PALYNOLOGY OF THE SOUTH SHILLONG FRONT PART II — THE PALAEOGENES OF KHASI AND JAINTIA HILLS

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ABSTRACT

Palynological study of 90 samples of the Palaeogene sediments collected from five traverses on the south of Khasi and Jaintia hills has yielded a rich assemblage of spores, pollen and microplankton including a few dinoflagellates and fungal spores. In this area, sediments of mainly shelf facies are exposed but near Haflong both shelf and geosynclinal facies lie very close. Stratigraphic sequence of the shelf facies consists of Langpar, Therria, Sylhet Limestone, Kopili and the undifferentiated Barail Sediments. In the geosynclinal part, over the Disangs lie the Barails which are differentiated into Laisong, Jenam and Renji Formations. The palynofossils recovered here are assigned to 41 genera and 67 species, out of which 23 species are newly proposed. Based on quantitative assessment of the marine and terrestrial forms, palaeoecological interpretations are made. The sediments studied here are homotaxial with the Palaeogene sediments of the Garo hills. The Disangs which were hitherto reported to be barren have yielded a good number of fossils.

INTRODUCTION

THE Khasi and Jaintia hills constituting eastern half of the Shillong Plateau or the Meghalaya show an excellent development of Tertiary rocks of both marine and non-marine nature. Palynological studies of the Tertiary sediments of Assam have been attempted by many workers like Sahni, Sitholey and Puri (1947), Sen (1948), Biswas (1962), Baksi (1962), Ghosh and Banerjee (1963), Sah and Dutta (1966, 1968), Srivastava and Banerjee (1969), Ghosh (T. K., 1969), Dutta and Sah (1970), Sah *et al.* (1970) and Kar *et al.* (1972), but no detailed regional study has so far been made. A systematic study of palynological fossils from the Palaeogene sediments along the South Shillong Front was taken up as a project at the Institute of Petroleum Exploration by the present authors. Results of a study of the palynofossil assemblages from the Palaeogene sediments of Garo hills are presented in the first part of this paper (Salujha *et al.*, 1971). The present paper incorporates results of a palynological study of the Palaeogene sediments of the Khasi and Jaintia hills. Ninety samples of shales, sandstones and limestones collected from five traverses of this area are studied here.

STRATIGRAPHY

Sediments of mainly shelf facies are exposed in the Khasi-Jaintia hills but towards east of the area near Haflong both shelf and geosynclinal facies lie very close. The oldest sediments lying unconformably over the Sylhet Trap or rocks of the Shillong Series are the Mahadeks which are divided into Mahadek and Langpar Formations. These beds show gradual thinning towards north as well as to east. The Langpar Formation is overlain by the Therria Formation. It consists of limestone at the base followed by sandstone at the top. The limestone is developed only on the southern side of the plateau and its place in the plateau area is taken over by the Cherra Sandstone. The contact between the Langpar and Therria Formations seems to be conformable. The Tura Sandstone of Garo hills has been correlated with the Cherra Sandstone. The Cherra Sandstone seems to be conformably overlain by the Sylhet Limestone Formation which consists of alternation of thick limestone and coarse grained sandstone. Based on broad lithological characters this formation has been divided into 5 members namely Lakadong Limestone, Lakadong Sandstone, Umlatdoh Limestone, Narpuh Sandstone and Prang Limestone. The Sylhet Limestone Formation is conformably overlain by the Kopili Formation, youngest member of the Jaintia group. It consists of alternation of sandstone and shales. The Kopili Formation is conformably overlain by sediments of the Barail group. The Barail rocks were deposited both in the shelf and geosynclinal parts with the only difference that in the shelf part it is very thin and more arenaceous and carbonaceous in comparison to the geosynclinal part. In the geosynclinal part the Barails are more than 10,000 ft. thick (Srivastava *et al.* 1969) and have been divided into three formations i.e. Laisong, Jenam and Renji depending upon predominance of sandstone over shale. The Barail group shows general thinning to the west.

Generalized rock stratigraphic sequence in the geosynclinal and the shelf facies is as follows.

