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Silurian *Ischadites tenuis* n.sp. (Receptaculitids) from Indiana

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ABSTRACT

A new receptaculitid species is based upon the well-preserved head elements and illustrated with SEM. These structures do not depart from the general dasycladacean pattern, but exclude receptaculitids from sponges.

INTRODUCTION

Receptaculitids are a large taxon of marine, calcareous organisms, both abundant and cosmopolitan in distribution, that ranged throughout the entire Paleozoic Era. The Cambrian forms have been recently recognized among the Australian archaeocyathids (Nitecki, unpublished). Commonly, receptaculitids occur in carbonate rocks and particularly are associated with reefs, of which these organisms appear to have been an important constituent in Lower Ordovician and Upper Silurian times.

Although receptaculitids have been described for over a century, it was not until recently that their true nature as algae was explicitly demonstrated. Byrnes (1968) demonstrated the algal character of the Australian receptaculitid *Ischadites struszi*. Nitecki (1972a) also suggested that the receptaculitids are algae, and that certain modern species of dasycladaceous algae are so similar to the Paleozoic fossils that both can be easily included in the same order (Nitecki, 1972b). Rietschel (1967-1970) published extensively on these fossils and assigned them to a new order of green algae. Elliott (1972) also considered receptaculitids green algae.

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Contrary opinions are, however, held by others. Zhuravleva (1970) and Zhuravleva and Miagkova (1970-1972) regard receptaculitids together with archaeocyathids (and certain other less-known Paleozoic fossils) as members of a new kingdom of organisms identified as Archaeata. Müller (1968) redescribed *Receptaculites neptuni* as a problematical fossil without a known systematic affinity. Foster (1973) has suggested that receptaculitids may be sponges as formerly regarded.

The taxon appears now to be divisible into three groups differentiated by degree of calcification, complexities of lateral branches, and by growth pattern. The first group, cyclocrinids, are morphologically the simplest (Nitecki, 1970). Fossils of the second group, the calathiids, possess a double well and are without preserved main axis (Nitecki, 1969). Receptaculitids proper, the third group, can be further subdivided on the basis of calcification of the main axis (Nitecki, 1972b).

North American Silurian receptaculitids are represented mostly by molds; whereas specimens reported herein represent actual skeletal material which seldom is preserved. The fossils consist of disarticulated lateral heads only, and these are illustrated by SEM photographs.

We are grateful to Professors N. Gary Lane of Indiana University, Bloomington and Raymond C. Gutschick of the University of Notre Dame, Notre Dame, Indiana, who kindly provided the specimens and called our attention to these fossils.

The photographs were made with a SEM Cambridge S4-10, provided to Field Museum of Natural History by a grant from the National Science Foundation, GB-34521.

MORPHOLOGY

Individual heads consist of plates and four ribs of stellate structures. The plates are very thin, about .02 mm., and are quadrilateral, sometimes square, but mostly rhomboid in outline. Commonly the ribs of the stellate structures are broken and incomplete, but where entirely present are pointed with one rib generally longer than the others (figs. 3, 7, 8). Presumably, the longer rib fitted below an elongate shorter rib of the adjoining head. Rarely, the stub of the central shaft is detached from the head. Where this has occurred no indication of the break is apparent; and we interpret the break to have been healed later (fig. 3). In spite of the loss of central support, the head was probably held in position within the thallus by other adjoining heads. A central thin canal is seen in some ribs and shafts (figs. 1A, 4).

The ribs are fused with the plate in the following ways:

- 1) the ribs and the plate form a flat ventral surface (fig. 2);

