some other formations.

Class uncertain

Pasceolus Billings

P. halli, middle Silurian, Anticosti.

P. globosus, Trenton limestone, Ottawa.

The parts which appeared as volume 1 were published separately in the following manner as pamphlets of Geological Survey of Canada: pp. 1–24 in November 1861 (text altered in 1865); pp. 25–26 in January 1862; pp. 57–168 in June 1862, pp. 57–72 reprinted or altered in 1865); pp. 169–344 in February 1865; pp. 345–426 with the complete volume in October 1865.

The volume is divided into 11 sub-headings that do not correspond to sections in pamphlet form. Date of publication of species therefore is that of individual part.

1856. Report for the year 1865; Rept. Progress 1853–1856, Geol. Surv. Canad., pp. 247–346.

The receptaculitid *Pasceolus* is compared to *Ischadites*, and *Pasceolus globosus* Billings and *P. halli* Billings are briefly described and discussed. This is also published in a French version.

1865. Rapport de l'annee 1865; Rept. Progress pendant les Années 1853–1856, Exploration geologique du Canada, pp. 261–360.

The receptaculitid *Pasceolus* is compared to *Ischadites* and the species *Pasceolus globosus* Billings and *P. halli* Billings are briefly described and discussed. This is also published as an English version.

1866. Catalogues of the Silurian fossils of the Island of Anticosti, with descriptions of some new genera and species. Geol. Surv. Canad. Special Report, 99 pp., figs.

The new species *Receptaculites* (?) (now *Ischadites*) *insularis* is described from the lower part of the Anticosti Group at Gamache Bay. Billings pointed out that this species belongs to a quite different genus than *Receptaculites*, possibly *Tetragonis* if T. *sulcata* were the type of that genus, but still referred the species to *Receptaculites* because of the situation in taxonomy at the time.

This report contains five papers, the "Protozoa" are described in the second part, "Catalogue of the Fossils of the Anticosti Group with descriptions of some of the species," on pages 29–72, with 11 text-figs.

Under *incerte sedis* the genus *Pasceolus* is redescribed, and the following species are discussed at length: *P. halli* Billings, *P. globosus*

Billings, *P.* (now *Nidulites*) *gregarius* Billings, and *P.* (now *Nidulites*) *intermedius* Billings.

1874. On some new or little known fossils from the Silurian and Devonian rocks of Ontario. Canad. Natur., ser. 2, **7**, pp. 230–240, text-figs. 1, 2.

The new genus *Aulocopina* and the new species *A. granti* are described and illustrated. The described material came from the "Niagara Formation" at Hamilton, Ontario, possibly out of what is now the Ancaster chert bed of the Lockport Formation.

Bolton, T. E.

1953. Silurian formations of the Niagara escarpment in Ontario (Preliminary Account). Canad. Dept. Mines Tech. Ser., paper 53–23, 19 pp., fig. 1.

Lists *Astylospongia praemorsa* (Goldfuss) and *Aulocopina granti* Billings from the Goat Island Member of the Lockport Formation. The fauna is concentrated principally in the Ancaster Chert.

1957. Silurian stratigraphy and palaeontology of the Niagara escarpment in Ontario. Geol. Surv. Canad. Memoir 289, 145 pp. 13 pls., 2 text-figs., 12 tables.

Astylospongia cf. *praemorsa* (Goldfuss) and *Hindia* sp. are reported from the Ancaster chert bed of the Lockport Formation, as is *Aulocopina granti* Billings, in the vicinity of Hamilton, Ontario.

1960. Catalogue of type invertebrate fossils of the Geological Survey of Canada. Geol. Surv. Canad., **1**, 215 pp.

Type specimens of 30 species of Ordovician and Silurian sponges are housed in the collection, including forms described by Billings, Wilson, Rauff, Ulrich, and Whiteaves. Genera and species listed include: *Archaeoscyphia minganensis* (Billings), *Astylospongia* (?) *perplexa* Wilson, *Aulocopella winnipegensis* Rauff, *Aulocopina granti* Billings, *Brachiospongia hullensis* Wilson, *Calathium affine* Billings, *C. anstedi* Billings, *C. crassum* Billings, *C. fittoni* Billings, *C. formosum* Billings, *Caryomanon editum punctatum* Wilson, *C. parvulum* (Billings), *Hindia parva* Ulrich, *Hudsonospongia irregularis* Raymond and Okulitch, *H. minganensis* Raymond and Okulitch, *H. duplicata* Raymond and Okulitch, *Okulitchina magna* Wilson, *O. parva* Wilson, *Rhabdaria fragilis* Billings, *R. furcata* Billings, *Steliella billingsi* Hinde *S. crassa* Hinde, *S. ottawaensis* Wilson, *Stephanella sancta* Hinde, *Trachyum cyathiforme* Billings, *Trichospongia hystrix* Whiteaves, *T.*

sericea Billings, *Nipterella paradoxica* Hinde, *Zittelella varians* (Billings.)

1966. Catalogue of type invertebrate fossils of the Geological Survey of Canada. Geol. Surv. Canad., **3**, 203 pp.

Type specimens of *Cyclocrinus intermedius* (Billings), *Ischadites canadensis* Billings, *I. ottawaensis* Wilson, *Pasceolus globosus* Billings, *P.* (now *Nidulites*) *gregarius* Billings, *P. halli* Billings, *P.* (now *Nidulites*) *intermedius* Billings, *Receptaculites* cf. *arcticus* Etheridge, *R. calciferous* Billings, *R.* (*?*) *elegantulus* Billings, *R.* (*?*) (now *Ischadites*) *insularis* Billings, *R.* (now *Ischadites*) *iowensis* (Owen), *R.* (now *Ischadites*) *jonesi* Billings, *R. occidentalis* Salter, *R. oweni* Hall, and *Receptaculites* sp. are listed as housed in the collection of Geolo-ical Survey of Canada. All these are placed in *incertae sedis*, except the genera *Cyclocrinus* and *Pasceolus*, which are listed as algae.

Bourcart, J. and Le Villain, G.

1931. La faune des Calcaires de Sidi Mouca D'Aglou. Notes Mem. Service Mines Carte Geol., 44 pp.

This is a general discussion of the geology of Cambrian rocks of the Anti Atlas of Morroco, but included is a general discussion of archaeocyathids, including mention of *Archaeoscyphia minganensis* (Billings) which was originally included with archaeocyathids. *A. minganensis* is found in the maritime region of Canada.

Bradley, J. H.

1925. Stratigraphy of the Kimmswick Limestone, Missouri and Illinois. Jour. Geol., **33**, no. 1, pp. 49–74.

Receptaculites oweni (Hall), *Ischadites iowensis* (Owen), and a new form, *Receptaculites cornutiformis*, occur in the Kimmswick Limestone. The latter form is described later by Bradley (1930).

1930. Fauna of the Kimmswick Limestone of Missouri and Illinois. Contrib. Univ. Chicago Walker Mus., **2**, no. 6, pp. 219–290, 1 pl.

Receptaculites cornutiformis is described from the Kimmswick Limestone near Glen Park, Missouri, but was earlier reported as well (Bradley 1925). It is similar to *Receptaculites oweni* (Hall).

Branson, E. B.

1941. Central and Northeastern Missouri and adjoining areas in Illinois. Guidebook 15th Ann. Field Conf. Kansas Geol. Soc., 120 pp., 59 pls.

Receptaculites oweni Hall is listed from two localities in northeastern Missouri from the Kimmswick Limestone.

1944. The geology of Missouri. Univ. Missouri Studies, **19**, no. 3, 535 pp., 46 pls.

Chancelloria aurora Lochman is noted and figured from the Upper Cambrian Bonneterre Dolomite, and *Dystactospongia minor* Ulrich and Everett, and *Hindia parva* Ulrich are listed from the Middle Ordovician Plattin Formation. *Calathium* sp. is noted from the Lower Ordovician Jefferson City Formation, and *Receptaculites cornutiformis* Bradley and *R. oweni* (Hall) are noted from the Kimmswick Limestone. *Hindia fibrosa* (Roemer) is reported from the Devonian and *Hindia* (?) sp. from the Mississippian.

Bretz, J. H.

1939. Geology of the Chicago region. Part 1—General. Bull. Ill. State Geol. Surv. **65**, 118 pp., 7 pls., 91 figs.

Calathium sp. is reported from the Silurian of the region, but this is probably a receptaculitid rather than related to the form described by Billings (see Toomey and Ingles, 1964).

Brown, C. E. and Whitlow, J. W.

1960. Geology of the Dubuque South quadrangle, Iowa-Illinois. Bull. U. S. Geol. Surv., 1123-A, pp. 1–93, pls. 1–7, 18 text-figs., 1 table.

Receptaculites oweni Hall is reported as a common fossil in the Galena Dolomite and occurs in three zones within the formation.

Bucher, W. H. and Caster, K. E.

1939. Elementary description of Cincinnatian fossils and strata and plates of commoner fossils in the vicinity of Cincinnati, Ohio. Univ. Cincinnati. 13 pp., 10 pls.

An introductory discussion of sponges is given, pointing out that articulated spicule skeletons are rare. *Stromatocerium huronense* is cited as a possible sponge, but this form is now considered a stromatoporid.

Buckley, E. R.

1909. Geology of the disseminated lead deposits of St. Francois and Washington Counties, Missouri. Missouri Bur. Geol. Mines, **9**, pt. 1, 259 pp., 39 pls., 10 text-figs.

The Kimmswick Dolomite is characterized by abundant remains of the "Sunflower coral" in the *Receptaculites* horizon, which makes it one of the most easily recognized in the Ordovician sequence.

Buehler, H. A. and Leighton, M. M.

1939. Southwestern Illinois and southeastern Missouri. 13th Ann. Field Conf., Kansas Geol. Soc., 176 pp.

Receptaculites sp. is listed from the Kimmswick Limestone in localities in Illinois and Missouri in areas covered by the conference.

Burbank, W. S.

1932. Geology and ore deposits of the Bonanza mining district, Colorado. U. S. Geol. Surv. Prof. Paper 169, 166 pp., 35 pls., 47 text-figs.

Receptaculites oweni Hall is reported as a common fossil from the lower part of the upper Tomichi Limestone.

Burke, F. J., Jr.

1965. Reply (to discussion by A. J. Boucot and by W. B. N. Berry on *Silurian stratigraphy of Gaspe Peninsula, Quebec*). Bull. Amer. Assoc. Petrol. Geol., **49**, pp. 2305–2316, 2 text-figs., 1 table.

The sponge *Hindia fibrosa* (Roemer) is reported from a list by Clarke (1908) as from the Cape Bon Ami Formation at Forillon Peninsula, and *Hindia* sp. is reported from a list of Cooper (1959) as from the Roncelles Formation at the Forillon Peninsula. Burke interprets the Cape Bon Ami Formation as Devonian, and the St. Leon and older Roncelles Formations as Silurian.

Butler, P. E.

1961. Morphologic classification of sponge spicules with descriptions of siliceous spicules from the Lower Ordovician Bellefonte Dolomite in central Pennsylvania. Jour. Paleontol., **35**, no. 1, pp. 191–200, pl. 39, 7 text-figs.

Describes the new species *Hyalostelia clinopentactinoides*, from 940 feet below the top of the Bellefonte Dolomite, from isolated spicules etched from the dolomite. Butler concludes that *Hyalostelia*

and *Tholiasterella* should not be included in the same family as was done by De Laubenfels (1955), because of structural dissimilarity.

An outlined and keyed classification of isolated sponge spicules is presented, with sketches of spicules in seven text-figures.

Butts, Charles

1940. Geology of the Appalachian Valley in Virginia. Part 1, Geologic text and illustrations; Part 2, Fossil plates and explanations. Bull. Virginia Geol. Surv., **52**, pt. 1, 568 pp., pls. 1–63, 10 text-figs., 10 tables; pt. 2, 271 pp., pls. 64–135.

Hindia sphaeroidalis Duncan is listed from the Murfreesboro Limestone, and also occurs with *Anthaspidella* (?) or *Zittelella* (?) sp., *Hindia parva* Ulrich, *Nidulites ovoides* Butts, and *Receptaculites* sp. in the Lenoir Limestone. *Anthaspidella*? sp., *Dystactospongia* sp., *Hindia parva* Ulrich, *Receptaculites* sp., *R.* cf. *R. elegantulus* Billings. and *Zittelella* cf. *Z. varians* Billings are reported from the Ottosee Formation. *Receptaculites* sp. also occurs in the Athens and Whitsbury Formations, and with *Nidulites pyriformis* Bassler in the Chambersburg Limestone. A short comparative description is given of the new species *Nidulites ovoides* Butts.

Anthaspidella(?) or *Zittelella*(?) sp., *Hindia* cf. *parva* Ulrich, and *Nidulites ovoides* Butts are figured from the Lenoir Limestone. *Dystactospongia*(?) sp., *Receptaculites* and two undetermined sponges are figured from the Ottosee Formation, and *Nidulites pyriformis* Bassler is figured from Chambersburg and Ottosee Formations.

Caley, J. F.

1940. Palaeozoic geology of the Toronto-Hamilton area, Ontario. Geol. Surv. Canad. Mem. 224, 284 pp., 2 maps, numerous tables.

Notes the occurrence of *Receptaculites* (now *Ischadites*) *canadensis* Billings in the Cabot Head member of the Medina Sandstone and *Astylospongia praemorsa* (Goldfuss) from the Lockport Formation, both of which are Silurian, from southern Ontario.

Calvin, Samuel

1893. On the structure and probable affinities of *Cerionites dactylioides* Owen. Amer. Geol., **12**, pp. 53–57, 1 text-fig. (also in Proc. Iowa Acad. Sci., **1**, pt. 3, pp. 13–15).

The receptaculitid *Cerionites dactylioides* Owen is illustrated and described from the Niagaran limestones near Maquoketa, Iowa. It is considered a colonial organism, related to Protozoa.

Campbell, C. D.

1947. Cambrian rocks of Northeastern Stevens County, Washington. Bull. Geol. Soc. Amer., **58**, pp. 597–612.

Archaeocyathus sp. is reported from the Lower Cambrian argillite of the district, but no mention is made of sponges.

Carlson, J. E.

1961. Geology of the Montfort and Linden quadrangles, Wisconsin. Bull. U. S. Geol. Surv., 1123-B, pp. 95–138, pls. 8, 9, text-figs. 19–21.

Receptaculites oweni Hall is reported to be common in the Galena Dolomite, within the *Receptaculites* zone.

Carozzi, A. V. and Textoris, D. A.

1965. Atlas of Paleozoic carbonate microfacies of the eastern Stable Interior (abstr.). Program, Ann. Meet. Geol. Soc. Amer., 1965, p. 28.

The carbonates are divided into two general facies, one includes Upper Cambrian, Ordovician, Upper Devonian, Upper Mississippian and Pennsylvanian rocks, and the other Silurian, Lower and Middle Devonian, and Lower and Middle Mississippian. Sponges are cited in the first group, among other organisms, as a major contributor.

Chamberlin, T. C.

1878. Part II. Geology of Eastern Wisconsin. *In* Geology of Wisconsin, Survey of 1873–1877, **2**: pp. 1–48, pls. 2–13A.

Receptaculites globularis (now *Ischadites iowensis*) Hall, *R.* (now *Ischadites*) *iowensis* (Owen), and *R. oweni* Hall are listed from the Galena beds, and *Astylospongia* sp. from both the Trenton and Galena beds. Niagaran *Receptaculites hemisphericus* Hall and *R.* (now *Ischadites*) *infundibuliformis* Hall are listed from the Waukesha and Racine beds.

Chamberlin, T. C. and Salisbury, R. D.

1907. Geology (3 vols.). Vol. 2, Earth history, second ed., Henry Holt and Company, New York. 692 pp.

The following sponges are discussed and illustrated in this historical textbook: *Astraeospongia meniscus* (Roemer) and *Astylospongia praemorsa* (Goldfuss) from the Silurian; *Brachiospongia digitata*

(Owen) and *Strotospongia maculosa* Miller and *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* Billings from the Ordovician. Receptaculitids include *Ischadites* sp. and *Receptaculites occidentalis* Salter from the Ordovician which are also discussed and illustrated.

1909. A college text-book of geology. Henry Holt and Co., New York. xvi + 978 pp., 608 text-figs.

Cambrian sponges are reported as abundant, but no illustrations or faunal list are given.

The following Ordovician sponges and receptaculitids are figured: *Receptaculites occidentalis* Salter, *Brachiospongia digitata* (Owen), *Archeocyathus* (now *Archaeoscyphia*) *minganensis* (Billings), *Strotospongia maculosa* Ulrich and Everett, and *Ischadites* sp.

Receptaculites oweni Hall is listed and figured.

Chavan, A. and Cailleux, A.

1957. Détermination pratique des Fossiles. Masson et. Cie., Paris. 386 pp., 586 text-figs.

Only the genus *Astylospongia* is mentioned in the brief discussion on Paleozoic sponges.

Chronic, John

1961. Early and Middle Paleozoic index fossils of Colorado. *In* Symposium on Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf., Rocky Mtn. Assoc. Geol., pp. 91–100, 3 pls.

Sponges are reported from the Manitou Formation, along with other elements of the fauna. Specimens of *Receptaculites oweni* Hall are illustrated from the Fremont Formation and a sponge-like organism, *Dictyorhabdus priscus* Walcott, is illustrated from the Harding Formation.

Chronic, J. and Ferris, C. S., Jr.

1961. Early Paleozoic outlier in southeastern Wyoming. *In* Symposium on Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf., Rocky Mtn. Assoc. Geol., pp. 143–146, 4 text-figs.

Ischadites cf. *I. iowensis* (Owen) and *Receptaculites* cf. *R. oweni* Hall are reported from Ordovician limestones of the Ferris outlier in Sec. 9, T.12N., R.72W., Albany Co., Wyoming.

Clark, T. H. and Stearn, C. W.

1960. The geological evolution of North America, A regional approach to historical geology. The Ronald Press Company, New York. 434 pp., 285 text-figs.

Sponges are mentioned as minor elements of the fauna through geologic time, but which became locally important in some reef limestones. Sponge morphology is summarized as an appendix. Precambrian, Cambrian, and Permian sponge localities are cited.

Clarke, J. M.

1905. Catalogue of type specimens of Paleozoic fossils in New York State Museum. Bull. N. Y. State Mus., **65**, pp. 11–34; 769–772.

Most of the fossil sponges cited are from the Devonian and Mississippian, but the types of *Cyathophycus reticulatus* Walcott, and of *Cyathophycus subsphaericus* (now *Teganium subsphaericum*) Walcott, both from the Ordovician Utica Shale of New York State are in the museum collections.

1920. The great glass-sponge colonies of the Devonian; their origin, rise, and disappearance. Jour. Geol., **28**, no. 1, pp. 25–37, 19 text-figs.

This article is a short history of the Dictyospongidae, in which occurrence, habitat, abundance, and ontogeny of the Devonian sponges are discussed. *Dictyospongia danbyi* McCoy, is reported from Westmoreland, England, from the Silurian.

Clarke, J. M. and Ruedemann, R.

1903. Catalogue of type specimens of Paleozoic fossils in the New York State Museum. Bull. N. Y. State Mus., **65**, pp. 1–847.

Cyathophycus reticulatus Walcott and *C.* (now *Teganium*) *subsphaericus* Walcott are cited from the Utica Slate, Holland Patent, New York. Several archaeocyathids are also cited, all from Cambrian beds at Troy, New York.

Cloud, P. E., Jr. and Barnes, V. E.

1948. The Ellenburger Group of Central Texas. Texas Univ. Pub. 4621, 473 pp., 45 pls., 3 tables, 8 text-figs.

Calathium, Archaeoscyphia and hexactinellid sponge spicules are listed from the Ellenburger group in Central Texas and the El Paso Formation in West Texas.

1957. Early Ordovician sea in central Texas. *In* Treatise on marine ecology and paleoecology, vol. 2, Paleoecology. Mem. Geol. Soc. Amer., 67, **2:** pp. 163–214, 3 text-figs.

Archaeoscyphia sp. is reported as locally common in the Honeycut and Gorman Formations. This form may have been widely distributed as a sponge "roller," somewhat like recent forms in the Bahama Islands, and accumulated with chert "cannonballs." *Archaeoscyphia annulata* is the only sponge species recognized.

Collinson, C. W.

1959. Guide for beginning fossil hunters. Ill. State Geol. Surv., Educ. ser., **4,** 39 pp., illus.

The following sponges and receptaculitids from Illinois are illustrated: *Sphaerospongia* sp. = (*Cyclocrinites dactyloides* (Owen)), *Ischadites* sp., *Astraeospongia* sp., *Hindia* sp., *Receptaculites* sp., and *Astylospongia* sp.

Cooper, B. N. and Cooper, G. A.

1946. Lower Middle Ordovician stratigraphy of the Shenandoah Valley, Virginia. Bull. Geol. Soc. Amer., **57,** no. 1, pp. 35–114, pl. 2, figs. 3, 4.

Nidulites pyriformis Bassler occurs in the Chambersburg and Athens Formations of Virginia and in the Ottosee Formation in Clinch Mountain, Virginia. *Receptaculites* sp. occurs in the Chambersburg, Athens, and Whitesburg Formations of Virginia, and *Receptaculites* cf. *R. occidentalis* Billings occurs in the Ottosee Formation in Clinch Mountain, Virginia, along with *Dystactospongia* sp.

Cooper, B. N. and Prouty, C. E.

1943. Stratigraphy of the Lower Middle Ordovician of Tazewell County, Virginia. Bull. Geol. Soc. Amer., **54,** no. 6, pp. 819–886.

Dystactospongia minor Ulrich and Everett, *Dystactospongia* sp., *Eospongia roemeri* Billings, *E.* (now *Zittelella*) *varians* Billings, *E.* cf. *E.* (now *Zittelella*) *varians* Billings, *Eospongia* sp., *Nidulites pyriformis* Bassler, *Nidulites* sp., *Receptaculites biconstrictus* Ulrich, and *Receptaculites* sp. are reported from various formations in the district. *Nidulites* sp. is sufficiently abundant that it characterizes beds in the Ottosee Formation, though it ranges higher and lower.

Craig, J., Devine, J., McGill, P., and Memeley, R.

1967. Chinchaga and Keg River Formations of Slave River area, northern Alberta. Bull. Canad. Petrol. Geol., **15**, no. 2, p. 125–137, 1 pl., 8 text-figs.

The receptaculitid *Sphaerospongia tesselata* (Phillips) is reported as one of the diagnostic fossils from the *arctica* Zone of Givetian age from the Keg River Formation.

Crawford, R. D.

1913. Geology and ore deposits of the Monarch and Tomichi districts, Colorado. Bull. Colo. Geol. Surv., **4**, 317 pp., 25 pls., 15 text-figs.

Receptaculites oweni Hall is reported from an upper limestone above the "parting quartzite" of the Tomichi Limestone. Crawford suggests a correlation of this unit with the Fremont Limestone, and cites the occurrence of *R. oweni* Hall in the lower part of that unit in the Canyon City area, as collected by Walcott (1892).

Crawford, R. D. and Worcester, P. G.

1916. Geology and ore deposits of the Gold Brick district, Colorado. Bull. Colo. Geol. Surv., **10**, 116 pp., 9 pls., 4 text-figs.

Receptaculites oweni Hall is listed from the Upper Ordovician upper Yule Limestone (now Fremont Limestone) from the Gold Brick district.

Croneis, C. and Krumbein, W. C.

1936. Down to earth, an introduction to geology. Univ. Chicago Press. 501 pp., 64 pls., 336 text-figs.

Sponges are reported as ranging from Precambrian to Recent in this introductory physical and historical geology text.

Croneis, C. G. and Grubbs, D. M.

1939. Silurian sea balls. Jour. Geol., **47**, no. 6, pp. 598–612, 6 text-figs.

Siliceous nodules from the Niagaran dolomite in the Chicago area contain isolated hexactinellid and astraeospongid spicules. The "sea balls" with spicules are considered to be the result of accretion on a storm-swept bottom.

Cullison, J. S.

1944. The stratigraphy of some Lower Ordovician formations of the Ozark Uplift. Bull. Univ. Missouri School Mines Metal., tech. ser., **15**, no. 2, 112 pp., 35 pls.

The new sponges *Ozarkocoelia irregularis* and *Archaeoscyphia annulata* are described and figured from the Rich Fountain Formation the former from the School Mine Ledge of the formation. *Archaeoscyphia annulata* Cullison is also possibly present in the lower part of the Lutie member of the Theodosia Formation.

Cummings, E. R.

1908. The stratigraphy and paleontology of the Cincinnati series of Indiana. Indiana Dept. Geol. Nat. Res., Rept. 32, pp. 605–1188, 55 pls., 12 text-figs., 6 maps and charts.

Strepochetus richmondensis Miller is described as a possible sponge, but this form, now *Stromatocerium richmondensis* (Miller), is now considered a stromatoporid.

Cummings, E. R. and Shrock, R. R.

1928. The geology of the Silurian Rocks of northern Indiana. Indiana Div. Geol., Conserv. Comm. pub. 75, 226 pp., 78 text-figs.

Receptaculites sp. is listed from the Silurian Huntington Dolomite from northern Indiana.

Dake, C. L. and Bridge, Josiah.

1932. Faunal correlation of the Ellenburger Limestone of Texas. Bull. Geol. Soc. Amer., **43**, pp. 725–748, pl. 12, 2 text-figs.

Calathium sp. is reported and figured as the principle fossil in the Jefferson City equivalent within the Ellenburger Limestone. The form is reported to be conspecific with those in the Jefferson City Dolomite of Missouri. This form is not a *Calathium*, but probably *Archaeoscyphia*.

Dallas, W. S.

1877. Studies on fossil sponges I, Hexactinellidae. Ann. Mag. Nat. Hist., ser. 4, **20**, pp. 257–273, 405–424, 501–517 (English trans. of K. A. Zittel).

Affinities of hexactinellid sponges and the basis of their classification is discussed, along with types of preservation and the use of a petrographic microscope on spicules.

A classification is presented and involves, among others, *Astylospongia, Palaeomanon, Eospongia, ?Protospongia, Calathium, ?Trachyum, Acanthospongia, Protachilleum,* and *Acestra* (now *Opeamorphus*). Most of these are now considered lithistid demosponges, but *Protospongia, Acanthospongia,* and *Opeamorphus* are still included in the hexactinellids.

1878. Studies on fossil sponges II, Lithistidae. Ann. Mag. Nat. Hist., ser. 5, **2,** pp. 113–135, 235–248, 324–341, 385–394, 467-482, pl. 8 (English trans. of K. A. Zittel.)

Early work on lithistid sponges is discussed, along with previous classifications, and a key to genera. The only Lower Palaeozoic sponge considered is *Aulocopium* from the Silurian of Europe.

1884. On Astylospongidae and Anomocladina. Ann. Mag. Nat. Hist., ser. 5, **14,** pp. 271–276 (English trans. from K. A. Zittel).

Characteristics of *Astylospongia* and *Palaeomanon* are contrasted with typical hexactinellids, with the conclusion that Astylospongidae do not belong to the Hexactinellida. *Astylospongia, Palaeomanon, Protachilleum, ?Eospongia, Melonella, Cylindrophyma, Mastosia,* and *Vetulina* are included in the family Anomocladina.

Dana, J. D.

1871. Manual of Geology: treating of the principles of science with special reference to American Geological history, for the use of colleges, academies, and schools of science. 2nd rev. ed., Ivison, Blakeman, Taylor and Co., New York and Chicago. 800 pp., 986 text-figs.

Archeocyathus (now *Archaeoscyphia*) *minganensis* Billings is listed from the Potsdam of the Straits of Belle Isle.

Eospongia roemeri Billings and *E.* (now *Zittelella*) *varians* Billings are listed from the Chazyan rocks of Mingan Islands, and *Astylospongia* (now *Caryomanon*) *parvula* Billings is listed from Trentonian rocks from near Ottawa.

1880. Manual of geology: treating of the principles of science with special reference to American geological history. 3rd ed. American Book Company, New York. xvi + 911 pp., 12 pls. 1 map, 1162 text-figs.

The following species are listed:

Archaeocyathus (now *Archaeoscyphia*) *minganensis* Billings and *Trichospongia sericea* Billings from Mingan Islands (Calciferous); *Calathium* (?) *pannosum* Billings, *C. anstedi* Billings, and *Trachyum cyathiforme* Billings from Newfoundland (Quebec Group); *Eospongia roemeri* Billings, *E.* (now *Zittelella*) *varians* Billings from Mingan Island (Chazy), and *Receptaculites* sp. from Tennessee (Chazy); *Astylospongia* (now *Caryomanon*) *parvula* Billings from Trenton near Ottawa; *Receptaculites globularis* Hall (now *Ischadites iowensis* (Owen)); and *R. oweni* Hall from Galena beds of Illinois and Wisconsin; and the genera *Astraeospongia*, *Astylospongia*, and *Palaeomanon* in Niagaran rocks of Tennessee; of these, *Astraeospongia meniscus* (Roemer) is the most common.

1895. Manual of geology treating of the principles of science with special reference to American geological history, 4th ed. American Book Co., New York. 1087 pp., 1575 text-figs.

The Cambrian sponges *Leptomitus zitteli* Walcott and *Protospongia fenestrata* Salter are figured, as are the Ordovician sponges: *Archaeoscyphia minganensis* (Billings), *Protospongia tetranema* Dawson, *P. mononema* Dawson and Hinde, *P.* (now *Diagonella*) *cyathiformis* Dawson and Hinde, *P.* (now *Diagonella*) *coronata* Dawson and Hinde, *P. quebecensis* Dawson and Hinde are figured. *Brachiospongia digitata* (Owen) is figured from the Trentonian rocks of Tennessee, and *Astraeospongia meniscus* (Roemer), *Astylospongia* sp., and *Palaeomanon* sp. are cited from the Silurian of Tennessee.

Darton, N. H.

1917. A comparison of Paleozoic sections in southern New Mexico. U. S. Geol. Surv. Prof. Paper 108-C, pp. 31–55, pls. 13–21, text-figs. 3–15.

Calathium cf. *C. anstedi* Billings is listed from the El Paso Limestone in Alamo Canyon of the Sacramento Mountains and from the San Andres Mountains as well. *Calathium anstedi* Billings is cited in collections from the El Paso Limestone in the Silver City region.

Receptaculites, near *R. oweni* Hall, are reported from the Montoya Limestone in the Franklin Mountains, at El Paso, and from the Sacramento Mountains to the north.

Davies, A. M.

1920. An Introduction to Paleontology. Thomas Murby and Co., London, pp. 316–329, 5 figs.

There is a short generalized textbook discussion of sponges.

Dawson, J. W.

1865. On the structure of certain organic remains in the Laurentian limestones of Canada. Quart. Jour. Geol. Soc. London, **21**, pp. 51–59, pls. 6–7. (reprinted in Canad. Natur., n. s., **2**: pp. 99–111, 127–128, 2 pls.)

Receptaculites 12 inches in diameter are mentioned and the eozoön of Dawson is compared with *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* Billings from the Calciferous beds of the Mingan Islands.

1875. Life's dawn on earth; Being the history of the oldest known fossil remains, etc., London, 239 pp.

Archaeocyathids are discussed as close to proto-foraminifera as described by Billings. *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* Billings is figured, along with some archaeocyathids.

1880. The chain of life in geological time. Religious Tract Soc., Picadilly. 272 pp. (2nd ed., 1885; 3rd ed., 1888).

A non-scientific treatment of the morphology of various groups of organisms among other things, including illustrations of *Astylospongia praemorsa* (Goldfuss) and *Protospongia fenestrata* Salter.

1888. Preliminary note on new species of sponges from the Quebec Group at Little Métis. Canad. Rec. Sci., **3**, no. 2, pp. 49–50 (reprinted as: New species of fossil sponges, from Little Métis, Province of Quebec, Canada. Peter Redpath Mus., McGill University, Montreal, Notes on Specimens, April, 1888, pp. 49–50, 1 text-fig.).

Describes the new species *Protospongia tetranema*, *Hyalonema* (now *Kiwetinokia*) *metissica*, *Cyathophycus quebecense*, and other forms, and includes a note on *Cyathophycus reticulatus* Walcott, describing specimens from the Utica Shale, and relating them to the reticulate dictyosponges. The Little Métis sponges are from pyritic black shales, associated with fucoids, and the inarticulate brachiopod *Obolella*.

1889. On fossil sponges from beds of the Quebec Group of Sir William Logan, at Little Métis (abstr.). Canad. Rec. Sci., **3**, no. 7, pp. 429–430.

Six new species of *Protospongia*, one new species of *Cyathospongia* (now *Cyathophycus*), and five new genera were described in an oral presentation. The fossils were collected from Little Métis, Quebec.

Dawson, J. W. and Hinde, G. J.

1889. New species of fossil sponges from the Siluro-Cambrian at Little Métis on the Lower St. Lawrence. Trans. Roy. Soc. Canad., **7**, sec. 4, pp. 31–55, 3 pls., 27 text figs., 1 geol. map.

A varied siliceous sponge fauna is described from black, pyritic, siliceous shale at Little Métis, Quebec. *Protospongia mononema*, *P. polynema*, *P. delicatula*, *P.* (now *Diagonella*) *coronata*, *P.* (now *Diagonella*) *cyathiformis*, *Lasiothrix flabellata*, and *Halichondrites confusus* are described for the first time. Expanded descriptions are given for *Protospongia tetranema* Dawson, *Cyathophycus quebecense* (Dawson), *Acanthodictya hispida* Hinde, *Hyalostelia* (now *Kiwetinokia*) *metissica* Dawson, and miscellaneous unnamed spicule masses. Each species is illustrated with drawings, and photographs, heavily inked, of *Protospongia*, *Diagonella*, *Cyathophycus*, and *Acanthodictya*. This paper concerns the most prolific protosponge fauna known from North America.

Decker, C. E. and Merritt, C. A.

1931. The stratigraphy and physical characteristics of the Simpson Group. Bull. Okla. Geol. Surv., **55**, 112 pp., 15 pls., 2 text-figs.

A thin variety of *Receptaculites* sp. is reported from the middle Oil Creek Formation, and several different sponges, some of them cf. *Zittelella* sp., are reported from above the basal sandstone of the McLish Formation. *Receptaculites occidentalis* Salter is reported from the top of the Bromide Formation at several localities, and *Ischadites iowensis* (Owen) is reported from several localities in the upper Bromide and middle Viola Formations. *Receptaculites* sp. is reported to also range up to the middle Viola Formation.

DeLaubenfels, M. W.

1955. Porifera. *In* Treatise on Invertebrate Paleontology. Geol. Soc. Amer., Univ. of Kansas Press, pt. E, pp. 21–112, text-figs. 14–89.

This is the one of the most important compilations of paleontologic data on sponge genera to date. Each valid genus is summarized and many geno-type species illustrated with drawings. Nomenclature is brought up to a consistent level throughout the phylum. The work is incomplete, however, and the systematic part contains omissions and errors, and here its usefulness is reduced.

1957. Marine sponges. *In* Treatise on Marine Ecology and Paleoecology, v.1, Ecology. Geol. Soc. Amer. Mem. 67, **1**, pp. 1083 1086.

A summary review of papers dealing mainly with Recent marine and brackish-water sponges. A paper by A. Hyatt (1877) on Paleozoic sponges was reviewed for ecologic information.

1958. Nomenclature of Porifera, especially concerning the so-called "glass sponges" or Hyalospongea. Jour. Paleontol., **32**, no. 3, pp. 611–616.

The view that the preferable name for the glass sponges is Hyalosponge, as originally designated by Claus in 1872, is defended. This article was specifically written to rebut R. E. G. Reid's view that the name Hexactinellida be substituted. A summary is given of the names of the phylum Porifera and its classes. The Paleozoic genera *Leptomitus*, *Halichondrites*, and *Lasiothrix* are mentioned as being Hyalospongea, according to this author.

Dietrich, C. W.

1874. From die Silurische Fauna des Westlichen Tennessee. Cincinnati Quart. Jour. Sci., **1**, pp. 247–253 (English trans. of part of F. Roemer's work).

Translated descriptions of *Palaeomanon*, *Astraeospongia*, and *A. meniscus* Roemer, and comparison with related genera and species. Also includes descriptions of *Orthis fissiplica* Roemer and *Thecostegites hemisphaericus* Roemer.

Dowling, D. B.

1900. Report on the geology of the west shore and islands of Lake Winnipeg. Geol. Surv. Canad. Ann. Rept. 1898, n. ser., **11**, pt. F, 100-F pp., figs.