Geosynclinal facies:

Probable age	Group	Formation
Oligocene	Barail	Renji Jenam Laisong
Eocene to Upper Cretaceous	Disang	

Shelf facies:

Probable age	Group	Formation	Member
Oligocene	Barail	Undifferentiated	—
		Kopili	Prang Lst. Narpuh Sst Umlatdoh. Lst.
Eocene	Jaintia	Sylhet Limestone	Lakadong Sst. Lakadong Lst.
		Therria	Cherra/Therria Sst. Therria Lst.
		Langpar	—
Upper Cretaceous	Mahadek	Mahadek	Mahadek Sst. Borghat conglomerate member
	Unconformity		
Lr.-Mid. Jurassic	Sylhet Trap		Sylhet Trap

MATERIAL AND METHODS

Ninety samples belonging to various formations of the Palaeogenes of Khasi-Jaintia hills are studied. These samples belong to five traverses namely Umsohryngkew, Hari river, Prang river, Lubha river and Bali-chara Nadi (Map). The stratigraphic formations to which these samples belong are tabulated as under:

Barails .. 11	Renji .. 5 Jenam .. 15 Laisong .. 26		
Jaintia	Kopili .. 12 Sylhet .. 3 Therria .. 2	Disangs. .. 9	
	Langpar 7		

Microfossils are recovered from the rock samples by the use of Hydrofluoric acid, Nitric acid and Potassium hydroxide. An alternative treatment by the use of Sodium pyrophosphate is also given for this purpose. Sporiferous material is separted by using heavy liquid of specific gravity 2·2. Polyvinyl alcohol and Canada balsam are used for mounting slides.

Quantitative assessment of the various palynomorphs is made by counting 200 grains for each sample and their frequencies are plotted for zonation and correlation of sediments.

SYSTEMATIC PALYNOLOGY

The palynomorphs recovered from the Palaeogene sediments of Khasi-Jaintia hills consists of 41 genera and 67 species. Spores and pollen are classified according to the system proposed by Potonié (1956, 1958, 1960, 1966). Microplankton are arranged according to the system of classification proposed by Downie *et al.* (1963). The species already recorded are listed whereas others which are new are described.

Anteturma — *Sporites* H. Pot. 1893.
Turma — *Triletes* (Reinsch, 1881) Pot. & Kr. 1954.
Subturma — *Azonotriletes* Luber, 1935.
Infraturma — *Laevigati* (Benn. & Kids. 1886) Pot. 1956.

Genus — *Cyathidites* Couper, 1953.

Genotype — *Cyathidites australis* Couper, 1953.

Cyathidites (*Leiotriletes*) *dehiscensi* (Baksi, 1962) Sal., Kind. & Reh. 1971.

