A DEVONIAN MIOFLORA FROM P'OSHI DISTRICT, (YUNNAN) CHINA*

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ABSTRACT

An assemblage consisting of miospores, chitinozoa and scolecodonts has been described from the Devonian of P'oshi District of Yunnan. The miospore flora comprises few, simple, apiculate triletes, dominant triletes with equatorial thickening mainly represented by *Cymbosporites* Allen, and certain spinose trilete genera with spines having anchor-shaped apex. Chitinozoa are fairly abundant while scolecodonts are rare. Detailed comparisons with other Devonian assemblages have suggested a Middle Devonian age for the present assemblage.

INTRODUCTION

IN the year 1947 Hsü described some plant fossils from the Lower Devonian sediments of P'oshi District, Yunnan, China. Most of these fossils were fragmentary and hence their identifications were rather arbitrary. He (Hsü 1950) further communicated a short note on the spore contents of these sediments and indicated the richness of the mioflora. In 1966, Kräusel and Venkatachala macerated these samples and found a good deal of compressed pieces of elastic cuticles, which they assigned to Spongiophytaceae. The same material was further tried for the miospore contents by us, and an assemblage having diversified forms of microspores, chitinozoa and scolecodonts has been found. The present paper deals with the systematics, distribution and the relationships of this assemblage.

The material consists of hard, light to dark coloured, grey-brown, muddy sandstone. The collection is located at the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow, India (BSIP 31604-31607). The samples were first broken into pieces of 5-8 mm. size and kept in Hydrofluoric acid for about 2 days. Afterwards the acid was washed off and 10 per cent Hydrochloric acid was added to the material. After repeated washings with water, the acid free material was mounted in glycerine jelly. The dispersed spores have been described according to the classification of Potonié and Kremp (1954, 1956) and Potonié (1956, 1958, 1960, 1970). Chitinozoa have been classified according to the system proposed by Eisenack (1931) and later amplified by Jansonius (1964, 1967, 1970) and Cramer (1967) while scolecodonts have been described in accordance with the descriptions given by Eller (1938, 1941, 1964, 1967), Taugourdeau (1967) and Jansonius and Craig (1971).

All slides have been deposited at the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow under the Register Nos. 4315 to 4332. The photomicrographs have been taken on 10 Din microfile on Ortholux microscope No. 494429.

For all the new species the Locus typicus is — P'oshi District, Yunnan, China; and Stratum typicum is — Middle Devonian.

SYSTEMATIC DESCRIPTION

SPORITES

Anteturma — ***Proximegerminantes*** **Potonié 1970**
Turma — ***Triletes*** **Reinsch 1891**
Subturma — ***Azonotriletes*** **Luber 1935**
Infraturma — ***Laevigati*** **(Bennie & Kidst.) Pot. 1956**

Genus — ***Leiotriletes*** **Naumova emend. Pot. & Kr. 1954**

Type species — *Leiotriletes sphaerotriangulus* (Loose) Pot. & Kr. 1954.

Leiotriletes sp.

Pl. 1, Fig. 1

Description — Spores are subtriangular and range from 40-55 μ in size. Proximally the exine gets folded along the trilete rays; these flapy folds are widest in their middle and narrow out towards the marginal ends.

*Contributed to the Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany Silver Jubilee, December 1971.

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Exine is smooth but unevenly and unequally thickened giving the surface a characteristically patchy look. In optical section the thickness of the exine is ± 1 μ.

Comparison — *Leiotriletes pagius* Allen (1965) has triangular amb with simple, straight trilete rays. *L. dissimilis* and *L. confertus* (McGregor, 1960) differ from the present species in having thinner exine and simple, unfolded trilete rays. From other species of the genus, *Leiotriletes* sp. differs in the nature of exinal folds along the rays as well as in the unevenly thickened exine.

Genus — *Punctatisporites* Ibr. emend. Pot. & Kr. 1954

Type species — *Punctatisporites punctatus* Ibr. 1933.

Punctatisporites poshiensis sp. nov.

Pl. 1, Figs. 2-4

Holotype — Pl. 1, Fig. 3, Size 48 μ, Slide No. 4315.

Diagnosis — Subcircular. Y-mark short, rays 10-15 μ long, thin lipped. Exine thin, indistinctly intrapunctate, usually folded.

Description — Miospores are subcircular and usually folded. The size ranges from 48-60 μ. The trilete mark is not strongly developed, being represented by short, thin rays which do not reach beyond half of the spore. Exine is thin and variously folded. *Extrema lineamenta* is smooth.

Comparison — *Punctatisporites punctatus* is smaller with well developed trilete mark. *P. laevigatus* (Naum.) Allen (1965), differs in having well marked trilete mark and very thick exine in optical section. *P. glaber* (Naum.) Playf. (1962) and *P. minutus* Kos. (1950) are different in being smaller in size and in having well developed Y-mark. *Punctatisporites fissus* and *P. nitidus* described by Hoffmeister *et al.* (1955) are roundly triangular forms with well developed trilete rays and thicker exine at the equator and thus differ from the present species. *P. obesus* (Loose) Pot. & Kr. 1955 includes bigger spores (up to 115 μ) which possess bigger puncta. The present species differs from others in the nature of poorly developed trilete mark, thin, folded exine and indistinctly intrapunctate structure.

Punctatisporites crassus sp. nov.

Pl. 1, Figs. 5-8

Holotype — Pl. 1, Fig. 8, Size 54 μ, Slide No. 4320.

Diagnosis — Circular to subcircular. Trilete mark fairly developed, rays being 1/2 to 2/3 radius long and pointed at the ends; labra thin and vertex low. Exine thin, coarsely and closely intrapunctate all over.

Description — The size range of the miospores recorded here is 64-90 μ. The nature of germinal aperture is simple in having thin and plain lips and pointed ray ends. The exine thickness is not measurable in optical section; it is laevigate and distinctly intrapunctate, puncta being densely disposed uniformly; the adjacent puncta give a coarse appearance to exine surface. *Extrema lineamenta* is smooth.

Comparison — *Punctatisporitis punctatus* Ibr. (1933) has well developed trilete mark and indistinct intrapunctation. *P. poshiensis* sp. nov. is smaller in size having finer and indistinct intrapunctation. *P. laevigatus* (Naum.) Allen (1965) although resembles the present species in size and nature of punctation, differs in having 4 μ thick exine in optical section. Among the other comparable species, *P. obesus* (Loose) Pot. & Kr. (1955) differs in being much bigger in average size.

Remarks — The spores studied by us include roundly triangular subcircular as well as circular forms. The ornamentation is uniformly similar in all these variants and as such are considered to belong to the same species. This variation in shape is considered here, as only a minor difference. *Punctatisporites* as exemplified by the type species is a roundly triangular spore and differs from *Calamospora* S. W. & B. (1944) in its shape and structure. *Calamospora* as far as known to the authors is a psilate spore genus.

Genus — *Retusotriletes* Naumova emend. Streel 1964

Type species — *Retusotriletes simplex* Naumova 1953.

Retusotriletes concinus Kedo, 1955

Pl. 1, Figs. 9, 10

Holotype — Kedo, 1955; Pl. 4, Fig. 15.

Description of specimens studied — Miospores are circular, 50 to 70 μ in diameter. Trilete mark is well defined, rays being 21-27 μ long and straight; labra are thin and level with the exine. Curvaturae are arc shaped, complete and form a wide contact area. Exine is thick, smooth and does not show any inner line demarcating the thickness, in optical section.

Remarks — The specimens found in the present assemblage closely resemble *R. concinus* in the nature of trilete mark, contact area and the exine.

Infraturma — *Apiculati* (Benn. & Kidst.) Pot. 1956
Subinfraturma — *Nodati* Dybova & Jackowitz 1957

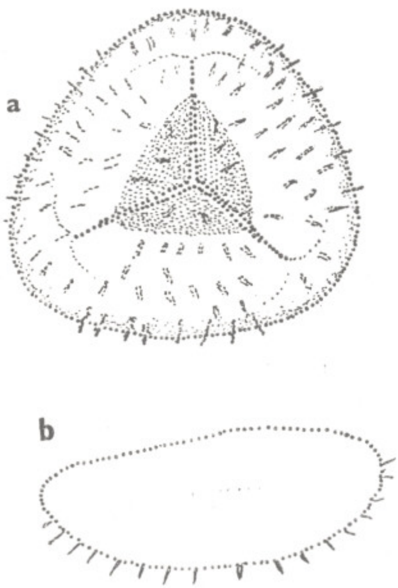
Genus — *Poshisporites* gen. nov.

Type species — *Poshisporites distinctus* sp. nov.

Generic diagnosis — Subtriangular trilete spores with convex sides and rounded angles. Exine proximally smooth, distally bearing closely set bristle-like to bacula-like processes. A polar triangular thickening present around the apex.

Organization — Text-fig. 1.

Generic description — Miospores are strongly subtriangular. Trilete mark is well defined; rays are 1/2 to 3/4 the radius in length. The labra are thin or rarely thick and the vertex is not elevated. Beyond some ray-ends, occasionally imperfect, short curvaturae-like impressions are seen. Around the apex a well defined to ill-defined, triangular denser region, presumably due to exinal thickening, is usually present. The exine of the miospore is ornamented only on the distal side, with fine to coarse 0·5 to 1·5 μ long, hair-like bristles or short, round to blunt tipped bacula. In polar view these ornament are seen projecting out at the outline of the spore, particularly inter-radially whereas the margin at the angles is almost smooth.



TEXT-FIG. 1 — Organization in *Poshisporites* gen. nov., a. Proximal view, b. Meridional section.

Comparison — *Retusotriletes* and *Phyllothecotriletes* Luber (1955) differ in the psilate nature of the exine. *Apiculiretusispora* Streel (1964) differs in the presence of perfect curvaturae, in the absence of apical thickening around the apex and in the ornamentation extending subequatorially proximally. *Aneurospora* Streel (1964) differs in being a cingulate genus having perfect curvaturae. Among other comparable genera, *Streelispora* and *Synorisporites* Richardson & Lister, (1969) differ in having crassitude at the equator and also in the presence of proximal, inter-radial sculpture. *Cymbosporites* is distinguished by its distal patina and an equatorial crassitude-like thickening. *Poshisporites* is closely comparable to *Diatomozonotriletes* (Naum.) Playford (1963), in the differential distribution of its ornament; however, it differs significantly in the roundly triangular shape of the spore body, baculose ornamentation, and the thickened exine around the apex. *Poshisporites* appears to be an older member of a group represented by *Diatomozonotriletes* and *Reinschospora* in younger ages.

Poshisporites distinctus sp. nov.
Pl. 1, Figs. 11-15

Holotype — Pl. 1, Fig. 13, Size 32 μ, Slide No. 4319.

Diagnosis — Subtriangular. Size range 32-43 μ. Rays simple, straight almost reaching up to the margin. Arcuate curvaturae visible only at ray ends, short. Exine thin, bristles 1 to 1·5 μ long, narrow, blunt or pointed, closely set. Angles smooth.