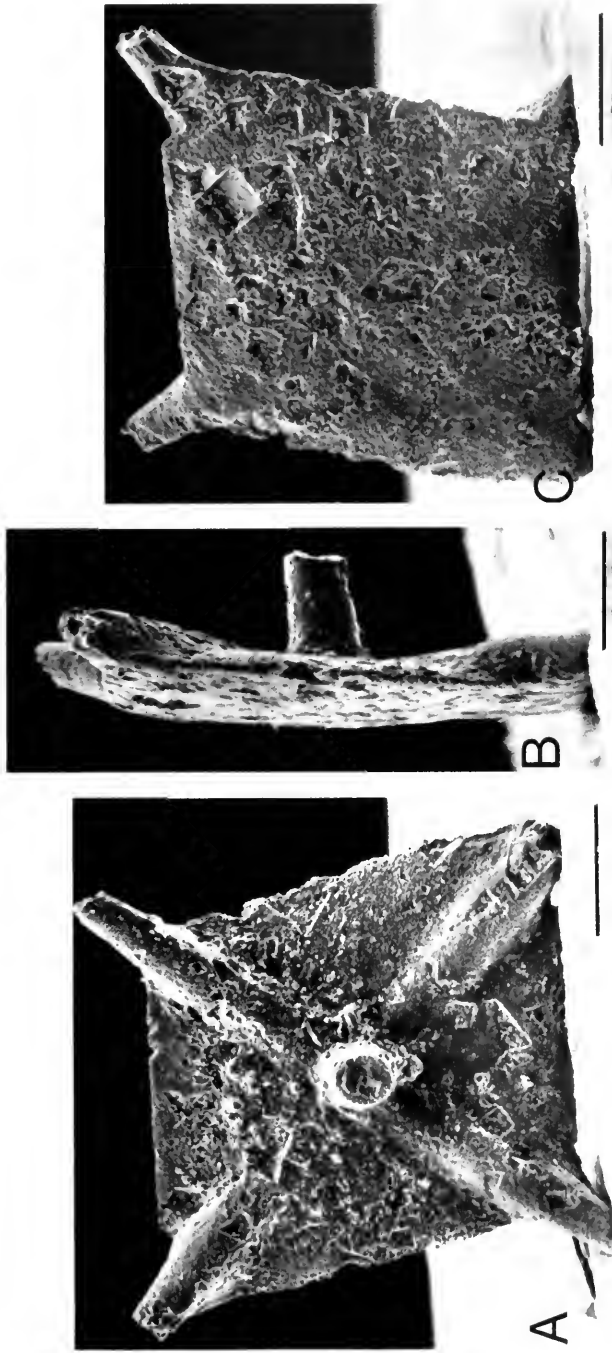


FIG. 1. A, ventral; B, side, and C, dorsal view of a single head of the holotype of *L. tenuis* FMNH PP 18306. Note the characterizing kite-like outline. Locality 1. In A, the central canal in the shaft of the lateral is seen but is more pronounced in Figure 4. Shapes of dolomite crystals now dissolved tend to modify former smooth surface. (Scale line = 0.1 mm. in all figures)

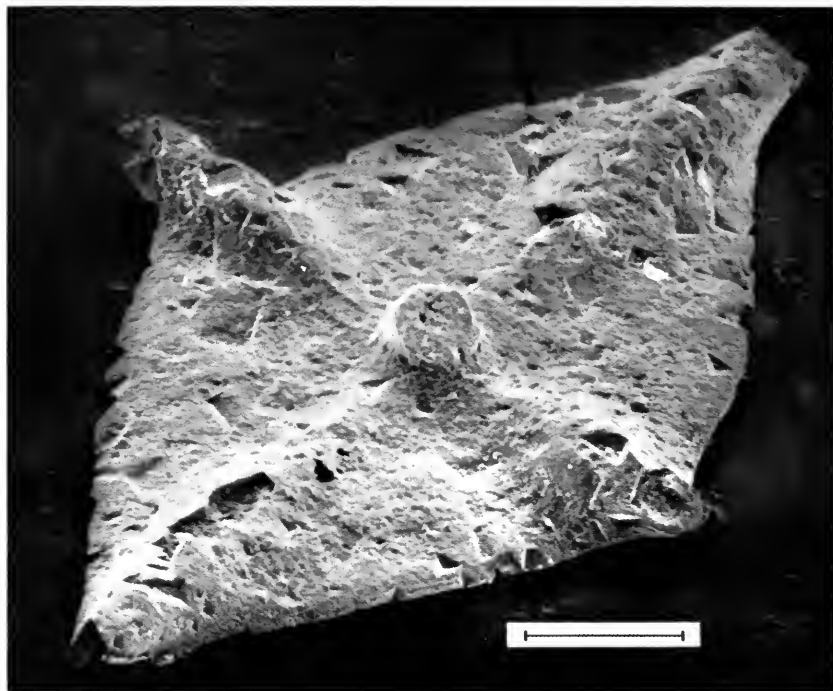


FIG. 2. Ventral view of stellate structures fused with plate. Central canal in shaft is poorly marked. FMNH PP 18307. Locality 1.

- 2) the ribs project somewhat above the surface of the plate (figs. 3, 4);
- 3) the ribs are distinctly elevated above the plate and the ribs join the plate only in the center (fig. 5).

Among some 250 specimens examined, each plate had been fused to the ribs of stellate structures; and the indications are that the plate always formed a single unit with the ribs.

The dorsal part of the plate does not reveal any anatomical details and has a relatively smooth surface without any openings (figs. 1C, 6, 7, 8). The smoothness of this surface is modified by secondary crystallization of dolomite consisting of more or less isolated crystals scattered over the entire plate. Subsequent solution of such crystals have left outlines of various shapes related to rhombohedrons (figs. 1, 2, 5, 7).