The following fossils are listed from the Trenton (Galena) rocks from around Lake Winnipeg in Manitoba: *Receptaculites oweni* Hall, *Ischadites iowensis* (Owen), *Pasceolus* (now *Nidulites*) *gregarius* Billings, *Aulocopella winnipegensis* Rauff, and *Trichospongia hystrix* Whiteaves.

Dresser, J. A. and Denis, T. C.

1941. Geology of Quebec,Vol. II, Descriptive Geology. Quebec Bur. Mines Geol. Rept. 20, **2**, 544 pp., 44 pls., 41 text-figs, 3 maps.

The sponges *Eospongia* (now *Zittelella*) *varians* Billings, from the Mingan Formation of the Mingan Islands, and *Hyalostelia anticostiana* Twenhofel, from the Jupiter River of Anticosti, are figured, as is the receptaculitid, *Cyclocrinites* (now *Nidulites*) *intermedius* (Billings) from the Gun River Formation of Anticosti.

Astylospongia sp. and *Hindia* cf. *fibrosa* (now *sphaeroidalis*) (Roemer) are reported from the Ordovician Whitehead Formation of eastern Gaspe, and *Hindia fibrosa* (now *sphaeroidalis*) (Roemer) is reported from the Silurian Chaleur series of southern Gaspe. *Zittelella* sp. is reported from the Hastings Creek and Naylor Ledge Formations, and *Hindia* sp. and *Brachiospongia digitata* (Owen), and receptaculitid, *Receptaculites occidentalis* Salter are reported from the Trenton Limestone at Quebec. *Receptaculites occidentalis* (*?*) Salter and *R. neptuni* DeFrance are reported from Trenton Limestone near Lake St. Jean and Saguenay.

Drewes, Harald

1963. Geology of the Funeral Peak Quadrangle, California, on the east flank of Death Valley. U. S. Geol. Surv. Prof. Paper 413, 78 pp., 2 pls., 14 figs., 12 tables.

Fragments of supposed *Receptaculites* are reported from the east flank of Death Valley in the Funeral Peak Quadrangle.

Duncan, P. M.

1879. On some spheroidal lithistid spongida from the Upper Silurian formation of New Brunswick. Ann. Mag. Nat. Hist., ser. 5, **4**, pp. 84–91, pl. 9.

The genus *Hindia* and the species *H. sphaeroidalis* are proposed in the paper, along with an adequate illustration of the gross and microscopic characters of the form. The lithistid sponge origin of the fossil is clearly demonstrated. Specimens came from the calcareous shale of Lower Helderberg or Upper Silurian age in New Brunswick.

1886. On the genus *Hindia* and its species. Ann. Mag. Nat. Hist., ser. 5, **18**, pp. 226–228.

Hindia sphaeroidalis Duncan is considered the valid name for what Hinde termed *H. fibrosa* (Roemer), largely because the description of Roemer is so inadequate. Duncan considers the spicules to be calcareous because of the apparent penetration of algae into the

spicules, a relation virtually impossible if the spicules were originally siliceous.

1887. A reply to Dr. G. J. Hinde's communication "On the genus *Hindia* Dunc., and the name of its typical species." Ann. Mag. Nat. Hist., ser. 5, **19**, pp. 260–264.

A continuation of the feud between Duncan and Hinde on the matter whether *Hindia sphaeroidalis* Duncan or *H. fibrosa* (Roemer) is the type species of the genus. Duncan reaffirms his position that his species is the correct type since *H. fibrosa* is so poorly described, and was described by Roemer as a coral.

Eardley, A. J.

1965. General college geology. Harper and Row, Publishers, New York. 499 pp., 5 pls., 547 text-figs.

Receptaculites sp. and *Astraeospongia* sp. are illustrated, and a general treatment of faunas through time is presented. A superficial discussion of morphology of sponges is also given.

East, E. H.

1966. Structure and stratigraphy of San Francisco Mountains, Western Utah. Bull. Amer. Assoc. Petrol. Geol., **50**, no. 5, pp. 901–920, 10 figs.

Lists *Receptaculites mammillaris* Walcott from the Ordovician Pogonip Group.

Easton, W. H.

1960. Invertebrate Paleontology. Harper Brothers, New York, 701 pp., 297 text-figs.

A generalized text-book treatment of sponges is presented, with the following forms either figured or discussed, or both: *Astraeospongium, Astylospongia, Caryomanon, Microspongia* (now *Hindia*) *fibrosa* (Roemer) from the Silurian and *Chancelloria, Choia ridleyi* Walcott, *Eiffelia, Protospongia fenestrata* Salter, and *P. mononema* Dawson and Hinde from the Cambrian.

Receptaculitids similarly treated include: *Ischadites iowensis* (Owen), *Receptaculites iowensis* (now *Ischadites ohioensis* Hall and Whitfield), *R. mammillaris* Walcott, *R. neptuni* De France, *R. occidentalis* Salter, and *R. oweni* Hall.

Ells, R. W.

1905. The district around Kingston, Ontario. *In* Part A. Summary Rept. Geol. Surv. Dept. for 1901. Geol. Surv. Canad. Ann. Rept. 1901, new ser., **14**, pp. 172A–185A.

Lists *Receptaculites* in Trenton limestone in the bed of Sucker Creek near Deseronto Junction, near Kingston, Ontario.

Emmons, Ebenezer

1855. American geology, containing a statement of the principles of the science with full illustrations of the characteristic American fossils, pt. 2. Albany, N. Y. 251 pp., 84 text-figs., 18 pls.

Receptaculites (now *Ischadites*) *circularis* is described and illustrated as a new species and is compared to *R. neptuni* DeFrance, which is also figured and briefly described.

Part 2 of volume 1 was published in 1855 and part 1 was reprinted at the same time. Another edition was published in Albany in 1875 and included not only both parts of volume 1, but another part as well.

Erwin, R. B.

1957. The geology of the limestone of Isle La Motte and South Hero Islands, Vermont. Bull. Vermont Geol. Surv. **9**, 94 pp., 20 pls., 3 tables.

Zittelella varians (Billings) is reported from the "Upper Limestone" beds of the Crown Point Limestone at Fisk Point and from the Valcour Limestone, both on Isle La Motte, and from the same formations on South Hero Island.

Ethridge, Robert

1878. Paleontology of the coasts of the Arctic lands (visited by the late British expedition under Captain Sir George Nares R.N., K.C.B., F.R.S.). Quart. Jour. Geol. Soc. London, **34**, pp. 568–636, pls. 25–29.

The new receptaculitid *Receptaculites arcticus* is described from Ordovician rocks at Cape Louis Napoleon and Cape Frazer, Arctic Archipelago, Grinnell Land. In addition, several fragments of *R. occidentalis* Salter are described from the same beds at Cape Louis Napoleon.

Fenton, C. L.

1928. The stratigraphy and larger fossils of the Plattin Formation in Ste. Genevieve County, Missouri. Amer. Midl. Nat., **11**, no. 2, pp. 125–143, 7 pls.

A specimen of *Dystactospongia minor* Ulrich and Everett is described, but not figured, from the Platteville Limestone at Dixon, Illinois, and from the Plattin Formation of Ste. Genevieve Co., Missouri.

Fenton, C. L., and Fenton, M. A.

1958. The fossil book and record of prehistoric life. Doubleday & Co., Inc., Garden City, New York. xiii + 482 pp.

A general text-book review of sponges, including illustrations of *Astylospongia praemorsa* (Goldfuss), *Strobilospongia* (now *Pattersonia*) *tuberosa* Beecher, *Brachiospongia digitata* (Owen), *Astraeospongia meniscus* (Roemer), *Ischadites iowensis* (Owen), *Receptaculites oweni* (Hall), and *Vauxia dignata* (misspelling of *digitata*) Walcott.

Finks, R. M.

1960. Late Paleozoic sponge faunas of the Texas region, The siliceous sponges. Bull. Amer. Mus. Nat. Hist., **120**, art. 1, 160 pp., 50 pls., 77 text-figs.

Although this paper concerns primarily the Late Paleozoic sponges of Texas and the Midcontinent region, Early Paleozoic sponges are included in the discussion of evolution of Paleozoic siliceous sponges, in discussion of the Anthaspidellidae and Chiastoclonellidae in the Tetracladina, and of the new superfamilies Protospongioidea and Brachiospongioidea in the Lyssakida. This paper is a primary reference for Late Paleozoic sponges.

1967. S. A. Miller's Paleozoic sponge families of 1889. Jour. Paleont., **41**, no. 3, pp. 803–807.

The families: Anthaspidellidae, Astraeospongiidae, Dystactospongiidae, Leptomitidae, Microspongiidae, and Pattersoniidae were proposed by Miller, although some have been ascribed to other authors. In addition, the receptaculitid family, Pasceolidae, was proposed by Miller. Lists of genera included in the various families are given.

The genera: *Anthaspidella*, *Camarocladia*, *Edriospongia*, *Streptosolen*, *Strotospongia*, and *Zittelella* are considered to have been taken

by Miller from proofs of Ulrich and Everett's paper, and are therefore to be cited as genera of Ulrich and Everett, in Miller, since Miller's paper predates the publication of the major paper by Ulrich and Everett.

Fisher, D. J.

1925. Geology and mineral resources of the Joliet Quadrangle. Bull. Ill. State Geol. Surv., **51**, 160 pp., 6 pls. 47 text-figs., 9 tables.

Calathium sp. is illustrated from Niagaran dolomite from Joliet, Illinois. This is the same specimen later illustrated by Bretz. (See also Toomey and Ingels, 1964).

Flower, R. H.

1952. Cephalopods from the Harding and Manitou Formations of Colorado. Jour. Paleontol., **26**, no. 3, pp. 505–518, pls. 60–61.

Dictyorhabdus priscus Walcott was originally described as part of a chimaeroid fish and was later referred to the cephalopods, but is here classed as a hexactinellid sponge. Specimens are described and figured from the Harding Sandstone near Canyon City, Colorado.

. . . "There is little to support its vertebrate nature . . . ornament . . . was external in position . . . appearance of a budding, colonial organism. In . . . section . . . it shows only a fine lamination as pointed by Stromer (1920, p. 10). Flower (1952, p. 506) apparently interpreted a figure published by Dean (1906, fig. 114) as a thin-section, which it is not. His . . . misinterpretation . . . led him to identify *Dictyorhabdus* as a glass sponge, which is surely far from the truth. Dean (1906, p. 135) suggested that it might be fragments of the shells of mollusks . . . the shell . . . is not calcium carbonate, but probably phosphatic. Therefore, it . . . must remain for now among the problematica" (Denison, 1967, Fieldiana, Geology, vol. 16, no. 6, p. 186).

Foerste, A. F.

1903. The Cincinnati Group in western Tennessee, between the Tennessee River and the Central Basin. Jour. Geol., **11**, pp. 29–45.

A sponge species related to *Hindia gregaria* Bassler is reported as abundant in lower layers of the Saltillo Limestone of the Cincinnati Group at Clifton, Tennessee.

1903. Silurian and Devonian limestones of Western Tennessee. Jour. Geol., **11**, pp. 554–583; 679–715, 10 figs.

The following sponges are listed from the Silurian of western Tennessee: *Chiastoclonella headi* Rauff, *Dendroclonella rugosa* Rauff, *Anomoclonella zitteli* Rauff, *Astylomanon* (now *Palaeomanon*) *cratera* (Roemer), *A.* (now *Palaeomanon*) *pluriexcavatum* (Rauff), *A.* (now *Palaeomanon*) *verrucosum* (Rauff), *A.* (now *Palaeomanon*) *verrucosum bulbifera* (Rauff), *Astylospongia imbricato-articulata* Roemer, *A. praemorsa* (Goldfuss), *A. praemorsa pusilla*, *Carpomanon glandulosum* Rauff, *Caryomanon incisolobatum* Rauff, *C. roemer* (Hinde), *C. stellatim-sulcatum* (Roemer) and *C. stellatim-sulcatum distorta* Rauff, *Pycnopegma callosum* Rauff, *P. pileum* Rauff, and *P. stromatoporoides* Rauff. *Astraeaspongia meniscus* (Roemer) and *Hindia sphaeroidalis* Duncan.

1909. Fossils from the Silurian formations of Tennessee, Indiana, and Kentucky. Bull. Sci. Lab. Denison Univ., **14**, pp. 61–116, 4 pls.

Caryomanon patei, a new species, is described and illustrated from the Brownsport Formation near the A. B. Gant place, northeast of Martins Mills, Tennessee.

1909. Preliminary notes on Cincinnatian and Lexington fossils. Bull. Sci. Lab. Denison Univ., **14**, pp. 289–324, pls. 7–11.

Brachiospongia laevis and *Dystactospongia madisonensis* are two new species described from Kentucky and Indiana, respectively. *Brachiospongia* occurs in the Mount Hope bed and *Dystactospongia* is reported from the lower Saluda beds. *Heterospongia* sp. is reported from the Liberty beds near Lebanon, Kentucky.

1910. Preliminary notes on Cincinnatian and Lexington fossils of Ohio, Indiana, Kentucky, and Tennessee. Bull. Sci. Lab. Denison Univ., **16**: pp. 17–87, 6 pls.

The new species *Pasceolus camdenensis* is described from Camden, Ohio, and is superficially similar to cystoids. The sponge *Dystactospongia madisonensis* Foerste is also reported from the lower part of the Saluda Formation, but is not described here.

1916. Notes on Cincinnatian fossil types. Bull. Sci. Lab. Denison University, **18**, pp. 285–355, pls. 1–8.

The new genus *Caliculospongia* and the new species *C. pauper* and *Dystactospongia* (?) *cavernosa* are described and figured from the Cincinnatian near Lexington, Kentucky, and Cincinnati, Ohio, respectively. The label was lost on *D.* (?) *cavernosa*, but it was prob-

ably collected from the Maysville Group. *C. pauper* was collected from the Cynthiana Formation in northeast Lexington.

In addition, specimens of *Dystactospongia madisonensis* Foerste and *Leptopoterion faberi* (Miller) are described and figured, along with the receptaculitids *Pasceolus claudei* Miller and *P. tumidus* (James). Foerste suggests that *P. darwini* Miller, *P. claudei* Miller, and *P. tumidus* (James) might all belong to the same species.

1916. Upper Ordovician formations in Ontario and Quebec. Geol. Surv. Canad. Mem., **83,** 279 pp., 8 figs.

Cyathophycus reticulatus Walcott is reported as a characteristic fossil of the Utica Shale in New York.

1920. The Kimmswick and Plattin Limestone of northeastern Missouri. Bull. Sci. Lab. Denison Univ., **19:** pp. 175–224, pls. 21–23.

Receptaculites oweni Hall is widespread in the Kimmswick Limestone, but is not reported in this paper from the Plattin Limestone. *Hindia parva* Ulrich is reported from the Auburn Chert in Lincoln County, Missouri, from rocks equivalent to the upper Plattin Limestone.

Ford, S. W.

1878. Descriptions of two new species of Primordial fossils. Amer. Jour. Sci., Arts., ser. 3, **15,** no. 86, art. 16, pp. 124–127, 1 text-fig.

This paper deals with archaeocyathids, but *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* Billings is considered a sponge because of the presence of branched spicules.

Fortier, Y. O.

1963. General geology and systematic stratigraphy, chap. 2. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem., **320,** pp. 15–100, tables 1–7.

Receptaculites sp. is reported from talus of the Middle Ordovician Croker Bay Formation at Dundas Harbour on Devon Island.

Fredrickson, E. A.

1961. Pre-Pennsylvanian rocks of the Canon City area. *In* Symposium on Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf. Rocky Mtn. Assoc. Geol., pp. 133–142, 2 text-figs.

Faintly spicular (?) chert is noted in a measured section of the Manitou Formation in Fantom Canyon, Fremont County, and *Receptaculites* (?) sp. is reported in the lower and middle part of the Fremont Formation in Priest Canyon. *Receptaculites oweni* Hall is reported from the Fremont Formation on Paradise Ridge.

Fritz, M. A.

1941. Catalogue of types in the Royal Ontario Museum of Palaeontology. Contr. Roy. Ontario Mus. Palaeontol., no. 5, pt. 1, pp. 1–50.

The holotype of *Aulocopium* (*Aulocopella?*) *gigantea* Parks, cotypes of *Eocoryne geminum* Matthew, and topotypes of *Eocoryne geminum* Matthew and *Protospongia* (?) *minor* Matthew are in the collection. Also included are diplotypes of *Gaspespongia basalis* Parks and *Matthewcyathus pavanoides* (Matthew), the latter an archaeocyathid.

Garrels, R. M.

1951. A textbook of geology. Harper & Brothers, New York. 511 pp., 298 text-figs.

A very general discussion of sponges is given, with *Hydnoceras* from the Devonian illustrated.

Girty, G. H.

1895. A revision of the sponges and coelenterates of the lower Helderberg Group of New York. 14th Ann. Rept. New York State Geol., **1894**, pp. 259–309, 7 pls.

Hindia fibrosa Roemer is described from the Lower *Pentamerus* beds and from the Lower Helderberg Group in New York. *Receptaculites* is discussed and specimens of *Receptaculites oweni* Hall are described. The new genus *Lysactinella* is also proposed.

Glenister, B. F.

1963. Burnett Inlet. *In* Geology of the northcentral part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem., **320**, pp. 179–184.

Receptaculites sp. is reported from 100 to 350 feet above the base of the Limestone Member of the Middle and Upper Ordovician Cornwallis Formation at Burnett Inlet on Devon Island.

Glenister, B. F. and Thorsteinsson, R.

1963. Herschel Bay and Rigby Bay. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem., **320**, pp. 195–201, text-fig. 5.

Receptaculites sp. is reported from the middle unit of the Ordovician Cornwallis Formation at Herschel Bay, Devon Island.

Goldring, W.

1943. Geology of the Coxsackie Quadrangle, N. Y. N. Y. State Mus. Bull., **332**, 374 pp., 71 text-figs.

The sponges *Pyritonema* (now *Hyalostelia*) *rigidium* (Ruedemann) and *Teganium merino* Ruedemann are reported from the Mount Merino beds at Mount Merino. Archaeocyathids are also reported with the sponges.

Goldstein, A., Jr. and Hendricks, T. A.

1953. Siliceous sediments of Ouachita facies in Oklahoma. Bull. Geol. Soc. Amer., **64**, pp. 421–442, 2 figs., 4 pls.

Partially silicified calcareous sponge spicules (some apparently originally siliceous) are reported from Ordovician rocks on Black Knob Ridge in Oklahoma.

Grabau, A. W.

1921. A textbook of geology, Part II. Historical geology. D. C. Heslter and Co., N. Y., viii + 976 pp., 1980 figs.

Sponges are treated in the stratigraphic context. *Brachiospongia digitata* (Owen) and *Receptaculites oweni* Hall are illustrated and discussed from Ordovician rocks. The Silurian sponges *Astraeospongia meniscus* (Roemer) and *Astylospongia praemorsa* (Goldfuss) are similarly treated.

In the systematic section the following sponges are illustrated and discussed: *Choia carteri* Walcott, *Protospongia hicksi* Hinde, *Vauxia hindii*, *V. gracilenta* Walcott, *Eiffelia globosa* Walcott, *Chancelloria eros* Walcott, *Takakkawia lineata* Walcott, *Chancelloria libo* Walcott, and *Receptaculites* sp.

Grabau, A. W. and Shimer, H. W.

1906. North American index fossils. Part 1, Protozoa, Porifera, Hydrozoa, and Anthozoa. New Era Printing Co., Lancaster, Pa. 106 pp., 175 text-figs.

The following genera and species of sponges are mentioned and briefly described: *Astraeospongia meniscus* (Roemer,) *Astylospongia* (now *Caryomanon*) *inciso-lobata* Roemer, *A. praemorsa* (Goldfuss), *Brachiospongia digitata* (Owen), *Hindia fibrosa* Hinde (now *H. sphaeroidalis* Duncan), in addition to other later forms. *Astylospongia praemorsa* (Goldfuss) and *Brachiospongia digitata* (Owen) are also figured.

Receptaculitids included in the descriptions include: *R. hemisphericus* Hall, *R. mammillaris* Walcott, *R.* (now *Ischadites*) *ohioensis* Hall and Whitfield, *R. oweni* Hall, and *Ischadites iowensis* (Owen). The latter three species are also figured.

Grant, C. C.

1895. Palaeozoic Sponges. Jour. Proc. Hamilton Assoc. 1894–95, no. 11, p. 84.

Protospongia fenestrata Salter is mentioned in this paper which relates to the range of hexactinellid sponges.

Grant, R. E.

1965. Faunas and stratigraphy of the Snowy Range Formation (Upper Cambrian) in southwestern Montana and northwestern Wyoming. Mem. Geol. Soc. Amer., **96,** 171 pp., 15 pls., 1 text-fig.

Multivasculatus ovatus Howell and Van Houten is described and figured as two isolated hexactinellid spicules. It is concluded that the *Protospongia* sp. described by Lochman (1950) are of this species since the spicules are hexacts rather than tetracts such as typify *Protospongia*. The hexacts are a good local guide to Trempealeauan rocks for they are rare in Franconian units.

Greacen, K. F. and Ball, J. R.

1944. Studies of Silurian fossils in the Thomas A. Greene Collection at Milwaukee-Downer College. Trans. Wisc. Acad. Sci., **36,** pp. 415–419.

Sponges are listed by genus only and include the following forms: *Receptaculites, Ischadites, Cerionites,* and "an undetermined 'rare'

form." Much of the paper concerns the historical background of T. A. Greene and his collection.

1946. Silurian invertebrate fossils from Illinois in the Thomas A. Greene Memorial Museum at Milwaukee-Downer College. Bull. Milwaukee-Downer Coll., 61 pp.

Ischadites or *Receptaculites* sp., *Cerionites dactyloides* (Owen), *Cerionites* sp., and an undetermined form are reported from Illinois, and *Receptaculites hemisphericus* (Hall), *R. tesselatus* (Winchell and Marcy) (now *Ischadites infundibulum* (Hall)), and *Receptaculites* sp. are reported from Illinois and Wisconsin. Most specimens came from near Bridgeport and Hawthorne, Illinois and from Racine, Wisconsin.

Greife, J. L. and Langenheim, R. L.

1963. Sponges and brachiopods from the Middle Ordovician Mazourka Formation, Independence Quadrangle, California. Jour. Paleontol., **37**, pp. 564–574, pls. 63–65, text-figs. 1, 2.

A fauna of brachiopods and sponges is summarized from the Mazourka Formation in the Independence quadrangle of southeastern California. The new species *Nevadocoelia mazourkensis* and *Calycocoelia inyoensis* are described and figured, and the following previously described species are described and figured: *Nevadocoelia* cf. *N. pulchra* Bassler, *Lissocoelia ramosa* Bassler, *Calycocoelia typicalis* Bassler, *Patellispongia* cf. *P. oculata* Bassler, *Hesperocoelia undulata* Bassler, and *Streptosolen* sp.

Greiner, H. R.

1963. Haughton Dome and area southwest of Thomas Lee Inlet. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem., **320**, pp. 208–216, text-fig. 7.

Receptaculites sp. is reported from a unit which may include top beds of the Ordovician Cornwallis Formation or lower beds of the Ordovician and Silurian Allen Bay Formation from the flank of Haughton Dome, on Devon Island.

1963. Boat Point. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Mem. Geol. Surv. Canad., **320**, pp. 216–219, text-fig. 8.

Astraeospongia sp. and *Receptaculites* sp. are reported from talus of either the Lower or Upper Dolomite of the Ordovician and Silurian Allen Bay Formation south of Boat Point, Devon Island.

Gümbel, C. W.

1865. Beiträge zur Kenntniss der Organisation und systematischen Stellung von *Receptaculites*. Trans. Roy. Bayerisch Acad. Sci., Math-Phys. Chem. (Abh. d. k. bayer. akad. d. Wiss.), **12**, pt. 1, 49 pp., 1 pl. (pp. 168–215).

The synonymy of receptaculitids, bibliography, and history is given. Receptaculitids are assigned to Foraminifera.

Gutschick, R. C.

1954. A new species of *Astraeospongia* from the Middle Ordovician of northern Illinois. Jour. Paleontol., **28**, no. 4, pp. 430–433, 2 text-figs.

The new species *Astraeospongia dixonensis* is proposed on the basis of 11 octactinellid spicules recovered in an acetic acid residue from the Mifflin Formation, Briton Member, near Dixon, Illinois. All 11 spicules are figured by bleached photographs, and one photograph is shown.

Hague, Arnold

1892. Geology of the Eureka district, Nevada. U. S. Geol. Surv. Monogr. 20, 419 pp., 8 pls.

Protospongia fenestrata Salter is listed from the Hamburg Limestone of the district. *Receptaculites ellipticus* Walcott, *R. elongatus* Walcott, and *R. mammillaris* Walcott are reported from the Pogonip rocks of the Eureka area, as well as from Lone Mountain to the northwest and the Fish Springs Range to the south.

Hall, C. W. and Sardeson, F. W.

1892. Paleozoic formations of southwestern Minnesota. Bull. Geol. Soc. Amer., **3**, pp. 331–368, pls. 10–12.

The questionable forms *Raufella* (sic) *filosa* Ulrich and *R. palmipes* Ulrich are listed from the *Stictopora* beds of the Trentonian limestone and shales.

Receptaculites (now *Ischadites*) *iowensis* Owen and *R. oweni* Hall are listed from the *Orthisian* bed, and *R. oweni* from the *Maclurea* bed of the Galena beds.

Hall, James

1847. Descriptions of the organic remains of the lower division of the New York system. Palaeontology of New York, New York Geol. Surv., **1,** 338 pp., 87 pls.

A receptaculitid, designated as an undetermined genus but a new species, *cyathiformis,* is described and illustrated from the Trenton Limestone at Carlisle, Pennsylvania. This is now considered *Ischadites cyathiformis* (Hall). *Receptaculites neptuni* (now *R. oweni* Hall) is described and illustrated from the Trenton Limestone at Carlisle, Pennsylvania.

1859. Descriptions and figures of the organic remains of the lower Helderberg Group and the Oriskany Sandstone. Palaeontology of New York, N. Y. Geol. Surv., **3,** 523 pp. (with accompanying volume of 120 plates)

The new species *Dictyocrinus* (now *Ischadites*) *squamifer* is described and figured, from the Lower Helderberg Group at Schoharie, New York.

1861. Descriptions of new species of fossils. *In* Report of the superintendent of the Geological Survey, exhibiting the progress of the work, January 1, 1861. E. A. Calkins & Co., Madison, Wisc. Pp. 9–52.

Description of the genus *Solenoides* (now *Receptaculites*) of Owen (1852) is given, along with the description of *S. iowensis.* Hall places this form in *Receptaculites,* and also gives short descriptions of the new species *R. fungosum* (now *Ischadites iowensis*), *R. globulare* (now *I. iowensis*), *R.* (now *Ischadites*) *infundibulum,* and *R. hemisphericum.*

1862. Note on the geologic range of the genus *Receptaculites* in American Palaeozoic strata. 16th Ann. Rept. Regents of the Univ. of the State of New York on the condition of the State Cabinet of Nat. Hist., App. D, Contr. Paleontol., pp. 67–69.

The genus *Receptaculites* is discussed and the relation of the genotype *R. neptuni* Murchison to *Coscinopora sulcata* (now *R. oweni*) Owen and *Orbiculites* (?) *reticulata* (now *Ischadites iowensis*) Owen are described. The following species are mentioned in the discussion: *Receptaculites fungosus* (now *I. iowensis*) Hall, *R. hemisphericus* (Hall), *R. infundibuliformis* (now *I. infundibulum*) Eaton, *R.* (now *I.*) *infundibulum* Hall, *R. iowensis* (now *I. iowensis*) Billings, *R. neptuni* (now *R. occidentalis* Salter) Murchison, *R. oweni* (Hall), *R. occidentalis* Salter, *R. orbicularis,* and *R.* (now *I.*) *subturbinatus* Hall.

Receptaculites neptuni DeFrance is reported from the Trenton limestone, along with *R. occidentalis* Salter, a form which also occurs in the Galena Limestone with: *R. oweni* Hall, *R.* (now *Ischadites*) *iowensis* (Hall), *R. fungosis* (now *Ischadites iowensis*), and *R. orbicularia*. Niagaran *Receptaculites* includes *R. infundibulum* (Hall) (now *I. infundibulum*), *R. hemisphericus* Hall, and *R.* (now *Ischadites*) *subturbinatus* (Hall). *Receptaculites infundibuliformis* (now *I. infundibulum*) (Hall) occurs in the Lower Helderberg, along with the sponges *Astylospongia*, *Palaeomanon*, and *Astraeospongium*.

1863. Note on the occurrence of *Astylospongia* in the lower Helderberg rocks. 16th Ann. Rept. Regents Univ. of State of New York on the condition of the State Cabinet of Nat. History, and the antiquarian and historical collection annexed thereto, Appendix D, Contributions of Paleontology; principally from investigations made during the years 1861 and 1862, pp. 69–70.

This description of the Lower Helderberg (now Silurian) fauna of Tennessee includes *Astraeospongia meniscus* (Roemer), *Astylospongia imbricato-articulata* Roemer, *A. inciso-lobata* (now *Caryomanon incisolobatum*) Roemer, *A. inornata* (now *Hindia sphaeroidalis*) Hall, *A. praemorsa* (Goldfuss), *A. stellatim-sulcata* (now *Carpomanon stellatim-sulcatum*) Roemer.

1863. Notice of some new species of fossils from a locality of the Niagara group, in Indiana; with a list of identified species from the same place. Issued in advance of Trans. Albany Inst. (Advance sheet), 34 pp.

Receptaculites (now *Ischadites*) *subturbinatus*, a new species, is described from the Niagaran of Indiana, and is compared to *R. hemisphericus* Hall.

Astylospongia praemorsa (Goldfuss) is also identified from the same beds.

1864. Notice of some new species of fossils from a locality of the Niagara Group, in Indiana with a list of identified species from the same place. Trans. Albany Inst., **4**, art. 12, pp. 195–228.

Numerous specimens of *Astylospongia praemorsa* (Goldfuss), smaller than related forms in Hall's collections from Tennessee, occur at the locality. *Receptaculites subturbinatus* (Hall) is also a small species of the genus and is compared with *R. hemisphericus* Hall from Wisconsin. Most of the paper deals with the abundant echinoderm, brachiopod, and arthropod fauna.

1867. Account of some new or little known species of fossils from rocks of the age of the Niagaran Group. 20th Ann. Rept. State Cab. Nat. Hist., pp. 305–401, 12 pls. (Revised edition 1870, and also originally printed in advance, for the 18th Rept. on the New York State Cabinet).

Ischadites (now *Receptaculites*) *tesselatus* Winchell and Marcy and *Receptaculites infundibulus* (now *I. infundibulum*) Hall are reported as being identical in form and character.

1868. Index and list of fossils. *In* 20th Ann. Rept. Regents Univ. State N. Y. on the Condition of the State Cabinet of Nat. Hist., (first edition), pp. 395–401.

Receptaculites hemisphericus Hall and *R.* (now *Ischadites*) *infundibulus* Hall are listed as occurring in Niagaran rocks in Wisconsin, Illinois, and Iowa.

1870. Descriptions of new or little known species of fossils from rocks of the age of the Niagara group. *In* 20th Ann. Rept. Regents of the Univ. State N. Y. on the Condition of the State Cabinet of Nat. Hist., (revised edition) pp. 347–438.

Receptaculites hemisphericus Hall and *R.* (now *Ischadites*) *infundibulus* Hall are listed as occurring in Niagaran rocks in Wisconsin, Illinois, and Iowa.

1871. Organic remains of the Niagara group and associated limestones. Geol. Surv. State Wisc., 1859–1863, Palaeontol., 94 pp., pls. 1–25.

Receptaculites hemisphericus Hall and *R.* (now *Ischadites*) *infundibulus* Hall are listed as occurring in Niagaran rocks in Wisconsin, Illinois, and Iowa.

1875. The fauna of the Niagara Group in central Indiana (doc. ed. without text); 28th Ann. Rept., N. Y. State Mus. Nat. Hist., 32 pls. and explanations.

Receptaculites (now *Ischadites*) *subturbinatus* (Hall), *Astylospongia praemorsa* (Goldfuss), and *A. ?* (*Palaeomanon*) *bursa* Hall are figured on Plate 3. The latter form is a new species, illustrated and described in the plate explanation here for the first time. All three forms occur at Waldron, Indiana.

1879. Descriptions of new species of fossils from the Niagara Formation at Waldron, Indiana. Adv. Sheet, printed by J. Munsell, Albany, N. Y., 20 pp.

The new species *Receptaculites sacculus* is described, but not illustrated, from the Waldron Shale at Waldron, Indiana.

1879. The fauna of the Niagara Group in central Indiana. 28th Ann. Rept. N. Y. State Mus. Nat. Hist., pp. 99–203, pls. 3–34.

Specimens of *Receptaculites* (now *Ischadites*) *subturbinatus* Hall, *Astylospongia praemorsa* (Goldfuss), *Astylospongia praemorsa* var. *nuxmoschata* (now *Caryospongia juglans nuxmoschata*) Hall, *Astylospongia* (*Palaeomanon*) *bursa* (now *P. bursa*) Hall are described and figured. A single specimen of *Astylospongia imbricato-articulata* Roemer is also mentioned from the same locality, Waldron Shale at Waldron, Indiana.

1882. Paleontology, descriptions of the species of fossils found in the Niagara Group at Waldron, Indiana. Indiana Dept. Geol. Nat. Hist., 11th Ann. Report, 1881, pp. 217–345.

The following sponges are described and illustrated with a synonomy for each: *Astylospongia* (*Palaeomanon*) *bursa* (now *P. bursa*) Hall is compared to *Palaeomanon cratera* (Roemer), *A. imbricato-articulata* (Roemer), (not figured), *A. praemorsa* (now *A. praemorsa pusilla*) Hall, and *A. praemorsa* var. *nuxmoschata* (now *Caryospongia juglans nuxmoschata*) Hall. The receptaculitids, *R. sacculus* Hall and *R.* (now *Ischadites*) *subturbinatus* Hall are also described and figured.

1882. Notes on the family Dictyospongidae, plates 17–20, with explanations. Issued in advance of the 35th Ann. Rept. N. Y. State Mus. Nat. Hist., 1884.

This paper is composed of plates and explanations. It is included in the 35th Ann. Report. N. Y. State Mus. Nat. Hist., 1884.

1883. List of Niagara fossils from Waldron, Indiana. N. Y. State Cab. Nat. Hist. 36th Ann. Rept., App. A., pp. 21–25.

Receptaculites (now *Ischadites*) *subturbinatus* (Hall), *R. sacculus* Hall, *Astylospongia praemorsa* (Goldfuss), and other sponges which are unidentified are listed from the Silurian at Waldron, Indiana.

1883. Van Cleves Fossil Corals. 12th Rept. State Geol., Indiana Geol. Nat. Hist., Paleontol., pp. 234–384.

Receptaculites oweni (Hall) is illustrated and described and compared to *R. occidentalis* Salter and *Coscinopora sulcata* (now *Receptaculites oweni*) Owen.

1884. (First Annual) Report of the State Geologist of New York for 1882. N. Y. Assembly Doc. 32, 15 pp., plates 17–21.

The following species of *Receptaculites* are figured: *R. squamifer* Hall and the new species *R. monticulatus* from the Lower Helderberg of Schoharie and Clarkesville, N. Y., respectively; and *R. infundibuliformis* (now *Ischadites infundibulum* (Hall) and the new species *R. bursiformis* Hall from Schoharie, New York, on the advanced printing of plate 24.

1884. Descriptions of the species of fossil reticulate sponges, constituting the family Dictyospongidae. 35th Ann. Rept., N. Y. State Mus. Nat. Hist., pp. 465–481, pls. 17–21.

Several new genera and species are proposed for Devonian and Mississippian sponges, along with expanded or supplementary descriptions of forms previously described. The only Ordovician sponges reported and described are *Cyathophycus reticulatus* Walcott and *C. subsphericus* Walcott, now considered *Teganium subsphericum* Rauff, both from the Utica Shale. *C. reticulatus* is illustrated.

This part was issued twice, separately, as extracts. One part under the same title without plates, consisting of 19 pages (pp. 1–19), and the second part with plates (pp. 465–481, pls. 18–20 (21)). The dates on both are 1884.