Description — Trilete rays are straight, usually closed, rarely open to form a triangular rent. A trigonal, diffused thickening is visible around the trilete apex. The *area contagionis* is not well marked, except at the ray ends where curvaturae are visible on either sides. Bristle-like hairlets are densely disposed all over the distal side and project out along the equatorial line at the inter-radial sides only.

Poshisporites minutus sp. nov.

Pl. 1, Figs. 16-18a

Holotype — Pl. 1, Figs. 18, 18a; Size 22 μ, Slide No. 4315.

Diagnosis — Triangular. Size range 22-31 μ. Trilete rays 3/4 to almost equal to the radius, simple, straight. Curvaturae faintly visible only at ray ends. Exine thick, beset with ±0·5 μ to 1 μ long, close bristles. Angles smooth.

Description —The miospores are triangular with straight to slightly convex sides and broad, round angles. Trilete sutures are linear and straight, labra are thin with the vertex low, and ends pointed. The ornament is proximally absent. The contact markings are weakly developed, only at ray ends. The bristle-like projections are seen only at the inter-radial margin.

Comparison — The present species differs from *P. distinctus* in being smaller in size and in having shorter bristles.

Poshisporites triangulatus sp. nov.

Pl. 1, Figs. 19-20a

Holotype — Pl. 1, Figs. 20, Size 32 μ, Slide No. 4315.

Diagnosis — Triangular. Size range 32-45 μ. Trilete rays prominent, 4/5 radius long, labra 2-3 μ thick, vertex raised, ends wider. Exine proximally psilate but distally baculose, bacula 0·5-1·0 μ in length and 0·5 μ in width, fused at places. Angles smooth.

Description — Miospores are triangular with straight to slightly convex sides and narrow, round corners. The trilete rays show a tendency of thickened lips and wider ends. The bacula are sometimes fused, and emerge beyond equatorial contour, mostly at the inter-radial regions, the angles being smooth.

Comparison — From the genotype, this species differs in the shape, nature of trilete mark, as well as in the nature of ornamentation. *P. minutus* also differs in having thinner, simple trilete rays and finer processes apart from being smaller in size.

Infraturma — *Apiculati* (Benn. & Kids.) Pot. 1956
Subinfraturma — *Granulati* Dyb. & Jachow. 1957

Genus — *Granulatisporites* (Ibr.) Pot. & Kr. 1954

Type species— Granulatisporites granulatus Ibr. 1933.

Granulatisporites sp. cf. *G. rousei* Staplin 1960

Pl. 1, Figs. 22, 23

Holotype — Staplin, 1960; Pl. 3, Fig. 19.

Description of the specimens studied — The specimens measure 40-60 μ. The shape of the spores is subtriangular with slightly convex sides and broad, round corners. Trilete mark is distinct with rays reaching up to 2/3 radius; labra are thin and vertex is low. Exine is covered all over with closely set 1×1 μ grana. The latter project out at the equatorial margin to give it a micro-granulose appearance.

Comparison — *G. rousei* possesses sparsely distributed bigger grana.

Granulatisporites sinensis sp. nov.

Pl. 1, Figs. 21, 21a, 26, 27

Holotype — Pl. 1; Figs. 21, 21a; Size 30 μ; Slide No. 4315.

Diagnosis — Triangular. Size range 24-37 μ. Trilete mark distinct, rays reaching up to the equator, 24-37 μ long, straight, simple with thin labra and pointed ends. Body exine thin, proximally almost psilate, distally granulose, grana 0·5 μ in diameter, closely set. Equatorial margin microgranulose and wavy.

Description — Miospores are triangular with straight or slightly convex and round corners. Trilete mark does not show a tendency of thickening or elevation. Contact markings or curvaturae are absent. The closely set grana are circular in shape and spaced uniformly with less than 1 μ distance between the two. The proximal face shows reduced nature of ornamentation and in some cases the exine even remains almost psilate. This is due to the contact faces developing lesser ornament which has been a trend in the genera of the infraturma Apiculati.

Comparison— *Granulatisporites muninensis* Allen (1965) resembles *G. sinensis* in having laevigate proximal and ornamented distal surface but differs in being smaller in size, having thick-lipped Y-rays and arcuate curvaturae.

Subinfraturma — *Baculati* Dybova & Jackowitz 1957

Genus — *Dibolisporites* Richardson 1965

Type species — *Dibolisporites echinaceus* (Eisenack) Richards. 1965.

Dibolisporites wetteldorfensis Lanninger 1968

Pl. 2, Figs. 24, 25

Holotype — Lanninger, 1968, Pl. 22, Fig. 17.

Description — The specimens are subtriangular with slightly convex sides and narrow, rounded corners. The size range recorded is 30-36 μ. The trilete mark is very well defined with straight, 2-3 μ thick-lipped rays ending at or near the corners. Exine is covered sparsely on contact faces but densely on proximo-equatorial and distal regions with variously shaped, 1-3 μ long ×1-3 μ wide coni, pila and bacula-like processes. These get fused at places on distal face and along the equatorial margin, giving the latter a falsely crassitudinous appearance. The interornament area of exine shows fine intrapunctation on the proximal face.

Remarks — The specimens referred to this species closely resemble those described by Lanninger (1968, p. 127) from Lower Devonian of Eifel, in the nature of ornamentation, trilete mark and the exine.

Dibolisporites sp. cf. *D. echinaceus* (Eisenack) Richards. 1965

Pl. 2, Fig. 30

Holotype — Eisenack 1944, Pl. 2, Fig. 5.

Description — The spore resembles *D. echinaceus* in size and the nature of processes but the nature of trilete mark is not clear in this specimen. The spore is circular and of 90 μ diameter. The processes are 4-6 μ long, pointed, with hair-like elongation of tips; 2-3 μ high coni and short spines are also mixed with these appendages. The density of ornamentation is more on the distal face than on the proximal.

Dibolisporites sp.

Pl. 1, Figs. 28, 29

Description— A subcircular miospore measuring 60 μ across and bearing closely packed, finger shaped coni as well as round tipped bacula, has been placed in this species. The trilete mark is not distinct. The processes are 3-6 μ in length.

Turma — *Zonales* (Benn. & Kids.) Pot. 1956
Subturma — *Zonotriletes* Waltz 1933
Infraturma — *Crassiti* Bharad. & Venkatach. 1961

Genus — *Crassispora* Bhard. 1957

Type species — *Crassispora ovalis* (Bhard. 1957) Bhard. 1957.

Crassispora yunnanensis sp. nov.

Pl. 2, Figs. 31-33

Holotype — Pl. 2, Fig. 33, Size 50 μ, Slide No. 4325.

Diagnosis — Subtriangular; size range 45-54 μ. Trilete mark distinct, rays reaching almost up to the equator, lips 2-3 μ thick. Exine thick, finely verrucose. Crassitude represented by 2-4 μ wide, merging, equatorial thickening.

Description — Trilete rays are 20-26 μ long, straight and tapering. The labra are 1-2 μ thick; sutures are usually closed but may be open (Pl. 1, Fig. 4). The exine is thick with a tendency of centrifugal thickness forming a narrow, merging crassitude along the equatorial region. *Extrema lineamenta* is miroverrucose.

Comparison — *C. ovalis* is different in possessing longer coni for its ornamentation. *C. pfalzensis* Bharad. & Venkatach. (1963) differs in being bigger in size and in having coni as its ornaments.

Crassispora densa sp. nov.

Pl. 2, Figs. 34-36

Holotype — Pl. 2, Fig. 35, Size 44 μ, Slide No. 4321.

Diagnosis — Subtriangular, size range 40-55 μ. Trilete rays ± 2/3 radius long, lips 2-3 μ thick. Contact area distinct, arcuate rims being complete and fairly bent;

exine thicker at the equatorial region forming 4-8 μ crassitudinal band. Coarsely granulose on distal side.

Description — The rays are well developed with 2-3 μ wide lips and slightly raised vertex. The ray ends are joined with curvaturae which encircle 3/4 area of the proximal surface. The exine is thick, more so in equatorial region to form a 4-8 μ wide crassitudinal band. Grana are faint and sparse proximally but distinct and coarse on the distal surface. The grana measure 0·5-1·0 μ in diameter.

Comparison — *C. yunnanensis* sp. nov. is different in having narrower crassitudinal thickening and microverrucose ornamentation. *C. ovalis* Bhard., *C. vestita* Bharad. & Venkat. and *C. pfalzensis* Bharad. & Venkat. are different from the present species in having coni for their ornamentation.

Infraturma — *Patinati* Butterw. & Williams 1958

Genus — *Cymbosporites* Allen 1965

Type species —*Cymbosporites cyathus* Allen 1965.

Remarks — Allen (*l.c.*) interpreted the organization of *Cymbosporites* as patinate, presumably in view of the specimen illustrated by him (*l.c.* Pl. 101, Fig. 10) which is slightly obliquely flattened to show a part of the distal subequatorial region. The exine in that region appears slightly denser. However, in the other specimens of the type species including the holotype the densest region is the curvaturae and some or all the angular regions beyond the ray-ends, whereas in the inter-radial equator and most of the distal polar region the exine is rather thin as apparent from the lighter shade in the photographs. In another species, *C. catillus* Allen (*l.c.* Pl. 100, Figs. 11, 12) too the denser region is equatorial and the thinner region is polar. Considering this observation in the light of what the specimens of really patinate genera viz. *Tholisporites*, *Archaeozonotriletes* and *Chelinospora* look like in polar or oblique views, *Cymbosporites* does not appear to be truly patinate. The study of the specimens described here (Pl. 2; Figs. 35, 50-55, 66) also indicates an absence of well defined patina in the species otherwise morphographically resembling *C. cyathus* and *C. catillus*. *Cymbosporites* compares closely with the non-flanged species of *Lycospora* which could as well be included here.

Cymbosporites microverrucosus sp. nov.
Pl. 2, Figs. 37-43

Holotype — Pl. 2, Fig. 39, Size 34 μ, Slide No. 4316.

Diagnosis — Subcircular to roundly triangular. Size range 26-50 μ. Trilete mark distinct, rays slightly wavy, labra 1·5 μ thick, vertex slightly raised, ends tapering, reaching almost up to the margin. Exine thin in contact faces, thick in proximo-equatorial and distal region forming a merging, 2-4·5 μ wide, thick zone along the equator. Ornamentation verrucose; verrucae 1-3 μ wide and ± 1 μ high, partly fusing and closely packed.

Description — The trilete rays are well defined and tapering. The equatorial thickening appears to be merging with the proximal thinner region and no sharp line of demarcation is present between the two. The ornament is absent on the thinner area but the proximo-equatorial and the distal surfaces are profusely beset with small verrucae giving a negative vermiculate-reticulate appearance; this is also due to the confluence of some of the verrucae. The margin at equator is wavy because of the projecting verrucae.

