

American Museum Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK 24, N.Y.

NUMBER 1728

MAY 11, 1955

The Type of the Stromatoporoid Species *Stromatocerium rugosum* Hall

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INTRODUCTION

In connection with our preparation of a monograph on the structure, phylogeny, and classification of the hydroid Order Stromatoporoidea, we have found it necessary to study the type specimens or topotypes of the type species wherever possible.

Stromatocerium was erected by James Hall in 1847, the third genus of stromatoporoids to be named, having been preceded only by *Stromatopora* Goldfuss, 1826, and by *Aulacera* Phillips, 1843. Although the genus has been referred to in the literature many times, and specimens from many places have been identified with *S. rugosum*, no one could know what *Stromatocerium* really is, for the type specimen had never been sectioned and its characters determined. Any massive form with smooth surface and composed of thin latilaminae from Black River or Trenton rocks has usually been identified as *Stromatocerium rugosum*. That description, drawn only from external characters, applies equally well to the genera *Stromatocerium*, *Labechia*, *Rosenella*, *Pseudostylodictyon*, *Pseudolabechia*, *Labechiella*, and other genera, and even to algal bodies, all occurring in the middle Ordovician. They differ in their internal characters; some have broad cyst plates, some have narrow, arched plates; most have round pillars. *Stromatocerium* has flat and arched cyst plates edge to edge simulating laminae, and broad, not round, pillars.

Nicholson and Murie² (1878, p. 223) "emended" the description of

¹ Indiana University, Bloomington, Indiana.

² All references cited through the text are listed in the generic and specific synonymies.

Stromatocerium and substituted *Stromatocerium canadense* Nicholson and Murie as the type, on the basis that Hall's species could not be recognized. Nicholson, in his great "Monograph of the British stromatoporoïds" (1886-1892), omitted the genus *Stromatocerium* and placed *S. canadense* in the genus *Labechia*. Parks (1907, p. 10) wanted to substitute a new species, *Stromatocerium michiganense*, as the type species, on the ground that his specimen was better preserved and that there was no doubt as to the character of the pillars of his species. The latest reference to the genus (Shimer and Shrock, 1949, p. 63) is a composite of *Stromatocerium* and *Labechia*, taken from Parks (1907). These few references will emphasize the need for understanding the microscopic characters of the genus, for taxonomic characters of stromatoporoids are drawn almost entirely from internal structures.

From Hall's original discussion of the genus and species, the impression is drawn that Isle La Motte, Vermont, was the type locality. He says (1847, p. 48), "In the black marble of Isle La Motte, and in the same rock at Chazy, but more particularly in the dark limestone containing the COLUMNARIA, we find numerous specimens of obscure corals having a structure represented in figs. 2, 2a and b. They are completely silicified, so that the more minute structure cannot be decided; but since they are abundant, and require notice, I have proposed the provisional name of *Stromatocerium*, from στρωμα, -ατος, a layer or lamina, and χηριον, honeycomb." There is no statement as to where the two figured specimens came from. The first figure, with an enlargement of part of it, has latilaminae 2 to 4 mm. thick, some undulating, apparently suggesting the name *rugosum*, for the surface is not rugose, and the enlargement shows "some indication of tubes or cells," which are in reality pillars and the spaces between. That specimen should obviously be the type specimen.

Through the kindness of Dr. Otto Haas, Associate Curator of Fossil Invertebrates of the American Museum of Natural History, we have been able to borrow the type specimen of *Stromatocerium rugosum*, which has been preserved in the James Hall collection of fossils in that Museum. On the specimen is a label reading, in script. "*Stromatocerium rugosum*, Watertown, N. Y." It also has a green diamond, indicating a figured specimen, and Hall's figure is a very good representation of the type specimen. The Museum label has the word "Type" and "Black River Limestone, WATERTOWN, N. Y.," and "No. 590/5." There can thus be no doubt that Hall's genus *Stromatocerium* and his species *S. rugosum* were founded on that specimen.