1884. Fossil corals of the Niagara Group. 35th Ann. Rept., N. Y. State Mus. Nat. Hist., pp. 409–420, pls. 23–30.

The new genus *Cyathospongia* and the new species *C. excrescens* are described from the "Niagara" limestone at the Falls of the Ohio River.

1885. On the fossil reticulate sponges constituting the family Dictyospongidae (abstr.). Rept. 54th Meet. Brit. Assoc. Adv. Sci., Montreal, 1884, pp. 725–726; and in Geol. Mag., ser. 3, **1**, pp. 557–558.

Mentions six foreign species and 37 American species of dictyosponges described under the genera: *Cyathophycus, Dictyophyton, Ectenodictya, Lyrodictya,* and *Physospongia* by Hall and *Uphantaenia* Vanuxem. All are Mississippian and Devonian except *Cyathophycus* which is reported from the Ordovician Utica Slate of New York.

1887. Note on the occurrence of the Dictyospongidae in the state of New York. Ann. Rept., New York State Geol., **6**, pp. 36–38.

Cyathophycus reticulatus Walcott and *C.* (now *Teganium*) *subsphericus* Walcott are reported from the Utica Shale; and *Rhombodictyon discum* Whitfield and *R. reniforme* Whitfield occur in the Hudson River Slate.

1890. On new genera and species of the family Dictyospongidae. New forms of Dictyospongidae from the rocks of the Chemung Group. Bull. Geol. Soc. Amer., **1**, pp. 22–23.

Most of the forms described and discussed are from the Devonian Chemung Group, but comments are also made on *Protospongia*, *Cyathophycus*, and *Acanthodictya* from older rocks.

Hall, James and Clarke, J. M.

1898. A memoir on the Palaeozoic reticulate sponges constituting the family Dictyospongidae. Mem. N. Y. State Mus., **2**, 350 pp., 70 pls., 45 figs.

Most of this classic monograph consists of description and illustration of the famed Devonian and Mississippian glass sponges, but some Ordovician and Silurian representatives of the family are described and illustrated. *Cyathophycus reticulatum* (Walcott) and *Sphaerodictya* (now *Teganium*) *subsphaerica* (Rauff) are both reported from the Utica Shale, and *Dictyospongia danbyi* (M'Coy) is reported from the Silurian of Great Britain. *Cyathophycus reticulata* and *Sphaerodictya subsphaerica* are figured. The new genus *Dictyospongia* is proposed for *Tetragonis* (=*Dictyophyton*) *danbyi* (M'Coy).

The memoir was issued later in two parts. Part one was published twice under the same title.

(1) N. Y. Geol. Surv., 15th Ann. Rept., **2**: pp. 753–890, 47 pls., 17 figs.

(2) N. Y. State Mus., 49th Ann. Rept., **3**: pp. 743–894, 67 pls., 17 figs.

Hall, James and Simpson, G. B.

1887. Corals and Bryozoa; text and plates containing descriptions and figures of species from the Lower Helderberg, Upper Helderberg, and Hamilton Groups. Palaeontology of New York N. Y. State Geol. Surv., **6**, 298 pp., 66 pls.

Receptaculites infundibuliformis Hall (now *Ischadites infundibulum*) and *Ischadites squamifer* Hall are described and figured from the Lower Helderberg, and *I. bursiformis* Hall and Simpson is described and illustrated from the Schoharie Grit from Albany and Schoharie counties, New York.

Hall, James and Whitfield, R. P.

1875. Fossils of the Niagara Group. *In* Descriptions of invertebrate fossils, mainly from the Silurian System. Geol. Surv. Ohio, Palaeontol., **2**, Pt. 2, sec. 1, pp. 121–157, pls. 6–9.

The new Niagaran receptaculitid, *Receptaculites* (now *Ischadites*) *ohioensis*, is described and figured from near Yellow Springs, Ohio.

Hall, James and Whitney, J. D.

1862. Report on the geological survey of the state of Wisconsin., **1**, 455 pp., plates, maps and figures.

Receptaculites oweni Hall is illustrated from the Galena Limestone. *Receptaculites fungosus* Hall (now *Ischadites iowensis* (Owen)) *R. globularis* Hall (now *I. iowensis* (Owen)), *R.* (now *Ischadites*) *iowensis* Owen, and *R. oweni* Hall are listed from the Galena Limestone and *R. hemisphericus* Hall, and *R.* (now *Ischadites*) *infundibulus* Hall from the Racine Limestone.

Hall, J. W. and Fritz-Gaertner, R.

1879. On the structure of *Astraeospongia meniscus*. 30th Ann. Rept., N. Y. State Mus. Nat. Hist., pp. 111–116, pl. 3.

The external form is described as per Roemer, and internal "tubes" are described as seen in longitudinal section. The convex side shows a slight depression, often marked by a star. A yellowish substance, "mostly alumina, surrounds the stars and seems to have been a skin or epitheca." Methods of study of this film are discussed, along with the method of growth of the organism. Illustrations are lithographs. All specimens described are from western Tennessee.

The 30th Annual Report of the N. Y. State Museum of Natural History was transmitted to the legislature on April 13, 1877. The title page is dated 1878, however, the date on the paper jacket, which we have before us, is 1879. Therefore, we assume, the date of publication to be 1879 (or at least 1878)—but not 1877.

Harrington, J. W.

1940. Some new features of the internal structure of *Receptaculites* (abstr.). Va. Jour. Sci., **1**, pp. 244–245.

Based on internal structure, the receptaculitids are considered closely related to the sponges. Detail of significant structures is not given.

Hector, James

1861. On the geology of the country between Lake Superior and the Pacific Ocean (between the 48th and 54th parallels of latitude), by the government exploring expeditions under the command of Captain J. Palliser (1857–60). Quart. Jour. Geol. Soc. London, **17**, pp. 388–445, 1 plate, 13 text-figs.

Receptaculites occidentalis Salter is cited from Lower Fort Garry on the Red River.

Henbest, L. G.

1936. Radiolarians in the Arkansas Novaculite, Caballos Novaculite, and Bigfork Chert. Jour. Paleontol., **10**, no. 1, pp. 76–78.

Isolated monaxons and polyaxons of sponges are reported from the Ordovician Bigfork Chert of the Atoka Quadrangle in Oklahoma.

Hinde, G. J.

1883. Catalogue of the fossil sponges in the Geological Department of the British Museum (Natural History). London. 248 pp., 38 pls.

The new genus *Climacospongia* and the new species *C. radiata* Hinde are described from the Silurian of Perry County, Tennessee. From the Silurian of Tennessee also are reported: *Astylospongia praemorsa* (Goldfuss), *Astylospongia* (now *Carpomanon*) *stellatimsulcata* (Roemer), *Astylospongia* (now *Caryomanon*) *inciso-lobata* (Roemer), *Astylospongia imbricato-articulata* Roemer, and *Palaeomanon cratera* (Roemer). The new species *Astylospongia*? (now *Caryomanon*) *roemeri* is described and figured from an unknown locality but is similar in preservation to the other *Astylospongia* from North America.

Brachiospongia digitata (Owen) is reported from the Cincinnatian rocks of Kentucky, and *Astraeospongia meniscus* (Roemer) is reported and described from the Niagaran rocks of Perry County, Tennessee. *Hyalostellia parallela* M'Coy is described from Trentonian Limestone at Ottawa, Ontario, and *Hindia fibrosa* (Roemer) is described from the "Silurian (Lower Helderberg Group)" near Dalhousie, New Brunswick, from the Silurian of Perry County, Tennessee, and from the Lower Helderberg at Schoharie, New York.

Several other Paleozoic sponges and numerous Mesozoic and Cenozoic sponges are described in the volume. This is a standard reference work.

1884. On the structure and affinities of the family of the Receptaculitidae, including therein the genera *Ischadites,* Murch. (*Tetragonis,* Eichw.); *Sphaerospongia,* Pengelly; *Acanthochonia,* gen. nov.; and *Receptaculites,* DeFrance. Quart. Jour. Geol. Soc. London, **40,** pp. 795–849, pls. 36–37.

The receptaculitids are regarded as siliceous hexactinellids in which one ray of the spicule is modified into the rhomboidal to hexagonal plate of the outer wall. The history and stratigraphic distribution of the various genera are given, along with some revision of the various species and an extensive review of the literature dealing with receptaculitids.

One section deals with characteristics of the genera: *Ischadites, Sphaerospongia, Receptaculites,* and the new genus *Acanthochonia,* which is described in some detail.

Earlier workers have placed various forms with the Receptaculitidae, but Hinde concludes the following should not be included in the family: *Mastopora, Escharipora, Nidulites* (which may be equivalent to *Escharipora* and *Cyclocrinus*), *Pasceolus, Sphaerospongia hospitalis* Salter, *S. melliflua* Salter, and *Archaeocyathus.* Hinde is uncertain about the position of *Goniolina* D'Orbigny.

Description and a synonymy are given for *Ischadites koenigii* (Murchison); *I. murchisonii* (Eichwald); *I. lindstroemi* Hinde, a new species; *I. tessellatus* Winchell and Marcy; *I.* ? *inosculans* Salter; *Sphaerospongia tessellata* (Phillips); *Acanthochonia barrandei* Hinde, a new species; *Receptaculites neptuni* DeFrance; *R. occidentalis* Salter; *R. orbis* Eichwald; *R. australis,* Salter; *R.* ? *canadensis* Billings; *R. calciferus* Billings; *R. arcticus* Etheridge; *R. carbonarius* Römer; and *R.* ? *rhombifer* (Römer). Of these, only *Ischadites koenigii* (now part *I. iowensis* and part *I. subturbinatus*) (Murchison), from Illinois, Iowa, Ohio, and Quebec; *I. tessellatus* Winchell and Marcy, from Illinois; *Receptaculites occidentalis* Salter, from Illinois, Wisconsin, Iowa, and Ontario; *R.* ? (now *Ischadites*) *canadensis* Billings, from Ontario; *R. calciferus* Billings, from Mingan Islands, Quebec; and *R. arcticus* Etheridge, from Arctic Canada are reported from North America.

1887. A monograph of the British fossil sponges, Part I, Sponges of Palaeozoic and Jurassic strata. Palaeontol. Soc., London, **40,** pp. 1–92, pls. 1–8.

In addition to description of the currently known British fossil sponges, the paper summarizes the general character of sponges,

presents a classification of fossil sponges, and lists an extensive bibliography. The paper is a standard reference for fossil sponges and describes several species also known from North America. Included are: *Protospongia fenestrata* Salter, *P. hicksi* Hinde, *Astylospongia* (now *Caryomanon*) *incisolobata* (Roemer), *Ischadites koenigii* (now part. *I. iowensis*) (Hinde), and possibly some species of *Hyalostelia*.

Other parts of the same series were published as follows: Part II, pp. 93–188, pl. 9, in **41,** 1888; Part III, pp. 189–254, pls. 10–19, in **47,** 1893; and Part IV, Title Page and Index, pp. 255–264, in **65,** 1912. No early Paleozoic forms from North America were described in these latter parts.

1887. On the genus *Hindia* Duncan, and the name of the typical specimen. Ann. Mag. Nat. Hist., ser. 5, **19,** no. 8: pp. 67–79, 2 text-figs.

The microscopic structure of the tetracladine sponge is described, and the siliceous nature of the spicules established. Hinde discounts the evidence of boring by a plant as proving a calcareous nature of *Hindia* spicules, for, according to Hinde, the organism apparently bored siliceous material too. *Hindia fibrosa* (now. *? H. sphaeroidalis* Duncan) Hinde is illustrated.

1888. Notes on sponges from the Quebec Group at Métis, and from the Utica Slate. *In* New species of fossil sponges from Little Métis, Province of Quebec, Canada. Notes on Specimens, Canad. Rec. Sci., **3:** pp. 59–68, (reprint, 1888, Peter Redpath Museum, McGill University, Montreal, Notes on Specimens, pp. 59–68).

Protospongia tetranema Dawson and *Cyathophycus reticulatus* Walcott are described from specimens loaned by Dawson. All are compared with protosponges from Great Britain and with the Devonian dictyosponges from New York.

1888. Note on the spicules described by Billings in connection with the structure of *Archaeocyathus minganensis.* Geol. Mag., ser. 3, **5:** pp. 226–228, 1 text-fig.

Hinde concludes that the spicules described by Billings as from *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* Billings are broken portions of the outer wall, and not spicules at all. *Archaeoscyphia* has an anthaspidellid spicule, and the current thought is that the spicules described by Dawson may have been related to this species.

1889. On *Archaeocyathus* Billings, and on other genera, allied to or associated with it, from the Cambrian strata of North America, Spain, Sardinia, and Scotland. Quart. Jour. Geol. Soc. London, **45**: pp. 125–148, pl. 5.

Archaeocyathus (now *Archaeoscyphia*) *minganensis* Billings and *Calathium?* (now *Nipterella*) *paradoxica* (Billings) are considered to be lithistid sponges by Hinde and are described. *Calathium* and *Trichospongia* are considered to be siliceous sponges and are also described and figured.

1889. On a new genus of siliceous sponge from the Trenton Formation at Ottawa. Canad. Rec. Sci., **3**: pp. 395–398, 1 pl.

The new genus *Steliella* and the new species *S. billingsi* and *S. crassa* are described from specimens collected by Billings in Ottawa. Minute structures are lost in each because of preservation, but spicule structure is considered to be lithistid.

1891. Notes on a new fossil sponge from the Utica Shale formation (Ordovician) at Ottawa, Canada. Geol. Mag., ser. 3, **8**: pp. 22–24, 1 text-fig.

The new genus *Stephanella* and the new species *S. sancta* are erected for a sponge with radiating spicules. Hinde was not certain if they were hexactinellids, related in some way to the forms at Métis, Quebec described by Dawson, or if they were monactinellids.

1893. On *Palaeosaccus dawsoni*, Hinde, a new genus and species of hexactinellid sponge from the Quebec Group (Ordovician) at Little Métis, Quebec, Canada. Geol. Mag., ser. 3, **10**, no. 344, pp. 56–58, pl. 4.

The general background of Dawson's discovery of the Little Métis sponge fauna is given, and the new sponge, *Palaeosaccus dawsoni* Hinde, is described and illustrated from a specimen Dawson sent to Hinde for description.

Hintze, L. F.

1951. Lower Ordovician detailed stratigraphic sections for western Utah. Bull. Utah Geol. Min. Surv. **39**: 100 pp., 11 text-figs.

Receptaculites mammillaris Walcott is reported from the Kanosh Shale in the southern Confusion Range, at Desert Range Experiment Station, and in the San Francisco Mountains, and from equivalent shale in the lower Swan Peak Quartzite on Promontory Range in northcentral Utah. *R. elongatus* Walcott (now *Calathium* sp.)

occurs in the upper part of the Fillmore Limestone in the Confusion Range.

Zittelella cf. *Z. clarae* Howell, and *Zittelella*? sp. are reported from the Fillmore and Wahwah Limestones, in the Confusion Range.

1951. Ordovician stratigraphy of Central Utah. *In* Guidebook to the geology of Utah, no. 6, Geology of the Canyon, House and Confusion Ranges, Millard County, Utah. Intermtn. Assoc. Petrol. Geol., pp. 38–43, text-figs. 8, 9.

Receptaculitids are reported as occurring in the Pogonip Group, in unit V, within the Chazyan. No genera are listed.

1952. Lower Ordovician trilobites from western Utah and eastern Nevada. Bull. Utah Geol. Min. Surv. **48**: 249 pp., 28 pls.

Questionable sponges are reported from trilobite zones H and I; *Zittelella* cf. *Z. clarae* Howell is reported from zone J., and *Receptaculites mammillaris* Walcott and *R. elongatus* Walcott occur in zone M. *R. mammillaris* Walcott occurs in the southern Snake Range, Pioche District, Egan Range, and in the White Pine Range. *R. elongatus* Walcott is reported from the Egan and White Pine Ranges.

1960. Ordovician of the Utah-Nevada Great Basin. *In* Guidebook to the geology of East Central Nevada 1960. 11th Ann. Field Conf., Intermtn. Assoc. Petrol. Geol., pp. 59–62, 1 text-fig.

Receptaculites sp. is listed from Kanosh Shale of the Pogonip Group in the southern Egan Range in eastern Nevada.

Hoernes, R.

1906. Paläontologie. G. J. Göschen'sche Verlagshandlung, Leipzig. 206 pp., 87 text-figs.

A general text-book of paleontology in which the following genera are mentioned: *Astylospongia* sp., *Astraeospongia* sp., *Aulocopium* sp., *Dictyophyton* sp., *Palaeomanon* sp., and *Protospongia* sp.

Holtedahl, Olaf

1912. On some Ordovician fossils from Boothia, Felix, and King William Land. Collected during the Norwegian Expedition of the Gjøa, Captain Amundsen, through the North-west Passage. Videnskabs-Selks Christiania, Skrift, I. Math-Naturv. Kl. 1912, no. 9, 11 pp., 4 pls., 1 text-fig.

Receptaculites oweni Hall is described and illustrated from King William Land in the Arctic.

Hopper, R. H.

1947. Geologic section from the Sierra Nevada to Death Valley, California. Bull. Geol. Soc. Amer., **58:** no. 5: pp. 393–432.

Receptaculites sp. is cited from both the Pogonip-age rocks, in a unit designated as Cambrian and Lower Ordovician dolomite and limestone, and the Upper Ordovician Ely Spring Dolomite in the Panamint Range. Hunt and Mabey (1966, p. 35) conclude that the Ely Spring occurrence may be within a block of dolomitized Pogonip rocks since *Receptaculites* is not known from elsewhere within the district from Ely Spring-age material.

Hovey, H. C.

1874. On *Brachiospongia*. Trans Kansas Acad. Sci., **3:** pp. 10–11, figs. 1, 2 (reprint: 1875, Kansas State Board of Agriculture, Ann. Rept., **3:** pp. 344–345, figs. 1, 2: reprint: 1875, Sci. Amer., **32:** pp. 387; reprint: 1896, Trans. Kansas Acad. Sci., **3:** pp. 111–113, figs. 1, 2).

Owen, in the Second Report of the Geology of Kentucky, called this genus amorphozoon and named it *Scyphia* (now *Brachiospongia*) *digitata*. He later redescribed it and changed the name to *Syphonia* (now *Brachiospongia*) *digitata* (Owen) recognizing it as a sponge.

Hovey and others re-examined the specimen and named it *Brachiospongia roemerana* (now *Brachiospongia digitata*) Marsh. The specimen is from Ordovician rocks from Franklin County, Kentucky. Specimens have also been found in the same geologic horizon in Tennessee. It is now considered as *B. digitata* (Owen).

Howell, B. F.

1937. Two new sponges from the Silurian of Tennessee. Bull. Wagner Free Inst. Sci., **12,** no. 4: pp. 31–34, 1 pl.

The new sponges *Palaeomanon incisum* and *Carpomanon verrucosum* are described from the Brownsport Formation of Perry County, Tennessee. They are closely related to *Palaeomanon cratera balantium* Rauff, *P. cratera lecythium* Rauff, and to *Carpomanon stellatimsulcatum* (Roemer).

1938. The sponge "*Zittelella varians*" from the Ordovician of Vermont. Bull. Wagner Free Inst. Sci., **13,** no. 4: pp. 31–33, 1 pl.

A specimen of *Zittelella varians* (Billings) is figured and described from the Chazy Limestone of Isle La Motte, Vermont, and taxonomic

position of species is summarized and comparison is made between the genera *Eospongia* and *Zittelella*. The species *Z. varians* is compared with *Z. typicalis* Ulrich and Everett and *Z. inosculata* Ulrich and Everett.

1940. A new Silurian sponge from Tennessee. Bull. Wagner Free Inst. Sci., **15**, no. 4: pp. 45–48, 1 pl.

The new species *Microspongia* (now *Hindia*) *cylindrica* is described from the Middle Silurian of Tennessee, probably from the Beech River Formation of the Brownsport Group, at Clifton, in Wayne county. Nomenclature of *Microspongia* and *Hindia* is discussed and even though the description is captioned *Microspongia cylindrica,* illustrations are designated as *Hindia cylindrica* for the same specimen.

1941. A new sponge from the Ordovician of Nevada. Bull. Wagner Free Inst. Sci., **16**, no. 1: pp. 1–3, 1 pl.

Zittelella clarae, a new species, is described from the Tank Hill limestone of the Ely Springs Range, southeastern Nevada. Two partial sections of the species occur in a block of limestone.

1941. *Receptaculites mammillaris* from the Ordovician Tank Hill Formation of Nevada. Bull. Wagner Free Inst. Sci., **16**, no. 4: pp. 35–38, 2 pls.

Additional detail and excellent illustrations are given to the sketchy description of *Receptaculites mammillaris* Walcott. The species occurs in the Tank Hill Formation of the Ely Springs Range and in the Pogonip (?) Formation of the Eureka District, both in Nevada. *Receptaculites ellipticus* Walcott and *Zittelella clarae* Howell occur with other fossils in the same beds.

1942. New Silurian astylospongid from Tennessee. Bull. Wagner Free Inst. Sci., **17**, no. 4: pp. 37–38, 1 pl.

The new species *Palaeomanon elongatum* is reported from the Brownsport Formation near Perryville, Decatur County, Tennessee. It is compared to the closely related *P. cratera* (Roemer) from which it differs in being more elongate and having a more constricted osculum. Both species are figured for comparison.

1942. The age of the sponge beds at Little Métis, Quebec (abstr.). Bull. Geol. Soc. Amer., **53**, no. 12, pt. 2: p. 1830.

1943. New records of Receptaculitidae from the Mississippi Valley. Bull. Wagner Free Inst. Sci., **18**, no. 4: pp. 35–42, 1 pl.

The occurrence of *Ischadites infundibulum* (Hall) is noted for the first time from the Gowan Formation (Niagaran) of Iowa, and type specimens of the species are illustrated from photographs for the first time. In addition, photographs of *Ischadites reticulatus* (Owen) and *Cerionites dactyloides* (Owen) are also included. Taxonomic status of these species and their generic placement is discussed.

1944. The age of the Sponge beds at Little Métis, Quebec. Bull. Wagner Free Inst. Sci., **19**, no. 1: pp. 1–16, 1 pl.

The different sponges discovered at Little Métis are discussed in an attempt to definitely assign the beds to a particular age.

Sponge genera mentioned include: *Halichondrites, Choia, Protospongia, Diagonella, Kiwetinokia, Acanthodictya, Cyathophycus, Palaeosaccus,* and *Lasiothrix.*

The plate is of brachiopods.

Howell, B. F. and Landes, R. W.

1936. New monactinellid sponges from the Ordovician of Wisconsin (abstr.). Proc. Geol. Soc. Amer., **1935**: pp. 364–365.

1936. New monactinellid sponges from the Ordovician of Wisconsin. Jour. Paleontol., **10**, no. 1: pp. 53–59, 21 figs.

The genus *Halichondrites* is discussed and the new species *H. ? actiniformis* and *H. ? robustus,* are proposed, along with the new genus *Petrosites,* and the new species *P. humilis, P. tenuis,* and *P. variabilis.*

Descriptions of the above are based on isolated spicules from acid residues of the Oneota Dolomite collected on U. S. Highway 12, three or four miles south of Springfield Corners, Wisconsin. The spicules are illustrated by line drawings.

Howell, B. F. and Van Houten, F. B.

1940. A new sponge from the Cambrian of Wyoming. Bull. Wagner Free Inst. Sci., **15**, no. 1: pp. 1–8, 3 pls.

The new genus of lyssakinid sponge *Multivasculatus* and its single species, *M. ovatus,* are described and figured from the Gallatin Formation in the Bighorn Mountains of north-central Wyoming. The new genus is compared to *Pyritonema* and the mode of growth is described as similar to modern *Halichondria,* that is with a basal encrusting layer from which rise vase-shaped branches.

Humphrey, F. L.

1960. Geology of the White Pine Mining District, White Pine County, Nevada. Bull. Nev. Bureau Mines, **57**: 119 pp., 2 pls., 25 text-figs.

Receptaculites mammillaris Walcott is reported from the *Mitrospira*-zone of the Pogonip Formation, along with *R. elongatus* Walcott from the crest of Pogonip Ridge, west of the old townsite of Hamilton. These forms are locally abundant approximately 30 feet above the base of a massive limestone member in the formation.

Hunt, C. B. and Mabey, D. R.

1966. Stratigraphy and structure of Death Valley, California. U. S. Geol. Surv. Prof. Paper 494-A, 162 pp., 3 pls., 120 text-figs., 26 tables.

Abundant siliceous spicules are reported from the Nopah Formation. *Receptaculites* sp. is reported from the Pogonip Group, but the presence of *Receptaculites* sp. in the Ely Springs Dolomite of the region, as noted by Hopper (1947), is questioned since the species is not known from that horizon from any other locality in the region.

Ingels, J. J. C.

1963. Geometry, paleontology, and petrography of Thornton reef complex, Silurian of northeastern Illinois. Bull. Amer. Assoc. Petrol. Geol., **47**: pp. 405–440.

Calathium? sp. is reported in flank deposits of the Thornton reef complex. A later paper by Toomey and Ingels (1964) indicates that these structures are probably tabulate corals and not sponges or *Calathium*.

Ives, R. L.

1946. Stansbury Island, Utah. Rocks and Minerals, **21**, no. 5: pp. 265–271, 5 text-figs.

"Sponges?" are reported in Early Paleozoic limestones of the Stansbury Island.

1946. The Granite Peak area, Utah. Rocks and Minerals, **21**, no. 6: pp. 339–344, 6 text-figs.

The occurrence of "barrel sponges (?)" is noted in the limestone of Sapphire Mountain.

1946. Minerals of Kelly's Hole, Utah. Rocks and Minerals, **21**, no. 12: pp. 839–844, 7 text-figs.

Poorly preserved sponges are reported in Paleozoic rocks of the Dugway Range, Utah.

James, J. F.

1885. Remarks on the genera *Lepidolites, Anomaloides, Ischadites,* and *Receptaculites* from the Cincinnati Group. Jour. Cincinnati Soc. Nat. Hist , **8**: pp. 163–166.

Lepidolites and *Pasceolus* are proposed to belong to the Receptaculitidae of the sponges, and James states that species of *Lepidolites* are like *Ischadites* and should be included there. *Anomaloides* is also placed as a junior synonym of *Receptaculites,* but recent work recognizes all the above mentioned genera as distinct from each other in the Receptaculitidae.

1887. Protozoa of the Cincinnati Group. Jour. Cincinnati Soc. Nat. Hist., **9**: pp. 244–252.

Brief descriptions of sponges are included with other organisms in the Order Spongida. Sponge species described include: *Astylospongia* (now *Hindia*) *gregaria* Miller and Dyer, *A.* (now *Pasceolus darwini*) *tumida* U. P. James, *Pattersonia difficilis* Miller, *Brachiospongia digitata* (Owen), *B. tuberculata* (now *B. digitata*) U. P. James, and *Stromatopora* (now *Dystactospongia*) *insolens* Miller. Also included are the receptaculitids, *Pasceolus globosus* Billings, *P. darwini* Miller, *Ischadites* (now *Lepidolites*) *dickhauti* Ulrich, and *Receptaculites* (now *Anomaloides*) *reticulatus* Ulrich.

1891. Manual of the paleontology of the Cincinnati Group. Cincinnati Soc. Nat. Hist., **14**, no. 1: pp. 45–72, 6 text-figs.

The following genera of sponges and receptaculitids are described with brief discussion of some species: *Astylospongia, A. tumidus* (now *Pasceolus darwini*) James, *A.* (now *Hindia*) *subrotundus* James, and relates to *Pasceolus,* and *Hindia.*

Leptopoterion, L. mammiferum Miller; *Microspongia, M.* (now *Hindia*) *gregaria* Miller and Dyer, mentioning the probable synonym of *Hindia parva* Ulrich and the differences of *H. sphaeroidalis* Duncan, *M. subrotundus* (now *H. subrotundus*); *Hindia, H. parva* Ulrich and its relation to *Microspongia* (now *Hindia*) *gregaria* Miller and Dyer; *Cylindrocoelia, C. covingtonensis* Ulrich; *Rhombodictyon, R. globosus* James; *Pasceolus, P. globosus* Billings, *P. darwini* Miller, *P. claudii* Miller, *P.* (?) *tumidus* (now *P. darwini*) James; *Receptaculites,* and its relation to *Anomaloides, Ischadites,* and *Lepidolites, R. reticulata* (now *I. iowensis*) Hall, *R.* (now *I.*) *circularis* Emmons;

Cyathophycus, *C.* (now *Trichophycus*) *siluriana* James; *Chirospongia*, *C. wenti* (now *Pattersonia aurita*) Miller, *C. faberi* (now *Leptopoterion mammiferum*) Miller; *Brachiospongia*, *B. digitata* Marsh—relates to *Scyphia* (now *Brachiospongia*) *digitata* Owen, *B. lyoni* (now *B. digitata*) Marsh, *B. roemerana* (now *B. digitata*) Marsh, *B. horeyi* (now *B. digitata*) Marsh, *B. tuberculata* James; *Pattersonia*, (possible synonym with *Strobilospongia* and *Chirospongia*), *P. difficilis* Miller, *P. tuberosa* Miller; *Dystactospongia*, *D. insolens* Miller, *D. minima* Ulrich; *Heterospongia*, as related to *Dystactospongia*, *H. subramosa* Ulrich synonym with *H. knotti* Ulrich, *H. aspera* Ulrich.

Poor illustrations of *Microspongia subrotundus* U. P. James, *Rhombodictyon globosus* James, *Pasceolus* (?) *tumidus* U. P. James, *Anomaloides* sp., *Receptaculites* sp., *Cyathophycus siluriana* James, and *Brachiospongia digitata* (Owen) are included.

1895. Sponges, recent and fossil. Amer. Nat., **29**: pp. 536–545, 7 text-figs.

This is a general article on characteristics of sponges. *Leptomitus*, *Protospongia*, *Brachiospongia*, *Cyathophycus*, ?Dictyospongidae, and *Astylospongia* are mentioned.

1895. The first fauna of the earth (part 2). Amer. Nat., **29**: pp. 979–985, text-figs. 4–12.

Four species of sponges are reported as known from the Cambrian.

James, U. P.

1871. Catalogue of the Lower Silurian fossils, Cincinnati Group, found at Cincinnati and vicinity—within a range of forty or fifty miles. Cincinnati, 14 pp.

The first part of the catalogue apparently contained no listed sponges or receptaculitids but additions published in 1873 did contain listings (see James, 1873), as did the second edition (James, 1875, 1879).

1873. Additions to catalogue of Lower Silurian fossils, Cincinnati Group. Paleontology, 4 pp.

Astylospongia sp. and *Pasceolus* sp. are added to the list of fossils collected from the Cincinnatian rocks, published in 1871, but which apparently did not include any sponges.

1875. Catalogue of the Lower Silurian fossils of the Cincinnati Group, found at Cincinnati, Ohio and vicinity—within a range of forty or fifty miles, with descriptions of some new species of corals and polyzoa. Cincinnati, Ohio. 8 pp.

Pasceolus claudii Miller, *P. darwini* Miller, and *Pasceolus* sp. are listed.

1878. Descriptions of newly discovered species of fossils from the Lower Silurian formation—Cincinnati Group. Paleontology, no. 1, pp. 1–7.

The sponge *Astylospongia tumidus* James (now *Pasceolus darwini* Miller) is described as part of a fauna from Cincinnatian rocks.

1878. Descriptions of newly discovered species of fossils and remarks on others, from the Lower and Upper Silurian rocks of Ohio. Paleontologist, no. 2, pp. 9–13.

The new sponge species *Trachyum undosum* is described from Clintonian rocks near Clinton, Ohio.

The new species *Chaetetes subrotundus* is described, a designation later changed to *Astylospongia* (now *Hindia*) *subrotundus* (James, 1881).

1879. Descriptions of newly discovered fossils—On geological nomenclature—And supplement to catalogue. Paleontology., no. 4, pp. 25–34.

The new species *Brachiospongia tuberculata* is described and compared to *B. digitata* (Owen), *B. roemerana* Marsh (now *B. digitata* (Owen)), and *B. lyoni* Marsh (now *B. digitata* (Owen)). The latter two species are now considered with *B. digitata.*

In the supplement, *Astylospongia tumidus* James (now *Pasceolus darwini* Miller), *Brachiospongia tuberculata* James, *Microspongia* (now *Hindia*) *gregaria* Miller and Dyer, and *Astylospongia subrotundus* James (now *Hindia subrotunda*) are listed as occurring in the Cincinnatian rocks.

1881. Contributions to paleontology: fossils of the Lower Silurian Formation: Ohio, Indiana and Kentucky. Paleontologist, no. 5, pp. 33–44.

Astylospongia (now *Hindia*) *subrotundus* James is proposed for *Chaetetes subrotundus* James, 1878.

Jicka, H. L. Jr.

1954. Geology and mineral deposits of Lake Valley quadrangle, Grant, Luna, and Sierra counties, New Mexico. New Mexico Inst. Mining Technol., Bull. State Bur. Mines Min. Resources, **37**: 93 pp., 5 pls., 13 text-figs., 8 tables.

Calathium sp. and *Archaeoscyphia* sp. are reported in a measured section of the Bat Cave Formation of the El Paso Group in the Cooks Range, and *Receptaculites* sp. is reported from the Cable Canyon Sandstone of the Montoya Group in the same region.

Jillson, W. R.

1931. The paleontology of Kentucky. Ky. Geol. Surv., 469 pp., 78 pls., figs.

Brachiospongia digitata (Owen) is illustrated from the Brannon Limestone of Franklin County, Kentucky.

1953. *Brachiospongia minimus*, a new species of digitate sponge from the Upper Eden Shale of northern Robertson County, Kentucky. Roberts Printing Co., Frankfort, Ky., 14 pp.

The new species *B. minimus* is proposed from small species collected from the upper Eden Shale.

1961. *Brachiospongia bifurcata*. A new species of digitate sponge from the Upper Middle Ordovician of Franklin County, Kentucky. Perry Publ. Co., Frankfort, Ky., 10 pp., 5 figs.

New species *Brachiospongia bifurcata* (now *digitata*) is described and illustrated from the Upper Middle Ordovician of Franklin County, Kentucky.

Johnson, J. H.

1934. Paleozoic formations of the Mosquito Range, Colorado. U. S. Geol. Surv. Prof. Paper 185-B, pp. 15–43, pls. 1–7, text-fig. 2.

Receptaculites sp. is reported from the Upper Ordovician Fremont Limestone of the district.

1944. Paleozoic stratigraphy of the Sawatch Range, Colorado. Bull. Geol. Soc. Amer., **55**: pp. 303–378, 11 pls.

Johnson cites the occurrence of *Receptaculites oweni* Hall, noted by Crawford (1913), from the Upper Ordovician Fremont Limestone. *Receptaculites* sp. was noted by Johnson in Deadman Creek, Gunnison County, from the Fremont Limestone.

1945. A resume of the Paleozoic stratigraphy of Colorado. Colo. School Mines Quart., **40**, no. 3: 109 pp.

An unidentified sponge is reported from the Manitou Formation in the Bonanza District quadrangle. *Receptaculites oweni* Hall is

reported from the Fremont Formation at Harding Quarry near Canyon City, and *Receptaculites* sp. from the same unit in the Salida region and the Bonanza District.

1952. Ordovician rock—building algae. Quart. Colo. School Mines, **47**, no. 2: pp. 29–56, 12 pls., 3 tables.

Abbreviated, uncritical translation of Pia's 1927 discussion on calcareous algae, with reproduction of Pia's original illustrations. *Pasceolus* species are placed in *Cyclocrinus* Eichwald and *Nidulites pyriformis* Bassler is included in *Mastopora*. Types of *Mastopora pyriformis* (Bassler) are shown in photograph.

Johnson, W. A.

1912. Geology of Lake Simcoe area, Ontario, Brechin and Kirkfield sheets. Sessional paper 26, Summary Rept. Geol. Surv. Canad., Dept. Mines 1911, pp. 253–261.

Receptaculites occidentalis Salter is listed from the Coboconk and Kirkfield Limestone at Carden, Ontario and from the Kirkfield Limestone at Feneton Falls, Ontario. *Ischadites* sp. is reported from 2½ miles south of Brechin, Ontario, from the *Prasopora* beds of the Kirkfield Limestone.

Jones, T. R.

1882. Catalogue of the fossil foraminifers in the collection of the British Museum (Natural History), Cromwell Road. S. W. Taylor and Francis, London. 100 pp.

Receptaculites are referred to the Foraminifera and a number of North American specimens are listed as housed with the collections of the British Museum (Natural History). These include receptaculitids cited in Etheridge's 1878 memoir in Quart. Jour. Geol. Soc. London, **34**: pp. 576–577.

