TETRAMERIC CRINOID COLUMNALS FROM THE ORDOVICIAN OF WALES

by S. K. DONOVAN

ABSTRACT. *Colpodecrinus forbesi* sp. nov. is founded on the evidence of unusual tetrameric crinoid columnals similar to those of *C. quadrifidus* Sprinkle and Kolata. The columnals of *C. forbesi* have quadrangular lumina, either tetrastellate or square, whereas those of *C. quadrifidus* are tetralobate.

THE echinoderm endoskeleton is constructed of numerous ossicles that are usually dispersed after death and which are sometimes sufficiently distinct to be of stratigraphic value. Such dissociated plates can sometimes be related to better known taxa based on whole specimens (e.g. see Donovan and Paul 1982). Although the majority of dissociated crinoid columnals lack distinctive features enabling more than a very general identification, some are sufficiently unique to be of some stratigraphic value (e.g. Rasmussen 1961). However, even columnals of a particular pelmatozoan group which appear to be extremely distinctive may prove to be homeomorphic with those of other stems (Broadhead and Strimple 1977).

Forbes (1848, p. 522) mentioned and illustrated an unusual echinoderm fossil collected by officers of the Geological Survey in North Wales during 1847 (text-fig. 1). This specimen is most remarkable in having fourfold symmetry with a definite suture between each lobe. Forbes tentatively interpreted this as the base of the theca of an unidentified cystidean. It is reinterpreted here as the external mould of a crinoid columnal of an unusual type which closely resembles the columnals of the species *Colpodecrinus quadrifidus* Sprinkle and Kolata, 1982. The almost unique tetrameric divison of each columnal into four individual calcite plates (meres) makes the generic identification possible. The only other crinoid to possess a tetrameric stem is the lower Arenig species *Ramseyocrinus cambriensis* (Hicks) (Bates 1968). However, *Ramseyocrinus* had a lobate stem whereas *Colpodecrinus* columnals are almost circular (text-figs. 1A, 2A, B, C).

Terminology used in this paper follows Ubaghs (1978).

SYSTEMATIC PALAEONTOLOGY

Class CRINOIDEA J. S. Miller, 1824
Subclass CAMERATA Wachsmuth and Springer, 1881
?Order MONOBATHRIDA Moore and Laudon, 1943
Family COLPODECRINIDAE Sprinkle and Kolata, 1982
Genus *Colpodecrinus* Sprinkle and Kolata, 1982

Type species. C. quadrifidus Sprinkle and Kolata, 1982.

Diagnosis of stem. Stem tetragonal, heteromorphic, tetramere lobes aligned with infrabasal centres, lumen lobes sutural.

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Colpodecrinus forbesi sp. nov.

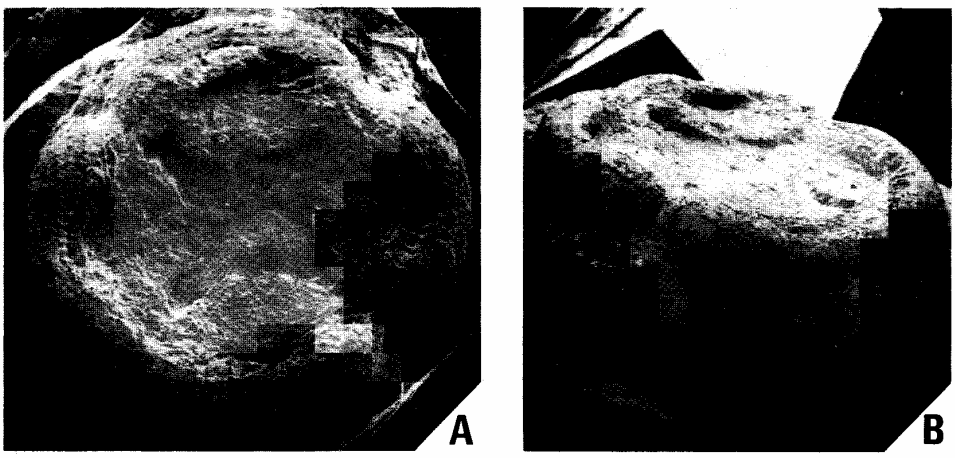
Text-figs. 1, 2A, B, D

v. 1848 Incertae sedis; Forbes, p. 522, pl. 23, fig. 14.

