Occurrences of Scyphocrinites loboliths in the Upper Silurian Upper Setul limestone of Pulau Langgun, Langkawi, Kedah and Guar Sanai, Berseri, Perlis

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Abstract: Scyphocrinites loboliths, the bulbous floats attached to the roots of a Late Silurian to Early Devonian crinoid, have been found within the Upper Silurian Upper Setul limestone along the beach north of Telok Memplam, Pulau Langgun, Langkawi, Kedah and in limestone blocks from an earth quarry at Guar Sanai, near Guar Jentik, Berseri, Perlis. The loboliths belong to the plated type characterized by having plated chamber walls, fewness of internal chambers and the presence of chamber openings near the axil of the primary root.

INTRODUCTION

Exposed about 300m northwards along the beach at Telok Memplam on Pulau Langgun (loc. 1 in Figure 1), Langkawi, upsection of the Lower Detrital Member of Jones (1981) is a bed of what appears to be nodular limestone (Figure 2) within the Upper Silurian Upper Setul limestone. Although the globular outlines of calcite rims enclosing sparry calcite infills gave some indication that they were probably fossils of some sort, they had remained a puzzle to many geologists who had examined them as we found it difficult to place them within any of the commonly known fossil groups. This situation persisted until a fortuitous visit to an earth quarry (Figure 3) at Guar Sanai (loc. 2 in Figure 1), near Guar Jentik, Berseri, Perlis in October last year enabled the author and Drs. L.R.M. Cocks and R. Fortey of the British Museum of Natural History to examine two loose blocks of limestone with similar fossils weathering out on the exposed bedding surfaces. Prof. C.R.C. Paul of Liverpool University identified them as the floats of Scyphocrinites from some photographs of the specimens. A third block was discovered on a later visit to the site in March 2001.

FIELD OCCURRENCES AND STRATIGRAPHIC POSITION

The first locality (N06° 26.822', E 099° 53.149') is probably the band of nodular limestone marked by the number 21 in Jones' (1981, Figure 19) map of the northwest coastline of Pulau Langgun. It is stratigraphically placed within the Upper Silurian Upper Setul limestone bracketed between the Lower Silurian Lower Detrital Member and the Lower Devonian Upper Detrital Member. Its exact stratigraphic distance above or below the detrital members cannot be determined as the section is discontinuous and disrupted by several tectonic breaks. It is important to note, however, that the limestone band in Langgun is close to the overlying basal beds of the Upper Detrital Member which are crowded with dacyroconarid tentaculitids and associated lamellibranchs and scattered graptolites of the Monograptus hercynicus group (Jones, 1981, p. 66). The graptolites belong to the Monograptus uniformis Zone at the base of the Gedinnian Stage of the Lower Devonian. The tentaculitids include Nowakia and Styliolina that give a Early Devonian age.

The second locality (N06° 33.138', E100° 12.442') on the Perlis mainland is an earth quarry at the foot of a small hill that is the southermmost ridge accessible from 1.35 km south of the junction with Jalan Guar Jentik (R118 Road) along the R121 Road to Kangar. It is not formally named in the topographic map but the owner of the house adjacent to the quarry, Mr. Drasman b. Jaffar (pers comm) gave its name as Guar Sanai. As can be seen from Figure 3, slabs of fossiliferous limestone appear to have fallen off several broken blocks in the quarry face. Its precise stratigraphic position again appears to be indeterminable due to the faulted nature of the outcrop but black shales (030°/55°SE) crowded with tentaculitids are again found nearby in the quarry just south of the Scyphocrinites limestones while low-dipping weathered mudstones containing Posidonia are found just west of the blocks. The limestone outcrop nearest the blocks has steeply dipping beds (040°/78°ESE). The tentaculitid shales are younger than the fossiliferous limestones and are not likely to be too many meters upsection of the Scyphocrinites-bearing bed. The contact between the Upper Setul limestone and the base of the Upper Detrital Member has been described as conformable by Jones (1981) in Pulau Langgun but the detailed stratigraphy could not be worked out due to the intense and complicated folding that had affected the upper part of the sequence.