We have made eight thin sections, three vertical and five tangential, of a part of the type specimen. The slides are designated 590/5 A to H



FIG. 1. *Stromatocentrum rugosum* Hall, type specimen figured by Hall, 1847. Notch is place from which six thin sections were made; two were made from top, rear side of specimen. Thin latilaminae, vague pillars, and lack of mamelons shown. Unretouched. Natural size.

in the collections of the American Museum of Natural History. We are therefore in position to make known for the first time what the internal structures of *Stromatocerium rugosum* really are. Identification seems always to have been made on the general horizon of occurrence, and on a massive form composed of rather thin latilaminae, 2 to 4 mm. thick, and

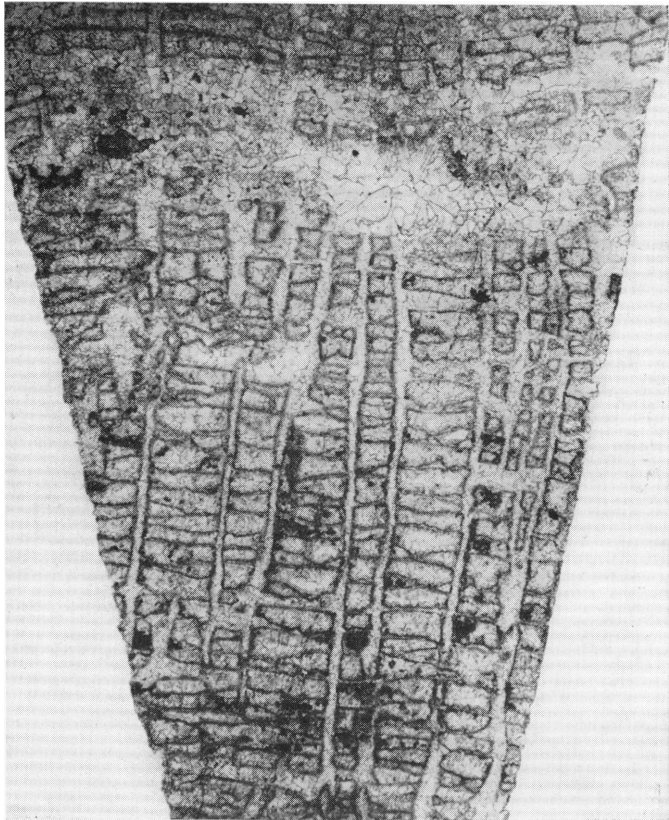


FIG. 2. *Stromatocerium rugosum* Hall. Vertical section. Most of pillars are cut narrow way; they have been recrystallized. Both flat and arched cyst plates shown; near top the structure has been destroyed by fossilization. Retouched. $\times 10$. (Slide 590/5 A.)

lack of mamelons. Latilaminae are by no means peculiar to *Stromatocerium*, for they occur in most specimens of stromatoporoids, and are due to pauses in growth, in turn due to ecological conditions, probably summer and winter, and are without systematic significance of any kind. The "vertical tubes or cells" mentioned by Hall (p. 48) are not tubes but are spaces between pillars.

It is remarkable that the late H. M. Seely, of Middlebury College (1904, p. 144, pl. 74, fig. 5), seems to have identified correctly a specimen of *S. rugosum* from the Black River limestone of Isle La Motte, Vermont. We have studied Seely's slides, but not his specimen figured on plate 70, which has not been located, and also other specimens of *S. rugosum* from Isle La Motte, and we can agree with Seely's identification. The late W. A. Parks, of the University of Toronto (1910, pl. 21, fig. 6), seems also to have found a typical specimen of *S. rugosum* from the Black River limestone of Paquette Rapids, Ontario, and to have understood correctly the broad, flanged pillars (as seen in tangential section) peculiar to the genus *Stromatocerium*. The numerous references to the genus and the species, based on the form of the coenosteum, should be questioned. It is remarkable that no specimen from Watertown, New York, other than Hall's has been referred to.

