PALYNO-STRATIGRAPHY OF THE SEDIMENTARY FORMATIONS OF ASSAM: 1. STRATIGRAPHICAL POSITION OF THE CHERRA FORMATION

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ABSTRACT

Palynological studies are being pursued in the South Shillong region, to explore the possibility of resolving the probable age and stratigraphical position of the Cherra sandstone stage, which still seems to be a matter of controversy. The present paper presents the result of a preliminary investigation on a number of samples belonging to different levels of the Cherra formation. The rich miofloral assemblage contained within the samples is not only rich in angiospermic pollen grains but also shows great diversity in species. The spores are comparatively poorly represented, though one of the forms usually predominates in number. Certain elements in the palynological assemblage studied so far, though not yet conclusive, provide some evidence which points towards a lower Eocene age for the Cherra formation. However field evidences clearly indicate that the Cherra formation is part of the overlying Eocene succession rather than the underlying Upper Cretaceous succession.

INTRODUCTION

THE present paper presents the palynological assemblage of the Cherra formation of the South Shillong Plateau. The 200 ft. thick coal-bearing sandstone derives its name from the village of Cherrapunji (25°17′ N; 91°44′ E), where it is best developed. The sandstone is massive and fine to medium-grained in texture. It is generally felspathic and at places extremely friable and powdery. The sandstone is interstratified with coal, buff-coloured and carbonaceous shales and clay. The sandstones dip gently (maximum 12°) towards S40° E. The Cherra formation is underlain by the Langpar stage and overlain by Nummulitic Limestone. The general succession in the area is as follows:

Sylhet Limestone Stage	Lakadong Sandstone with coal; Lakadong Limestone (Nummulitic)	Lower to Middle Eocene
CHERRA FORMATION	THERRIA STAGE	? Paleocene
~~ (local unconformity) ~~~		
Langpar Stage		Danian
Mahadek (also known as Mahadeo)		Maestrichtian
~~ (Unconformity) ~~~		
Sylhet trap		Jurassic
~~ (Unconformity) ~~~		
Granites, Khasi-greenstone, Quartzites, Schists		Archaeans

Although several attempts have been made to solve the age complex of the Cherra formation, the question regarding its precise age and stratigraphical position still remains a subject of controversy. The lack of unanimity of earlier workers has been due to incomplete evidence concerning the circumstances of deposition of the strata concerned and also due to the lack of specific fossil information. The age of the overlying Nummulitic Sylhet Limestone has been dated as Eocene while the underlying marine Langpar stage is dated as Danian, on palaeontological evidence. The unsolved question remains as to whether the Cherra formation is related to the Tertiary sequence, that is, Lower Eocene (Palaeocene) in age or whether it is part of the Upper Cretaceous sequence.

Since Medlicott's pioneer work of 1865, who regarded the Cherra formation to be Upper Cretaceous and the Laitryngew Coal-bearing sandstone as Nummulitic in age, numerous geologists have worked in the area and put forth differing opinions. Palmer (1923) considered the Cherra Stage as definitely older than what Medlicott thought. In 1940 A.M.N. Ghosh, after extensively mapping the area, regarded the Cherra Stage as a basal member of the Sylhet Limestone stage and considered it equivalent to the Ranikot stage of Western India i.e. Eocene in age.

The first palynological fossil record from this area was by A. K. Ghosh (1941) in the form of an illustration of a 'Podocarpian' pollen. Later Sen (1948) described some spores and pollen grains from Laitryngew coal and inferred that the microflora indicated a Tertiary age for the coal bearing strata.

Recently Biswas (1962) has published a detailed paper on the stratigraphy of the Mahadeo, Langpar, Cherra and Tura formations of Assam. He regards the Cherra formation as part of the Upper Cretaceous sequence. More recently Dutta *et al.* (1963) after detailed geological mapping, have published a paper on the age of the coal-bearing sandstone at Laitryngew, and they consider the Cherra formation as part of the Tertiary sequence.

LOCALITIES AND NATURE OF COLLECTIONS

The material for the present study was collected from the following 5 localities. They represent different horizons of the Cherra sandstone stage. While sampling, adequate care was taken to avoid surface contamination.

Upper Horizon	Locality 5.	Mawkma (Registration No. 32955) floor of top seam 0·27 meters.
	Locality 4.	Same as Locality 3. (Registration No. 32937) roof of top seam 0·37 m.
Middle Horizon	Locality 3.	Umstew (sample registration No. 32936 A) floor of bottom seam. 0·41 meters.
	Locality 2.	Laitryngew (sample registration No. 32991) floor of bottom seam. 0·62 meters.
Lower Horizon	Locality 1.	Umsawmat (sample registration No. 32951). Carbonaceous shale with alternating sand bands 1·5 meters.

CLASSIFICATION AND SYSTEMATIC STUDY

In this work the spores and pollen grains have been arranged according to the classification system proposed by Potonié & Kremp (1954, 1955, 56) and subsequently enlarged by Potonié (1956, 1958, 60).

The following are the explanations for terms used in describing the distribution of species in the systematic study:

Rare = <3 specimens
Frequent = 3-5 specimens
Common = 6-9 specimens
Abundant = >10 specimens

Infraturma — *Laevigati* (Bennie & Kidston, 1886) Potonié

Genus *Biretisporites* (Delcourt & Sprumont) emend. Delcourt, Dettmann & Huges, 1963

Biretisporites triglobosus sp. nov.

1952 — *Trilites* Spm. 6. Vimal, p. 138.
1964 — ? Cyatheaceous spore. Bose & Sah, p. 220; Pl. 1, Fig. 6.

Holotype — Pl. 1, Fig. 11; 79μ; Reg. No. 32951; Slide No. 12/1.

Isotype — Pl. 1, Fig. 12; Reg. No. 32950; Slide No. 2/1.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Known size range 65 μ-87 μ, holotype 79μ; Trilete distinct, laesura straight, extending up to 3/4 of the radial distance; commissures raised, flanked by a distinct margo which at the ray ends appear to dilate into a small, dark, globular thickening; exine finely sculptured.

Description — Miospores tetrahedral, rounded triangular in polar view, with broadly rounded angles and convex sides. Exine fairly thick, measuring upto 2·5μ. In surface view the sculpturing appears as minute, evenly placed projections.

Comparison — The species compares well with *Biretisporites spectabilis* Dettmann (1963, Pl. 2, Figs. 3-8, pp. 26-27) in general shape and size but differs in having globular thickenings at the ray ends. In this character the present species also differs from the other species of this genus. Identical grains have been described by Vimal (1952, Pl. 5, Figs. 9-11, Pl. 7, Figs. 9-11, P. 138) from the Eocene lignites of Dandot.

Affinity — Tree fern ? Matoniaceae.

Distribution — Recovered from the Cherra sandstone stage of Umsawmat, Assam. Vimal (1952) has described them from the Eocene lignites of Dandot, Pakistan.

Infraturma — *Murornati* Potonié & Kremp

Genus *Lycopodiumsporites* Thiergart, 1938

Lycopodiumsporites parvireticulatus sp. nov.

1964 — Pteridophytic spores — Type 3. Bose & Sah, p. 220; Pl. 1, Fig. 2.

Holotype — Pl. 1, Fig. 1; 37μ; Reg. No. 32991, Slide No. 23/2.

Isotype — Pl. 1, Fig. 3; Reg. No. 32991; Slide No 16/1.

Type Locality — India, Laitryngew, South Shillong Plateau, Assam, Lower Eocene.

Diagnosis — Size range 36μ-44μ; trilete, laesura 3/4th of the radius, lips thin; exine also thin, ornamented on both the proximal and distal surfaces with perfect, regular reticulum, muri thin and membranous, up to 1μ high; lumina small, ±polygonal in outline.

Description — Miospores tetrahedral, triangular in polar view, with rounded apices and convex to sometimes±straight sides. Proximal surface pyramidal; *extremalineamenta* covered with small thin ridges, alternating with deep pits.