Comparison— *C. cyathus* Allen (1965) bears bigger coni like processes and possesses a wider equatorial thickening and also includes bigger spore size. *C. catillus* Allen (1965) although resembles the present species in certain characters, differs in having sharper, defined equatorial thickening, has indistinct lasurae and finer ornamentation. *C. verrucosus* Richardson & Lister (1969) differs in having coarser verrucae and wrinkled radially folded proximal exine.

Cymbosporites vestigius sp. nov.
Pl. 2, Figs. 44-47

Holotype — Pl. 2, Fig. 47, Size 50 μ, Slide No. 4315.

Diagnosis — Circulo-triangular, size range 36-60 μ. Trilete mark well defined, rays reaching almost up to the margin. Labra 1-2 μ thick; contact areas weakly developed and rarely visible only at ray ends. Exine proximally thin all over except in the 2-4 μ wide equatorial region where irregularly thickened with merging, broken appearance.

Verrucae 2-5 μ high on proximo-equatorial region and distal surface, compact, and confluenced.

Description — Trilete rays are straight to slightly wavy and are prominently developed. The proximal surface shows low sculpture. Along the margin, the verrucae are fused. The equatorial region on proximal face is narrow and incompletely thickened. The distal verrucae are compactly disposed and confluent at places to impart a cristate look. The equator is irregularly broken due to projecting verrucae.

Comparison — *C. cyathus* Allen (1965) differs from the present species in having bigger, coni-like processes as well as in the equatorially wider, band of thickening. *C. catillus* Allen (1965) also differs in having weaker trilete mark, wider and well defined equatorial thickening and smaller verrucae. *C. microverrucosus* sp. nov. is different in having smaller verrucae and wider equatorial thickening. The present species has narrow, irregularly thickened, merging thickening at the proximo-equatorial region. *C. verrucosus* Richards. & List. (1969) also differs in having wrinkled, radially folded proximal membrane of exine.

Cymbosporites conatus sp. nov.

Pl. 2, Figs. 48-54

Holotype — Pl. 2, Fig. 54, Size 28 μ, Slide No. 4319.

Diagnosis — Subtriangular. Size range 27-35 μ. Trilete mark well developed, rays reaching up to the margin, 12-18 μ long; labra 1-2 μ thick sometimes wider at the ray ends. Exine thin on contact areas; thick proximo-equatorial band and distal face covered with 1-2 μ high, round to pointed, closely set coni.

Description — Miospores are subtriangular with convex sides and round angles. Trilete rays are thickened, wider at ends and straight or slightly wavy. Arculate rims are absent. The proximal contact area is finely sculptured while rest of the exine is conate. Coni are low and denser in arrangement on distal face than on the equatorial region. On margin, the coni are rare and low.

Comparison — *C. cyathus* Allen (1965) a comparable species bearing coni as sculptural elements, differs from the present species in being bigger in size-range and in having bigger processes with wider bases. Other species of the genus do not possess coni.

Cymbosporites novus sp. nov.

Pl. 2, Figs. 55-59

Holotype — Pl. 2, Fig. 55, Size 84 μ, Slide No. 4316.

Diagnosis — Triangular to subtriangular. Size range 42-120 μ. Trilete mark well developed, rays reaching almost up to the equator; labra usually 2-5 μ thick; straight to slightly wavy, uniformly wide or tapering at ends. Proximo-equatorial thickening 3-8 μ wide forming a merging, thickened zone. Proximally exine laevigate to finely sculptured, equatorial thickening and distal base covered with small (1-3 μ long) coni, verrucae (2-5 μ high) or even dome shaped (3-5 μ × 2-3 μ) processes, the latter bearing a short detachable apical prickle. The bases of the closely packed processes imparting a negatively reticulate look particularly on the distal surface. On the *extrema lineamenta* the processes projecting out prominently. An indeterminate yet usual feature being the presence of a denser area in and around the central region in this species.

Description — Miospores are usually subtriangular with deeply convex sides and broadly rounded corners. The trilete rays are ± reaching the equator and are well pronounced. Contact markings are absent. The proximo-equatorial thickening is narrow, without a sharp line of distinction from the central thinner region. The ornamentation is denser on the distal side and of varied type ranging from coni to dome-shaped apical-spine-bearing verrucae.

Comparison — The present species resembles with the genoholotype in shape and size but differs in having a merging type of proximo-equatorial patina (i.e. the central thinner area is not well delimited), in the extent of trilete rays and in the absence of arcuate foldings of the proximal exine at the margin of the central area. Other species of the genus do not compare with the present one in the nature of ornamentation and the large size.

Cymbosporites arcuatus sp. nov.

Pl. 3, Figs. 60-63

Holotype — Pl. 3, Fig. 62, Size 62 μ, Slide No. 4319.

Diagnosis— Subtriangular. Size range 52-72 μ. Trilete mark distinct, rays well developed, wavy and 2-6 μ thick, ends wider and merging with the thickening along the margin of thin area. Proximo-equatorial thickening 4-9 μ wide, well-defined. Proximal thin area finely sculptured, proximo-equatorial thickening and distal face microverrucose, verrucae less than 1 μ in size.

Description— Miospores subtriangular with slightly convex sides and broadly round corners. Size ranges from 52-72 μ. Trilete rays ending with the proximo-equatorial thickening. The delimitation of proximo-equatorial thickening is sharp. The outline is microverrucose.

Comparison — In the well defined nature of proximo-equatorial thickening the present species resembles with the genoholotype but differs in the nature of ornamentation. Other species also differ from the present species in having a merging equatorial thickening and in the type of ornamentation. *C. catillus* Allen (1965) is smaller in size and bears a weak trilete mark without a tendency to widen at the ends.

Infraturma — *Cingulati* Potonié & Kl. 1954

Genus — *Densosporites* Berry emend. Butterw. et al. 1964

Type species —Densosporites covensis Berry 1937.

Densosporites minutus sp. nov.

Pl. 3, Figs. 64-68

Holotype — Pl. 3, Fig. 67, Size 35 μ, Slide No. 4321.

Diagnosis — Roundly triangular. Trilete mark usually not clear, rarely faintly visible with simple rays reaching only up to the proximo-equatorial thickened zone. Exine in proximo-equatorial zone thick, glossy, well delimited, 3-10 μ wide. Proximal inter-radial region thin, finely sculptured; thickened zone bearing 1-5 μ wide, 2-10 μ high globule-like rounded verrucae, distal face finely verrucose; outline of the miospores usually entire and smooth, sometimes irregular due to projecting globular verrucae.

Description — Size ranges from 22-40 μ. The big globular processes are restricted to the equatorial thickened zone where they are just adjacent to each other. The shape of proximal polar thin area corresponds with the over all spore shape, and is very well defined.

Comparison — *D. minutus* is averagely the smallest species of the genus with a comparatively wide proximo-equatorial thickening besides having more prominent distal ornamentation as compared to *D. covensis*, *D. satatus* and *D. annulatus*.

Genus — *Cincturasporites* Hacq. & Barss emend. Bharad. & Venkatach. 1963

Type species — Cincturasporites altilis Hacq. & Barss 1957.

Cincturasporites densus sp. nov.

Pl. 3, Figs. 69-71

Holotype — Pl. 3, Fig. 69, Size 60 μ, Slide No. 4316.

Diagnosis — Subcircular. Size range 45-60 μ. Trilete mark not well defined. Cingulum 10-20 μ wide in equatorial region thickened with glossy, radial thickenings. Ornamentation consisting of 4-8 μ long, 3-5 μ wide, rounded knobs. Margin wavy.

Description — Size-range recorded is 45-60 μ. The trilete mark is usually not defined and very weakly developed, the rays where visible, do not enter the cingulum. The exine on proximal area is thin. The processes on cingulum and distally are globular to elongate verrucae like and densely packed or even fused. The cingulum is unequally thickened to give a somewhat radial pattern. Processes project out on the equator.

Comparison — *C. radialis* Bharad. & Venkat. 1963 resembles with this species in the nature of radial pattern of equatorial cingulum but differs in having bigger, rounded knobs for ornamentation. Other known species of the genus do not possess radial pattern of the cingulum, and hence differ from the present species.

Infraturma — *Zonati* Potonié & Kremp 1954

Genus — *Ancyrospora* Richards. emend. Richardson 1962

Type species — *A. grandispinosa* Richardson, 1960.

Ancyrospora implicata sp. nov.
Pl. 3, Figs. 72-76

Holotype — Pl. 3, Fig. 73, Size 84 μ, Slide No. 4326.

Diagnosis — Subcircular. Size range 80-190 μ including processes. Central body circular, 46-100 μ in diameter, well defined, dark brown; trilete mark usually not clearly visible, probably due to body thickness. Equatorial zona thin, 15-50 μ wide around the central body; the proximal equatorial region and the entire distal surface covered with 15-50 μ long and 10-25 μ wide at the base, gradually narrowing appendages bearing variously bifurcate, glossy tips; apices of these processes being 2-5 μ long, horn or grapnel shaped. Distally the processes arranged in ± concentric pattern, being in order of increasing size towards the periphery of the zona.

Description — Size range recorded here is 80-190 μ. The body is well marked but the zona appears to be a result of partial fusion of the broad-based somewhat cylindrical appendages. Tips are detachable and glossy in appearance and bifurcating. The zona is thin, finely sculptured and densely covered with appendages.

Comparison — The only comparable species, *A. longispinosa* Richards. (1962) differs from the present species in having well defined trilete mark, thinner body, narrower zona and longer processes. *A. ancyrea* (Eisenack) Richards. (1962) has thinner body and prominent trilete mark. *A. longii* (Taugourdeau-Lantz) Allen (1965) is also different in having elevated trilete mark and thinner body. *A. trocha* Allen (1965) has radial muri on the exine besides the spines, thus differs from the present species.

Remarks — In the present assemblage, the species *A. implicata* sp. nov. is fairly well represented and two types of forms are present i.e. smaller and bigger. But they do not show any other morphographical differences than the size and that too in a gradual range hence no attempt has been made to split it into two species.

Genus — *Radiatispinospora* gen. nov.

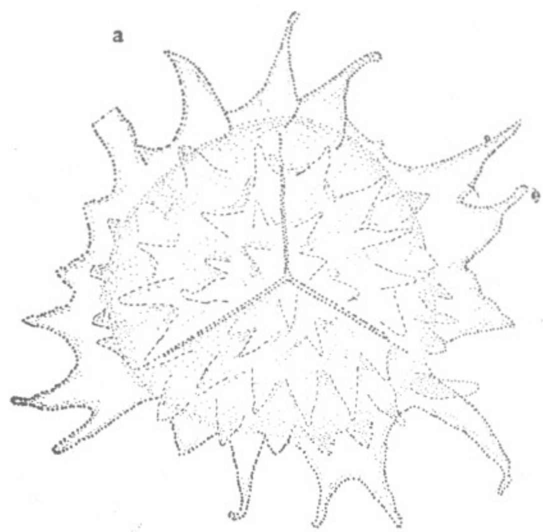
Type species — *Radiatispinospora radiata* sp. nov.