Stromatocerium rugosum Hall may be briefly described thus: Coenosteum massive; surface without mamelons but with small centers of radial pillars; skeleton composed of broad, thin, close-set, curved plates, approaching laminae, and large, long, continuous pillars, which are broad, irregular, and flanged in tangential section. The genus *Stromatocerium* belongs in the family Labechiidae of the Order Stromatoporoidea and is a typical stromatoporoid, even to the curved plates, which occur in small to large numbers in most genera of stromatoporoids.

SYSTEMATIC DESCRIPTIONS

GENUS *STROMATOCERIUM* HALL, 1847

Stromatocerium HALL, 1847, Paleontology of New York, vol. 1, p. 48, pl. 12, fig. 2 (middle Ordovician, Black River group, Watertown, New York; genotype, monotypic: *Stromatocerium rugosum* Hall). SEELY, 1904, Rept. State Geol. Vermont, vol. 4, p. 144, pl. 70, pl. 74, fig. 6. PARKS, 1910, Univ. Toronto Studies, geol. ser., no. 7, p. 8, pl. 21, figs. 3-7. KÜHN, 1928, Fossilium catalogus, Hydrozoa, p. 47; 1939, in Schindewolf, Handbuch der Paläozoologie, vol. 2A, p. A52, fig. 80.

Coenosteum hemispherical to discoidal, conspicuously latilaminate, composed of cystose plates, mostly broad and flat and edge to edge or overlapping at the ends, some short and arcuate. The cyst plates are composed of three layers, a median thin, dense layer, a thin, flocculent upper layer, and a thin or thick, flocculent lower layer. Pillars long, continuous through many plates, flat, flaring, and flocculent, but not hollow. In tangential section, the pillars are angled and branching, zigzag, curved or irregular, but not round. Surface smooth, undulating or strongly mamillate and papillate, with primitive astrorhizae.

HORIZONS AND LOCALITIES: Middle Ordovician, Black River and

lower Trenton. United States and Canada, doubtfully in south Manchuria and Shantung. Four described and one or two new species.

Stromatocerium is the only genus of stromatoporoids in which the pillars are flat and not round. It has been confused with *Labechia*, which has arcuate cyst plates and round pillars. The latilaminae give the impression that the fossil is composed of laminae, but study of thin sections shows that the microlaminae are in reality broad, low, cyst plates. The

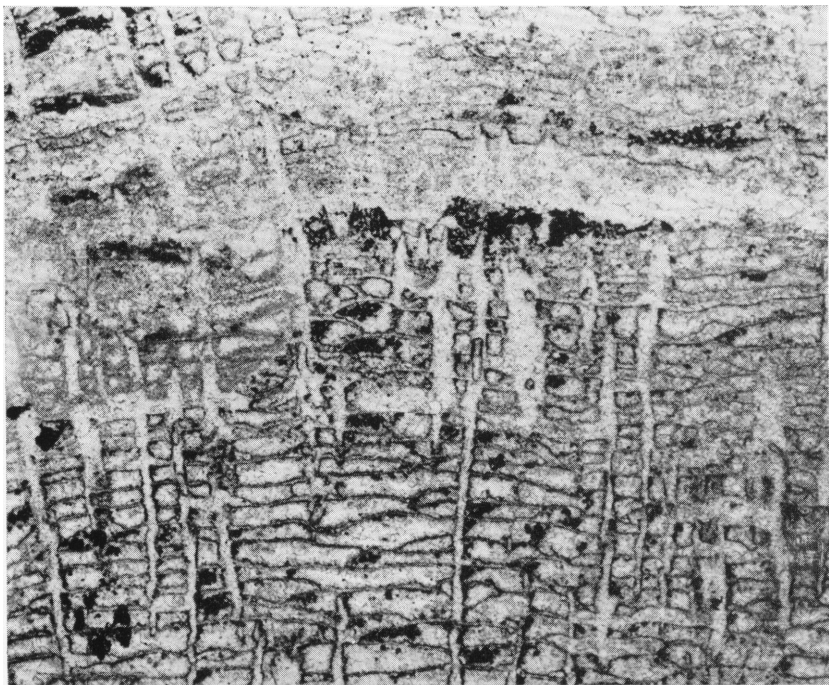


FIG. 3. *Stromatocerium rugosum* Hall. Vertical section. Pillars cut the narrow way; some are broad in middle part of figure, but not so broad as they appear in tangential sections. Junction of two latilaminae occurs in middle of upper half. Unretouched. $\times 10$. (Slide 590/5 B.)

