

Some Mid-Permian Fossils from Felda Mayam, Central Peninsular Malaysia

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Abstract

A small suite of fossils consisting of ammonoids, brachiopods, bivalves, crinoids and plants were recovered from an outcrop in the Felda Mayam area, central Pahang, Peninsular Malaysia. The fossil locality represents the northernmost extent of a new rock unit, the Bera Formation. The peculiar permianellid brachiopod genus *Dicystoconcha* is recorded in Peninsular Malaysia for the first time. The assemblages of ammonoids and brachiopods indicate a Roadian to Wordian (early Guadalupian/Middle Permian) age. The brachiopod assemblage suggests warm-water Tethyan affinities.

Sebahagian Fosil Pertengahan Perm dari Felda Mayam, Pahang Tengah Semenanjung Malaysia

Abstrak

Beberapa siri fosil yang terdiri daripada ammonoid, brakiopod, bivalvia, crinoid dan tumbuhan telah dijumpai pada singkapan di Felda Mayam, Pahang Tengah Semenanjung Malaysia. Lokality fosil ini mewakili sambungan unit batuan baru di bahagian paling utara, iaitu Formasi Bera. Himpunan brakiopod permianellid genus *Dicystoconcha* telah direkodkan di Semenanjung Malaysia buat pertama kalinya. Himpunan brakiopod ini mencadangkan sekitaran Tethyan adalah sederhana panas. Usia di antara Roadian-Wordian diberikan kepada horizon fosil di Felda Mayam ini.

INTRODUCTION AND REGIONAL GEOLOGY

This paper reports a new Permian fossil outcrop found in the agricultural settlement of Felda Mayam in the northern Bera District. The main purpose of this study was to determine the geological age of the fossil horizon. The Permian time-scale compiled by the International Subcommission of Permian Stratigraphy (Jin *et al.*, 1997; Wardlaw, 1999) is used in this paper. Fossils were collected by the authors between 1998 and 2000. All specimens illustrated in this paper was registered at the National University of Malaysia (Universiti Kebangsaan Malaysia) with prefix UKM-F.

The regional geology of the Bera District has previously been described in only two brief reports (Cook and Suntharalingam, 1970; MacDonald, 1970). Leman *et al.* (2000) has proposed a new rock unit, the Bera Formation, for the Permian strata exposed around the area, mostly of the road-cuts. They focused mainly on those outcrops in the southern part of the district. A moderately diverse brachiopod fauna, consisting of 17 (both identified and unidentified) species, has been described by Sone *et al.* (in press) from the Sungai Bera section in the vicinity of Tasik

(Lake) Bera. The fauna shows strong linkage to that of Member C (*Yabeina-Lepidolina* fusulinid beds) of the Sisophon Limestone, west Cambodia, and indicates an early Capitanian (late Middle Permian) age.

The present fossil locality, namely the Felda Mayam outcrop (03°21'56"N–102°39'33"E), is found in the northern part of the Bera District (Fig. 1), and is rather isolated from other outcrops of the Bera Formation. It represents the northernmost extent of the formation. The fossil stratum crops out at the northern margin of the local community park (Fig. 2). The entire horizon appears to be steeply dipping at 20°W to the strike of 40°, and extends about 30 m thick in the field. Its lithology is composed entirely of clastic sediments – sandstone, siltstone and tuffaceous shale.

The fossils are found in the upper half of the sequence (Fig. 3). In the middle of the sequence, abundant but poorly preserved silicified brachiopod shells and crinoid fragments (mostly stems) were found in brown, coarse thick-bedded sandstones, which are interbedded with siltstones. In the upper part of the sequence, ammonoids (moulds) are common, and plant fragments and bivalves are scarcely present in thinly bedded, purple to grey shales, whose colour probably indicates some tuffaceous content.