Generic Diagnosis — Radial trilete miospores. Central body subcircular, distally and equatorially bearing gradually tapering spines at the equator, largest and usually fused at the bases to form a pseudo-zona.

Organization — See Text-figure 2.

Generic Description — Miospores are usually broadly subtriangular to subcircular in overall shape. The trilete mark is well developed; trilete rays reach up to the body equator. The proximal exine of the central body is finely ornamented and thin. The distal surface as well as the equator bears big, flat spine-like processes with wider bases gradually narrowing to form rounded conical tips. No furcation of the tip has been noticed. The processes are centri-

a



b

TEXT-FIG. 2 — Organization in *Radiatispinospora* gen. nov., a. Proximal view, b. Meriodional section.

fugally bigger in size so that the equatorial ones are the biggest. They are continuous at base, mostly so at the margin of the spore, and appear to form a zona-like structure. The tips of the spines are variously turned or straight and narrow to widely rounded.

Comparison — *Hystricosporites* McGregor (1960) differs in being azonate and in bearing bifurcated spines. *Ancyrospora*, a closely comparable genus, bears variously bifurcate processes. In the present genus the tips of the processes are simple. *Ancyrospora* also shows a well developed exoexinal extension to form a flange whereas in the present genus the fusion of the bases of spines simulates flange. *Archaeotriletes* (Naum.) Pot. (1958) has a thin membraneous zona and the spinose processes are club shaped which arise from the central area. *Nikitinisporites* Chaloner (1959) is much bigger in size, and has elevated trilete mark, raised contact face along the trilete mark, as well as it possesses bifurcate processes. *Dicrospora* Winslow (1962) has bifurcate to multipartite spines.

The present genus is distinctive in having simple spines with fusing tendency at their base and forming an incipient zonal structure.

Derivation of name — After the nature of the radiating spines.

Radiatispinospora radiata sp. nov.

Pl. 4, Figs. 77-78

Holotype — Pl. 4, Fig. 78, Size 80 μ without spines, Slide No. 4326.

Diagnosis— Subcircular, Trilete rays thick lipped 2-4 μ wide, reaching almost up to the margin. Body thick, dark brown. Processes 10-25 μ long 8-12 μ wide at the base, gradually narrowing towards tips, apices roundly conical without furcation; peripheral processes fused at bases up to 10 μ, forming a pseudo-zona. Distally in the central area spines smaller.

Description— The size range recorded here is 80-150 μ. The trilete mark though thick is not clearly seen due to exine thickness. The proximal exine of the body is finely sculptured. The processes are radiating at the periphery and fused at the bases. The distal central region is covered with closely set, smaller spines.

Genus — *Archaeotriletes* Naumova 1953

Type species — *Archaeotriletes conspicuus* Naumova 1953.

Archaeotriletes porrectus Balme & Hassell 1962

Pl. 5, Figs. 84, 85

Holotype — Balme & Hassell 1962, Pl. 5, Fig. 3.

Description — Spores are subcircular in laterally flattened condition, 120-140 μ along the body. Triradiate lips are expanded, 5-10 μ wide, raised. Body excluding the contact area is covered with massive 10-20 μ long, tapering spines with bifurcated to anchor-shaped tips which usually break off. Flange is thin, uniform, subequatorial and 30-40 μ wide.

The elevation of flange in laterally compressed specimens is 30-40 μ forming a wing like shape. The trilete mark is prominent but the demarcation of contact area is not very sharp. The spines are 10-20 μ long with 5-10 μ wide base and tapering sides. Usually the furcating tips break off. The flange in laterally flattened specimens usually appears as girdling the body and superimposed on the contact area.

Remarks — The specimens described by Balme & Hassell are somewhat smaller in size range otherwise in other morphographical characters they resemble closely with the present specimens.

Group — *Acritarcha* Evitt 1963
Sub-Group — *Sphaeromorphitae* Downie, Evitt & Sarj. 1963

Genus — *Leiosphaeridia* (Eis.) Downie & Sarj. 1963

Type species — *Leiosphaeridia baltica* Eisenack 1958.

Leiosphaeridia sp.

Pl. 4, Figs. 79, 80

Description — Miospores alete, 40-70 μ in size and subcircular in shape. Exine thin variously folded with microverrucose ornamentation of low type.

Remarks — Only a few specimens referable to the alete genus *Leiosphaeridia* have been encountered in the present assemblage hence a detailed variation study could not be done.

CHITINOZOA

Phyllum — Uncertain
Class — Uncertain
Order — Chitinozoa Eisenack 1931
Family — *Sphaerochitinidae* Jans. 1964

Genus — *Pseudoclathrochitina* Cramer 1967

Type species — *Pseudoclathrochitina carmenchuae* (Cramer 1964) Cramer 1967.

Pseudoclathrochitina ovata sp. nov.

Pl. 4, Fig. 81

Holotype — Pl. 4, Fig. 81, Size 480×240 μ, Slide No. 4325.

Diagnosis — Vesicle oval, cylindroid without differentiation in body and neck; base broadly oval, ornamented with short cingulum, indistinctly perforated. Oral pole oval, aperture not organised. Cuticle psilate, unevenly thickened, denser and opaque towards the aboral pole.

Description— Vesicle length 480 μ× width 240 μ. Shoulders and flexure are not defined as the sides are convex and form an oval shape. The distal cingulum is 60×10 μ appearing to form a tuft or ring at the base. Oral pore is not organized. Cuticle is unevenly thickened and appears to be criss cross folded; narrow pleats appear in thinner area.

Comparison — The closest resembling species is *P. carmenchuae* Cram. which differs from the present one in the pronounced, coarsely foveolate cingulum, in the presence of lips and by the wholly opaque cuticle without microfolds.

Genus — *Clathrochitina* Eisenack 1959

Type species — *Clathrochitina clathrata* Eisenack 1959.

Clathrochitina sp.
Pl. 4, Fig. 82

Description — Vesicle is 280 μ long, ovoidal with 120 μ broad, round base and narrower cylindrical neck. The shoulders are pronounced but the angle of flexure is smooth. The entire basal portion is ornamented with anastomosing meshes of reticulae. The oral aperture is narrow but the internal characters are not visible. The cuticle is thick, opaque and black in colour.

Remarks — This specimen resembles *Clathrochitina* sp. illustrated by Moreau-Benoit (1967).

Family — *DESMOCHITINIDAE* Eisenack 1931

Genus — *Desmochitina* Eisenack 1931

Type species — *Desmochitina nodosa* Eisenack 1931.

Desmochitina distincta sp. nov.

Pl. 4, Fig. 83

Holotype — Pl. 4, Fig. 83, Size 120×60μ, Slide No. 4331.

Diagnosis — Vesicle elongate, sides ± parrallel and the body and neck not differentiated, ± cylindrical with broad, flat oral pole and round aboral pole; shoulders not distinct. Base convex with narrow, 20×20 μ callus; collar distinct, flat. Internal characters not visible. Cuticle smooth, apaque.

Description — Vesicle is elongate with broader oral end and round, convex aboral end with a distinct, narrow 20×20 μ callus.

Comparison — Among the comparable species *Desmochitina elegans* Taug. & Jekho. (1960) differs from the present species in having elongated, narrow basal region and a fan-shaped callus; *D. urna* Eis. (1934) has a flask shaped vesicle with a short basal callus.

Desmochitina sp.

Pl. 5, Fig. 86

Description — Vesicle is ovoidal, oblong, 240×160 μ, with broad, straight oral end. Aboral end is round with a broad, prominent callus.

Remarks — No comparable specimen has been described with these characters but since the occurrence of the specimens is rare, the specific delimitation has not been attempted here.

Family — *CONOCHITINIDAE* Eisenack 1931

Genus — *Lagenochitina* Eisenack 1931

Type species — *Lagenochitina baltica* Eis. 1931.

Lagenochitina foveolata sp. nov.

Pl. 5, Figs. 88, 89

Holotype — Pl. 5, Fig. 88, Size 210 μ × 44 μ, Slide No. 4319.

Diagnosis — Vesicle elongated cylindro-spheroidal with ovoidal body chamber and cylindrical neck. Size range 100-210 μ × 40-88 μ wide base roundly convex, usually broken, sides convex, shoulders poorly developed; flexure indistinct collar indistinct, without thinning, apical angle 30-45°. Vesicle completely psilate, 2-4 μ thick, finely punctate with sparse, 1-3 μ foveolae. Pseudostome entire. *Extrema lineamenta* smooth.

Comparison — *Lagenochitina vitrea* (Taugourdeau) Cramer (1966) is a comparable species which differs in having structureless vesicle, thinner and distinct neck-end and somewhat flat aboral pole. Among the other resembling species, *L. ovoidea* Benoit & Taug. (1961) has a shorter neck with a collar and *L. cylindrica* Eisenack possesses an elongated cylindrical chamber, apart from the structureless cuticle. *Lagenochitina inflata* Benoit & Taug. (1961) differs in having fusiform body with roundly conical aboral end and having structureless cuticle.

Genus — *Conochitina* Eisenack 1931

Type species — *Conochitina claviformis* Eisenack 1931.

Conochitina ambigua sp. nov.

Pl. 5, Fig. 87

Holotype — Pl. 5, Fig. 87, Size 88 μ × 44 μ, Slide No. 4319.

Diagnosis — Vesicle cylindro-oval with distinct, body, short, 28 μ wide neck and wider lips. Body chamber with slightly convex aboral pole, straight sides and pronounced shoulders; flexure distinct, broad; neck short with wide aperture; apical angle ± 60 μ. Basal callus not clear, with few small projections.

Description — Size of the vesicle 88 μ along the longer axis, 44 μ along the width of the body, and width of the neck 28 μ, the oral top 30 μ. Vesicle is thick, more so on the neck and the lip, opaque, structureless. Ornamentation at aboral pole reduced, apparent as fimbriate. Neck is represented by a concavely constricted area, 10 μ long 28 μ wide and then widening to form prominent lips for the aperture. Internal characters are not visible. Outline is psilate.

Comparison — The closely comparable species *Conochitina parvidecipiens* Cramer (1967) differs from the present species in having longer neck and almost flat base at the aboral pole.

Conochitina sp. cf. *C. simplex* Eis. 1931

Pl. 6, Fig. 92

Description — Vesicle is elongate-conate in overall shape, 480 × 160 μ oral end narrower, with round top. Shoulders and flexure not defined. Cuticle is unevenly thickened, psilate, without any apparent processes at the aboral end.

Conochitina constricta sp. nov.

Pl. 6, Figs. 90, 91

Holotype — Pl. 6, Fig. 91, Size 320 μ, Slide No. 4327.

Diagnosis — Vesicle elongate, body distinct with slanting sides, ± flat aboral end. Neck elongate, constricted, distinct; lips wider and thinner. Prostome visible. Cuticle thin and unornamented.

