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THE OCCURENCE OF *PISOCRINUS* OR AN ALLIED GENUS, IN THE UPPER SILURIAN ROCKS OF THE YASS DISTRICT.

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(Plate xxxvii.)

Some months since Mr. A. J. Shearsby, a valued correspondent, and contributor to the Museum collections, forwarded a large number of small Crinoid calyces, etc., collected from a bed of shale at two localities in the Yass District. These calyces I believe to be referable to De Koninck's genus *Pisocrinus*, and purpose describing them as *P. (?) yassensis*.

Our knowledge of the Lower Palæozoic Crinoidea, not only of New South Wales, but indeed of Australia generally is very limited. It may be summed up in the descriptions of three species; and some indefinite references to stem ossicles by Blandowski, Selwyn, and Smyth, which need only be mentioned as a matter of history. The latter may be referred to first:—

Mr. W. von Blandowski, at one time Curator of the National (or, as it was then called, the Museum of Natural History) Museum, Melbourne, briefly recorded "Fossil Animalculæ in the Primitive Rocks from the Upper Yarra District."[1] The specimens were collected by Mr. F. Acheson on the left bank of Anderson's Creek, about one mile from its junction with the Yarra, and consisted of Crinoid stem-joints, Polyzoa, and Molluscan casts. The stem-joints were referred to "*Cyatocrinites* probably *pinnatus*" but the figures given on an accompanying plate,[2] lead to the belief that two distinct forms were found. On the same plate other crinoidal fragments are represented[3] from the quartzose sandstone of the Heathcote, (McIvor) gold-field. Subsequently Dr. (then Mr.) A. R. C. Selwyn, in a list of Victorian Palæozoic fossils, mentioned[4] the occurrence of *Actinocrinus* and *Cyathocrinus* at Watson's Creek, Upper Yarra District. Selwyn's records were repeated by Dr. J. J. Bigsby in his Thesaurus Siluricus',[5] and *Actinocrinus* stems

[1] Blandowski—Trans. Phil. Soc. Vict., i., 1855, p. 122, plate; Personal Observations in Victoria, 1855, p. 27.
[2] Blandowski—Trans. Phil. Soc. Vict., i., 1855, pl. figs. 309, 310.
[3] Blandowski—*loc. cit.*, pl. figs. 311, &c.,
[4] Selwyn—Quart. Journ. Geol. Soc., xiv., 1858, p. 538.
[5] Bigsby—Thesaurus Siluricus, 1868, pp. 18 and 19.

from the same prolific district by Mr. R. Brough Smyth, in a list of Victorian fossils prepared by Prof. Sir F. McCoy.[6]

The only early record from New South Wales that occurs to my mind is one by the Rev. W. B. Clarke of "crinoidal columns" in Devonian or Passage Beds,[7] but without locality.

Not until 1897 was a Crinoid definitely described from Australian Lower Palæozoic rocks by Dr. F. A. Bather, who figured[8] a very imperfect impression from the Upper Silurian shales, near Prince's Bridge, Melbourne, as *Haplocrinus victoriæ*. This was supplemented in 1903 by the description of two species, referable to distinct genera, by Mr. F. Chapman. For the first a new genus was proposed —*Helicocrinus*, and the species named *H. plumosus*;[9] the second was referred to *Botryocrinus* as *B. longibrachiatus*, Chapman.[10] Both are from the Upper Silurian rocks of the Melbourne suburbs.

The specimens of *Pisocrinus (?) yassensis* were collected by Mr. Shearsby at two localities—viz., Limestone Creek, Parish of Derrengullen, Co. King, and Hatton's Corner, Yass River, near the town of Yass; the two localities are at no great distance from one another. The Crinoid, according to Mr. Shearsby's notes, occurs at Limestone Creek, near Limestone Church, in a bed of olive-grey shale, about fifty yards below the Bowning to Wargeila crossing place. The bed is at least twenty feet thick, dips 15° W. S. W., and is overlaid by a limestone containing a copious coral fauna. The Crinoid is plentifully distributed through the lower five feet of the exposed shales, and is accompanied by casts of *Mucophyllum crateroides*, Eth. fil., numbers of a very characteristic *Cyathophyllum*,[11] *Rhizophyllum interpunctatum*, De Kon., and other corals.

