

SECTION B, GEOLOGY

A New Species of *Septemchiton*

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INTRODUCTION — A reexamination of the problematical Ordovician microfossil described as tegmates (Rhoads, 1962) has revealed their origin as the disarticulated plates of a primitive chiton. Their morphology indicates a close relationship to *Septemchiton vermiformis* Bergenhayn, of the upper Ordovician of Scotland. The nomen *Septemchiton iowensis* is proposed for the hypothetically reconstructed organism.

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The "depauperate zone" of the basal Maquoketa Shale of eastern Iowa and northwestern Illinois consists of a yellowish-brown, glauconitic phosphate containing an unusual diminutive fauna. The "dwarf" fauna includes abundant pelecypods, gastropods, straight nautiloids, brachiopods, calyptoptmatids, hyolithelminthes (?) and cricoconarids. The normalized fauna includes phosphate-coated conodonts and ostracods, plus scaphopods and rare nautiloids. The curious tent-like microfossils now believed to be *Septemchiton* plates are found in abundance.

These chiton plates were originally described by Ladd (1925) as *Ceratiocaris (Limnocaris) praecedens*, a phyllocarid crustacean. The invalidity of this assignment was proven by Rhoads (1962, p. 1340) by a comparison of the growth lines of a true phyllocarid to these problematical fossils of the Maquoketa Shale. Rhoads (1962) applied the term "tegmates" to the *problematica*, and classified them into three genera and six species of *incertae sedis*. I believe that Rhoads' three genera represent the anterior plate, intermediate plate, and an internal mold of an intermediate plate of the primitive, seven-segmented, vermiform chiton, *Septemchiton iowensis* n. sp. The fragile, elongate posterior plate was not classified by Rhoads.

The terminology used herein is modified from Bergenhayn (1955, p. 7). The plates are termed: Anterior (plate I), Intermediate (plates II-VI), and Posterior (plate VII). Each plate is divided into a central, triangular, flat dorsum and the steeply sloping sides, *areae laterales*. From study of recent chitons, it is believed that each plate was originally composed of four layers: an organic, ornamented periostracum; a punctate, partly organic tegmentum; a broader, wider, non-punctate, mostly inorganic articulation; and an inorganic, generally non-punctate hypostracum. In the Paleoloricata the articulation and hypostracum are noticeably reduced, being no wider or longer than the overlying tegmentum. Therefore, the plates had little or no insertion area. In most cases, only the tegmentum is preserved, probably because of its organic constituents. The outermost layer, periostracum, is absent in most specimens, probably due to mechanical removal.

SYSTEMATIC PALEONTOLOGY—

Phylum *Mollusca*Class *Amphineura* von Ihring, 1876Subclass *Polyplacophora* de Blainville, 1816Order *Paleoloricata* Bergenhayn, 1955Suborder *Septemchitonina* Bergenhayn, 1955Family *Septemchitonidae* Bergenhayn, 1955Genus *Septemchiton* Bergenhayn, 1955

Bergenhayn's generic diagnosis is simply: "*Dieselbe wie die der Familie,*" (The same as that of the family) (1955, p. 24), which implies a seven-segmented chiton having clearly developed "shell" areas completely covering the organism. I believe that the vermiform character of the *Septemchiton* is also of generic significance.

SEPTEMCHITON IOWENSIS n. sp.

(Figs. 1,2,3,5,6,8,9,10, 11)

DIAGNOSIS — An elongate *Septemchiton* of highly arched plates. With respect to the intermediate plates (Figs. 1,3,6,8,11), the anterior plate (Figs. 2,5) is short and wide, and the posterior plate (Figs. 9,10) is narrow, tapered, and elongate.

LOCATION AND MATERIAL — Depauperate Zone, basal Maquoketa Shale. The collecting locality is one mile northeast of Graf, Iowa, on the northwest side of Highway 52, just beyond the second crossing of the Little Maquoketa River: SE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 20, T.89N., R. 1 E.

GEOLOGIC AGE — Late Edenian, Upper Ordovician.