Comparison — This species is readily distinguishable from the other species of *Lycopodiumsporites* in possessing a comparatively finer reticulum with smaller meshes. A comparable grain has been figured by Biswas (1962, P. 44, Pl. 10, Fig. 8) as *Stenozonotriletes kaufmanni* from the Sylhet Limestone Formation of the Therria Ghat Section of Assam. Closer comparison is not possible owing to the inadequate description given by Biswas. The meshes forming the reticulum of *S. kaufmanni*, however, seem to be still smaller. Biswas also mentions the presence of minute papillae on the flange, which are not present in our specimens.

Spores of *Lycopodiumsporites parvireticulatus* resemble spores of *Lycopodium clavatum* group figured by Knox (1950, Pl. X).

Affinity — Lycopodiales

Distribution — Abundant, found in all the zones of the Cherra formation.

Lycopodiumsporites sp.

Pl. 1, Figs. 8-9

1964 — Trilete spore Type 1; Bose & Sah p. 220, Pl. 1, Fig. 3.

Description — Miospore tetrahedral, planoconvex, distal surface convex; outline subtriangular in polar view, with rounded apices and straight to convex sides. Size 32-36 μ. Trilete distinct, laesura extending up to 1/2 the radius. Exine thin, ornamented on both proximal and distal surfaces with a week and coarse-meshed reticulum. Muri of the reticulum thin but projecting; lumina irregular to polygonal.

Comparison — Only a few grains of this type were recovered. *L. parvireticulatus* differs from this species in having smaller meshes and lower muri. *L. papillaesporites* Rouse (1957, p. 361, Pl. 3, Figs. 50-52) shows a close general resemblance but differs in having a perispore which is not seen in any of our specimens. From the other species it appears to differ mainly in the form and nature of the reticulum. All the specimens recovered are insufficiently preserved and therefore the creation of a new species has been withheld for the present.

Turma — *Monoletes* Ibrahim
Subturma — *Azonomonoletes* Luber
Infraturma — *Laevigatomonoleti* Dybova & Jachowicz
Genus *Monolites* (Erdtman) Potonié, 1956

Monolites mawkmaensis sp. nov.
Pl. 1, Fig. 14

Holotype — Pl. 1, Fig. 14; Size 36μ; Reg. No. 32955; Slide No. 1/3.

Isotype — Pl. 1, Fig. 15, Reg. No. 32991; Slide No. 4/3.

Type Locality — India; Mawkma, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 33-54μ; amb oval to oval-elongate; monolete, suture distinct, thin, extending to more than 3/4th the longer axis; exine up to 2μ thick, ornamentation finely punctate, generally obscure.

Comparison — *Monolites* (*Laevigatosporites*) *discordatus* (Pflug) Potonié (*see* Thomson & Pflug, 1953, Pl. 3, Figs. 40-43; Potonié 1956, P. 77) shows general similarity in form but differs in its larger size and in having a comparatively shorter furrow with thickened lips. *M.* (*Laevigatosporites*) *ovoidens* Takahashi (1961, Pl. 16, Figs. 9-14, pp. 288-289) differs in having a distinctly thick exine wall. *M. major* (Cookson, 1947, Pl. 15, Fig. 56, p. 135) differs in its much larger size. The monolete grain figured by Vimal (1952, Pl. 6, Fig. 18; Pl. 8, Fig. 17) from Eocene lignite of Dandot seems comparable but in the thick exine wall it approaches more nearer to *M. ovoidens* than *M. mawkmaensis*.

Affinity — ? Polypodiaceae.

Distribution — Common in Mawkma shale but also found in Laitryngew.

Genus *Polypodiisporites* Potonié, 1934

Polypodiisporites sp.
Pl. 1, Fig. 5

1964 — Polypodiaceous spore. Bose & Sah, p. 220-221, Pl. 1, Fig. 7.

Description — Miospores bilateral, concavo-convex in lateral view. Size range varies from 23-28μ × 48-62μ. Amb oval-elongate, extremities well rounded. Monolete, laesura thin, about 2/3 the length of the longer axis, and present along the concave crest. Sculpturing of the exine obscure but at places appears to be distinctly verrucate.

Remarks — This form is rather rare and the preservation is not good enough to compare it with the other species.

Subturma — *Azonomonoletes* Luber
Infraturma — *Sculptatomonoleti* Dybova & Jachowicz
Genus *Schizaeoisporites* Potonié, 1951

Schizaeoisporites sp.
Pl. 1, Fig. 13

Description — Miospore monolete, measuring 37μ along the longer axis. Amb± bean-shaped. Monolete mark almost as long as the longer axis, bordered by a narrow ridge on either side. Exine up to 1·5μ thick, ornamented by transverse ridges running parallel to one another, some of these branch and appear to anastomose.

Affinity — Schizeaceae.

Distribution — Very rare. A single grain found at Umstew.

Turma — *Aletes* Ibrahim
Subturma — *Azonaletes* (Luber) Potonie & Kremp
Infraturma — *Spinonapiti* Erdman
Genus *Peltandripites* Wodehouse, 1933

Peltandripites dubius sp. nov.

Holotype — Pl. 1, Fig. 23; Size 21μ; Reg. No. 32951, Slide No. 4/2.

Isotype — Pl. 1, Fig. 24; Reg. No. 32951, Slide No. 6/2.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 18-23μ; amb subspheroidal to ellipsoidal; grains with spiny processes, nonaperturate; exine thin, densely covered with conical spines, with a broad base and pointed apex.

Comparison — *P. dubius* differs from *P. davisii* in the form and number of spinose processes. The spines in *P. dubius* seem more pyramidal and densely packed.

Affinity — Uncertain, in their general form, shape and small size, the grains compare with some members of the Araceae.

Distribution — The grains are fairly common and seem to be restricted to Umsawmat samples.

Subturma — *Azonaletes* (Luber) Potonié & Kremp
Infraturma — *Reticulonapiti* (Erdtman) Vimal
Genus *Retialetes* gen. nov.

Type Species — *Retialetes emendatus* gen. et sp. nov.; Pl. 1, Fig. 16; Size 51μ; Reg. No. 32955; Slide No. 1/2.

Type Locality — India; Mawkma, South Shillong Plateau, Assam; Lower Eocene.

Generic Diagnosis — Nonaperturate; equatorial outline spheroidal to±oval; medium-sized; exine ornamented with a perfect reticulum, lumina fairly large; equatorial outline wavy.

Retialetes emendatus sp. nov.

Holotype — Pl. 1, Fig. 16; Size 51μ; Reg. No. 32955, Slide No. 1/2.

Isotype — India; Mawkma; South Shillong Plateau, Assam; Lower Eocene.

Specific Diagnosis — Size range 46-58μ; equatorial outline spheroidal; nonaperturate; exine up to 7μ thick, distinctly tegillate, coarsely reticulate, muri±uniform in width and fairly high, lumina of different shapes and sizes, measuring perhaps five to ten times the width of the muri; *extrema lineamenta* notched due to the projections of the muri.

Comparison — The grains can readily be distinguished by the large meshes forming the reticulum. Amongst the non-aperturate grains with a reticulate exine, the genera *Undulatasporites* Leschik (1955) and *Reticulatasporites* Leschik (l.c.) can be distinguished by the much smaller size of the meshes forming the reticulum. *Januasporites* Pocock (1962, P. 56) differs in having a two-layered exine. These spores resemble closely to *Weylandipollis retiformis* Takahashi (1964, Pl. 32, Figs. 1a-16) in the ornamentation of exine but differ in being nonaperturate, while *W. retiformis* is distinctly monosulcate.

Affinity — Uncertain.

Distribution — The species is abundant in Umsawmat beds and very common in Mawkma beds but it has not been observed in Laitryngew beds.