Derivation of name. After Professor Edward Forbes, who first figured the holotype specimen.

Diagnosis. A species of *Colpodecrinus* known from columnals only. Lumen tetragonal, with sharp angles; epifacet (latus) strongly convex.

Material. Forbes's original specimen, an external mould with no counterpart, is now registered as Institute of Geological Sciences GSM 48379 and is designated as the holotype. A second, poorly preserved specimen (British Museum (Natural History) E68627) has been collected by Dr. D. K. Wright of Kingston Polytechnic (text-fig. 2A, B). This paratype differs from the holotype in having fewer, coarser crenellae, a broader crenularium, and a square lumen.



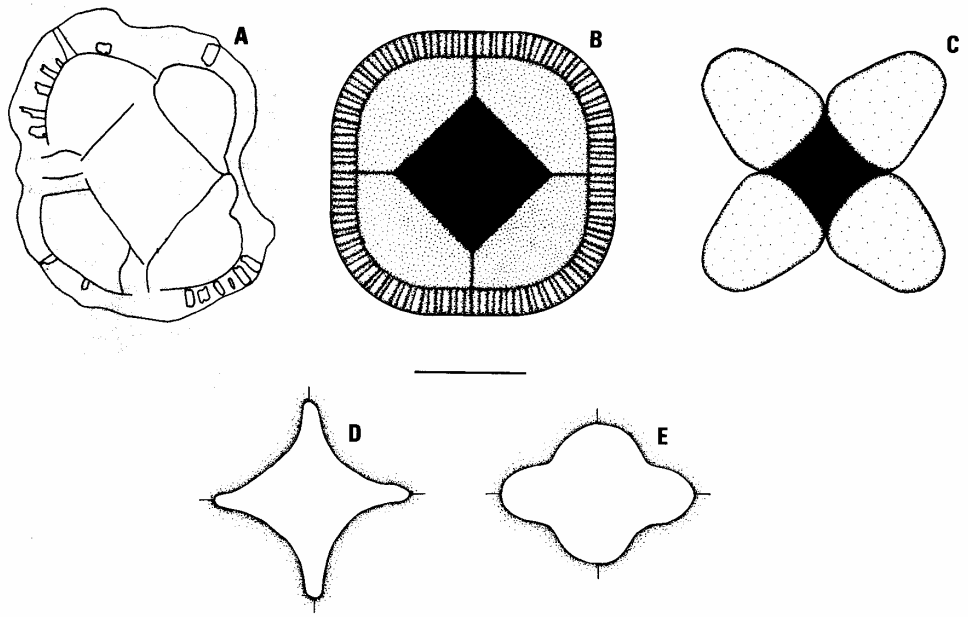
TEXT-FIG. 1A, B. Latex cast of the holotype of *Colpodecrinus forbesi* sp. nov., IGS GSM48379. SEM photographs. A, articular facet. B, oblique view to illustrate the epifacet curvature. Both ×8.

Horizon and locality. Forbes (1848) merely described the holotype as being from the 'Silurian' (i.e. including the Ordovician) of North Wales. The specimen label states 'Caradoc. 2 miles W of Ysputty Evans'. The old series Geological Survey one-inch map 75 NE has a patch of Bala Limestone at National Grid Reference SH 818 500 which apparently corresponds to this locality (S. P. Tunnicliff, pers. comm.). The paratype specimen is from the Glanrafon Beds at SH 7612 5104, south-east of Dolwyddelan, which Dr. Wright regards as being of Soudleyan age (pers. comm.).

Description. Columnal rounded, almost circular, composed of tetrameres. Lumen large, tetrastellate to square, occupying less than half the area of the facet, angles corresponding to the meric sutures of the columnal. Areola of each tetramere large, slightly depressed, triangular to lozenge-like in outline. Marginal symplexy, approximately fifteen to twenty-four crenellae per mere. Epifacet convex, semicircular in outline.

