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Charles D. and Mary Vaux Walcott  
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A NEW DEVONIAN CRINOID  
FROM WESTERN MARYLAND

(WITH 1 PLATE)

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Division of Invertebrate Paleontology and Paleobotany  
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(PUBLICATION 4107)

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A NEW DEVONIAN CRINOID FROM  
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(WITH 1 PLATE)

Specimens of lecanocrinids are fairly abundant in middle and upper Silurian rocks of many parts of the world. On the other hand, only three species and few specimens of lecanocrinids are known from Devonian rocks. Of these three species, *Lecanocrinus magniradialis* (Weller) from the Helderbergian of New Jersey, *L. soyei* Oehlert from the lower Devonian of France, and *Geroldicrinus roemeri* (Schultze) from the "Stringocephalen-kalk" of Germany, two are known from incomplete specimens consisting of dorsal cup and a few IBrr, while the third species is known from seven specimens, including one complete crown. The specimen from western Maryland is of special interest because it is an almost complete crown, the first from the Devonian of North America. From this specimen it is possible to determine the character of the rays and to study the lateral union of the rays by close sutures above the level of the RR. The specimen furnishes valuable information concerning the relations between the Silurian and Devonian lecanocrinids.

This important Devonian crinoid was collected by A. G. Perdew, of Cumberland, Md., from the New Scotland formation, 2 miles east of Cumberland.

SYSTEMATIC DESCRIPTIONS

Family LECANOCRINIDAE Springer, 1913

Crown short, rotund; IBB erect or confined to basal concavity; rays in contact except at anal side, arms almost straight or coiled tightly upon themselves at distal ends. Silurian-Permian.

LECANOCRININAE Bowsher, new subfamily

Crown short, rotund; 3 IBB erect or confined to basal concavity; rays in contact except at anal side; RA and anal X; arms incurving at tips. Silurian-Devonian.

*Remarks.*—It is beyond the scope of this paper to review the classification of the numerous flexible crinoids formerly referred to the Lecanocrinidae. Jaekel (1918, p. 80) proposed the families Mespilocrinidae, Nipterocrinidae, and Calpiocrinidae to include some genera of flexible crinoids formerly referred to the family. Other genera are properly referred to Homalocrinidae Angelin, 1878, and Palaeoholopidae Wanner, 1916.

Springer (1920) placed much stress on whether IBB are erect, subhorizontal or confined to the basal concavity. He made these structural features of fundamental importance in classification. *Lecanocrinus* (s.s.) has erect IBB but *Miracrinus*, which is certainly a lecanocrinid, has the IBB confined to the basal concavity. The IBB of *Geroldicrinus* are also confined largely to the basal concavity. Because of obvious relations between *Lecanocrinus* (s.s.) and *Miracrinus* they are referred to the same subfamily.

As defined, the subfamily Lecanocrininae includes only the genus *Lecanocrinus* and the three subgenera, *Lecanocrinus* (s.s.), *Geroldicrinus* Jaekel, and *Miracrinus*, new subgenus.

#### Genus **LECANOCRINUS** Hall, 1852

A flexible crinoid and truncate bowl-shaped to conical cup which has 3 with IBB, rhombic RA lying obliquely below the left of the rpR and an anal X which is not followed by visible perisome. The IBB may be visible from the side or confined to the basal concavity. The crown is stout, rotund, and the arms may or may not be coiled at the distal ends. The arms may be free above the RR or suturally united for some distance above the cup. There are no iRR plates.

*Type species.*—*Lecanocrinus macropetalus* Hall, 1852.

*Range.*—Silurian and Devonian.

#### Subgenus **LECANOCRINUS** (*sensu stricto*) Hall, 1852

Lecanocrinids with the RA and X well developed, IBB erect and visible from the sides. The arms are free above the IBrr, are relatively long, not tightly coiled upon themselves at distal ends, and tend to dichotomize unequally.

*Type species.*—Same as for the genus *Lecanocrinus*.

