# Association of Crinoids with *Callixylon* in the Lower Ohio Shale.

By

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(With 2 figures.)

The Geological Museum of the Ohio State University has recently received an unusually large and well-preserved fossil log from the lower part of the Ohio shale (Upper Devonian) of Delaware county, Ohio. It is a portion of a trunk of the well-known species *Callixylon newberryi* (DAWSON) consisting of 13 pieces which fit together to form a slightly recurved log 11 feet, 7 inches long. In cross section it is considerably compressed and measures about 7 × 21 inches at the larger end, 5 × 14 at the smaller. Externally it is more or less completely covered by a thin jet-like layer of bituminous material and is marked transversely by „nodes" filled mostly with dense, granular pyrite and quartz, longitudinally by low ridges resulting from compression, the whole resembling closely the other large specimens of this species described by ARNOLD.[1] Internally the woody structure is in part silicified and of a deep brown color, and in part pyritized. The original cellular structure is well preserved and shows in thin sections the secondary wood structure typical of the species.

The notable thing about this specimen, however, is not its size or occurrence, but the presence of numerous fragments of crinoid stems on the trunk. These fragmental stems, which are pyritized and occur in five places (fig. 1 a and b), consist of from a few segments to one continuous stem 16 inches in length that extends from one transverse crack across the next one.

Although it is difficult to identify the species and even genera to which isolated stems of crinoids belong, in this case it is possible to be rather specific. The deeply concave and strongly striate faces of the segment ossicles are typical of the genus *Melocrinus*, a wide-spread Devonian camerate crinoid. Only one species of this genus is now known to occur in the Upper Devonian rocks of Ohio, — *M. bainbridgensis* HALL & WHITFIELD. The types of this species are in the Ohio State University Geological Museum and have been recently redescribed by Miss

GOLDRING.[2] They were originally described as coming from a 6-inch calcareous layer near the base of the „Huron Shales" near Bainbridge, Ross county, Ohio. This horizon is almost certainly in the Olentangy

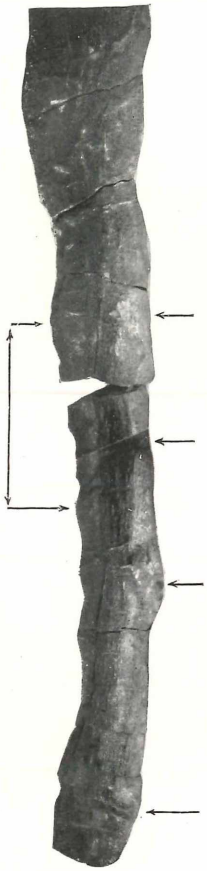


Fig. 1 a. Log of *Callixylon newberryi*, 11 feet, 7 inches long, in the Geological Museum of the Ohio State University. Arrows point to locations of crinoid stems.

Fig. 1 b. Stem of *Meloerinus* on *Callixylon newberryi*. Left end of the longest stem. Note quartz-pyrite-filled shrinkage crack to the left with disarticulated end of the stem. × 1.

shale. Elsewhere stems and plates of this species occur abundantly in a similar layer in the middle of the Olentangy near Delaware, Ohio.[3] Crinoid stems have been reported from the concretions at the base of the Ohio shale in Delaware county by WESTGATE.[4*]

* Examination of one of these concretionary nuclei in Dr. WESTGATE's collection at Ohio Wesleyan University shows a tangled bundle of many small crinoid

No direct attachment of the *Melocrinus* stems to the log of *Callixylon* has been detected, but there are reasons for believing that attachment of some kind did exist at the time of burial. The conditions under which black muds or shales accumulate, although not always exactly the same, are admittedly uniformly inhibitive to organic life with the exception of the few well-known types. Crinoids are not known to occur elsewhere in the Ohio shale with the exception of the concretions already mentioned. Other occurrences of species of *Melocrinus* are not in black shales but in sediments representing purer marine conditions of deposition. In New York state *Melocrinus clarkei*, a species very closely related to *M. bainbridgensis*, occurs in a calcareous layer in the lowest part of the West River shales just above the Genundewa limestone band.[5] Further, the pieces of *Callixylon* now occurring as fossils certainly floated as part of the nekroplankton into the areas of black mud deposition.