cyst plates and lack of thin laminae place the genus in the Labechiidae, a family of 16 named genera, which are characteristic of the Ordovician. *Stromatocerium* in no way suggests a honeycomb, as stated by Hall; the pillars with cyst plates between, in vertical section, do have a similarity on a smaller scale to the coral *Columnaria*, with which it is associated. Contorted latilaminae are not constant, and are without generic or specific value in the genus.

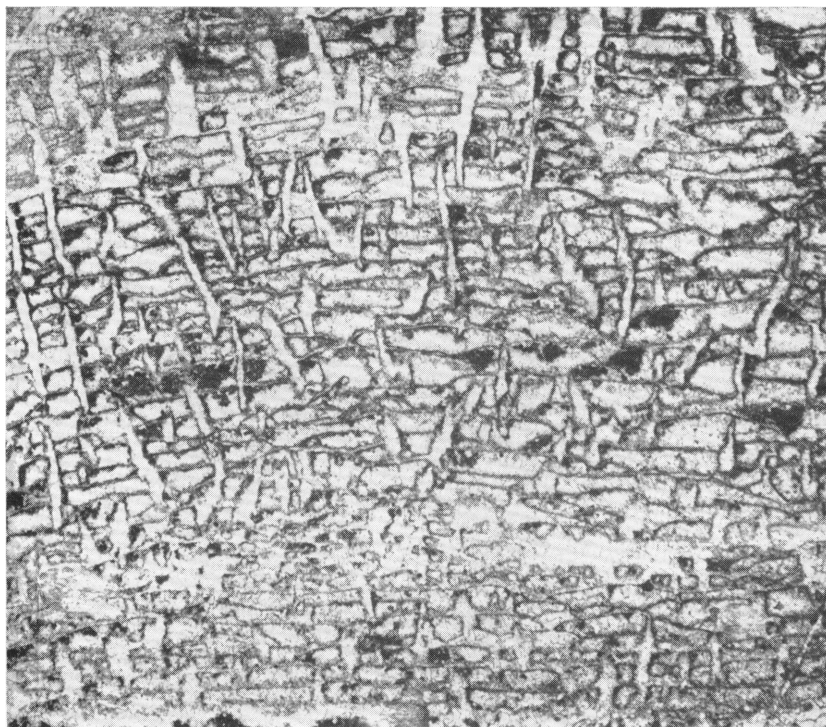


FIG. 4. *Stromatocerium rugosum* Hall. Slightly oblique vertical section, showing broad and arched cysts and broad and narrow pillars. Obscure zone near bottom is base of a latilamina. Unretouched. $\times 10$. (Slide 590/5 F.)

KEY TO THE DESCRIBED SPECIES OF *Stromatocerium*

1. Pillars large, broad, thick, 0.3 mm. *S. rugosum* Hall
 Pillars small, broad, thin, 0.03 to 0.07 mm. 2
2. Mamelons large, 10 mm. high *S. tumidum* Wilson
 Mamelons small, low, 5 mm. or less 3
3. Pillars with broad flanges *S. michiganense* Parks
 Pillars with narrow flanges 4
4. Pillars intermittently developed *S. canadense* Nicholson and Murie
 Pillars regularly developed species unpublished

Stromatocerium rugosum Hall

Figures 1-7

Stromatocerium rugosum HALL, 1847, Paleontology of New York, vol. 1, p. 48, pl. 12, figs. 2, 2a, b (middle Ordovician, Black River limestone, Watertown, New York). BILLINGS, 1856, Canadian Nat. Geol., vol. 1, p. 127, figs. 14, 15. HITCHCOCK, 1861, Report on the geology of Vermont, p. 290, fig. 190. CHAPMAN,