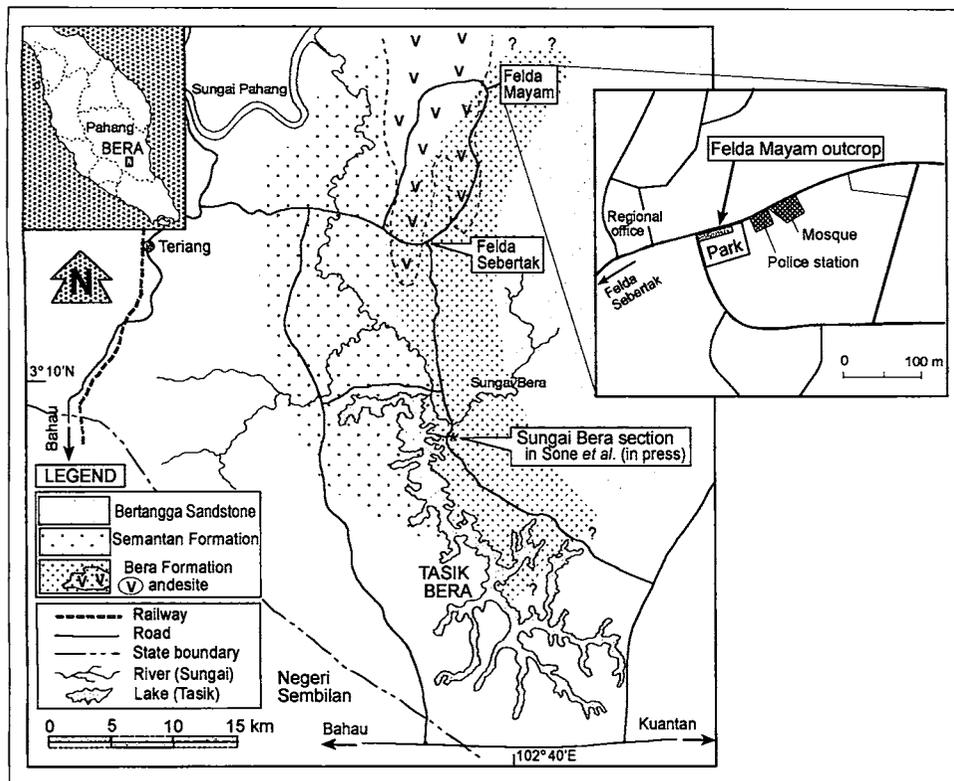


Figure 1: Possible extent of the Bera Formation and the location of the Felda Mayam outcrop (base map after Leman *et al.*, 2000).

COMPOSITION AND THE AGE OF THE FELDA MAYAM FOSSILS

The ammonoid *Agathiceras* is predominant and abundant, judging from its large number of specimens found relative to the total number of fossils encountered in the entire fauna (Table 1). *Agathiceras* Gemmellaro is one of the most common ammonoids in Late Palaeozoic rocks. It is a cosmopolitan genus, and its stratigraphic range is Moscovian (lower Late Carboniferous) through Wordian, with greatest abundance in the Roadian and Wordian (Glenister *et al.*, 1990; Zhou *et al.*, 1999). Another ammonoid species of Felda Mayam belongs to either *Bamyaniceras* Termier and Termier or *Propinacoceras* Gemmellaro. The two genera are considerably close to each other in the subfamily Propinacoceratinae, since only details of a suture may indicate their generic differences. Either genus, an Artinskian through Wordian range is indicated (Zhou *et al.*, 1999). Both genera are of wide distributions; *Bamyaniceras* is recognised specifically in North American southwest, Pamirs, Afghanistan, Timor and Western Australia, whereas *Propinacoceras* is dominant in Russia (Urals), Canada (British Columbia), Sicily, southern Oman, Iraq (Kurdistan) and China (Xizang, Gansu, Jilin). Leonova (1998) considered that *Bamyaniceras* is indicative of Tethyan or warm-water faunas. The presence of the two ammonoid genera – *Agathiceras* and either *Bamyaniceras* or *Propinacoceras* – indicates that the Felda Mayam horizon is pre-Capitanian.

Dicystoconcha Termier, Termier, Lapparent & Martin is a very peculiar permianellid brachiopod. This is owing

to its morphological and ecological characteristics, that is, it was attached to a cylindrical object such as a crinoid stem by using the circular to semi-circular attachment ring developed at the beak (Fig. 4). The Felda Mayam form resembles the type species, *D. lapparenti* whose range is considered Kungurian through Wordian in this study as will be discussed later. Species of *Dicystoconcha* are restricted to the Tethyan Province, specifically in Afghanistan, South China, Northeast China and southern Primorie of Russia (see Shen and Shi, 1998). This is the first record of the genus in Peninsular Malaysia. Species of *Leptodus* Kayser are recognised throughout the Tethyan Province, and are common in the late Middle through Late Permian but generally rare in older rocks; an Early Permian (pre-Roadian) occurrence is very unlikely. It is of some interest that the single specimen belonging to the subfamily Auriculispininae is recognised. Genera of Auriculispininae are generally restricted to cool-water/temperate palaeoclimatic zones, such as the Gondwanan and Boreal Provinces, and their transitional zones to the Tethys.