At Hatton's Corner, a single specimen only was found in the thick shale below the wonderfully well defined limestone exposed there.[12] When I last visited this instructive locality, I

[6] Smyth—[First] Progress Report, [Second] Geol. Survey Vict., 1874, p. 34.

[7] Clarke—Researches S. Goldfields N. S. Wales, 2nd Ed., 1860, p. 286.

[8] Bather—Geol. Mag., (4), iv., 1897, p. 337, pl. xv.

[9] Chapman—Proc. R. Soc. Vict., n. s., xv., 2., 1903, pp. 107-108.

[10] Chapman—*Loc. cit.*, p. 108.

[11] To be described later as *Cyathophyllum shearsbyi*.

[12] Both the limestone and shale were described by Mr. C. Jenkins (Proc. Linn. Soc. N. S. Wales, iii., 1, 1878, p. 26), as members of his "Hume beds," and the *Calceola* mentioned by him in *Rhizophyllum interpunctatum*. In addition to this paper the geology of the district will be found treated in the two following papers:—

David (T.W.E.)—Report on the Fossiliferous Beds, Yass. Ann. Rept. Dept. Mines N.S. Wales for 1882 (1883), p. 148, 3 plates.

Mitchell (J.)—Notes on the Geology of Bowning, N. S. Wales. Proc. Linn. Soc. N. S. Wales, (2), i., 4, 1887, p. 1193, pl. xxi.

did not meet with *Pisocrinus*, but Mr. Shearsby's notes on a collection from the Limestone Creek shale, strongly support the view that it, and the bed referred to at Hatton's Corner are one and the same.[13] The *Cyathophyllum* is plentiful there, and so is *Rhizophyllum interpunctatum;* this bed of shale is also the horizon of *Barrandella linguifera*, Sby., var. *wilkinsoni*, Eth. fil. So characteristic of the Hatton's Corner shale are all three fossils that the name of either may be selected as a designation for the bed in question. I prefer the name of "Barrandella Shale," as the *Rhizophyllum* is also found in a lower bed of the section at this locality.[14]

Genus Pisocrinus, *De Koninck*, 1858.

(Bull. Acad. R. Belg., (2), iv., 1858, p. 104; Geologist, i., 1858, p. 182.)[15]

PISOCRINUS (?) YASSENSIS, *sp. nov.*

(Plate xxxvii., figs. 1—14.)

Sp. Char.—Dorsal cup small, rather variable in form, obconical to bowl-shaped, and in transverse section circular to sub-pentagonal. Base circular; BB entirely concealed in the deep stem depression, and entirely covered by the uppermost ossicle; sutures too faint to be perceptible, even in the best preserved specimens. RR5, the larger radials only curving sufficiently round to form the margin of the circular stem depression; l. ant. R[16] triangular, not reaching to the basals, with its lower sides equal to one another; l. post. R hexagonal, being bounded by the l. ant. R, ant. R, R′, r. post R, and facet; r. post. R and r. ant. R. four-sided, the adjoining sides above the apex of R′ well marked whilst the sides abutting against the same plate are longer than the outer sides; ant. R six-sided only, being bounded by r. and l. ant. Rs, R′, certain basals, and facet; radial articular facets with a triangular ground plan, curved on the outer, or wall side of the cup, and excavated on the inner or calycinal side; radial processes well developed, halberd head-shaped when conjoined.; R′ pentagonal, and its apex not produced into a process separating the r. ant. and post. Rs, nor does the plate curve inwards to form part of the basal cavity, but its apical margins are longer than those between the

[13] David previously suggested this, *loc. cit.*, p. 148, vert. section, bed C.-D.

[14] David—*Loc. cit.*, vert. section, bed I′.

[15] Emended Bather—1893.

[16] Omitting from consideration the radial processes.

l. post. and ant. Rs respectively. Anal *x* and tube unknown. Calicinal cavity hour-glass-shaped, constricted at about the centre. Arms and tegmen unknown ; stem not known with certainty.

Obs.—I have quite failed to distinguish the very minute and somewhat deeply-sunk basal plates (BB). I believe there are five, but I cannot assert it as an ascertained fact. I think five basals must exist from the otherwise general agreement of this Crinoid in its structure with Dr. Bather's emended description[17] of the genus *Pisocrinus*. If three basals are present, and not five, there is only one other genus in the Pisocrinidæ in which these little fossils can be placed—*Triacrinus*, but all other features point to the former genus as the proper one.