Turma — *Plicates* (Naumova) Potonié
Subturma — *Monocolpates* Iversen & Tröels-Smith
Infraturma — *Retectines* (Malwakina) Potonié
Genus *Monosulcites* (Erdtman; Cookson) Couper, 1953

Monosulcites rarispinosus sp. nov.

Holotype — Pl. 1, Fig. 28; Size 52μ; Reg. No. 32991; Slide No. 17/2.

Isotype — Pl. 1, Fig. 26; Reg. No. 32991; Slide No. 2/25.

Type Locality — India; Laitryngew, South Shillong Plateau, Assam, Lower Eocene.

Diagnosis — Size range 44-56μ; amb spheroidal to subspheroidal. Monosulcate, sulcus usually distinct, long (extending almost up to the poles), and usually broad. Exine thin, less than 2μ; undifferentiated; spinose, spines sparse, small (less than 2μ) and with pointed tips.

Comparison — These grains do not differ much in general appearance from specimens figured as *Monocolpites multispinosus* by van der Hammen (1954, Pl. 2).

Affinity — Although somewhat similar grains are met with in some members of the Nymphaeaceae, the overall appearance of the grains suggest affinity to Palmae.

Distribution — A fairly common species restricted to Laitryngew.

Monosulcites (*Araceaepites*) *wodehousei* (Biswas, 1962) comb. nov.

Holotype — *Monosulcites* (*Araceaepites*) *wodehousei* Biswas, 1962, p. 47, Pl. 12, Fig. 30.

Isotype — Pl. 1, Fig. 30; Size 74μ; Reg. No. 32951, Slide No. 1/3.

Type Locality — Sylhet Limestone Formation, Um Sohryngkew River Section, Therriaghat; Assam; Mid. Eocene.

Restated Diagnosis — Size range 40-62μ; amb spheroidal to subspheroidal. Monosulcate, sulcus long, usually obscure. Exine thick, up to 4μ; sexine as thick as nexine, showing fine pitted-reticulate sculpture in surface view; densely spinose, spines 9-14 μ long, with bulbous base and rounded tips.

Comparison — The specimen figured by van der Hammen (1954, Pl. 3) as *Monocolpites multispinosus*, from Columbia, seem identical. As the details of *M. multispinosus* are not available further comparisons have been avoided.

Affinity — These grains compare closely to the pollen of some members of Palmae. The general characters suggest that the grains might belong to some extant Palm genus. However, Biswas (*l.c.*) considers their affinity to Araceae. The grains of Araceae have thinner and undifferentiated exine.

Distribution — This species is fairly common at Umsawmat. At other localities it is comparatively rare.

Monosulcites (*Colocasioideaepites*) *brevispinosus* (Biswas, 1962) comb. nov.

1962 — *Colocasioideaepites brevispina* Biswas; in Baksi, 1962, p. 17; Pl. 2, Fig. 22.

Holotype — *Monosulcites* (*Colocasioideaepites*) *brevispinosus* Biswas, 1962; p. 42; Pl. 8, Fig. 43.

Isotype — Pl. 1, Fig. 29; Size 72μ, Reg. No. 32951, Slide No. 1/8.

Type locality — India; Tura Formation, Tura-Dalu Road Section, Assam; Lower Eocene.

Restated Diagnosis — Size range 41μ to 72μ; bilateral; amb subspheroidal to slightly ellipsoidal, with broadly rounded poles. Monosulcate, sulcus thin, usually obscure. Exine up to 2μ; sexine thicker than nexine; fine pitted-reticulate sculpture in surface view; also densely spinose, spines 5-8μ long, with a bulbous base and pointed apex.

Comparison — Grains of *M. brevispinosus* are morphologically very similar to those of *M. wodehousei* but differ in having comparatively shorter spines with pointed tips. The surface pattern in *M. brevispinosus* also appears to be comparatively finer than those of the latter. This species can also be distinguished from the other species in the form and nature of spines and also in other details of exine ornamentation.

Affinity — Biswas (*l.c.* p. 42) regarded this species to be of Araceaous affinity as is evident from his generic designation. It is quite likely that these grains may be related to Araceae. However, similar grains are also met with in the families Palmae and Nymphaeaceae. The character of the exine suggests a closer affinity to Palmae than with other families.

Distribution — This species is fairly common and found in all the samples.

Monosulcites sp.

Pl. 2, Fig. 1.

Description — Grain elongate, 70μ in size; bilateral; monosulcate, sulcus long and ridged on either side. Exine 2-3μ thick; sexine as thick as nexine; spinose, spines 3-5μ long, slightly broad at the base, and ending in a small globular head.

Affinity — Unknown

Distribution — Very rare.

Infraturma — *Monoptyches* (Naumova) Potonié

Genus *Palmaepollenites* Potonié, 1951

Palmaepollenites communis sp. nov.

Holotype — Pl. 1, Fig. 10; Size 32 × 15μ; Reg. No. 32991; Slide No. 1/11.

Isotype — Reg. No. 32991, Slide No. 25/2.

Type locality — India, Laitryngew, South Shillong, Plateau, Assam; Lower Eocene.

Diagnosis — Size range 30×15μ-34×20 μ; bilateral, amb ellipsoidal. Monosulcate, sulcus straight, usually extending from pole to pole, sometimes slightly shorter; lips slightly raised. Exine thin, less than 1μ; generally smooth, but sometimes appear to be faintly sculptured.

Comparison — The small size, comparatively narrow-ellipsoidal form of the grains and longer sulcus distinguishes it from the other species of *Palmaepollenites* described so far.

Affinity — Palmae.

Distribution — This species is abundant in number but seems to have a limited distribution, being restricted to the Laitryngew beds.

Palmaepollenites eocenicus (Biswas, 1962) comb. nov.

Holotype — *Palmaepollenites* (*Palmaepites*) *eocenica* Biswas, 1962, p. 40, Pl. 6, Fig. 26.

Isotype — Pl. 1, Fig. 7; Reg. No. 32936A; Slide No. 9/6.

Type locality — India, Tura Formation of the Tura-Dalu Road Section, Assam; Lower-Middle Eocene.

Restated Diagnosis — Size range 35 × 24μ to 44 × 40μ; amb oval to ellipsoidal. Monosulcate, sulcus long, but not completely reaching the equator, lips thin and usually gaping. Exine up to 2μ thick, smooth, but at places appears to be faintly sculptured.

Comparison — *Palmaepollenites eocenicus* resembles *P. tranquillus* (POTONIÉ 1956, PL. 11, FIGS. 138-139; THOMSON & PFLUG 1953, PL. 4, FIGS. 24-37) but appears to be distinct in form and sculpturing of the exine. A number of species have been described by Takahashi (1961, PL. 6) from West Japan but they all differ in having a distinctly sculptured exine.

Affinity — Palmae.

Distribution — Biswas (1962, p. 40) mentions that this species is " characteristic of the Lower-Middle Eocene of Bengal Basin and Indus Basin ". In the Cherra formation it has a rare occurrence.

Palmaepollenites (*Monocolpopollenites*) *verrucatus* (Takahashi, 1961) comb. nov.

Pl. 1, Fig. 6

1961 — *Monocolpopollenites verrucatus* Takahashi, p. 293; Pl. 16, Figs. 28-29.

Remarks — The genus *Monocolpopollenites* is regarded as a synonym of the earlier recorded genus *Palmaepollenites* (POTONIÉ, 1958, p. 98).

Description — Grains monosulcate; amb oval-elliptical, with broadly rounded poles. Size range 35-39μ (longer axis). Sulcus long, almost reaching the poles, with widely gaping lips. Exine thin, ornamented with dense verrucae.

Comparison — These grains differ from those of *P.* (*Monocolpopollenites*) *serratus* (THOMSON & PFLUG, 1953, PL. 4, FIGS. 67-74; p. 64) and the other species of this genus in having comparatively denser and smaller verrucae.