In our samples we have recovered lateral shafts of some other ischaditid species, possibly *I. subturbinatus* (Hall, 1863). These are much larger than the heads of *I. tenuis* and their termini differ considerably from the latter species. Such shafts found infrequently show preservation of one end only.

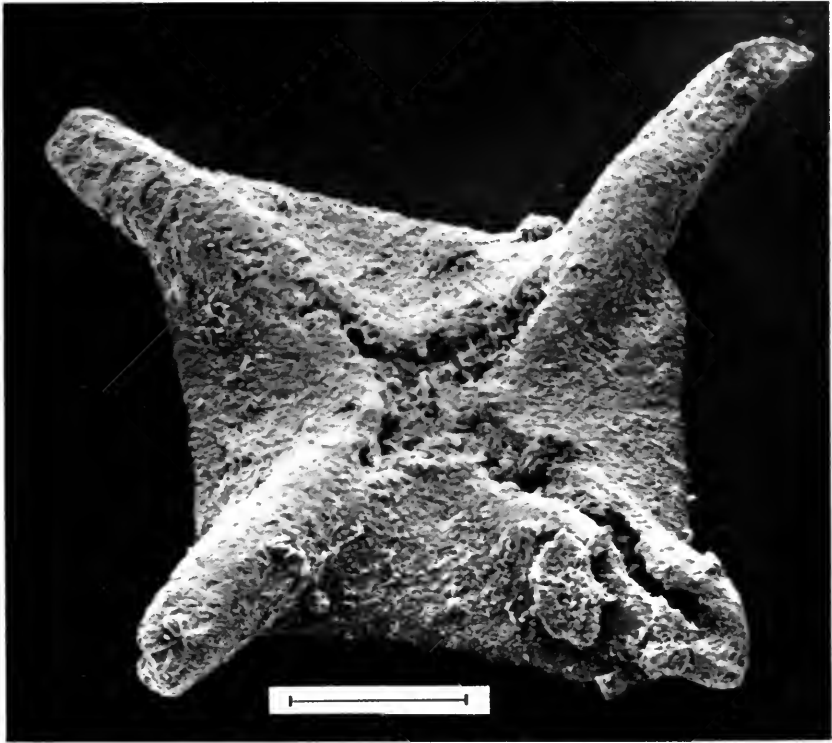


FIG. 3. Ventral view of stellate structures and plate. Shaft of lateral is not preserved but canals in stellate structures are indicated. The thickness of the carbonate layer is suggested in the lower right hand rib of stellate structure. FMNH PP 18308. Locality 2.

Calcification appears to have been relatively thick. Figure 3 shows the exposed interiors of damaged ribs. Similarly where canals are preserved (figs. 1A, 2-4), the skeleton is indeed very massive.

COMPARISONS WITH OTHER FORMS

Silurian receptaculitids in North America are divided into three tribes: Cyclocriniteae, Calathieae, and Receptaculiteae (Nitecki, 1972b). Our fossils are those of the Receptaculiteae. Receptaculiteae are represented by two genera, *Receptaculites* and *Ischadites*, which are differentiated by the thickness of the shafts of laterals and the complexities of their heads. The heads of our specimens are those of the genus *Ischadites*. Eight species of *Ischadites* are recognized in the American Silurian rocks. These species are differentiated mainly by the morphology of laterals and secondarily by the degrees of calcification and by the shape of thalli.

The heads of *I. tenuis* are similar to those of *I. subturbinatus*; but, in the latter the lateral shaft is enlarged just below the stellate structure, and the head appears more bulbous. Moreover, the heads of *I. subturbinatus* tend to be over 0.2 cm. in the longest dimension, roughly four times



FIG. 4. Ventral view of stellate structures protruding from the plate. The canals in lower ribs of stellate structures are visible. FMNH PP 18309. Locality 1.

larger than *I. tenuis*. Although the actual plates of *I. subturbinatus* have not been observed and are known only from reconstruction, the position of their stellate structures indicates that the plates have been considerably more concave than those of *I. tenuis*.

The heads of *I. tenuis*, as preserved, add little information to the broader aspect of receptaculitid taxonomic position. Except for the stellate structure, such heads compare favorably with similar organelles in living Dasycladales. However, the structures described here are not spicular and, therefore, are not comparable with living or fossil sponges.

SYSTEMATICS

Ischadites tenuis, n.sp. Figures 1-8.

Definition.—Small ischaditid, plates no larger than 0.05 cm. across; heads of branches flat, consisting of four rays fused with thin quadrilateral plates; central canals thin, and calcification heavy.