*Range.*—Silurian.

#### Subgenus **GEROLDICRINUS** Jaekel, 1918

Lecanocrinids with the anal X well developed but RA much reduced by resorption, IBB subhorizontal and nearly confined to the

basal concavity. The arms are short, not coiled upon themselves at distal ends, and divide only twice isotomously.

*Type species.*—*Lecanocrinus (Geroldicrinus) roemeri* (Schultze).

*Range.*—Middle Devonian.

#### MIRACRINUS Bowsher, new subgenus

*Diagnosis.*—A lecanocrinid with a bowl-shaped cup, IBB hidden in basal concavity by the column, with the arms suturally united laterally

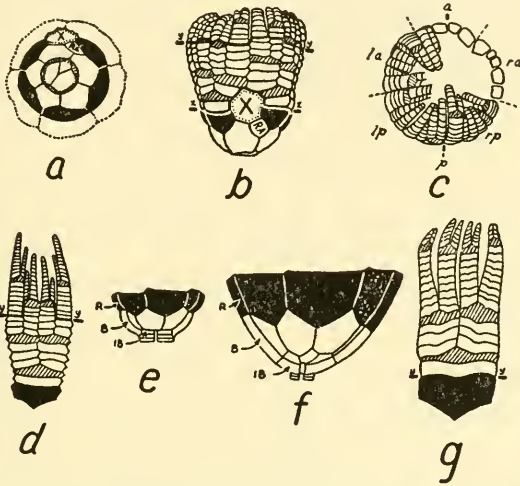


Fig. 1.—Diagrams showing the typical structures of *Lecanocrinus* (s.s.) and *Lecanocrinus (Miracrinus)* Bowsher, new subgenus.

*a*, Diagram of the cup of *Miracrinus* showing the IBB, BB, RR (solid black), RA, and anal X, X 1. *b*, Diagram showing the posterior interradius of the holotype of *Lecanocrinus (Miracrinus) perdevi*, the type species of the subgenus *Miracrinus* (U.S.N.M. No. 118033), X 1. *x* is at the level of the R-IBr suture, top of the cup, and *y* is at the top level of sutural union of the brachials of the posterior rays, X 1. *c*, Top view of *Lecanocrinus (Miracrinus) perdevi* showing the structure of the distal parts of the rays, X 1. *d*, Reconstruction of the left anterior ray of *Lecanocrinus (Miracrinus) perdevi*, X 1. *y* is at the top level of sutural union in the crown. *e*, Reconstruction of the dorsal cup of *Lecanocrinus (Miracrinus) perdevi* showing the IBB hidden in the basal cavity, X 1. *f*, Reconstruction of the dorsal cup of *Lecanocrinus (Lecanocrinus) macropetalus* Hall for comparison with that of *Miracrinus*, X 1. *g*, Reconstruction of the anterior ray of *Lecanocrinus (Lecanocrinus) macropetalus* (from specimens in Springer Collection, U.S.N.M. No. S1593) for comparison with that of *Miracrinus*, X 1. *y* marks the top of the cup and in general the upper level of sutural union of ossicles of the crown.

for nearly half their length, arms long, with considerably reduced IIIBr series in the inner part of each ray, and arms tightly coiled upon themselves at distal ends.

*Description.*—*Miracrinus* has a slightly flattened bowl-shaped cup which is about twice as wide as high (text fig. 1e). The plates of the

cup are massive. The IBB are hidden in a basal concavity into which the proximal columnal of the stem fits. The structure of the cup is typically lecanocrinid with a rhombic RA lying obliquely below the left of the rpR and a strong polygonal anal plate which extends for half its length above the level of the RR (text fig. 1b). The Brr of the arms are rigidly united within the ray and to those of adjacent rays to a level approximately twice the height of the dorsal cup (text fig. 1b). This in effect extends the level of the rigid cup to nearly half the length of the stout arms. Above this level the arms coil tightly upon themselves and the distal ends are hidden from view. The general pattern of the arms is lecanocrinid. The ambulacral tracts of this crinoid bifurcate three times giving eight terminal tracts to each ray. The ray

