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Discovery of scyphocrinoid loboliths, the unusual floats of a crinoid in the Silurian-Devonian Upper Setul Limestone of northwest Peninsular Malaysia

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ABSTRACT Scyphocrinoid loboliths, the bulbous floats attached to the roots of a group of large Late Silurian to Early Devonian (about 410 million years old) crinoids, have been found within the top part of the Upper Setul limestone along the beach north of Teluk Memplam, Pulau Langgun, Langkawi, Kedah and in limestone blocks from an earth quarry at Guar Jentik, Berseri, Perlis, northwest Peninsular Malaysia. The loboliths belong to the plate type characterized by having plated chamber walls, fewness of internal chambers and the presence of chamber openings near the axil of the primary root. Plate loboliths belong to species of *Marhoumacrinus* and *Camarocrinus* of uppermost Pridolian to lowermost Lochkovian age and occur above cirrus loboliths which are of Pridolian age only.

Introduction

Exposed about 300m northwards along the beach at Teluk Memplam, Pulau Langgun, Langkawi, Kedah, upsection of the Lower Detrital Member of Jones (1981) is a bed of nodular limestone within his 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 at Guar Jentik, Beseri, Perlis in October 2000 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. A preliminary report of the discovery was published in the Proceedings of the 2001 Annual Conference of the Geological Society of Malaysia (Lee, 2001).

Field occurrences and stratigraphic position

The first locality (N06^{o} 26.822', E 099^{o} 53.149') is the band of nodular limestone marked by the number 21 in Jones' (1981, Fig. 19) map of the northwest coastline of Pulau Langgun. This limestone band in Langgun is close to the overlying basal beds of the Upper

Detrital Member which are crowded with dacryoconarid 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 Devonoian. The tentaculitids include *Nowakia* and *Styliolina* that give an 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 southernmost ridge accessible from 1.35 km south of the junction with Guar Jentik Road (R118 Road) along the R121 Road to Kangar. Slabs of fossiliferous limestone appear to have fallen off several broken blocks in the quarry face. It also underlies black shales crowded with tentaculitids.

Scyphocrinoid loboliths

Loboliths are the bladder-like roots of floating scyphocrinoids. Haude (1992) separated the stratigraphically older, more primitive cirrus lobolith (Pridolian only) which belongs to *Scyphocrinites* and *Carolicrinus* from the younger plate lobolith (uppermost Pridolian – lowermost Lochkovian) belonging to *Marhoumacrinus* and *Camarocrinus*. 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 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 Fig. 1.

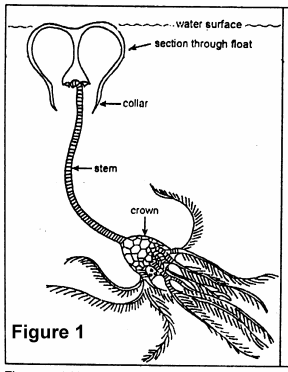

Figure 1. Life position of *Scyphocrinites* as suggested in Haude (1972). Hypothetical section shows bladder-like chambers with collar wall detached from stem.

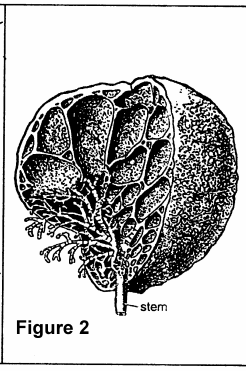

Figure 2. Cirrus type *Scyphocrinites* lobolith with many chambers and cirral chamber walls (modified from Haude, 1972).

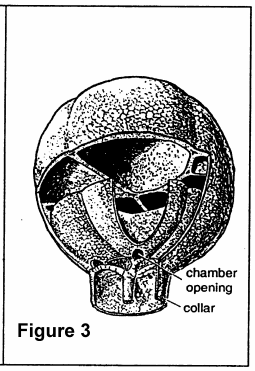

Figure 3. Plated type *Scyphocrinites* lobolith with few chambers, plated outer wall, chamber openings and collar around stem base (modified from Haude, 1972).

According to Haude (1972), there are two types of *Camarocrinus* loboliths. The first (Fig. 2) is known as the cirrus type with walls of dense three-layered latticework of numerous spicule-like skeletal elements called cirrals. The second type (Fig. 3) 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, plated appearance, and presence of openings to the chambers seen in the specimens from Guar Jentik place them undoubtedly under the plate type.

Materials

Material from Teluk Memplam, Pulau Langgun, Langkawi, Kedah.

The micritic lobolith-bearing limestone bed in Langgun is about 30 cm thick. It is light brown in colour when weathered and grey when fresh. 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.

MATERIAL FROM GUAR JENTIK, 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 numerous scyphocrinoid 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. It was made up of three beds of greyish limestone, 10 cm, 6 cm and 15 cm thick, separated by thin 2 and 1cm thick irregular beds of brownish marly limestone. Fifteen loboliths 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 measuring 0.8 m by 0.8 m and 15 cm thick was splitted 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 measures 1.1 m by 0.6 m and is 0.25 m thick. It has 16 floats on its surface. The third block had only one float exposed on its surface at the quarry. A beautifully preserved float with four inflated chambers) was exposed when the marly layer beneath was splitted to try to extract the surface specimen. The isolated underlying specimen was further splitted to reveal 5 chambers when an attempt was made to extract it from the block.

Crinoid stems and disarticulated ossicles are found together with the loboliths exposed on the weathered bedding surfaces of the limestone, probably indicative of a higher energy

environment of deposition than for the 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 of Invertebrate Palaeontology (Fig. 292, p. T490). More importantly, some sections of stems associated with the loboliths have an elliptical cross-section which according to Haude (1992) is found only in sections of stems away from the floats or crowns belonging to the plate type. 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. Recrystallization and etching have rendered most wall plates indistinct but some suggestion of the double-layered wall structure of the plate type lobolith can still be detected.

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 Jentik have a less rounded and more "petalloid" shape with more (up to six) chambers exposed compared to the Memplam floats and could have suffered greater compaction. The flower-like specimen about 10 cm across with six petal like lobes on the outside and smaller petal like chamber openings each measuring 2.5 cm long and 1 cm wide in the middle was useful in identifying it as the plate type lobolith of Haude (1972).

Discussion

Scyphocrinoids 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. Haude (1992) proposed that the premortal plate loboliths of *Marhoumacrinus* or *Camarocrinus* floated near or beneath the water surface with lots of epizoic encrusting roots of small scyphocrinoids and several colonies of *Hederella* attached. The postmortal lobolith divested of its long stem and crown was less loaded and floated with its rounded distal part above the water level. Postmortal floats would settled with their necks facing upwards as would be expected if empty jars are filled with water and settled to the bottom.

The cosmopolitan distribution of pelagic scyphocrinoids 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 scyphocrinoids from Europe, North America, North Africa and Asia. It is fortunate that such beds have been discovered in Malaysia and due to its widespread nature we would probably find more of such occurrences in other Silurian-Devonian boundary limestones in northern Malaya, southern Thailand and other parts of Southeast Asia including Yunnan.

CONCLUSIONS

The discovery and identification of plate scyphocrinoid loboliths as floats attached to the roots of crinoids in the Upper Setul limestone of Teluk Memplam and Guar Jentik have solved the puzzle of what were these unusual fossils. Its presence has further refined the

age of the top part of the Upper Setul limestone as uppermost Pridolian to lowermost Lochkovian. 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 particularly Yunnan in Asia.

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