SCYPHOCRINITES LOBOLITHS

Loboliths are the bladder-like roots of a floating crinoid named Scyphocrinites (Haude, 1972). Hall (1879) first introduced the name Camarocrinus (i.e. chambered crinoid)
for the large, bulbous, chambered structures found at several localities in Lower Devonian rocks of North America, but also known since the middle of the 19th century from the Upper Silurian of Bohemia under the vernacular French name of lobolithes (Ubaghs, 1978). Hall also recognized their real nature as holdfasts of a crinoid, which now is determined almost certainly to belong to the camerate Scyphocrinites. Some bulbs are reported to reach or even exceed 20 cm in diameter. Scyphocrinites is believed to have floated upside down with the bulbous float at the surface and the crown suspended below as illustrated in Figure 4.

The initial difficulty in identifying the large globular fossils in the Telok Memplam limestone bed is understandable considering that bulbous holdfasts of Scyphocrinites have been variously interpreted by the following authors quoted in Ubaghs (1978, p. T93) as: - bodies of organisms belonging to an independent class of echinoderms (Barrande, 1887), as cystoids (Sun and Szetu, 1947), as genital sacs (Jäckel, 1904), brood-pouches or receptacles (Haeckel, 1896), pathologic cysts induced by myzostomids (Haeckel, 1896; Ehrenberg, 1926), inflated roots serving for permanent or temporary settlement on muddy bottoms (Springer, 1917) and floating organs (Hall, 1879; Schuchert, 1904; Yakovlev, 1953; Stukalina, 1967; Haude, 1972). Ubaghs (1978) favours the last hypothesis for it is consistent with the morphological characteristics of the bulbs, their worldwide distribution, approximation to a mechanical model (paradigm) for their function, and calculation of their buoyancy as attachments to living crinoids which floated on the surface or at shallow depths in widespread ancient seas as proposed in Haude (1972).

According to Haude, there are two types of Camarocrinus loboliths. The first (Figure 5) is known as the cirrus type with walls of dense three-layered tetracommata of numerous spicule-like skeletal elements called cirrals. The second type (Figure 6) differs from the first in its plated appearance, the occurrence of a short projecting collar around the stem base and presence of primary roots, associated with fewness of chambers (usually 4 to 7, apparently 11 at most), and the existence of an opening to each chamber in the axil of the primary roots (Ubaghs, 1978). The fewness of chambers (Figures 7, 8 and 9), plated appearance (Figure 10), and presence of openings to the chambers (Figure 11) seen in the specimens from Guar...
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Sanai place them undoubtedly under the second type that is called the plated type.

The taxonomic classification of Scyphocrinites in the Treatise on Invertebrate Paleontology Part (T) Echinodermata is given below:

- Class: CRINOIDEA Miller 1821
- Subclass: CAMERATA Wachsmuth & Springer 1885
- Order: MONOBATHRIDA Moore & Laudon 1943
- Suborder: GLYPTOCRANINA Moore 1952
- Superfamily: MELOCRINITACEA d’Orbigny 1852
- Family: SCYPHOCRINITIDAE Jaekel 1918
- Genus: SCYPHOCRINITES Zenker 1833

DESCRIPTION OF MATERIAL

Material from Telok Memplam, Pulau Langgun, Langkawi, Kedah

The limestone bed (Figure 2) containing Scyphocrinites in Pulau Langgun is about 30 cm thick. It is light brown in colour when weathered and grey when fresh. The matrix is of very fine grain micrite. The fossils stand out quite distinctly as orange coloured globular structures or irregular nodular micrite-filled lumps enclosed within darker coloured brownish walls. Some of the floats are more than 12 cm in diameter. The chamber walls are about 1.5 mm thick for the external wall to paper-thin for the internal partitions. Some specimens appear to have a thick rim of more resistant calcite about 1 cm thick extending into the chamber from the inside of the walls (Figure 12). The rims are pitted and could be associated with organic extensions into the chambers. Similar rims are also present in one of the loboliths from Guar Sanai (Figure 8). Extensive recrystallisation has destroyed most of the detailed wall structures leaving neither cirrus nor plates on the outer irregular pitted surfaces of the specimens.

The loboliths from Telok Memplam tend to be concentrated at the bottom of the bed with the larger specimens below and the smaller and more irregular broken specimens above (Figure 2). The chambers within the unbroken larger fossils are filled with coarse white sparry calcite that weathers to an orange colour when exposed while the smaller broken specimens are filled with grey micrite. This indicates that some of the floats were empty of sediments and thus allowed sparry calcite to precipitate in them after deposition. Gravity separation had caused the bigger, perhaps water-filled, floats to sink to the bottom while the lighter smaller floats settled on top of them. Erosion of the top layer probably damaged the small floats and allowed for micrite to be deposited within the broken chambers.

