

222

# RETIZONOMONOLETES HUNANENSIS FANG ET AL., 1993 AND THE LEPIDOPHYTA MORPHON

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Abstract - *Retizonomonoletes hunanensis*, *Retispora lepidophyta* and *R. macroreticulata* are reviewed within the concept of a "*lepidophyta* morphon". Chinese occurrences of the two former and their stratigraphical significance are discussed and an abundant material is illustrated from both Belgium and South China.



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## 1. INTRODUCTION

*Retispora lepidophyta* (Kedo) has been shown to be one of the most widespread and useful spore taxa in the Upper Devonian (Owens & Streel, 1967; Streel, 1970, 1974; Playford, 1976). Its worldwide occurrence between 70° southern latitude and 30° northern latitude allows long distance correlations. *R. lepidophyta* is reported from Gondwana, Euramerica, Angara and "Pacifica" (Zhang, 1984; Hou & Wang, 1985; Streel, 1986; Fang et al., 1993).

In South China, miospores assigned to *R. lepidophyta* have been reported from several places and particularly central Hunan (Hou, J.B., 1982; Gao, 1990; Hou, H.F., 1991). Surprisingly, most of these occurrences are below the coral *Cystophrentis* zone, which was therefore considered of Carboniferous age by spore specialists. This conclusion implied that the main elements of the Devonian fauna persisted in Lower Carboniferous (cyrtosporiferid brachiopods, icriodontid conodonts, stromatoporoids, quasiendothyrid foraminifers...). As pointed out by Fang et al. (1993), most of the Chinese specimens of *R. lepidophyta* in the literature are in fact misidentified and belong to *Retizonomonoletes hunanensis* Fang et al. 1993, a similar but monolete species.

In the investigated sections of central Hunan, true *R. lepidophyta* are only met with at Malanian, in the uppermost part of the Menggongao Formation. This discovery has strong stratigraphical implications and confirms the Upper Devonian age of the Menggongao Formation as deduced from other fossil groups.

## 2. THE LEPIDOPHYTA MORPHON

First introduced by van der Zwan (1979), the morphon concept is defined as "a group of palynological species united by continuous variation of morphological characteristics" (van der Zwan, *op. cit.*, p. 11) There is no possible variation between monolete and trilete species. The attention must be called, however, on the convergence and the importance, for biostratigraphic purpose, of proper identification. So understood, the *lepidophyta* morphon is here introduced to group *Retizonomonoletes hunanensis*, *Retispora lepidophyta* and also *R. macroreticulata* (Kedo) Byvsheva 1985. Common characteristics are camerate structures, amb subcircular to oval and regular to irregular bladder ornamented by foveae and/or muri and additional apiculate ornaments.

### 3. SYSTEMATICS

#### Genus *Retispora* Staplin 1960

Type Species : *Retispora (Hymenozonotrilletes) lepidophyta* (Kedo) Playford 1976

Diagnosis : Staplin 1960, p.32.

#### *Retispora lepidophyta* (Kedo)

Playford 1976

Pl. III, figs. 1-7; Pl. IV, figs. 1,5;  
Pl. V, figs. 1-2.

- 1957 *Hymenozonotrilletes lepidophytus* Kedo, p. 24, pl. 2, figs. 19-21.
- 1958 *Hymenozonotrilletes molestus* Ishchenko, pl. 7, fig. 82.
- 1958 *Hymenozonotrilletes mentitus* Ishchenko, pl. 7, fig. 83.
- 1960 *Retispora florida* Staplin, p. 32, pl. 7, figs. 9,13.
- 1962 *Leiozonotrilletes naumovae* Balme & Hassell, pp. 18,20, pl. 4, figs. 10-12, text-fig. 4.
- 1962 *Endosporites lacunosus* Winslow, pp. 44-45, pl. 16, figs. 1-5.
- 1962 *Archaeozonotrilletes microreticulatus* Caron Moniez, p. 113, pl. 16, fig. 20.
- 1962 *Archaeozonotrilletes reticulatus* Caron Moniez, p. 114, pl. 17, figs. 9,10.
- 1963 *Hymenozonotrilletes lepidophytus* Kedo var. *tener* Kedo, p. 59, pl. 5, fig. 110.
- 1964 *Leiozonotrilletes* sp. Wray, pl. 1, fig. 25.
- 1966 *Remysporites lepidophytus* (Kedo) Luber in Pokrovskaya, p. 84, pl. 40, fig. 14.
- 1971 *Hymenozonotrilletes lepidophytus* Kedo var. *minor* Kedo, in Kedo & Golubtsov, pp. 26-30, pl. 1, figs. 1-16.
- 1974 *Spelaeotrilletes lepidophytus* (Kedo) Streeel in Becker *et al.*, p. 26.
- 1976 *Retispora lepidophyta* (Kedo) Playford, pp. 45-46, pl. 10, figs. 1-15.

**Diagnosis** : Kedo 1957, p. 24.

**Description** : Camerate trilete miospore, with a subcircular to subtriangular shape and rounded corners; intexine smooth; exoexine ornamented on the distal surface with a network of foveae 2 to 6  $\mu$ m in diameter. Between foveae, spines or cones are 0.5 to 1  $\mu$ m in length and in width. The distribution of these ornaments is very sparse. The distance between each of them is 3 to 6 times their width.

