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THE CRINOID *OPSIOCRINUS MARIAE* KIER IN THE BELL SHALE OF MICHIGAN

BY

ROBERT V. KESLING and DAVID L. MEYER

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CONTENTS

INTRODUCTION

OCCURRENCE of the small camerate crinoid *Opsiocrinus mariae* Kier in the Middle Devonian Bell Shale of Michigan gives added support to the correlation, in part, of this formation with the Silica Formation of northwestern Ohio.

In 1952, in the course of investigating the crinoid fauna of the Silica Formation in the abandoned quarry of the Medusa Portland Cement Company at Silica, near Sylvania, Ohio, Porter M. Kier found and described some small specimens as *Opsiocrinus mariana* [sic], type species of his new genus *Opsiocrinus,* which he made the type genus of the family Opsiocrinidae. He placed the Opsiocrinidae in the order Monobathra, believing the crinoids to be monocyclic, and compared his new family with the Xenocrinidae.

A few years later, Dr. G. Ubaghs, of the Laboratoire de Paléontologie, Université de Liége, Belgium, borrowed the type specimens for study. By a fortunate accident in transit, the column was broken from one of the specimens, revealing that infrabasals were present in the small area formerly concealed by the column.

When informed by Dr. Ubaghs that the crinoid was dicyclic rather than monocyclic, because of the five tiny infrabasals in the pit of the columnar facet, Kier published a short note on *Opsiocrinus mariae,* in which he called attention to the dicyclic nature of the species, abandoned his family Opsiocrinidae, and suggested other familial relationships. Both

papers by Kier were published in this series, the first in Volume X (No. 4) and the second in Volume XIV (No. 13).

Among numerous small crinoids collected by Dr. George M. Ehlers from exposures of the Bell Shale in the abandoned quarry of the Kelley's Island Lime and Transport Company at Rockport, near Alpena, Michigan, was a specimen of *Opsiocrinus*. From data accompanying the specimen, we believe it was picked up in 1954. In 1958, in a preliminary study of Bell Shale crinoids, R. V. Kesling identified the specimen as *Opsiocrinus,* and separated it from the other small crinoids from the same formation. Recently, we have examined the specimen in detail. Although it is incomplete, we conclude that the Bell Shale crinoid is conspecific with *Opsiocrinus mariae* described from the Silica Formation by Kier. It shows to advantage the proximal columnal fitting into the columnar facet. Other features do little more than substantiate parts of the original description and its emendation.

In 1958, Kier assigned *Opsiocrinus* to the Rhodocrinitidae but expressed some doubt about its relationships. Inasmuch as this crinoid does not fit the diagnoses of any of the families of the camerate Diplobathra, we deem it advisable to revive the family Opsiocrinidae of Kier and to emend it as required. Several of its features are persistent, descending with little change from those of the Ordovician family Reteocrinidae.

The specimen described herein is catalogued and deposited in the Museum of Paleontology of The University of Michigan as Hypotype No. 47095.

LOCALITY

Abandoned quarry of the Kelley's Island Lime and Transport Company, Rockport, northeastern corner of Alpena County, Michigan, in the NW. ¼ sec. 6, T. 32 N., R. 9 E.; east bank of a drainage ditch about ¼ mile west-northwest of the quarry buildings. Exposure of shale, highly fossiliferous, gray, argillaceous; the upper part of the Bell Shale, only a few feet at most below the Rockport Quarry Limestone. Fossil found by George M. Ehlers in 1954.

DESCRIPTION

Subclass CAMERATA Wachsmuth and Springer
Order DIPLOBATHRA Moore and Laudon, 1943
Family Opsiocrinidae Kier, 1952, emend.

Type genus.—By monotypy, *Opsiocrinus* Kier, 1952, p. 64.

Emended description.—Cup relatively low, subconical; radials (*RR*) separated all around cup; basals (*BB*) large, forming a conspicuous basal circlet of the cup as viewed laterally, indented at center, with five infra-

basals (*IBB*) forming a small pentagon in the columnar facet, completely hidden by column. Interbrachials (*IBrBr*) depressed, small, fairly regular, especially in the dorsal part of each interray; posterior interray conspicuous, wider than other interrays, with a median uniserial row of large, raised, subquadrangular plates tapering gradually from the anal *X*, bordered on each side by small, rather irregular plates filling the rest of the interray; radial series of plates elevated above interrays but lacking median ridges. Arms becoming free at about the level of second secundibrachials ($SBrBr_2$), uniserial in young specimens becoming biserial in adults.