Material from Guar Sanai, Berseri, Perlis

The material from this locality comes from three big loose blocks of limestone at the foot of the quarry. Two of the blocks had many Scyphocrinites floats clearly exposed on their weathered surfaces while the third had only one specimen exposed on its surface. The fresh limestone is grey in colour and it weathers to light brown on the surfaces that were probably covered with soil prior to being exposed by earth excavation at the quarry. The fossils are more resistant to weathering and stand proud from the limestone surfaces.

The larger of the two more fossiliferous blocks was 1.4 m long by 0.8 m wide and 0.3 m thick (Figure 7). It was made up of three beds of greyish limestone, 10 cm, 6 cm
and 15 cm thick, separated by thin 2 and 1 cm thick irregular beds of brownish marly limestone. Fifteen specimens of *Scyphocrinites* floats were found on the surface of the 10 cm thick topmost bed. Very few specimens were found in the bed below it. A triangular block (Figure 8) measuring 0.8 m by 0.8 m and 15 cm thick was split off from the top of this block and taken back to the Geology Department of the University of Malaya for further study and display. The second block (Figure 9) measures 1.1 m by 0.6 m and is 0.25 m thick. It has 16 floats on its surface. Both the blocks were transported to Mr. Drasman’s compound by an excavator for safekeeping. The third block had only one float exposed on its surface at the quarry. A beautifully preserved float with four inflated chambers (Figure 13) was exposed when the marly layer beneath was split to try to extract the surface specimen. The isolated underlying specimen was further split to reveal 5 chambers when an attempt was made to extract it from the block.

Crinoid stems and disarticulated ossicles (Figure 10) are found together with the *Scyphocrinites* loboliths exposed on the weathered bedding surfaces of the limestone, probably indicative of a higher energy environment of deposition than for the Telok Memplam bed. Some of these ossicles have a distinct star-shaped lumen while others have a wide pentagonal lumen that match those illustrated for *Scyphocrinites* in the Treatise (Figure 292, p. T490).

Walls and internal partitions are clearly visible in many of the floats. The wall plates are between 1 to 3 mm thick with 1.5 mm being most common while the internal partitions are usually less than 0.5 mm thick. Wall plates of various sizes up to 5 mm across can be seen in some of the specimens although some etching and recrystallisation had affected most of them.

Some specimens within the blocks have sparry calcite infills while some are filled with clay or micrite. The largest float found was 16 cm in diameter and 7 cm high although its non-globular section perpendicular to bedding indicated that it was somewhat flattened. These specimens from Guar Sanai have a less rounded and more “petalloid” shape with more (up to six) chambers exposed compared to the Telok Memplam floats and could have suffered greater compaction. The flower-like specimen about 10 cm across...
DISCUSSION

Prof. C. R. C. Paul (pers comm) commented that Scyphocrinites floated upside down with the bulbous float at the surface and the cup suspended below. The floats probably separated from the stem and crown after death and continued to float for a long time after separation. Beds crowded with floats are known pretty widely and these are two of them.

The cosmopolitan distribution of Scyphocrinites as a pelagic crinoid provided with float and its abrupt appearing and disappearing within a relative short time span makes it an exceptionally precise age indicator useful for correlation of remotely separate marine deposits throughout the Late Silurian to Early Devonian world. The Treatise (p. T489) records Scyphocrinites from Europe, North America, North Africa and Asia. We are fortunate that such beds are found in Malaysia and due to its widespread nature we would probably find more of such occurrences in other Late Silurian limestones in northern Malaya, southern Thailand and other parts of Southeast Asia.

CONCLUSIONS

The discovery and identification of Scyphocrinites loboliths as floats attached to the roots of crinoids in the Upper Setul limestone of Pulau Langgun and Guar Sanai have solved the puzzle of what were these unusual fossils. Its presence has affirmed the Late Silurian date assigned to the limestone by previous workers. It also indicates open marine connections to and permits correlation with the other parts of the Late Silurian to Early Devonian seas in Europe, North America, North Africa and Asia.

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