A recent note by WICKWIRE[6] describes an occurrence of crinoid stems on fossil wood in the New Albany black shale near Lexington, Indiana, but does not indicate the identity of either stems or wood. Of interest, however, is the fact that all of the hundred or more stems occurring on the same side of a small piece of wood (16 × 13 × 8 cm.) are oriented in the same direction, lengthwise of the log with which they are associated. No definite conclusion is reached by WICKWIRE, but he suggests that little or no movement after death of the crinoids is indicated by the well-articulated stems.

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stems, 2,5–3,0 mm. in diameter, thoroughly calcitized and determinable only as probably of the *Melocrinus* type, but smaller than those of *M. bainbridgensis*.

In the Paleontological Museum of the University of Cincinnati there is a portion of a large log of *C. newberryi* from the New Albany black shale of Clark County, Indiana, on which there is a long crinoid stem lengthwise of the log, of the same diameter as those in the Delaware County, Ohio, black shale concretions.

* Through the kindness of Dr. WICKWIRE I have been able to examine the two specimens described by him. The wood is thoroughly silicified and consists of two fragments of *C. newberryi*, as determined by thin section. The larger piece has a layer 2 cm. thick of articulated stems averaging 4 mm. in diameter of the *Melocrinus* type, but slightly smaller than average *M. bainbridgensis*. They are silicified, solidly cemented together by flint and show no trace of attachment. Originally the mass of stems must have been much larger. The smaller fragment has most of one side covered by an uneven layer of disarticulated crinoid stems segments of the *Melocrinus* type averaging 6 mm. in diameter, ranging downward in size to 1,5 mm., with a few articulated sections 12 to 45 mm. in length. The flint matrix is not so well developed. On exposed surfaces of the wood there are strong impressions of segments made before fossilization while the wood was soft from immersion. There is no trace of other types of crinoid ossicles.

The smaller-sized stems of the large piece are very much like those found in the concretions near the base of the Ohio shale and probably represent a distinct species.

In the „Schwarzer Jura" (Liassic) of Württemberg there occur driftwood logs to which are attached splendid completely pyritized specimens of *Pentacrinus*. According to WALTHER,[7] the black muds of the Posidonienschiefer were deposited in an arm of the sea in which the upper water strata were well-oxygenated whereas the lower strata and bottom were foul. In the upper layers lived abundant plankton as well as ammonites, belemnites, fish, ichthyosaurs, with scattered floating logs bearing on their under surfaces colonies of pentacrinids. BERINGER[8] speaks of these crinoids as pseudoplankton with secondary attachment, a condition between sessility and vagility. Previously the same author, as well as others, had indicated the absence of any evidence of the Posidonienschiefer fauna having been indigenous to the area in which it is now found.[9]

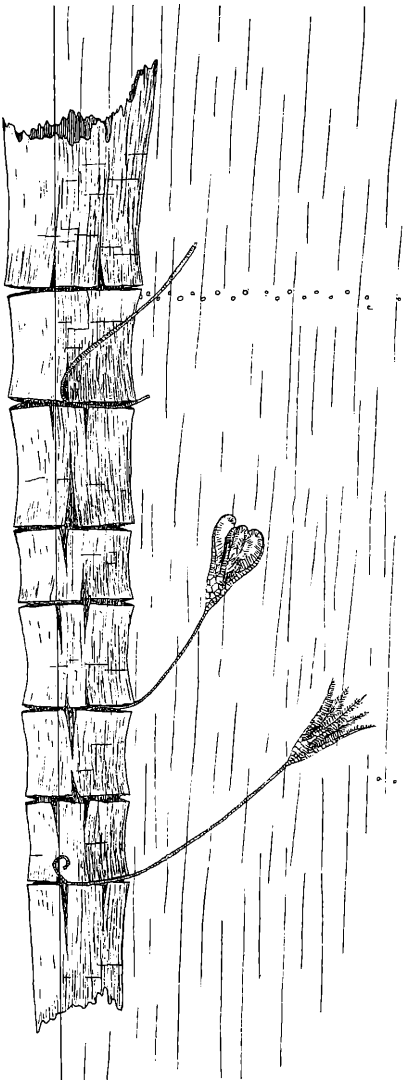

Fig. 2. A log of *Callixylon newberryi* with *Melocrinus bainbridgensis* drifting in the Ohio shale sea.