1861, Canadian Jour., new ser., vol. 6, p. 508, fig. 72; 1864, A popular . . . exposition of . . . minerals and geology of Canada, p. 102, fig. 72. ROMINGER, 1866, Proc. Acad. Nat. Sci. Philadelphia, p. 118. NICHOLSON AND MURIE, 1878, Jour. Linnean Soc., London, zool., vol. 14, p. 222. WINCHELL, 1886, Geological studies, p. 321, fig. 223 (from Hall, fig. 2b). MILLER, 1889, North American geology and paleontology, p. 165, fig. 123 (from Billings). LESLEY, 1890, Geol. Surv. Pennsylvania, Rept. P4, p. 1102, fig. (from Winchell, after Hall, fig. 2b). WHITEAVES, 1896, Canadian Rec. Sci., vol. 7, p. 149. SEELY, 1904, Rept. State Geol. Vermont, p. 144, pl. 70, pl. 74, fig. 5. GRABAU AND SHIMER, 1909, North American index fossils, vol. 1, p. 46. PARKS, 1910, Univ. Toronto Studies, geol. ser., no. 7, p. 11, pl. 21, figs. 3-7. KÜHN, 1928, Fossilium catalogus, Hydrozoa, p. 47. WILSON, 1948, Canada Geol. Surv. Bull., no. 11, p. 47, figs. 1-3. SHIMER AND SHROCK, 1949, Index fossils of North America, p. 63, pl. 19, figs. 12, 13 (from Parks).

Coenosteum hemispherical; the type is 120 mm. in diameter and 78 mm. high, and is a fragment 30 mm. thick, an arc constituting about one-fourth of the original coenosteum. Surface nearly smooth, with radial groups of pillars, 5 to 6 mm. in diameter and nearly touching, simulating *astrorhizae*, obvious on a smoothed surface. Undulatory *latilaminae* are distinct on the weathered, oblique surface of the type specimen, and are 2 to 4 mm. thick (fig. 1).

The type specimen has been infiltrated with calcium carbonate, recrystallized, somewhat leached, and in small part silicified, so that the interior of the pillars and the median plate of the cyst plates have been reduced to clear, granular, crystalline calcite. The specimen has a few fractures filled with clear calcite. Yet all significant structures of the genus and the species can be satisfactorily made out. Some of the chamber cavities are filled with clear, crystalline calcite, some with black, very fine-grained, calcareous and carbonaceous material like the associated rock. The structures are thus in white in a dark background, the reverse as seen in most stromatoporoids. The specimens mentioned by Hall (p. 48) from Isle La Motte as abundant and "completely silicified" show no internal structures as mentioned by Hall. We have specimens from the solid limestone of Isle La Motte and elsewhere that are infiltrated with calcium carbonate and in part recrystallized as in the type specimen, and the structures can be seen satisfactorily.

In vertical thin section, the skeleton consists mainly of broad cyst plates, which might be mistaken for laminae, some short, arcuate cyst plates, and long, vertical pillars (figs. 2-4). The broad cyst plates are from 2 to 5 mm. broad, nearly flat, but are shown to be cyst plates rather than laminae, for they come down to the underlying cyst plates at the ends, and the cysts on two sides of the pillars therefore frequently do not match. There are also narrow, arcuate cysts 0.25 to 0.5 mm. broad. The cyst plates are close together vertically, 15 to 20 in 4 mm. The cyst plates

are tripartite, the median plate 0.05 mm. thick, originally compact but now composed of clear, granular calcite; the upper cyst plate is dark, granular, and flocculent, and about as thick as the median plate; the lower cyst plate is dark, granular, and flocculent next to the median plate, and about as thick, and is continued downward by a very thick, clear, granular, and flocculent layer which is easily overlooked and not well shown in the figures. The wall structure in this species is the same as in most genera of the Labechiidae, differing in details and in preservation.