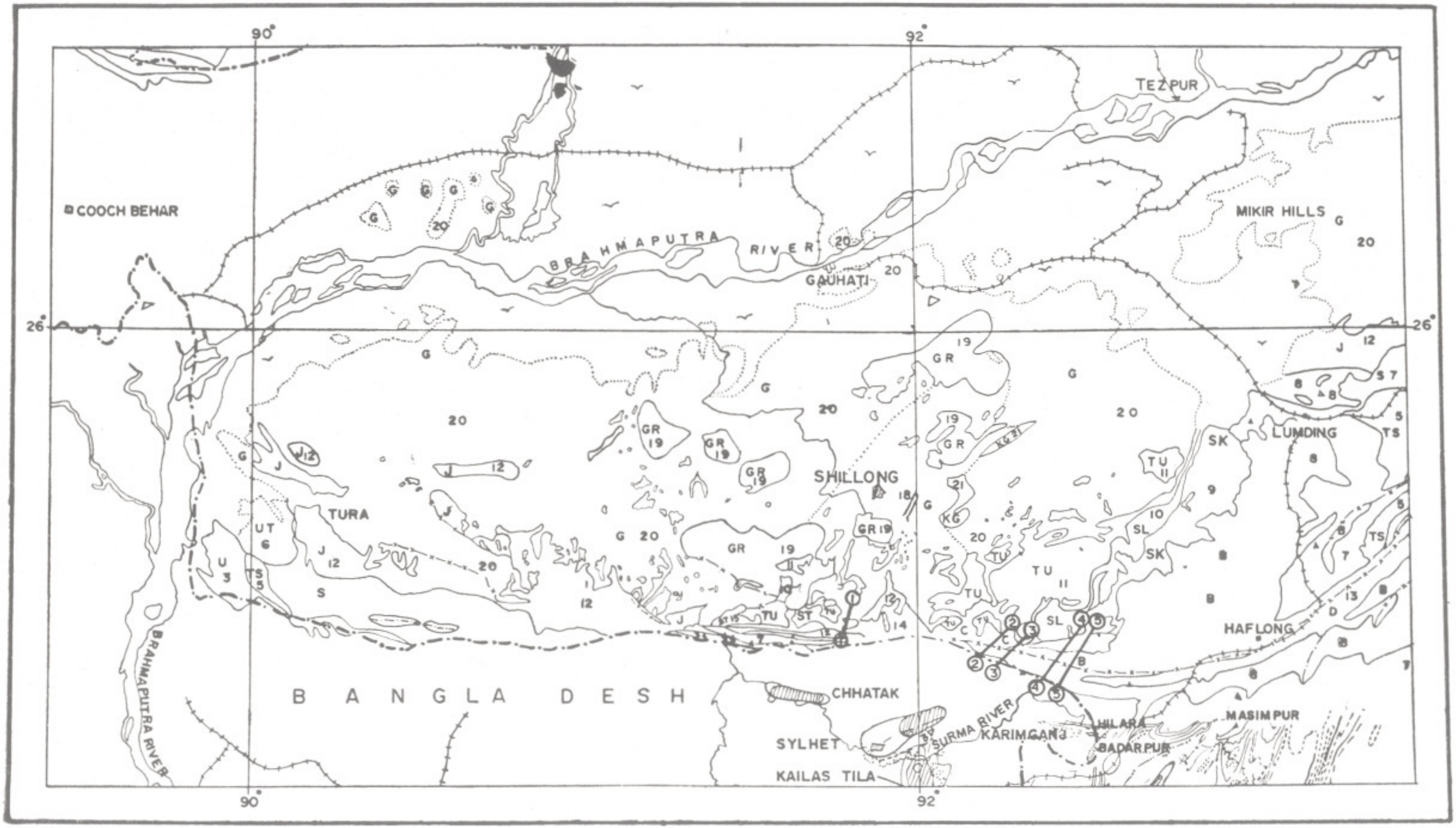
Pl. 1, fig.1

Cyathidites magnanimus sp. nov.

Pl. 1, figs. 2-3

GEOLOGICAL MAP SHOWING POSITION OF TRAVERSES ON THE SOUTH OF KHASI-JAINTIA HILLS

SCALE :- 1:1000,000 OR 1" TO 15·78 MILES



GEOLOGICAL MAP AFTER FULORIA (1969)

INDEX

NAMES OF TRAVERSES

1. UM-SOHRYNGKEW RIVER Tr.
2. HARI RIVER Tr.
3. PRANG RIVER Tr.
4. LUBHA RIVER Tr.
5. BALI-CHARA NADI Tr.

1		ALLUVIUM
3	U	DUPI TILA / NAMSANG
5	TS	TIPAM SANDSTONE
6	UT	UPPER TERTIARY
7	S	SURMA
8	B	BARAIL
9	SK	KOPILI ALTERNATIONS
10	SL	SYLHET LIMESTONE
11	TU	TURA BEDS
12	J	JAINTIA
13	D	DISANG
14	C	CRETACEOUS
15	ST	RAJMAHAL, SYLHET, ABOR TRAP
18		LOWER PRE-CAMBRIAN
19	GR	GRANITE } ARCHAEAN
20	G	GNEISS } ARCHAEAN
21	KG	KHASIA GREENSTONE

Holotype — Pl. 1, fig. 2.

Type locality — Jenam Formation, Haflong Silchar road traverse, District Cachar.

Diagnosis and description — Golden yellow, triangular with straight to slightly convex sides, size 48·4-74 μ; trilete mark distinct, open, indicated by a triangular, thin area, rays 3/4 or more the radius long, with a 4-6 μ wide inter-ray thickening; exine over 1 μ thick, faintly structured with sparsely arranged foveolations.

Comparison — The present species differs from *Cyathidites* (*Leiotriletes*) *garoensis* (Salujha *et al.*, 1971; Pl. 1. figs. 3-4) in having a wider inter-ray thickening and the exine bearing distinct foveolations.

Botanical affinity — Cyatheaceae.

Cyathidites sp.

Pl. 1, fig. 4

Description — Golden yellow, triangular with rounded angles and almost straight sides, size 56 μ; trilete mark faintly discernible, rays 1/2-2/3 the radius long with pointed ends; exine 1·2-1·5 μ thick, granulose, grana ±1 μ in diameter, sparsely spaced.

Comparison — *Leiotriletes virkii* (Biswas, 1962; Pl. 9, fig. 53) distinguishes in having a finely granulose ornamentation and the transverse folds at the tip of the rays.

Genus — *Stereisporites* Thoms. & Pfl. 1953.

Genotype — *Stereisporites stereoides* (Pot. & Ven. 1934) Thoms. & Pfl. 1953

Stereisporites formosus sp. nov.

Pl. 1, figs. 5-6

Holotype — Pl. 1, fig. 5.

Type locality — Jenam Formation, Haflong-Silchar road traverse, District Cachar.

Diagnosis and description — Brown, triangular to subcircular with convex sides, size 33·4-58·6 μ; Y-mark distinct, rays 3/4 the radius long or more with blunt ends; exine ±1·5 μ thick, distinctly granulate, grana over 1 μ wide, closely spaced, occasionally coalescing to give a reticulate appearance.