Remarks.—As apparent in the following key, the Opsiocrinidae can be readily distinguished from most other families of camerate Diplobathra by the separation of all its *RR*. It shows affinities with the Rhodocrinitidae in its low dorsal cup, with the Archaeocrinidae in its depressed *IBrBr* areas with regular plates, and with the Reteocrinidae in the median series of plates in the posterior interray.

KEY TO FAMILIES OF THE ORDER DIPLOBATHRA, SUBCLASS CAMERATA

1. *RR* in contact except at posterior interray 5
   No two *RR* in contact 2
2. *IBrBr* small and irregular ..... Reteocrinidae
   IBrBr fairly regular 3
3. *IBrBr* areas not depressed, no anal median ridge ..... Rhodocrinitidae
   IBrBr areas depressed, anal median ridge present in most 4
4. Dorsal cup high ..... Archaeocrinidae
   Dorsal cup low ..... Opsiocrinidae
5. Several *IBrBr* 6
   Few if any *IBrBr* 7
6. *IBrBr* very large, in depressed area ..... Ptychocrinidae
   IBrBr medium, not in depressed area ..... Dimerocrinitidae
7. Few small *IBrBr* in each interray ..... Lampterocrinidae
   One *IBr* in each interray ..... Gazacrinidae
   No *IBrBr* in dorsal cup ..... Nyctocrinidae

It should be pointed out that the Diplobathra having *RR* separated are not readily divisible into families. In particular, the Archaeocrinidae is an assemblage of forms that are gradational between the Reteocrinidae and the Rhodocrinitidae; some archaeocrinids have a median series of anal plates, median ray ridges, and conspicuous, visible *IBB* like the Reteocrinidae, whereas others lack a median series of anal plates, lack median ray ridges, and have small, inconspicuous *IBB* like the Rhodocrinitidae (Moore and Laudon, 1943, pp. 79–83). The cup in Rhodocrinitidae is rounded, not subconical as in the Opsiocrinidae, the *IBrBr* areas are not depressed, and the anal plates fill the posterior interray evenly, with no development of an anal median ridge.

In particular, the median series of anal plates must be regarded as a

primitive character. Moore and Laudon (1943, p. 12) stated that "Much evidence in the primitive archaic camerate crinoids suggests that the anal series had its origin in a sixth ray. This sixth ray had already been largely suppressed in the earliest known Ordovician camerate crinoids. In both dicyclic *Reteocrinus* and monocyclic *Xenocrinus* a conspicuous median ridge divides the anal interradius. In position and appearance it is identical with the other rays but it does not give rise to arms . . . The entire trend of evolution in the anal interradius in camerate crinoids is toward gradual reduction of the anal series." We presume that the median series in the Opsiocrinidae is a persistent rather than a recurrent feature.

Genus *Opsiocrinus* Kier

Type species.—By original designation, *Opsiocrinus mariae* Kier, 1952, p. 66.

Opsiocrinus mariae Kier

(Figs. 1–2; Pl. I, Figs. 1–6)

Opsiocrinus mariana Kier, 1952, pp. 66–67, Pl. III, Figs. 2–3; Kier, 1958, pp. 201–2, Figs. 1–2, Pl. I, Figs. 1–6.

Revised description.—Dorsal cup subconical; its sides distinctly convex in young specimens, very slightly convex and set at 40 degrees from vertical in adults. Height of cup slightly less than width; dorsal width about ⅓ ventral width. Arms extending from cup with little curvature, free above $SBrBr_2$, effectively concealing much of tegmen in complete heads.

Five *IBB*, small, situated in columnar facet and hidden by column in complete specimens. On dorsal surface (next to proximal columnal), *IBB* forming pentagon with sutures extending to apices; deeper in cup, at about middle of plates, forming decagon with protuberant corners (Kier, 1958, Fig. 1*b*); and on inner surface forming pentagon with sutures normal to the sides (Kier, 1958, Fig. 1*c*).

Five *BB*, large, subequal with posterior *B* slightly larger than others (Pl. I, Fig. 5). Each *B* hexagonal, wider than high as viewed laterally (Pl. I, Figs. 4, 6). At base of cup, *BB* indented to form columnar facet, nearly deep enough to accommodate full thickness of thin, star-shaped proximal columnal; each *B* with the center of its basal margin indented around an apex of the proximal columnal (Pl. I, Fig. 2).

