

PEDICELLARIAE OF TWO SILURIAN ECHINOIDS FROM WESTERN ENGLAND

by D. BRYAN BLAKE

ABSTRACT. Pedicellariae have been discovered on the Silurian (Ludlovian) echinoids *Echinocystites pomum* and *Palaeodiscus ferox* from Leintwardine, England. All pedicellariae of both species are tridentate in form and simple in morphology. Most are interambulacral in position. Pedicellariae of *E. pomum* are abundant, all are probably three-valved, and of variable size. Those of *P. ferox* are relatively rare, apparently two-valved, and small in size. These pedicellariae, and an Australian occurrence, are the oldest known echinoid pedicellariae. The unusually large size of one fossil pedicellaria, combined with a general morphology of all pedicellariae intermediate between that of spines and modern pedicellariae suggests that pedicellariae were derived from spines.

WHILE studying materials in the Echinoderm Collections of the British Museum (Natural History), Dr. J. Wyatt Durham observed pedicellariae on specimens of the Silurian echinoid *Echinocystites pomum* and made latex casts of four specimens (three with pedicellariae) of this species and of two specimens of *Palaeodiscus ferox*. In subsequent studies, the writer observed the presence of pedicellariae on both specimens of *P. ferox*. All fossils are from the Ludlow Flags of Leintwardine, Herefordshire. These occurrences, with that of Philip (1963), who recorded pedicellariae associated with a lepidocentroid from rocks regarded as Ludlovian in age from New South Wales, Australia, represent the oldest known echinoid pedicellariae and thus merit detailed consideration.

The Leintwardine material has been studied by many workers including Gregory (1897), Thomson (1861), and Hawkins (1927) but the presence of pedicellariae has not been previously noted in spite of the fact that one of the specimens is the lectotype of *Echinocystites pomum*. Mortensen (1928–51) considered pedicellariae important in echinoid systematics in his monograph of the group but noted and regretted the rarity of fossil pedicellariae (op. cit., vol. 1, p. 33). He did not mention pedicellariae in his discussion of either of these two genera (op. cit., vol. 2, pp. 54–6, 60–3). Reports of the few described Palaeozoic pedicellariae are reviewed by Geis (1936).

Acknowledgements. Dr. Durham made available latex casts of specimens of *E. pomum* and *P. ferox*; the original external moulds of these specimens are in the collections of the British Museum (Natural History) in London. Dr. Porter M. Kier loaned a specimen of *E. pomum* belonging to the Geological Survey of Great Britain which he had prepared for study and identified. Thanks are due to Dr. R. P. S. Jefferies and the authorities of the British Museum (Natural History) for permitting Dr. Durham to prepare latex casts of their specimens and to Dr. Jefferies for information on the histories of some of the specimens.

Echinocystites pomum

All pedicellariae appear to be of the tridentate type, and all probably originally had three valves. ('Tridentate' is one of the four basic types of pedicellariae; most, but not all, have three valves (Mortensen, op. cit., vol. 2, p. 33).) They are numerous; sixty were counted on one incompletely preserved test. The blades of a pedicellaria are in contact

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throughout their length; they are slender and elongate with a circular cross-section, and are attenuated distally. The blades bear longitudinal striae but apparently no marginal dentition; their general morphology is essentially identical to that of the spines. The bases are triangular and grade evenly into the blades. Unlike blades of many tridentate pedicellariae, there is little or no constriction near the base. The interior of the base is massive, apparently without a sharp keel-like apophysis. Many heads are located near to tubercles suggesting that stems were lacking, very short, or had contracted upon death. Small pedicellariae are most common, but a considerable range in size exists; there are no distinct size classes. Bases range in diameter from under 0.25 mm. to about 1.75 mm. In general, head length in essentially complete examples ranges from about 0.75 mm. in specimens with small bases to about 3.75 mm. on a specimen of base diameter of 0.75 mm. However, one unusually large pedicellaria (text-fig. 1A) has a base diameter of 1.75 mm. and a length slightly over 11 mm. Blade length is not necessarily directly proportional to base diameter because blade length on bases of a given size is variable.

Only two valves are visible on a number of pedicellariae. However, the great variability of preservation of the three-valved forms and the essential similarity of morphology between those with three valves and those with only two implies that the apparent two-valved pedicellariae are probably incompletely preserved typical three-valved pedicellariae.