Comparison — *Stereisporites assamensis* (Sah & Dutta, 1968; Pl. 1, fig. 2) has a thicker exine which is smooth with elevated lips of the laesura. cf. *S. ambiguus* recorded by Salujha *et al.* (1971; Pl. 1, figs. 6-7) is bigger in size with a distinct labra along the Y-rays and the exine is foveolate.

Botanical affinity — ? Cyatheaceae.

Genus — *Biretisporites* (Delc. & Sprum. 1955) Delc., Dettman & Hughes, 1963.

Genotype — *Biretisporites potoniaei* Delc. & Sprum. 1955

Biretisporites singularis sp. nov.

Pl. 1, fig. 7

Holotype — Salujha *et al.* 1971; Pl. 1, fig. 9.

Type locality — Renji Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Light brown, roundly triangular with straight sides, size 44·8-54·2 μ; trilete mark distinct, arms raised, almost 2/3 the radius long, enveloped by a 1·5-2 μ broad lip on either side of the rays, lips appear to be over turning; exine 1·2-1·5 μ thick, almost smooth to faintly ornamented, occasionally giving a variegated appearance.

Comparison — *Biretisporites triglobosus*, (Sah and Dutta, 1966; Pl. 1, figs. 11-12) which is later included under *Dandotiaspora dilata* by Sah *et al.* (1971), differs from the present species in being larger in size with its exine thickened on distal side and the ray ends dilating into globular structures. *B. bellus* (Sah and Kar, 1969; Pl. 1, figs. 4-5) is smaller in size and the trilete rays extendingupto the equator. *Biretisporites* sp. recorded by Dutta and Sah (1970; Pl. fig. 12) has laesura of the trilete mark extending upto the periphery.

Botanical affinity — ?Matoniaceae.

Infraturma — *Murornati* Pot & Kr. 1954.

Genus — *Foveosporites* Balme, 1957.

Genotype — *Foveosporites canalis* Balme, 1957.

Foveosporites spectabilis sp. nov.

Pl. 1, fig. 8

Holotype Salujha *et al.* 1971; Pl. 1, fig. 14.

Type locality — Kopili Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, roundly triangular with straight to curved sides, measuring 28·8-52·8 *u*; trilete mark distinct, sometimes open, rays 2/3-3/4 the radius long, ends pointed; exine ±1 μ thick, microfoveolate, foveola ±1 μ wide, sparsely spaced.

Comparison — *Foveosporites canalis*, the genotype illustrated by Balme (1957; Pl. 1, figs. 15-17) has laesurae with raised lips and extending right upto the periphery of the spore. *F. pachyexinous* and *F. triangulus* (Dutta and Sah, 1970; Pl. 2, figs. 24-27, Pl. 2, figs. 22-23 differ in having a thicker exine and laesura of the trilete mark reaching the equator. *Foveosporites* sp. (Sah and Kar, 1969; Pl. 1, fig. 23) is subcircular, bigger in size with a thick exine.

Botanical affinity — Uncertain.

Genus — *Lycopodiumsporties* (Theig. 1938) Delc & Sprum. 1955.

Genotype — *Lycopodiumsporites agathoecus* (R. Pot. 1934) Thierg. 1938.

Lycopodiumsporites parvireticulatus Sah & Dutta, 1966.

Pl. 1, fig. 9

Lycopodiumsporites rarus sp. nov.

Pl. 1, figs. 10-11

Holotype — Pl. 1, fig. 10.

Type locality — Therria Formation, Umsohiyngkew traverse, Khasi-Jaintia hills.

Diagnosis and description — Brown, triangular with rounded angles with almost straight sides, size 36·8-72 μ; trilete mark distinct, rays 3/4 the radius long; exine 1-1·5 μ thick, faintly but finely reticulate, muri over 1 μ thick, lumina usually 1-1·5 μ wide, muri seen protruding at the margin.

Comparision — The present species differs from *Lycopodiumsporites parvireticulatus* (Sah and Dutta, 1966; Pl. 1, figs. 1-4 in having a faintly reticulate exine with incomplete muri forming lumina of varying shapes. *L. bellus* recorded by Sah and Kar (1969; Pl. 2, figs. 9a-11) differs in being smaller with a thicker exine and coarsely reticulate ornamentation. *L. palaeocenicus* (Dutta and Sah, 1970; Pl. 2, figs. 53-55, 58-59) has comparatively larger meshes and distinctly raised muri.

Botanical afflnity — Lycopodiales

Lycopodiumsporites insignis sp. nov.