**Zonation** : The entry of *R. lepidophyta*, soon succeeded by *Apiculiretusispora verrucosa* marks the base of the Opperl Zone LV (Streeel *et al.*,

1987). Above the LV Zone, several interval zones (LL, LE and LN) are defined by the successive first occurrence of *Knoxisporites literatus*, *Hymenozonotrilletes explanatus* and *Verrucosisporites nitidus* and by the last occurrence of *R. lepidophyta*. The LV-LL boundary closely approximates the *expansa-praesulcata* boundary of the conodont zonation (Bless *et al.*, 1993). The LL-LE boundary lies in the Early *praesulcata* whereas the LE-LN transition is in the Middle *praesulcata* Zone. The last occurrence of *R. lepidophyta* is just below the Devonian-Carboniferous boundary as defined by the incoming of *Siphonodella sulcata*. In addition, four biometric zones (C,D,E,F) have been erected on biometric characteristics of *R. lepidophyta* (Streeel, 1966): from large specimens at the bottom to progressively smaller ones when approaching the Devonian-Carboniferous boundary. C-D and D-E transitions are both included in the LV Zone (or just higher as regards the latter). The LV Zone is also known to contain the *radiata-kobeitusana* transition of the foraminifer succession. This is generally taking place within biometric interval C (Streeel, in Dreesen *et al.*, 1993).

#### *Retispora macroreticulata* (Kedo)

Byvsheva 1985

Pl. IV, figs. 3-4; Pl. V, fig. 3.

- 1971 *Hymenozonotrilletes lepidophytus* Kedo var. *macroreticulatus* Kedo, in Kedo & Golubtsov, pl. 2, figs. 1-3.
- 1971 *Hymenozonotrilletes lepidophytus* Kedo var. *major* Umnova, p. 119, pl. 3, fig. 67.
- 1971 *Hymenozonotrilletes lepidophytus* Kedo var. *cassis* Umnova, pp. 119-120, pl. 3, fig. 66.
- 1974 *Hymenozonotrilletes lepidophytus* Kedo var. *macroreticulatus* Kedo, p. 91, pl. 1, figs. 4-5.
- 1974 *Spelaeotrilletes* sp. A Streeel, in Becker *et al.*, p. 26, pl. 20, figs. 5-7.
- 1975 *Spelaeotrilletes* sp. Turnau, p. 519, pl. 7, fig. 4.
- 1975 *Hymenozonotrilletes cassiculatus* Higgs, p. 399, pl. 5, figs. 1-3.
- 1977 *Endosporites admirandus* (Kedo) Streeel, p. 405, pl.2, fig. 5, non figs. 3,4,6.
- 1978 *Spelaeotrilletes cassiculatus* (Higgs) Turnau, p. 11, pl. 5, fig. 3.
- 1981 *Retispora cassicula* (Higgs) Higgs and Russell, p. 38.
- 1985 *Retispora macroreticulata* (Kedo) Byvsheva, p. 141, pl. 28, fig. 11.

**Diagnosis** : Kedo 1974, p. 91.

Genus *Retizonomonoletes* Fang et al. 1993

Type species : *Retizonomonoletes hunanensis*  
Fang et al., 1993

**New description of the genus :** Monolete camerate miospore; amb oval or subcircular; central body (intexine) rigid, oval to subcircular, surrounded by a saccus-like outer wall (exoexine). Equatorially, the bladder extends beyond the body margin mainly in the extension of the mono-lete mark. It may be less widely separated from the body near the shorter axis of the spore. The bladder is closely adpressed to the body in the polar regions and seems to be thicker equatorially (limbus ?). This limbus (?) makes an encroachment on the broad sides of the proximal surface. Exoexine ornamented, on the distal face and on the proximal face outside the contact area, with a thin discontinuous reticulate or foveolate pattern, and additional apiculate ornaments. Laesura straight, simple. Intexine smooth.

**Remarks :** This genus is distinguished from the genus *Archaeoperisaccus* Naumova 1953 by its limbus (?) and its ornamentation. It is distinguished from the genus *Retispora* Staplin 1960 by its monolete aperture.

*Retizonomonoletes hunanensis*

Fang et al. 1993

Pl. I, figs. 1-11; Pl. II, figs. 1-10  
Pl. IV, figs. 2,6,7; Pl. V, fig. 4.

1981 *Spelaeotriletes lepidophytus* (Kedo) Streeel,  
in Gao, pl. 2, fig. 20.

1982 *Spelaeotriletes lepidophytus* (Kedo) Streeel,  
in Hou Jingheng, pl. 2, fig. 13.

1987 *Retispora lepidophyta* (Kedo) Playford, Gao  
in Wang Genxian et al., pl. 1, fig. 3.

	<i>lepidophyta</i>	<i>macro-reticulata</i>	<i>hunanensis</i>
Diameter of sexine	35-110 µm	110-200 µm	29-82 µm
Diameter of nexine	26-72 µm	80-140 µm	16-33 µm
Size of conispinae : Height	0.2-2.0 µm	0.2-0.5 µm	0.5-3 µm
Size of conispinae : Width	0.2-2.0 µm	0.2-0.5 µm	0.2-1 µm
Distribution of conispinae	sparse	dense	dense
Distance between conispinae compared to their width	3-6 x	11-4 x	1-2 x
Equatorial thickness of sexine	thick	thin	thick
Width of the thickness of sexine	1-2 µm	< 1 µm	1-2 µm
Laesurae	trilete thick	trilete thin	monolete thin

1987 *Retispora lepidophyta* (Kedo) Playford, in  
Ouyang & Chen, pl. 3, figs. 33-35.

1990 *Retispora lepidophyta* (Kedo) Playford, in  
Gao, pl. 2, figs. 9-12.