TABLE 1.—Formula of the la ray of the type species of *Miracrinus*

$$\begin{array}{l}
 \left. \begin{array}{l} \text{I } 1 + 2 \dots \end{array} \right\} \begin{array}{l} \left. \begin{array}{l} \text{II } 1 - 3 + 4 \dots \end{array} \right\} \begin{array}{l} \text{III } 1 - 3, \bar{4} - \bar{10} + \bar{11} \dots \left\{ \begin{array}{l} \bar{\text{IV}} \bar{1} - \bar{12} + \bar{13} \\ \bar{\text{IV}} \bar{1} - \bar{6} + \bar{7} \end{array} \right. \\ \text{III } 1 - 5 + \bar{6} \dots \dots \dots \left\{ \begin{array}{l} \bar{\text{IV}} \bar{1} - \bar{7} + \bar{8} \\ \bar{\text{IV}} \bar{1} - \bar{10} + \bar{11} \end{array} \right. \\ \\ \left. \begin{array}{l} \text{II } 1 - 3 + 4 \dots \end{array} \right\} \begin{array}{l} \text{III } 1 - 5 + \bar{6} \dots \dots \dots \left\{ \begin{array}{l} \bar{\text{IV}} \bar{1} - \bar{10} + \bar{11} \\ \bar{\text{IV}} \bar{1} - \bar{5} + \bar{6} \end{array} \right. \\ \text{III } 1 - 2, \bar{3} - \bar{9} + \bar{10} \dots \dots \dots \left\{ \begin{array}{l} \bar{\text{IV}} \bar{1} - \bar{7} + \bar{8} \\ \bar{\text{IV}} \bar{1} - \bar{12} + \bar{13} \end{array} \right. \end{array}
 \end{array}$$

This arm division is considered typical for *Miracrinus*. The posterior rays of the crown differ slightly from normal because of effect of the large anal plate. Bars over the numbers in the table indicate Brr of the free arms.

divides isotomously to the level of the IIAXx but dichotomies above this level are unequal. The anterior ray on the only known representative of the type species is incomplete, so the formula of the la ray is presented as typical of the genus (table 1, text fig. 1d, and pl. 1, figs. 2 and 9). The inner arms of the rays are short, having only 6 IIIBrr, whereas the outer arms are much longer, having from 10 to 11 IIIBrr. The terminal arms are of unequal size. The inside arms of each half ray have fewer IVBrr, from 6 to 8, than the outside arms which have from 11 to 13 IVBrr. It is believed that the unequal dichotomies are a result of the tight coiling of the arms (text fig. 1c).

*Remarks.*—*Miracrinus* differs from *Lecanocrinus* (s.s.) in having the IBB confined to the basal concavity and rays suturally united part way up the arms. *Miracrinus* differs from *Geroldicrinus* in having a



truncate bowl-shaped cup, larger RA, arms suturally united to the level of the IIIAxx, unequal dichotomy of the arms and longer arms.

*Type species.*—*Lecanocrinus (Miracrinus) perdewi* Bowsher, new species.

*Occurrence.*—Lower Devonian of Maryland and New Jersey.

**LECANOCRINUS (MIRACRINUS) PERDEWI** Bowsher, new species

*Diagnosis.*—Truncate bowl-shaped dorsal cup of medium height, small subhorizontal IBB almost completely hidden in the basal concavity which is filled by the proximal columnal, moderately bulbous BB and RR, Brr of the ray rigidly united within the ray and to adjacent rays up to approximately the level of the IIIBrr<sub>3-4</sub> in the anterior rays and distal parts of the free arms sharply coiled upon themselves.

*Description.*—Parts of the last two proximal or part of the proximal columnal remains on the holotype and only known specimen. It is not possible to determine accurately the depth of the IBB concavity which is filled by these columnal fragments (text fig. 1e). The character of the columnal or columnals is not preserved: only crenulae are visible on the holotype (pl. 1, fig. 7.).