TYPE MATERIAL — Cotype material # 4470, at the repository of the University of Oklahoma.

NAME — The name *Septemchiton iowensis* is taken from the state from which the type material comes. The earlier names of Rhoads (1962) are considered parataxial, and were, therefore, not amended to the taxon *Septemchiton*.

DESCRIPTION — Reconstruction of the organism from the disarticulated plates indicates that *Septemchiton iowensis* was vermiform, with a length: width ratio of about 32:1 on the hard parts. As the width of the girdle is unknown, the length width ratio of the organism as a whole is unknown. Bergenhayn's figure of 17:1 for *Septemchiton vermiformis* is probably also approximate for *S. iowensis*. The hard parts themselves indicate a minimum length of 22 mm and minimum average width of 0.8 mm. The reconstructed organism is slightly tapered to the posterior, with increased taper in the posterior plate. There is evidence for little or no overlap of the plates. The three plate forms are found in the ratio 6.9:1:0.1 for intermediate: anterior: posterior plates. The noticeable paucity of posterior plates is believed to be a function of their extreme fragility. This is borne out by the abundance of posterior valve fragments observed in screened residues. The destructive removal of the posterior plates tends to skew the ratio positively towards the intermediate and anterior valves. Even with this consideration, however, the ratio can be taken to indicate an eight-segmented chiton as well as a seven-segmented chiton. The reason for reference of *S. iowensis* to the latter lies in its extreme similarity to the proven seven-segmented chiton *S. vermiformis*.

The plates of *S. iowensis* consist only of the phosphatized tegmentum layer. Coarse, cylindrical punctae filled with a darker phosphatic material penetrate the tegmentum. No distinct pattern is observed in the distribution of the punctae, except in the posterior plate. The punctae lack the interconnecting canal system of the "eyes" of the modern chitons. Whether this be due to the lack of the periostracum or to the primitive nature of *Septemchiton iowensis* is unknown. Growth lines are distinct on the better preserved material. Analysis of the growth lines indicate 15 to 20 unequal growth periods during the lifetime of the animal. Growth was toward the anterior in the anterior and intermediate plates, but towards the posterior in the posterior plate. In all specimens observed the articulation was not observed, the punctae of the tegmentum penetrating directly to the sedimentary debris of the internal mold. In rare cases, a phosphatized scaphopod lies within this mold, giving the appearance of an internal structure (Columella of Rhoads, 1962, p. 1336).

The anterior plate is shorter and wider than the other plates, averaging 3.8 mm long by 1.5 mm wide. Its maximum height (1.5 mm average) is near the posterior margin, from which it tapers by ventral reduction to a blunt anterior angle. The dorsum is slightly convex in lateral view, with slightly developed "steps" corresponding to growth lines in the anterior half. In dorsal view, the dorsum appears as a narrow, rounded triangular area with a conspicuous notch at the anterodorsal slope. The *areae laterales* slope steeply away from the dorsum and flare outward posteriorly, giving a concave lateral aspect to the dorsal view. Growth lines and punctae are present, but not so distinct as in the intermediate plates. Rhoads (1962) assigned these plates to his tegmate "species" *Triangulata simplex*.

The five intermediate plates (Figs. 1,3,6,8,11) of *S. iowensis* average 2.9 mm length, 0.8 mm width, and 0.9 mm height. The largest observed measured 3 mm in length, 1.0 mm in width, and 1.3 mm in height. The plates are tapered toward the anterior, especially in the anterior quarter of the plate. The dorsum consists of a triangular area bearing a sulcate furrow in its anterior two-thirds. The *areae laterales* are steeply sloping and essentially straight, except for a slight outward flare in the posterior one-third. The growth lines and punctae are excellently preserved on the intermediate plates, the punctae occurring randomly. These plates have been given the name *Bursata belleuensis* and *Bursata iowensis* by Rhoads (1962). Rhoads' tegmate *Subcylindrica eligensis* is an internal mold of an intermediate plate, and shows the peculiar internal ligule of the inner posterior anatomy. It is assumed that the ligule had some attachment or insertion function.