Pl. 1, figs. 14-15

Holotype — Pl. 1, fig. 14.

Type locality — Kopili Formation, Umiew river traverse, Khasi Jaintia hills.

Diagnosis and description — Light brown, subcircular, measuring 42·6-50·8×52·8-61·2 μ; trilete mark distinct, rays 2/3-3/4 the radius long, ends pointed; exine over 1·5 μ thick, finely reticulate with prominent 1-1·5 μ broad lumina, muri ±1 μ thick, grains occasionally folded.

Comparison — *Lycopodiumsporites elegans* recorded by Salujha *et al.* (1971; Pl. 1, figs. 19-20) resembles the present species in its subcircular appearance but differs in having longer laesura and coarsely reticulate exine. *L. bellus* (Sah and Kar, 1969; Pl. 2, figs. 9a-11) differs in being smaller with a thicker exine and coarsely reticulate ornamentation. *L. palaeocenicus* (Dutta and Sah, 1970; Pl. 2, figs. 53-55, 58-59) has larger meshes and distinctly raised muri.

Botanical affinity — Lycopodiales.

Lycopodiumsporites sp. A

Pl. 1, fig. 12

Description — Brown, triangular with convex sides, measuring 56·8 μ; trilete mark present, rays reaching almost upto the equator; exine over 1·5 μ thick, finely reticulate, muri over 1 μ thick enclosing ±1·5 μ wide lumina, muri seen protruding at the margin.

Comparison — *Lycopodiumsporites abundans* recorded by Salujha *et al.* (1971; Pl. 1, figs. 17-18) is bigger in size with a thin inter-ray thickening and exine ornamented with incomplete mesh work.

Lycopodiumsporites sp. B

Pl. 1, fig. 13

Description — Brown, triangular with rounded angles and concave sides, size 62·8 μ; trilete mark distinct, rays reaching almost upto the equator; inter-ray area showing a 3-4 μ wide thickening; exine over 2 μ thick, coarsely reticulate, muri broken, forming an incomplete meshwork.

Comparison — The present species distinguishes in having a very wide thickening along the Y-rays and a coarsely reticulate ornamentation on the exine. *L. palaeocenicus* recorded by Dutta and Sah (1970; Pl. 2, figs. 53-55, 58-59) lacks the characteristic thickening along the laesura of the trilete mark.

Genus — Magnastriatites Germ., Hopp. & Muller, 1968.

Genotype — *Magnastriatites howardi* Germ., Hopp. & Muller, 1968.

Remarks — Germeraad, Hopping and Muller (1968) created a new genus *Magnastriatites* distinguishing it from *Cicatricosisporites* by its coarsely striate ornamentation, larger size and a circular ridge surrounding the proximal contact area. The specimens recovered here and those included under *Cicatricosisporites venustus* by Salujha *et al.* (1971; Pl. 1, figs. 22-23) conform to the generic diagnosis of *Magnastriatites*, thus they are transferred to this genus.

Magnastriatites venustus Sal., Kind, & Reh. 1971

Pl. 1, fig. 16

Genus — Cicatricosisporites (Pot. & Gell. 1933) Pot. 1966

Genotype — *Cicatricosisporites dorogensis* Pot. & Gell. 1933.

Cicatricosisporites sp.

Pl. 1, fig. 17

Description — Golden yellow roundly triangular, measuring 56·8 μ; trilete mark faintly discernible, terminating limits of the laesura not clear; exine ±1·2 μ thick, striated, striations 1·5-2 μ wide, area in between the adjoining striations 3·5-4·5 μ wide, smooth.

Comparison — *Cicatricosisporites pudens* recorded by Salujha *et al.* 1971; Pl. 1, figs. 24-25) differs in having a distinct and raised trilete mark with a thick labra and foveolate inter-striation area.

Botanical affinity — Parkeriaceae.

Genus — *Corrugatisporites* (Thoms. & Pflug) Weyl. & Greif. 1953.

Genotype — *Corrugatisporites toratus* Weyl. & Greif. 1953.

Corrugatisporites sp.

Pl. 1, fig. 18

Description — Brown, triangular with straight to slightly convex sides, measuring 53·6 μ; trilete mark distinct, arms 3/4 the radius long, with a ±2·5 μ wide inter-radial thickening; exine ±2·5 μ thick, rugulate, rugulae coalescing to give a reticulate appearance, sometimes protruding at the margin.

Comparison — The present species differs from *Corrugatisporites lepidus* (Salujha *et al.*, 1971; Pl. 2, figs. 27-28) in being larger, with short laesura and a wide thickening inbetween them. *C. formosus* (Dutta and Sah, 1970; Pl. 2. figs. 16-20) has a faint trilete mark and lacks the inter-radial thickening.