Kay, G. M.

1937. Stratigraphy of the Trenton Group. Bull. Geol. Soc. Amer., **48**, no. 2: pp. 233–302, pls. 1–10, 13 text-figs.

Receptaculites occidentalis Salter is reported from the Isle La Motte Limestone at lower Rockland, Glenn Falls, N. Y.

Pasceolus globosus Billings ("*Ischadites*" sp.) is noted as locally abundant at the base of the Cobourg Formation in northwest N. Y. and in Prince Edward Co., Ontario. It has been considered to mark the top of the Sherman Fall Limestone in Trenton Falls Gorge, N. Y.

Pasceolus globosus Billings occurs in the Hallowell Member of the Cobourg Formation in Hallowell township, Prince Edward Co., Ontario.

Receptaculites oweni Hall is noted from the Liskeard Formation at New Liskeard, Lake Timiskaming, Ontario.

1942. Ottawa-Bonnecherre Graben and Lake Ontario homocline. Bull. Geol. Soc. Amer., **53**: pp. 585–646, 7 pls., 7 text-figs., 13 tables.

Eospongia (?) sp. is reported from the lower Chaumont beds at Fourth Chute on the Bonnechere River. The questionable sponge *Camarocladia* sp. is reported from the Hull beds of Ontario. *Receptaculites occidentalis* Salter is listed from the Rockland Limestone at several localities, including Paquette Rapids at Allumette Island, Quebec; at Meath Station; and at Fourth Chute, Renfrew County, Ontario.

Kay, G. M. and Crawford, J. P.

1964. Paleozoic facies from the miogeosynclinal to the eugeosynclinal belt in thrust slices, Central Nevada. Bull. Geol. Soc. Amer., **75**, no. 5: pp. 425–454, 6 pls., 9 figs., 6 tables.

The occurrence of the Antelope Valley sponge fauna reported by Bassler (1927, 1941) from the McMoningal Creek region in the Toquima Range is mentioned from Ikes Canyon. Geologic maps accompany the report and are the first available for the locality.

Kayser, Emanuel

1875. Ueber die Billings'sche Gattung *Pasceolus* und ihre verbreitung in paläozoischen Ablagerungen. Zeit. d. deutsch. geol. Gessell., **27**: pp. 776–783, pl. 20.

Pasceolus globosus Billings is listed from the Upper Silurian of Ottawa, and *P. halli*, *P. gregarius*, and *P. intermedius* are listed from the Middle Silurian of Anticosti. Other forms listed occur in the European Silurian and Devonian sections.

The genus *Pasceolus* is described and its taxonomic position and relationships are discussed.

Keefer, W. R. and Van Lieu, J. A.

1966. Paleozoic formations in the Wind River Basin, Wyoming; Geology of the Wind River Basin, Central Wyoming. U. S.

Geol. Surv. Prof. Paper 495-B, 60 pp., 6 pls., 23 text-figs., 8 tables.

Receptaculites arcticus Etheridge is listed from Sinks Canyon, as reported by Miller (1932), and *Receptaculites* sp. from Sweetwater Canyon, as reported by Bell (1955, unpublished PhD. dissertation, Univ. Wyoming), both in the Bighorn Dolomite of northwestern Wyoming.

Kerr, J. W.

1967. New nomenclature for Ordovician rock units of the eastern and southern Queen Elizabeth Islands, Arctic Canada. Bull. Canad. Petrol. Geol., **15**, no. 1: pp. 91–113, 5 text-figs.

Receptaculites sp. is reported from Unit 4 of the Cornwallis Formation (Thorsteinsson, 1963, p. 392) from Copes Bay in eastern Ellesmere Island, and is reported as a sporadic fossil throughout the new Edenian Thumb Mountain Formation in the Cornwallis Group, particularly near the head of Strathcona Fiord in southern Ellesmere Island. *Receptaculites* sp. is also reported from the overlying Irene Bay Formation, the youngest of the Cornwallis Group, from Copes Bay, and Strathcona Fiord, Ellesmere Island.

Kesling, R. V. and Graham, A.

1962. *Ischadites* is a dasycladacean alga. Jour. Paleontol., **36**, no. 5: pp. 943–952, pls. 135, 136, 2 text-figs.

Undoubted gametocysts are reported on a Trentonian *Ischadites* from Michigan, and are interpreted to show this genus is a dasycladacean alga. A description of the gametocysts and a history of classification of *Ischadites* are given.

Keyes, C. R.

1890. Review of the progress of American invertebrate paleontology for the year 1889. Amer. Nat., **24**, no. 278: pp. 131–138.

Keyes reviewed papers published in paleontology in the previous year, and in relation to sponges, reviews articles by Dawson, Lesley, Beecher, Miller, Walcott, and Ulrich.

1894. Paleontology of Missouri, Part I (including stratigraphic catalogue of Missouri fossils and state geological map). Missouri Geol. Surv., ser. 1, **4**, 103 pp. 12 pls.

A list of the orders of Porifera is given in a table on page 91. *Receptaculites oweni* is reported from the Trenton limestone of Jefferson, Pike and St. Louis counties.

Kilfoyle, C. F.

1954. Catalog of type specimens of fossils in the New York State Museum. Bull. N. Y. State Mus., **348**, Supp. 4, 719 pp.

Early Paleozoic sponges listed are: *Cyathodictya* (?) *pyriformis* Ruedemann, Upper Utica shales, in Ouisa Creek, Newvilles, N. Y. *C. reticulata* (Walcott), Upper Utica shale, Holland Patent, N. Y.; and *C.* ? *tabularis* Ruedemann, Canajoharie shale, Canajoharie, N. Y. *Foerstella flabellata* Ruedemann, Upper Utica shale, Holland Patent, N. Y.; *F. rotunda* Ruedemann, Upper Utica shale, Holland Patent, N. Y.; and *Graptospongia pusilla* Ruedemann, Normanskill shale, Schuylerville, Saratoga Co., N. Y.

King, P. B.

1937. Geology of the Marathon region, Texas. U. S. Geol. Surv. Prof. Paper 187, 148 pp., 24 pls., 33 text-figs.

At least three species of sponges, including *Calathium* cf. *C. formosum* Billings are reported as present in the Lower Ordovician Monument Spring Member of the Marathon Limestone. A sketch shows masses of limestone where sponges occur within the member on Alsate Creek.

1965. Geology of the Sierra Diablo Region, Texas. U. S. Geol. Surv. Prof. Paper 480, 185 pp., 16 pls., 8 text-figs., 14 tables.

Calathium sp. is reported from the Lower Ordovician El Paso Limestone, Division B, on Beach Mountain, and *Receptaculites* sp. is reported from the Upham Member of the Montoya Dolomite from the same area.

Archaeoscyphia is reported from Division A of the Lower Ordovician El Paso Limestone.

Kirk, Edwin

1934. The Lower Ordovician El Paso Limestone of Texas and its correlatives. Amer. Jour. Sci., ser. 5, **28**, no. 168: pp. 443–463.

Sponges are reported to be associated with cephalopods in the El Paso Limestone of the Franklin Mountains. *Calathium* cf. *C. anstedi* Billings is listed from the lower part of the formation. The *Piloceras-Calathium* assemblage is used to distinguish a faunal zone.

Calathium sp. is reported from the Ordovician of the Pioche district, Nevada, and the *Receptaculites* fauna is noted as occurring in the Tank Hill Formation of the same region.

The identification by Dake and Bridge of *Archaeoscyphia* as a species of *Calathium* from the Ellenburger Limestone of Texas is corrected.

Klemic, H. and West, W. S.

1964. Geology of the Belmont and Calamine quadrangles, Wisconsin. Bull. U. S. Geol. Surv., 1123-G, pp. 361–435, pls. 22–24, text-figs. 47–50.

Receptaculites oweni Hall is reported to be common in both the cherty and noncherty portions of the Galena Dolomite.

Koening, J. W., Martin, J. A. and Collinson, C. W.

1961. Northeastern Missouri and West-Central Illinois Guide Book, Twenty-sixth regional field conference, The Kansas Geological Society. Missouri Geol. Surv. Rept. Invest. 27, 168 pp., and illustrations.

Receptaculites sp. is listed from the Kimmswick Limestone in the Hannibal Quadrangle, Roth County, Missouri.

Astraeospongia hamiltonensis Meek and Worthen is reported from the Devonian Cedar Valley Formation and is said to be indistinguishable from the Silurian *A. meniscus* (Roemer).

Kottlowski, F. E., Flower, R. H., Thompson, M. L., and Foster, R. W.

1956. Stratigraphic studies of the San Andres Mountains, New Mexico. New Mexico Inst. Mining Tech., Bur. Mines Min. Resources Mem. 1, 132 pp., 5 pls., 15 text-figs., 6 tables.

Sponges are reported from the Lower Ordovician El Paso Group of the San Andres Mountains, Big Hatchet Mountains, and Cooks Range. *Archaeoscyphia* sp. is reported in a summary of Cloud and Barnes section at El Paso, and *Calathium* sp. is reported from the upper Canadian part of the group in Rhodes Canyon in the San Andres Mountains. Unidentified spheroidal sponges are reported from the Upper Ordovician Aleman Dolomite in Rhodes Canyon.

Receptaculites sp. is reported as common in the Middle Ordovician Upham Dolomite in Rhodes Canyon, Hembrillo Canyon, and Ash Canyon, and in the Middle Ordovician Cable Canyon Sandstone in Rhodes Canyon.

Ladd, H. S.

1929. The stratigraphy and paleontology of the Maquoketa Shale of Iowa, pt. 1. Iowa Geol. Surv., **34**, pp. 305–448, pls. 4–17, text-figs. 64–76.

Hindia parva (?) Ulrich is shown in lists as occurring at many localities from the Depauperate Zone of the lower part of the Maquoketa Shale, as well as the overlying Elgin Member. *Astylospongia* sp. is listed from the Elgin Member, as well.

Langenheim, R. L., Barnes, J. A., Delise, K. C., Ross, W. A. and Stanton, J. L.

1956. Middle and Upper(?) Ordovician rocks of Independence Quadrangle, California. Bull. Amer. Assoc. Petrol. Geol., **40**: pp. 2081–2097, 4 text-figs.

A varied sponge fauna is reported from the Middle Ordovician Mazourka Formation, including: *Allosaccus*(?) sp., *Calycocoelia typicalis* Bassler, *Lissocoelia ramosa* Bassler, *Nevadocoelia pulchra*(?) Bassler, *Nevadocoelia* (?) sp., *Patellispongia oculata* Bassler, and *Streptosolen occidentalis* (?) Bassler. The sponge *Anthaspidella* cf. *A. scutula* is reported from the upper Eureka Group. *Receptaculites* sp. is also reported from the Mazourka Formation.

Langenheim, R. L., Jr., Barr, F. T., Shank, S. E., Stensaas, L. J., and Wilson, E. C.

1960. Preliminary report on the geology of the Ely No. 3 quadrangle, White Pine County, Nevada. *In* Guidebook to the geology of east central Nevada, 1960; Intermtn. Assoc. Petrol. Geol. 11th Ann. Field Conf., pp. 148–156, 3 text-figs.

Receptaculites mammillaris Walcott is reported from lower and middle Lehman Formation in White Pine County, Nevada.

LeConte, Joseph

1877. Elements of Geology. D. Appleton & Co., New York. 588 pp., 1002 text-figs.

The sponge *Brachiospongia digitata* (Owen) and the receptaculitids *Receptaculites formosus* Meek and Worthen (now *I. infundibulum*) and *Receptaculites* sp. are illustrated in this general introductory textbook.

Lesley, J. P.

1889–1890. A dictionary of the fossils of Pennsylvania and neighboring states named in the reports and catalogues of the survey. Penn. Geol. Surv. Rept. P 4, 3 vols., 1283 pp., **1,** pp. 1–437, covers A–M; **2,** pp. 438–914, covers N–R; **3,** pp. 915–1283, covers S–Z.

Ethmophyllum (now *Archaeoscyphia*) *minganense* Billings is figured and listed from the Mingan Islands Ordovician. *Protospongia* (now *Diagonella*) *coronata* Dawson and Hinde, *P. mononema* Dawson and Hinde, and *P. tetranema* Dawson are listed, and *P. delicatula* Dawson and Hinde, *P. polynema* Dawson and Hinde, and *P.* (now *Diagonella*) *cyathiformis* Dawson and Hinde are listed and figured from the Lower Silurian (Ordovician) Quebec Group along the St. Lawrence River (at Little Métis, Quebec). Additional sponges listed from the same Quebec locality include the genera; *Lasiothrix*, *Hyalostelia*, *Cyathospongia* (now *Cyathophycus*), and *Acanthodictya*.

Questionable sponges are reported from the Cambrian slates of Middle Granville, New York, and from the St. John's series of New Brunswick. *Rhombodictya discum* Whitfield and *R. reniforme* Whitfield are reported from the Utica Slate of New York. These latter structures are now considered inorganic.

Receptaculitids listed include the following: *Receptaculites* (now *Ischadites*) *circularis* Emmons from the Hudson River Formation; *R.* (now *Ischadites*) *iowensis* (Owen) from Turkey River, Iowa; *R.* (now *Ischadites*) *infundibuliformis* Hall from the Lower Helderberg at Clarkesville, New York; *R. neptuni* Hall (now *R. occidentalis* Salter) from the Trenton Formation; *R.* (now *Ischadites*) *ohioensis* Hall and Whitfield from the Niagara Limestone; *R. oweni* Hall from the Niagara Formation of Indiana, and *R.* (now *Ischadites* (?) *iowensis* (Owen)) *reticulatus* Hall, from the Niagaran; *R. sacculus* Hall from the Niagaran Limestone of Indiana; *R.* (now *Ischadites*) *subturbinatus*) Hall from the Niagaran of Wisconsin, and *Pasceolus halli* Billings from the Anticosti Group in the Gulf of St. Lawrence.

Lochman, Christina

1940. Fauna of the basal Bonneterre Dolomite (Upper Cambrian) of southeastern Missouri. Jour. Paleontol., **14,** no. 1: pp. 1–53, 6 pls., 1 text-fig.

The new species *Chancelloria aurora* is described from the Upper Cambrian Bonneterre Dolomite (*Cedaria* zone) from Missouri. The

spicules in this area are abundant, but are, on the whole, smaller than those in the *Crepicephalus* horizon of Texas and Montana.

1950. Upper Cambrian faunas of the Little Rocky Mountains, Montana. Jour. Paleontol., **24,** no. 3: pp. 322–349, pls. 46–51.

A large number of stauractine sponge spicules were found embedded in clay from the Upper Cambrian, Pilgrim Formation, Montana. They are tentatively assigned to *Protospongia?* sp.

1952. Trilobites. *In* Cooper, G. A., *et al.* Cambrian stratigraphy and paleontology near Caborca, northwestern Sonora, Mexico. Smithson. Misc. Coll., **119,** no. 1: pp. 60–161, pl. 15–31, text-figs. 8, 9.

A specimen of *Chancelloria eros* Walcott is described from the Middle Cambrian Arrojos Formation west-southwest of Caborca, but other specimens occur in lenticular limestones in the lower part of the formation.

1966. Lower Ordovician (Arenig) faunas from the Williston Basin, Montana and North Dakota. Jour. Paleontol., **40:** pp. 512–548, pls. 61–65, 2 text-figs.

Several calcareous astraeospongid spicules were recovered from cores within Zone E of the Deadwood Formation, from the Shell Oil Company no. 32-33B N.P. Unit, McCone County, Montana.

Lochman-Balk, Christina, and Wilson, J. L.

1967. Stratigraphy of Upper Cambrian-Lower Ordovician subsurface sequence in Williston Basin. Amer. Assoc. Petrol. Geol. Bull., **51,** no. 6, pp. 883–917, 14 text-figs., 9 tables.

Hexactinellid sponge spicules are reported from Zone G and F in a well in the Pine Field, Wibaux County, Montana, from Ross (1957).

Longwell, C. R., Pampeyan, E. H., Bower, B., and Roberts, R. J.

1965. Geology and mineral deposits of Clark County, Nevada. Bull. Nevada Bur. Mines, **62:** 218 pp., 16 pls., 22 text-figs., 18 tables.

Receptaculites sp. is reported as a distinctive sponge from the upper 200 to 300 feet of the Pogonip Group, equivalent to the Antelope Valley Limestone in the Eureka District to the west.

Lord, C. S.

1963. Snare River and Ingray Lake Map-Areas, Northwest Territories. Mem. Geol. Surv. Canad., **235**: 55 pp., 2 geol. maps.

Calathium sp. is reported from Upper Ordovician (Richmond) dolomite on La Martre River about 11 miles from its mouth, in association with numerous other fossils. This is above the normal stratigraphic range of *Calathium*.

Loswell, T. J.

1957. Geology of the Bowling Green Quadrangle, Missouri. Missouri Geol. Surv. Rept. Invest. 22, 64 pp., 1 pl., 4 text-figs.

Receptaculites oweni Hall is listed from many localities of Kimmswick Limestone in the Bowling Green Quadrangle, Missouri.

Love, J. D.

1939. Geology along the southern margin of the Absoroka Range, Wyoming. Geol. Soc. Amer., Special Paper 20, 134 pp., 17 pls., 3 text-figs.

Receptaculites sp. is cited from Windy Gap, Absoroka Range, from the Upper Ordovician Bighorn Dolomite.

Lowenstam, H. A.

1942. Facies relation and origin of some Niagaran cherts (abstr.). Bull. Geol. Soc. Amer., **53**, no. 12: pp. 1805–1806.

Chert, found in interbioherm or flank facies of Niagaran reefs, is considered to be the result of localized solution of isolated spicules and redeposition as silicified fossils or as chert nodules. Zones now devoid of sponges would have been the source.

1948. Biostratigraphic studies of the Niagaran inter-reef formations in northeastern Illinois. Papers Ill. State Mus. Sci., **4**: 146 pp., 7 pls., 1 text-fig.

The sponges *Astraeospongia* sp., represented by isolated spicules, *Hindia fibrosa* Hinde (now *H. sphaeroidalis* Duncan), ?*Palaeomanon cratera* (Roemer), and other astylospongids are reported as "southern" elements of the Joliet Formation fauna. Sponges are usually rare, but are important elements of the cherty fauna.

Astraeospongia n. sp., *Hindia fibrosa* (now *H. sphaeroidalis* Duncan), and Astylospongidae are reported from the cherty upper dolomite of the Waukesha beds near Joliet. Dissociated sponges occur

in the same unit near Lermont, and show relatively slow rates of sedimentation, particularly in the muddy still-water bottoms where sponge colonies were extensive.

Sponges are common in the upper part of the Waukesha beds exposed in Ludwig's Quarry in Des Plaines Valley. These include: *Astraeospongia* n. sp., *Carpomanon incisolobatum* (Roemer), *Carpospongia castanae* Lowenstam, *Caryospongia juglans* (Quenstedt), and unidentified astylospongids.

At Elmhurst, the following sponges are noted from inter-reef facies: *Astraeospongia* sp., *Hindia fibrosa* (now *H. sphaeroidalis*), *Astylospongia praemorsa* (Goldfuss), *Paleaomanon verrucosum* (Rauff), *P. cratera* (Roemer), *Carpospongia castanae* Lowenstam, *Caryospongia juglans* (Quenstedt), *Carpomanon incisolobatum* (Roemer), *C. stellatimsulcatum* (Rauff), and additional indeterminate sponges. Prior to this, all but *Astraeospongia*, were known only from the Brownsport Formation in Tennessee.

It is concluded that sponges faunas are characteristic features of the still-water, inter-reef faunas.

Astraeospongia sp., *Hindia fibrosa* (now *H. sphaeroidalis* Duncan), and various astylospongids occur in the type section of the Waukesha Formation near Bellwood, and *Pyritonema* sp., *Caryospongia juglans* (Quenstedt), *Palaeomanon verrucosum* (Rauff), and indeterminate astylospongids are from near McCook, along with the long ranging *Astraeospongia* n. sp.

A summary chart shows the new species of *Astraeospongia* as ranging throughout the Waukesha, but *Astraeospongia meniscus* (Roemer) as common only near the top and *Carpospongia castanae* Lowenstam near the middle of the formation. A summary list of Waukesha fossils lists all of the above forms.

Astraeospongia meniscus (Roemer) forms a distinctive facies in the Blue Island zone of the Racine-Port Bryon Formations along the Calumet Sag Channel, west of Blue Island. Here *Astraeospongia* is used as a measure of rates of sedimentation, along with other organisms.

In the Thornton outcrops, *Hindia fibrosa* (now *H. sphaeroidalis* Duncan) and astylospongids occur in the inter-reef beds, but *Astraeospongia meniscus* (Roemer) is reported from the Wabash reef inter-reef facies as a diagnostic inter-reef Racine Guelph species.

1956. Guidebook, Niagaran reef at Thornton, Illinois, Field conference, April 22, 1956. Ill. State Geol. Surv., Amer. Assoc.

Petrol. Geol., and Soc. Econ. Paleont. Min., Urbana, 19 pp., 8 text-figs. (reprinted as Ill. State Geol. Surv. Guidebook, Ser. 4, 1956.)

The position of sponges within the Niagaran Thornton reef is briefly discussed.

1957. Niagaran reefs in the Great Lakes area. *In* Treatise on marine ecology and paleoecology, v. 2, Paleoecology. Geol. Soc. Amer. Mem. 67, pp. 215–248, 4 text-figs.

This is a summary of earlier well documented paleoecologic and stratigraphic work on the Silurian reefs of the Midcontinent. The sponges *Astylospongia*, *Palaeomanon*, *Microspongia*, and *Astraeospongia* are members of the quiet-water fauna, and species of *Astraeospongia* and *Microspongia* are also present in the semi-rough-water stage. Sponges are more rare in the rough-water stage, but the receptaculitid *Ischadites* is reported from here, and is considered as successful because wave energy could be laterally transmitted through the skeleton.

McFarlan, A. C.

1931. Ordovician fauna. *In* W. R. Jillson, The paleontology of Kentucky. Kentucky Geol. Surv., pp. 47–165, 16 pls., 2 text-figs., 1 section.

The following Ordovician sponges are described and illustrated by specimens from Kentucky: *Heterospongia subramosa* Ulrich, *H. knotti* Ulrich, *Brachiospongia digitata* (Owen), *Pattersonia aurita* (Beecher), and *Hindia parva* Ulrich.

1961. Outline of the geology of the Cement Creek area, Gunnison County, Colorado. *In* Symposium of Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf., Rocky Mtn. Assoc. Geol., pp. 125–132, 5 text-figs.

Receptaculites sp. is reported from the Fremont Formation on the flanks of Cement Mountain, in the Crested Butte Quadrangle of southwestern Colorado.

1961. Geology of Kentucky. Kentucky Geol. Surv., 531 pp., 67 pls., 42 text-figs.

Brachiospongia digitata (Owen) and *Pattersonia aurita* (Beecher) are listed from the Brannon Limestone, and *P. aurita* (Beecher) is also listed from the Benson Limestone. *Heterospongia knotti* Ulrich is listed as typical of the Oregonia Member of the Arnheim Forma-

tion in the region between Lincoln and Marion Counties, although it also occurs in the Mt. Auburn Member of the McMillan Formation in the southern Blue Grass region.

Earlier printings were also made in 1943 and 1950, and except for minor corrections, are similar to the later printing.

McInnes, William

1911. Saskatchewan River district. Summary Rept. Geol. Surv. Dept. Mines (Canada), 1910, pp. 169–173.

Ordovician *Receptaculites oweni* Hall is cited from Bigstone Lake and from Pelican Lake, just north of the Saskatchewan River in eastern Saskatchewan.

1913. The basins of Nelson and Churchill Rivers. Canad. Dept. Mines, Geol. Surv. Mem. 30, 146 pp., 19 pls., 1 map.

Receptaculites oweni Hall and *Pasceolus* (*Cyclocrinus*) *spaskii*(?) Eichwald were collected in the vicinity of Cormorant Lake, near Lake Winnipeg.

McKee, E. D.

1945. Stratigraphy and ecology of the Grand Canyon Cambrian. *In* Cambrian History of the Grand Canyon Region. Carnegie Inst. Washington Publ. 563, pp. 87–88, 15 plates.

Sponge spicules have been found in the basal part of the Columbine Falls section, and in the basal part of the Meriwiteca Canyon section. Also, specimens thought to be either sponges or archaeocyathids were found in the Fossil Rapids section.

McLaren, D. J.

1963. Southwestern Ellesmere Island between Goose Fiord and Bjorne Peninsula. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem. 320 pp. 310–338, text-figs. 17–18.

Receptaculites sp. is reported from both the upper and lower members of the Devonian Blue Fiord Formation, inland from Blue Fiord.

McLearn, F. H.

1915. Notes on the cores of Winnipeg Wells, Manitoba. Summary Rept., Geol. Surv. Dept. Mines, (Canada), 1914, p. 72.

A large *Receptaculites* cf. *oweni* Hall has been recovered from the well 12 miles north from Winnipeg, Manitoba from the upper portion of the Trenton (Galena) beds.

Maher, J. C.

1950. Detailed sections of pre-Pennsylvanian rocks along the Front Range of Colorado. U. S. Geol. Surv. Circ. 68, 20 pp.

Receptaculites (?) sp. is reported in a measured section of the Priest Canyon section of the Fremont Formation near Canon City, Colorado. Spicules (?) and spicular chert (?) are also reported from the Manitou Formation.

Marsh, O. C.

1867. Notice of a new genus of fossil sponges from the Lower Silurian. Amer. Jour. Sci. Arts, ser. 2, **44**, no. 30, art. 11: p. 88.

Several specimens of *Scyphia* (now *Brachiospongia*) *digitata* Owen occur in limestones of the Ordovician of Franklin county, Kentucky. The name *Brachiospongia* is proposed and the specimen in the Yale collection given the specific name of *B. Roemerana*, that one in the collection of S. S. Lyon termed *B. Lyonii* if it is new. Marsh said a full description of these specimens would appear in an early number of the American Journal of Science, with illustrations. Both species are now considered synonymous with *B. digitata* (Owen).

1868. On some new fossil sponges from the Lower Silurian. Proc. Amer. Assoc. Adv. Sci., p. 160.

Only titles of papers read at the 16th annual meetings of the association are published, thus only the title appears.

Mather, K. F.

1917. The Trenton fauna of Wolfe Island, Ontario. Ottawa Nat., **31**, pp. 34–40, pl. 1.

The only sponge-like organism mentioned is *Receptaculites occidentalis* Salter, from the Ordovician Trenton Limestone, at Marysville, Wolfe Island. The plate with the article does not include this species.

Matthew, G. F.

1886. Illustrations of the fauna of the St. John Group continued, No. III.—Descriptions of new genera and species, (including

a description of a new species of Solenopleura by J. F. Whiteaves). Trans. Proc. Roy. Soc. Canad., **3**, sec. 4: pp. 29–84, pls. 5–7.

The new genus, *Eocoryne* and the species *E. geminum* are described and illustrated from the fine shale of Division 1c at Hanford Brook and Division 1d at Porter's Brook, Saint Martin's, New Brunswick. These sponges are solid siliceous masses that have a spicular pattern. *Protospongia* (?) *minor* n. sp. and *P.* (?) *minor* var. *distans* (n. var.) described and illustrated are probably both graptolites, possibly *Dictyonema.*

1890. On Cambrian organisms in Acadia. Trans. Roy. Soc. Canad., **7**, sec. 4: pp. 135–160, pls. 5–9

The new genus *Dichoplectella,* and the new species *D. irregularis, Plocoscyphia* (?) *perantiqua, Astrocladia* (?) *elongata, A.* (?) *elegans, A.* (?) *virguloides,* and *Hyalostelia minima* from the St. John Group at Greenwich, Westfield, and at St. Martins, New Brunswick are proposed and figured.

1890. On the occurrence of sponges in Laurentian rocks at St. John, N. B. Bull. Nat. Hist. Soc. New Brunswick, ser. 2, **9**: pp. 42–45, 2 text-figs.

Cyathospongia (?) *eozoica* and *Halichondrites graphitiferus* are described as new species from the upper part of the Laurentian rocks along the Kennebacasis River at St. John. These forms described by Matthew are now considered inorganic, and not sponges, but features related to metamorphism of the Precambrian rocks.

1892. List of the fossils found in the Cambrian rocks in and near St. John. Bull. Nat. Hist. Soc. New Brunswick, ser. 2, **10**, app. B, pp. 11–23.

The following forms are listed as occurring in the St. John Group, at St. John, under "Spongida:" *Plocoscyphia* (?) *perantiqua, Astrocladia* (?) *elongata, A. elegans, A.* (?) *virguloides, Archaeocyathus* (?) *pavonoides, Hyalostelia minima, Dichoplectella irregularis, Protospongia* (?) *minor, P.* (?) *minor distans,* and *Protsopongia* (?) sp. All of these forms were named by Matthew.

Matthew, W. H.

1960. Texas fossils. An amateur collector's handbook. Guidebook Univ. Texas Bur. Econ. Geol. 2, 123 pp.

A general description of sponges is given, mentioning that sponges have been collected from the Paleozoic and Mesozoic formations of

north and Trans-Pecos Texas. Genera figured are *Meandrostia*, *Heliospongia*, *Astraeospongium*, *Astylospongia*, *Receptaculites*, and *Girtyocoelia*.

Matthews, W. H. III

1962. Fossils, an introduction to prehistoric life. Barnes & Noble, Inc., 337 pp., 180 text-figs.

A superficial textbook treatment of sponges is given, with illustrations of *Astylospongia*, *Astraeospongium*, and some Upper Paleozoic sponges. *Receptaculites* is cited among the pleosponges. In the section dealing with various periods of geologic time, sponges are cited from the Cambrian, and a restoration of the Cambrian Burgess Shale illustrates some of the sponges from that locality, but does not mention them by name.

Meek, F. B.

1868 (1869). Note on *Ethmophyllum* and *Archeocyathus*. Amer. Jour. Sci. Arts, ser. 2, **46**, no. 136: p. 144.

Archeocyathus and *Ethmophyllum* are compared very briefly to *Archeocyathus* (now *Archaeoscyphia*) *minganensis* Billings.

Meek, F. B. and Worthen, A. H.

1868. Part II, Palaeontology. Geol. Palaeontol., **3**, Geol. Surv. Illinois, pp. 291–574, i-vi, 20 pls.

Receptaculites globularis (now *Ischadites iowensis*) Hall, from the Galena beds at Scales Mound; *Receptaculites* sp. from the same unit at Galena, Illinois; and *R. oweni* from the same unit at Galena, Dixon, and at other Illinois localities are only the species of sponges or receptaculitids reported from the Galena Formation.

Niagaran sponges and receptaculitids reported are *Astylospongia*? *christiani*, a new species, and *Pasceolus* (also spelled on same page *Paceolus* (now *Cerionites*) *dactylioides* (Owen), both forms from Carrol County, Illinois.

Astraeospongia hamiltonensis Meek and Worthen is described from the Hamilton rocks of the Upper Devonian at New Buffalo, Iowa.

Other fossils are described from the whole Paleozoic sequence.

1870. Descriptions of new species and genera of fossils from the Palaeozoic rocks of the Western States. Proc. Acad. Nat. Sci. Phil., **22**, pp. 22–23.

Receptaculites formosus is described from the Niagaran of Bridgeport, Illinois, as a foraminifer.

Merriam, C. W.

1963. Paleozoic rocks of Antelope Valley, Eureka and Nye Counties, Nevada. U. S. Geol. Surv., Prof. Paper 423, 67 pp., 2 pls., 8 text-figs., 2 tables.

The prolific sponge fauna of the Antelope Valley Limestone is reported from central Nevada. The fauna is dominated by the Archaeoscyphidae. The quasi-sponge, *Calathium* (?) sp., is reported from the Antelope Valley Limestone as well.

Receptaculitids reported include: *R. mammillaris* Walcott, *R. elongata* Walcott, and *R.* cf. *R. occidentalis* Salter, from the Pogonip Group and Copenhagen Formation in the Antelope Valley region.

Mertie, J. B., Jr.

1933. The Tatonduk-Nation district. *In* Mineral resources of Alaska. Rept. Prog. Invest. 1930, Bull. U. S. Geol. Surv., **836**, pp. 347–443, pl. 7, text-figs. 11–13.

Sponge spicules are reported along with Upper Ordovician graptolites in collections made by L. D. Burling from rocks of the district.

Mickleborough, J. and Wetherby, A. G.

1878. A classified list of Lower Silurian fossils, Cincinnati Group. Jour. Cincinnati Soc. Nat. Hist., **1**, no. 2: pp. 61–86 (also printed separately in 1878 as a pamphlet containing pages 1–26).

Astylospongia favolata James, *Astylospongia tumida* James (now *Pasceolus darwini* Miller), *Microspongia* (now *Hindia*) *gregaria* Miller and Dyer, *Pasceolus claudii* Miller, *Pasceolus darwini* Miller are listed from the Cincinnati Group.

Miller, A. K.

1930. The age and correlation of the Bighorn Formation of northwestern United States. Amer. Jour. Sci., ser. 5, **20**: pp. 195–213.

Receptaculites arcticus (?) Ethington and *Cyclocrinites* aff. *C.* (now *Nidulites*) *gregarius* (Billings) are reported from the Lander Sandstone in the Wind River Mountains, near Lander, Wyoming. *Receptaculites arcticus* Ethington is also reported from the Bighorn Formation in the same vicinity, and *R. oweni* Hall is reported from the Bighorn Formation from the Bighorn Mountains.

Miller, S. A.

1874. Genus *Pasceolus*.—(Billings). Cincinnati Quart. Jour. Sci., **1**: pp. 4–7, text-figs. 1–3.

Miller summarizes the generic characters of the genus and the original description of *Pasceolus* by Billings, and describes the new species *P. darwini* from Ordovician rocks near Cincinnati, Ohio and Maysville, Kentucky; and *P. claudei* from Ordovician rocks near Maysville, Kentucky. Woodcuts illustrate the two new species as text-figs. 1–3.

1877. The American Palaeozoic fossils. A catalogue of the genera and species, with names of authors, dates, places of publication, groups of rocks in which found, and the etymology and signification of the words, and an introduction devoted to the stratigraphical geology of the Paleozoic rocks. Cincinnati, Ohio. 245 pp.

This is a comprehensive list of the genera and species of fossils known to this date, and includes over 55 species of sponges and receptaculitids. Taxonomy is up-dated and bibliographic references are cited.

1879. Catalogue of fossils found in the Hudson River, Utica Slate and Trenton Groups, as exposed in the southeast part of Indiana, southwest part of Ohio, and northern part of Kentucky. 8th, 9th and 10th Ann. Rept. [one volume] Geol. Surv. Ind., pp. 22–56.

Pasceolus claudei Miller and *P. darwini* Miller are listed as Rhizopods; *Brachiospongia digitata* (Owen), *B. lyoni* Marsh, *B. roemerana* Marsh (now both *R. digitata* (Owen)), and *Microspongia* (now *Hindia*) *gregaria* Miller and Dyer are listed as Porifera.

1882. Description of two new genera and eight new species of fossils from the Hudson River Group, with remarks upon others. Jour. Cincinnati Soc. Nat. Hist., **5**, no. 1: pp. 34–44, pl. 2, fig. 2, 3.

The new genera *Dystactospongia* and *Pattersonia* and the new species *Dystactospongia insolens*, and *Pattersonia difficilis* are described from the Hudson River Group, at Cincinnati, Ohio.

1883. The American Paleozoic fossils: a catalogue of the genera and species, with names of authors, dates, places of publication, groups of rocks in which found, and the etymology and signification of the words, and an introduction devoted to the strati-

graphical geology of the Paleozoic rocks. Cincinnati, Ohio. pp. 246–334.

This is an addition to the first edition published in 1877, and contains additional sponges. Both editions were bound together in 1883 to form one book with consecutive pages.

