101. Occurrences of the *Machaeridia* in Japan and Malaysia^{*)}

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The *Machaeridia* proposed by Withers, 1926, for an independent group perhaps of the Echinodermata which had long been referred to the Cirripedia, Arthropoda since 1865. In Moore's Treatise it is tentatively included in the Homalozoa, Echinodermata (Ubaghs, 1967), as done by Whitehouse (1941).

In the Orient Reed (1915) was the first to report an occurrence of *Turrilepas* sp. in the Lower Silurian Panghsa-pyge beds of the Northern Shan states, Burma. Later Withers (1926) proposed *Lepidocoleus birmanicus* for it. Subsequently *Machaeridia* remains were found in South Korea as follows:

Plumulites chikunensis Kobayashi, 1934. Middle Ordovician (Llandeilian) Chikunsan shale.

Plumulites primus Kobayashi, 1934. Lower Ordovician (upper Tremadocian) *Protopliomerops* zone, Dumgol (Tomkol) shales.

Plumulites cf. *primus* and *Plumulites* sp. nov. (Kobayashi, 1960).

Lower Ordovician Munggog (Bunkoku) formation.

These Korean species are all subtriangular keeled plates except for the last which is represented by very narrow kite-shaped plates. They are curved and their concave margin swinging inward so strongly that the plates are suddenly expanded laterally near the base. Fine striae on the two sides of the mesial ridge form an angle of about 100 degrees. It is probable that this form belong to *Plumulites primus* or its close ally.

Beside these Yin (1937) described *Virgulaxonina elegans*, gen. et sp. nov. from the upper Arenigian Shihtien shales in Yunnan, China (Yin and Lu, 1937). While Yin erected *Virgulaxonina* as a new genus of *Incerta Sedis*, Fisher (1962) located it in the Pterygothecidae Syssovie, 1958, in the Hyolithida Matthew, 1899, Calyptomatida Fisher, 1962, which the last was proposed as an independent Molluscan class. Yin, however, excluded it from the Hyolithidae, because it is platy, instead of conical. *V. elegans* is most probably a kite-shaped plate of *Plumulites* of which fine innumerable growth lines are most distinctive.

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Recently Sheng illustrated *Virgulaxonia* sp. from the Ashgillian of Chekiang, China, suggesting its possible reference to the Trilobita, but it must be a right keeled plate of *Plumulites* distinct from the preceding in the narrower median ridge and more prominent transverse striae, less in number. *Plumulites shengi* is proposed for this species, the specimen in fig. 15, pl. IV in Sheng (1974) being the holotype.

An additional species is *Plumulites malayensis*, nov. from the Upper Ordovician limestone at Pulau Langgon, Langkawi Islands, Malaysia. It is a keeled plate with an apical angle of about 35 degrees; its outline slightly twisted triangle; basal margin biconvex, divided by a pronounced median fold; growth lines more than 20.

Fig. 1: *Plumulites malayensis*, nov. Keeled plate, holotype. $\times 12.5$
 Fig. 2: *Turrilepas japonicus*, nov. Kite-shaped plate, holotype.
 $\times 11$ Fig. 3: Ditto. Keeled plate, paratype. $\times 12$ Fig. 4: Ditto.
 Keeled plate. $\times 10$ Fig. 5: (?) Ditto. Proximal plate. $\times 10$
 Fig. 6: *Plumulites elegans* (Yin, 1937). Kite-shaped plate. $\times 3.3$

Beside these Ordovician species, an Upper Silurian one was recently found in Japan at Hitoegane, Fukuji district, Gifu Prefecture.

***Turrilepas japonicus* Kobayashi and Hamada, sp. nov.**

Kite-shaped plate semicircular in outline; distal margin a little shorter than the maximum length and more or less concave; other margins continuous, describing a semicircle; growth lines 14 or more in number, widely spaced, distinctly bent from proximal to free margin, showing a change of outline through growth. This plate best agrees with the kite-shaped plate of *Turrilepas wrightiana* (de Koninck) in fig. 8, pl. VI, Withers, 1926, but the concentric growth ridges appear coarser and distinctly broken at intersection with radial

striae in the interspace in this species.

Keeled plate quadrate; distal and fixed margins forming an angle of about 77 degrees; two other margins disposed to form an angle of 105 degrees or so, but at their junction where is a low carina is a small curve; distal margin nearly as long as fixed margin; free margin shorter and proximal margin still shorter; growth lines parallel to and separated from one another by broad flat intervals and suddenly flexed very near fixed margin; fine radial striae present. The keel is unusually weak, probably weakened secondarily to some degrees.

Beside a few other imperfect plates, Hitoegane collection contains a subpentagonal, gently convex shell which is somewhat similar to *Lingula* and *Modiola*, but it is asymmetrical and distinctly angulate. Although this outline is unusual also for Machaeridian plates, it would be an aberrant proximal plate of *T. japonicus*, as it has the same kind of concentric ridges and radial striae.

The above seven species in *Plumulites*, *Lepidocoleus* and *Turrilepas* reveal fairly continuous record of the Machaeridia in the Orient from Tremadocian to Ludlovian. Precisely speaking, there are Tremadocian *Plumulites primus*, Arenigian *P. elegans*, Llandeilian *P. chikunensis*, Upper Ordovician *P. malayensis*, Ashgillian *P. shengi*, Llandoveryan *Lepidocoleus birmanicus* and Ludlovian *Turrilepas japonicus*.

According to Withers' monograph four Silurian species are known from Australia, namely,

Turrilepas sp. Etheridge, 1890 and *Plumulites mitchelli*

Etheridge, 1890. Ludlovian lower Trilobite beds, N. S. W.

Plumulites ornatus (Chapman, 1910). Melbournian, Victoria.

Plumulites yeringiae Chapman, 1910. Yeringian, Victoria.

In adding Stepanov's *Plumulites wrightii*, 1908, i.e. *Plumulites* sp. by Withers from Wenlockian of Lake Balkhash, Turkestan to them, the enigmatic organism was wide spread not only in Eur-America, but also in Asia-Australia in the Silurian period. *P. yeringiae* would be a Lower Devonian survivor in the western Pacific area.

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