Discussion. The lumina of columnals of *C. quadrifidus* are orientated with the angles corresponding to the meric sutures of the stem. The lumen angles are well rounded with the lumen sides slightly infolded to give a petalloid appearance (text-fig. 2E). This differs from *C. forbesi*, which has strongly angular corners to the lumen (text-figs. 1A, 2A, B, D).

Ubaghs (1978) states that, apart from the unusual camerate genus *Cleiocrinus*, pentameric (quinquepartite) stems are limited to the inadunate crinoids. In addition, there are two rhombiferan cystoid genera with pentameric columnals, *Caryocystites* (Bockelie 1982) and *Echinosphaerites* (Barrande 1887; Bockelie 1981). Similarly, until the description of *Colpodecrinus*, the only crinoid known to have a tetrameric stem was the inadunate species *Ramseyocrinus cambriensis* (Hicks). The possession of a meric stem is undoubtedly a primitive feature but the relationship of *Colpodecrinus* to more advanced camerate genera with tetragonal, holomeric (i.e. composed of a single plate) columnals, such as *Xenocrinus*, is obscure.



TEXT-FIG. 2A, B. The paratype of *Colpodecrinus forbesi* sp. nov., BM(NH) E68627. A, camera lucida drawing of external mould of facet. B, reconstruction of facet. C, reconstruction of facet of *Ramseyocrinus cambriensis* (Hicks). D, E, lumina of *C. forbesi* (D) and *C. quadrifidus* (E). Scale bar represents 1 mm for A, B and 2·5 mm for C, D, E.

The ligamentary attachment between the meres of early crinoids seems to have been weak and their columnals are preserved either as pluricolumnals (due, presumably, to rapid burial) or as dissociated meres. For example, one specimen of *R. cambriensis* (NMW 29.308.G220) is a pluricolumnal that has started to disarticulate both between meres and at the quadquepartite sutures. The contact between meres increases in later crinoids such as *C. forbesi* (cf. text-fig. 2B and C), making them more likely to be preserved as single columnals.

C. quadrifidus is found only in the Upper Echinoderm Zone of the Upper Mountain Lake Member, Bromide Formation, Oklahoma, U.S.A. (Sprinkle and Kolata 1982), which correlates approximately with the upper Llandeilo–lower Caradoc of Europe (Williams *et al.* 1972; Fay and Graffham 1982). *C. forbesi*, based on the stratigraphic position of the paratype, is probably a slightly younger species.

The principal objection to erecting a new species based solely upon columnal evidence is the possibility that two or more crinoids may have identical stems. As has already been stressed, however, the columnals of *Colpodecrinus* are particularly unusual and such confusion is unlikely in the present example. It is also possible that we may be dealing with a previously unknown fragment from a species already described (in this case the type species). The longest attached stem fragment of *C. quadrifidus* is 16 mm long and the longest pluricolumnal 34 mm long. The articular facet morphology remains similar on both these stem fragments (Sprinkle and Kolata 1982). Although it is apparent that these stem fragments do not constitute the whole column, there is no evidence of a change in morphology in the available material. I conclude therefore that the differences in morphology, the spatial separation by the Iapetus Ocean, and the younger age of the Welsh specimens indicate that there are two distinct species of *Colpodecrinus*.

Two other crinoid species have been described from the Soudleyan stage in Britain, *Balacrinus basalis* (M'Coy) and *Iocrinus whitteryi* Ramsbottom, but neither is closely related to species from the Bromide Formation. Bates (1965, p. 357) has already discussed the division of the genus *Iocrinus* into two distinct geographical groups. The genus *Balacrinus* is monospecific. Additionally, a heterocrinid from below the Tramore Limestone (Ramsbottom 1961, p. 10) is of approximately the same age as the Upper Mountain Lake Member but no heterocrinids are known from the Bromide Formation. There is therefore little evidence for a general migration of Bromide crinoids to Britain.

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