Turning to the living stalked crinoids it appears that comparatively little is known of the mode of life of these forms. It is fairly certain, however, that most living pentacrinids are attached only in the younger stages and become detached in maturity to lead a semi-free existence near the bottom. Some specimens of fixed mature individuals, however, have been found. In this connection CARPENTER[10] remarks that "the possibility of their becoming attached to floating timber does not seem so very distant. they may have been attached above by a slightly spreading base as on the modern telegraph cables; or, on the other hand, they may have been drifted in large numbers by the currents after detaching themselves from their original base of attachment." It is con-

ceivable that the Ohio shale crinoids, having originated elsewhere in a different environment, may have become secondarily fastened to the floating logs of *Callixylon*. Most of the stems on the large log occur very close to or on the pyrite-quartz filling of the transverse shrinkage cracks[11] of the wood, a circumstance which suggests that the trailing tips of the stems of drifting, detached *Melocrinus* may have become wedged in the openings (fig. 2).

The data now at hand are insufficient to establish clearly the proper significance of the association of crinoid stems with fossil wood in the Ohio shale, but some suggestions can be made:

The logs of the terrestrial *Callixylon newberryi* drifted into a well-oxygenated marine area; upon some of them settled larvae of *Melocrinus (M. bainbridgensis ?)* which matured and remained attached. The log, with its freight drifted on into the area of black mud deposition, became waterlogged and sank to the bottom, where the noxious conditions soon asphyxiated the crinoids. Or, possibly the crinoids died as the log drifted into the black mud area, the crowns became detached and the stems dangled limply from the log as it floated. If the black muds were accumulating in fairly deep water, as are those of the Black Sea today, the upper water strata may have been sufficiently aerated to permit continued existence of the crinoids as epiplanktonic organismus as long as the log remained afloat. But if the muds were being deposited in very shallow water as are those of parts of the Baltic coast the crinoids must have died as soon as they were carried in. There is also the possibility that if the crinoids became attached to the logs more or less by accident in the manner already suggested, they may have voluntarily severed the connection, the logs drifting away with the distal portions of adherent stems. In any event, it is clear that connected to the basins of black mud deposition in central Ohio during the early Upper Devonian there were areas of pure marine conditions where crinoids flourished.

The paleogeography of the Upper Devonian period in the Ohio valley region is very poorly understood, mainly because of imperfect knowledge concerning the age relationships of the black shale terranes. Some data on the position of the land and water areas should be forthcoming from a study of the distribution of species of *Callixylon*. *C. newberryi* occurs in the middle and upper parts of the New Albany shale of Indiana, the Ohio shale of Ohio, the New Albany and "Chattanooga" shales of Kentucky and the Antrim shale of Michigan. Several other species occur in black shales (Genesee) and sandstones (Shumla-Northeast) to the east in New York. This distribution suggests that the latter trees lived on the low forelands of northwestern Appalachia, and that *C. newberryi* lived on the lowlands to the west of the so-called Penn-York embayment.

## Abstract.

A large fossil trunk of the Upper Devonian cordaitan tree, *Callixylon newberryi*, in the Ohio State University Geological Museum, from the lower Ohio shale of Delaware county, Ohio, is particularly interesting because of associated crinoid stems of the genus *Melocrinus*. Crinoids are not known to occur in the black Ohio shale and this association suggests some sort of attachment of the crinoids or their stems to the log while it was floating, and may afford some data on the paleogeography of the areas of black shale deposition.

## Literature.

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