In addition to the marine invertebrate fossils mentioned above, the plant fossil *Taeniopteris* sp. (Fig. 6—La-b) was also found in association with the ammonoid-bearing bed. It is the most common plant genus in the Malaysian mid-Permian, since a total of 13 (both identified and unidentified) species of *Taeniopteris* have been recorded from two floras of central Peninsular Malaysia. They are the so-called Jengka Pass flora of Pahang (Konno and Asama, 1970) and Linggiu flora of Johore (Konno *et al.*, 1970); both floras have been considered Kazanian (roughly equivalent to the Wordian) in age. Their relationship to the *ex-situ* plant

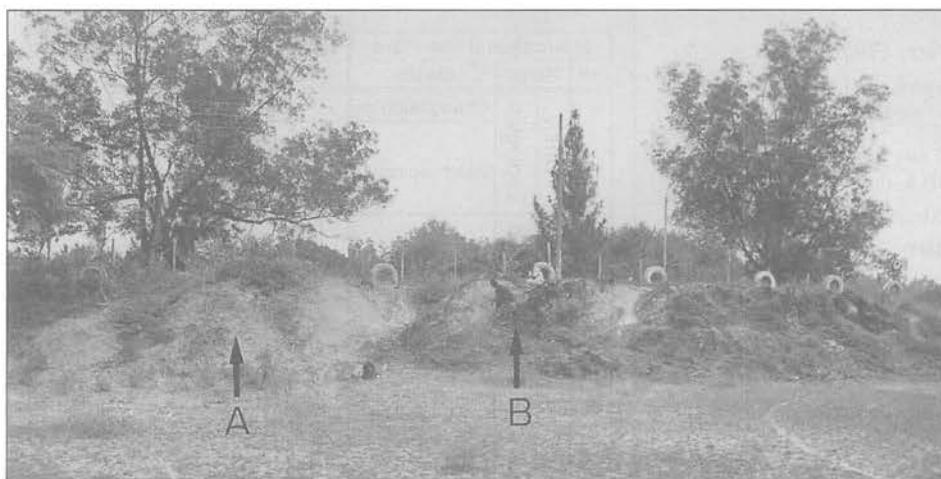


Fig. 2: Felda Mayam outcrop. A = ammonoid horizon, B = brachiopod horizon.

Table 1: Permian fossils from the Felda Mayam outcrop

Species	No. of Samples
Ammonoids	
<i>Agathiceras</i> sp.	20+
<i>Bamyaniceras</i> or <i>Propinacoceras</i> sp.	2
Brachiopods	
<i>Dicystoconcha</i> cf. <i>lapparenti</i> Termier, Lapparent & Martin, 1974	1
<i>Leptodus</i> sp.	1
Auriculispinae gen. et sp. indet.	1
Productidae gen. et sp. indet.	3
Plant	
<i>Taeniopteris</i> sp.	3

deposit of Felda Mayam is uncertain. *Taeniopteris* is a long-ranging, cosmopolitan genus; hence, the Felda Mayam form does not provide a precise age indication without confident specific identification.

In conclusion, the ammonoid genera suggest a pre-Capitanian age, and the concurrent range zone of the brachiopods is Roadian and Wordian. Thus, based on the assemblage zone of the ammonoids and brachiopods, a Roadian–Wordian age is given to the Felda Mayam fossil horizons (Fig. 5). The brachiopods represent a general warm-water Tethyan fauna. A further investigation on the possible flora in Felda Mayam may improve the still broadly-defined early Guadalupian (Middle Permian) age of the present horizon.

Systematic palaeontology

The classification of the ammonoid family-group follows the coming Treatise Revision partly presented by Zhou *et al.* (1999, appendix). For the Brachiopoda, the supra-ordinal classification follows Williams *et al.* (1996), and Brunton *et al.* (1995) for the Productida. The brachiopod suborder Strophalosiidina Schuchert, 1913 refers to C.H.C. Brunton (pers. comm., 27 January 2000).