Affinity — ? Palmae. The grains also resemble those of some species of Magnoliaceae.

Distribution — Described by Takahashi (1961) from the older Tertiary rocks of West Japan. Very rare in the Cherra Stage.

Genus *Monocolpites* Erdtman, 1947

Monocolpites sp.

Pl. 1, Fig. 22

Description — Pollen grain elliptical in shape, large, measuring 69 × 36μ. Monocolpate, furrow narrow, extending meridionally from pole to pole. Exine thin, sculptureless.

Affinity — Uncertain (? Magnoliaceae).

Distribution — A single grain found in Mawkma shales.

Subturma — *Dicolpates* Erdtman

Genus *Schizosporis* Cookson & *Dettman*, 1959

Schizosporis crassimurus sp. nov.

Holotype — Pl. 1, Fig. 18; Size 46μ; Reg. No. 32951; Slide No. 6/1.

Isotype — Pl. 1, Fig. 19; Reg. No. 32951, Slide No. 1/6.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 36μ-53μ, amb oval, ± flattened at the poles, dividing subequatorially into two equal, boat-shaped halves. Exine reticulate, crassimurate, muri as much as 3μ broad, lumina variously shaped, usually of the same width as muri or sometimes slightly wider.

Comparison — Organizationally *Schizosporis crassimurus* compares closely with those of *S. rugulatus* Cookson & Dettmann (l.c., PL. 1, FIGS. 5-6), but can be distinguished by its much smaller size, thicker muri and a perfect reticulum while in the latter they are rugulate and never form a perfect reticulum. The present species differs from the other species of *Schizosporis* either in size or the ornamentation of the exine. The grain figured by Baksi (1962, p. 17, PL. 2, FIG. 20) as *Microreticulatipites intecta* probably belongs to this species.

Affinity — Uncertain. The grains show morphological resemblance to certain members of the family Nelumbiaceae.

Distribution — The genus *Schizosporis* seems to have a wide geographical and geological distribution. The earliest record of the genus (though unclassified) is from the Lower Tertiaries of South America and Argentina (KUYL, MULLER & WATERBOLK, 1955, PL. 5, FIGS. 1-4). Four species *S. reticulatus*, *S. parvus*, *S. rugulatus* and *S. spriggi* have been recorded from the Cretaceous of Australia (COOKSON & DETTMANN, 1959). All the four species of Cookson & Dettmann and two new species, *S. cooksoni* and *S. grandis* have been recorded by Pocock (1962, pp. 75-77) from Upper Jurassic and Cretaceous of Canada. Recently Takahashi (1964, p. 221) has also recorded the genus from the Upper Cretaceous of Japan.

The present species is abundant in the basal zones of the Cherra formation but progressively decreases towards the younger zones. Its occurrence in the Langpar or the Sylhet stages has not yet been definitely ascertained.

Schizosporis assamica sp. nov.

Holotype— Pl. 1,Fig. 20; Size 45μ; Reg. No. 32991, Slide No. 22/1

Isotype— Pl. 1, Fig. 21; Reg. No. 32937; Slide No. 21/1.

Type locality— India; Laitryngew, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis—Size range 41-50μ; amb circular to slightly elliptical; usually found to be splitting subequatorially into two equal disc-like halves. Exine up to 1·5μ thick, unsculptured, but a faint l.o. pattern seen under oil immersion.

Comparison — *Schizosporis assamica* compares closely with *S. spriggi* Cookson & Dettmann (*l.c.*, p. 216; Pl. 1, Figs. 10-13) in form and organization but differs in its comparatively smaller size. *Schizosporis parvus* Cookson & Dettmann (*l.c.*, p. 216, Pl. 1, Figs. 15-20) differs in being elliptical in both equatorial and polar views. A close similarity is seen with grains figured by van der Hammen (1956, pp. 113-114; Pl. 1, Fig.3) as *Proxapertites operculatus* from the Palaeocene of Columbia. It is quite likely that both may belong to the same species.

Affinity — ? Palmae. The grains compare well with those of *Astrocaryum acaule* (Hammen 1957, Fig. 3).

Distribution —Amongst the samples examined till now this species is abundantly found in all the horizons of the Cherra formation.

Subturma — *Tryptyches* (Naumova) Potonié

Genus *Tricolpites* (Erdtman, 1947; Cookson 1947; Ross, 1949) Couper, 1953

Tricolpites levis sp. nov.

Holotype — Pl. 2, Fig. 9; Size 24μ; Reg. No. 32955; Slide No. 3/3.

Isotype — Pl. 2, Fig. 10; Reg. No. 32951; Slide No. 9/1.

Type Locality — India; Mawkma, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size 24μ-30μ; amb spherical to subspherical; 3-colpate, longicolpate, furrows thin; exine also thin, less than 1μ, smooth, in some specimens a faint sculpture is discernible under oil immersion.

Comparison — The present species compares well with those of *Tricolpites reticulata* Cookson (1947, p. 134; Pl. 15, Fig. 45) from the Lower Tertiary of Kerguelen. However, the latter can be distinguished by its finely reticulate exine.

Affinity — Uncertain.

Distribution — The species is fairly common in all the zones of the Cherra formation.

Tricolpites longicolpus sp. nov.

Holotype — Pl. 2, Fig. 11; Size 23μ; Reg. No. 32951; Slide No. 2/6.

Isotype — Pl. 2, Fig. 12; Reg. No. 32951; Slide No. 1/4.

Type Locality — India; Umsawmat, South Shillong Plateau, Assam.

Diagnosis — Size range 23μ-28μ; grains spherical to lobate in polar view; tricolp (or)-ate, tenuimarginate, colpi long, extending to more than 3/4 the radial distance; exine upto 3·5μ thick, surface ± smooth to finely matted.

Comparison — *Tricolpites longicolpus* differs from *T. levis* in having a comparatively thicker exine. It can be distinguished from the other species by its long colpi and smooth exine. A comparable grain has been figured as *Quercus* by Thiergart (1940, p. 38, Pl. 2, Fig. 18).

Affinity — Uncertain.

Distribution — Rare. Found only in the Umsawmat beds.

Genus *Polycolpites* Couper, 1953

Polycolpites obscurus sp. nov.

Holotype — Pl. 2, Fig. 14; Size 23μ; Reg. No. 32951; Slide No. 2/5.

Isotype — Pl. 2, Fig. 13; Reg. No. 32955, Slide No. 2/2.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 21-26μ; amb ± circular; polyaperturate, apertures colpoid, furrows 5-6 in number, not gaping and more than 1/2the radius long; exine thin but firm, ornamentation obscure.

Comparison — The only form with which this species could be compared is *Nothofagidites* sp. described by Potonié (1960, p. 472; Pl. 2, Fig. 45) from the Eocene coal of Burma. The two appear identical and may belong to the same species.

Affinity — Uncertain.

Distribution — The species is fairly common and found in all the levels of the Cherra stage.

Polycolpites cooksonii sp. nov.

1952 — *Hexacolpites* Spm. 2., Vimal; p. 142; Pl. 6, Fig. 33, Pl. 8, Fig. 28.

Holotype — Pl. 2, Fig. 17; Size 28μ; Reg. No. 32991; Slide No. 4/1.

Isotype — Pl. 2, Fig. 18; Reg. No. 32951, Slide No. 8/1.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 28μ-34μ; amb clefted, angular, sides ± straight to slightly convex; polyaperturate, apertures colp (or)-oidate, at angles, furrows 5-6μ deep; exine upto 4μ thick, sexine — nexine undifferentiated, sculpture finely granulose.

Comparison — The present grains show some resemblance to those of *Nothofagus tepungai* Couper (1953, pp. 50-51; Pl. 6, Fig. 80) from the Oligocene of New Zealand. *N. tepungai*, however, differs in possessing a thin exine and densely papillate sculpture. The grain figured by Vimal (1952, p. 142; Pl. 6, Fig. 33; Pl. 8, Fig. 28) from Eocene of Dandot seems identical.