Five *RR*, all separated, about equal (Fig. 1). Each *R* with its dorsal apex inserted in angle between adjacent *BB*. Shape of *RR* very little modified by *IBrBr*; right and left posterior *RR* subhexagonal, each with its side facing posterior interray bordered by *X* and one other *IBr*; other

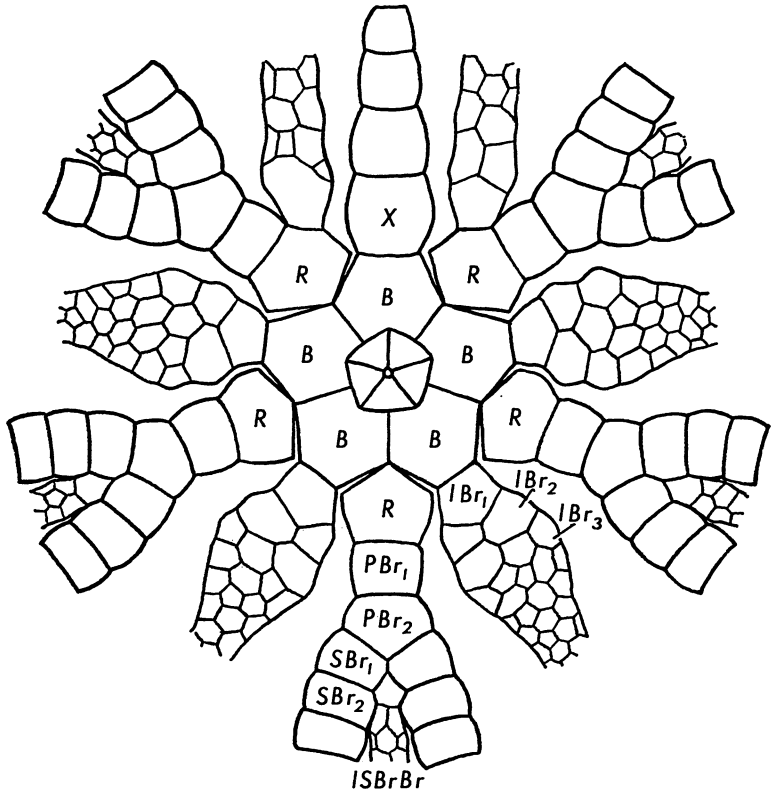

FIG. 1. *Opsiocrinus mariae* Kier. Plate diagram with selected plates labeled with symbols; posterior interray at top; infrabasals (*IBB*) forming central pentagon. × 10.

three *RR* subpentagonal, each of their ventral sides in contact with one or two *IBrBr* (Fig. 1; Pl. I, Fig. 6).

In each ray, PBr_1 distinctly narrower and smaller than *R* or PBr_2, subquadrate with convex sides, height less than ⅔ width. PBr_2 axillary, pentagonal, smaller than *R*, its sides convex. All plates in each ray convex; no trace of median elements (Pl. I, Fig. 5). $SBrBr_1$ diverging at about midheight, each about the same size as PBr_1, outer edge convex. $SBrBr_2$ and succeeding *SBrBr* tapering very gradually; proximal *SBrBr* subquadrate with convex sides, intermediate *SBrBr* trapezoidal with one side shorter than the other, and distal *SBrBr* triangular, forming alternating wedges where arm becomes biserial.

Ten free arms, their length more than twice the width of the dorsal cup, with rounded backs. Each arm uniserial to about SBr_{11}, thereafter biserial.

Pinnules closely spaced, stout, long, gradually tapering (Pl. I, Fig. 3), longest pinnules containing at least twelve segments.

Posterior interray conspicuously wider than other interrays (Fig. 2*a,b*). *X* larger than any *R* and about the same size as *B*, set directly atop posterior *B* and dorsally in contact with left and right posterior *RR*, its sides subparallel. *X* and succeeding anals (X_1, X_2, X_3) forming uniserial me-

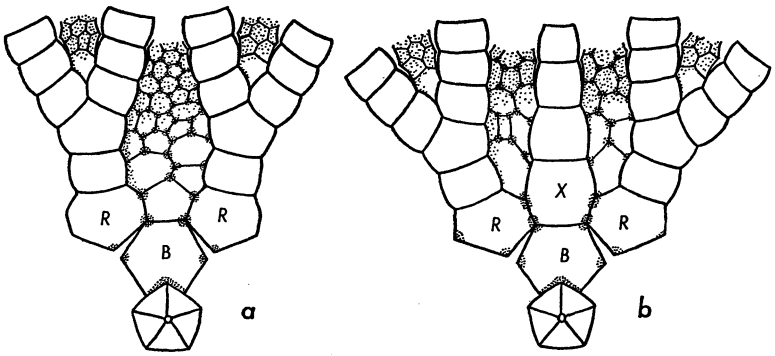

FIG. 2. *Opsiocrinus mariae* Kier. *a.* Plate diagram of normal interray (left, left anterior, right anterior, or right). *b.* Plate diagram of posterior interray. Both × 8.