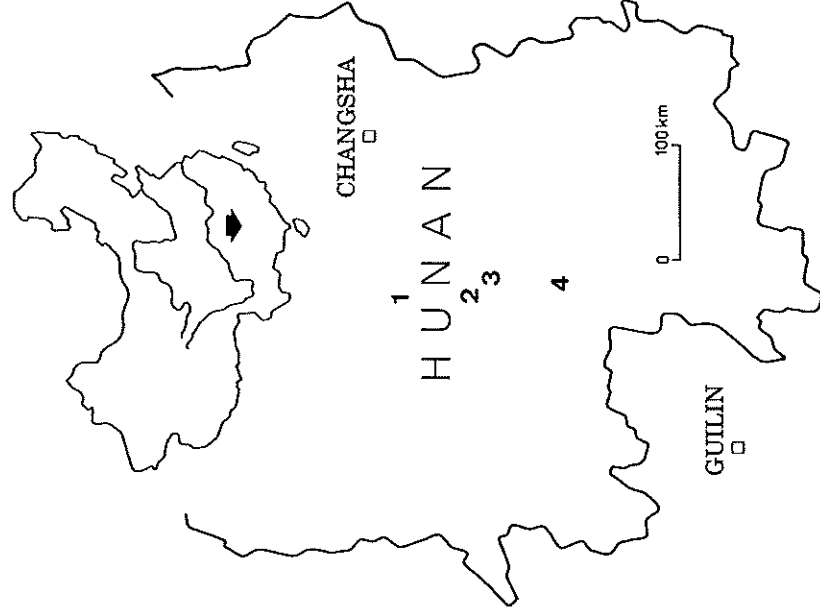
1992 *Retispora lepidophyta* (Kedo) Playford, in  
Gao, pl. 4, figs. 1-6.

1993 *Retizonomonoletes hunanensis* Fang et al.,  
fig. 2.

**Description :** Monolete camerate miospore; amb oval to subcircular. The intexine (oval to subcircular) is laevigate, 1/3 - 1/2 of the total spore diameter. Equatorially, the bladder extends beyond the body margin mainly in the extension of the monolete mark. It may be less widely separated from the body near the shorter axis of the spore. The bladder seems to be thicker equatorially (limbus ?). It delineates a clear encroachment of the distal face on the proximal face, in front of the end of the monolete mark. Usually, only one of the two encroachments is visible. The mono-lete mark is generally incurved, 4/5 or equal to exoexine radius. The distal face and the proximal one outside the contact area are both ornamented with a thin discontinuous reticulate pattern, which consists of spinae, conis (0.5 - 3 µm in width and height) or grana on short verrucate ridges and discrete elements. The verrucate ridges are less than 1 µm in width. All transitions exist between a more or less regular foveolate sculpture forming a negative reticulum (1 - 5 µm in width) to a very irregular reticulate positive pattern.

**Occurrence:** Upper Devonian of southern and eastern China.

The parameters of the three species of the *lepidophyta* morphon are given in the following table (based on published data and on our Chinese material).



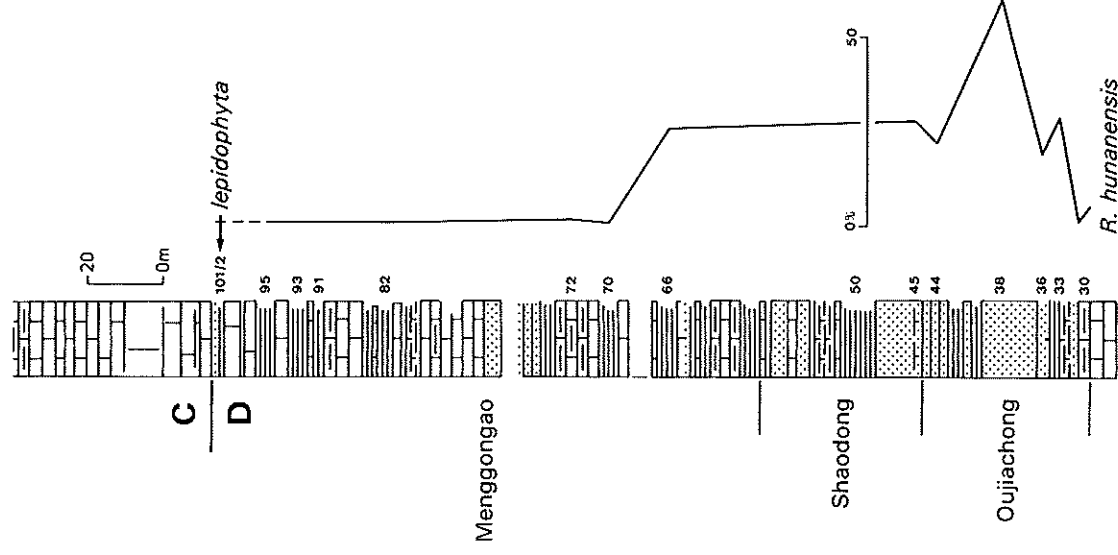
**Figure 1** - Localities sampled in central and south-central Hunan : 1) Oujiaichong, 2) Malanbian, 3) Shaodong, 4) Sujiaping.

#### 4. CHINESE OCCURRENCES

About one hundred samples have been collected from the sections at Oujiaichong, Malanbian, Shaodong and Sujiaping (Fig. 1) for investigation of miospores. The large predominance of species only known from South China indicates that a strong endemism must have affected the Upper Devonian vegetation in this area. Only just prior to the Devonian-Carboniferous transition, the occurrence at Malanbian of a few specimens of *R. lepidophyta* attests to more open conditions. It also contributes, together with forams and conodonts, to the precise dating of the D/C boundary.

##### 4.1 Malanbian section (Fig. 2)

*Retispora lepidophyta* has been found in bed 101 and in the basal part of bed 102. Both samples are from the first fifty centimetres of the 3.5 m clastic beds at the upper part of the Menggonggao Formation. Below bed 101, thirty samples have been studied from the Menggonggao, Shaodong and Oujiaichong Formations. All samples lack *R. lepidophyta*. By contrast, *R. hunanensis* is a common member (up to 60%) of every assemblage



**Figure 2** - *Retisporomonoletes hunanensis* abundance and *Retispora lepidophyta* occurrence in the section at Malanbian.

from bed 33 in the Oujiaichong Formation up to bed 66 in the Menggonggao Formation. In the upper part of the Menggonggao Formation, *R. hunanensis* has become rare but it is still continuously present as high as bed 95. It last occurs in the upper part of bed 102, surviving by only a few inches *R. lepidophyta*.