Affinity — ? Rubiaceae. The grains show close similarity to the grains of *Galium*. The pollen grains in Labiateae are 3 or 6 colpate.

Distribution — P. cooksonii is a fairly abundant form and found in all the levels of the Cherra formation.

Polycolpites sp. cf. *P. cooksonii*

Pl. 2, Fig. 21

Description — Grains small, measuring 35-43μ. Amb distinctly clefted, angular. Apertures colpoid, 6-7 in number, furrows unrimmed, fairly deep, widely gaping, extending to 1/2 or slightly more of the radial distance. Exine fairly thick, up to 4μ; sculpturing finely granulose to obscure.

Comparison — These grains are identical to *P. cooksonii* except that they possess 7 furrows.

Distribution — Common. Found in all the localities so far studied.

Polycolpites vimalii sp. nov.

1952 — *Octacolpites* Spm. 1. Vimal; p. 143; Pl. 6, Fig. 37; Pl. 8, Fig. 32.

1962 — *Octacolpites brevicolpa* Baksi, p. 17; Pl. 1, Fig. 17.

1964 — 8-Zonicolporate grain, Bose & Sah, Pl. 1, Fig. 24.

Holotype — Pl. 2, Fig. 22; Size 37μ; Reg. No. 32936A, Slide No. 3/6.

Isotype — Reg. No. 32936A, Slide No. 3/10.

Type Locality — India; Umstew, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 31-42μ; amb ± spheroidal, lobed; apertures 8 in number, colpcid, furrows narrow, deep, ± 1/2 the radius; exine rather thick, measuring up to 6μ; ornamentation densely granulose.

Comparison — *P. vimalii* can be distinguished from the other species in the larger number of colpi, and thick, coarsely granulate exine. The grains, under *Octacolpites* Spm. 1., figured by Vimal (1952, p. 143; Pl. 6, Fig. 37; Pl. 8, Fig. 32) from the Eocene of Dandot and by Baksi (1962, p. 17; Pl. 1, Fig. 17 from Simsang River Tertiaries seem identical.

Affinity — Rubiaceae. The grains show very close similarity to those of *Galium*.

Distribution — This species is fairly common but restricted to the Umstew beds.

Polycolpites sp.

Pl. 2, Fig. 20

Description — Grain medium-sized, 46μ across. Amb angular, clefted, sides between apertures convex. Tetracolpate, furrows equatorial, wedge-shaped, gaping and fairly long, extending to more than 1/2 the radius. Exine up to 4μ thick, surface sculpture obscure.

Comparison — Vimal (1953, p. 141; Pl. 6, Fig. 30; Pl. 8, Fig. 26) has figured and described a grain under *Tetracolpites* Spm. 1. from the Eocene of Dandot, which seem very similar to that of the present grain.

Genus *Rhoipites* Wodehouse, 1933

Rhoipites striatus sp. nov.

Holotype — Pl. 2, Fig. 4; Size 37 × 21μ; Reg. No. 32936A; slide No. 3/2.

Isotype — Reg. No. 32936A; Slide No. 6/6.

Type Locality — Assam; Umstew, South Shillong Plateau; Lower Eocene.

Diagnosis — Size range 34-37μ × 21-24 μ; prolate; 3-zonicolporoidate; exine moderately thick, finely striate.

Description — Pollen grains small, prolate to per-prolate in equatorial view. Trilongicolporoidate, colpi extending from pole to pole. Pores indistinct. Exine up

to 2μ thick; sexine as thick as nexine; striations distinct.

Comparison — *R. striatus* essentially differs from the other species of *Rhoipites* in having a distinctly striate exine. The grains show closest similarity to those of *Acer* and it is quite likely that they might be related to the family Aceraceae.

Affinity — ? Aceraceae.

Distribution — Rare. Only two specimens were found in shale sample from Umstew.

Subturma — *Spirapertiti* subturma nov.

Diagnosis of Subturma — Pollen grains characterized by having spirally disposed apertures.

Genus *Spirapollis* gen. nov.

Type Species — *Spirapollis assamensis* sp. nov.

Generic Diagnosis — Grains spiraperturate; amb spheroidal to subspheroidal; exine moderately thick, psilate to sculptured.

Comparison — These grains are very distinctive and can be distinguished by the spiral arrangement of their apertures. Amongst the living forms spiraperturate grains are found in the families Berberidaceae, Eriocaulaceae, Acanthaceae, Liliaceae, etc.

Spirapollis assamensis sp. nov.

Holotype — Pl. 2, Fig. 7; Size 21μ; Reg. No. 32991, Slide No. 2/7.

Isotype — Pl. 2, Fig. 6; Reg. No. 32991; Slide No. 1/17.

Type Locality — India; Laitryngew, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Pollen grains small, measuring from 15μ-22μ; amb spheroidal to sub-spheroidal; spiraperturate; exine up to 1μ thick, undifferentiated, sculpturing obscure.

Comparison — *Spirapollis assamensis* is not comparable to any of the fossil grains recorded so far.

Affinity — These distinctive grains compare closely with pollen of *Berberis* and it is quite likely that they represent the Berberidaceae. However, spiraperturate grains are also met with in some members of the family Eriocaualceae, Acanthaceae and Liliaceae.

Distribution — This species is of common occurrence. It has been recovered from Laitryngew and Umsawmat localities only.

Subturma — *Ptychotriporines* (Naumova) Potonié

Genus *Nyssapollenites* Thiergart, 1937

Nyssapollenites sp.

Pl. 2, Fig. 8

Description — Pollen grains ± spheroidal in polar view; small, measuring 23-26μ in diameter. Grains 3-colporate, brevicoplate, ora lalongate. Exine up to 1·5μ thick, undifferentiated, with finely pitted-reticulate sculpture in surface view.

Affinity — ? Nyssaceae.

Distribution — Very rare. Restricted to Umsawmat bed.

Subturma — *Ptychopolyporines* (Naumova) Potonié

Genus *Polygalacidites* gen. nov.

Type Species — *Polygalacidites clarus* gen. et sp. nov., Size 25μ; Reg. No. 32951; Slide No. 10/2.

Type Locality — India; Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Generic Diagnosis — Pollen grains small; amb spheroidal to sub-spheroidal; polycolporate, generally synorate, colpi long or short; exine smooth to finely sculptured.

Comparison — The new genus differs from *Trifossapollenites* Rouse (1957, p. 372) in having tricolporate condition.

Polygalacidites clarus sp. nov.

Holotype — Pl. 2, Fig. 25; Size 25μ; Reg. No. 32951; Slide No. 10/2.

Isotype — Pl. 2, Fig. 24; Reg. No. 32951; Slide No. 11/1.

Type Locality — India, Umsawmat, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 22μ-27μ; grains spheroidal to subspheroidal in polar view, ± prolates-pheroidal in equatorial; 5-6 colporate, colpi long, ora faint, in some specimens distinctly synorate; exine up to 1μ thick, sculptureless.

Comparison — This species is not comparable to any of the fossil species recorded so far.

Affinity — The grains of *Polycolporites clarus* show strong resemblance to pollen grains of *Polygala* (Family Polygalaceae).

Distribution — A rare type, restricted to the Umsawmat beds.

Turma — *Porosa* (Naumova) Potonié 1960
Subturma — *Triporines* (Naumova) Potonié
Genus *Triporopollenites* (Pflug) Potonié, 1960

Triporopollenites vimalii sp. nov.

1952 — *Triorites* Spm. 2. Vimal; p. 143; Pl. 6, Fig. 39; Pl. 8, Fig. 34.
1964 — Tricolporate Type 5. Bose & Sah; p. 221; Pl. 1, Figs. 16, 18.

Holotype — Pl. 2, Fig. 32; Size 27μ; Reg. No. 32955; Slide No. 1/5.

