

15. FOSSILS in the OXFORD UNIVERSITY MUSEUM.—II.¹ On Two NEW GENERA and SPECIES of CRINOIDEA (*BRAHMACRINUS PONDEROSUS* and *CICEROCRINUS ELEGANS*). By Prof. W. J. SOLLAS, M.A., D.Sc., LL.D., F.R.S., V.P.G.S. (Read January 24th, 1900.)

[PLATE XVI.]

I. *BRAHMACRINUS PONDEROSUS*, gen. et sp. nov.
(Pl. XVI, figs. 1 & 2.)

THIS somewhat barbarically ornate crinoid is represented in the University Collection by two calyces, which are both devoid of arms and stem. One of the specimens is exceedingly well preserved, and affords a fairly complete knowledge of the structure of the calyx. In the British Museum (Natural History) five specimens of the same crinoid are displayed; these also are calyces without arms or stem. Some of the specimens in the British Museum were obtained from Preston (Lancashire), and some from Yorkshire; those in the Oxford University Museum are from the latter county, where they occur in the Carboniferous Limestone.

The size of the calyx is fairly constant in all specimens, measuring, in that selected for description, 45 mm. in height by 40 mm. in maximum breadth. The dorsal cup is obconic in form, with the apex (corresponding to the base of the crinoid) truncate; the ventral disc is gently convex, and supports an excentric anal tube.

The basals are large, and three in number; two are equal in size and larger than the third, which is the left anterior. The sutures, which are persistent, are not quite symmetric with regard to the radial plates, which they meet on one side of the median line. The basals, like the other plates of the calyx, are much swollen, except immediately over the sutures, which consequently lie at the bottom of a deep groove.

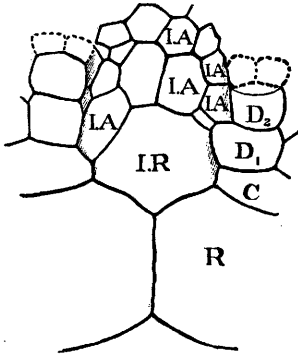
The five radials are also large, 13 mm. in height by 18 mm. in maximum breadth, very thick, but marked by a transverse crescentic depression, which lies in the upper half of each plate. Owing to their contact with more than one interrarial plate the outline of the basals is many-sided, usually octagonal. The upper median facet is slightly curved for the reception of the single costal, a much swollen plate, scarcely 9 mm. broad and 5 mm. high. It is completely incorporated in the calyx, forming an integral part of the wall.

The distichals are two in number, of the same breadth, namely, 5 mm., and the first is 3.5 mm. in height; they also form part of

¹ No. I, on Silurian Echinoidea & Ophiuroidea, was published in Quart. Journ. Geol. Soc. vol. lv (1899) p. 692.

the calyx, but the second distichal is not so intimately incorporated with the calyx as the first.

Fig. 1.—Diagram showing the arrangement of the plates of the calyx of *Brahmacrinus ponderosus*. ($\times 1.5$.)



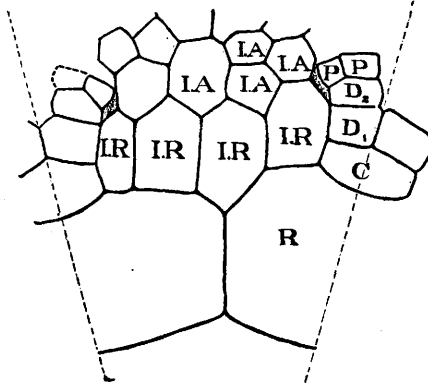
[In this and the succeeding figure the letters have the following meaning:—R=radial; C=costal; D₁=first distichal; D₂=second distichal; P=palmar; I.R.=interradial; I.A.=interambulacral.]

The first palmars are connected with the calyx by small plates which extend between them and the ventral disc; their articular surface looks vertically upward and exposes a central canal, from which ridges and furrows extend radiately.

A single interradial, which is in union with two radials below, occurs in each interradius (fig. 1), but in the anal interradius additional plates are present, one on the right of the median interradial and two on the left (fig. 2). These additional plates are united with the radials below; and those at the extremity of the series, on either side, meet also the costals and first distichals. The single interradial of the other interradia is clearly exposed in one instance only; it meets the costal and first distichal in front and the costal behind, being separated from the first distichal on this side by a supplementary intervening plate.

The dorsal cup passes gradually into the ventral disc: if we assign all the plates that lie below the ambitus (which runs through the first distichal) to the dorsal cup, then the plates that remain to be described must be regarded as ventral.