1889. Class Porifera. *In* North American Geology and Palaeontology, Cincinnati. pp. 152–167, figs. 89–127.

This summary chapter is an alphabetical list of genera and species of all fossil sponges known to Miller. The diagnoses of the following new sponges are given: *Anthaspidella* Ulrich and Everett, *A. fenestrata* Ulrich and Everett, *A. firma* Ulrich and Everett, *A. florifera* Ulrich and Everett, *A. grandis* Ulrich and Everett, *A. magnifica* Ulrich and Everett, *A. mammulata* Ulrich and Everett, *A. obliqua* Ulrich and Everett, *A. parvistellata* Ulrich and Everett, *A. scutula* Ulrich and Everett; *Camarocladia* Ulrich and Everett, *C. dichotoma* Ulrich and Everett; *Chirospongia* Miller, *C. faberi* Miller, *C. wenti* Miller; *Edriospongia* Ulrich and Everett, *E. basalis* Ulrich and Everett; *Streptosolen* Ulrich and Everett, *S. obconicus* Ulrich and Everett; *Strotospongia* Ulrich and Everett, *S. maculosa* Ulrich and Everett; *Zittelella* Ulrich and Everett, *Z. inosculata* Ulrich and Everett, *Z. lobata* Ulrich and Everett, *Z. typicalis* Ulrich and Everett. (See Finks, 1967.)

1892. North American Geology and Palaeontology, First Appendix, 1892, pp. 665–718, figs. 1195–1265.

Several sponges are briefly discussed, including the following: *Acanthodictya* (*A. hispida*) Hinde; *Cyathophycus silurians* James, *Cyathospongia quebecensis* Dawson and Hinde; *Halichondrites* (*H. confusus* Dawson and Hinde); *Hyalostelia* (now *Kiwetinokia*) *metissica* Hinde; *Lasiothrix* (*L. curviscostata* Dawson and Hinde); *Protospongia* (now *Diagonella*) *coronata* Dawson and Hinde, *P.* (now *Diagonella*) *cyathiformus* Dawson and Hinde, *P. delicatula* Dawson and Hinde, *P. mononema* Dawson and Hinde, *P. polynema* Dawson and Hinde, and *P. tetranema* Dawson, and *Rhombodictyon globosus* James.

1897. Second appendix to North American geology and paleontology, October, 1897, pp. 719–793, figs. 1266–1458.

Additional sponges are listed. No new names are introduced.

Miller, S. A. and Dyer, C. B.

1878. Contributions to Paleontology. Jour. Cincinnati Soc. Nat. Hist., **1**: pp. 24–39, 2 pls.

The new fossils *Microspongia* n. g., and *M. gregaria* n. sp. are described and illustrated, from the Cincinnati Group at Cincinnati. These are small spherical sponges which commonly occur in clusters, and range from one-eighth to more than one-half inch in diameter. These fossils are now included in the genus *Hindia*.

Miller, S. A., and Gurley, W. F. E.

1896. New species of Paleozoic invertebrates from Illinois and other states. Bull. Ill. State Mus. Nat. Hist., **11**: pp. 8–50, 5 pls.

The new species *Receptaculites dixonensis* is described from the Galena limestone of the "lead region of Wisconsin, Iowa, and Illinois," near Dixon, Illinois.

Moore, R. C.

1958. Introductory historical geology, 2nd ed., McGraw-Hill, New York. 656 pp., 591 text-figs.

The Cambrian sponges *Choia*, *Vauxia*, and *Chancelloria*, and the Silurian sponge, *Astraeospongium*, are figured or mentioned. *Astraeospongium* and *Astylospongia*, along with *Receptaculites*, are discussed.

Moore, R. C., Laliker, C. G., and Fischer, A. G.

1952. Invertebrate Fossils. McGraw-Hill, New York. 766 pp.,

This is a general textbook treatment of the morphology of sponges. Pertinent genera described and figured include; *Chancelloria eros* Walcott, Middle Cambrian (Burgess), British Columbia; *Choia carteri* Walcott, Middle Cambrian (Burgess), British Columbia; *Eiffelia globosa* Walcott (Burgess), British Columbia; *Protospongia fenestrata* Salter, Middle Cambrian (Burgess), British Columbia; *Vauxia gracilenta* Walcott, (Burgess), British Columbia; *Brachiospongia digitata* (Owen), Middle Ordovician, Kentucky; *Dystactospongia minor* Ulrich and Everett, Middle Ordovician, Tennessee; *Hindia parva* Ulrich, Middle Ordovician, Minnesota; *Ischadites iowensis* Owen, Middle Ordovician, Minnesota; *Nidulites pyriformis* Bassler, Middle Ordovician, Pennsylvania; *Receptaculites oweni* Hall, Middle Ordovician, Minnesota; *Astraeospongia meniscus* (Roemer), Niagaran, Tennessee; *Astylospongia praemorsa* (Goldfuss), Niagaran, Tennessee.

Moorhouse, W. W. and Beals, F. W.

1962. Fossils from the Animikie, Port Arthur, Ontario. Trans. Roy. Soc. Canad., ser. 3, **56**, sec. 3, pt. 1: pp. 97–110, 3 pls.

Questionable sponge spicules are reported and figured from the Precambrian Animikie Chert from Port Arthur. They are approximately two billion years old and are the oldest known evidence of sponges, particularly if the spicules reported by Cayeux from Brittany are not Precambrian.

Moret, Leon

1952. Embranchement des Spongiaires. *In* Piveteau, J. Traite de Paleontologie. Masson et. Cie, Paris. 782 pp. 142 text-figs.

Basic morphology, stratigraphic range, and other aspects of paleontology are presented. The following sponges are treated: *Anomoclonella* sp., *Astylomanon* (now *Palaeomanon*) sp., *Astylospongia* sp., *Astraeospongia* sp., *Atikokania* sp., *Aulocopium* sp., *Brachiospongia* sp., *Carpospongia* sp., *Climacospongia* sp., *Cyathophycus* sp., *Dictyospongia* sp., *Hindia* sp., *Pattersonia* sp., *Protospongia* sp., and *Saccospongia* sp., all of which occur in Early Paleozoic or Precambrian rocks of North America.

1953. Manuel de paleontologie animale, 3rd ed. Masson & Cie, Paris. 759 pp., 277 text-figs.

A general treatment of morphology, geologic importance, and taxonomy of sponges is given. Mention or illustration is made of *Astraeospongium*, *Astylospongia*, *Brachiospongia*, *Carpospongia*, *Dictyospongia*, and *Protospongia*. *Receptaculites neptuni* DeFrance is also mentioned.

Morris, H. T.

1957. General geology of the East Tintic Mountains, Utah. *In* Geology of the East Tintic Mountains and ore deposits of the Tintic mining districts, Guidebook to the geology of Utah. Utah Geol. Soc. Guidebook no. 12, pp. 1–56, 5 text-figs.

"*Receptaculites*" sp. is noted in the Opohonga limestone of the district.

Morris, H. T. and Lovering, T. S.

1961. Stratigraphy of the East Tintic Mountains, Utah. U. S. Geol. Surv., Prof. Paper 361, 145 pp., 5 pls., 61 text-figs., 18 tables.

Several specimens of "*Receptaculites*" sp. are reported from the upper part of the Opohonga Limestone in Black Rock Canyon, eight miles northwest of Eureka, Utah.

Mullens, T. E.

1964. Geology of the Cuba City, New Diggings, and Shullsburg quadrangles, Wisconsin and Illinois. Bull. U. S. Geol. Surv., 1123-H, pp. 437–531, pls. 25–32, text-figs. 51–66, 1 table.

Receptaculites oweni Hall is reported to be common in the Galena Dolomite, and small B-B shot-sized sponges are common in the basal two feet of the Maquoketa Shale, in the depauperate fauna zone.

Müller, A. H.

1963. Lehrbuch der Paläozoologie. Band II, Invertebraten. Teil 1, Protozoa—Mollusca. Veb. Gustav Fischer Verlag, Jena. 574 pp., 712 text-figs.

A general treatment of morphology, ecology, and systematic paleontology of sponges is given, with considerable, but understandable, emphasis on European forms.

The following forms are briefly described: *Eospongia* sp. from Canada, *Palaeomanon* from the Silurian of Tennessee, and *Camarocladia* sp. from the Cambrian of North America. The following forms are figured and briefly described: *Aulocopium aurantium* Oswald from the Upper Silurian (Gotlandian) of North America and Europe; *Astylospongia praemorsa* (Goldfuss), from the same age and area; *Protospongia mononema* Dawson and Hinde, from the Lower Cambrian and Ordovician of northwestern Europe, North America, and China; *Astraeospongia meniscus* (Roemer), from the Upper Silurian and Devonian of North America and Europe; and the receptaculitids, *Receptaculites* sp., from the Ordovician to Devonian of North America and Europe, and *Sphaerospongia tesselata* (Phill.) from the Devonian of Europe. *Ischadites* is briefly described.

Munyan, A. C.

1947. A new species of sponge from the Middle Cambrian. Jour. Paleontol., **21**, no. 6: pp. 546–548, 2 figs.

A new species, *Protospongia coosensis*, is described from the Middle Cambrian Conasauga Formation from near Livingston, Floyd County, Georgia.

Murchison, R. I.

1859. Siluria. The history of the oldest fossiliferous rocks and their foundations; with a brief sketch of the distributions of

gold over the earth. 3rd ed. 592 pp., 41 pls., numerous text-figs., sections, and maps.

In this third edition of the "Silurian system," Murchison briefly discusses the occurrence of *Receptaculites* in North America (p. 466) without recognizing its relation to *Ischadites*, but rather considering these American forms to be foraminifers.

Needham, C. E.

1933. Sponge spicules from the Lower Ordovician of Wisconsin. Science, **77**: pp. 450–451.

Sponge spicules are described from the Oneota dolomite (Lower Ordovician) of Wisconsin located on U. S. Highway 12, about three or four miles south of Springfield Corners, Wisconsin. Since Zittel and Berry stated that monactinellid spicules are known from rocks as old as Silurian, perhaps these Ordovician ones may be the oldest monactinellid spicules thus far discovered.

Nelson, R. B.

1966. Structural development of northernmost Snake Range, Kern Mountains, and Deep Creek Range, Nevada and Utah. Bull. Amer. Assoc. Petrol. Geol, **50**: pp. 921–951, 2 text-figs., 2 tables.

Receptaculites sp. is cited from the Kanosh Shale of the Pogonip Group in the Deep Creek Range.

Nelson, S. J.

1964. Ordovician stratigraphy of northern Hudson Bay Lowland, Manitoba. Bull. Geol. Surv. Canad., **108**: 36 pp., 7 pls., 4 text-figs., 1 table.

Receptaculites sp. is reported from several collections of invertebrate fossils from the Red Riveran Portage Chute Formation.

Nelson, S. J. and Johnson, R. D.

1966. Geology of Hudson Bay Basin. Bull. Canad. Petrol. Geol., **14**: pp. 520–578, 16 text-figs.

The paper concerns primarily stratigraphy of the Ordovician, Silurian, and Devonian geology of the Hudson Bay Lowlands, and islands to the north end of the Bay. *Receptaculites* sp. is reported from Late Ordovician Portage Chute beds on the North Knife River

near Churchill, Manitoba. It is also reported from equivalent beds on Southhampton Island to the north.

Nettelroth, Henry

1889. Kentucky fossil shells. A monograph of the fossil shells of the Silurian and Devonian rocks of Kentucky. Kentucky Geol. Surv. State Mus., Frankfort, 245 pp.

Brachiospongia digitata (Owen) is described and illustrated from specimens collected at Benson Creek, west of Frankfort, from the Cincinnatian series.

Nicholson, H. A.

1873. On some new species of *Stromatopora*. Ann. Mag. Nat. Hist., ser. 4, **12**: pp. 89–95, pl. 4.

New species of *Stromatopora* are described as having certain affinities with sponges, but these forms are now considered coelenterates.

1874. Report upon the palaeontology of the Province of Ontario. Hunter, Rose & Co., Toronto. 133 pp.

In a brief treatment of the sponges, *Astraeospongia* sp. is described and is compared to *A. hamiltonensis* Meek and Worthen.

1874. On the affinities of the genus *Stromatopora*, with descriptions of two new species. Ann. Mag. Nat. Hist., ser. 4, **8**: pp. 4–14, text-figs. 1–3.

The genus *Stromatopora* is referred to the Calcispongiae, with three Devonian and one upper Silurian (Niagara limestone) species. The description and illustrations are of stromatoporids, now considered among coelenterates.

Nicholson, H. A. and Lydekker, R.

1889. A manual of palaeontology for the use of students with a general introduction on the principles of palaeontology. 3rd ed., v. 1. Wm. Blackwood and Sons, Edinburgh and London. 885 pp., 812 text-figs.

A generalized textbook treatment of sponges is given, and mention is made of the following forms: *Archaeoscyphia minganensis* (Billings), *Astraeospongia meniscus* (Roemer), *Astylospongia, Atractosella, Aulocopium, Calathium, Climacospongia, Eospongia, Hindia, Hyalostelia, Palaeomanon, Protachilleum, Protospongia fenestrata* Salter, and the receptaculitids, *Ischadites, Receptaculites neptuni* De-

France, and *Sphaerospongia*. The receptaculitids are questionably placed with hexactinellid sponges.

Pasceolus, *Cyclocrinus*, and *Nidulites* are discussed and considered of uncertain affinities.

Nickles, J. M.

1902. The geology of Cincinnati. Jour. Cincinnati Soc. Nat. Hist., **20**, no. 2: pp. 49–100, 1 plate.

The following fossils are listed: *Pasceolus globosus* Billings from the Cincinnati beds, the Utica, Lorraine, and Richmond Groups.

Lepidolites dickhauti Ulrich is reported from Lower Utica beds; and *Anomalispongia* (now *Anomaloides*) *reticulata* Ulrich from the Mt. Hope beds.

Cylindrocoelia covingtonensis Ulrich, *Dystactospongia insolens* Miller, *Hindia sphaeroidalis-gregaria* (Miller and Dyer) are reported from the Fairmont beds; and *Leptopoterion mammiferum* Ulrich, *Pattersonia difficilis* Miller, and *P. ulrichi* Rauff from the Corryville beds.

Lower Richmond forms reported are *Brachiospongia tuberculata* James; *Dystactospongia minima* Ulrich, and *Hindia sphaeroidalis parva* (now *H. parva*) Ulrich; Middle Richmond forms are *Streptospongia labyrinthica* Ulrich and *Strephochetus richmondensis* Miller; and Upper Richmond forms *Heterospongia aspera* Ulrich, *H. knotti* Ulrich, and *H. ramosa* Ulrich.

Niles, A. E.

1865. Untitled minutes of the March 2, 1864 meeting. Proc. Boston Soc. Nat. Hist., **10**: p. 19.

Specimens of *Pasceolus halli* Billings were exhibited, and various authors concluded that this form should be included in the Cystideans, in the family Sphaeronitidae. The specimens were collected at Ellis Bay, on Anticosti Island.

Nitecki, M. H.

1965. Catalogue of type specimens in Chicago Natural History Museum. Porifera. Fieldiana: Geol., **13**: no. 6: pp. 477–509.

Six holotype sponges of James and Miller, eight holotype receptaculitids of Hall, Miller, Owen, and Bradley, and five referred specimens of sponges and receptaculitids of various authors are in the collection.

1967. *Receptaculites* Deshayes, 1828 (receptaculitids): proposed validation under the plenary powers. Z. N. (S) 1787. Bull. Zool. Nomencl., **24**, part 2, pp. 119–120.

This paper proposed that the seldom used generic name *Receptacules* DeFrance, 1827, be overlooked, and that the later but widely used generic name *Receptaculites* Deshayes, 1828, be accepted.

Nolan, T. B., Merriam, C. W., and Williams, J. S.

1956. The stratigraphic section in the vicinity of Eureka, Nevada. U. S. Geol. Surv., Prof. Paper 276, 77 pp., 2 pls., 2 text-figs.

Receptaculites elongatus Walcott and *R. mammillaris* Walcott occur in the *Mitrospira* zone and probably also range into higher zones within the Antelope Valley Limestone (Upper Pogonip group). Walcott described both the above species from the Eureka district, but Newberry earlier had described *R. mammillaris* in manuscript, and is given credit by Walcott as author of the species. Walcott is now considered the legal author of the species.

Norris, A. W.

1963. Northwest coast of Baffin Island between Port Bowen and Sargent Point. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Mem. Geol. Surv. Canad., **320**: pp. 150–155.

Receptaculites (?) sp. is reported from the brecciated unit within the Read Bay Formation at Port Bowen Bay.

1965. Stratigraphy of Middle Devonian and older Palaeozoic rocks of the Great Slave Lake region, Northwest Territories. Mem. Geol. Surv. Canad., **322**: 180 pp., 9 text-figs.

Ischadites sp. is reported from the type section of the La Matre Falls Formation, and *Ischadites* (?) sp. is listed with a collection of fossils from the Le Matre Formation and the Chedabucto Lake Formation.

Norris, D. K. and Price, R. A.

1966. Middle Cambrian lithostratigraphy of southeastern Canadian Cordillera. Bull. Canad. Petrol. Geol., **14**: pp. 385–404, 2 pls., 3 text-figs.

Chancelloria sp. is reported in a chart of occurrences from 195 feet above the base of the Gordon Formation at Windsor Mountain, 50 miles east of Cranbrook, B. C.

North, F. K. and Henderson, G. G. L.

1954. Summary of the geology of the Southern Rocky Mountains of Canada, a review of the structure and Paleozoic stratigraphy of the Canadian Rocky Mountains between latitudes 49° 30′ and 52° 30′. Guidebook 4th Ann. Field Conf., Alberta Soc. Petrol. Geol., pp. 15–81, 1 correlation table, 1 text-fig.

Sponges are reported from the Sarbach Formation in the Clearwater region of Alberta, presumably those cited by Walcott (1928) as *Calathium* (?) sp. and *Receptaculites* (?) sp.

Northrop, S. A.

1939. Paleontology and stratigraphy of the Silurian rocks of the Port Daniel-Black Cape region, Gaspe. Geol. Soc. Amer. Spec. Paper 21, 275 pp., 28 pls., 1 text-fig.

Hindia fibrosa (now *H. sphaeroidalis* Duncan) (Roemer) and *Caryospongia* cf. *C. juglans* Quenstedt are reported from the Chaleur Bay region. *Hindia* occurs in the Indian Point Formation, and *Caryospongia* from the LaVieille Formation. *Gaspespongia basalis* Parks is listed as a sponge from the LaVieille Formation, but this form is now considered an alga.

Okulitch, V. J.

1935. Cyathospongia—A new class of Porifera to include the Archaeocyathinae. Trans. Royal. Soc. Canad., ser. 3, **29**: pp. 75–106.

This paper is mainly concerned with archaeocyathid morphology and classification, but does include *Archaeocyathus* (now *Archaeoscyphia*) *minganensis* (Billings) in a listing of included forms. This form is now well recognized as a lithistid sponge and not an archaeocyathid.

Okulitch, V. J., Cooper, G. A., Arellano, A. R. V., Johnson, J. H., Stowanow, Alexander, and Lochman, Christina

1952. Cambrian stratigraphy and paleontology near Caborca, northwestern Sonora, Mexico. Smithsonian Misc. Coll., **119**, no. 1: 183 pp., 31 pls., 9 text-figs.

Eight species of archeocyathids are described, but no sponges occur in any of the collections.

1960. The Lower Cambrian fauna. *In* T. W. M. Cameron, ed., Evolution; its science and doctrine, Symposium presented to the Roy. Soc. Canad., pp. 12–21.

Lower Cambrian sponges include disarticulated spicules of the genera *Leptomitus* and *Protospongia*. *Choia* is cited as a calcareous sponge, and *Camarocladia* is said to range throughout the Cambrian.

Okulitch, V. J. and Bell, W. G.

1955. *Gallatinospongia*, a new siliceous sponge from the Upper Cambrian of Wyoming. Jour. Paleontol., **29**, no. 3: pp. 460–461, pls. 48–49.

Gallatinospongia n. g. is defined with the type species as *G. conica* n. sp. The type species is described and illustrated with specimens from 294 feet above the base of the Gallatin Formation on the southeast flank of the Wind River Mountains in central Wyoming.

Okulitch, V. J. and Nelson, S. N.

1957. Sponges of the Paleozoic. *In* Treatise on Marine Ecology and Paleoecology. Vol. 2, Paleoecology. Geol. Soc. Amer. Mem. **67**, 2: pp. 763–769.

A review and compilation of papers dealing with fossil sponges in which ecologic data are presented. A summary statement at the first presents data on particular faunas for each of the geologic periods, followed by abstracts of the pertinent ecologic data in significant papers.

Olson, E. C.

1965. Fossil. *In* Encyclopedia Britannica, **9**: pp. 649–651, 5 figs.

Two fossils from Illinois, *Receptaculites* sp. and *Zittelella* sp., are illustrated and listed as sponges.

Orton, Edward

1873. Catalogue of the described fossils of the Cincinnati Group as shown in south-western Ohio. Rept. Geol. Surv. Ohio, **1**: pp. 400–411.

Astylospongia sp. indet. is listed.

Owen, D. D.

1844. Report of a geological exploration of part of Iowa, Wisconsin, and Illinois, in 1839. Two sets were issued, set one,

(or part 1;) Message Pres. U. S. covering the mineral lands of the U. S., 26th Cong., 1st. ser., House Ex. Doc. 239, pp. 9–115; (part 2) 28th congr., 1st. ser., Senate Ex. Doc. 407, pp. 15–145, plates, Washington.

(The complete title of second part is: Report of a Geological Exploration of part of Iowa, Wisconsin, and Illinois, made under instructions from the Secretary of the Treasury of the United States, in the autumn of the year 1839; with charts and illustrations.)

The fossil part was printed June 4, 1840 without charts and without illustrations of fossils. *"Coscinopora sulcata"* Goldfuss was introduced in 1840.

The 1840 edition includes descriptions and illustrations of both *Orbitulites? reticulata* (now *Ischadites iowensis* (Owen)) and *Lunulites* (?) (now *Cerionites*) *dactioloides* Owen. *Coscinopora* (= *Receptaculites oweni* Hall) was illustrated in the 1844 edition on pl. 7, fig. 5.

The illustrations of the 1844 edition were also issued as a separate pamphlet.

1852. Description of new and imperfectly known genera and species of organic remains, collected during the Geological Surveys of Wisconsin, Iowa, and Minnesota, by D. D. Owen. *In* Report of a geological survey of Wisconsin, Iowa, and Minnesota; and incidentally of a portion of Nebraska Territory. Lippincott, Grambo and Co., Philadephia. pp. 573–587, pls. 1–3.

Selenoides iowensis (now *Ischadites iowensis*), a new genus and species, is described and figured from the Lower Silurian (Ordovician) of Iowa and compared to *Orbitolites*. Owen did not recognize the relation of *Selenoides iowensis* to the other receptaculitids listed in the same volume (e.g., *Coscinopora*), nor did he compare it with *Orbitolites reticulata* (= *I. iowensis*).

1857. Second report of the Geological Survey in Kentucky, made during the years 1856 and 1857. Frankfort, Ky., **2**, 391 pp.

Scyphia (now *Brachiospongia*) *digitata* n. sp. is described from Franklin County, Kentucky, in the lower Benson Formation "in the neighborhood of the Riffle, near Bright's Mill."

Owen, Richard

1862. *Siphonia digitata*. *In* Description of fossils; Report of a geological reconnaissance of Indiana. Indiana Geol. Surv., 1859 1860, pp. 362–363, text-fig. 1.

The sponge *Siphonia* (now *Brachiospongia*) *digitata* (Owen) is described and figured in a line cut from the "lower Silurian" near Frankfort, Kentucky.

Paige, Sidney

1916. Description of the Silver City quadrangle, New Mexico. U. S. Geol. Surv. Geol. Atlas U. S., Silver City Folio no. 199, 19 pp., 3 maps, 1 sheet illust.

Calathium anstedi Billings is reported from the El Paso Limestone from Lone Mountain.

Palmer, A. R.

1954. The faunas of the Riley Formation in Central Texas. Jour. Paleontol., **28**, no. 6: pp. 709–786, pl. 72–92, 6 text-figs.

Three general types of spicules were found in acetic acid residues. A- four or six rays in a plane normal to a central spine; from the *Coosella* zone; B- *Chancelloria* Walcott from the *Coosella* and *Marysvillia* zones; and C- small hexactinellid forms from the *Aphelaspis* zone of the Riley Formation in Texas.

Parks, W. A.

1915. Paleozoic fossils from a region South-west of Hudson Bay. A description of the fossils collected by Joseph B. Tyrell, Esq., F.R.S.C., in the district of Patricia, Ontario, and in Northern Manitoba during the summer of 1912. Toronto Trans. Canad. Inst., **11**: pp. 3–95, (also printed in Toronto Univ. Studies Geol. Ser., no. 9, 1915).

Aulocopium (*Aulocopella?*) *gigantea* n. sp., is described from the Ordovician rocks of northern Manitoba.

1933. New species of stromatoporoids, sponges, and corals from the Silurian strata of Baie des Chaleurs. Toronto Univ. Studies, Geol. ser, no. 33, 40 pp., 8 pls.

The new genus *Gaspespongia*, and its single new species *G. basalis*, are described from the LaVieille Formation at Port Daniel, Quebec. In addition, specimens of *Caryospongia* cf. *juglans* Quenstedt, and an indeterminate spicular mass of certain sponge origin are also described. The new species *Girvanella* (?) *siluria* is also described and figured, and Parks points out the genus *Strepochetus* is considered a synonym. *Girvanella* is a valid algal genus, and from the description and illustration of Park's species, this form should not be con-

sidered a sponge. *Gaspespongia basalis* is likewise now considered as algae.

Pate, W. F. and Bassler, R. S.

1908. The Late Niagaran strata of West Tennessee. Proc. U. S. Nat. Mus., **34**: pp. 407–437, 3 text-figs.

Stratigraphy of sponge-bearing Silurian beds is summarized and occurrence of the following are noted: *Astraeospongia meniscus* (Roemer) in the Meniscus Limestone; *A. meniscus* (Roemer), *Astylomanon* (now *Palaeomanon*) *cratera* (Roemer), *Caryomanon incisolobatum* (Roemer), *Carpomanon stellatimsulcatum* (Rauff) in the Beech River Formation, and *Astraeospongia meniscus* (Roemer) in the Decatur Limestone. *Hindia sphaeroidalis* Duncan is reported from the Ordovician Hermitage Formation.

Peck, J. H., Jr. and McFarland, H. B.

1954. Whitfield collection of types at the University of California. Jour. Paleontol., **28**, no. 3: pp. 297–309, pl. 29.

Specimens indicated by Whitfield to be at the University of California, but which were not received, include: *Cerionites dactyloides* (Owen) and *Receptaculites hemisphericus* Hall.

Specimens indicated by Whitfield (1899) as at the State Museum, State University, Columbus, Ohio, that are actually at the University of California: *Receptaculites ohioensis* Hall and Whitfield.

Specimens (holotypes) at the University of California: *Receptaculites devonicus* Whitfield from the Devonian, upper Helderberg Group near Columbus, Ohio; and *Receptaculites ohioensis* Hall and Whitfield from the Silurian, Niagara Group, Yellow Springs, Ohio.

Perkins, G. H.

1902. The Geology of Grand Isle. Rept. Vermont State Geol., **3**: pp. 102–173.

The author mentions *Eospongia* (now *Zittelella*) *varians* Billings in a faunal list of the limestone at Wilcox Point. He quotes H. M. Seely as mentioning *Spongia* from Providence Island and indicates that the upper Chazy Limestone is full of *Eospongia*. Sponges are mentioned several times in stratigraphic sections between Rockwell Bay and Table Bay.

Pestana, H. R.

1960. Fossils from the Johnson Spring Formation, Middle Ordovician, Independence Quadrangle, California. Jour. Paleontol., **34**: pp. 862–873, 4 pls., 1 fig.

Anthaspidella inyoensis n. sp. is described and figured from the Johnson Spring formation. This species resembles *A. scutula* Ulrich and Everett.

Pia, Julius

1927. Thallophyta, Handbuch der Paläobotanik. von Max Hirmer, pp. 31–136, figs. 14–129.

The genera *Pasceolus* and *Cerionites* are included in *Cyclocrinus* Eichwald. American species are generally insufficiently known, and are placed in *Cyclocrinus* without critical analysis. *Nidulites pyriformis* Bassler is illustrated and placed in *Mastopora* Eichwald. All these genera are considered dasycladacean algae. This is a good general treatment of Paleozoic calcareous algae, among other subjects.

Pitcher, Max

1964. Evolution of Chazyan (Ordovician) reefs of eastern United States and Canada. (abstr.) Bull. Amer. Assoc. Petrol. Geol., **48**, no. 4: p. 542.

Middle Ordovician reef assemblages are discussed and *Zittelella* occurs in the reef assemblages. Bryozoans dominate throughout the sequence of faunas, and sponges are important in association with tabulate corals and stromatoporids in Middle Chazyan assemblages.

1964. Evolution of Chazyan (Ordovician) reefs of eastern United States and Canada. Bull. Canad. Petrol. Geol., **12**, no. 3: pp. 632–691, 3 pls., 49 text-figs.

Sponges, provisionally identified as *Zittelella*, occur as major elements in the cores of Chazyan reefs in the Lake Champlain region of New York, in the middle of the type Chazyan sequence. They are particularly important elements in Crown Point reefs, where both conical and flattened forms are present. In some reefs they comprise the predominent constituent, forming as much as 50 per cent of the volume. Spicular root tufts are also present and show marked orientation, probably parallel current directions. Conical sponges functioned as frame structures, and laminar sponges functioned as binders in the reef fabric.

Pray, L. C.

1961. Geology of the Sacramento Mountains escarpment, Otero County, New Mexico. New Mexico Inst. Mining Technol., State Bur. Mines Min. Res. Bull., 35, 144 pp., 4 pls., 34 text-figs.

Sponges are reported to be conspicuous elements of the fauna of the lower part of the Upper Ordovician Montoya Formation, but are not identified.

Purdue, A. H. and Miser, H. D.

1923. Description of the Hot Springs district. U. S. Geol. Surv. Geol. Atlas U. S., Hot Springs Folio, Arkansas, no. 215, 12 pp., 3 maps, 1 sheet section, 1 sheet illust., 8 text-figs.

Hindia sp. is reported from near the top of the Middle Ordovician Bigfork Chert from the De Queen quadrangle.

Rasetti, Franco

1945. Faunes Cambriennes des conglomerats de la "formation de Sillery." Natur. Canad., **72,** nos. 3–4: pp. 53–67.

Ajacicyathus rimouski, an archaeocyathid, occurs in Cambrian rocks near Bic, and the sponge, *Trachyum vestustum* Dawson, occurs in conglomerates at Métis, Quebec.

Rauff, Hermann

1892. Untersuchungen über die Organization und systematische Stellung der Receptaculitiden. Abhandl. der K. bayer. Akad. der Wiss. 11, **17,** Bd. 3, Abth., 78 pp. (pp. 645–722), 7 pls.

This is a major reference on receptaculitids, for anatomy of all forms known to this date is thoroughly redescribed. Receptaculitids are considered calcareous organisms and hence can not be placed in hexactinellid sponges. Their systematic position is considered uncertain.

1893. Ueber angebliche Spongien aus dem Archaicum. Jahrb. Mineral., **2:** p. 57–67, 3 figs.

Structures from Laurentian rocks described by Matthew as sponges are most doubtful, for even their organic origin can be questioned.

1893–1894. Palaeospongiologie, Erster oder allgemeiner Theil, und Zweiter Theil, erste Halfte. Palaeontographica, **40:** 346 pp., 17 pls., text-figs. 1–75.

This is the most comprehensive and important work on Paleozoic sponges in German. The literature, anatomy, and systematics are thoroughly treated. Most American genera and species are redescribed and illustrated, and in additon, the following new species and genera are described: *Teganium, Caryospongia, Carpospongia, Dictyophytra (?) walcotti, Pattersonia ulrichi, Astylomanon verrucosum, A. pleuriexcavatum,* and *Carpomanon glandulosum.* Many additional American sponges are redescribed.

The first part concerns the literature and general structure of sponges, with the systematic descriptions forming the second part. Thus the newly described forms date from 1894.

1895. Palaeospongiologie, Zweiter Theil. Fortsetzung. Palaeontographica, **41**: pp. 347–395 (223–271), pls. 18–24, text-figs. 76–124.

This is the third and final part of Rauff's monograph, and it concerns mainly the sponges of the Silurian. The following new genera are proposed: *Anomoclonella, Pycnopegma, Dendroclonella,* and the new subgenus, *Aulocopium (Aulocopella)*; and the following new species are defined and illustrated: *Anomoclonella zitteli, Pycnopegma pileum, P. callosum, P. stromatoporoides, Chiastoclonella headi, Dendroclonella rugosa,* and *Aulocopium (Aulocopella) winnipegensis.* Several additional Silurian species are redescribed and illustrated.

Raymond, P. E.

1914. The Trenton Group in Ontario and Quebec. *In* Summary Rept. Geol. Surv. Dept. Mines for 1912 (Canada), pp. 342–350.

Receptaculites orientalis is listed from the Trenton Group at Montmorency Falls and St. Charles.

1916. Expedition to the Baltic Provinces of Russia and Scandinavia. Part I.—The correlation of the Ordovician strata of the Baltic Basin with those of eastern North America. Bull. Mus. Comp. Zool. Harvard College, **56,** no. 3, (Geol. Ser. **10**), pp. 177–286, 8 pls.

Receptaculites occidentalis is reported as being found in the Rockland Formation, near Ottawa, Canada.

1931. Notes on invertebrate fossils with descriptions of new species. Bull. Mus. Comp. Zool. Harvard College, (Geol. Ser. **9,** no. 6), **55,** no. 6, pp. 165–213, 5 plates.

Archaeoscyphia minganensis (Billings), is compared to *Archaeocyathus profundus.*

Raymond, P. E. and Okulitch, V. J.

1940. Some Chazyan Sponges. Harvard Coll., Bull. Mus. Comp. Zool., **86,** no. 5: pp. 197–214, 7 pls., 3 text-figs.

The following new species of sponges are described and figured: *Zittelella pannosa, Hudsonospongia cyclostoma, H. minganensis, H. porosa, H. fistulosa, H. irregularis, H. duplicata, H. ovoidea, Allosaccus prolixus, Rhopalocoelia clarkii, R. regularis, Psarodictyon magnificum, P. planum.* The new genera *Hudsonospongia, Allosaccus, Rhopalocoelia, Psarodictyon,* and *Exchopora* are established. *Eospongia roemeri* Billings is redefined and limited; *Zittelella varians* (Billings), formerly *Eospongia,* is redescribed; *Exchopora canadensis,* formerly *Calathium canadensis* (Billings), and *E. infelix,* formerly *Calathium* (*?Zittelella*) *infelix* Billings are redefined, and *Psarodictyon trentonensis,* formerly *Zittelella trentonensis* Ulrich and Everett is redefined. All specimens were collected in Lower Ordovician rocks of eastern North America.

Read, H. H. and Watson, J. J.

1962. Introduction to Geology, Volume I, Principles. McMillan, London. 304 pp.

This is a very generalized, textbook discussion of sponges.

Reid, R. E. H.

1957. On Hexactinellida, "Hyalospongea," and the classification of siliceous sponges. Jour. Paleontol., **31,** no. 1: pp. 282–286.

Usage of the term Hyalospongea as a Class name by DeLaubenfels (1955) in the Treatise of Invertebrate Paleontology and abandonment of the term Hexactinellida is criticized, largely because of widespread current usage and lack of characterization of the Hyalospongea by accepted diagnostic features of Hexactinellida, along with inclusion of sponges which are not hexactinellid as generally understood. Reid proposes as an alternative to the Treatise classification that sponges be placed in Class Calcarea and Class Silicea, with the four subclasses: Demospongida, Heteractinellida, Octactinellida, and Hexactinellida.

The Early Paleozoic genera *Astraeospongium* and *Chancelloria* would be included in the Octactinellida.

1957. Correction. Jour. Paleontol., **31:** no. 5: p. 1028.

Corrects a quotation in discussion of Class Silicea Bowerbank from "or with no spicules" to read "or with no skeleton."

1963. Hexactinellida or Hyalospongea? Jour. Paleontol., **37**, no. 1: pp. 232–243.

Hyalospongea of the *Treatise of Invertebrate Paleontology* should be subdivided into separate classes Hexactinellida and Heteractinida, the former based on siliceous sponges with a wholly triaxial spicule system and the latter with spicules which are mainly polyactinal. The latter class would include what Reid (1957) earlier differentiated into Octactinellida and Heteractinellida.

1963. Preliminary notice of a classification of the Demospongia. Irish Naturalists' Jour., **14**, no. 5: pp. 90–94.

A modified classification of the Demospongia is outlined with six orders and ten suborders. The families Anthaspidellidae Ulrich (including Archaeoscyphiidae and Aulocopiidae Rauff) and Chiastoclonellidae Rauff should probably be put a new different order. Carboniferous anthaspidellids from Ireland appear to be monocrepid rather than tetraclads. Anthaspidellid skeletal structure is reported as similar to the modern sublithistid *Lithochela* Burton.