dian row, elevated above lateral *IBrBr* of the interray, tapering ventrally; except for small lateral indentations at their junctions, each succeeding anal subquadrate with convex sides, its shape little affected by adjacent *IBrBr* (Pl. I, Figs. 1, 3–4). X_1 about ⅔ the size of *X*, X_2 about ½ the size of *X*, and X_3 about ⅓ the size of *X*. On each side of median row, other *IBrBr* arranged in irregular mosaic, the first plate large and inserted between *X* on one side and *R* and PBr_1 on other side, followed by two or three plates in second tier; remaining *IBrBr* decreasing in size and merging with similar plates in tegmen (Fig. 2*b*; Pl. I, Figs. 1, 3–4).

Other interrays (right, right anterior, left anterior, and left) slightly depressed below bordering rays (Pl. I, Fig. 5), dorsally in contact with *BB*, filled with mosaic of small plates. IBR_1, the largest plate in each interray, pentagonal. Two $IBrBr_2$, three or four $IBrBr_3$, and succeeding *IBrBr* smaller and irregular, merging with similar plates in tegmen.

Intraray areas between pairs of arms narrow. $ISBr_1$, the largest plate in each intraray area, its acuminate end between paired $SBrBr_1$ and its sides adjacent to $SBrBr_2$. $ISBrBr_2$ and succeeding plates irregular, inconspicuous in complete calyx.

Tegmen somewhat elevated, incompletely known. Anal opening not observed.

Column incomplete in known specimens, composed of star-shaped nodal and internodal columnals, the former larger and extending beyond the latter. Internodal columnals of two sizes, large alternating with smaller (Kier, 1952, p. 67). Articulating surfaces, at least in proximal columnals, with raised margin crossed on each of the five sides by nine or ten sharply defined grooves normal to the edge (Pl. I, Fig. 2).

All plates smooth. Small pits at *B-B-R* junctions (Fig. 2*a, b*; Pl. I, Figs. 1–3). Short grooves along each *X-R* suture, leaving narrow "bridge" from one plate to the other (Pl. I, Fig. 1). Corners of all *IBrBr* depressed, accentuating mosaic pattern (Pl. I, Figs. 3, 5–6).

Occurrence.—Unit 13 of Silica Formation, south quarry of Medusa Portland Cement Company, NE¼ sec. 18, Sylvania Twp., Lucas County, west of Centennial Road and south of Brint Road, Silica, about three miles southwest of Sylvania, Ohio; UMMP Holotype 27682 (Pl. I, Fig. 3), UMMP Paratype 27683, and UMMP Hypotype 33842 (Pl. I, Figs. 4–6). Upper part of Bell shale, locality given above: UMMP Hyptotype 47095 (Pl. I, Figs. 1–2).

LITERATURE CITED

KIER, P. M. 1952. Echinoderms of the Middle Devonian Silica Formation of Ohio. Contrib. Mus. Paleontol. Univ. Mich., Vol. 10, No. 4, pp. 58–81, 4 pls.

——— 1958. Infrabasals in the Crinoid *Opsiocrinus* Kier. *Ibid.,* Vol. 14, No. 13, pp. 201–6, 1 pl., 2 figs.

MOORE, R. C., and LAUDON, L. R. 1943. Evolution and Classification of Paleozoic Crinoids. Geol. Soc. Amer., Spec. Papers, No. 46, x + 153 pp., 14 pls., 18 figs.

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PLATE

EXPLANATION OF PLATE I

(All figures × 10)

PAGE

Opsiocrinus mariae Kier 180

FIGS. 1–2. Inclined posterior and basal views of incomplete calyx, UMMP Hypotype 47095, Bell Shale. Thin proximal columnal in basal recess of dorsal cup conceals *IBB*.

FIG. 3. Posterior view, slightly inclined, of immature specimen, UMMP Holotype 27682, Silica Formation. Also illustrated in Kier, 1952, Pl. 3, Fig. 2.

FIGS. 4–6. Posterior, basal, and left anterior views of UMMP Hypotype 33842, Silica Formation. Also illustrated in Kier, 1958, Pl. I, Figs. 1–6.

PLATE I