Fig. 2.—Diagram showing the arrangement of the plates in the anal interradius of *Brahmacrinus ponderosus*. ($\times 1.5$.)



In the centre of the disc stands a single plate; next to it on one side are the remains of the excentric anal tube (broken off at a height of 7 mm. from the base); the rest of its periphery is bounded by six other plates symmetrically arranged, three on each side of the antero-

posterior plane; surrounding these follow a large number of plates not disposed according to any general law, which complete the plating of the disc; towards the arms they diminish in size, but between the arms, on passing over the ambitus to meet the interradians, they become larger. A series of small plates is continued between the members of each pair of arms, the terminal single plate of the series lying between the second distichals. A single series of minute plates bounds the outer side of the distichals; the first plate of this series is in contact with an interradial; the last overlies the covering-plates of the arm, where these pass into the disc, and terminates in a fractured surface, which exposes the end of a deep groove, somewhat cylindrical in form, excavated in its lower half. This, however, is clearly seen in one instance alone: it may possibly represent a reduced pinnule of the first distichal that has become adherent to the disc.

All the plates of the dorsal cup are very thick and massive, and the sutures, which are very obvious and slightly depressed, lie at the bottom of deep depressions. Most of the plates of the ventral disc are likewise thickened, each into a single tubercle, but small intercalated plates occur, which are devoid of tubercles.

The arms are not preserved, but since the palmars, when present, are found to be united with the disc by marginal plates, it may be presumed that these were not freely movable, and if so the number of the arms would be twenty (5×4).

This remarkable crinoid forcibly recalls in structure and general character the genus *Platycrinus*, with examples of which I found it associated both in the Oxford University Museum and the British Museum. The incorporation of the costal and distichal plates in the calyx affords, however, a very obvious distinction, and there can be little doubt that the present form represents a new generic type, for which I propose the name *Brahmacrinus*, suggested by its resemblance in general appearance to the capital of a column of a Hindu temple.

In some forms of *Platycrinus*, and more particularly in the allied genus *Pleurocrinus*, the costal and first distichal, although projecting beyond the outline of the calyx, are immovably attached to it by adbrachial plates and plates of the ventral disc. But in all such cases it will be found that the costal is completely bounded by the radial and first distichal, and never comes into contact with an interradial plate, as it constantly does in *Brahmacrinus*.

The question will naturally arise as to the family with which *Brahmacrinus* should be associated. If its general appearance reminds us of the Platycrinidæ, the analysis of the calyx as inevitably suggests the Melocrinidæ, from the members of which it is chiefly distinguished by the comparatively small size of the costal and distichal plates; the Melocrinid genus which approaches it most closely is *Stereocrinus*, but this differs not only in the much greater size of the costals and radials, but also by the presence of

slit-like openings at the sides of the arms, which are absent in *Brahmacrinus*.

Brahmacrinus cannot well be assigned to either of the families considered; it is possibly an annectant form, uniting the Melocrinidæ and the Platycrinidæ, and may indifferently be associated with either.

Diagnosis of *BRAHMACRINUS*.

Calyx having the same composition as in *Platycrinus*, but distinguished by the incorporation of the single costal and the two distichals. The costal and first distichal are suturally united with an interradial of the first series. Anal tube excentric. Anal inter-radius distinguished from the remaining interradia by additional plates in the first interradial series.

BR. PONDEROSUS. Type-species.

Plates of the calyx thick, those of the dorsal cup especially so, separated by deep grooves, corresponding with the sutures, which are slightly impressed. Radial plates with a crescentic excavation. Arms twenty (5×4). Carboniferous Limestone.

II. *CICEROCRINUS ELEGANS*, gen. et sp. nov.

(Pl. XVI, figs. 3 & 4.)

A single specimen of this elegant little crinoid was found in the Grindrod Collection, bearing the label 'Crinoid, new, ? *Cheirocrinus*,' but without locality or any indication of the horizon from which it was obtained. Since, however, it was placed in a drawer full of Wenlock fossils, and is embedded in a matrix of limestone crowded with Silurian species, it may be referred with great probability to the Wenlock Limestone. The stem, of which 15 mm. is visible, is round and smooth, and composed, at least just below the cup, of a great number of simple disciform ossicles; in a length of 4 mm. twenty discs were counted. In diameter the stem measures 2.5 mm.