##### 4.2 Oujiaichong, Shaodong and Sujiaping

In the Oujiaichong section, *R. hunanensis* is present and locally abundant from bed 106 in the Magunao Limestone up to bed 197 in the Menggonggao Formation. It was also found from the Menggonggao Formation at Shaodong and the Oujiaichong Formation at Sujiaping. The latter are just spot samples. Only at Oujiaichong is it

possible to reconstruct something of an abundance curve. Peak occurrences in the Ouyiachong Formation and drastically receding frequencies in the upper part of the Menggongao Formation make such a curve roughly parallel with that at Malanbian.

## 5. CONCLUSION

Owing to the occurrence of the guide-species, beds 101-102 at Malanbian may be assigned to the *lepidophyta* range-zone. Measured diameters of 48 to 65  $\mu\text{m}$  (main: 57  $\mu\text{m}$ ) are indicative of biometric interval D, i.e. the upper part of the LV Zone. More material is needed in order to achieve precise correlation through reliable histograms. A Strunian age near the top of the Menggongao Formation may be considered established, however. Subsequent disappearance of *R. lepidophyta* further suggests the Devonian-Carboniferous boundary lying close to that level, i.e. within or just above the clastic beds.

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- possible to reconstruct something of an abundance curve. Peak occurrences in the Ouyiachong Formation and drastically receding frequencies in the upper part of the Menggongao Formation make such a curve roughly parallel with that at Malanbian.
5. CONCLUSION
- Owing to the occurrence of the guide-species, beds 101-102 at Malanbian may be assigned to the *lepidophyta* range-zone. Measured diameters of 48 to 65  $\mu\text{m}$  (main: 57  $\mu\text{m}$ ) are indicative of biometric interval D, i.e. the upper part of the LV Zone. More material is needed in order to achieve precise correlation through reliable histograms. A Strunian age near the top of the Menggongao Formation may be considered established, however. Subsequent disappearance of *R. lepidophyta* further suggests the Devonian-Carboniferous boundary lying close to that level, i.e. within or just above the clastic beds.
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Continued on page 88

## PLATE I

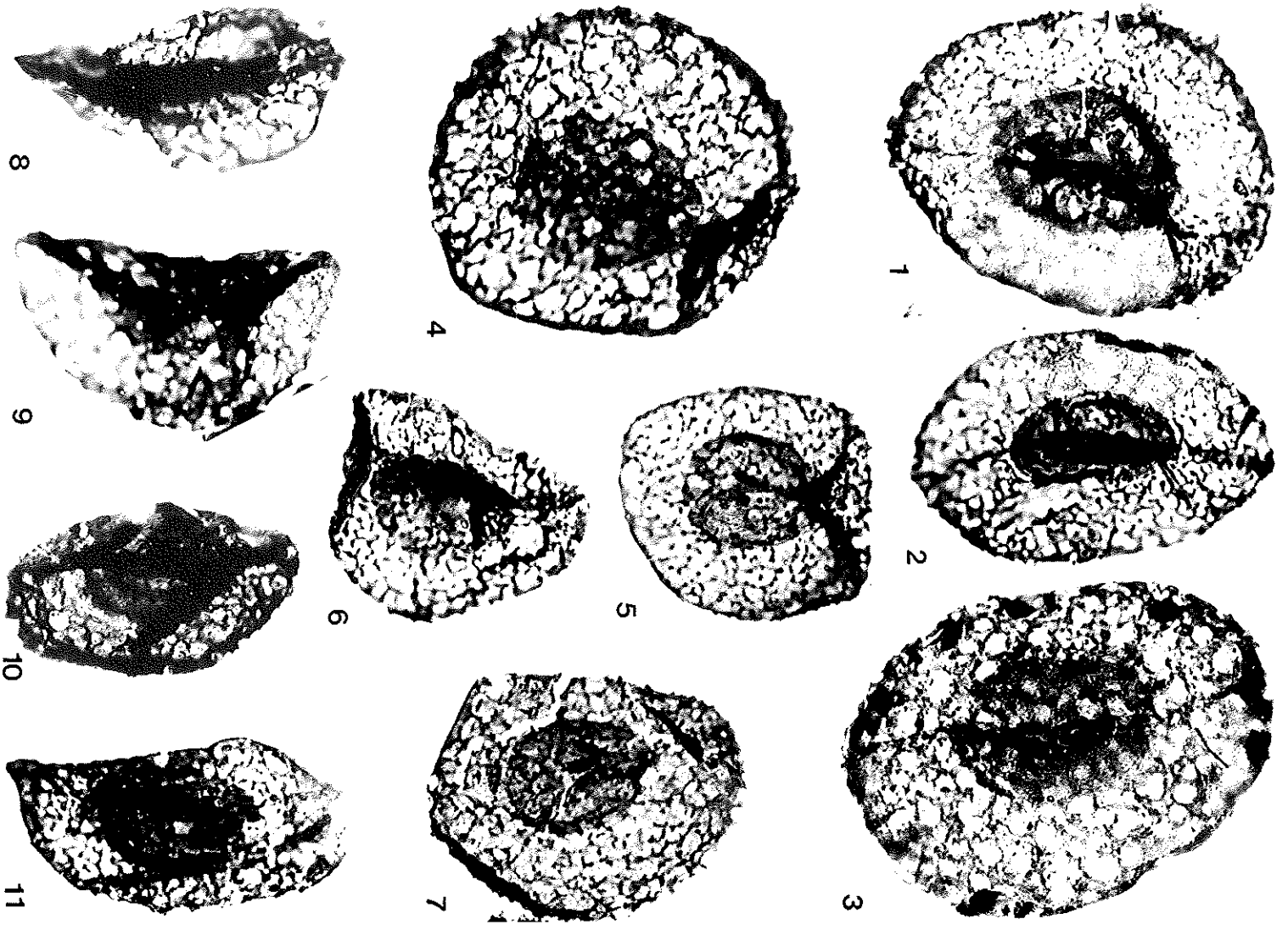
All figures x 1000

Digits, e.g. 31527 = slide, 27-65 = grid reference.