Resser, C. E.

1938. Cambrian system (restricted) of the Southern Appalachians. Geol. Soc. Amer., Spec. Paper 15, 140 pp., 16 pls. (abstract, 1937, Proc. 1936, p. 96.)

Achaeocyathid reefs are described. Mention is made of Walcott's description of *Chancelloria drusilla* spicules from Cambrian cobbles of Northern Georgia.

1945. Part II, Cambrian fossils of the Grand Canyon. *In* Cambrian history of the Grand Canyon region. Carnegie Inst. Wash. Pub. **563**, pp. 171–220, pls. 16–27.

Sponge spicules, similar to *Tholiasterella (?) hindei* Walcott, are briefly described and figured from the Muav Limestone from Meriwitica Canyon and Columbine Falls. A large lacy mass collected near Fossil Rapids may be a sponge.

Resser, C. E. and Howell, B. F.

1938. Lower Cambrian *Olenellus* zone of the Appalachians. Bull. Geol. Soc. Amer., **49**, no. 2: pp. 195–248, pls. 1–13.

Leptomitus Walcott and *Tuponia* Walcott are synonymous. *Leptomitus* has priority, thus *Tuponia lineata* Walcott, *T. bellilineata* Walcott, *T. flexilis* Walcott, and *T. flexilis intermedia* Walcott are

assigned to *Leptomitus*. *L. zitteli* Walcott is figured from the Lower Cambrian Parker Shale of western Vermont. *L. walcotti* n. sp. and *L. minor* n. sp. are figured and described from the Lower Cambrian Kinzers Formation from the Lancaster and York Basins which parallel the Blue Ridge between the Delaware and Potomac Rivers.

Richards, P. W.

1956. Geology of the area east and southeast of Livingston, Park County, Montana. Bull. U. S. Geol. Surv., 1021-L, pp. 385–438, pls. 34–36, text-figs. 58–61.

Receptaculites sp. is reported from near the middle of the upper massive member of the Bighorn Dolomite.

Richardson, E. S., Jr.

1950. A middle Devonian octactinellid sponge from New York. Fieldiana: Geol., **10**, no. 10, pp. 79–88, text-figs. 33–37.

Nomenclature of the genus *Astraeospongia* Roemer is discussed and in table form, spicules of known species of *Astraeospongia* are compared.

Richardson, G. B.

1909. Description of the El Paso quadrangle, Texas. U. S. Geol. Surv., Geol. Atlas U. S., El Paso Folio, no. 166, 11 pp., 3 maps, 1 sheet illust., 8 text-figs.

Receptaculites oweni Hall is reported from the Upper Ordovician Montoya Limestone in the Franklin Mountains, near El Paso.

Rigby, J. K.

1958. Geology of the Stansbury Mountains, Tooele County, Utah. Utah Geol. Soc. Guidebook no. 13, pp. 1–134, 9 pls., 20 text-figs.

Receptaculites elongatus Walcott and *Nevadocoelia* sp. are reported from the middle part of the Garden City Formation, in trilobite zone G of Hintze and Ross. Most of the receptaculitids are probably *Calathium* sp.

1962. Canadian and Chazyan receptaculitids from Utah and Nevada. (abstr.) Geol. Soc. Amer., Spec. Paper 68, pp. 51–52.

Canadian receptaculitids, the oldest known thus far in North America, occur in the lower part of the Pogonip Group. These are elongate conical forms. Platter-shaped forms occur higher in the section in the upper Pogonip Group.

1964. Structure and affinity of the problematical genus *Rauffella* Ulrich. (abstr.) Geol. Soc. Amer., Spec. Paper 76, pp. 290–291.

Rauffella, from the Decorah Shale of Minnesota, with *R. palmipes* Ulrich, considered a probable fucoid, and *R. filosa* Ulrich, are described. *R. filosa* is considered, at least in part, related to the Cambrian lyssakid sponge *Leptomitus*. Additional investigation since the paper was presented suggests that both species are fucoidal and not sponges.

1965. Evolution of Lower and Middle Ordovician sponge reefs in western Utah. (abstr.) Geol. Soc. Amer., Spec. Paper 87, p. 137.

Development and replacement of communities is well shown in sponge reefs of the Pogonip Group in the Confusion Range of western Utah. Sponges play a minor role in early reefs, but become more important in the middle of the Group. Isolated sponges, but no reefs, are known in the upper part of the Group.

1965. Spiculation of the lyssakid sponge, *Protospongia hicksi* Hinde (abstr.). Geol. Soc. Amer., Spec. Paper 82, pp. 162–163.

A fragment of *Protospongia hicksi* Hinde is described from the Middle Cambrian Marjum Limestone, House Range, Utah. Five orders of cruciform spicules are preserved in the natural mold, the shape of which suggests a conical form for the species.

1965. Spicule structure of *Dystactospongia madisonensis* Foerste from the Ohio Ordovician. (abstr.) Geol. Soc. Amer., Spec. Paper 87, p. 261.

A silicified specimen of the sponge contains ophioraphid spicules which suggests that the species is a choristid demosponge. Smooth but complexly contorted spicules are packed in rope-like tracts, and lie roughly parallel to canal surfaces.

1965. Stratigraphy and porifera of Ordovician rocks near Columbia Icefields, Jasper National Park, Alberta, Canada. Brigham Young Univ., Geol. Stud., **12**: pp. 165–184, 6 pls., 2 text-figs.

Two unnamed, but new species of anthaspidellid sponges, in addition to two hexactinellid forms, and an astraeospongid form are described and figured from the Sarbach Formation. All but the anthaspidellid species are preserved as isolated spicules. Reference is made to *Receptaculites* (?) sp. and *Calathium* (?) sp., both reported by Walcott (1928), from nearby localities.

1966. *Protospongia hicksi* Hinde from the Middle Cambrian of Western Utah. Jour. Paleontol., **40**: pp. 549–554, pl. 66, 7 text-figs.

A large fragment of the lyssakid sponge *Protospongia hicksi* Hinde is described and illustrated from the Marjum Formation in the House Range, Millard County, Utah.

1966. Microstructure and classification of an Ordovician sponge, *Dystactospongia madisonensis* Foerste from Indiana. Jour. Paleontol., **40**, pp. 1127–1130, pl. 146.

Unusually well preserved microstructure is described from a single specimen of the sponge, *Dystactospongia madisonensis* Foerste, from the Saluda Formation near Versailles, Indiana. Ophioraphid (?) spicules are preserved in a silicified region, suggesting that the sponge is a choristid demosponge.

1966. A new polyactinal sponge from the Ordovician Pogonip Group, Toquima Range, Nevada (abstr.). Geol. Soc. Amer., Cord. Sec., Program 62nd Ann. Meeting, p. 62.

A single specimen of a new polyactinal sponge, related to or resembling *Eiffelia* or *Astraeospongia*, is noted from the famous Ike's Canyon sponge beds in the Toquima Range, Nevada. The specimen consists of interleaved spicules composed of six distinctly curved dermal rays, distal ray, and possibly a proximal ray as well.

1967. Two new Early Paleozoic sponges and the sponge-like organism, *Gaspespongia basalis* Parks, from the Gaspe Peninsula, Quebec. Jour. Paleontol., **41**, no. 3, pp. 766–775, pls. 101–102, 5 text-figs.

The new species, *Calycocoelia solenos*, is proposed for specimens from the Ordovician Whitehead Formation at Grande Coupe, Percé, and the new genus, *Malumispongium*, is proposed for specimens earlier identified as *Aulocopium hartnageli* by Clarke (1924). The new family, Malumispongiidae, and the new superfamily, Malumispongioidea, are based on the same form which occurs abundantly in the Silurian La Vieille Formation at Black Cape, Quebec.

Gaspespongia basalis was described as a sponge by Parks (1933), but is considered in the present paper as a stromatolitic alga.

Ringueberg, E. N. W.

1884. New fossils from the four groups of the Niagara period of western New York. Proc. Acad. Nat. Sci., Philadelphia, pp. 144–150, pls. 2, 3.

The new genus and species, *Fungispongia irregularis*, is described from the Clinton beds at Lockport, New York. This form is not a sponge, but is probably the attachment base of an echinoderm which has been burrowed.

Roberts, R. J.

1966. Trip nos. 6, 6A, Geology of the Antler Peak quadrangle, Humbolt and Lander Counties. *In* Guidebook for field-trip excursions in northern Nevada. Mackay School Mines, Nevada Bureau Mines, Geol. Soc. Amer., Cord. Sec., pp. F1–F34, 9 text-figs.

Sponges are reported, along with archaeocyathids, from the Cambrian Scott Canyon Formation in the Antler Peak region southwest of Battle Mountain, Nevada. No generic designations are given.

Robinson, C. S.

1961. Pre-Pennsylvanian stratigraphy of the Monarch District, Chaffee County, Colorado. *In* Symposium on Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf., Rocky Mtn. Assoc. Geol., pp. 119–124, 3 text-figs.

Receptaculites oweni Hall is reported from the lower Fremont Dolomite, as noted by Crawford (1913).

Robison, R. A.

1962. Late Middle Cambrian faunas from the Wheeler and Marjum formations of Western Utah. Thesis, Tex. Univ., 304 pp., 1962; Abstr. No. 62–4868, Dissertation Abstr. **23,** no. 5, p. 1661.

Two sponges were observed in the formations.

1964. Late Middle Cambrian faunas from Western Utah. Jour. Paleontol., **38,** no. 3: pp. 510–566, 4 text-figs., pls. 79–92.

The sponges *Choia utahensis* Walcott and *Chancelloria* sp., and other miscellaneous unidentified hyalospongid spicules are reported from the Wheeler and Marjum formations of the House Range in western Millard County, Utah, along with an extensive trilobite, brachiopod, and molluscan fauna. Both these sponges were earlier reported by Walcott from the same beds, but new specimens are described by Robison.

Roemer, Ferdinand

1848. Ueber eine neue Art der Gattung *Blumenbachium* (König) und mehre unzweifelhafte Spongien in obersilurischen Kalk-

schichten der Grafschaft Decatur im Staate Tennessee in Nord-Amerika. Neues Jahrb. Miner. pp. 680–686, pl. 9.

The new sponge *Blumenbachium* (now *Astraeospongia*) *meniscus*, is described and figured from the vicinity of Brownsport and Perryville, Decatur County, western Tennessee, and from the bank of Bear Grass Creek near Louisville, Kentucky.

Siphonia excavata Goldfuss is mentioned as a possible synonym of *S.* (now *Astylospongia*) *praemorsa* Goldfuss. *S. cratera* (now *Palaeomanon cratera*) n. sp., is described and figured.

1860. Die silurische Fauna des westlichen Tennessee; Eine palaeontologische Monographie. Breslau, pp. 1–100, pls. 1- 5.

This important paper marks the beginning of investigation of the prolific siliceous sponge faunas of the western Tennessee Silurian. The new genera, *Astylospongia* and *Palaeomanon* are proposed, and the species *A. praemorsa* (Goldfuss), *A. stellatim-sulcata* (now *Carpomanon stellatim-sulcatum*) Roemer, *A. inciso-lobata* (now *Caryomanon incisolobatum*) Roemer, *A. imbricato-articulata* Roemer, *P. cratera* (Roemer), and *Astraeospongia meniscus* (Roemer) are described and figured from Tennessee material. The fauna of Decatur County, Tennessee is compared to that of the Niagaran of New York and to the Silurian of England, Gotland, and Malmö.

1874. From "Die Silurische Fauna des Westlichen Tennessee." Cincinnati Quart. Jour. Sci., **1**: pp. 190–192 (translator to English unknown).

Translation of the descriptions of the new species *Astylospongia* (now *Carpomanon*) *stellatim-sulcata*, *A.* (now *Caryomanon*) *incisolobata*, *A. imbricato-articulata*, and *Palaeomanon cratera* are made from Roemers work.

1880, 1897. Lethaea geognostica oder Beschreibung and Abbildung der fur die Gebirgs-Formationen Bezeichnendsten Versteinerungen, I Theil, Lethaea palaeozoica, **1**: E. Schweizerbart'sche Verlag., Stuttgart. 688 pp., pls. A–B, 226 text-figs.

The family Receptaculitidae is included provisionally with Foraminifera. Descriptions are given for *Receptaculites*, *Ischadites*, *Cyclocrinus* (now *Cyclocrinites*), *Pasceolus*, and the sponge *Archaeocyathus* (part now *Archaeoscyphia*). In addition, lists are given with geologic and geographic distribution of various species. Included are: *R. calciferus* Billings, *R. elegantulus* Billings, *R. occidentalis* Salter, *R.* (now *Ischadites iowensis*) *fungosus* Hall, *R.* (now *I. iowensis*) *globularis* Hall, *R. oweni* Hall, *R.* (now *Ischadites*) *insularis*

Billings, *R.* (now *Ischadites*) *canadensis* Billings, *R.* (now *Cerionites*) *dactyloides* Miller, *R.* (now *Ischadites infundibulum*) *farmosus* Meek and Worthen, *R. hemisphericus* Hall, *R.* (now *Ischadites*) *ohioensis* Hall and Whitfield, *R.* (now *Ischadites*) *reticulatus* Miller, *R.* (now *Ischadites*) *subturbinatus* Hall, *R.* (now *Ischadites*) *jonesi* Billings, *Pasceolus halli* Billings, *P. globosus* Billings, *P.* (now *Nidulites*) *gregarius* Billings, *P.* (now *Nidulites*) *intermedius* Billings, *P. darwinii* Miller, and *P. claudei* Miller.

Several Paleozoic sponges are described and figured in the section on Sponges, including *Astylospongia praemorsa* (Goldfuss), *A.* (now *Carpomanon*) *stellatim-sulcata* Roemer, *Palaeomanon cratera* (Roemer), and *Astraeospongia meniscus* (Roemer). *Protospongia fenestrata* Salter and *Brachiospongia roemerana* (now *B. digitata*) Marsh are also figured and described, but the latter is separated since its internal structure was not known. Other species, including *Astylospongia* (now *Caryomanon*) *inciso-lobata* Roemer, *A. imbricato-articulata* Roemer, *A.* ? *christiana* Meek and Worthen, *A.* ? (*Palaeomanon*) *bursa* Hall, *A.* (now *Caryomanon*) *parvula* Billings, and *A. perryi* Billings are listed with North American occurrences.

Archaeocyathus (now *Archaeoscyphia*) *minganensis* Billings is figured and briefly described in the section on receptaculitids.

1902. Lethaea geognostica oder Beschreibung und Abbildung fur die Gebirgs-Formationen Bezeichnensten Versteinerungen, **2.** E. Schweirzerbart'sche Verlag., Stuttgart. 783 pp., 551 text-figs.

Aulocopium, Protospongia fenestrata Salter, and the receptaculitid *Receptaculites* are reported from the Cambrian and Silurian of North America, the latter two from the Eureka district of Nevada.

Rogers, W. S., Jackson, Margie, and McKinney, Kenneth

1964. A new genus of sponge from the Middle Ordovician. Jour. Paleontol., **38**, no. 1: pp. 135–137, 5 text-figs.

The new genus, *Offella,* and species, *O. spongeum,* are described from the Odenville biofacies of the lower Middle Ordovician Lenoir Limestone from the Cahaba Valley of Alabama. Many specimens were collected from siliceous acid-residues of limestone. The species is a small sac-shaped lyssakid sponge. The genus is similar to *Lasiothrix* and is placed in the Leptomitidae. A series of four specimens are illustrated in a half-tone figure, but show the gross character of the specimen well.

Ross, R. J., Jr.

1957. Ordovician fossils from wells in the Williston Basin, eastern Montana. U. S. Geol. Surv. Bull. 1021-M, pp. 439 510, pls. 37–44.

Receptaculites oweni, *Receptaculites* sp., and hexactinellid sponge spicules are listed from several deep wells in the Williston Basin, eastern Montana. The fossils are all of Ordovician age.

Rowley, R. R.

1908. The geology of Pike County. Missouri Bur. Geol. Mines, ser. 2, **8**: 122 pp., 20 pls., 13 text-figs.

Zittelella sp. and *Receptaculites globularis* and *R. oweni* Hall are listed from Trentonian rocks of the county. The Trentonian rocks of Pike County are equated to the Kimmswick Limestone because of the occurrence of the "sunflower coral," *Receptaculites*, in both.

Isolated sponge spicules are described and illustrated with crude line drawings.

Roy, S. K.

1941. The Upper Ordovician fauna of Frobisher Bay, Baffin Land; Field Mus. Nat. Hist., Geol. ser. Mem., **2**, 212 pp., 146 figs.

Ordovician fossils taken from a talus slope on Silliman's Fossil Mountain, Frobisher Bay, Baffin Land, are described and illustrated. The relationship of *Receptaculites* to *Ischadites* is reviewed. In a comparative chart descriptions and equivalences of terminology, with reference to *Receptaculites*, used by Billings, Dames, Gümbel, Hinde, and Rauff are given.

Receptaculites sp. is described and figured and appears similar to, or conspecific with, *R. articus* Etheridge.

Receptaculites sp. resembles figures of *Ischadites murchisoni* Eichwald, but structurally is a *Receptaculites*.

R. (?) *fieldi* n. sp. is described and figured.

Ruedemann, Rudolph

1908. Graptolites of New York, Part 2, Graptolites of the higher beds. N. Y. State Mus. Mem., **2**, 560 pp.

The name *Graptospongia pusilla* is proposed for carbonaceous bodies which "have the form of sponges and may be remains of either horny or calcareous sponges, the calcareous portion of whose

skeletons has been dissolved." The suggestion is made that *Daw sonia acuminata* Nicholson represents young specimens of *Grapto spongia*, since they occur together in the Normanskill Shale at Schuy lerville, Saratoga County, New York.

1912. The Lower Siluric shales of the Mohawk Valley. N. Y State Mus. Bull. 162, pp. 1–151, pls. 1–10, 30 text-figs.

Cyathodictya? tubularis n. sp. is named from the Ordovician Cana joharie Shale at Canajoharie, New York.

1925. The Utica and Lorraine Formations of New York. Part 1 Stratigraphy. New York State Mus. Bull. 258, 175 pp., 7 pls. 10 text-figs.

Cyathodictya (?) *pyriformis* Ruedemann is reported from the up per Utica Shale near Nowadaga, New York. The most prolific sponge fauna from the Utica Shale, however, occurs at Holland Patent, and includes the following: *Cyathodictya reticulata* (Walcott) *C. walcotti* (Rauff), *Sphaerodictya subsphaerica* (Walcott), *Teganium subsphaericum* Rauff, *T. macrosclera* Ruedemann, *Foerstella rotunda* Ruedemann, *F. flabellata* Ruedemann, *Sycodictya rara* Ruedemann and *Pyritonema capilliforme*. *Polyplectella mira* Ruedemann is re ported from the Frankfort Shale near Rome, New York.

Isolated sponge spicules are reported from the Schaghticoke Shale and *Graptospongia pusilla* Ruedemann is reported from the Norman skill Shale. *Rhombodictyon*, reported by Whitfield from the Nor manskill Shale, is considered inorganic, probably merely paralle shrinkage cracks.

1925. The Utica and Lorraine Formations of New York, Part 2 Systematic Paleontology, no. 1. New York State Mus. Bull 262, 171 pp., 13 pls., 75 text-figs.

The new genera *Foerstella*, *Polyplectella*, and *Sycodictya* are de scribed, as are the new species *F. rotunda*, *F. flabellata*, *P. mira* and *S. rara* of these genera. Additional new species defined include *Teganium macrosclera*, *T. rauffi*, *Pyritonema capilliforme*, *P. rigidum* and *Cyathodictya* (?) *pyriformis*. All of these are from the Utica Shale except *Teganium rauffi* which was found in the Canajoharie Shale, *Polyplectella mira* which was found in the Frankfort Shale and *Pyritonema* (now *Hyalostelia*) *rigidum* which was found in the Normanskill Shale.

The receptaculitid, *Ischadites circularis* (Emmons), is reported from the Lorraine Shale.

1930. Geology of the Capital district (Albany, Cohoes, Troy, and Schenectady quadrangles), with a chapter on glacial geology by John H. Cook. New York State Mus. Bull. 285, 218 pp., 79 text-figs.

Cyathodictya (?) *tubularis* Ruedemann and sponge spicules are reported from the Middle Ordovician Canajoharie Shale. Large spicules of *Protospongia* sp. are reported from the Lower Ordovician Schaghticoke Shale at Schaghticoke.

1934. Paleozoic plankton of North America. Geol. Soc. Amer. Mem. 2, 141 pp., 26 pls., 6 text-figs.

Protospongia, Cyathodictya, Teganium, and others are mentioned from Dawson's paper of 1890. In addition the new species: *Graptospongia pusilla* from the Ordovician Normanskill Shale; *G. silurica* from the Silurian graptolite shale at Klakes Bay, Prince of Wales Island, Alaska; *Teganium minutum* from the Ordovician Snake Hill Shale, New York. *T. claviforme* from the Silurian of Klakes Bay, Alaska; *Cyathodictya* (?) *subannulata* from the same Alaskan locality, and *Megastylia calciformis* from the Ordovician Schaghticoke Shale at Schaghticoke, New York are described and illustrated, as is a specimen of *Cyathodictya* (?) *tubulare* Ruedemann from the Canajoharie Shale at Canajoharie, New York.

1942. Cambrian and Ordovician fossils. An epiplanktonic sponge, *Teganium merino* sp. nov. New York State Mus. Bull. 327, p. 23, 1 fig.

Teganium merino n. sp. is described and figured from the Ordovician, lower Normanskill Shale, at Mt. Merino, N. Y.

1942. Cambrian and Ordovician geology of the Catskill quadrangle. *In* Pt. 1, Geology of the Catskill and Kaaterskill quadrangles. N. Y. State Mus. Bull. 331, pp. 7–188.

Pyritonema (now *Hyalostelia*) *rigidum* (Ruedemann) and a new sponge, *Teganium merino,* are reported from the Mt. Merino beds at Mt. Merino. Archaeocyathids are listed as sponges, but are now classified separately.

Salter, J. W.

1859. Figures and descriptions of Canadian organic remains, Decade I, (Fossils from the Calciferous, Chazy, and Trenton Formations at Paquette Rapids and Allumette Island, Ottawa River, Pontiac County; and Beauharnois, Beauharnois County, Quebec). Geol. Surv. Canad., Separate Rept. 423, 47 pp., 10 pls.

The new species, *Receptaculites occidentalis*, is described and illustrated from Pauquette Rapids. Receptaculitids are considered foraminifera.

1864. On some new fossils from the Lingula Flags of Wales. Quart. Jour. Geol. Soc. London, **20**: pp. 233–441, pl. 13, 3 text-figs.

Protospongia fenestrata n. gen., n. sp. is figured and described from the Cambrian Lingula Flags of Wales.

Astylospongia cf. *A. incisolobata* (now *Caryomanon incisolobatum*) Roemer is reported from Shoales Hook, near Haverfordwest from Ordovician Caradoc strata.

Sando, W. J.

1957. Beekmantown Group (Lower Ordovician) of Maryland. Geol. Soc. Amer. Mem. 68, 161 pp., 15 pls., 20 text-figs.

The sponge *Archaeoscyphia annulata* (?) Cullison is described from the Rockdale Run and Rich Fountain Formations, and individual specimens are illustrated.

Sardeson, F. W.

1896. The fauna of the Magnesian Series. Proc. Minn. Acad. Sci., **4**, Bull. 1, Paper F.: pp. 92–105, pls. 5–6.

A single specimen of a "*Receptaculites*-like" structure is reported from the Shakopee Dolomite on Plate 6, but is not otherwise described.

1896–1897. The Galena and Maquoketa series. Amer. Geol., **18**: pp. 356–368; **19**: pp. 21–35, 91–111, 180–190, pls. 4–5.

The Galena Dolomite is placed within the zone of *Receptaculites oweni* Hall.

1916. Description of the Minneapolis and St. Paul district, Minnesota. U. S. Geol. Surv., Geol. Atlas U. S., Minneapolis-St. Paul Folio, Minn., no. 201, 14 pp., 6 maps, 2 sheets illust.

Receptaculites oweni Hall is reported as a characteristic fossil in the Galena Dolomite of the district.

Savage, T. E. and Van Tuyl, F. M.

1919. Geology and stratigraphy of the area of Paleozoic rocks in the vicinity of Hudson and James Bay. Bull. Geol. Soc. Amer., **30**: pp. 339–379, pls. 11–13.

Receptaculites oweni Hall is listed from localities on the Nelson River, from the Ordovician Nelson River Limestone at Upper Limestone Rapids. *Cerionites* sp. is also listed from the Shammattawa Limestone along the Shammattawa River.

Schaeffer, F. E.

1960. Stratigraphy of the Silver Island Mountains. *In* Guidebook to the geology of Utah, no. 15, Geology of Silver Island Mountains, Box Elder and Tooele Counties, Utah, and Elko County, Nevada. Utah Geol. Soc., pp. 15–113, text-figs. 2 15.

Receptaculites sp. is reported from Zone M faunas from the Kanosh Shale in the Silver Island Range.

Schmitt, Joseph

1904. Monographie de I'Ile Anticosti (golfe Saint Laurent). Paris. 370 pp.

Receptaculites (now *Ischadites*) *insularis* Billings is listed from the island, and is classed among the protozoans.

Schuchert, Charles

1900. On the Lower Silurian (Trenton) fauna of Baffin Land. Proc. U. S. Mus., **22**: pp. 143–177, pls. 12–14.

Receptaculites arcticus Etheridge is reported and compared with *R. oweni* Hall, which also occurs in the region, as does *R. buliformis* Eaton.

1924. A Textbook of Geology, Part II, Historical Geology. 2nd ed. John Wiley and Sons Inc., New York, New York. 724 pp., 237 figs.

Sponges are referred to in this book in a textbook manner.

Schuchert, Charles and Cooper, G. A.

1930. Upper Ordovician and Lower Devonian stratigraphy and paleontology of Percé, Quebec. Amer. Jour. Sci., ser. 5, **20**: pp. 161–176, 265–288, 365–392, 3 pls., 11 text-figs.

Hindia cf. *H. fibrosa* Hinde (now *H. sphaeroidalis* Duncan) and *Astylospongia* sp. were collected from the south flank of Mount Joli, from the Upper Ordovician Whitehead Formation. *Hindia fibrosa* Hinde was also collected from the same vicinity from the Devonian Mt. Joli Formation.

Schuchert, Charles and Dunbar, C. O.

1933. A textbook of geology part II—historical geology. John Wiley and Sons, Inc., New York. 551 pp., 332 figs.

Only a general statement is made that siliceous sponges are locally abundant in Cambrian rocks and that sponges are not important in the overlying Ordovician rocks.

1934. Stratigraphy of Western Newfoundland. Geol. Soc. Amer. Mem. 1, 123 pp., 11 pls., 8 text-figs.

Sponges are reported as common in the Middle Ordovician Table Head Formation, with *Eospongia* sp. common in the lower part of the section at Table Head and near Point Riche, *Archaeoscyphia minganensis* (Billings) and *Calathium fittoni* Billings are reported from 30 to 100 feet above the base of the formation. In addition, *Receptaculites* sp. is reported from the St. George Series on the eastern shore of Port au Choix peninsula.

Schuchert, Charles and Twenhofel, W. H.

1910. Ordovicic-Siluric section of the Mingan and Anticosti Islands, Gulf of St. Lawrence. Bull. Geol. Soc. Amer., **21**: pp. 677–716.

Archaeoscyphia minganense (Billings) is reported from the Romaine Formation of Romaine Island, and *Eospongia roemeri* Billings and *Zittelella varians* (Billings) are reported from the Mingan Formation of the Mingan Islands. *Hindia sphaeroidalis* Duncan is reported from the Ellis Bay Formation, along with the receptaculitids *Pasceolus* sp. and *Pasceolus halli* Billings. *Ischadites* sp. is reported from the Mingan Formation.

Scott, H. W.

1937. Classification of sponge spicules. (abstr.) Proc. Geol. Soc. Amer., **1936**: p. 359.

Spicules are the basis of a new method of classification proposed by Scott. For example, all orthotriaens are called the genus Orthotriaenites, etc. This proposal has not and probably will not find much favor.

Seely, H. M.

1885. A new genus of Chazy sponge, *Strephochetus*. Amer. Jour. Sci., ser. 3, **30**: pp. 355–357, 3 text-figs.

The genus *Strephochetus* and the species, *S. ocellatus*, are proposed as sponges from the Chazyan of Vermont. This organism is now considered an alga, probably *Girvanella*, and is certainly not a sponge.

1886. The genus *Strephochetus*, distribution and species. Amer. Jour. Sci., ser. 3, **32**: pp. 31–34.

Strephochetus ocellatus Seely, and the new species, *S. brainerdi*, *S. atratus*, and *S. richmondensis* are described from Ordovician rocks of Vermont and New York and are considered sponges in the paper. These various species are merely differently shaped algal masses, probably composed of *Girvanella* or a similar vermiform type, and are not sponges.

1902. Some sponges of the Chazy Formation. *In* Perkins, G. H. The geology of Grand Isle. Rept. Vermont State Geol. on the Mineral Industries and Geology of Certain Areas of Vermont, **3**: pp. 151–161, pls. 56–59.

Small nodular masses of calcium carbonate in the Ordovician Chazy Formation were considered to be sponges by the author. These are variously classified under the genus *Strephochetus*. These forms are now considered as algae, probably *Girvanella*.

Esopongia (now *Zittelella*) *varians* Billings is also reported from the formation from Isle La Motte and South Hero Island. The species is particularly common in the middle of the formation, and is the only sponge described in the paper.

1906. Cryptozoa of the early Champlain sea. Vt. Geol. Surv., Rept. State Geol. 5, pp. 156–173, 5 pls.

The various stromatolitic algal masses grouped under the general name, *Cryptozoon*, are described here, and the whole is considered among the calcareous sponges. These organisms are no longer considered sponges, except for *Eospongia* which is a valid lithistid genus.

1906. Beekmantown and Chazy formations in the Champlain Valley, Contributions to their geology and palaeontology. Vt. Geol. Surv., Rept. State Geol. Vermont, 5: pp. 174–187, 1 pl.

The new genus *Wingia* is proposed from the Beekmantown, division D, at Ball Bay, Providence Island, and at Shoreham.

W. congregata n. sp., *W. lapilla* n. sp., and *W. discordea* n. sp. are figured and described. None of these forms is considered as a recognizable sponge.

1908. Stellae and rhabdoliths of the genus *Strephochetus*. Rept., State Geol. Vermont, 6: pp. 187–188, 1 pl.

Strephochetus ocellatus Seeley is described and figured. Supposed spicules of the species are also figured. This form is not considered a sponge, but more probably an algae related to *Girvanella*.

Shaw, A. B.

1957. Paleontology of northwestern Vermont, VI, The early middle Cambrian fauna. Jour. Paleontol., **31:** no. 4: pp. 785–792, 2 pls.

Seven hexactine sponge spicules, preserved as external molds, are reported from the upper Packer Slate.

Shaw, E. W. and Trowbridge, A. C.

1916. Description of the Galena and Elizabeth quadrangles, Illinois-Iowa. U. S. Geol. Surv. Geol. Atlas U. S., Galena- Elizabeth Folio no. 200, 13 pp., 13 pls., 4 maps, 9 text-figs.

A sponge-like fossil, now recognizable from illustrations as *Receptaculites* sp., is reported to be typical of the Galena Formation, and is illustrated from the area.

Shideler, W. H.

1934. New Cincinnatian sponges. (abstr.) Proc. Geol. Soc. Amer., **1933,** pp. 341–342.

Brachiospongia sp. is reported from the Mount Hope beds, and *Dystactospongia* sp. from the Arnheim Formation. A new *Dystactospongia* (?)-like genus is also reported from the Arnheim Formation, Tennessee.

Shimer, H. W.

1929. An introduction to the study of fossils. MacMillan Co., New York. 450 pp., 175 text-figs.

An introductory treatment of sponges is given. *Astylospongia praemorsa* (Goldfuss) is described and illustrated as an example.

1933. An introduction to the study of fossils. MacMillan Company, New York. 496 pp., 207 text-figs.

An introductory text-book treatment of the phylum Porifera. *Astylospongia praemorsa* (Goldfuss) is illustrated from the Silurian of Indiana.

Shimer, H. W. and Shrock, R. R.

1944. Index fossils of North America. John Wiley and Sons Inc., New York. 837 pp., 303 pls.

A summary of distinctive or stratigraphically important fossils is presented, and includes the following sponges: *Archaeoscyphia minganensis* (Billings), *Astraeospongia meniscus* (Roemer), *Astylospongia praemorsa* (Goldfuss), *Chancelloria aurora* Lochman, *C. eros* Walcott, *Choia carteri* Walcott, *Eiffelia globosa* Walcott, *Eospongia roemeri* Billings, *Hindia fibrosa* (Roemer) (now *H. sphaeroidalis* Duncan), *H. parva* (Ulrich), *Hudsonospongia cyclostoma* Raymond and Okulitch, *Kiwetinokia utahensis* Walcott, *Leptomitus lineatus* (Walcott), *L. zitteli* (Walcott), *Lissocoelia ramosa* (Bassler,) *Multivasculatus ovatus* Howell and Landes, *Nevadocoelia wistae* Bassler, *Petrosites humilis* Howell and Landes, *Protospongia fenestrata* (Salter) *Vauxia gracilenta* Walcott, *Zittelella typicalis* Ulrich and Everett, and *Z. varians* (Billings). Also described and illustrated are *Camarocladia dichotoma* Ulrich and Everett, and *C. rugosa* Ulrich which probably should be no longer considered sponges, but trace fossils.

Also described and illustrated are the receptaculitids *Receptaculites occidentalis* Salter, *R. oweni* Hall, *Ischadites iowensis* (Owen), *Nidulites pyriformis* Bassler, and *Cyclocrinites globosus* (Billings).

Shrock, R. R. and Twenhofel, W. H.

1953. Principles of invertebrate paleontology, 2nd ed., McGraw-Hill, New York. 816 pp., 470 text-figs.

A general treatment of sponges is given in the text-book. *Astraeospongia* sp. from the Silurian of Tennessee, *Protospongia* from the Upper Cambrian, and *Zittelella* sp. from the Ordovician of Illinois, are cited and figured.

Receptaculitids similarly treated include *Ischadites iowensis* from the Middle Ordovician Prosser Formation of Iowa and *Receptaculites oweni* Hall from the Middle Ordovician of Illinois.

Sinclair, G. W.

1956. Notes on some Ordovician sponges and their names. Jour. Paleontol., **30**: pp. 760–761.

A summary of several errors observed in the Porifera section of the *Treatise of Invertebrate Paleontology*, primarily concerned with type species and nomenclatural problems.

Slind, O. L. and Perkins, G. D.

1966. Lower Paleozoic and Proterozoic sediments of the Rocky Mountains between Jasper, Alberta, and Pine River, British Columbia. Bull. Canad. Petrol. Geol., **14:** pp. 442–468, 5 text-figs., 1 table.

"Small sponges" are reported as common in the Tatei-Chetang Formation of Middle Cambrian age, in the Jackpine River area, Sec. 27, 34, T. 53, R.10W. 6 Mer., and *Chancelloria* cf. *eros* is identified from the same formation in the Monte Cristo area, Sec. 23, T. 50, R.7W. 6 Mer., on strike to the southeast. *Archaeoscyphia* cf. *annulata* Cullison is also reported from the Ordovician Cushina Formation, in rocks of Zone G age of Hintze and Ross, in the Horseshoe Lake region (lat. 54° 07′ N., long. 120° 47′ W.).

Smith, A. G. and Toomey, D. F.

1964. Chitons from the Kinblade Formation. Okla. Geol. Survey Cir. 66, 41 pp., 8 pls., 2 text-figs.

Abundant *Calathium* and *Archaeoscyphia* occur in the Kinblade Limestone in Murray County and in Carter County, Oklahoma. Text-figure 1 illustrates the sponge beds of the formation in the Arbuckle Mountains, a bed which is found in both the Arbuckle and Tishomingo anticlines in the mountains.

Sollas, W. J.

1880. On the structure and affinities of the Genus *Protospongia* (Salter). Quart. Jour. Geol. Soc. London, **36:** pp. 362–367, 2 text-figs.