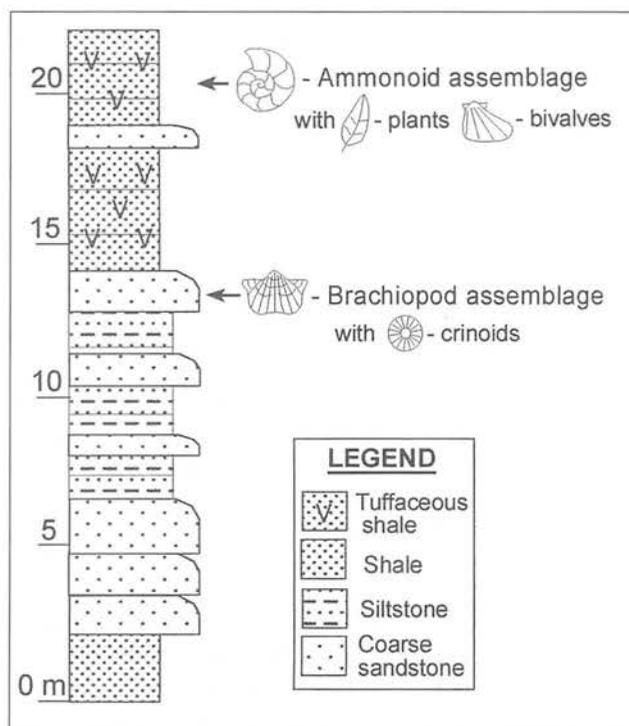


Figure 3: Stratigraphic log of the Felda Mayam outcrop.

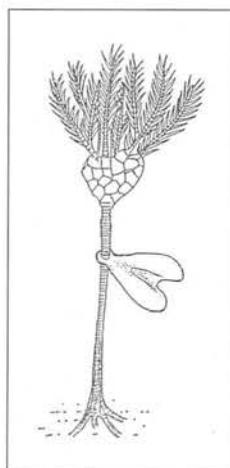


Figure 4: Living style of a permianellid brachiopod (modified after Wang & Jin, 1991, p. 493, fig. 10).

Phylum MOLLUSCA

Class CEPHALOPODA Cuvier, 1797

Subclass AMMONOIDEA Agassiz, 1847

Order GONIATITIDA Hyatt, 1884

Suborder GONIATITINA Hyatt, 1884

Superfamily GONIATITOIDEA de Haan, 1825

Family Agathiceratidae Arthaber, 1911

Genus *Agathiceras* Gemmellaro, 1887*Agathiceras* sp.

Fig. 6—A—D

Remarks.—This genus is rather readily recognised because of the characteristic longitudinal lirae. The shells are small- to medium-sized (28 mm in average diameter) for the genus. The umbilicus is moderately large. The constrictions of the phragmocone are developed; this is indicative of some maturity. The suture is not discernible; hence, a specific identification is difficult. Another Malaysian *Agathiceras* was illustrated by Lee (1980, p. 68, pl. 3, figs. 13–15) as the type species *A. suessi* Gemmellaro from a Wordian bed of Sungai Cheroh, western Pahang. It has an exceptionally large size, exceeding 5 cm in diameter, and has a relatively small umbilicus; it is unlike the Felda Mayam species.

Order PROLECANITIDA Miller and Furnish, 1954

Superfamily MEDLICOTTIOIDEA Karpinsky, 1889

Family MEDLICOTTIIDAE Karpinsky, 1889

Subfamily PROPINACOCERATINAE Gemmellaro, 1887

Genus *Bamyaniceras* Termier and Termier, 1970 or *Propinacoceras* Gemmellaro, 1887*Bamyaniceras* or *Propinacoceras* sp.

Fig. 6—E—F

Remarks.—Only moulds of the venters were available. The flattened venter is about 13 mm wide. It bears two rows of the transverse nodes, which are separated by a shallow median groove. The suture is unknown. The present species must belong to either *Bamyaniceras* or *Propinacoceras*, as suggested by the distinctive flattened transverse ventral nodes. The two genera are considerably close to each other, since their external features are almost identical; only slight differences of sutures in shape of ventrolateral saddles and in size and location of primary external lateral lobes may indicate their generic differences.