Figs. 1-11 *Retizonomonoletes hunanensis* Fang *et al.*, 1993. Malanbian section.

- 1) 31527, 27-65 : Oujiaichong Fm. Holotype.
- 2) 31527, 31-94 : Oujiaichong Fm.
- 3) 31527, 09-98 : Oujiaichong Fm. Paratype.
- 4) 31514, 10-98 : Oujiaichong Fm.
- 5) 31719, 19-74 : Menggongao Fm.
- 6) 31553, 11-95 : Oujiaichong Fm.
- 7) 31719, 30-62 : Menggongao Fm.
- 8) 31552, 29-04 : Oujiaichong Fm.
- 9) 31553, 16-52 : Oujiaichong Fm.
- 10) 31892, 15-17 : Oujiaichong Fm.
- 11) 31554, 18-33 : Oujiaichong Fm.





## PLATE II

Figs. 1-10 *Retizononoletes hunanensis* Fang *et al.* 1993.  
All specimens from the Malanbian section except 2,3 (Oujiachong).

- 1) 31948, 27-11 : Oujiachong Fm.
- 2) 31551, 28-20 : Oujiachong Fm.
- 3) 31530, 23-68 : Oujiachong Fm.
- 4) 31514, 32-28 : Oujiachong Fm.
- 5) 31948, 17-45 : Oujiachong Fm.
- 6) 31514, 09-35 : Oujiachong Fm.
- 7) 31514, 25-66 : Oujiachong Fm.
- 8) 31514, 26-24 : Oujiachong Fm.
- 9) 31890, 22-45 : Menggongao Fm.
- 10) 31890, 19-87 : Menggongao Fm.



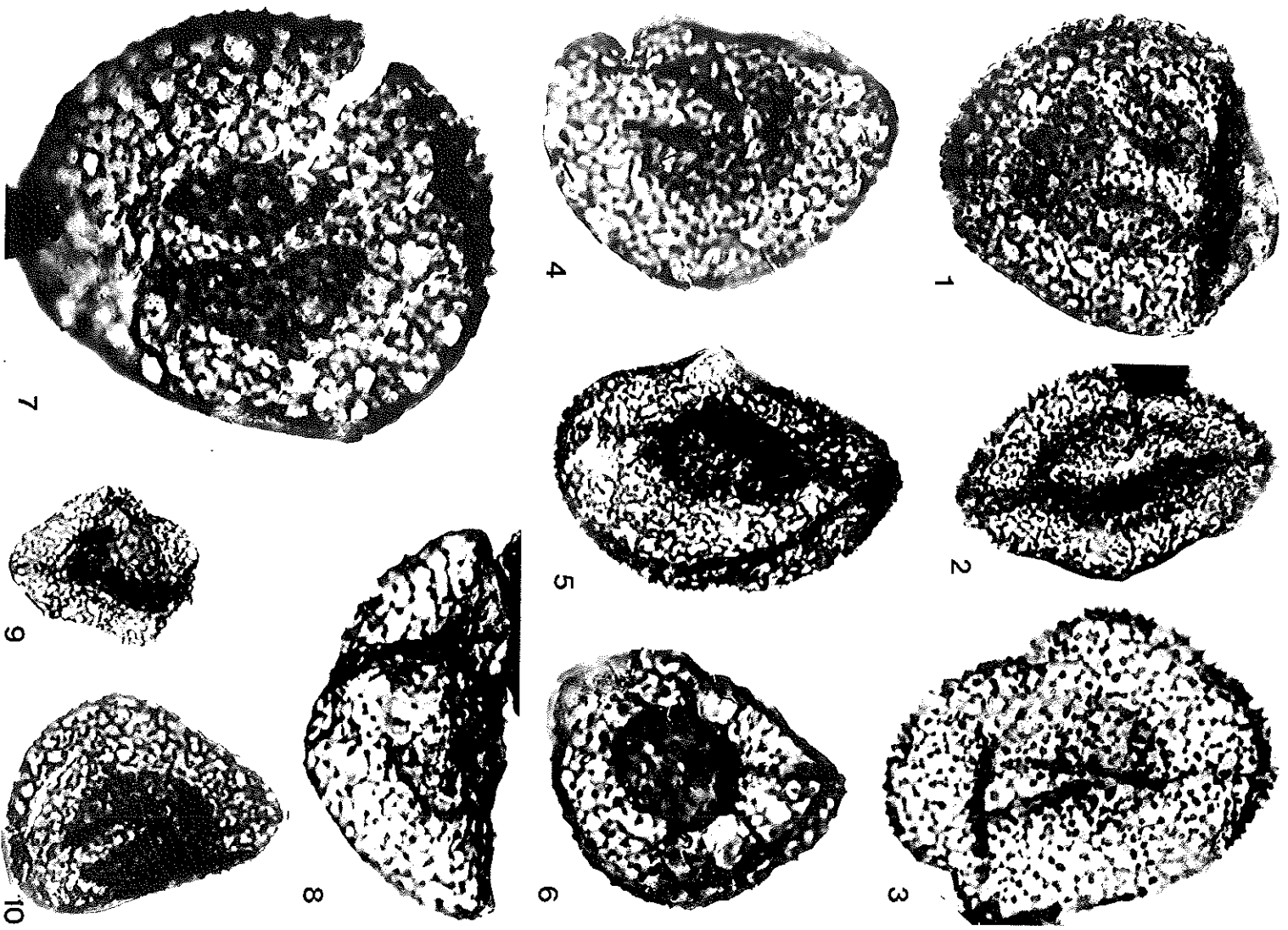


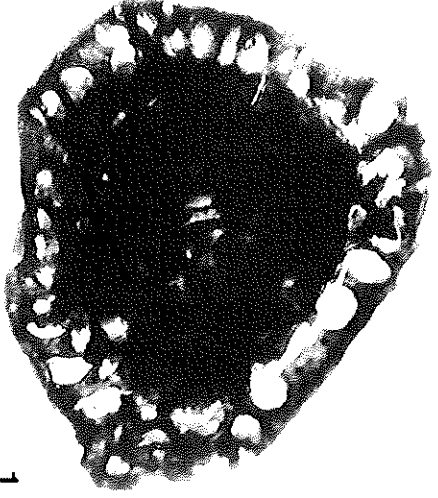
PLATE III

Figs. 1-7

*Retispora lepidophyta* (Kedo) Playford 1976.