FIG. 5. Ventral view of broken ribs of stellate structures elevated above the plate. Note difference from Figure 2. The shaft of lateral is absent and is regarded as an example in which the broken surface was later healed. FMNH PP 18310. Locality 1.

Holotype.—A single lateral head, PP 18306 (shown in fig. 1), deposited in Field Museum of Natural History. Locality 1.

Other material.—Over 250 heads and branches in Field Museum.

Stratigraphic position and localities.—1). A washed sample of weathered Laurel Limestone (Silurian) from the spillway of Brushy Creek reservoir behind Muscatatuck State School east of North Vernon in Jennings County, Indiana.

2). Thin bedded cherty nodules in green shale or argillaceous dolomite. Upper Niagaran (Silurian) Monon Quarry, E½ sec. 29, T28N, R4W, White County, Indiana.



FIG. 6. Dorsal view of flat surface of plate with protruding ribs of stellate structures. Note that the outline tends to be quadrilateral. FMNH PP 18312. Locality 2.

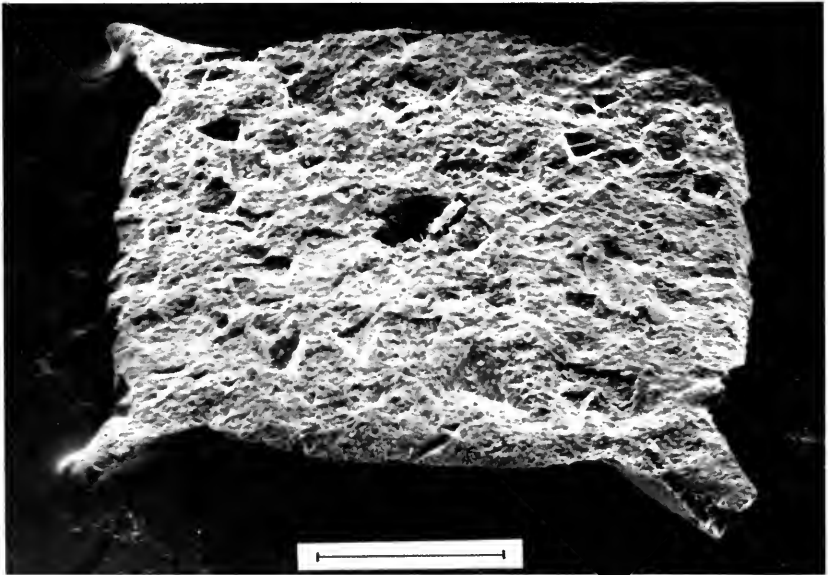


FIG. 7. Dorsal surface of plate of *I. tenuis* with two complete pointed ends of ribs of stellate structures forming an integral part of head. Ribs in other specimens have been broken. The hole near the center of the plate is an artifact. FMNH PP 18313. Locality 1.

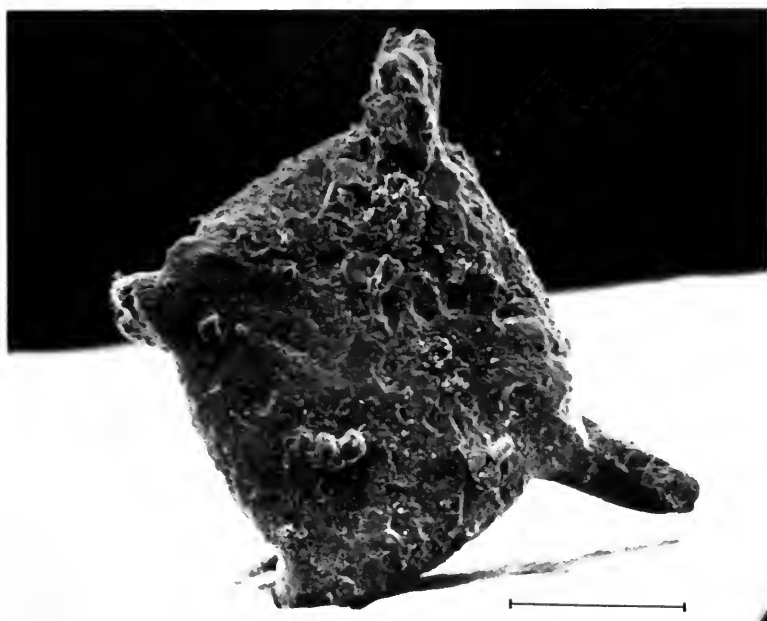


FIG. 8. Oblique view of dorsal side of head. One rib longer than the others is characteristic of many receptaculitids. FMNH PP 18314. Locality 2.

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