A portion of the small rp IB may be present just beneath the BB but silicification of the specimen does not permit accurate determination of sutures in this part of the cup. It is my opinion that the sutures between the BB disappear beneath the proximal columnal and that the 3 IBB are almost, if not completely, hidden in the basal concavity (pl. 1, figs. 3 and 7, and text fig. 1, a, b, and e). These same figures show the coarse silicification which has obliterated any trace of surface ornamentation.

Only the slightly bulbous nature of the BB and RR is of particular significance: the BB and RR are otherwise as in most lecanocrinids (pl. 1, figs. 2 and 9, and text fig. 1, b and e).

The position and character of the anal and RA is typical of most lecanocrinids. These plates of the posterior interradius are also slightly bulbous (pl. 1, figs. 1 and 8, and text fig. 1b). It is considered particularly significant in this species that the posterior rays are rigidly united laterally for some distance above the anal plate (pl. 1, figs. 1 and 8, and text fig. 1b): the most posterior arm of the lp ray becomes free above the IIIBr<sub>4</sub> and the adjacent arm of the rp ray becomes free above the IIIBr<sub>3</sub>. The rays are rigidly united to the level of the IIIBrr<sub>3-4</sub> in the anterior rays. The arms show greater regularity in the anterior rays than in the posterior ones because the

posterior rays are influenced by the huge anal plate. The upper level of close sutural union in the posterior rays is shown in text figure 1b and for the anterior rays in text figure 1d.

The pattern of the 1a ray is presented in table 1 because the anterior ray is incomplete and because of the obvious irregularities in the posterior rays. The arms of this species are massive, tend to be bulbous, and are long for a lecanocrinid. The Brr of the arms tend to be hemispherical in cross section.

The distal ends of the free arms of this species are tightly coiled upon themselves. The character of the distal ends of the free arms is shown in pl. 1, figures 4, 5, 6, 10, and 11, and text figure 1c.

The perisome is not preserved on the holotype.

The measurements of the type and only known specimen of *Miracrinus perdevi* are: width of the proximal columnal, 4.5 mm.; height of dorsal cup, at posterior side, 5.5 mm.; greatest width of the cup, at the level of the RR-IBr suture, 12 mm.; total height of the specimen, 19.1 mm.; and greatest diameter around the arms, at a level slightly above the middle of the arms, 16.4 mm.

*Remarks.*—Of known lecanocrinids, only *Lecanocrinus* (*Miracrinus*) *magniradialis* (Weller) (1903, p. 299) could be confused with *Lecanocrinus* (*Miracrinus*) *perdevi*. The latter is distinguished from *L. (M.) magniradialis* by having a more bowl-shaped cup, and more bulbous plates of the cup. *Lecanocrinus (M.) magniradialis* is known only from a poorly preserved cup which seems to be different from *M. perdevi*. The latter is readily distinguished from other lecanocrinids by its bowl-shaped cup (text fig. 1, e and f), long arms, unequal dichotomy of the arms, and the rigidly united arms which form a part of the cup.

*Occurrence.*—The holotype was found near the top of the limestone which is the lower part of the New Scotland formation of the Helderbergian stage (lower Devonian), Sensabaugh quarry, now operating, near the city dump, 1.2 miles N. 30° E. of the junction of Evitts Creek and the Potomac River, 2 miles east of Cumberland.

*Holotype.*—U.S.N.M. No. 118033.

#### RELATIONS OF MIRACRINUS TO OTHER LECANOCRINIDS

*Miracrinus* and *Geroldicrinus* Jaekel are the only lecanocrinids known from the Devonian. These two subgenera seem to be the result of divergent evolution from Silurian lecanocrinids. *Geroldicrinus* from the middle Devonian has only two, possibly three, dichotomies in each ray and the short, stout, slightly coiled arms divide isotomously.