Dr. Bather's remarks that in the type, *P. pilula*, De Kon., the dorsal cup varies much in shape. "So much so indeed that one is tempted to make more than one species,"[18] applies to a great extent in the present instance. In *P.(?) yassensis* three principal varieties can be distinguished:—

a. Bowl-shaped dorsal cup, the diameter exceeding the height.

b. More or less conical dorsal cup, the height exceeding or equal to the diameter.

c. Pentalobate dorsal cup.[19]

The following table shows the respective measurements of seven examples of vars. *a* and *b* ; var. *a* is by far the most common.

Example.	Var. *a.*		Example.	Var. *b.*	
	Height.	Diam.		Height.	Diam.
A.	5 mm.	6 mm.	B.	6 mm.	5 mm.
C.	4 ,,	5 ,,	G.	5 ,,	5 ,,
D.	6 ,,	$6\frac{1}{2}$,,	—	—	—
E.	4 ,,	5 ,,	—	—	—
F.	5 ,,	6 ,,	—	—	—

The basal cavity for the reception of the stem ossicles is hollow, there is no rim as in *P. pilula*, and the basals within the

[17] Bather—Crinoidea of Gotland, pt. 1, 1893, p. 22.
[18] Bather—*Ibid*, p. 28.
[19] This variety will be treated separately.

depression are flat. The inter-basal sutures are too faint to be discernable, and even in some examples the inter-radial sutures are seen with difficulty.

The radial processes are from one and a half to two millimetres long, and when those of contiguous radials are united the outline is more or less halberd-shaped, and they seemed to resemble more those of *P. pilula* than those of *P. ollula.*

The constriction of the calicinal centre is excellently shown on several specimens, some internal casts pure and simple, others in which the plates have been partially broken away; the constricted outline is distinctly hour-glass shaped.

I have succeeded in isolating the following plates:—The right and left anterior radials (Pl. xxxvii., fig. 9 and 11.), left posterior radial (Pl. xxxvii., fig. 8.), and the radianal (Pl. xxxvii., fig. 10).

Hand specimens of shale from the bed yielding the remains of *P. (?) yassensis* are full of stem ossicles of more than one crinoid, but those I believe to appertain to this species are very small, short, and oblong, unsculptured, with plain sutures, and a small apparently circular axial canal. They closely resemble the stem joints of *P. pilula*, as figured by Bather.[20]

The surface of the plates, when well preserved and unweathered, is fine-granulated or frosted. I believe this to be true sculpture as it is present on all the better preserved specimens. In this instance it certainly is not produced by weathering as suggested by Dr. Bather in the case of *P. pilula.*[21] The late Mr. S. A. Miller said that in perfectly preserved specimens of his *P. campana*[22] the surface was probably granular.

Pisocrinus (?) yassensis in no way resembles *P. pocillum*, Angelin,[23] specifically, and of the two other European species, *P. pilula*, De Kon.,[24] and *P. ollula*, Angelin,[25] it is certainly most nearly akin to the latter, for the basal plates do not show in a side view, or elevation of the calyx, as they do not only in *P. pilula*, but in the following American forms:—*P. gemmiformis*, S. A. Miller,[26] *P. pyriformis*, Ringueberg,[27] *P. globosus*,

[20] Bather—*Loc. cit.*, pl. i. f. 1.
[21] Bather—*Loc. cit.*, p. 28.
[22] Miller—Indiana. 17th Ann. Report Geol. and Nat. Resources for 1891 (1892), p. 642.
[23] Bather—*Loc. cit.*, pl. i., f. 20-23.
[24] Bather—*Loc. cit.*, pl. i., f. 1–11.
[25] Bather—*Loc. cit.*, pl. i., f. 12-19.
[26] Miller—Journ. Cincin. Soc. Nat. Hist., ii., 2, 1879, pl. ix. f. 6, 6 *a-c.*
[27] Ringueberg—*Triacrinus*, Proc. Acad. Nat. Sci. Philad. for 1884 (1885), pl. iii., f. 1, 1 *a-e.* Bather cannot distinguish this from the more conical vars. of *P. pilula*; probably a synonym.