All specimens from the clastic beds, upper part of the Menggongao Formation, Malanbian.

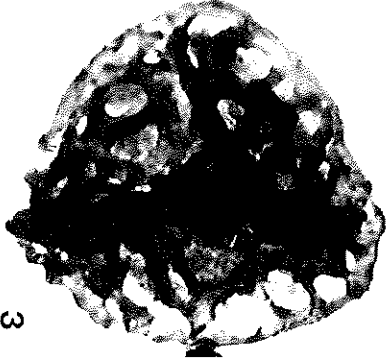
- 1) 31528, 24-32.
- 2) 31515, 19-15.
- 3) 31528, 19-04.
- 4) 31550, 23-17.
- 5) 31550, 24-16.
- 6) 31515, 26-76.
- 7) 31528, 10-52.



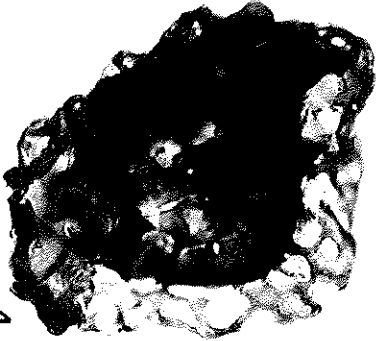
1



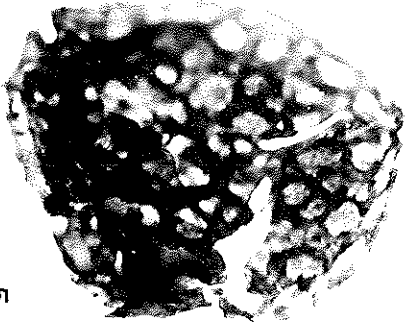
2



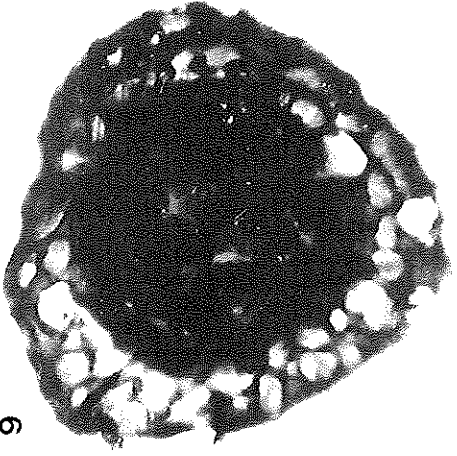
3



4



5



6



7

PLATE IV

Figs. 1,5

*Retispora lepidophyta* (Kedo) Playford 1976.

- 1) Evieux Formation, Langlier quarry, Dinant basin, Belgium, x 500.
- 5) *Id*<sup>o</sup>, SEM micrograph, showing muri and additional ornaments, weel visible at the equator, x 2500.