The cup is conical, smooth, and devoid of ornament; it measures 13 mm. in height and 6 mm. in maximum breadth, that is, at the upper margin. In general appearance it much resembles an elongated form of *Pisocrinus*, such as *P. pocillum*, Ang.

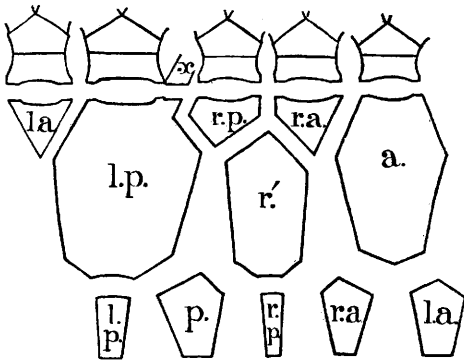
The basals are five in number (fig. 3, p. 268); of these, three are each suturally united above with two radials; the remaining two are each in contact with one radial only: thus the right posterior basal meets the middle of the base of the radi-anal marked R' in Mr. Bather's paradigm of *Pisocrinus*,¹ and Az. by Wachsmuth & Springer; while the left posterior similarly meets the middle of the base of the left posterior radial.

The relative position of the left posterior basal constitutes the

¹ 'Crinoidea of Gotland.—pt. i. Crinoidea Inadunata' Kongl. Svenska Vetenskaps-Akad. Handl. vol. xxv (1893) No. 2, p. 25, fig. 2.

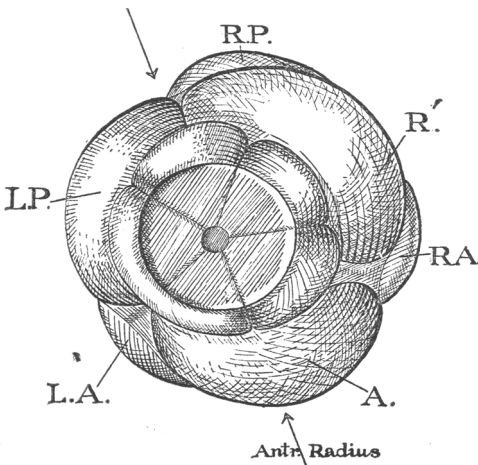
sole important difference between this calyx and that of *Pisocrinus*; in the latter, the second of the two plates exclusively united to a radial is the left anterior basal, which meets the middle of the base of the anterior radial. This is correctly indicated both by Bather

Fig. 3.—Analytical representation of the calyx of *Ciceroocrinus elegans*. ($\times 2$.)



[The plates of the lowest series are basals, those of the two series of the next zone, radials; the remaining plates are brachials, except *x*, which is the anal plate. *r*=right; *l*=left; *a*=anterior; *p*=posterior; *r'*=radi-anal.]

Fig. 4.—*Pisocrinus*, sp.: an exceptional specimen, in which the basal plates are symmetrically arranged, seen from the base. (\times nearly 30 diam.)



and Wachsmuth & Springer, but, though true for the great majority of examples of *Pisocrinus*, the relation is not absolutely constant. Out of some hundreds of specimens of *Pisocrinus pillula* I have succeeded in finding three wherein the arrangement of the basal plates is precisely that which obtains in *Ciceroocrinus*, while in a single example the basal plates are disposed in a manner almost precisely intermediate to that of *Pisocrinus* and *Ciceroocrinus*. Thus, as shown in fig. 4, the right posterior is, as in both genera, interradial in position, and it never exhibits any tendency to deviate from this position; the left anterior and left posterior basals, however, are of approximately equal size, and meet in a longitudinal suture which corresponds to the suture between the anterior and left posterior

radials. From this intermediate form the normal *Pisocrinus*-calyx arises by an overgrowth towards the anterior of the left posterior basal, while the calyx of *Ciceroocrinus* is produced by an overgrowth of the left anterior basal posteriorly. The radial plates of the calyx of *Ciceroocrinus* correspond in their arrangement precisely with those of *Pisocrinus*, and differ only by their more elongate form, as is shown in the accompanying diagram (fig. 3), which is drawn to scale. The plate marked *x* by Mr. Bather is seen in a position precisely corresponding to that which it occupies in *Pisocrinus*.

It would thus appear that no essential difference distinguishes the calyces of *Ciceroocrinus* and *Pisocrinus*; it is otherwise, however, when we pass to a consideration of the arms. These are five in number, well developed, and by no means excessively slender; in length they measure 37 mm., and in breadth 2·3 mm. near their origin, and 1·5 mm. near their termination. They are branched, pinnulate, with alternating syzygial ossicles.