Description — Vesicle measures 320-400 μ along the length and 160-190 μ at the body width. The neck is constricted, narrow and well delimited. Apical angle varies from 45 to 60 degrees. The lips are wider and thinner, like a funnel. Aboral pole is flat and cuticle is thicker in the body neck region.

Comparison — *C. simplex* Eis., *C. laqinomorpha* Eis. and *C. oelandica* differ in the absence of lips. *C. bulmani* Janson. (1964) differs in having spines in the basal region.

Genus — *Rhabdochitina* Eisenack 1931

Type species — *Rhabdochitina magna* Eisenack 1931.

Rhabdochitina punctata sp. nov.

Pl. 6, Fig. 93

Holotype — Pl. 6, Fig. 93, Size 340 μ, Slide No. 4332.

Diagnosis — Elongated cylindroid; no distinct demarcation in neck and the body, longer axis 260-340 μ, width 80-90 μ, gradually narrowing tubular neck. The pseudostomal region narrower and ill-defined. Vesicle finely punctate with 2-3 μ wide pits placed 5-10 μ apart. Outline smooth.

Description — The sides of the vesicle are smooth and no angle of neck is formed. The specimens are semi-transparent and reveal structural pattern as finely punctate. The cuticle is 2-3 μ thick uniformly. The pseudostoma is simple without a collar.

Comparison — *R. magna* Eis. differs in having uniformly wide cylindrical vesicle and in the absence of punctation in the cuticle.

Rhabdochitina serpentina sp. nov.

Pl. 7, Figs. 97-98

Holotype — Pl. 7, Fig. 97, Size 1040×28 μ, Slide No. 4316.

Diagnosis — Large, cylindrical vesicle, width ± uniform all along the length. Cuticle thick, almost opaque, laevigate.

Description — Recorded size varies from 800 to 1040 μ length and 20-30 μ in width. No distinction in body and neck has been ever seen. The specimens are usually found in coiled condition. The ends are without any ornamentation or distinction of lips. The surface is smooth.

Comparison — *R. conocephala* Eis. (1934) closely approximates the present species. However, the present species differs in having narrower vesicle and in its coiled nature.

Incertae sedis

Pl. 7, Fig. 96

Remarks — A small flat thalloid, cylinderoid body with one end branched shows internal thicker region and outer thinner region. No such form has ever been described under chitinozoa and since only one specimen has been found here, nothing definite could be said about its systematic position.

SCOLECODONTES

Genus — *Staurocephalites* Hinde 1879

Type species — *Staurocephalites niagarensis* Hinde 1879.

Staurocephalites sp. cf. *S. articulatus* Eller 1955

Pl. 7, Fig. 99

Description— The shape of the scolecodont is oval, 400 × 150 μ. Inner margin is slightly concave in the centre and rounded at the anterior and posterior ends; 24 denticles are present in a single series on the inner margin, teeth are closely set, elongated conical with round tips, slightly oblique, bigger at the anterior region and gradually decreasing towards the posterior ends, backward-directed. A large deep fossa, not sharply defined, extends half the length of the jaw.

Staurocephalites densidentatus sp. nov.

Pl. 7, Fig. 100

Holotype — Pl. 7, Fig. 100, Size 560 × 180 μ, Slide No. 4330.

Diagnosis — Jaws plano-convex, elongate. Denticular face distinctly convex, covered with closely spaced, 4-16 μ high, backward directed, conical, 22 denticles; the size of the denticles regularly decreasing towards the posterior end. Fosse indistinct.

Description — The teeth are conical with pointed ends and broad base; they decrease in size as well as they are oblique towards the posterior end. The teeth are so close that their bases touch each other.

Comparison — This species resembles *S. articulatus* Eller 1955 and *S. longirostris* Eller 1964 in the nature of body and denticles, but differs in having packed, distinctly convex interior face having closely packed dents which gradually decrease in size towards the posterior end.

Genus — *Nereigenys* Jansonius & Craig 1971

Type species — *Nereigenys disjuncta* (E.) Jans. & Craig 1971.

Nereigenys sp.

Pl. 7, Fig. 101

Description — The jaw is elongate with the anterior end sharply conical and curved towards the internal face. Denticles are 11 in number, bigger at the anterior region, sparse and almost straight. The fossa is large and distinct at the posterior region.

Remarks — The specimen is closely comparable to *Nereigenys* cf. *harbisonae* Eller 1941.

Genus — *Kettnerites* Zebera 1935

Type species — *Kettnerites kosoviensis* Zeb. 1935.

Kettnerites kosoviensis Zeb. 1935

Pl. 6, Figs. 94, 95

Remarks — Specimens show denticular arrangement and an overall shape which closely resemble with the specimens described for this species by Zebera (1935) and Taugourdeau (1967).

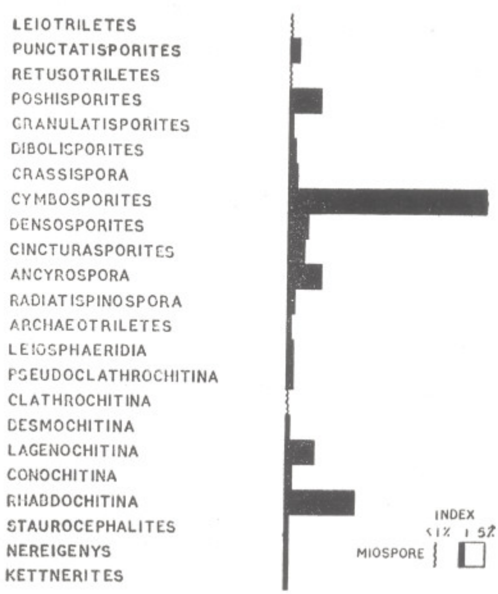
Kettnerites sp.

Pl. 7, Fig. 102

Remarks — The specimen shows slightly convex interior face with 8, rounded cone-shaped teeth with regular decreasing order in size towards the posterior end.

PALYNOLOGICAL COMPOSITION

The foregoing account reveals that the miospore assemblage is fairly diversified one and comprises 13 genera and 28 species. This assemblage is associated with quite abundant chitinozoa and a few scolecodont remains.



HISTOGRAM 1 — Showing percentage frequency of various genera in the P'oshi assemblage.

The quantitative representation of various genera is given in the Histogram I. Such an analysis reveals that the genus *Cymbosporites* Allen (1965) is dominating the whole assemblage. The other important constituents of the assemblage are:

Ancyrospora
Radiatispinospora
Poshisporites
Cincturasporites

The Chitinozoa are very significant in that the genera *Rhabdochitina* and *Lagenochitina* form a significant population of the assemblage. Annelid jaws are present but are rare in number and usually less than one percent of the total in frequency.

COMPARISON

Devonian palynology has attracted considerable attention of a large number of workers in recent years. Important contributions have been discussed by Chaloner (1967) and hence only some of them have been cited here. During the last five years additional data have been published, out of which the contributions of Andreeva (1966), Mortimer (1967), Streel (1967), Allen (1965), Schultz (1968), Schweitzer (1968), Lanninger (1968), Riegel (1968), Richardson and Lister (1969) and Bharadwaj, Tiwari and Venkatachala (1971) are important.

Chaloner (1967) has given a range chart for the distribution of miospore genera in the different stages of Devonian as available to him till then (For details of references see Chaloner 1967). A comparison of the present assemblage with that given by Chaloner (1967, Fig. 1) indicates that the genera *Punctatisporites*, *Retusotriletes*, *Lycospora* and *Granulatisporites* do not indicate affiliation with any particular stage since they are mostly present in all the stages from Gedinnian to Famennian.

The presence of *Dibolisporites* and *Ancyrospora* in the present assemblage is suggestive of an Emsian to Givetian age. The dominance of *Cymbosporites* is indicative of Givetian Stage of the Middle Devonian, although spores illustrated by McGregor and Owens (1966, pl. figs. 20, 22-24) from the Emsian of Canada which are probably *Cymbosporites*, would extend the range into

Emsian. However, *Cincturasporites* tends to limit this assemblage as Givetian or younger. The association of *Cymbosporites* in the *Triangulus-Assemblage* of Allen (1967) from Vestspitsbergen, with *Samarisporites, Hystricosporites, Auroraspora* and *Ancyrospora* suggests a corresponding Givetian age for the Chinese assemblage described here. With the Middle Devonian mioflora from some coal in Illinois (Peppers & Damberger 1969) the present assemblage resembles only in having *Retusotriletes* and *Leiosphaeridia*. The differences between the two are greater in that the genera *Spinozonotriletes, Emphanisporites, Rhabdosporites* and *Tasmanites* are absent from the present assemblage while a number of important miospores of the latter i.e. *Cymbosporites, Cincturasporites, Ancyrospora* are absent in the Illinois flora.

The Lower Devonian miofloras from Southern Britain, described by Chaloner and Streel (1966) and Mortimer (1967) show little resemblance with the present mioflora from China. However, the presence of *Emphanisporites, Rhabdosporites* and *Acinosporites* and the absence of *Poshisporites* and *Cincturasporites*, in the British material differentiates the two. The youngest mioflora from Brightling No. 1 borehole sample, as described by Mortimer (1967) to resemble with Emsian Stage of Lower Devonian, compares with the assemblage described in the present paper in so much as it has a representation of *Cymbosporites* and *Ancyrospora*. However, *Geminospora, Perotriletes, Rhabdosporites* and *Grandispora*, also reported from the Emsian of Vestspitzbergen or France, are not present in the Chinese Devonian.

It is apparent from this comparison that the assemblage from P'oshi region in Yunnan can be attributed to Eifelian to Givetian (Middle Devonian) age.

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EXPLANATION OF PLATES

(All figures unless otherwise stated are × 500).

PLATE 1

1. *Leiotriletes* sp. Ph. No. 440/5, Slide Regd. No. 4320.

2-4. *Punctatisporites poshiensis* sp. nov. Ph. Nos. 435/11, 434/16 (Holotype); 435/32; Slide Regd. Nos. 4316, 4315, 4319.

5-8. *Punctatisporites crassus* sp. nov. Ph. Nos. 435/26, 436/12, 435/5, 439/33 (Holotype); Slide Regd. Nos. 4318, 4319, 4316, 4320.

9-10. *Retusotriletes concinus* Kedo Ph. Nos. 439/22, 434/15; Slide Regd. Nos. 4317, 4315.

11-15. *Poshisporites distinctus* sp. nov. Ph. Nos. 439/42, 436/34, 436/8 (Holotype), 435/6, 435/36; Slide Regd. Nos. 4321, 4328, 4319, 4316, 4319.

16-18a. *Poshisporites minutus* sp. nov. Ph. Nos. 436/7, 439/48, 434/7, 434/6 (Holotype); Slide Regd. Nos. 4319 4323 4315.