Bamyaniceras and *Propinacoceras* have different distribution patterns in the Tethyan Province. The former is rather common in the southern part of the Tethys, particularly in the Early Permian of Afghanistan, Timor and Western Australia, whereas the latter is dominant in the Early Permian of Russia (Urals) and in the Middle Permian (Wordian) of Sicily and China (Jilin, Gansu, Xizang). Previously described Western Australian species of *Propinacoceras* have now been revised to those of *Bamyaniceras* (see Glenister *et al.*, 1993). Two of Timorese propinacoceratids of Haniel (1915), *P. simile* and *P. insulcatum*, also belong to species of *Bamyaniceras*, judging from their possession of large simple or bifid ventrolateral saddles.

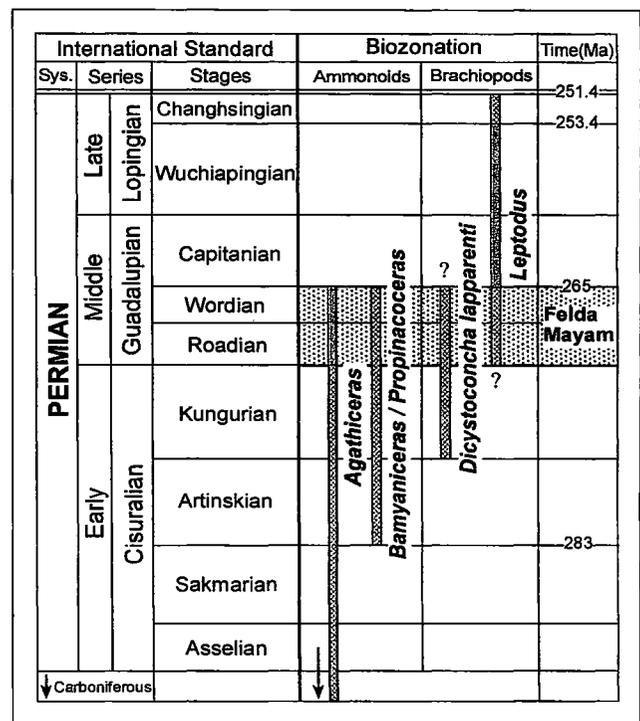


Figure 5: Range of the geological age of the Felda Mayam fossil assemblage, with reference to stratigraphic ranges of the referable genera and species. The dark parts of the *Agathiceras* and *Leptodus* ranges indicate the possible acmezones. Permian time-scale after Wardlaw (1999).

Phylum BRACHIOPODA

Class STROPHOMENATA Williams, Carlson, Brunton, Holmer and Popov, 1996

Order PRODUCTIDA Sarytcheva and Sokol'skaya, 1959

Suborder STROPHALOSIIDINA Schuchert, 1913

Superfamily LYTTONIOIDEA Waagen, 1883

Family PERMIANELLIDAE He and Zhu, 1979

Genus *Dicystoconcha* Termier, Termier, Lapparent and Martin, 1974*Dicystoconcha* cf. *lapparenti* Termier, Termier, Lapparent and Martin, 1974

Fig. 6—G

Compare:

1974 *Dicystoconcha lapparenti* Termier *et al.*, p. 123, pl. 22, figs. 1–21984 *Guangjiayanella guangjiayanensis* Yang, p. 213, pl. 31, figs. 11–161989 *Guangdongina xiamaoensis* Mou and Liu, p. 458, pl. 1, figs. 1–9; pl. 2, figs. 1–71989 *Guangdongina leguminiformis* Mou and Liu, p. 458, pl. 3, figs. 4–81989 *Guangdongina perforans* Mou and Liu, p. 459, pl. 2, fig. 8; pl. 3, figs. 1–31989 *Guangdongina* sp. Mou and Liu, p. 459, pl. 2, fig. 91991 *Dicystoconcha lapparenti* — Wang and Jin, p. 495, pl. 1, figs. 1–9; pl. 3, figs. 1–7**Remarks.**—One incomplete ventral valve was available.