Ringueberg,[28] *P. campana*, S. A. Miller,[29] and *P. benedicti*, S. A. Miller.[30] In addition to the same character separating the Australian Crinoid proper from *P. gorbyi*, S. A. Miller,[31] another American species, the projection of the five regular radials in this latter, which Mr. Miller described as "strongly lobed towards the tenons of the arm blades" will tend further to distinguish it. At the same time, this projection producing a subpentalobate outline indicates a transition towards our var. *c. Pisocrinus tennesseensis*, Roemer[32] was described from a specimen not sufficiently perfect to enable a comparison to be made.

It will be apparent from these comparisons that *P. (?) yassensis* need only be considered in its relations to *P. ollula*, Angelin. The difference between the two species lies chiefly in the form of the radials, which in *P. ollula* are said by Bather to be of the "same general shape as in *P. pilula*. That being the case we find as follows:—In *P. (?) yassensis* the l. post. R is hexagonal instead of heptagonal; the ant. R is six-sided only instead of eight-sided; R' is pentagonal and not heptagonal or "seven sided," and the apex of the plate is never produced into a process more or less separating the two smaller radials.

P (?) yassensis has been found, as already explained, both at Limestone Creek, and at Hatton's Corner, near Yass.

P. (?) YASSENSIS, *var.* LOBATA, *var. nov.*

(Plate xxxvii.., fig. 15.)

Obs.—I have separated a few specimens from the typical form on account of the greater convexity of the radials, and the projection of their outer ventral edges, giving rise to a pentalobate outline to the calyx, whether viewed from the dorsal or ventral aspects. This lobation is itself even open to variation, as it is much more pronounced in some than in others, and in one specimen may be said to be exaggerated. With this character there is a more or less corresponding transverse narrowing and longitudinal lengthening of the radial facets.

The variety has only been met with at Limestone Creek.

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[28] Ringueberg—*Loc. cit.*, pl. iii., f. 2. 2 *a-d*. Bather says this is a mere var. or synonym of *P. gemmiformis*, S. A. Miller.

[29] Miller—Indiana. 17th. Ann. Rept. Geol. and Nat. Resources for 1891 (1892), pl. xi, f. 4 and 5.

[30] Miller—*Loc. cit.*, pl. vi., f. 13-16.

[31] Miller—*Loc. cit.*, pl. vi., f. 17-23.

[32] Roemer—Silurische Fauna W. Tennessee, 1860, pl. iv., f. 6 *a* and *b*.

EXPLANATION OF PLATE XXXVII.

PISOCRINUS (?) YASSENSIS, *Eth. fil.*

Fig. 1. Side view of calyx, showing l. ant. R, ant. and l. post. Rs. —× 3.

„ 2. Ventral or summit view of calyx, exhibiting the radial processes. —× 3.

„ 3. Side view of calyx with the radianal (R′), the r. ant. and r. post, Rs.—×3.

„ 4. View of the dorsal surface, with the basal concavity, basals (united), and axial canal.—× 3.

„ 5. Longitudinal natural section, exhibiting the internal cast, and basals *in situ*.—× 3.

„ 6. Internal matrix cast.—× 3.

„ 7. Ventral or summit view of calyx, with the radial processes and a facet.—× 3.

„ 8. Left posterior radial (l. post. R), adhering to a fragment of matrix.—× 3.

„ 9. Right anterior radial (r. ant. R).—× 3.

„ 10. Radianal (R′).—× 3.

„ 11. Left anterior radial (l. ant. R).—× 3.

„ 12. Side view of more or less bowl-shaped calyx.—× 3.

„ 13. Side view of a similar specimen to fig. 12, showing sculpture. —× 3.

„ 14. Three stem ossicles, believed to be those of this species.—× 3.

P. (?) YASSENSIS, VAR. LOBATA, *Eth. fil.*

„ 15. Dorsal or basal view of a strongly pentalobate specimen.—× 3.

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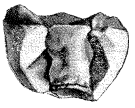

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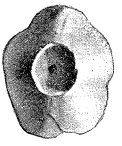

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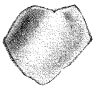

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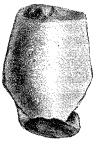

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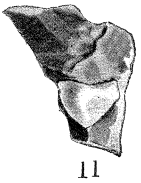

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