Acanthospongia McCoy and *Protospongia* Salter are considered Sarco-hexactinellid sponges as Carter earlier concluded. The holotype of *Protospongia fenestrata* Hicks is both redescribed and refigured.

1881. On *Astroconia granti*, a new lyssakine hexactinellid from the Silurian Formation of Canada. Quart. Jour. Geol. Soc. London, **37:** pp. 254–260, text-figs. 1–11.

Isolated siliceous hexactines are described and figured from the Silurian carbonates near Hamilton, Ontario as the basis of the species. The spicules are distinctively acerate, and well preserved.

1885. Note on the structure of the skeleton in Anomocladina. Ann. Mag. Nat. Hist., ser 5, **15:** pp. 236–238, 1 text-fig.

The method of junction of spicules of *Vetulina*, which "exhibit the characters which Zittel first assigned to the corpuscles of the Anomocladina," is described and illustrated.

1888. On *Vetulina stalactites* (O.S.) and the skeleton of the Anomocladina. Proc. Roy. Irish Acad. Sci., ser. 2, 4: pp. 486–492, pls. 3, 4.

The spicular form of *Vetulina* is discussed as to shape and junctions. *Vetulina* and Astylospongidae are found to be closely analogous, and an amended definition of the family Anomocladina is given.

Spurr, J. E.

1906. Ore deposits of the Silver Peak quadrangle, Nevada. U. S. Geol. Surv. Prof. Paper 55, 174 pp., 26 pls., 40 text-figs.

Ethmophyllum whitneyi Meek, *Archaeocyathus atlanticus* Billings, and *Archaeocyathus* sp. indet. are listed from Cambro-Ordovician beds. No sponges are reported.

Squires, D. F. and Hawkins, E. J.

1958. Type specimens of invertebrate fossils in the collections of the Department of Geology and Paleontology, 1. Porifera. Amer. Mus. Novitates, no. 1913, 22 pp.

Primary types of *Astylospongia praemorsa* (now *Caryospongia juglans*) *nuxmoschata* Hall, Silurian Indiana; *Rhombodictyon discum* Whitfield, *R. reniforme* Whitfield, *R. reniforme rhombiforme* Whitfield all from the Ordovician near Albany, New York; *Receptaculites fungosum* (now *Ischadites iowensis*) Hall, Ordovician, Illinois; *R. globulare* (now *I. iowensis*) Hall, Ordovician Illinois, *R. hemisphericum* Hall, Silurian, Wisconsin; *R.* (now *Ischadites*) *infundibulum* Hall, Silurian, Wisconsin; *R.* (now *Ischadites*) *ohioensis* Hall and Whitfield, Silurian, Ohio; *R. oweni* Hall, Ordovician, Wisconsin; *R. pearyi* Whitfield, Silurian, Ellesmere Island, Northwest Territories; *R.* (now *Ischadites*) *subturbinatus* Hall, Silurian, Indiana; and a species *cyathiformis*, genus undetermined (now *Ischadites*) Hall, from the Ordovician, Illinois are in the collection.

In addition, figured specimens of *Astylospongia praemorsa* (Goldfuss), Silurian, Indiana; and *R. neptuni*(?) DeFrance, Ordovician, Pennsylvania, are cited.

Staatz, M. H. and Carr, W. J.

1964. Geology and mineral deposits of the Thomas and Dugway Ranges, Juab and Tooele Counties, Utah. U. S. Geol. Surv. Prof. Paper 415, 188 pp., 9 pls., 63 text-figs., 27 tables.

Archaeoscyphia sp. is reported from the Pogonip Group from the western side of the Dugway Range.

Stauffer, C. R. and Thiel, G. A.

1941. The Paleozoic and related rocks of southeastern Minnesota. Minn. Geol. Surv. Bull. 29, 261 pp., 62 text-figs.

Heterospongia subramosa Ulrich, *Hindia parva*? Ulrich, *Ischadites iowensis* (Owen), and *Receptaculites* sp. are reported from the Wykoff Member of the Maquoketa Formation; *Hindia parva* Ulrich, *Ischadites iowensis* (Owen), and *Receptaculites oweni* Hall occur in the Prosser Member. *Camarocladia rugosa* Ulrich, *Camarocladia* sp., *Cylindrocoelia minnesotensis* Ulrich, *Hindia parva* Ulrich. *Ischadites iowensis* (Owen), *Rauffella filosa* Ulrich, *R. palmipes* Ulrich, and *Receptaculites oweni* Hall are reported from the Decorah Member of the Galena Formation. *Cylindrocoelia minnesotensis* Ulrich, *Hindia inaequalis* Ulrich and Everett, *Rauffella filosa* Ulrich, and *R. palmipes* Ulrich are reported from the Sprechts Ferry Member; and *Hindia inaequalis* from the McGregor Member of the Platteville Formation. *Receptaculites oweni* and *Ischadites iowensis* occur in the Prosser, Stewartville, and Decorah Members of the Galena Formation in measured sections in Fillmore and Olmsted counties.

Steidtmann, Edward and Cathcart, S. H.

1922. Geology of the York tin deposits, Alaska. Bull. U. S. Geol. Surv., **733**: 130 pp., 12 pls., 23 text-figs.

Dystactospongia (?) sp. is reported from the Port Clarence Limestone of Kindle, from his collections 13b, from the Upper Ordovician rocks on the Don River, north of Port Clarence on the south side of Seward Peninsula.

Stevens, R. P.

1863. Report on the geological and mineralogical specimens collected by Mr. C. F. Hall in Frobisher Bay. Amer. Jour. Sci., ser. 2, **35**: pp. 293–294.

Receptaculites sp. is reported and is considered as unlike the species from the Galena Formation, but could be like *R. occidentalis* Salter.

Stolley, E.

1896. Untersuchungen über *Coelsophaeridium, Cyclocrinus, Mastopora,* und verwandte genera des Silur. Archiv fur Anthropologie und geologie Schleswip—Holsteins und der benachbarten Gebiete. Erster Band, Zweiter Heft, pp. 177–282 (1–106), 105 text-figs.

This is well illustrated and the most complete review of the genera *Coelosphaeridium, Cyclocrinus,* and *Mastopora.* These are placed in dasycladacean algae. *Pasceolus* is considered a synonym of *Cyclocrinus* and *Nidulites pyriformis* Bassler is placed in *Mastopora.* American species are inadequately known.

Stose, G. W.

1908. The Cambro-Ordovician limestones of the Appalachian Valley in Southern Pennsylvania. Jour. Geol., **16**: pp. 698–714.

Calathium sp. is reported from the lower Beekmantown Limestone, Stonehenge Member, and *Receptaculites* cf. *occidentalis* Salter is reported from the lowest faunal zone of Chambersburg Formation, from Chambersburg Quadrangle. *Hindia* sp. indet. is reported from the uppermost faunal zone of Chambersburg Formation from the Mercersburg Quadrangle. Identifications were made by E. O. Ulrich, but neither descriptions nor illustrations are given.

Stovall, J. W. and Brown, H. E.

1954. The principles of historical geology. Ginn and Company, Boston. 472 pp., illus.

A general text-book in historical geology which treats sponges lightly. Cambrian sponges are illustrated in a reconstruction and are said to have been present in fairly large numbers. Precambrian questionable sponge spicules are said to have been reported. *Astraeospongia meniscus* (Roemer) and *Astylospongia praemorsa* (Goldfuss), and the receptaculitid, *Receptaculites oweni* Hall are illustrated.

Strong, Moses

1878. Part IV. Geology and topography of the Lead region. *In* Geology of Wisconsin, **2.** Survey of 1873–1877, pp. 641–768, pls. 26–32, 21 text-figs.

Receptaculites oweni Hall is listed from the Galena Limestone.

Sweet, W. C.

1954. Harding and Fremont Formations, Colorado. Bull. Amer. Assoc. Petrol Geol., 38, no. 2: pp. 284–305, 4 text-figs., 2 tables.

The sponge-like structure, *Dictyorhabdus priscus* Walcott is reported as abundant in the middle of the Harding Formation in the Harding Quarry, Sec. 31, T.18S., R.70W., Fremont County. *Receptaculites*, cf. *R. arcticus* Etheridge is also reported from the massive dolomite member of the Fremont Formation in nearly every studied exposure of the unit. The genus is included in a measured section of the Priest Canyon Member of the formation in Priest Canyon, Sec. 13, T.18S., R.71W., Fremont County, Colorado.

1961. Middle and Upper Ordovician rocks, Central Colorado. *In* Symposium on Lower and Middle Paleozoic rocks of Colorado. 12th Field Conf., Rocky Mtn. Assoc. Geol., pp. 17–24, 4 text-figs.

Receptaculites sp. is reported from the lower massive dolomite member of the Fremont Formation in roadcut sections along U. S. Highway 50, 5 miles east of Salida. Questionable sponges are also reported as elements of the Harding fauna.

Taff, J. A.

1903. Description of the Tishomingo quadrangle, Indian Territory. U. S. Geol. Surv. Geol. Atlas U. S., Tishomingo Folio, no. 98, 8 pp., 3 maps, 1 sheet illust.

Two species of *Calathium* are reported from the Ordovician part of the Arbuckle Limestone, and *Receptaculites* n. sp. is listed from the upper part of the Silurian Simpson Formation.

1904. Preliminary report on the geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma. U. S. Geol. Surv. Prof. Paper 31, 97 pp., 8 pls., 1 text-fig.

A new species of *Receptaculites* is listed from the Ordovician Simpson Formation of the south side of the Arbuckle uplift, west of the Wichita River.

Taylor, A. R.

1964. Geology of the Reevey and Mifflin quadrangles, Wisconsin. U. S. Geol. Surv. Bull. 1123-F, pp. 279–360, pls. 20–21, text-figs, 43–46.

Receptaculites oweni Hall is common in both the cherty, and noncherty portions of the Galena Dolomite, and *Ischadites* sp. occurs as well in both.

Teichert, Curt

1937. Ordovician and Silurian faunas from Arctic Canada. The Fifth Thule Expedition 1921–24 Rept., **1**, no. 5: 169 pp., 24 pls. and 1 map.

Specimens of *Receptaculites* cf. *occidentalis* Salter from the Ordovician and *Receptaculites* sp. from the Silurian are figured and described. The Ordovician form is from the Melville Peninsula and the Silurian form from King William Land.

R. arcticus Etheridge, *R. neptuni* (De France), *R. oweni* Hall, and a number of undetermined species are also discussed.

Teller, E. E.

1911. A synopsis of the type specimens of fossils from the Paleozoic formations of Wisconsin. Bull. Wisc. Nat. Hist. Soc., **9**, no. 4, pp. 170–271.

The type specimens of *Receptaculites fungosus, Receptaculites globularis, Receptaculites hemisphericus, Receptaculites infundibulum,* and *Receptaculites oweni* have been collected in Wisconsin. The types of *Receptaculites hemisphericus, Receptaculites infundibulum* and *Receptaculites oweni* are stored in the American Museum of Natural History.

Thomas, A. O.

1923. Some new Paleozoic glass-sponges from Iowa. Proc. Iowa Acad. Sci., 1922, **29**: pp. 85–88, 1 pl.

The new species *Cyathodictya oblonga* from the Silurian, and the new genus and species *Iowaspongia annulata* from the Upper Devonian of Iowa are described and figured. Both are well illustrated. *Hindia parva* Ulrich occurs in the Ordovician; *Astylospongia christiani* Meek and Worthen in the Silurian; *Astraeospongia hamiltonensis* Meek and Worthen in the Devonian, and *Lyrodictya burlingtonensis* Thomas and *Belemnospongia fascicularis* Thomas in the Mississippian. *Receptaculites oweni* and *Ischadites iowensis* (Owen) occur in the Ordovician and *Receptaculites occidentalis* Salter and *Cerionites dactyloides* Whitfield occur in the Silurian.

Thorsteinsson, R.

1958. Summary of the geology of Cornwallis and Little Cornwallis Islands. *In* Sweet, W. C. and Miller, A. K. Ordovician cephalopods from Cornwallis and Little Cornwallis Islands, District of Franklin, Northwest Territories. Geol. Surv. Canad. Bull. **38**, pp. 1–25, 2 text-figs.

Receptaculites arcticus Etheridge is reported from the Allen Bay Formation in southern Cornwallis Island.

1963. Copes Bay. *In* Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Canad. Mem. 320, pp. 386–395, text-fig. 25.

Receptaculites sp. is reported from the upper part of the Ordovician Cornwallis Formation at Parrish Glacier on southern Ellesmere Island.

Thorsteinsson, R. and Tozer, E. T.

1962. Banks, Victoria and Stefansson Island, Arctic Archipelago. Geol. Surv. Canad. Mem. 330, 85 pp., 28 pls., 2 text-figs.

This geological reconnaissance of these islands mentions the occurrence of *Receptaculites* sp. from the Ordovician of the east coast of Victoria Island.

Toomey, D. F.

1964. Ellenburger (Lower Ordovician) sponge beds of Central Texas. Tulsa Geol. Soc. Digest, **32:** pp. 98–108, 3 pls., 2 text-figs.

Distribution of *Calathium* and *Archaeoscyphia* in Gorman and Honeycut Formations of the Ellenburger Group is documented. Most of the specimens are transported fragments and apparently represent accumulations on tidal flats.

Toomey, D. F. and Ingels, J. C.

1964. Reported Silurian occurrences of *Calathium* from the Thornton Reef, Illinois: a correction. Jour. Paleontol., **38,** no. 6: pp. 1102–1104, pl. 171.

Reported occurrences of *Calathium* (?) sp. from flank-reef deposits in Thornton Quarry are probably tabulate coelenterates and not the sponge-like form. A similar erroneous occurrence was reported by Bretz (1939) from the Chicago area, and is considered to be probably tabulate coral material as well.

A plate illustrates the distinctive morphology of the genus and should allow easy separation from the often confused *Archaeoscyphia*.

Toomey, D. F. and Ham, W. E.

1967. *Pulchrilamina*, a new mound-building organism from Lower Ordovician rocks of West Texas and southern Oklahoma. Jour. Paleontol., **41**, pp. 981–987, pls. 127–128, 2 text-figs.

Archaeoscyphia and the sponge-like organism, *Calathium*, occur with *Pulchrilamina*, a massive mound-building organism of uncertain biologic affinities, in the Lower Ordovician El Paso Group in the El Paso, Texas region, and in the Arbuckle Group in Oklahoma, where together the three organisms are the major constituents in reef-like mounds.

Troedsson, G. T.

1928. On the Middle and Upper Ordovician faunas of Northern Greenland, Pt. II. Meddel. om Grønland., **72**: pp. 1–197, 56 pls., 12 text-figs. (reprinted in Copenhague Univ. Mus. min. geol. Commun. paleontol, **30**, in 1928.)

All the specimens of receptaculitids described from the coasts around Kane Basin are placed into the species *Receptaculites arcticus* Etheridge.

Troost, Gerard

1838. Description d'un noveau genre de fossiles. Mem. Soc. Geol. France, **3**, pt. 1, Mem. 4: pp. 87–96, pls. 9–11.

Troost described and figured a sponge from the Ordovician of Tennessee, but did not give the specimen a name. It is now included in *Brachiospongia digitata* (Owen), and probably represents the first fossil sponge described from North America.

Twenhofel, W. H.

1914. The Anticosti Island Faunas. Canad. Geol. Surv. Mus. Bull. 3, Geol. ser. no. 19, 38 pp., 1 pl.

Ordovician forms listed from the English Head and Charleton Formations include *Rauffella* cf. *filosa* Ulrich and *Hindia fibrosa* (Roemer). *Cyclocrinites* (now *Pasceolus*) *halli* (Billings), *Ischadites? insularis* (Billings), *Hindia fibrosa* (Roemer), and *Rauffella* cf. *filosa* Ulrich are reported from the Ellis Bay Formation. The Silurian receptaculitids listed include *Cyclocrinites* (now *Pasceolus*) *halli* (Bill-

ings), from the Beesie River Formation, and *Cyclocrinites* (now *Nidulites*) *gregarius* (Billings), *C.* (now *Nidulites*) *intermedius* (Billings), and *Ischadites koenigi* Murchison from the Gun River Formation.

1927. Geology of Anticosti Island. Geol. Surv. Canad., Memoir 154, 481 pp., 60 pls.

The sponge *Hindia* cf. *fibrosa* (Roemer) is reported from the Ordovician English Head Formation from several localities. *Hyalostelia anticostiana* Twenhofel from the Silurian Jupiter Formation is described here. Problematical forms, *Ischadites? insularis* (Billings), *Ischadites* cf. *koenigi* Murchison, *Cyclocrinites* (now *Pasceolus*) *halli* (Billings), and *Cyclocrinites* (now *Nidulites*) *intermedius* (Billings) are reported from the Ordovician and Silurian.

Rauffella cf. *R. filosa* Ulrich is reported from the English Head Formation from several localities. This form is now considered a trace fossil and not a sponge.

1938. Geology and paleontology of the Mingan Islands, Quebec. Geol. Soc. Amer. Spec. Paper 11, 132 pp., 24 pls., 1 text-fig., 1 table.

Archaeoscyphia minganensis (Billings) is described from the Romaine Formation on Moutange Island. *Eospongia roemeri* Billings and *E.* (now *Zittelella*) *varians* Billings are described and illustrated from the Mingan Formation on several islands within the group, and *Trichospongia sericea* Billings is questionably referred to the Romaine Formation, although the type is missing.

Receptaculitids reported include the new species *Ischadites rhomboideus*, which is described and illustrated from the Mingan Formation on Mingan Island, *Receptaculites calciferus* Billings, and *R.* (*?*) *elegantulus* (Billings) which are described from the Romaine Formation of Mingan Island.

Nipterella paradoxica (Billings) is described from chert of the Romaine Formation.

1938. A new species of *Receptaculites* (*R. pedunculatus*) from the Silurian strata of eastern Wisconsin. Trans. Wisc. Acad. Sci. Arts, Letters, **31**: pp. 545–546, 2 text-figs.

The new species *Receptaculites pedunculatus* is described and illustrated with photographs of the exterior. The species was collected from the lower part of the Racine Dolomite near Cedarburg, Wisconsin.

Twenhofel, W. H. and Shrock, R. R.

1935. Invertebrate paleontology. McGraw-Hill Book Company, Inc., New York. 511 pp., 175 text-figs.

An introductory review of sponge morphology, classification, ecology, and geologic history is given. *Protospongia tetranema* Dawson, *Astraeospongia meniscus* (Roemer), and *Astylospongia praemorsa* (Goldfuss) are figured, although only identified by genus.

Receptaculitids, *R. oweni* Hall from the Middle Ordovician of Illinois, and *Ischadites iowensis* (Owen) from the Middle Ordovician of Iowa, are figured and briefly described. These forms are included in a section on "Forms of Unknown Affinities," along with archaeocyathids.

Twenhofel, W. H. *et. al.*

1954. Correlation of the Ordovician formations of North America. Bull. Geol. Soc. Amer., **65**: pp. 247–298, 2 figs., 1 pl.

The stratigraphic ranges of the following are indicated: *Archaeoscyphia* sp. in Roubidoux and Jefferson City Formations; *Receptaculites mammillaris* Walcott in Chazyan and, *R. biconstrictus* Ulrich in Black River Stages; *R. oweni* Hall in the Trentonian Stage; *R. "oweni"* Hall in the Trentonian Stage and Cincinnatian Series; *Nidulites* is said to range from the Valcour Formation thru the Black River Stage to the Rockland Formation; *Zittelella* ranges from the Crown Pt. Formation to the Lowville Formation.

Tyrrell, J. B.

1896. Report on the country between Athabasca Lake and Churchill River with notes on two routes travelled between the Churchill and Saskatchewan Rivers. Geol. Surv. Canad., Ann. Rept. for 1895, new ser., **8**, Rept. D, 120 pp., map and illustrations.

Receptaculites oweni Hall is listed in boulders of Paleozoic limestones on banks of the Big River.

1897. Report on the Doobaunt, Kazam and Ferguson Rivers and the north-west coast of Hudson Bay and on two overland routes from Hudson Bay to Lake Winnipeg. Geol. Surv. Canad. Ann. Rept. 1896, new ser., **9**, Rept. F., 218 pp., 11 pls., maps.

Receptaculites oweni Hall is cited from dolomitic boulders along the shores of Sturgeon Lake.

1902. Report on explorations in the north-eastern portion of the District of Saskatchewan and adjacent parts of the District of Keewatin. Geol. Surv. Canad., Ann. Rept. 1900, new ser., **13**, Rept. F., 48 pp., 1 pl.

Receptaculites oweni Hall is reported from Lake Winnipeg, Cumberland Lake, Sturgeon Lake, and Wekusko Lakes.

Ulrich, E. O.

1878. Descriptions of some new species of fossils from the Cincinnati Group. Jour. Cincinnati Soc. Nat. Hist., **1**, no. 2: pp. 92–100, pl. 4.

The new genus *Anomaloides* and its new species *A. reticulatus* are described from the Cincinnati Group at Covington, Kentucky. The genus is not placed in a larger group, but now is recognized among the Receptaculitidae even though in this paper it is considered among the Echinodermata.

1879. Descriptions of new genera and species of fossils from the Lower Silurian about Cincinnati. Jour. Cincinnati Soc. Nat. Hist., **2**: pp. 8–30, pl. 8.

The genus *Lepidolites* and the species *L. dickhauti* and *L. elongatus* (now *L. dickhauti*) are described from the "Hudson River Group at Covington, Kentucky." These subspherical and sub-cylindrical receptaculitids are hollow, and considered by Ulrich to be related to *Pasceolus*, but probably belonging to a new family, if not a new order. All but fragments of the specimens were iron-coated, and microstructure was difficult to see.

1880. Catalogue of fossils occurring in the Cincinnati Group of Ohio, Indiana, and Kentucky. James Barclay, Cincinnati, Ohio. 31 pp.

The following previously described species of sponges are listed: *Astylospongia* (now *Pasceolus darwini* Miller) *tumida* James, *Microspongia* (now *Hindia*) *gregaria* Miller and Dyer, *Streptospongia labyrinthica* Ulrich, *Heterospongia aspera* Ulrich, *H. knotti* Ulrich, *H. subramosa* Ulrich, *Brachiospongia digitata* (Owen), *B.* (now *B. digitata* (Owen)) *roemerana* Marsh, *B.* (now *B. digitata* (Owen)) *lyoni* Marsh, and *B. tuberculata* James.

Fossils classed as incerte sedis include the following: *Anomaloides reticulatus* Ulrich, *Lepidolites dickhauti* Ulrich, *L.* (now *L. dickhauti*) *elongatus* Ulrich, *Pasceolus claudei* Miller, *P. darwini* Miller, and *P. globosus* Billings.

Several species of sponges which have not been described are also listed here. These are considered as invalid names, and include: *Astylospongia globosa* Ulrich, *Eospongia(?) communis* Ulrich, *E. turnerensis* Ulrich, *Calathium obliquum* Ulrich, *Tricholites typicalis* Ulrich, *Streptospongia confusa* Ulrich, *Heterospongia nodulosa* Ulrich, and *Cystospongia tuberosa* Ulrich.

In addition, several bryozoans and coelenterates are listed as sponges in the catalogue.

1888. The palaeontological labors of Prof. Jos. F. James. Amer. Geol., **1**: pp. 323–327.

This is a paper very critical of James' work with Paleozoic fossils in the Cincinnati region, and reviews James' taxonomic and stratigraphic conclusions. James had concluded that *Anomaloides* and *Lepidolites* were the same genera, an idea which Ulrich dislikes and refutes by pointing out their dissimilarity and only very superficial similarity. At the same time he rejects James' placement of *Anomaloides* in the Receptaculitidae, and concludes that its position must remain uncertain.

Ulrich also rejects the placement of *Microspongia* as a synonym of *Astylospongia*, again pointing out their great internal differences, and points out that *Microspongia gregaria* Millller and Dyer is very similar to *Calamopora fibrosa* Roemer (now *Hindia sphaeroidalis* Duncan) and quite distinct from *Astylospongia*.

Ulrich concludes that *Dystactospongia* is not known from any "Lower Silurian" beds, although the genus is now known from Cincinnatian age rocks.

1889. Preliminary description of new Lower Silurian sponges. Amer. Geol., **3**: pp. 233–248, 1 fig.

A new genus *Rauffella* is described with two species, *R. palmipes* and *R. filosa* as a sponge. It is now considered a trace fossil. The following new sponge genera are proposed: *Leptopoterion*, *Heterospongia*, *Saccospongia*, *Streptospongia*, and *Cylindrocoelia*. New species of *Dystactospongia* and *Hindia* are also described.

Species described include: *Heterospongia subramosa* and *H. knotti*, *H. aspera*, *Saccospongia rudis* and *S. danvillensis*, *Dystactospongia minima*, *Hindia parva*, *Streptospongia labyrinthica*, *Cylindrocoelia endoceroidae*, *C. covingtonensis*, *C. minnesotensis*, *C. minor*, all from the Ordovician.

1890. American Palaeozoic sponges. Geol. Surv. Ill., **8**, pt. 2, sec. 3: pp. 209–241, 10 text-figs.

Thirty-four genera are mentioned as being found in American pre-Devonian rocks. Twenty two have been previously described, and they are: *Protospongia* Salter; *Archaeocyathus, Calathium, Eospongia, Trachyum, Trichospongia,* and *Aulocopina* Billings; *Aulocopium* Oswald; *Brachiospongia* Marsh; *Ethmophyllum* Meek; *Astylospongia, Palaeomanon,* and *Astraeospongia* Roemer; *Hindia* Duncan; *Pattersonia* and *Dystactospongia* S. A. Miller; *Leptomitus* and *Cyathophycus* Walcott; *Astroconia* Sollas; *Cyathospongia* Hall; *Lepidolites* Ulrich; and *Climacospongia* Hinde.

Of the remaining 12 genera, four are described in this paper, and the others in the April, 1889, "American Geologist."

Preservation and geologic distribution is discussed. A new family, the Anthaspidellidae, is described and includes the following genera: *Anthaspidella* n.g., *Zittelella* n.g., *Streptosolen* n.g., *Edriospongia* n.g., *Aulocopium* Oswald, *Climacospongia* Hinde, and several species referred to *Calathium* Billings (*C. canadense* Billings and conspecific specimens from the Trenton limestones of Tennessee).

Hindia, particularly *H. sphaeroidalis* Duncan, is discussed in order to clarify the taxonomy.

1895. On the structure and systematic position of "Anomaloides" and a proposal to change the name to *Anomalospongia.* Minn. Geol. Surv. Final Rept. 3, pt. 1, pp. 68–74, 1 text-fig.

The author recommends that *Anomaloides reticulatus* be changed to *Anomalospongia reticulata* since following the first description the sponge nature of the specimens became apparent. The specimens are described in some detail and the genus compared to various receptaculitids, with the suggestion that *Anomalospongia* (still considered to date as *Anomaloides*), Receptaculitidae, and *Amphispongia* be included in a new, unnamed, order, although *Anomalospongia* and *Amphispongia* would be placed in a new family separate from the Receptaculitidae.

1926. Relative values of criteria used in drawing the Ordovician-Silurian boundary. Bull. Geol. Soc. Amer., **37**: pp. 279–348.

Streptospongia sp. is listed from Richmondian rocks.

Ulrich, E. O. and Everett, Oliver

1890. Descriptions of Lower Silurian sponges. Geol. Surv. Ill., 8, pt. 2, sec. 5: pp. 253–282, pl. 1–8.

The new genera *Anthaspidella, Zittelella, Edriospongia, Streptosolen, Strotospongia,* and *Camarocladia* are well described and illustrated from the basal "Trenton" limestone near Dixon, Illinois.

The following species are described and illustrated: *Anthaspidella mammulata* U. & E., *A. florifera* U. & E., *A. parvistellata* U. & E., *A. scutula* U. & E., *A. grandis* U. & E., *A. firma* U. & E., *A. fenestrata* U. & E., *A. obligua* U. & E., *A.? magnifica* U. & E., *Zittelella typicalis* U. & E., *Z. typicalis* var. *pistilliformis* U. & E., *Z. typicalis* var. *turbinata* U. & E., *Z. typicalis* var. *subrotunda* U. & E., *Z. lobata* U. & E., *Z. inosculata* U. & E., *Edriospongia basalis* U. & E., *Streptosolen obconicus* U. & E., *Calathium*? (*?Zittelella*) *infelix* U. & E., *Hindia inaequalis* U. & E., *Strotospongia maculosa* U. & E., *Dystactospongia minor* U. & E., *D. rudis* U. & E., and *Camarocladia dichotoma* U. & E.

Vickers, Thomas

1874. Translation from Roemer, Ferdinand. "Die Silurische Fauna des Westlichen Tennessee." Cincinnatti Quart. Jour. Sci., **1**: pp. 29–35.

The fossil Spongiae are summarized, in particular the occurrence and similarities of Early Paleozoic forms. The genus *Astylospongia* is described and *A. praemorsa* (Goldfuss) is included in the genus. These described forms are limited to the Upper Silurian.
(See also: Roemer, translator unknown, 1874; and Dietrich, C. W., 1874, for other translated segments of Roemer's work, both published in the same volume.)

Walcott, C. D.

1881. On the nature of *Cyathophycus*. Amer. Jour. Sci., ser. 3, **22**: pp. 394–395.

Cyathophycus reticulatus was originally described as an alga from the Utica Shale by Walcott, but is here considered a sponge with affinities to *Euplectella.*

1883. Fossils of the Utica Slate. Trans. Albany Inst., **10**: pp. 18–38, pl. 2.

The new genera, *Cyathophycus* and *Discophycus,* and the new species *C. reticulatus, C.* (now *Sphaerodictya*) *subsphericus,* and *D. typicalis,* are described from the Utica Shale near Trenton, New York.

1884. Paleontology of the Eureka District. U. S. Geol. Surv. Monogr. 8, 298 pp., 24 pls.

The new species *Receptaculites mammillaris* and *R. ellipticus* are described and figured, and *R. elongatus* is described but not figured. All are from the upper part of the Pogonip Group (now termed Antelope Valley Formation of the Pogonip Group) within the Eureka district.

1886. Second contribution to the studies on the Cambrian faunas of North America. Bull. U. S. Geol. Surv., **30**: 369 pp., 33 pls.

The new genus and species *Leptomitus zitteli* are described and figured from the Middle Cambrian Georgia Formation at Georgia, Franklin County, Vermont.

Protospongia fenestrata Salter is discussed and spicules figured, with the species reported from the Middle Cambrian Prospect Mountain Limestone in the shale near the Eldorado Mine and on the east side of Secret Canyon in the Eureka District, Nevada. *Strephochetus* (?) sp. is reported as a sponge from the sandy shales above the Prospect Mountain Limestone in the Eureka District and Silver Peak region of Nevada, but this form is now considered algal and not a sponge.

Ethmophyllum minganense (now *Archaeoscyphia minganensis*) (Billinge) is figured, and *Trichospongia sericea* Billings is reported from the same beds.

1887. Note on the genus *Archaeocyathus* of Billings. Amer. Jour. Sci., ser. 3, **34**: pp. 145–146.

Archaeocyathus (now *Archaeoscyphia*) *minganensis* Billings is described, along with *A. atlanticus* and *A. profundus*, from the early Paleozoic. *A. minganensis* is now included in *Archaeoscyphia minganensis* (Billings), a true sponge, and is separated from the other species described which are considered among true archaeocyathids.

1889. Stratigraphic position of the *Olenellus* fauna in North America and Europe. Amer. Jour. Sci., **37**, art. 40: pp. 374–392; part 2, **38**, art. 3: pp. 29–42.

Protospongia fenestrata Salter is listed from the Middle Cambrian, and *Leptomitus zitteli* Walcott, and *Protospongia* sp. are listed as sponges in the Cambrian fauna of North America, along with the genus *Girvanella*, now recognized as an alga.

1889. [1890] Descriptive notes of new genera and species from the Lower Cambrian or *Olenellus* zone of North America. Proc. U. S. National Museum **12,** pp. 33–46.

The genus *Archaeocyathus* is considered to be a coral, and not a sponge.

1890. The fauna of the Lower Cambrian or *Olenellus* Zone. U. S. Geol. Surv., 10th Ann. Rept., pp. 509–763.

Leptomitus zitteli Walcott is reported from western Vermont, *Trachyum vestustum* Dawson is reported from Bic Harbor, Tres Pistoles, and St. Simon, Quebec, and *Protospongia* sp. from Washington County, New York. Questionable sponges are reported from the Middle Cambrian of Castle Mountain, British Columbia, and the conclusion is reached that *Leptomitus* is limited to the Lower Cambrian, but *Protospongia, Trachyum,* and *Astylospongia radiata* occur in both the Lower Cambrian and higher. *Protospongia* occurs in upper beds of the *Olenellus* zone of the Atlantic Province, and in the Middle Cambrian of Nevada, New Brunswick, Newfoundland, Wales and Sweden.

1891. Correlation papers; Cambrian. Bull. U. S. Geol. Surv. **81:** 447 pp.

Trachyum vestustum Dawson is cited from Métis, Quebec, and *Protospongia fenestrata* Salter is mentioned as part of collections from Secret Canyon in the Eureka district, Nevada. The latter species is considered a Middle Cambrian form.

The various sponges described by Matthew (1890) are listed from the St. John Group of New Brunswick, including: *Astrocladia elongata* Matthew, *A. elegans* Matthew, *A. virguloides* Matthew, *Plocoscyphia perantiqua* Matthew, *Dichoplectella irregularis* Matthew, and *Hyalostelia minima* Matthew.

The Ordovician receptaculitid, *Receptaculites mammillaris* Walcott is listed from the Pogonip Limestone of the Eureka district, Nevada.

1892. Preliminary notes on the discovery of a vertebrate fauna in Silurian (Ordovician) strata. Bull. Geol. Soc. Amer., **3**: pp. 153–172, pls. 3–5.

Receptaculites oweni Hall is noted with *Receptaculites* sp. undet. in the Upper Ordovician Fremont Limestone near Canyon City, Colorado.

1895. Lower Cambrian rocks in eastern California. Amer. Jour. Sci., ser. 3, **49**, art. 14: pp. 141–144.

No sponges are cited in the paper. Archaeocyathids are reported, however, and at the time of preparation of many indexes this group was included within the sponges, thus the citation of sponges in the paper.

1899. Chapter 12, Paleozoic fossils, section 1-Cambrian fossils. *In* Geology of the Yellowstone National Park, Part 2. U. S. Geol. Surv. Monogr. 32, pt. 2, pp. 440–418, pls. 60–65.

Haguia sphaerica, n. gen., n. sp., is described and illustrated as an archaeocyathid, but it could well be inorganic.

1912. Notes on fossils from limestone of Steeprock Series, Ontario, Canada. *In* The geology of Steeprock Lake, Ontario. Geol. Surv. Canad. Mem. 28, Appen., pp. 16–23, 2 pls.

The supposed sponges *Atikokania* n. gen., and the new species *A. lawsoni* and *A. irregularis* are described and figured from the Precambrian Steeprock Series.

1912. Cambrian Brachiopoda. U. S. Geol. Surv. Monogr. 51, pt. 1 (text), 872 pp., 76 text-figs.; pt. 2 (illust.) 363 pp., 104 pls.

Protospongia spicules are reported from 700 feet above the base of the Eldon Formation on Mt. Stephen, British Columbia, and from the Bloomington Formation in Blacksmith Fork, Utah. Unidentified sponge spicules are reported from near the base of the Marjum Limestone in the House Range, Utah.

1912. Cambrian of the Kicking Horse Valley, B. C. Summary Rept., Geol. Surv. Canad., Dept. Mines 1911, Sessional Paper no. 26, pp. 188–191.

Vauxia gracilenta, a new genus and species, is listed from a section of the Burgess Shale of the Stephen Formation. However, the listing is not accompanied by any description.

1914. Is "*Atikokania lawsoni*" a concretion?; Nature, **94**: p. 478.

Atikokania lawsoni Walcott and related forms should not be referred to the sponges or to the Archaeocyathinae but are probably inorganic. The author was influenced by George Abbott's article in *Nature*, January 20, 1914, on "Zonal Structures in Colloids."

1917. Cambrian geology and paleontology, IV, no. 2, The Albertella-fauna in British Columbia and Montana. Smithsonian Misc. Coll., **67**, no. 2: pp. 9–59, pls. 1–7.

Siliceous sponge spicules, described as the new species, *Tholiasterella*(?) *hindei*, are described and figured, from the Middle Cambrian Ross Lake Shale of the Ptarmigan Formation near Ross Lake, south southwest of Stephen, British Columbia. *Tholiasterella* is an Upper Paleozoic genus, but the spicules are not sufficiently different to establish a new genus.