Isotype — Pl. 2, Fig. 33; Reg. No. 32937; Slide No. 4/1.

Type Locality — India; Mawkma, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 26μ-30μ; amb triangular, sides straight to convex; triorate, ora circular, slightly aspidote, 3-4μ in diameter; exine upto 1·5μ, undifferentiated, nexine thickened at the pore regions; ornamentation obscure to faintly granulate.

Comparison — The grains described by Vimal (l.c.) from the Eocene lignite of Dandot (Pakistan) compare well with the present grains. The grains figured by Bose and Sah (1964, p. 221, Pl. 1, Fig. 16, 18) are identical.

Affinity — ? Urticaceae? Betulaceae.

Distribution — A common type, especially in Mawkma beds only.

Genus *Engelhardtioidites* Potonié, Thomsion & Thiergart, 1950

Engelhardtioidites parvus sp. nov.

Holotype — Pl. 2, Fig. 28; Size 11μ; Reg. No. 32991; Slide No. 2/11.

Isotype — Pl. 2, Fig. 29; Reg. No. 32991; Slide No. 2/19.

Type Locality — India; Laitryngew, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 11-13μ; amb triangular, angles well rounded, sides straight to slightly concave; 3-pororate, angulaperturate; exine upto 1μ thick, undifferentiated, thickened below the apertures; sculpturing obscure.

Comparison — *E. parvus* can be distinguished by its comparatively smaller size and distinctly thickened aperture regions.

Affinity — Uncertain. The grains come nearest to those of *Engelhardtia* (Juglandaceae), but the characters are not conclusive for absolute determination.

Distribution — The grains are quite frequent but seem to be restricted only to Laitryngew beds.

Genus *Myricaceoipollenites* Potonié, 1951

Myricaceoipollenites sp.

Pl. 2, Fig. 26

Description — Grains small, measuring 19-21μ in size; amb rounded triangular in polar view with convex sides. 3-pororate, pores ± circular. Exine fairly thick, undifferentiated; finely granulose.

Comparison — The grain described by Vimal (1952, p. 143; Pl. 6, Fig. 38; Pl. 8, Fig. 33) from the Eocene of Dandot seem identical.

Affinity — The general characters of the grains suggest an affinity with Myricaceae.

Distribution — Only a few grains were found at Laitryngew.

Genus *Myrtaceidites* (Cookson & Pike) Potonié, 1960

Myrtaceidites sp. cf. *M. eugeniioides* Cookson & Pike, 1954

Pl. 2, Fig. 30

Description — Grains small, measuring 12-14μ; amb triangular in polar view with straight to slightly convex sides; angulaperturate, 3-colporate, syncolpate, arci distinctly enclosing small polar island. Exine thin, sculpturing faintly mottled.

Comparison — The grains compare well with those of *Myrtaceidites eugeniioides* described and figured by Cookson & Pike (1954, p. 204; Pl. 1, Figs. 21-26) from Australia.

Affinity — Myrtaceae.

Distribution — Very rare.

Genus *Triorites* (Erdtman, Cookson) Couper, 1953

Triorites communis sp. nov.

Holotype — Pl. 2, Fig. 38; Size 36μ; Reg. No. 32991, Slide No. 2/6.

Isotype — Pl. 2, Fig. 37; Reg. No. 32951; Slide No. 7/1.

Type Locality — India; Laitryngew, South Shillong Plateau, Assam; Lower Eocene.

Diagnosis — Size range 34-53μ; amb triangular, sides between ora convex in polar view; triorate, ora distinctly pouted, circular, diameter about 8-12μ, usually surrounded by a collar-like thickening; exine upto 6μ thick, sexine thinner than nexine, finely granular.

Comparison — *Triorites communis* can be distinguished from the other species by its distinctly pouted ora, usually surrounded by a collar-like thickening.

Affinity — These distinctive grains possess general characters met with in the family Onagraceae (*Epilobium*) and it is quite likely that they may be related to some extinct members of the family Onagraceae.

Distribution — The present species has been observed in all the samples studied, but it is very common in the Laitryngew beds.

Triorites sp. 1

Pl. 2, Fig. 35

Description — Pollen grains triangular in polar view, sides between apertures convex, measuring 42μ. 3-aperturate, brevicolpate, ora circular, 6-8μ in diameter, distinctly pouted. Exine up to 5μ thick; nexine thicker than sexine, not thinning towards apertures; coarsely reticulate, muri as broad as the lumina; *extrema lineamenta* corrugated.

Affinity — Uncertain. The single but well preserved grain resembles some members of the family Onagraceae in the distinctly pouted nature of the apertures, coarsely reticulate exine and corrugate nexine. Somewhat similar grains are also met with in the Proteaceae.

Distribution — A single grain found in Mawkma bed.

Triorites sp. 2

Pl. 2, Fig. 31

Description — Grain triangular in polar view, with convex sides and rounded apices, measuring 28μ in diameter. Triorate, ora circular, 2μ across. Exine thin, less than 1μ; finely reticulate in surface view.

Affinity — Unknown.

DISCUSSION

The fossil spore and pollen assemblage from the Cherra formation comprises of 34 recognizable species belonging to 21 genera. Of these, 3 genera and 18 species are new. Four previously recorded species have been placed under new combinations. Of the remaining 12 species, 3 have been referred to already known species and the remaining nine are extremely rare or rather poorly preserved to allow proper specific determination

The Cherra assemblage is characterized by the abundance of angiospermic grains, both in variety and frequency, and by the scanty representation of coniferous and cycadophytic elements. Ghosh (1941) and Sen (1948) have each figured one bisaccate grain from the Laitryngew coal but none of the samples examined by us have yielded any bisaccate grain. The cycadophytic element is practically missing. After angiosperms the pteridophytes form the next important group, being represented by four genera but all of them are of rare occurrence. The assemblage is also characterized by the dominance (± 50 per cent) of two genera — *Schizosporis* and *Retialetes*.

The flora, as indicated by the constituent pollen grains and spores, appear to be tropical in nature, with perhaps moist humid conditions. This is evidenced by the presence of pollen referable to Palmae, Araceae, ?Nelumbiaceae, Rubiaceae, Polygalaceae etc. A tropical climate together with moist humid environment is also substantiated to some degree by the recent collection of plant megafossils from Laitryngew with a number of palm leaves (Bose & Sah, 1964). Although the megafossils are still under investigation, the abundant presence of palm leaves together with other leaves who, judging from their size and nature, suggest warm and moist conditions.

The other families, for example Onagraceae, Myrtaceae, Nyssaceae, Juglandaceae, Berberideae, etc., are represented by comparatively fewer frequencies. Amongst these, elements like Juglandaceae might have been transported from higher altitudes, while others do occur in tropical conditions.

From the fact that the Cherra formation is overlain by the Nummulitic and marine Sylhet Limestone formation and underlain by marine Langpar formation, it may be concluded that the Cherra formation was laid down during the temporary regression of the sea, when first shales were deposited, followed by carbonaceous shales and thick

sandstones, and lastly by shale, coal and clayey shales before the sea once more submerged the terrain. The withdrawal of the sea from the area during the deposition of the Cherra formation is further evidenced from the nature of its deposition. Field studies clearly indicate that to the north the Cherra Sandstone occurs as isolated patches while towards south it becomes continuous in a ± blanket type of deposition.

The presence of ripple marks and current bedding in the sandstones together with complete absence of brackish water elements in the palynological assemblage suggest that the Cherra formation might have been deposited under shallow, probably fresh water, or lagoonal environment.