Figs. 2,6,7

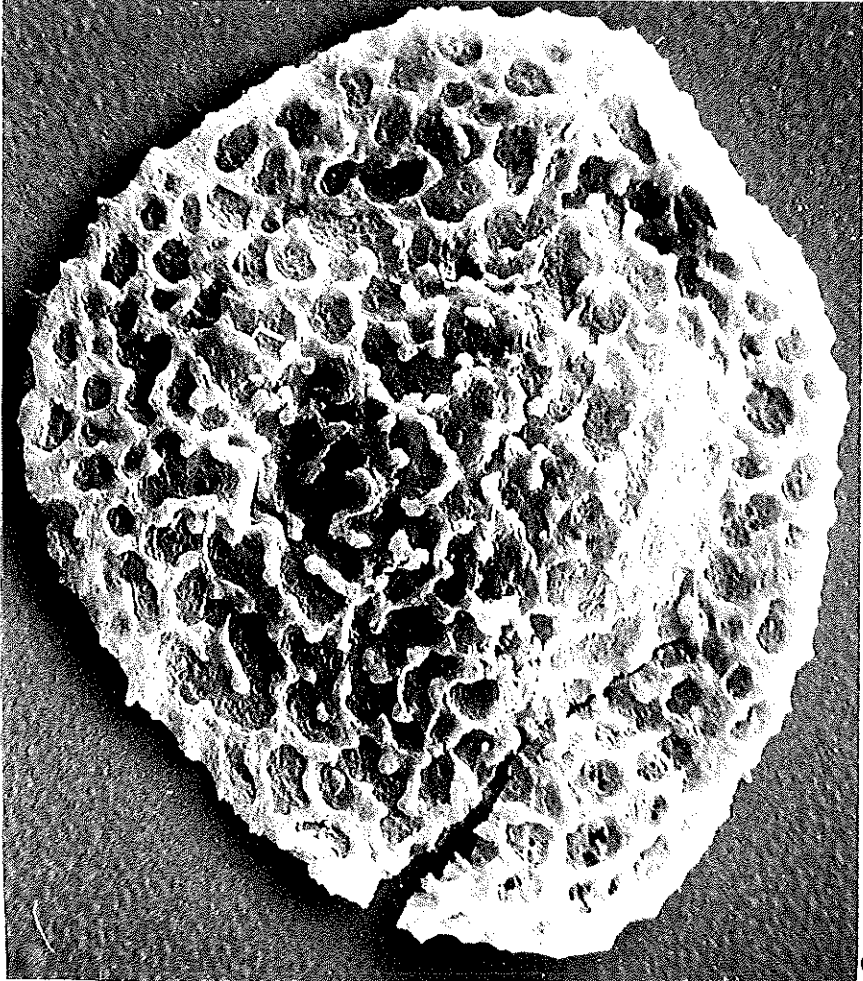
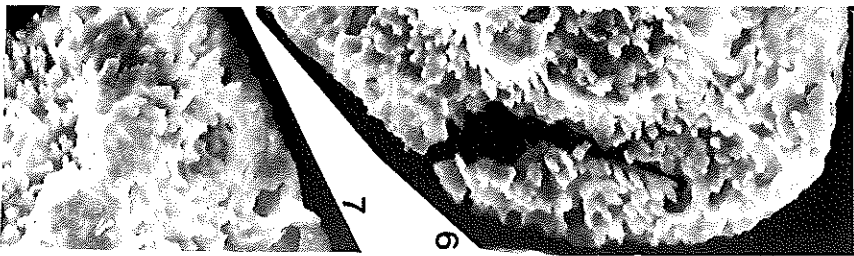
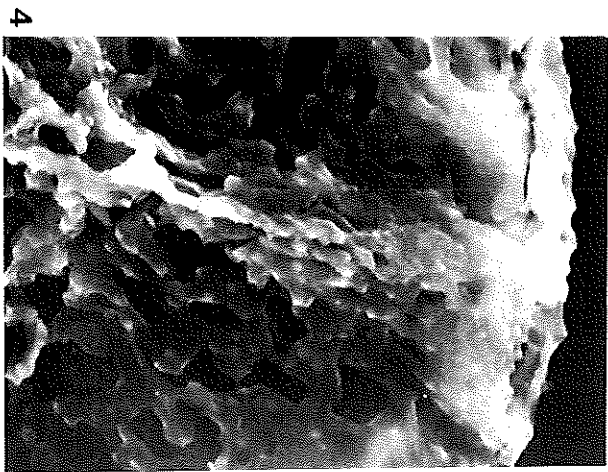
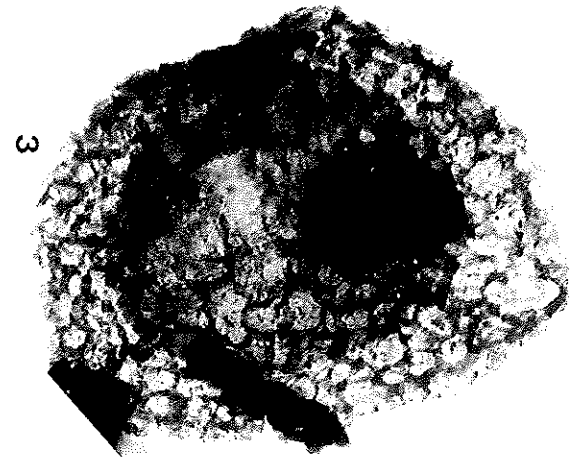
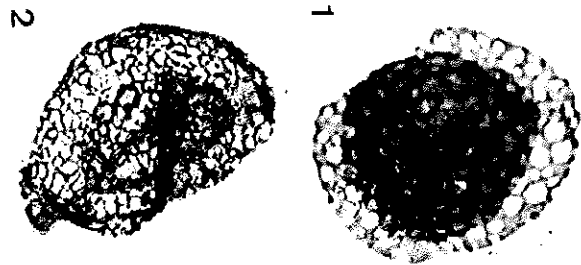
*Retizonomoletes hunanensis* Fang *et al.* 1993.

- 2) Oujiachong Formation, Malanbian, Hunan, x 500.
- 6,7) *Id*<sup>o</sup>, SEM micrographs, showing density of ornamentation, x 2500.