The primary brachials are two in number, their breadth is 2·3 mm., and their length taken together is 4 mm. The secondary brachials number eighteen: the length of the series is 16 mm. and its breadth 2 mm. The tertiary brachials are as many as twenty-eight, the length of the series being 17 mm., and its breadth 1·5 mm.

The strong pinnules are plainly exposed on one side of the second and third divisions of some of the arms. A single pinnule arises from every fourth ossicle on one side, so that syzygial sutures may be inferred; occasionally, however, three ossicles intervene between two successive episzygials. The articular surface for the pinnules is large, and the next ossicle which succeeds the episzygial is deeply excavated to receive the basal joint of the pinnule. The ossicles of the pinnules are few in number, and longer than broad.

The structure of the arms agrees closely with that of these organs in *Ectenocrinus*, as represented diagrammatically by Mr. Bather,¹ though the pinnules of *Ciceroocrinus* are represented by armlets in *Ectenocrinus*.

The association of branching pinnulate arms with a calyx possessing the characters of *Pisocrinus* renders necessary the erection of a new genus, for which I propose the name *Ciceroocrinus*.² The form described is the only known example of the genus, and may be specifically designated *elegans*.

The calyx of *Ciceroocrinus* is that of a Pisocrinid; the arms those of a Heterocrinid: but this conjunction of characters, though rendering necessary a fresh definition of the Pisocrinidæ, cannot be regarded as breaking down the distinction between this family and

¹ Ann. & Mag. Nat. Hist. ser. 6, vol. v (1890) pl. xv, fig. 7.

² *Cicer, cicris*, a chick-pea.

the Heterocrinidæ, which are fistulate, while the Pisocrinidæ, so far as we know, are not.¹ We shall thus have:—

Family Pisocrinidæ, Ang. (emend.).

Calyx small, monocyclic, with five radial plates and a single radi-anal on the dorsal and five oral plates on the ventral surface. Arms five, either simple, uniserial, and destitute of pinnules, or dichotomous and pinnulate.

Genus 1. *Pisocrinus*, De Kon. With five basals, of which the left anterior meets the middle of the base of the anterior radial, and is exclusively united with it. Arms simple, not pinnulate. Silurian.

Genus 2. *Triacrinus*, Münst. With three basals. Arms simple, not pinnulate. Devonian and Carboniferous.

Genus 3. *Cicerocrinus*, gen. nov. Calyx with five basals, of which the left posterior meets the middle of the base of the left posterior radial, and is exclusively united with it.

The arms regularly dichotomize twice; the brachial ossicles are united by syzygy, and bear pinnules.

Type, *Cicerocrinus elegans*, sp. nov. Stem, calyx, and arms devoid of ornament and smooth; stem round; calyx elongated, conical; primary brachials two, secondary (in the only specimen known) eighteen, and tertiary twenty-eight in number. Silurian. Locality (?), probably Dudley.

EXPLANATION OF PLATE XVI.

[The figures are all taken from photographs of the specimens, made by Mr. J. A. Robinson.]

Fig. 1. *Brahmacrinus ponderosus*, gen. et sp. nov. The calyx nearly of the natural size ($\times 0.9$), posterior view. The anal interradius almost faces the observer, but is turned slightly away to the left.

Fig. 2. The same: calyx seen from the right posterior side. $\times 0.9$.

Fig. 3. *Cicerocrinus elegans*, gen. et sp. nov. Specimen seen from the anterior side. Nat. size.

Fig. 4. The same, giving a magnified view of the arms. $\times 2$.

DISCUSSION.

Mr. F. A. BATHER congratulated the Author on his find of a new Monocyclic Inadunate crinoid from the Wenlock Limestone. A brief inspection of the fossil had not led him to doubt the Author's description, but he differed as to the systematic position of the genus for the following reasons:—Though the cup-structure was that of *Pisocrinus*, it must be remembered that the essentials of this structure were common to Heterocrinidæ, Calceocrinidæ, Pisocrinidæ,

¹ [Mr. Bather has called my attention to the fact that he has described a fistular character as existing in *Pisocrinus*. I have now consequently no hesitation in regarding *Cicerocrinus* as a link uniting the two families.]