1920. Middle Cambrian Spongiae, Cambrian Geology and Paleontology. Smithsonian Misc. Coll., **67**, no. 6: pp. 261 364, pls. 60–90, text-figs. 4–10.

This is the most comprehensive and significant paper on Cambrian sponges to date, for in it is described and illustrated the abundant Burgess Shale fauna of British Columbia, along with other known Middle Cambrian sponges of North America.

Included in the paper are descriptions of the following new genera: *Tuponia* (now *Leptomitus*,) *Takakkawia*, *Wapkia*, *Hazelia*, *Corralia*, *Sentinella*, *Choia*, *Hamptonia*, *Pirania*, *Kiwetinokia*, *Eiffelia*, and *Chancelloria*. New species defined and illustrated include: *Halichondrites elissa*, *Tuponia* (now *Leptomitus*) *lineata*, *T.* (now *Leptomitus*) *bellilineata*, *T.* (now *Leptomitus*) *flexilis*, *T.* (now *Leptomitus*) *flexilis* var. *intermedia*, *Takakkawia lineata*, *Wapkia grandis*, *Hazelia palmata*, *H. conferta*, *H. delicatula*, *H.* (?) *grandis*, *H. mammillata*, *H. nodulifera*, *H. obscura*, *Corralia undulata*, *Sentinella draco*, *Choia carteri*, *C. ridleyi*, *C. utahensis*, *Hamptonia bowerbanki*, *Pirania muricata*, *Protospongia erixo*, *Diagoniella hindei*, *Kiwetinokia utahensis*, *K. spiralis*, *Vauxia dignata*, *V. gracilenta*, *V. bellula*, *V. densa*, *V.* (?) *ventata*, *Eiffelia globosa*, *Chancelloria eros*, *C. drusilla*, *C. libo*, and *C. yorkensis*. Also described and illustrated are specimens of *Choia hindei* (Dawson), *Protospongia fenestrata* Salter, *P. hicksi* Hinde, and *Kiwetinokia metissica* (Dawson).

All the above species are from the Burgess or Stephen Shale except *Protospongia fenestrata* Salter, which is known also from Wales, Newfoundland, New Brunswick, Georgia, Idaho, Utah, and New York: *Choia utahensis* from Utah; *C. hindei* from Quebec; *Protospongia erixo* from Nevada; *Kiwetinokia utahensis* from Utah and Idaho; *K. spiralis* from Utah; *K. metissica* from Quebec, *Chancelloria drusilla* from Georgia, *C. libo* from Alabama, and *C. yorkensis* from Pennsylvania.

1928. Cambrian geology and paleontology, V, no. 5-Pre-Devonian Paleozoic formations of the Cordilleran provinces of Canada. Smithsonian Misc. Coll., **75**, no. 5: 368 pp., pls. 26 108, text-figs. 24–35.

Calathium (?) sp. and *Receptaculites (?)* sp. are reported from the lower and middle part of the Sarbach Formation in a section measured in Clearwater Cnayon, 25 miles north of Lake Louise, Alberta.

Walker A. E.

1895. Hamilton sponges. Jour. Proc. Hamilton Association for 1894–95, no. 11, pp. 85–87, 5 text-figs.

Aulocopina Granti, Aulocopina sp. *Astylo Spongia Piaemass* [sic] [=*Astylospongia praemorsa*], and *Astylo Spongia* sp. [=*Astylospongia* sp.] are illustrated from Hamilton, Ontario.

Ward, H. A.

1865. Description of the Wadsworth gallery of casts of fossil animals. New York State Cab. Nat. Hist., 18th Ann. Rept., pp. 17–52, 107 figs.

A line drawing of *Amorphozoum(?)* is included with reproductions of other fossils. This is one of the earliest illustrations of *Brachiospongia digitata* (Owen), a form from Upper Ordovician rocks near Lexington, in Franklin County, Kentucky.

1866. Catalogue of casts of fossils, from the principal museums of Europe and America, with short descriptions and illustrations. Benton and Andrews, Rochester, New York. 228 pp., numerous figs.

A line drawing, under the name *Amorphospongia,* is given of the sponge now called *Brachiospongia digitata* (Owen) from the Upper Ordovician of Kentucky.

Waterlot, G.

1932. Structure et position systematique du *Receptaculites neptuni* De France. Soc. Geol. du Nord, Annales 57, pp. 2–21, 1 plate.

Receptaculitids are discussed in general, with special emphasis on *Receptaculites neptuni* De France, *R. occidentalis* Salter, *R. australis* Salter, and the genera *Acanthochonia, Ischadites,* and *Sphaerospongia.* On the basis of detailed observations of the structure of the receptaculitids, Waterlot concludes that they should be placed in a separate group of calcareous sponges.

Webb, G. W.

1956. Middle Ordovician detailed stratigraphic sections for western Utah and eastern Nevada. Utah Geol. Min. Surv. Bull. 57, 77 pp., 11 text-figs.

Receptaculites sp. occurs in Kanoshian (Upper Pogonip Group) rocks in the Ely, Egan, Pahroc, and Arrow Canyon Ranges of eastern Nevada and in the Pogonip rocks at Lone Mountain in central Nevada. The species *Receptaculites mammillaris* Walcott is noted in Kanoshian rocks of the White Pine Range in eastern Nevada and in the lower Swan Peak Formation on Promontory Point in north-central Utah.

Weiss, M. P.

1954. Notes on some Middle Ordovician fossils from Minnesota. Jour. Paleontol., **28**, no. 4: pp. 427–429, pl. 41.

Ischadites iowensis (Owen) is described and figured. The author concludes that *I. ottawaensis* Wilson is a flattened *I. iowensis*. Specimens studied come from the *Ischadites iowensis* zone in the Prosser member of the Galena Formation.

Ischadites sp. is reported from the uppermost Stewartville member of the Galena Formation.

Rauffella filosa Ulrich was originally described as a sponge, but was assigned to worm burrows by Sardeson in 1925, and is included within the Phylum Annelida in the present paper. Photographs are figured here for the first time.

Welby, C. W.

1961. Bedrock geology of the central Champlain Valley of Vermont. Bull. Vermont Geol. Surv. **14**: 296 pp., 13 pls., 19 text-figs., 5 tables.

Zittelella varians (Billings) is reported from the Lower Chazyan Day Point Formation at Charlotte, Vermont, and from the Middle Chazyan Crown Point Limestone along the shore near Grosse Point. It is reported as a rare form at both localities.

Weller, Stuart

1903. Report on Paleontology, Vol. III, The Palaeozoic Faunas. Geol. Surv. New Jersey, 462 pp., 53 pls.

Hindia sp. and *Receptaculites* sp. are reported from the Trentonian rocks of New Jersey. Specimens of *Receptaculites occidentalis* Salter, *Hindia fibrosa* (Roemer) (now *H. sphaeroidalis* Duncan), and *H. parva* Ulrich are described and figured.

Weller, Stuart and St. Clair, Stuart

1928. Geology of Ste. Genevieve County, Missouri. Mo. Bur. Geol. Mines, ser. 2, **22**: 352 pp., 25 pls., 5 text-figs.

The sponge *Dystactospongia minor* Ulrich and Everett is reported from the Plattin Formation, and *Hindia sphaeroidalis* Duncan is reported from the Bailey Limestone near Little Saline Creek. *Calathium* sp. is cited from the Jefferson City Formation.

Receptaculites sp. is reported from the lower Thebes Limestone and the Kimmswick Limestone, the latter near Glen Park, and *R. oweni* Hall is reported from the Galena Limestone of the northern Mississippi Valley and from the Kimmswick Limestone at Glen Park.

Wells, J. W.

1940. *Sphaerospongia* in the Tully Formation. Jour. Paleontol., **14**: pp. 502–504, 2 text-figs.

Sphaerospongia cf. *S. tessellata* Wells is illustrated and described from the Tully Limestone, where it occurs with *Receptaculites* (?) sp., in New York.

Westgate, L. G. and Knopf, Adolph

1932. Geology and ore deposits of the Pioche district of Nevada. U. S. Geol. Surv. Prof. Paper 171, 79 pp., 8 pls., 13 text-figs.

Calathium sp. is reported from the Beekmantownian Yellow Hill Limestone near Yellow Hill. *Rauffella?* sp., a problematic form, and *Receptaculites ellipticus* Walcott, and *R. mammillaris* Walcott are reported from the Chazyan Tank Hill Limestone in the Ely Springs Range.

Wetzel, Otto

1940. Mikropalontologische Untersuchungen an eozoischen und palaozooischen Kieselgesteinen aus Nord amerika (U.S.A. und Kanada). Zentralbl. Mineralogie, Abt. B, Nr. 3, pp. 60–86.

The paper deals with microfossils which occur in chert nodules at various points in North America. Most significant for the present summary is the reported occurrence of an isolated single sponge spicule from the Beltian Spokane rocks in a colony of *Collenia nodosa* Walcott from 8 miles west of White Sulphur Springs, Montana. Other occurrences of sponges in Ordovician and Silurian siliceous

rocks are noted from Iowa and New York. The Precambrian occurrence is in the collection of the U. S. National Museum.

White, C. A.

1877. Fossils of the Canadian Period, Chapter IV. *In* Report upon the invertebrate fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona by parties of the expeditions of 1871, 1872, 1873, and 1874. U. S. Geog. Surv. West 100th Meridian, pp. 50–61, pl. 3.

A single fragment of *Receptaculites* (?) sp. is reported and described from Ordovician rocks near Fish Springs, House Range, Utah.

Whiteaves, J. F.

1880. Appendix 1, on some Silurian and Devonian fossils from Manitoba and the Valley of the Nelson and Churchill Rivers, for the most part collected by Dr. R. Bell in the summer of 1879. *In* Report on Explorations on the Churchill and Nelson Rivers and around God's and Island Lakes, 1879. Geol. Surv. Canad. Rept. Prog. 1878–79, pp. 45c–51c.

Receptaculites oweni Hall is reported from the banks of the Red River, in the Parish of St. Andrews, Manitoba, and from the second and third Limestone Rapids of the Nelson River.

1881. Appendix 1, List of fossils collected by Dr. R. Bell in Manitoba during season of 1880. *In* Bell, Robert. Report on Hudson's Bay and some of the lakes and rivers lying to the west of it, 1879–80. Geol. Surv. Canad. Rept. Prog. 1879–80, pp. 57c–58c.

Receptaculites oweni Hall is listed from the "Galena Limestone" at East Selkirk, Manitoba.

1899. Address by J. F. Whiteaves, Vice-President and Chairman, Section E; The Devonian System in Canada. Proc. Amer. Assoc. Adv. Sci., **48**: pp. 193–223 (reprinted in: 1899, Amer. Geol., **24**: pp. 210–240; Science, n. s., **10**: pp. 402–412, 430–438).

Sphaerospongia tesselata is reported as the most characteristic species of the *Stringocephalus* zone in Manitoba. Two undesignated species of sponges are reported from the Hamilton Formation of Ontario, two species, including Receptaculitidae, are reported from the vicinity of Lakes Winnepegosis and Manitoba, and one species from the Devonian of the McKenzie River basin.

1899. Recent discovery of rocks of the age of the Trenton Formation at Akpatok Island, Ungava Bay, Ungava. Amer. Jour. Sci., ser. 4, **7**: pp. 433–434.

Receptaculites oweni Hall is reported from the fauna of Akpatok Island, although the specimen is a small, well worn individual.

1902. The fossils of the Galena-Trenton and Black River formations of Lake Winnipeg and its vicinity. Geol. Surv. Canad., Palaeozoic Fossils, III, **3**: pp. 129–242, pls. 21–22.

Receptaculites, Ischadites, Pasceolus, Aulocopella, and *Trichospongia* are reported from the Ordovician in the vicinity of Lake Winnipeg. *Receptaculites oweni* Hall, *Ischadites iowensis* (Owen), *Pasceolus* (now *Nidulites*) *gregarius* Billings, and *P. hospitalis* (Salter) are illustrated and described. *Aulocopella winnipegensis* Rauff is illustrated and described, as is the new species *Trichospongia hystrix* Whiteaves.

1906. Palaeozoic fossils, Vol. 3, part 4 (and last). Geol. Surv. Canad., pp. 239–352, pls. 23–42, text-figs. 20–25.

Sphaerospongia tesselata (Phillips) recorded in "Contributions to Canadian Palaeontology" vol. 1, p. 259, is considered here as *Receptaculites* sp. indeterminate.

Whitfield, R. P.

1883. Part III, Palaeontology. *In* Geology of Wisconsin. Geol. Surv. Wisc., **1**, Survey of 1873–1879, pp. 163–349.

Cerionites dactyloides (Owen), *Receptaculites hemisphericus* Hall, and *Receptaculites oweni* Hall, are described and illustrated from the Niagara and Galena formations of Wisconsin.

Wisconsin fossils listed include: *Astylospongia* sp. from Trenton and Galena rocks, *Receptaculites globulum* Hall (now *Ischadites iowensis*), *R.* (now *Ischadites*) *iowensis* Owen, and *R. oweni* Hall from Galena rocks, and *Receptaculites hemisphericus* Hall, *R.* (now *Ischadites*) *infundibuliformus* Hall, and *Cerionites dactyloides* (Owen) from Trenton rocks.

1886. Notice of a new fossil body, probably a sponge related to *Dictyophyton*. Bull. Amer. Mus. Nat. Hist., **1**, no. 8: pp. 346–348, pl. 35, figs. 1–9.

A new genus, *Rhombodictyon,* with the type species *R. reniforme* is proposed. The following species and variety are described and and figured: *R. reniforme* n. sp., *R. reniforme rhombiforme* n. sp., *R.*

discus n. sp. The collecting horizon is assumed to be the Utica Slate, a few feet from an outcrop containing Norman's Kill-type graptolites, near Kenwood, New York. All figures are lithographs.

Ruedemann (1925) concluded these markings are inorganic and should not be placed among the sponges.

1895. Republication of descriptions of fossils from the Hall collection in the American Museum of Natural History, from the report of progress for 1861 of the Geological Survey of Wisconsin, by James Hall, with illustrations from the original type specimens not heretofore figured. Mem. Amer. Mus. Nat. Hist., **1**, pt. 2: pp. 39–74, pls. 4–12.

Quoted descriptions of Hall are given for *Receptaculites oweni* Hall, *R. globularis* (now *Ischadites iowensis* (Owen)) Hall, *R. fungosus* (now *I. iowensis* (Owen)) Hall, *R.* (now *Ischadites*) *infundibulum* Hall, and *R. hemisphericus* Hall, and original types are figured for the first time.

1900. Observations on and descriptions of Arctic fossils. Bull. Amer. Mus. Nat. Hist., **13**, art. 2: pp. 19–22.

The new species *Receptaculites pearyi* is described from the Silurian rocks of Cope Bay, Princess Marie Bay. This species is similar to *R. oweni* Hall, but differs from that form by having larger cells, even close to the point of origin.

Whitfield, R. P. and Hovey, E. O.

1898. Catalogue of the types and figured specimens in the paleontological collection of the Geological Department, American Museum of Natural History. Bull. Amer. Mus. Nat. Hist., **11**, pt. 1: pp. 1–72: pt. 2, pp. 73–188.

This list includes types from the Ordovician and Silurian. Those types from the Ordovician include: *Rhombodictyon discum* Whitfield, *R. reniforme* Whitfield, and *R. reniforme rhombiforme* Whitfield.

Types from the Silurian include: *Astylospongia* Roemer, *Astylospongia* (*Paleomanon*) *bursa* (now *P. bursa*) Hall, *A. praemorsa* (Goldfuss) (now *A. praemorsa pusilla* Hall) Hall, *A. praemorsa nuxmoschata* (now *Caryospongia juglans nuxmoschata*) Hall, *Receptaculites hemisphericus* Hall, *R. infundibuliformis* (Eaton) (now *Ischadites infundibulum* (Hall)) Hall, *R.* (now *Ischadites*) *infundibulum* Hall, *R.* (now *Ischadites*) *ohioensis* Hall and Whitfield, and *R.* (*now Ischadites*) *subturbinatus* Hall.

Whitlow, J. W. and Brown, C. E.

1963. Geology of the Dubuque North quadrangle, Iowa-Wisconsin-Illinois. U. S. Geol. Surv. Bull. 1123-C, pp. 139–168, pls. 10–11, figs. 22–24.

Receptaculites oweni Hall is reported as a distinctive fossil of the cherty portion of the Galena Dolomite.

Whitlow, J. W. and West, W. S.

1966. Geology of the Potosi quadrangle, Grand County, Wisconsin, and Dubuque County, Iowa. U. S. Geol. Surv. Bull. 1123-I, pp. 553–571, pls. 33–36, text-fig. 67.

Receptaculites oweni Hall is reported as common in the upper *Receptaculites* zone in the Stewartville Member in the noncherty unit of the Galena Dolomite.

Williams, H. S.

1895. Geological Biology—An introduction to the geological history of organisms. Henry Holt and Co., New York. 395 pp., 120 text-figs.

Sponges are included with Coelenterata in this early work. *Astylospongia praemorsa* (Goldfuss) is briefly described and illustrated as typical of the group.

Williams, J. S.

1948. Geology of the Paleozoic rocks, Logan quadrangle, Utah. Bull. Geol. Soc. Amer., **59**, no. 11: pp. 1121–1163, 6 pls., 2 text-figs.

"Several kinds" of sponges occur in the Garden City formation of northeastern Utah.

Williams, M. Y.

1919. The Silurian geology and faunas of Ontario Peninsula, and Manitoulin and adjacent Islands. Geol. Surv. Canad. Mem. 111, 195 pp., 34 pls., 6 text-figs.

Receptaculites (now *Ischadites*) *canadensis* Billings is listed from the Cabot Head Shale at Stoney Creek and Kelso, along the Niagara escarpment.

Many sponges are reported to have been collected from the Ancaster Chert member of the Lockport Dolomite, and *Astylospongia praemorsa* (?) (Goldfuss) is reported in a faunal list from the formation at Hamilton, Ontario.

1960. Evolution of Palaeozoic life: Ordovician to Permian. *In* Cameron, T. W. M. ed. Evolution: Its science and doctrine. Symposium presented to the Roy. Soc. Canad., pp. 22 43.

Statement is made that eight genera of siliceous sponges are guides to the Cambrian; four to the Ordovician, and two to the Silurian. Four genera of calcareous sponges are reported to extend from the Cambrian to the Pennsylvanian. *Astraeospongia* is reported to be restricted to the Silurian, and the receptaculitid, *Receptaculites* to the Ordovician.

Willis, Bailey

1912. Index to the stratigraphy of North America. U. S. Geol. Surv. Prof. Paper 71, 894 pp., 1 pl., 19 text-figs.

Eospongia sp. is reported from Unit M of Billings' Ordovician section of the Northern Peninsula of Newfoundland. The quasi-sponge, *Calathium* n. sp. is reported from the Ordovician El Paso Limestone at Van Horn and El Paso, Texas; and sponges are reported from Grenvillian rocks at St. John, New Brunswick, but no names are given.

Astylospongia (now *Caryomanon*) *parvula* Billings, and the receptaculitid, *Pasceolus globosus* Billings, are reported from Trentonian rocks at Ottawa, Ontario.

Receptaculites oweni Hall is reported from the Montoya Limestone in the Caballo Mountains of New Mexico and from Ordovician rocks on Lake Winnipeg, Manitoba. *R. occidentalis* Salter is reported from Black River beds at Ottawa, Ontario. *Receptaculites* sp. is reported from the Silurian rocks of Ellesmereland.

Willman, H. B. and Payne, J. N.

1943. Early Ordovician strata along Fox River in northern Illinois. Jour. Geol., **51,** no. 8: pp. 531–541.

Receptaculites sp. is reported as abundant in the upper Galena Dolomite along the banks of Fox River, in several small abandoned quarries north of Millbrook, near the mouth of Little Rock Creek, and on the southeast side of Fox River, opposite the mouth of Little Rock Creek.

Wilson, A. E.

1921. The range of certain Lower Ordovician faunas of the Ottawa Valley with descriptions of some new species. Canad. Geol. Surv. (Nat. Mus.) Bull. 33, pp. 19–57, 3 plates, 7 text-figs.

Hindia parva Ulrich is reported from the Leray Formation, and *Receptaculites occidentalis* is reported from the Leray and Rockland formations.

1931. Notes on the Baffin Land fossils collected by J. Dewey Spoer during 1925 and 1929. Trans. Roy. Soc. Canad., ser 3, **25**, section IV, pp. 288–292, pl. 1, figs. 1–4, pl. 2, figs. 1–5.

Specimens of *Receptaculites occidentalis* and *Receptaculites* cf. *arcticus* collected in Baffin Land are described and figured. The specimens are stored in the National Museum of Canada, in Ottawa.

1947. The Algae, Spongiae, Anthozoa, Stromatoporoidea, Graptoloidea, Vermes, Conodonts and trails of the Ottawa Formation, within the Ottawa-St. Lawrence Lowland (abstr.). Trans. Roy. Soc. Canad., **41**, sec. 3, p. 192.

The paper deals with miscellaneous groups of organisms which are sparsely represented in the Ottawa Formation. No mention is made of sponges in the abstract, other than in the title.

1948. Miscellaneous classes of fossils, Ottawa formation, Ottawa-St. Lawrence Valley. Geol. Surv. Canad. Bull. 11, 116 pp., 28 pls., 4 text-figs.

The new genus *Okulitchina*, and the new species *O. magna, O. parva, Astylospongia? perplexa, Steliella ottawaensis, Brachiospongia hullensis, Ischadites ottawaensis* are described. In addition, specimens of *Caryomanon parvulum* (Billings), *Hindia parva* Ulrich, *Steliella billingsi* Hinde, *S. crassa* Hinde, *Brachiospongia* cf. *digitata* (Owen), *Ischadites iowensis* (Owen), *Pasceolus globosus* Billings, *Receptaculites occidentalis* Salter are described and figured.

The descriptions of *Ischadites* refers the crystalline calcitic or empty molds of the rhabs to a canal system as well as the radiating clads at the outer surfaces of the shafts or rhabs.

Photographs well illustrate the specimens described.

1957. A guide to the geology of the Ottawa district. Canad. Field natur., **70**, 1956, no. 1, pp. 1–68, 5 pls., 1 map numerous text-figs.

Sponges and "near sponges" are briefly discussed and illustrated. *Receptaculites, Ischadites,* and *Pasceolus* are considered "near sponges." *Steliella billingsi* Hinde, *S. ottawaensis* Wilson, *S. crassa* Hinde and *Receptaculites occidentalis* Salter are illustrated.

Wilson A. G.

1895. The Upper Silurian in northeastern Iowa. Amer. Geol., **16:** pp. 275–281.

Cerionites dactyloides (Owen) is abundant in the upper "*Pentamerus* beds" within the state.

Wilson, C. W., Jr.

1948. The geology of Nashville, Tennessee. Tenn. Div. Geol. Bull. 53, 172 pp., 29 pls., 1 text-fig.

Hindia parva Ulrich is reported as abundant in the Upper Cannon and Catheys Formations and common in the *Constellaria* beds of the latter formation. *H.* cf. *sphaeroidalis* Duncan is reported as abundant in the upper part of the Catheys Formation as well. *Saccospongia danvillensis* Ulrich and *S. laxata* Bassler are reported as abundant in the upper dove-colored member of the Cannon Limestone. *Hindia parva* Ulrich, *H.* cf. *sphaeroidalis* Duncan, and *Saccospongia danvillensis* Ulrich are also figured.

Astraeospongia meniscus (Roemer) is listed and illustrated from the Bledsoe Limestone at Bakers Station.

The sponge-bed of early workers is named after the abundant stromatoporoid, *Stromatocerium pustulosum,* and not sponges in the present sense.

1949. Pre-Chattanooga stratigraphy in Central Tennessee. Bull. Tenn. Div. Geol., **56:** 407 pp., 28 pls., 89 text-figs.

Zittelella varians (Billings) is reported from the Ordovician Murfreesboro and Ridley Limestones, and *Camarocladia implicatum* Bassler is listed from the Lebanon Limestone. *Dystactospongia minor* Ulrich and Everett is listed from the Lower Carters Limestone, and *Dystactospongia* n. sp. and *Hindia sphaeroidalis* Duncan are reported from the Hermitage Formation.

Hindia sphaeroidalis var. Duncan and *H. parva* Ulrich are listed from the Bigby Limestone, and *H. parva* Ulrich, *Saccospongia danvillensis* Ulrich and *S. laxata* Bassler are listed from the Cannon Limestone. *Hindia sphaeroidalis* Duncan, *H.* cf. *sphaeroidalis* Duncan, and *H. parva* Ulrich are listed from the Catheys Formation.

Dystactospongia insolens Miller and *Hindia sphaeroidalis* var. Duncan are listed from the Leipers Formation and *Heterospongia subramosa* Ulrich, *Hindia sphaeroidalis* Duncan, and *Dystactospongia* sp. are listed from the Arnheim Formation.

Astraeospongia meniscus (Roemer), *Astylomanon* (now *Palaeomanon*) *cratera* (Roemer), *Caryomanon inciso-lobatum* (Roemer), and *C.* (now *Carpomanon*) *stellatim-sulcatum* (Roemer) are reported from the Silurian Beech River Formation in Decatur County. *Astylospongia praemorsa* (Goldfuss) and *Caryomanon* (now *Carpomanon*) *stellatim-sulcatum* (Roemer) are reported from the Bob Limestone. *Astraeospongia meniscus* (Roemer) is listed from the Decatur Limestone and Bledsoe Limestone, and *Hindia sphaeroidalis* Duncan is listed from the Bledsoe Limestone and overlying Devonian Ross Limestone.

Saccospongia danvillensis Ulrich from the Cannon Limestone, *Hindia parva* Ulrich and *H.* cf. *sphaeroidalis* Duncan from the Catheys Formation, *H. gregaria* Miller and Dyer from the Leipers Formation, *Astraeospongia meniscus* (Roemer) from the Bledsoe Limestone, and *Caryospongia juglans* (now *C. juglans nuxmoschata* (Hall)) (Quenstedt) and *Astylospongia praemorsa* (Goldfuss) (now *A. praemorsa pusilla* (Hall)) from the Waldron Shale are illustrated.

Wilson, C. W., Jr. and Wilson, J. M.

1962. The occurrence of *Brachiospongia* in the Ordovician of Tennessee. Jour. Tenn. Acad. Sci., **37**: pp. 117–118, 2 text-figs.

Troost's original description of a sponge later named *Brachiospongia digitata* was based upon a specimen from Tennessee. In 1940 several specimens were found in the uppermost Cannon Limestone in Carthage Quadrangle, Tennessee, but now all but one specimen are covered with subsequent construction.

Wilson, J. L.

1950. An Upper Cambrian pleospongid?. Jour. Paleontol., **24**, no. 5: pp. 591–593, pl. 80, 1 text-fig.

Wilbernicyathus donegani Wilson n. g. and sp. is described and figured with photographs. The species occurs in the uppermost Morgan Creek member of the Wilberns Formation, Camp San Saba section in the Llano Uplift of Texas. This form is now considered a lithistid sponge on the basis of spicule structure.

Winchell, Alexander and Marcy, Oliver

1866. Enumeration of fossils collected in the Niagara Limestone at Chicago, Illinois, with descriptions of several new species. Boston Soc. Nat. Hist. Mem. 1, pp. 81–114, pls. 2, 3.

Ischadites tessellatus (now *I. infundibulum* Hall) is described and illustrated as a new species, with mention of its occurrence in the Silurian rocks of Chicago. The species is compared to other receptaculitids.

Winchell, N. H. and Schuchert, Charles

1895. Sponges, Graptolites, and Corals from the Lower Silurian of Minnesota. Minn. Geol. Surv. Final Rept., **3**, pt. 1: pp. 55–95, pls. F, G., 7 text-figs.

Receptaculitids are extensively reviewed and current synonymy given for the American species. Genera treated include *Receptaculites*, *Ischadites*, *Lepidolites*, and *Cerionites*, with descriptions of *R. oweni* Hall and *I. iowensis* (Owen). A synonymy is presented for each of the following: *R. arcticus* Etheridge, *R. calciferus* Billings, *R. mammillaris* Walcott, *R. elongatus* Walcott, *R. ellipticus* Walcott, *R. occidentalis* Salter, *R. infundibuliformis* Eaton, *R. bursiformis* Hall, *R.? sacculus* Hall, *R. insularis* Billings, *R.? elegantulus* Billings, and *R.? devonicus* Whitfield, in addition to *I. cyathiformis* Hall, *I. circularis* (Emmons), *I. jonesi* Billings, *I. squamifer* Hall, *I. tessellatus* (now *I. infundibulum* (Hall)) Winchell and Marcy, *I. canadensis* (Billings), *I. subturbinatus* Hall and *I.* (now *Receptaculites*) *hemisphericus* Hall, and *L. dickhauti* Ulrich and *C. dactylioides* Owen.

A proposal is given to change the name *Anomaloides* to *Anomalospongia*, since now the sponge origin of the fossil is known, along with an extensive description of *A. reticulatus* Ulrich, in a paper within this larger compilation. Ulrich's proposal has not been accepted.

The original description of *Rauffella* and of *R. filosa* and *R. palmipes*, of *Cylindrocoelia* and *C. minnesotensis*, of *Heterospongia* and *H. subramosa(?)*, and of *Hindia parva*, all by Ulrich, are quoted, along with figures of each species, in addition to *R. oweni* Hall, *I. iowensis* (Owen), *I. koenigii* (Murchison), *Lepidolites dickhauti* Ulrich and *Anomalospongia* (now *Anomaloides*) *reticulata* Ulrich.

Winchell, N. H. and Ulrich, E. O.

1897. Introduction to vol. III, part II. The Lower Silurian deposits of the Upper Mississippi Province: a correlation of

the strata with those in the Cincinnati, Tennessee, New York, and Canadian Provinces, and the stratigraphic and geographic distribution of the fossils, pp. CXXVIII. *In* Minn. Geol. Surv. Geol. Minn., **3**, part 2, Final Rept.

The following sponges are listed from Trenton and Cincinnati periods: *Receptaculites oweni* Hall, *Receptaculites* sp. undet., *Ischadites iowensis* Owen, *Rauffella filosa* Ulrich, *Rauffella palmipes* Ulrich, *Heterospongia subramosa* Ulrich, *Hindia inaequalis* Ulrich, *Hindia parva* Ulrich, *Cylindrocoelia minnesotensis* Ulrich, *Brachiospongia* (?) *robbinsi* Ulrich, *Calathium* (?) *clavatum* Ulrich, *Calathium* (?) *hexagonalis* Ulrich, *Camarocladia dichotoma* Ulrich and Everett *Camarocladia fruticosa* Ulrich, *Camarocladia rugosa* Ulrich.

Woodford, A. O.

1965. Historical Geology. W. H. Freeman and Company, San Francisco. 512 pp., 407 text-figs.

Sponges are reported as occurring in the Middle and Upper Cambrian, but not in the Lower Cambrian. Archaeocyathids are referred to Porifera (?).

Woods, Henry

1896. Elementary palaeontology, Invertebrate. Cambridge Univ. Press. 295 pp., 122 figs.

An introductory treatment of invertebrate paleontology with a general treatment of sponges. *Astraeospongia, Astylospongia, and Protospongia fenestrata* Salter are given as examples, along with the receptaculitids *Ischadites* and *Receptaculites.*

1937. Palaeontology, Invertebrate. Cambridge Univ. Press, London. 475 pp., 221 text-figs.

A fairly detailed discussion of the morphology and occurrence of sponges is presented in this text-book treatment. *Astraeospongia* sp., *Astylospongia praemorsa* (Goldfuss), *Protospongia fenestrata* Salter, and *Pyritonema* sp. are mentioned. *Ischadites* and *Receptaculites* are examples of receptaculitids used in the discussion.

Worthen, A. H. and Meek, F. B.

1875. Palaeontology of Illinois, section II. Descriptions of invertebrates. Geol. Surv. Illinois, **6**, Geology and Palaeontology, pp. 489–532, pls. 23–33, 3 text-figs.

Cnemidium (?) *trentonensis* Worthen [new sp.?] is described and illustrated from Dixon, Lee County, Illinois, from lower Trenton rocks. The species is compared to *Astylospongia*.

Astylospongia praemorsa (?) (Goldfuss) is described and illustrated from rocks believed to be of Niagaran age from Carnell County, Illinois.

Receptaculites formosum Meek and Worthen (now *Ischadites infundibulum* (Hall)) is described and illustrated from Niagaran rocks at Bridgeport, Cook County, Illinois.

Zittel, Karl A.

1877. Studien über fossile Spongien, I Abtheil., Hexactinellidae. Abhandl. d. math.-phys. Classe d. Kon. Bayer. Akad Wissenschaften, **13**: pp. 1–63, pls. 1–4.

The systematic position, type of preservation, morphologic character, and classification of fossil hexactinellids, mainly Mesozoic forms, are given. Lyssakina, whose skeletal spicules are mainly free, and Dictyonina, whose skeletal spicules are mainly fused to form a lattice-like mesh, are the two main divisions recognized.

Paleozoic genera included in the Family Astylospongidae are: *Astylospongia*, *Palaeomanon*, *Eospongia*, and *Protachilleum*, all but the latter present in North America. The only other North American Early Paleozoic sponges noted are included in the Family Euretidae, including the following: ?*Protospongia*, *Calathium*, *Archaeocyathus*, ?*Trachyum*. Brief descriptions are given of each of the above genera.

1878–1880. Handbuch der Palaeontologie, Vol. 1 Protozoa, Coelenterata, Echinodermata, und Molluscoidea. Druck und Verlag von R. Oldenbourg, Munchen and Leipzig. 765 pp., 558 text-figs.

Aulocopium aurantium, from siliceous pebbles within the alluvium of North Germany and the genera *Aulocopina* Billings and *Silurispongia* Martin, both also from the Silurian, are reported within the Family Tetracladina, while *Astylospongia*, *Palaeomanon*, and *Eospongia* are reported from the Silurian (now Ordovician and Silurian), and *A. praemorsa* (Goldfuss) is illustrated.

Protospongia, *Calathium*, *Trachyum*, *Archaeocyathus*, *Brachiospongia*, and *Rhabdaria* are listed as within the Family Euretidae and *Astraeospongium* in the lyssakid Family Monakidae.

Archaeocyathus, Calathium, Eospongia, Rhabdaria and *Trachyum* are cited as the oldest known sponge remains and occur in the Potsdam or Calciferous beds of Canada. *Astraeospongium, Astylospongia, Palaeomanon, Protachilleum, Protospongia, Acanthospongia, Aulocopium,* and *Aulocopina* along with *Brachiospongia* and *Palaeospongia,* are listed as from the Silurian beds.

1879. Studien uber fossile Spongien. III., IV., V., Monactinellidae, Tetractinellidae, und Calcispongiae. Abh. math.-phys. C. bayer. Akad. Wissens. xiii. pt. 2, pp. 1–48, pls. 11, 12 to which the pages given below refer. (Translated in Ann. Mag. Nat. Hist., ser. 5, **3:** pp. 304 and 364; **4:** pp. 61 and 120, and mainly reproduced in Neus. Jahrb. Min. Paleo. and "Beitrage zur Systematik der Fossilen Spongien," Stuttgart: 1879, 10 pls.)

Cliona Grant, a burrowing form, may be traced back to Silurian beds. All other forms mentioned are late Paleozoic or younger. A classification and list of genera and species involved are presented.

1884. Ueber Astylospongidae und Anomocladina. Neus. Jahrb. Min. etc., **2:** pp. 75–80, pls. 1, 2.

Hinde's comparison of the Astylospongidae with the Anomocladina are discussed and Zittel agrees with his conclusions. The family Astylospongidae is removed from the Hexactinellidae and is placed among the lithistids with Anomocladina. Description of the Astylospongidae is altered for the main spicules consist of simple straight or curved rod-like structures with branching extremities which form nodes. Genera included in the family are: *Astylospongia, Palaeomanon, Protachilleum. Eospongia, Melonella, Cylindrophyma, Mastosia,* and the living genus *Vetulina. Hindia* is placed in the Megamorina.

1900. Text-book of Palaeontology, vol. 1, trans. and ed. by Eastman, Charles R. MacMillan & Co., London. 706 pp., 1476 figs.

This is an English translation of the *Grundzüge der Palaeontologie.* The section on sponges is essentially as in the original.

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