The cup of *Geroldicrinus* is conical and the sutural union of the arms, if present, is confined to the level of the IBrr. It appears probable that the geroldicrinids were derived from Silurian lecanocrinids of the type represented by *Lecanocrinus* (*Lecanocrinus*) *meniscus*, whereas the miracrinids appear to have developed from lecanocrinids of the type represented by *Lecanocrinus* (*Lecanocrinus*) *macropetalus*. A reconstruction of the anterior ray and dorsal cup of *L. macropetalus*, based on specimens in the Springer Collection, U. S. National Museum, No. S1593, is presented in text figure 1, g and d, for comparison with those of *L. (M.) perdewi* presented in text figure 1, d and e.

This crinoid, *L. (M.) perdewi*, is a very important one. There can be no doubt about the relations of *L. (M.) perdewi* to *Lecanocrinus* (s. s.). However, *L. (M.) perdewi* has subhorizontal IBB hidden in the basal concavity (text fig. 1e). This is one of the important characters used by Springer (1920, pp. 117-119) in differentiating the ichthyocrinids from the sagenocrinids and lecanocrinids. The presence of this character of IBB in *M. perdewi* suggests that, although this change from erect to subhorizontal is in some groups a phyletic change which may correlate with classification, it may in some groups of crinoids be of generic or even of infrageneric significance. Thus, one cannot always say that crinoids with erect IBB are primitive and those with invaginated IBB are more advanced. Such criteria of the age of a group of crinoids must be applied with great care.

One of the most startling characters of this interesting crinoid is the way in which the Brr of the arms are rigidly united by close sutures nearly half the length of the arms. *Lecanocrinus* (s.s.) shows some tendency toward this sort of fixation of the IBrr. Ubaghs (1943) discussed a similar form of fixation in the genus *Mespilocrinus*, which is closely related to *Lecanocrinus*. The result seems to be an immobilization of the lower part of the rays and consequent extension of the cup to include a part of the arms of the crinoid.

#### GENERIC ASSIGNMENT OF DEVONIAN LECANOCRINIDS

Only four species of lecanocrinids are known from the Devonian. *Ichthyocrinus magniradialis* Weller (1903, p. 299) from the New Scotland limestone from Nearpass quarry, Delaware, N. J., is tentatively referred to *Miracrinus*, along with *L. (M.) perdewi*, because of the general shape of the cup, although the specimen is poorly preserved and lacks arms. Additional material may show that this species should be referred to *Geroldicrinus* instead. *Lecanocrinus soyei* Oehlert from the lower Devonian, Sable, France, appears to be congeneric with *G.*

*roemeri* (Schultze) and is tentatively referred to that genus. The Devonian species are: *Lecanocrinus* (*Geroldicrinus*) *roemeri* (Schultze), *Lecanocrinus* (?*Geroldicrinus*) *soyei* (Oehlert), *Lecanocrinus* (*Miracrinus*) *perdewi* Bowsher, and *Lecanocrinus* (?*Miracrinus*) *magniradialis* (Weller).

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## PLATE I

*Lecanocrinus* (*Miracrinus*) *perdewi* Bowsher, new subgenus and new species: Holotype. U.S.N.M. No. 118033, New Scotland formation, Cumberland, Md. 1, Posterior interradius,  $\times 1$ . 2, Left anterior ray,  $\times 1$ . 3, Basal view,  $\times 1$ . 4, Top view,  $\times 1$ . 5, Posterior interradius and right posterior ray,  $\times 1$ . 6, Oblique top view showing the coiled arms,  $\times 1$ . 7, Basal view,  $\times 3$ . 8, Posterior interradius,  $\times 3$ . 9, Left anterior ray showing structure of anterior rays,  $\times 3$ . 10, Anterior ray; distal parts of arms missing,  $\times 3$ . 11, Oblique, anterior, top view showing the tightly coiled arms,  $\times 3$ .



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(See opposite page for explanation.)