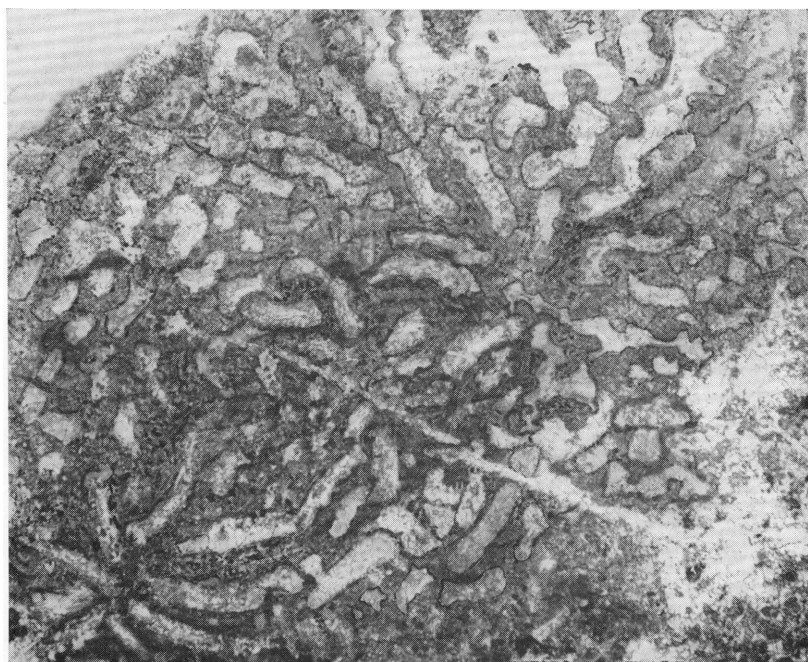


FIG. 5. *Stromatocerium rugosum* Hall. Tangential section through two radial centers. Pillars (light gray) are broad, variable in shape, and thicker than at lower levels. Specimen partly silicified in center, and lower right parts of the section and structure obscured. Retouched. $\times 10$. (Slide 590/5 E.)

The pillars are long, extending through one or several latilaminae; they are irregular in distribution, varying from four to 12 in 4 mm. They are narrow or broad, depending on the direction in which they are cut; where cut through the thin part of the pillar, as most pillars are cut, they have a thickness of 0.12 to 0.3 mm., and when cut the broad way the breadth runs up to 0.5 mm. or more (fig. 4). The pillars consist of a median zone of light-colored, finely granular calcite, the infiltrated and

recrystallized original material, and an outer thin zone of dark, granular, and flocculent tissue, in appearance like the upper and lower layers of the cyst plates. The median cyst plate in some places joins the median zone of pillars. We consider it entirely unlikely that the pillars or median cyst plates ever were hollow. Neither astrorhizal columns or tubes, nor canals are obvious in vertical sections.