A comparison of the Cherra assemblage with comparably contemporaneous assemblages from India and elsewhere reveals a greater closeness and uniformity with the Eocene assemblages of Assam, Burma and Dandot (Pakistan), than with any of the Upper Cretaceous assemblages of Australia, New Zealand, Japan, U.S.S.R., Canada or Greenland. Although the Cherra assemblage is fairly distinct and possesses some characteristic elements of its own, it still shows considerable similarity with the Eocene assemblages of the Sylhet stage, Kalewa coal and Dandot lignite, indicating some kind of relationship between them. Apart from showing closer similarity with certain Eocene assemblages, the Cherra assemblage has certain individual forms like Onagraceae, Polygalaceae etc. which have so far not been recorded from Cretaceous rocks. However, this evidence alone may not seem convincing. But instances of angular unconformity, though very rare, between the Cherra formation and the Langpar stage and the presence of conglomerates in between and at the base of the Cherra formation seem to strengthen the view that the former are related to the Sylhet Limestone stage and hence should, therefore, be considered as the basal members of the Tertiary sequence, and are most likely Paleocene in age.

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EXPLANATION OF PLATES

(*All magnifications* × 500)

PLATE 1

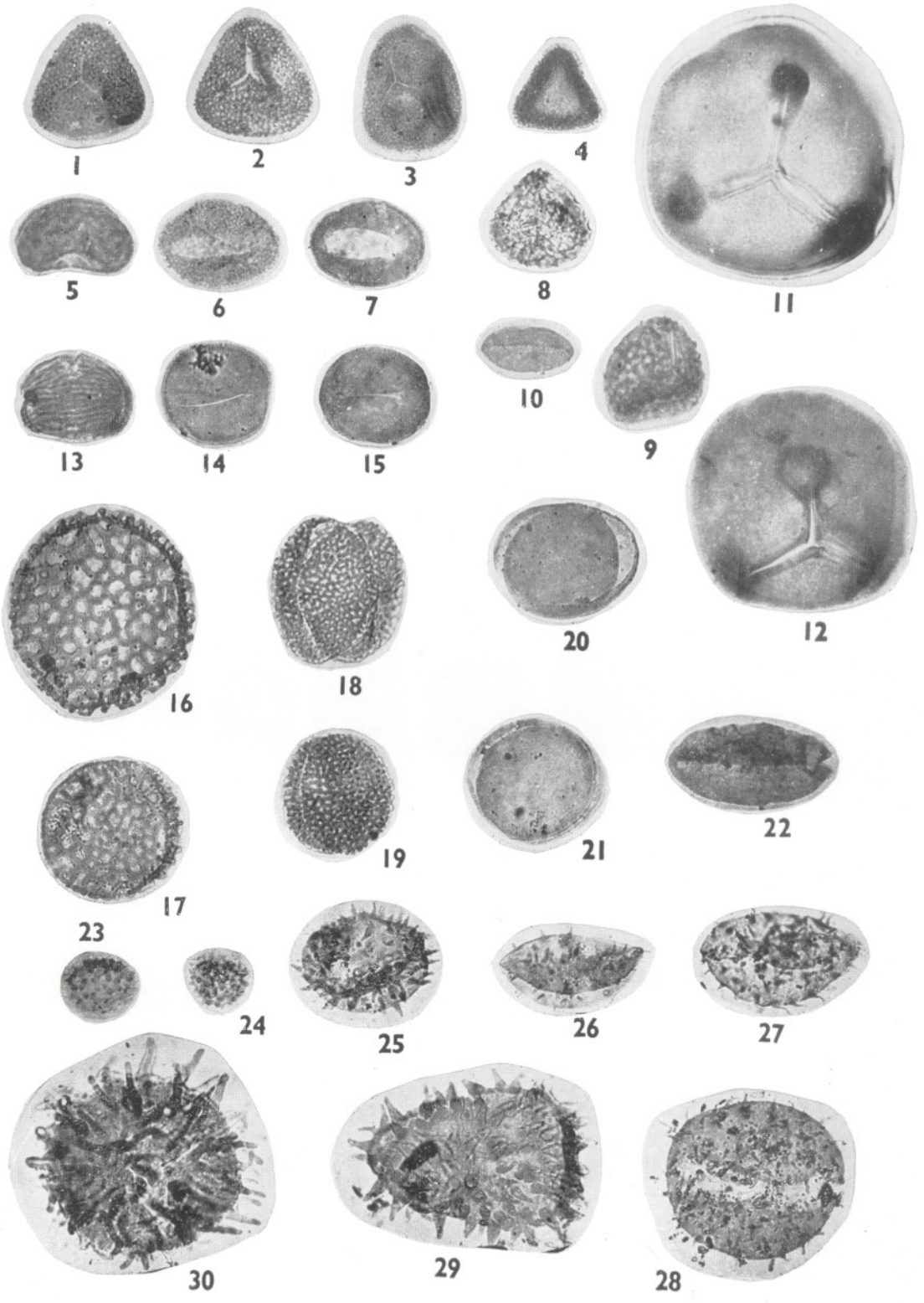
1. *Lycopodiumsporites parvireticulatus* sp. nov. Holotype. Reg. No. 32991. Slide No. 23/2.
2. *L. parvireticulatus*. Reg. No. 32991, Slide No. 16/1.
3. *L. parvireticulatus*. Isotype. Reg. No. 32950. Slide No. 3/1.
4. *L. parvireticulatus*. Reg. No. 32991, Slide No. 16/2.
5. *Polypodisporites*. Reg. No. 32951. Slide No. 5/2.
6. *Palmaepollenites* (*Monocolpopollenites*) *verrucatus* comb. nov. Reg. No. 32951. Slide No. 1/5.
7. *Palmaepollenites eocenicus* comb. nov. Reg. No. 32936A. Slide No. 9/6.
8. *Lycopodiumsporites* sp. Holotype. Reg. No. 32991. Slide No. 21/2.
9. *Lycopodiumsporites* sp. Isotype. Reg. No. 32991. Slide No. 21/N.
10. *Palmaepollenites communis* sp. nov. Holotype. Reg. No. 32991. Slide No. 1/11.
11. *Biretisporites triglobosus* sp. nov. Holotype. Reg. No. 32951. Slide No. 12/1.
12. *B. triglobosus*. Isotype. Reg. No. 32950. Slide No. 2/1.
13. *Schizaeoisporites* sp. Reg. No. 32937. Slide No. 2/2.
14. *Monolites mawkmaensis* sp. nov. Holotype. Reg. No. 32955. Slide No. 1/3.
15. *M. mawkmaensis*. Isotype. Reg. No. 32991. Slide No. 4/3.
16. *Retialetes emendatus* gen. et sp. nov. Holotype. Reg. No. 32955. Slide No. 1/2.
17. *R. emendatus*. Reg. No. 32991. Slide No. 2/2.
18. *Schizosporis crassimurus* sp. nov. Holotype. Reg. No. 32951. Slide No. 6/1.
19. *S. crassimurus*. Isotype. Reg. No. 32951. Slide No. 1/6.
20. *S. assamica* sp. nov. Holotype. Reg. No. 32991. Slide No. 22/1.
21. *S. assamica*. Isotype. Reg. No. 32937, Slide No. 21/1.
22. *Monocolpites* sp. Reg. No. 32955. Slide No. 3/2.
23. *Peltandripites dubius* sp. nov. Isotype. Reg. No. 32951. Slide No. 4/2.
24. *P. dubius*. Holotype. Reg. No. 32951. Slide No. 6/2.
25. *Monosulcites* (*Colocasioideaepites*) *brevispinosus* (Biswas) comb. nov. Reg. No. 32991. Slide No. 14/1.
26. *M. rarispinosus* sp. nov. Isotype. Reg. No. 32991. Slide No. 2/25.
27. *M. rarispinosus*. Reg. No. 32991. Slide No. 20/2.
28. *M. rarispinosus* sp. nov. Holotype. Reg. No. 32991. Slide No. 17/2.
29. *M.* (*Colocasioideaepites*) *brevispinosus* comb. nov. Isotype. Reg. No. 32951. Slide No. 1/8.
30. *M.* (*Araceaepites*) *wodehousii* (Biswas 1962) comb. nov. Reg. No. 32951. Slide No. 1/3.