19-20a. *Poshisporites triangulatus* sp. nov. Ph. Nos. 439/38, 434/19 (Holotype), 434/20; Slide Regd. Nos. 4320, 4315.

21-21a. *Granulatisporites sinensis* sp. nov. Ph. Nos. 440/1 (Holotype), 440/2; Slide Regd. No. 4315.

22-23. *Granulatisporites rousei* Stapl. Ph. Nos. 440/21, 439/10; Slide Regd. Nos. 4320, 4317.

24-25. *Dibolisporites wetteldorfensis* Lann. Ph. Nos. 440/36, 439/18; Slide Regd. Nos. 4316, 4320.

26-27. *Granulatisporites sinensis* sp. nov. (Contd.) Ph. Nos. 439/44, 439/47; Slide Regd. Nos. 4317, 4321.

28-29. *Dibolisporites* sp. Ph. Nos. 434/4, 435/22; Slide Regd. Nos. 4315, 4316.

PLATE 2

30. *Dibolisporites* cf. *echinaceus* (Eis.) Rich. Ph. No. 436/20; Slide Regd. No. 4322.

31-33. *Crassispora yunnanensis* sp. nov. Ph. Nos. 435/30, 435/37, 440/6 (Holotype); Slide Regd. Nos. 4319, 4319, 4325.

34-36. *Crassispora densa* sp. nov. Ph. Nos. 439/39, 439/41 (Holotype), 439/43; Slide Regd. Nos. 4316, 4321, 4321.

37-43. *Cymbosporites microverrucosus* sp. nov. Ph. Nos. 439/21, 440/7, 439/29 (Holotype), 440/10, 439/28, 436/4, 440/12; Slide Regd. Nos. 4320, 4319, 4316, 4328, 4320 4319, 4320.

44-47. *Cymbosporites vestigius* sp. nov. Ph. Nos. 434/12 434/21, 434/3, 434/10 (Holotype); Slide Regd. No. 4315.

48-54. *Cymbosporites conatus* sp. nov. Ph. Nos. 440/13 434/23, 439/12, 436/11, 435/29 434/2, 436/10 (Holotype); Slide Regd. Nos. 4317 4315, 4317, 4319, 4319, 4315, 4319.

55-59. *Cymbosporites novus* sp. nov. Ph. Nos. 435/3 (Holotype) 435/13, 439/27, 440/16, 439/30; Slide Regd. Nos. 4316, 4316, 4320, 4321, 4320.

PLATE 3

60-63. *Cymbosporites arcuatus* sp. nov. Ph. Nos· 435/27, 434/18, 436/3 (Holotype), 435/35; Slide Regd. Nos. 4319, 4315, 4319, 4319.

64-68. *Densosporites minutus* sp. nov. Ph. Nos. 436/9, 435/34, 434/1, 436/16 (Holotype), 439/37; Slide Regd. Nos. 4319, 4318, 4315, 4321, 4320.

69-71. *Cincturasporites densus* sp. nov. Ph. Nos. 440/24 (Holotype), 440/27, 434/24; Slide Regd. Nos. 4316, 4317, 4315.

72-75. *Ancyrospora implicata* sp. nov. Ph. Nos. 436/24, 436/39 (Holotype), 440/33, 440/31; Slide Regd. Nos. 4324, 4326, 4325, 4327.

76. *Radiatispinospora radiata* sp. nov. Ph. No. 436/25, Slide Regd. No. 4324.

PLATE 4

77-78. *Radiatispinospora radiata* sp. nov. (Contd.) Ph. Nos. 440/35, 440/34 (Holotype); Slide Regd. No. 4326.

79-80. *Leiosphaeridia* sp. Ph. Nos. 442/5, 442/2; Slide Regd. Nos. 4326, 4315.

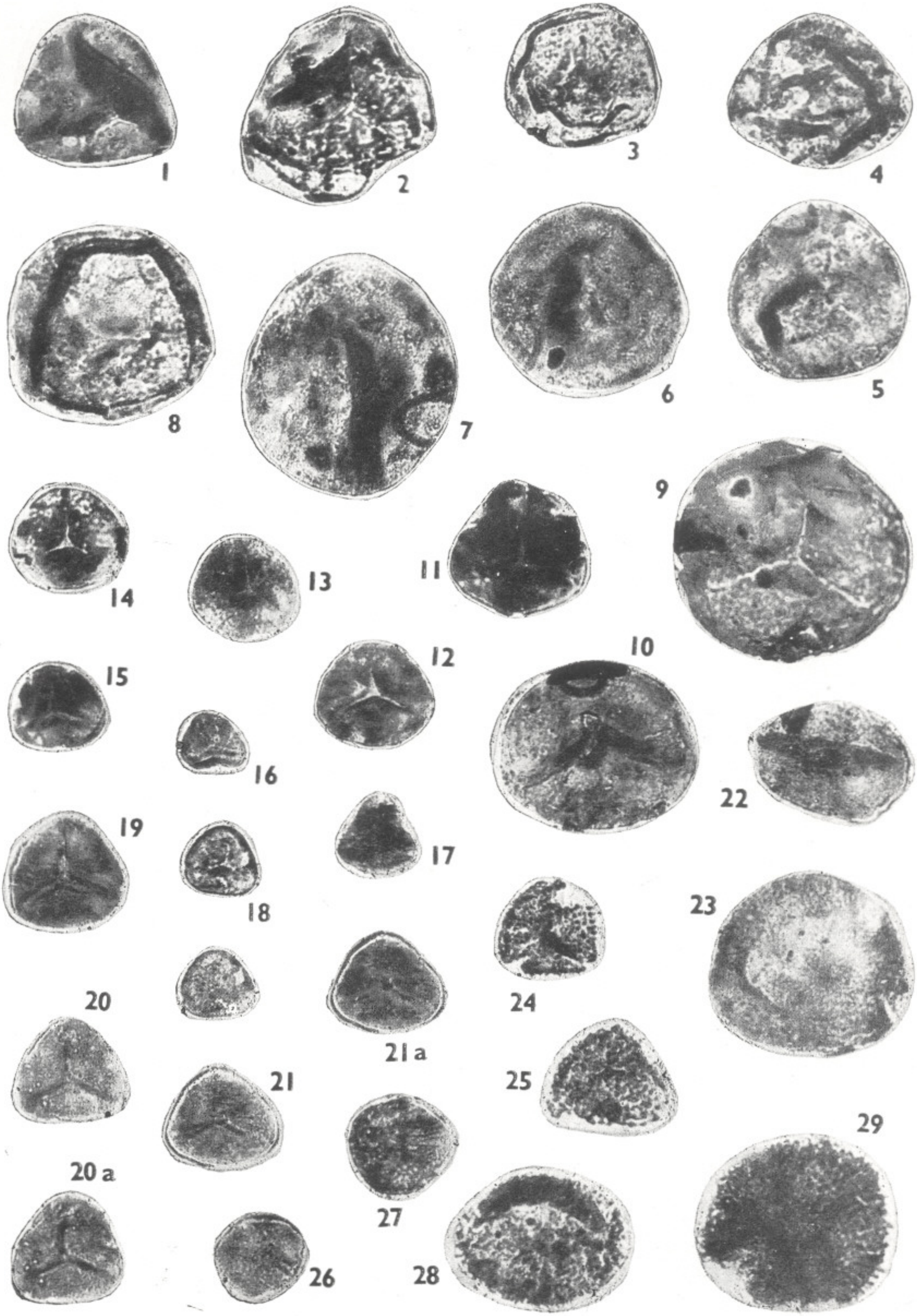
81. *Pseudoclathrochitina ovata* sp. nov. Ph. No. 436/28; Slide Regd. No. 4325.

82. *Clathrochitina* sp. Ph. No. 442/9; Slide Regd. No. 4327.

83. *Desmochitina distincta* sp. nov. Ph. No. 442/15 (Holotype); Slide Regd. No. 4331.