With two possible exceptions, all pedicellariae are interambulacral in position. They are widely distributed on the interambulacral columns; on one specimen, pedicellariae occur on plates which border the madreporite, while on another, pedicellariae occur on plates near the peristome. They may be densely grouped, occurring on neighbouring plates, or in some cases, more than one on a single plate. There appears to have been no areal restriction of pedicellariae of certain sizes, for large and small pedicellariae occur on neighbouring plates.

Material examined. Casts of B.M. (N.H.) BMNH 40158; E34352 (lectotype); 40156; GSM 102622.

Palaeodiscus ferox

Pedicellariae are rare on specimens of this species; only two well-preserved pedicellariae have been observed on each of the two specimens. In addition, a number of doubtful pedicellariae are present.

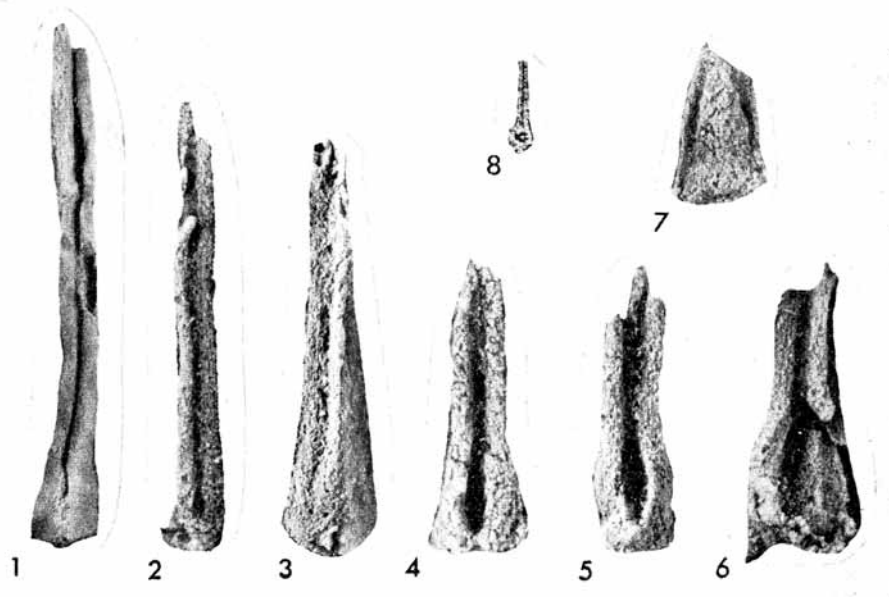
All pedicellariae are tridentate in form but with only two valves; there is no evidence for a third valve. The heads are elongate, triangular, and rounded proximally. The blades, like those of *Echinocystites*, are morphologically very similar to the spines; they are slender, elongate, circular, or sub-circular in cross-section, with longitudinal striae, and in contact throughout their length. There appears to have been no marginal dentition. Bases appear to have been triangular and only slightly enlarged. The heads are very small with a basal dimension of approximately 0.2 mm. and a length of about 0.8 mm. One of the well-preserved pedicellaria is ambulacral in position located near the groove between the rows of ambulacral plates; the others are interambulacral in position.

Although relatively few pedicellariae can be identified, the similarity of morphology between the blades and the spines suggests more pedicellariae may be present but are incompletely preserved or exposed and therefore unrecognized.

Material examined. Casts of *Palaeodiscus ferox*, BMNH E34360 and E34362.

DISCUSSION

The presence of previously unrecorded pedicellariae, in one case abundant, on much-studied echinoid species suggests fossil pedicellariae are probably more common than



TEXT-FIGS. 1A-G. *Echinocystites pomum* pedicellariae. 1, GSM 102622, $\times 7.5$. 2-5, 7, B.M. 40156, $\times 20$. 6, from B.M. E34352, $\times 20$. H. *Palaeodiscus ferox* pedicellaria. B.M. E34360.

previously has been thought. Further, because two families of Silurian echinoids are involved, evolution of these structures must have been relatively early and fairly widespread.

In many features, the Silurian pedicellariae are spine-like. The valves are circular in cross-section, the surface ornamentation is similar to that of the spines, marginal dentition is absent, the base of the blade is not strongly constricted, blades of a pedicellaria are in contact throughout their length, the bases are massive without a sharp apophysis. Further, one unusually long spine-like pedicellaria is present. These features render the Silurian pedicellariae morphologically intermediate between spines and modern types of pedicellariae and suggest the possibility that pedicellariae were derived from spines.

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