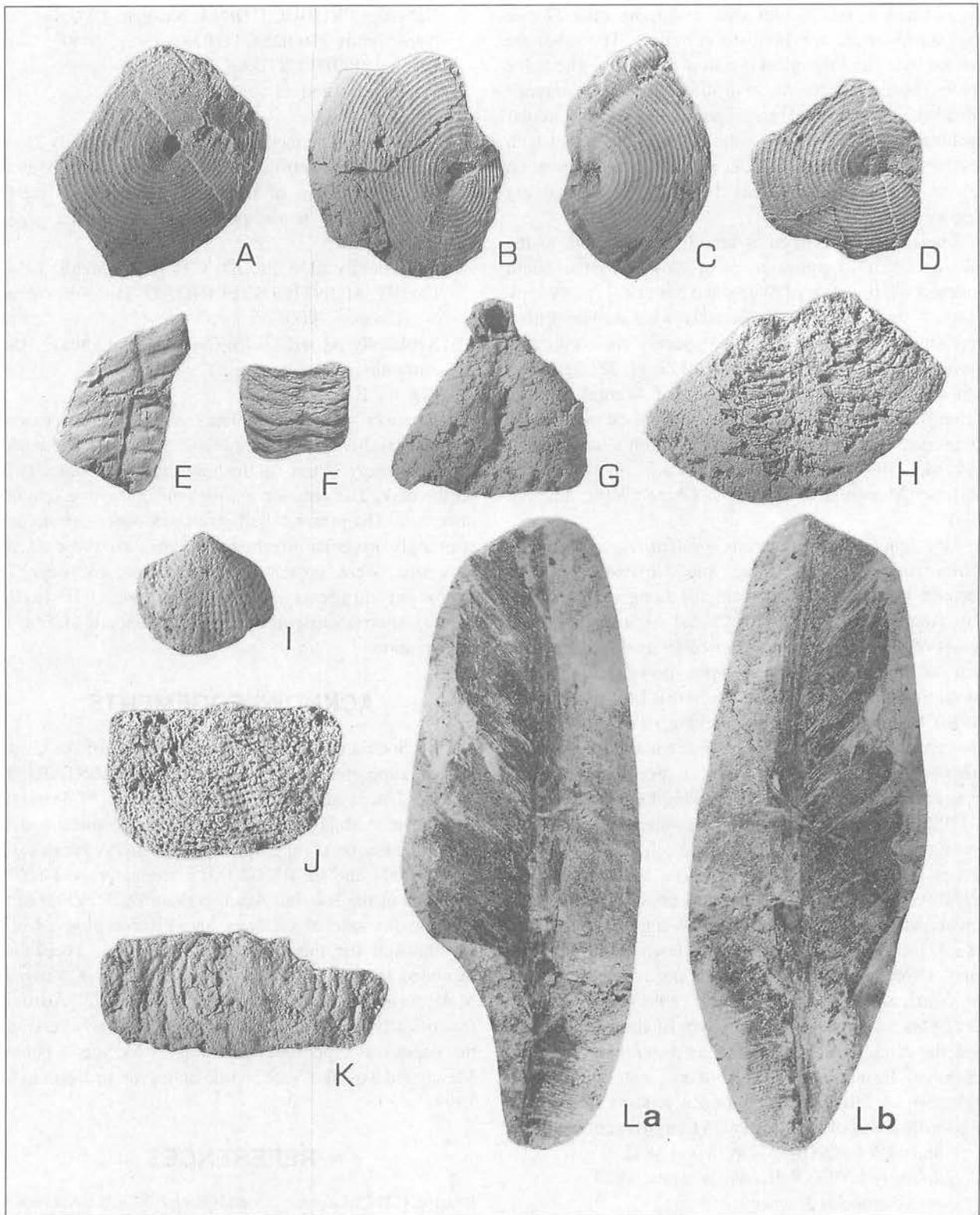


Figure 6: A–D, *Agathiceras* sp.; A–C, natural internal casts, x1.5, UKM-F282–284., D, rubber cast of the external mould, x1.5, UKM-F285. E–F, *Bamyaniceras* or *Propinacoceras* sp.; E, internal mould of the venter, x1.5, UKM-F286., F, internal mould of the venter, x1.5, UKM-F287. G, *Dicystoconcha* cf. *lapparenti* Termier, Termier, Lapparent & Martin, ventral valve, x1.5, UKM-F288. H, *Leptodus* sp., ventral view of the conjoined shells with an internal structure exposed, x1.5, UKM-F289. I–J, Productidae gen. et sp. indet.; I, ventral internal mould of the juvenile, x2.0, UKM-F290., J, dorsal external mould, x1.5, UKM-F291. K, Auriculispininae gen. et sp. indet., fragmentary dorsal valve with external mould, x1.5, UKM-F292. La–b, *Taeniopteris* sp.; impressions (both sides) of the same leaf, La, x1.5, UKM-F293., Lb, x1.5, UKM-F294.