In tangential thin section, the pillars are shown in white calcite, and

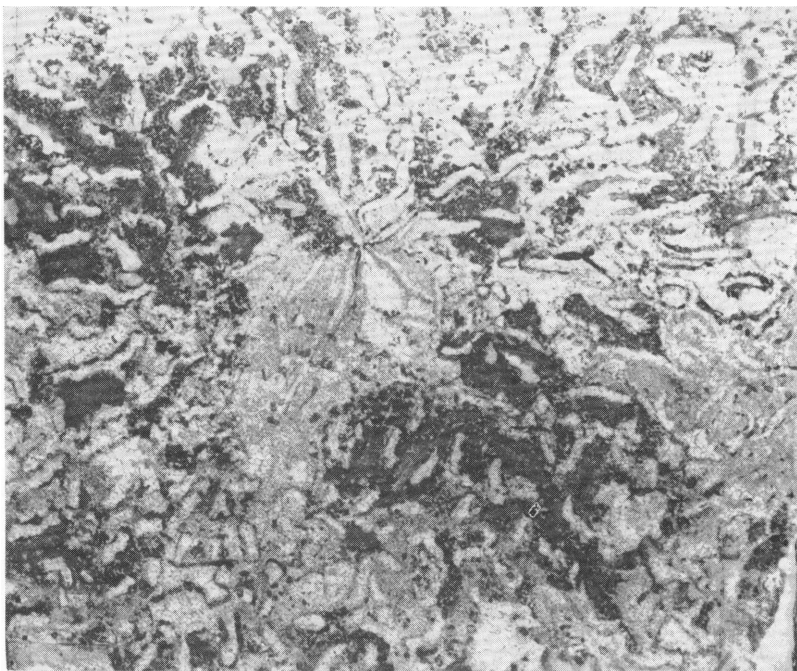


FIG. 6. *Stomatocerium rugosum* Hall. Tangential section through a radial center, showing more usual, thin, vermicular, and flanged pillars, 0.15 mm. thick, broad in radial centers, 1 to 1.5 mm., and less broad in inter-radial areas, 0.5 mm. Pillars in white. Retouched. $\times 10$. (Slide 590/5 C.)

the interspaces or chambers are filled with dark, fine-grained material. They radiate from centers, outlining dark, moderately branching spaces between, simulating astrorhizal canals (figs. 5-7). The radial centers are from 7 to 10 mm. apart and are not marked by a round spot or tube. The pillars are broad and thin, vermicular, curved, branched, and have short, spine-like flanges. Between the radial centers pillars are oval or amoeboid; scarcely any are round. They vary in thickness at different levels and vary in breadth between radial centers. The normal thickness

is 0.15 to 0.3 mm.; and the normal breadth, 1 to 2 mm. but ranges up to 3 mm. Some of the pillars are outlined by black rims (fig. 7).

Stromatocerium rugosum is characterized by the broad cyst plates, the large, broad pillars which radiate from centers, the lack of mamelons, the few arcuate cyst plates, and the lack of round pillars. The pillars are visible to the unaided eye in vertical and tangential sections.

HORIZON AND LOCALITIES: *Stromatocerium rugosum* occurs in the middle Ordovician, Black River limestone, of Watertown, New York. It also occurs in rocks of the same age at Chazy, New York; Isle La Motte,

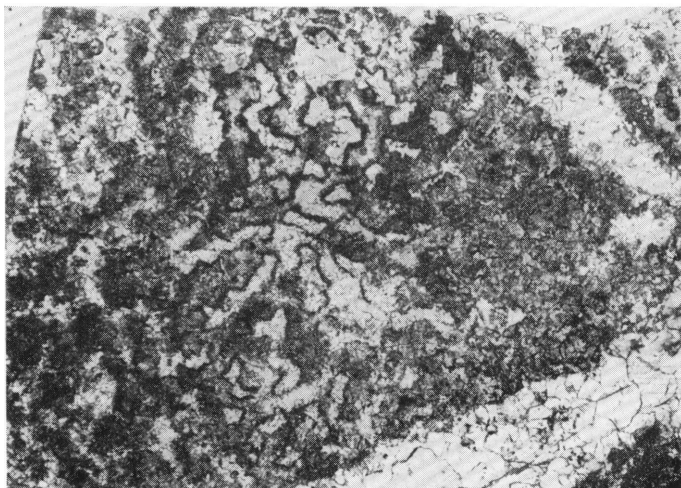


FIG. 7. *Stromatocerium rugosum* Hall. Tangential section through a radial center, showing broad, vermicular pillars outlined naturally in black, and thicker, irregular pillars on left. Unretouched. $\times 10$. (Slide 590/5 D.)

Vermont; Button Bay Island, off Ferrisburg, Vermont; at Paquette Rapids, Ontario; and in the Ridley limestone, Wilson County, Tennessee. The species is a good index fossil for the Black River stage. Identifications from other localities and horizons should be checked.

Holotype in the American Museum of Natural History (A.M.N.H. No. 590/5), with eight thin sections, designated 590/5 A to H. The above description is based on the holotype, and all the figures were made from the type specimen.

We are indebted to Mr. George R. Ringer, photographer of the Indiana State Geological Survey, for making the photographs.