Botanical affinity — *Lygodium* (Schizaeaeceae).

Turma — *Zonales* (Benn. & Kidst. 1886) Pot. 1956
Subturma — *Zonotriletes* Waltz, 1935
Infraturma — *Cingulati* Pot. & Kl. 1954

Genus — *Polypodiaceoisporites* Pot. 1951

Genotype — *Polypodiaceoisporites speciosus* (Pot. 1934) Pot. 1951.

Polypodiaceoisporites idoneus Sal., Kind. & Reh. 1971.

Pl. 1, fig. 19

Remarks — The cingulum enveloping the body is 4·5 μ wide whereas its width in the specimens recorded earlier is 2·5-4 μ. Thus the cingulum may be considered to be ranging from 2·5-4·5 μ in width.

Polypodiaceoisporites sp.

Pl. 1, fig. 20

Description — Golden yellow, roundly triangular with slightly convex sides, size 35·6 μ; cinglum 2-2·5 μ wide enveloping the inner body; trilete mark distinct, arms reaching up to the margin of the inner body; cingulum smooth, body faintly structured.

Comparison — The present species lacks distinct muri covering the body distally which is a characteristic feature of *P. idoneus* (Sal., Kind, & Reh. 1971; Pl. 2. figs. 29-30).

Botanical affinity — Uncertain.

Turma — *Monoletes* Ibr. 1933
Subturma — *Azonomonoletes* Luber, 1935
Infraturma — *Laevigatomonoleti* Dyb. & Jachow. 1957

Genus — *Laevigatosporites* Ibr. 1933

Genotype — *Laevigatosporites vulgaris* (Ibr. 1932) Ibr. 1953.

Laevigatosporites copiosus Sal., Kind, and Reh. 1971.

Pl. 1, fig. 21

Laevigatosporites caecus sp. nov.

Pl. 1, figs. 22-24

Holotype — Pl. 1, fig. 22.

Type locality — Renji Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Light brown, elliptical, measuring $18 \cdot 6$-$54 \cdot 6 \times 12 \cdot 4$-$42 \cdot 8$ μ; monolete mark faintly discernible in most of the specimens, occasionally distinct, running over 3/4 or whole length of the, longer axis; exine 2-3·5 μ thick, foveolate, foveola of irregular shapes, sparsely spaced.

Comparison — *Laevigatosporites lakiensis* (Sah and Kar, 1969; Pl. 2, figs. 13-18) is bigger in size with its monolete mark less than half the longer axis and laevigate exine. *L. copiosus* described by Salujha *et al.* (1971; Pl. 2. figs. 35-36) is smaller in size with a thinner exine. *Psilamonoletes* sp. (Banerjee, 1966; Pl. 1, fig. 2) compares closely and may belong to this species.

Infraturma — *Sculptatomonoleti* Dyb. & Jachow. 1957

Genus — *Schizaeoisporites* Pot. 1951

Genotype — *Schizaeoisporites eocaenicus* (Selling, 1944) Pot. 1956.

Schizaeoisporites sp.

Pl. 2, fig. 25

Description — Brown, oval, measuring $74 \cdot 2 \times 52 \cdot 8$ μ; monolete mark faintly discernible, its terminating limits not clear, exine 1·5-2 μ thick, striated, striations 1·2-1·5 μ wide, running parallel to each other, exine in between the striations coarsely, foveolate, foveola of varying shapes and sizes.

Comparison — *Schizaeoisporites crassimurus* (Dutta and Sah, 1970; Pl. 3, figs. 32-34) differs in being smaller in size with a distinct monolete mark and laesura 2/4 the longer axis with few but thicker ridges on the exine.

Genus — *Polypodiisporites* (Pot. 1934) Pot. 1956

Genotype — *Polypodiisporites favus* (Pot. 1931) Pot. 1934.

Polypodiisporites speciosus Sah, 1967.

Pl. 2, figs. 26-28

Polypodiisporites splendidus Sal., Kind, and Reh. 1971.

Pl. 2, fig. 29

Anteturma — *Pollenites* Pot. 1931
Turma — *Saccites* Erdt. 1947
Subturma — *Disaccites* Cooks. 1947
Infraturma — *Podocarpoditi* Pot., Thoms. & Theirg. 1950

Genus — *Podocarpidites* (Cooks. 1947) Pot. 1958

Genotype — *Podocarpidites ellipticus* Cooks, 1947

Podocarpidites classicus Sal., Kind. & Reh. 1971

Pl. 2, fig. 30

Infraturma — *Pinosacciti* (Erdt. 1945) Pot. 1958

Genus — *Alisporites* Daugherty, 1941

Genotype — *Alisporites opii* Daugherty, 1941.