EXPLANATION OF FIGURES

Figures 1-11 at 22X, Figure 12 at 5X.

- Fig. 1: Lateral view of intermediate plate of *Septemchiton iowensis*, n. sp., showing growth lines.
- Fig. 2: Lateral view of anterior plate of *S. iowensis*, n. sp.
- Fig. 3: Lateral view of intermediate plate of *S. iowensis* n. sp., showing punctae.
- Fig. 4: Unknown microfossil, possibly the intermediate plate of a chiton. Lateral view. From *Isoceras socialis* zone, Maquoketa Shale, Graf, Iowa.
- Fig. 5: Dorsal view of anterior plate of *S. iowensis*, n. sp.
- Fig. 6: Dorsal view of intermediate plate of *S. iowensis*, n. sp.
- Fig. 7: Unknown microfossil from Corbin Ranch Formation, south of Fittstown, Oklahoma. Possibly a chiton plate.
- Fig. 8: Transverse section of intermediate plate of *S. iowensis*, n. sp.
- Fig. 9: Lateral view of posterior plate of *S. iowensis*, n. sp., showing punctae: growth line relationship.
- Fig. 10: Dorsal view of posterior plate of *S. iowensis*, n. sp.
- Fig. 11: Longitudinal section of intermediate plate of *S. iowensis*, n. sp. showing insertion (?) projection.
- Fig. 12: *S. vermiformis* Bergenhayn, 1955, showing probable life form of *S. iowensis* n. sp. Drawn from Bergenhayn, 1955, Plate 2, Fig. 13.



The posterior plate (Figs. 9,10) is extremely long and thin. Average size is 3.5 mm in length, 0.5 mm in width, and 1.0 mm in height. The largest observed, a veritable giant in respect to all other plates observed, measured 9.0 mm in length. These narrow plates have an extremely thin, ridge-like dorsum, and broad, steeply sloping areae laterales. The ventral outline is straight, but curving abruptly into the blunt posterior angle. The dorsum is slightly convex in lateral view, the highest point being medial. The growth lines are best observed near the ventral margin, and on the posterior part of the plate. It is interesting that on the posterior plate, the punctae preferentially occur paralleling the growth lines. Such distribution is not found on the intermediate valves. Probably because of its fragility, the posterior plate is considerably less common than the other valves. It was not cited by Rhoads (1962).

DISCUSSION — The taxonomic affinity of *S. iowensis* is based upon the close morphological similarity to *S. vermiformis* Bergenhayn, 1955. Although greatly differing in size (*S. iowensis* = 22 mm; *S. vermiformis* = 112 mm), their ratios of total hard parts length:width is identical at 32:1. Further, the actual size of *S. iowensis* may be an unreliable factor, as this species occurs as a part of a dwarfed fauna. The only significant variations between *S. iowensis* and *S. vermiformis* are in plate ornamentation and detail, which are here considered as specific characteristics. The anterior plate of *S. iowensis* is relatively shorter and broader than that of *S. vermiformis*, and lacks the concave dorsum of the latter. The intermediate plates are similar in general outline. However, Bergenhayn's figures (1955, Pl. 2, Figs. 13, 13b) do not indicate the prominent growth lines of *S. iowensis* and show the punctae as being elliptical and in rows. The ridge of aligned tubercles described on the dorsum of *S. vermiformis* does not occur on the plates of *S. iowensis*. The posterior plates of the two species are similar, although that of *S. iowensis* lacks the mucro described from *S. vermiformis*.

Questionably similar fossils have been found near the base of the Beaverfoot Limestone of southeastern British Columbia (Sanders, 1962), in the Corbin Ranch Limestone Member of the Simpson Group, and in the *Isoceras* (*Orthoceras*) *socialis* zone of the Maquoketa Shale, Iowa. All of these occurrences are in the Middle and Upper Ordovician. Preservation, however, is not sufficient to warrant description without further collection and study. It should be noted that where these questionable *Septemchiton* valves are found, they are found in relative abundance, indicating gregariousness or restrictive ecologies.

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