It is medium-sized (26 mm wide and more than 27 mm long), and is ovate and bilobate in outline. The lobes are bisected by a shallow sulcal incision anteriorly. The valve appears moderately convex in profile, although its anterior part is lost. The marginal brim is not observed. The circular attachment ring is present at the anterior but is not well preserved. Some fine, weak concentric lines are present on the shell surface. Overall features well suggest *Dicystoconcha*.

The present specimen is broadly comparable to the type species, *D. lapparenti*, most closely to the South Chinese *D. lapparenti* of Wang and Jin (1991, p. 495, pl. 1, figs. 1–9) in having a moderately wide outline with a large attachment ring. The type species was originally reported by Termier *et al.* (1974, p. 123, pl. 22, figs. 1–2) from a Murghabian (Wordian) bed of Wardak, central Afghanistan, and was subsequently recognised in Chihisian (Kungurian to Roadian) horizons of South China (Yang, 1984; Mou and Liu, 1989; Wang and Jin, 1991) and Jilin and Inner Mongolia of Northeast China (Wang and Jin, 1991).

Five genera of permianellids — *Paritisteges*, *Tenerella*, *Obliquinsteges*, *Fabulasteges* and *Sicyusella*— were proposed by Liang (1990) from the Lengwu Formation (Capitanian), Zhejiang, South China. As many as seven species of these genera were later collectively assigned by Shen and Shi (1998: 272) to be synonyms of *D. lapparenti*. Considering their overall features, there is little doubt about that the Lengwu permianellids belong to *Dicystoconcha*. However, the Lengwu forms are somewhat more elongate, narrower in outline, and tend to be larger than typical *D. lapparenti* of older ages, as also pointed out by Shen and Shi (1998); hence, they may represent some species separate from the type. Due to this uncertainty, the Lengwu forms are not regarded as being conspecific to *D. lapparenti* herein. For the same reason, another Lengwu permianellid, *Dipunctella stenosulcata* Liang (in Wang *et al.*, 1982, p. 228, pl. 100, figs. 8–9; the same specimens also figured in Liang, 1990, pl. 42, figs. 10–11) is not recognised as *D. lapparenti*, although Wang and Jin (1991) and Shen and Shi (1998) assigned it to a synonym of the type species. Thus, the stratigraphic range of *D. lapparenti* is considered Kungurian through Wordian, but not extending up to Capitanian. A further investigation is required to confirm the specific status of the Capitanian Lengwu permianellids.

Family LYTTONIIDAE Waagen, 1883

Subfamily LYTTONIINAE Waagen, 1883

Genus *Leptodus* Kayser, 1883

Leptodus sp.

Fig. 6—H

Remarks—Poorly preserved conjoined shells were available. The symmetrical, continuous septal apparatus suggests *Leptodus*. The ventral valve is at least 49 mm wide and ovate in outline, and are quite flat in profile. The anterior part is lost; hence, the true length is uncertain. The mid-length of the lateral septa on each side is curved anteriorward.

Suborder PRODUCTIDINA Waagen, 1883

Superfamily PRODUCTOIDEA Gray, 1840

Family PRODUCTIDAE Gray, 1840

Productidae gen. et sp. indet.

Fig. 6—I–J

Remarks.—The medium-sized (approximately 26 mm wide) shell with well-defined fine reticulation over the corpus is suggestive of the Productidae, most likely a dictyoclostid. Due to the poor preservation, the generic status is unknown.

Superfamily LINOPRODUCTOIDEA Stehli, 1954

Family MONTICULIFERIDAE Muir-Wood and Cooper, 1960

Subfamily AURICULISPININAE Waterhouse, 1986

Auriculispininae gen. et sp. indet.

Fig. 6—K

Remarks.—One incomplete mould of a dorsal exterior was available. It is medium sized, with widest (approximately 31 mm) at the hinge, and is moderately flat on the disk. The anterior is lost; hence, the true length is uncertain. The present shell possesses coarse, prominent, seemingly irregular rugae, particularly on the ears, and very fine, weak costellae over the disk and ears. The ornament suggests Auriculispininae, but further identification is difficult due to the inadequate state of the preservation.

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