PLATE 5

84-85. *Archaeotriletes porrectus* Balme & Hussell Ph. Nos. 442/13, 442/11; Slide Regd. Nos. 4330, 4327.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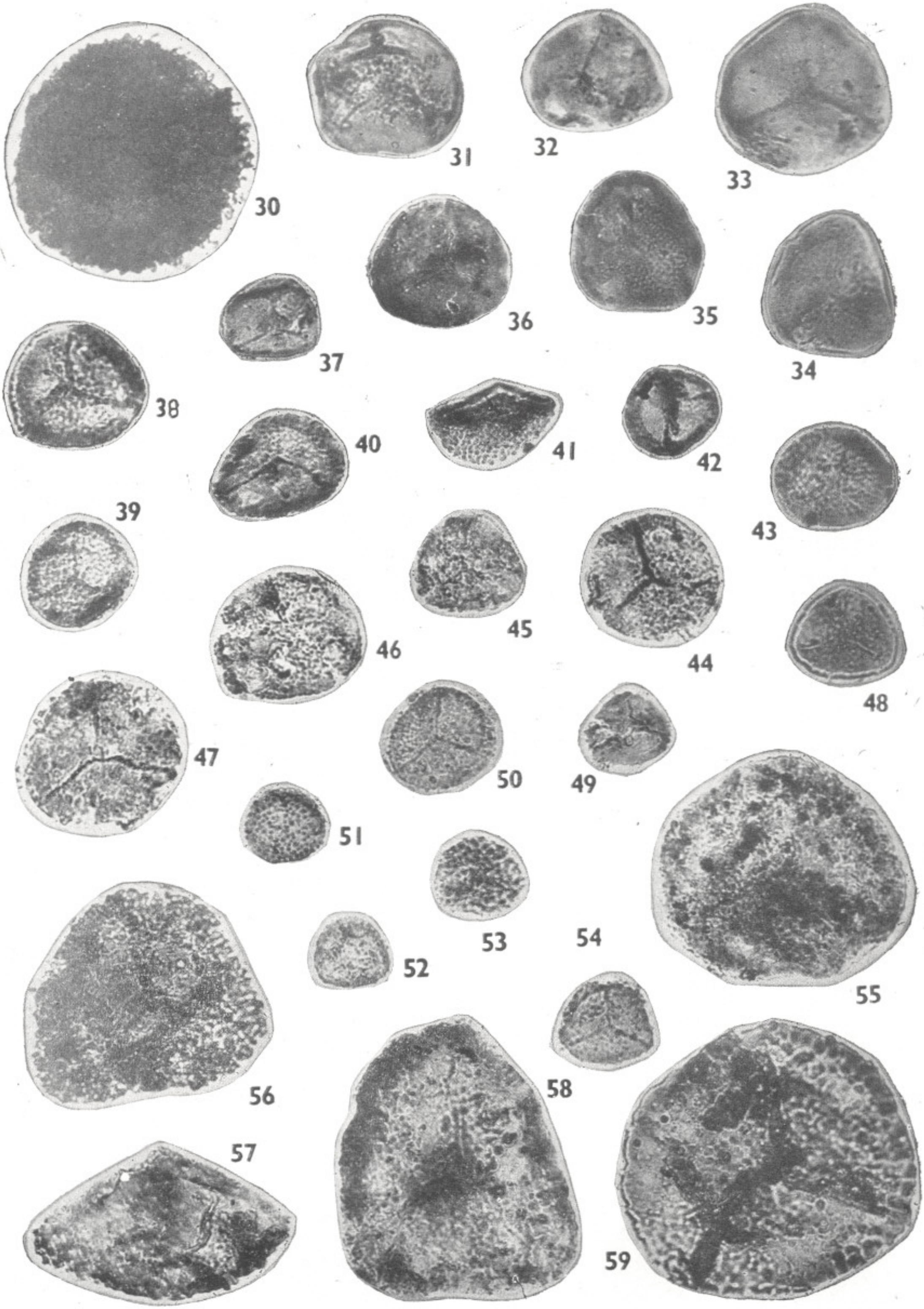
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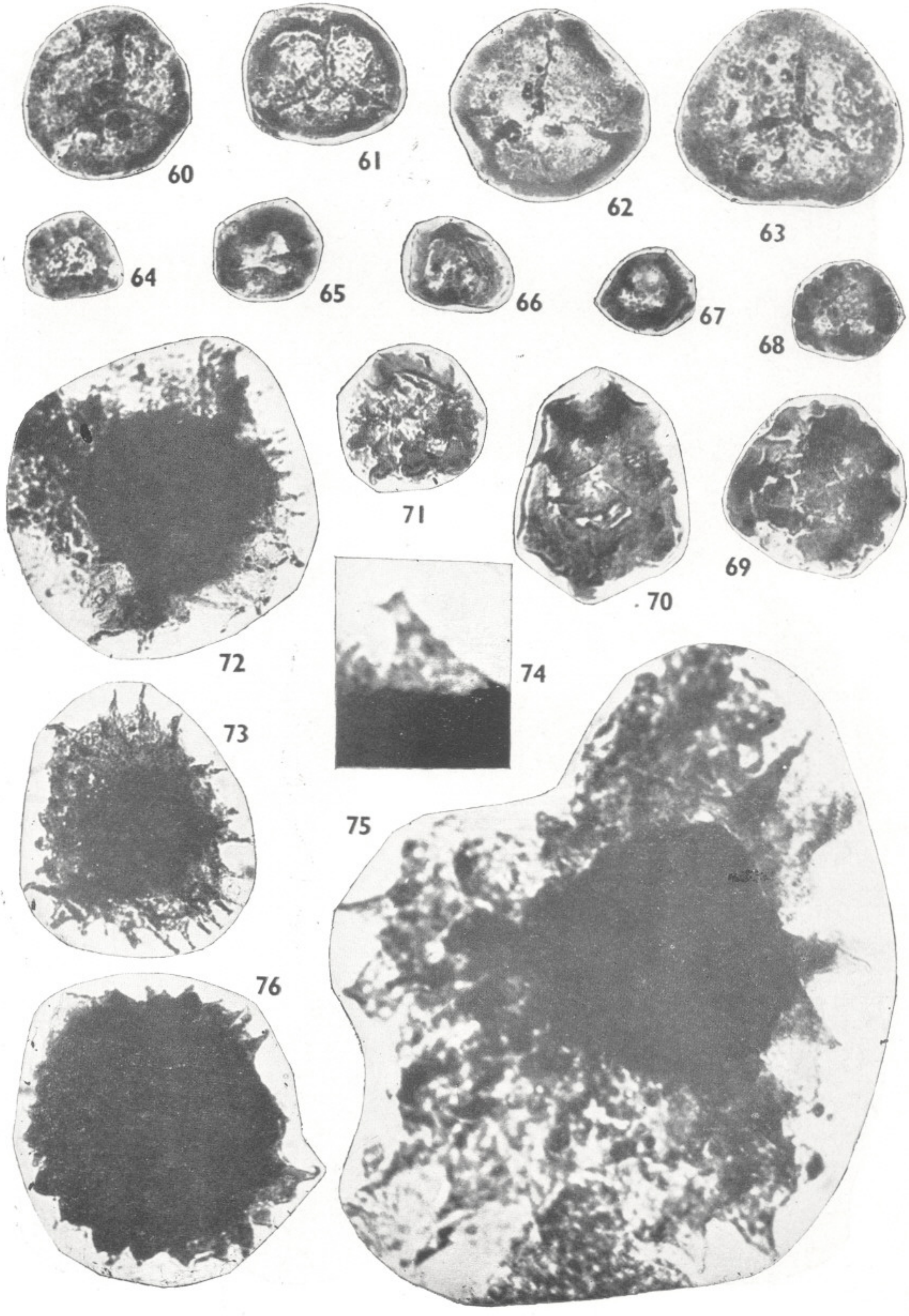
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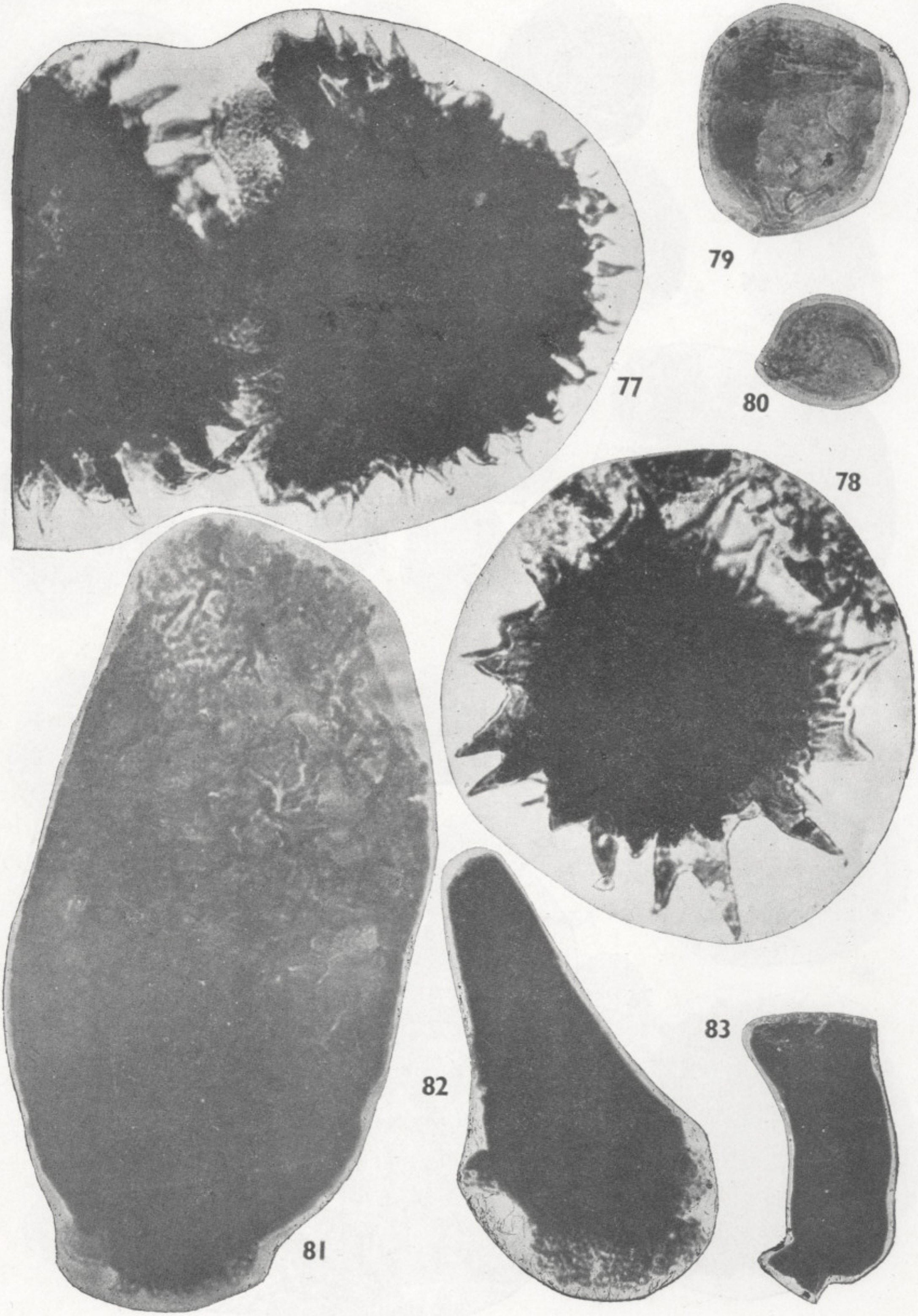

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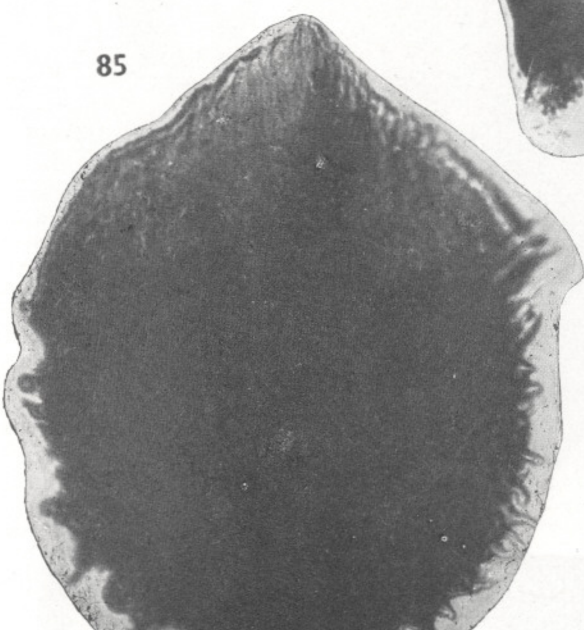

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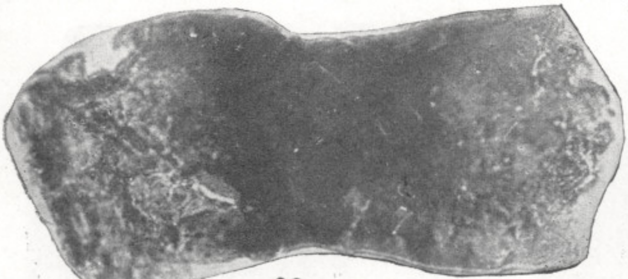