Alisporites sp.

Pl. 2, fig. 31

Description — Golden yellow, bilateral, bisaccate, overall size $94 \cdot 4 \times 48 \cdot 6$ μ; central body broadly oval, outline faintly discernible, measuring $52 \cdot 8 \times 40$ μ, smaller than the bladders in height, foveolate, foveola sparsely arranged, 1·2-1·5 μ broad, bladders hemispherical, microreticulate, attached distally leaving $a \pm 20 \cdot 8$ μ wide straight to slightly biconvex sulcus.

Comparison — *Alisporites clarus* recorded by Salujha *et al.* (1971; Pl. 2, figs. 46-47) has a distinct central body ornamented with grana and with a narrower sulcus distally. *Alisporites* sp. (Sah and Dutta, 1968; Pl. 1, fig. 10) is smaller in size with a vertically oval central body.

Turma — *Aletes* Ibr. 1933
Subturma — *Azonaletes* (Lub. 1935) Pot. & Kr. 1954
Infraturma — *Psilonapiti* Erdt. 1947

Genus — *Inaperturopollenites* (Thoms. & Pflug, 1953) Pot. 1958

Genotype — *Inaperturopollenites dubius*, (Pot. & Ven. 1934) Thoms. & Pflug, 1953.

Inaperturopollenites mirabilis sp. nov.

Pl. 2, figs. 32-34

Holotype — Pl. 2, fig. 32.

Type locality — Kopili Formation, Prang river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, normally circular, usually folded giving a subcircular appearance, size 32·4-62 μ; exine over 1 μ thick, granulose, grana +1·5 μ wide, closely spaced, occasionally coalescing to give a reticulate appearance.

Comparison — *Retiinaperturites depressus* recorded by Mathur (1966; Pl. 1, fig. 11) has a reticulate exine. The present species distinguishes in having a coarsely granulate exine.

Infraturma — *Spinonapiti* Erdt. 1947

Genus — *Peltandripites* Wodehouse, 1933

Genotype — *Peltandripites devisii* Wodehouse, 1933.

Peltandripites fastidiosus sp. nov.

Pl. 2, figs. 35-38

Holotype — Pl. 2, fig. 35.

Type locality — Kopili Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Light brown, normally circular, appearing subcircular due to folding or compression, size 18·6-35·6 μ; without any germinal mark; exine 1-1·5 μ thick, ornamented with sparsely arranged 1·5-2 μ long, ±1·5 μ wide uniformly, sharp to blunt tipped coni, sometimes coni protruding at the margin.

Comparison — *Peltandripites dubius* recorded by Sah and Dutta (1966; Pl. 1, figs 23-24) is smaller in size and covered with densely arranged spiny processes.

Turma — *Plicates* (Naum. 1937, 1939) Pot. 1960
Subturma — *Polyplicates* Erdt. 1952
Infraturma — *Costati* Pot. 1966

Genus — *Ephedripites* Bolch. 1953

Genotype — *Ephedripites mediolobatus* Bolch. 1953.

Ephedripites sp. A.

Pl. 2, fig. 39

Description — Brown, longish oval, with broadly rounded ends, size 50·6×30·4 μ; exine ±2·5 μ thick, bearing 4 prominent ridges with distinct septations inbetween, ridges ±2 μ wide, inter-ridge area smooth.

Comparison — Ghosh *et al*, (1963) have recorded closely comparable specimens from the Dharamsala (Tertiary) Formation of Kangra District in Punjab. These specimens (Ghosh *et al.*, 1963; figs. 1-4), are smaller in size and bearing larger number of ridges

Ephedripites sp. B

Pl. 2, fig. 40

Description — Golden yellow, longish oval with narrowly rounded ends, size 35·2 ×14·5 μ; exine ±1·2 μ thick, smooth, bearing 7 ridges, running from pole to pole without septations, ridges 1·2-1·5 μ thick.

Comparison — The present species differs from the one described above in having larger number of ridges without any septations.

Subturma — Monocolpates Iver. & Troels. 1950

Genus — Monocolpites Erdt. 1947

Lectogenotype — *Monocolpites longicolpatus* V. d. Hamm. 1956.

Monocolpites infrequens sp. nov.

Pl. 2, figs. 41-42

Holotype — Pl. 2, Fig. 41.

Type locality — Therria Formation, Umsohryngkew traverse, Khasi-Jaintia hills.

Diagnosis and description — Brown, oval with broadly rounded to flattened ends, size 38·6-50×16·8-32·5 μ; monocolpate, colpi 2·5-3 μ deep; exine ±1·2 μ thick, faintly structured, presumably beset with ±1 μ wide grana.