Catilloocrinidæ, and Haplocrinidæ, and that the particular Pisocrine arrangement was so natural a development from that of *Heterocrinus* that it would not, of itself, serve to distinguish the family Pisocrinidæ. On the other hand, the Pisocrinidæ, Catilloocrinidæ, and Haplocrinidæ all possessed unbranched non-pinnulate arms, while the arms of all Heterocrinidæ and Calceocrinidæ were branched on a definite plan. The variation of arm-structure in Pisocrinidæ and Catilloocrinidæ consisted solely in the gradual addition of unbranched arms, borne by small additional radials (pararadials). The variation of arm-structure in Heterocrinidæ and Calceocrinidæ consisted solely in a gradual advance, along definite lines, from isotomy to heterotomy, with the eventual production, in such a form as *Ectenocrinus*, of a bifurcated arm with ramuli along the sides of the rami, and with brachials forming syzygial pairs. Such a structure was absolutely removed from that of any Pisocrinid, but was, the speaker gathered, that of this new Silurian genus, which therefore fell into its natural position as the climax of the Heterocrinidæ.

Turning to the suggested new Carboniferous genus, Mr. Bather said that he felt unable to accept it. The proposed type-species had long been known; the attention of Wachsmuth & Springer had been specially drawn to it, and they had expressly retained it in *Platycrinus*, saying that 'a similar structure, in a less degree, is to be observed in a few American species.' The species was also connected with various British species, described and undescribed, showing no gap between it and ordinary *Platycrini*. It was hard to grasp what the Author intended as the diagnostic character. The presence of supplementary plates between the two main arm-branches was a feature of some interest, but the Author had rightly refrained from attaching importance to it. The abstract in their hands only mentioned 'the incorporation of the costal and distichal plates in the calyx,' a feature shared by many species of undoubted *Platycrinus* in both Europe and America. He understood, however, that the Author wished to take for his criterion the abutment of the costal (primibrach) on interbrachials. But this character could also be seen in such similar species as *Platycrinus punctatus*, *Pl. expansus*, and *Pl. tuberculatus*, not to mention such dissimilar species as *Pl. spinosus*, *Pl. mucronatus*, and *Pl. coronatus*. To speak of an 'annectant form uniting the Meloocrinidæ and the Platycrinidæ' was to ignore time as well as structure.

The Author remarked that, as regards the new Silurian genus, the issue was very simple, until it became obscured amid the foliage of a genealogical tree. The calyx presented not merely a general but a precise resemblance to that of *Pisocrinus*, the arms could be compared with those of more than one genus of Heterocrinidæ. If chief stress be laid on the calyx, then the new genus is a Pisocrinid; if on the arms, it is a Heterocrinid. But the arms of crinoids, being organs of the highest physiological importance, are highly variable and less suited for broad distinctions in classification than the calyx. If this new genus could only be attached to Mr. Bather's 'tree' by the arms, it would be a misfortune for the 'tree.'

In the case of the other new genus described, not only were the costals and distichals fully incorporated in the calyx, but they were brought into immediate contact with the interradials; an arrangement not met with in *Platycrinus*, certainly not in *Pleurocrinus* (*Platycrinus*) *rugosus*, mentioned by Mr. Bather. The Author had in many cases used the terms proposed by Mr. Bather, but in others he had employed those in general use, which were also those of Wachsmuth & Springer. It mattered less what a thing might be called than that the same thing should always be known by the same name. In matters of nomenclature it was becoming increasingly difficult to keep abreast of the fleeting fashions of the time, and fixity in the use of terms was fast becoming a crying need in zoology.

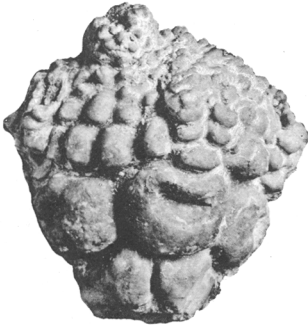
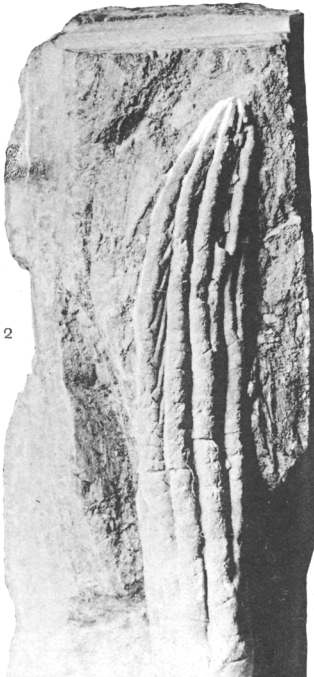


FIG. 1.



FIG. 3.



x 2

FIG. 4.



FIG. 2.