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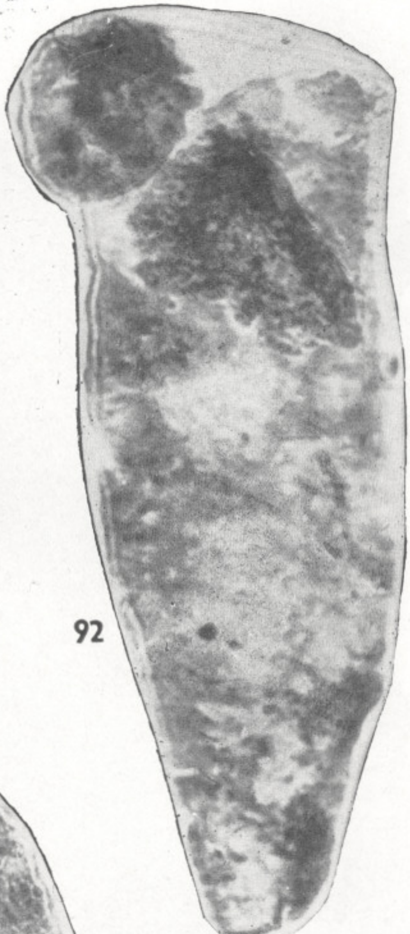

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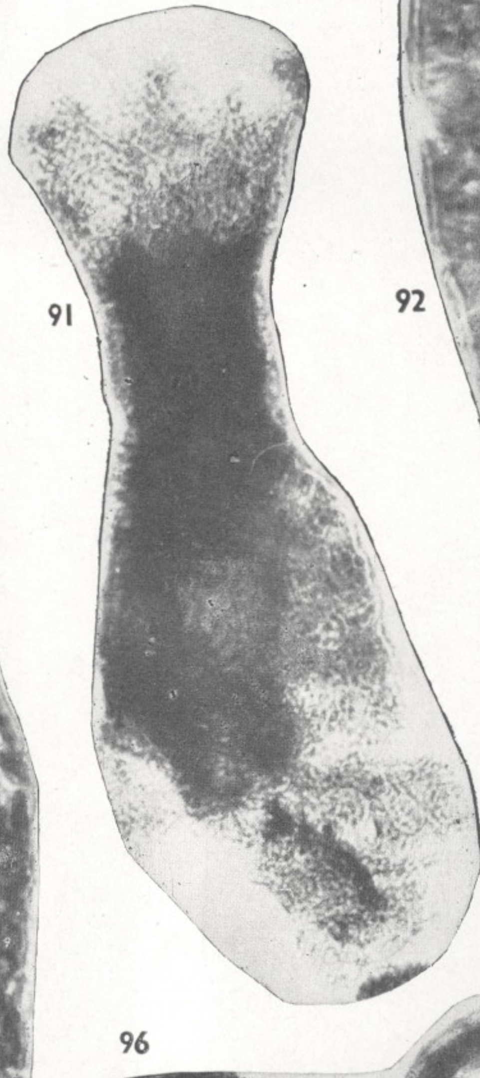

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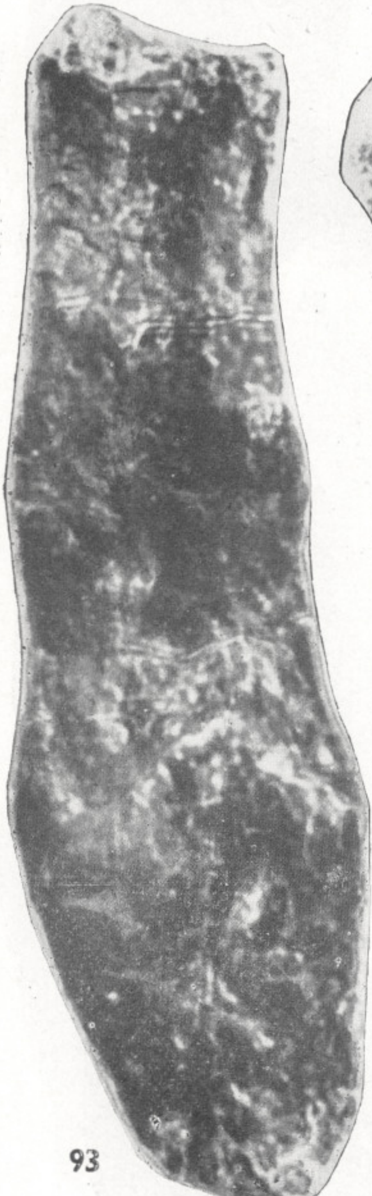

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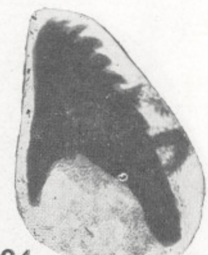

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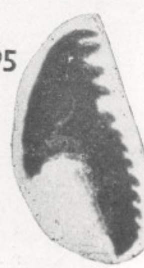

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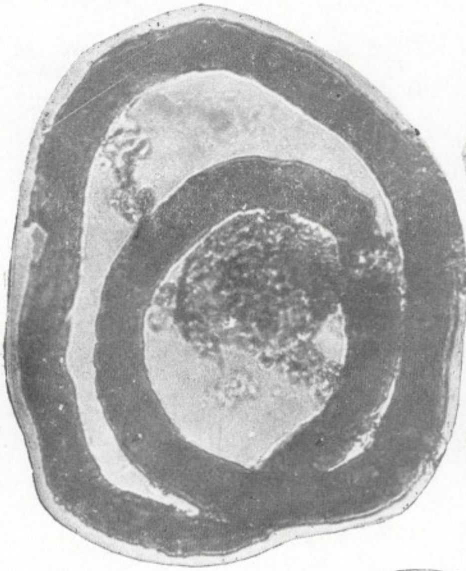
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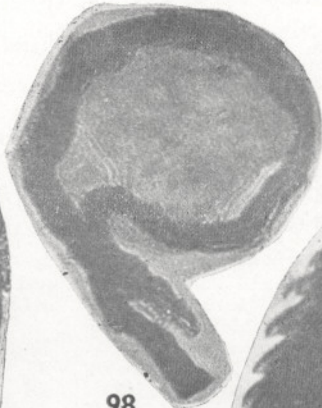
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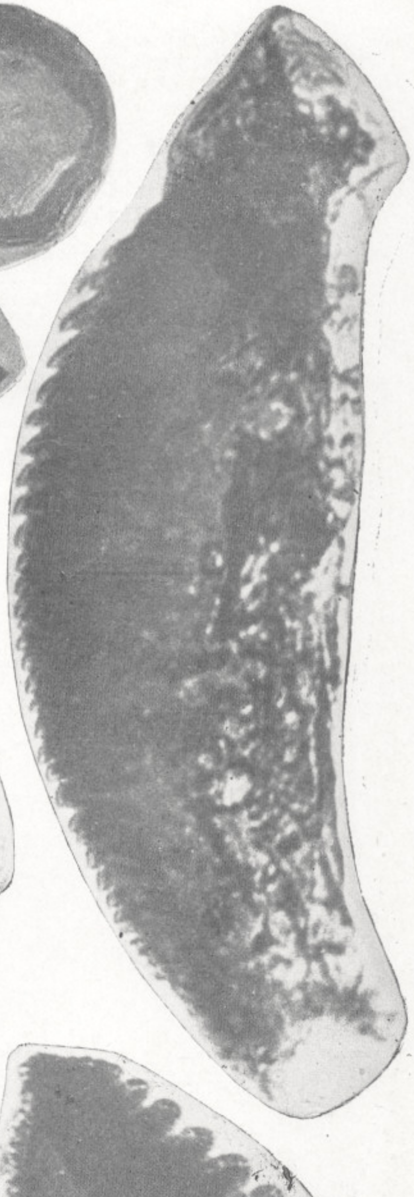
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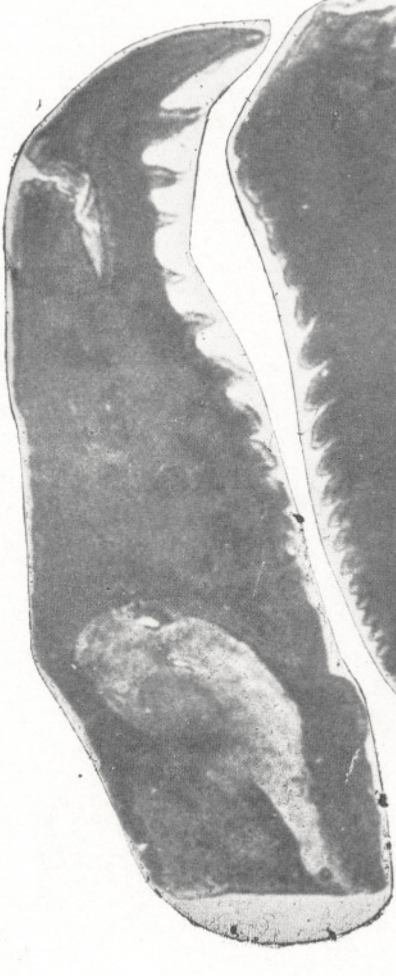
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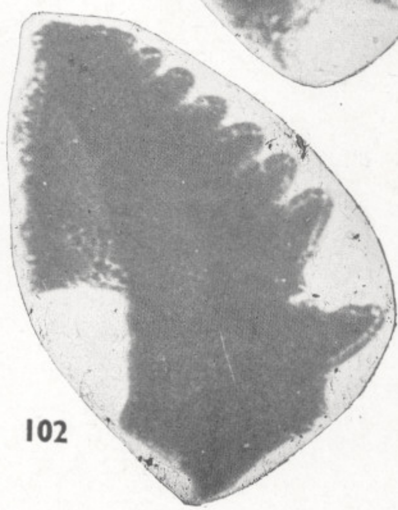
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86. *Desmochitina* sp. Ph. No. 442/8; Slide Regd. No. 4327.

87. *Conochitina ambiqua* sp. nov. Ph. No. 435/33 (Holotype); Slide Regd. No. 4319.

88-89. *Lagenochitina foveolata* sp. nov. Ph. Nos. 435/39 (Holotype), 435/8; Slide Regd. Nos. 4319, 4316.

PLATE 6

90-91. *Conochitina constricta* sp. nov. Ph. Nos. 442/4, 442/7 (Holotype); Slide Regd. Nos. 4316, 4327.

92. *Conochitina* cf. *simplex* Eis. Ph. No. 440/39, Slide Regd. No. 4327.

93. *Rhabdochitina punctata* sp. nov. Ph. No. 440/40 (Holotype); Slide Regd. No. 4332.

94-95. *Kettnerites kosoviensis* Zeb. Ph. Nos. 442/14, 442/16A; Slide Regd. Nos. 4330, 4329.

96. *Incertae sedis* Ph. No. 442/16; Slide Regd. No. 4329.

PLATE 7

97-98. *Rhabdochitina serpentina* sp. nov. Ph. Nos. 442/3 (Holotype), 442/6; Slide Regd. Nos. 4316, 4323.

99. *Staurocephalites* cf. *articulatus* Eller Ph. No. 440/44, Slide Regd. No. 4326.

100. *Staurocephalites densidentatus* sp. nov. Ph. No. 440/48 (Holotype); Slide Regd. No. 4330.

101. *Nereigenys* sp. Ph. No. 440/42; Slide Regd. No. 4325.

102. *Kettnerites* sp. Ph. No. 442/10; Slide Regd. No. 4327.