PLATE 2

(*All magnifications* × 500 *except otherwise mention*)

1. *Monosulcites* sp. Reg. No. 32936A. Slide No. 5/1.
2. *M.* (*Colocasioideaepites*) *brevispinosus* comb. nov. Reg. No. 32951. Slide No. 1/7.
3. *M.* (*Colocasioideaepites*) *brevispinosus* comb. nov. Reg. No. 32936A. Slide No. 3/1.
4. *Rhoipities striatus* sp. nov. Holotype. Reg. No. 32936A. Slide No. 3/2; × 1000.
5. *Spirapollis assamensis* gen. et sp. nov. Isotype. Reg. No. 32991. Slide No. 1/17; × 1000.
6. *S. assamensis* gen. et sp. nov. Holotype. Reg. No. 32991. Slide No. 2/7; × 1000.
7. *S. assamensis*. Reg. No. 32991. Slide No. 4/4: × 1000.
8. *Nyssapollenites* sp. Reg. No. 32991. Slide No. 12/4.

9. *Tricolpites levis* sp. nov. Holotype. Reg. No. 32955. Slide No. 3/3.
10. *T. levis* sp. nov. Isotype. Reg. No. 32951. Slide No. 9/1.
11. *T. longicolpus* sp. nov. Holotype. Reg. No. 32951. Slide No. 2/6.
12. *T. longicolpus*. Isotype. Reg. No. 32951, Slide No. 1/4.
13. *Polycolpites obscurus* sp. nov. Isotype. Reg. No. 32955. Slide No. 2/2.
14. *P. obscurus*. Holotype. Reg. No. 32951. Slide No. 2/5.
15. *P.cooksoni* sp. nov. Reg. No. 32951. Slide No. 4/1.
16. *P. cooksoni*. Reg. No. 32991. Slide No. 2/14.
17. *P. cooksoni*. Holotype. Reg. No. 32951. Slide No. 4/1.
18. *P. cooksoni*. Isotype. Reg. No. 32951. Slide No. 8/1.
19. *P. cooksoni*. Reg. No. 32951. Slide No. 8/2.
20. *Polycolpites* sp. Reg. No. 32955. Slide No. 8/2.
21. *Polycolpites* cf. *cooksoni*. Reg. No. 32991, Slide No. 2/4.
22. *P. vimalii* sp. nov. Holotype. Reg. No. 32936A. Slide No. 3/6.
23. *Polycolpites* cf. *cooksoni*. Reg. No. 32951. Slide No. 11/2.
24. *Polygalacidites clarus* sp. nov. Isotype. Reg. No. 32951. Slide No. 11/1.
25. *Polygalacidites clarus*. Holotype. Reg. No. 32951. Slide No. 10/2.
26. *Myricaceoipollenites potonie*. Reg. No. 32991. Slide No. 1/18.
27. *Engelhardtioidites parvaus* sp. nov. Reg. No. 32991. Slide No. 3/3; × 1000.
28. *E. parvus*. Holotype. Reg. No. 32991. Slide No. 2/11; × 1000.
29. *E. parvus*. Isotype. Reg. No. 32991. Slide No. 2/19; × 1000.
30. *Myrtaceidites* sp. cf. *M. Eugeiioides*. Reg. No. 32951. Slide No. 1/1; × 1000.
31. *Triorites* sp. 2. Reg. No. 32951. Slide No. 7/2.
32. *Triporopollenites vimalii* sp. nov. Reg. No. 32955. Slide No. 1/5.
33. *T. vimalii* sp. nov. Isotype. Reg. No. 32937. Slide No. 4/1.
34. *Triorites communis* sp. nov. Reg. No. 32991. Slide No. 1/21.
35. *Triorites* sp. 1. Reg. No. 32936A. Slide No. 7/1.
36. *T. communis*. Holotype. Reg. No. 32991. Slide No. 20/1.
37. *T. communis*. Isotype. Reg. No. 32951. Slide No. 7/1.
38. *T. communis*. Reg. No. 32991. Slide No. 2/6.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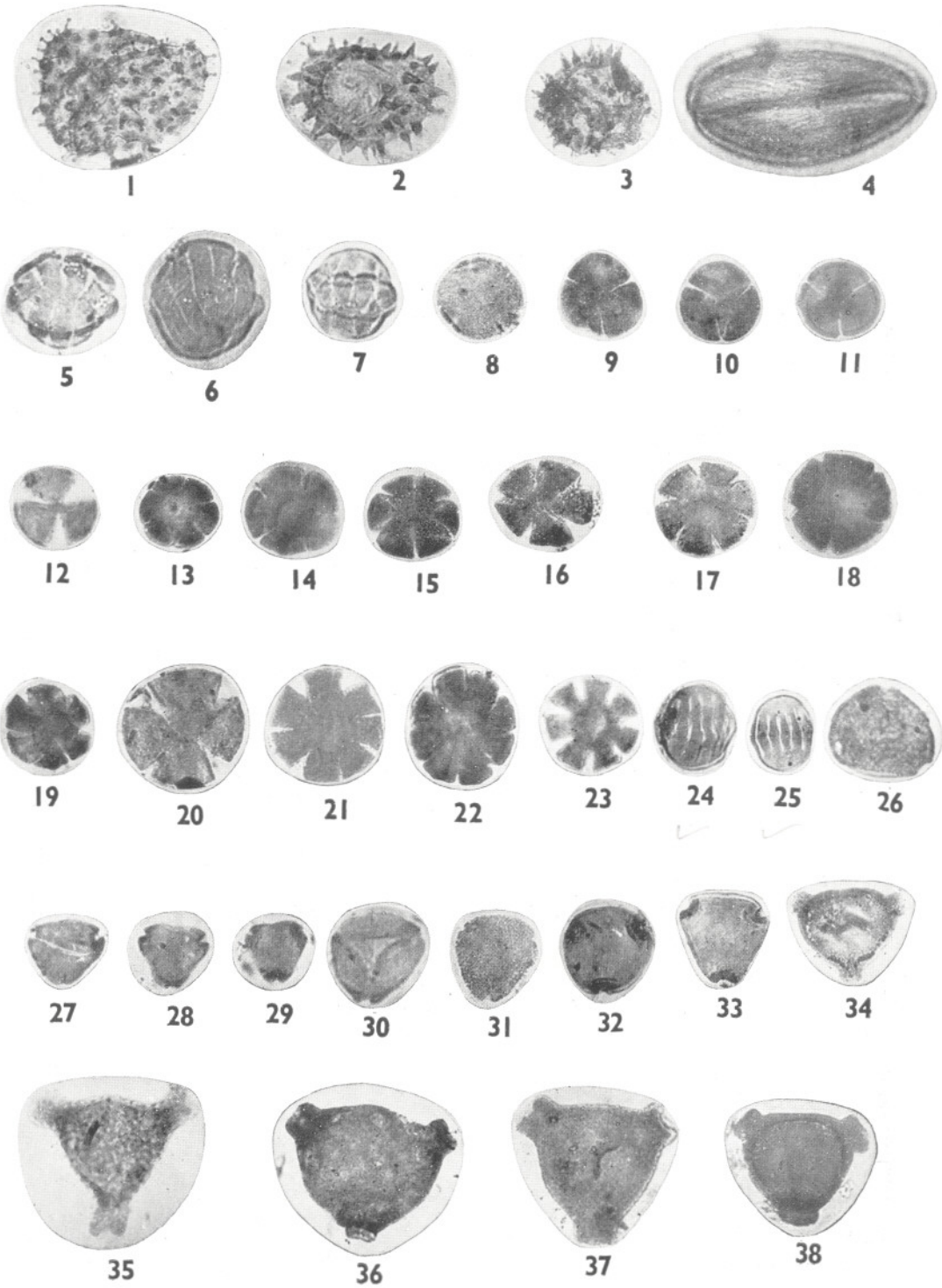
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