Figs. 3,4

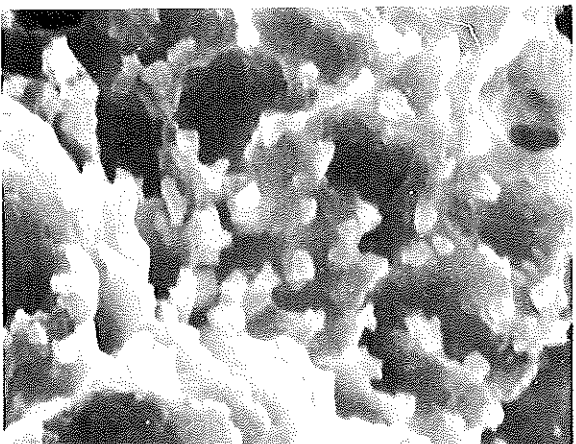
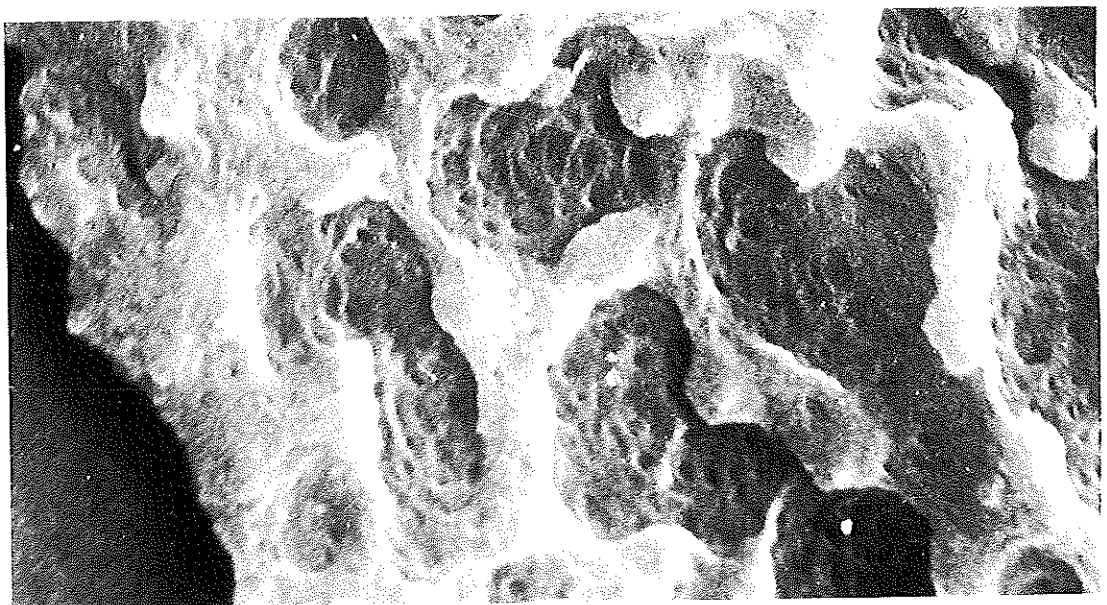
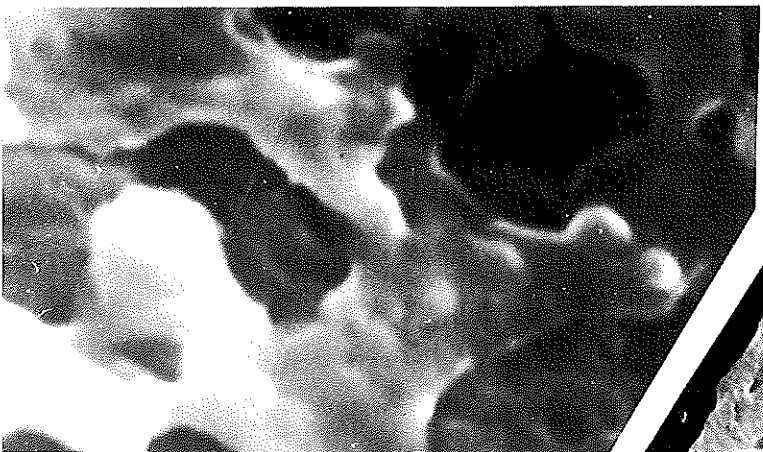
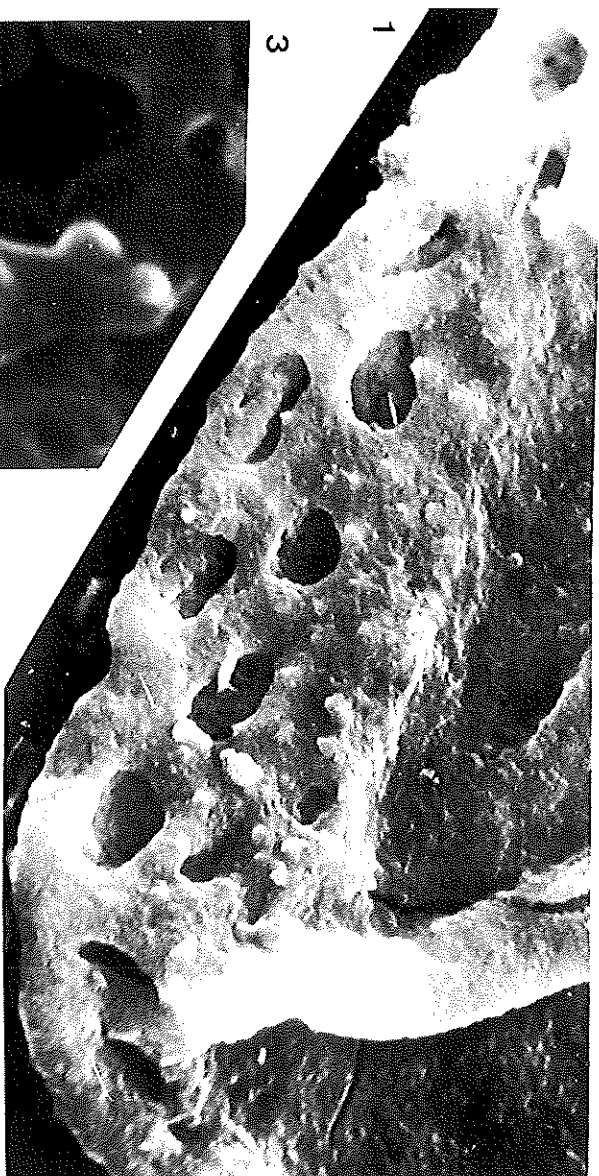
*Retispora macroreticulata* (Kedo) Byvsheva 1985.

- 3) Evieux Formation, Evieux-rail section, Dinant basin, Belgium, x 500.
- 4) *Id*<sup>o</sup>, SEM micrograph, showing muri and additional apiculate ornaments, x 2500.



## PLATE V

- Figs. 1,2 *Retispora lepidophyta* (Kedo) Playford 1976, Evieux Formation, Langhier quarry, Dinant Basin, Belgium.  
1) SEM micrograph, showing encroachment and ornamentation (foveae and comi), x 10,000.  
2) SEM micrograph, showing muri and ornamentation, x 10,000.
- Fig. 3 *Retispora macroreticulata* (Kedo) Byvsheva 1985, Evieux Formation, Evieux-rail section, Dinant Basin, Belgium. SEM micrograph, showing muri and additional ornamentation, x 10,000.
- Fig. 4 *Retizonomonoletes hunanensis* Fang *et al.* 1993, Oujiaichong Formation, Malanbian, Hunan. SEM micrograph, showing density of ornamentation, x 10,000.





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