Comparison — A specimen illustrated as *Monocolpites* sp. by Salujha *et al.* (1971; Pl. 2, fig. 51) is bigger in size with deeper colpi. *Monocolpites* sp. (Sah and Dutta, 1966; Pl. 1, fig. 22) compares closely with the present species.

Botanical affinity — Uncertain.

Monocolpites sp.

Pl. 2, fig. 43

Description — Brown, elliptical, size 22·4×75·6 μ; monocolpate, colpi 3·5-4 μ wide, running from pole to pole; exine over 1 μ thick, smooth.

Comparison — The present species differs from *Monocolpites infrequens*, described above in having pointed ends and its longer axis is larger.

Subturma — *Relectines* (Malawk. 1949) Pot. 1948.

Genus — *Couperipollis* Venkat. & Kar 1969

Genotype — *Couperipollis perspinosus* (Coup.) Venkat. & Kar. 1969.

Couperipollis exsertus sp. nov.

Pl. 2, figs. 44-45

Holotype — Pl. 2, fig. 44.

Type locality — Kopili Formation, Prang river traverse, Khasi-Jaintia hills.

Diagnosis and description — Brown, circular to subcircular, measuring 48-64·6×35·2-61·2 μ (including processes), sometimes folded; monosulcate; sulcus 2·6-8 μ wide, sometimes more; exine 1.5-2 μ thick, ornamented with 3·5-6 μ long and 2·5-3·5 μ broad processes with pointed tips and bulbous base, processes closely spaced coalescing to give a reticulate appearance; exine inbetween the processes foveolate.

Comparison — *Couperipollis kutchensis* (Venkat. & Kar, 1969; Pl. 1, figs. 15-16) differs in having longer spines. *Monosulcites rarispinosus* recorded by Sah and Dutta (1966; Pl. 1. figs. 26-28) has smaller and sparsely arranged processes. Dutta and Sah (1970) have recorded quite a few species of *Monosulcites*. Out of these *M. magnus* (Dutta and Sah, 1970; Pl. 5, figs. 1-2) comes close to the present species but differs in being bigger in size and bearing longer spines for ornamentation. *Couperipollis achinatus* (Sah and Kar, 1970; Pl, 1, figs. 8-9) differs in being smaller, oval in shape and colpus extending from one end to the other.

Botanical affinity — Nymphaeaceae/Palmae.

Couperipollis sp.

Pl. 2, fig. 46

Description — Light brown, circular, measuring 35·6 μ; monosulcate, sulcus faintly discernible, its limits not clear; exine ± 1·5 μ thick, ornamented with 2-4 μ long, 2·5-3 μ broad, closely spaced processes with pointed to blunt tips; exine inbetween the processes smooth.

Comparison — The present species distinguishes in its smaller size with a faintly discernible sulcus and smaller, closely spaced processes.

Botanical affinity — Nymphaeaceae/Palmae.

Subturma — Monoptyches (Naum. 1937) Pot. 1958

Genus — *Palmaepollenites* Pot. 1951

Genotype — *Palmaepollenites tranquillus* Pot. 1934) Pot. 1951.

Palmaepollenites subtilis Sal., Kind. & Reh. 1971.

Pl. 2, fig. 47

Palmaepollenites sp.

Pl. 2, fig. 48

Description — Golden yellow, longish oval to elliptical, measuring 76·4×30·8 μ; monosulcate, sulcus 3·5-4 μ wide; running from one pole to the other; exine ±1 μ thick, faintly granulose, grana over 1 μ in diameter, sparsely arranged.

Comparison — *Palmaepollenites ovatus* (Sah and Kar, 1970; Pl. 1, fig. 13) is smaller, roundly oval with a thicker, intragranulose exine. *P. plicatus* also recorded by Sah and Kar (1970; Pl. 1, figs, 14-15) resembles the present species in its sulcus running from one end to the other but differs in having a laevigate exine. *P. subtilis* recorded by Salujha *et al.* (1971; Pl. 2, figs. 53-54) is smaller in size with a wide sulcus. *P. communis* (Sah and Dutta, 1966; Pl. 1, fig. 10) is also smaller in size with slightly raised lips.

Botanical affinity — Palmae.

Subturma — Dicolpates Erdt. 1947

Genus — Dicolpopollis (Pflan. 1956) Pot. 1966

Genotype — *Dicolpopollis kockeli* Pflan. 1956.

Dicolpopollis fragilis Sal., Kind. and Reh. 1971.

Pl. 2, fig. 49

Dicolpopollis sp.

Pl. 2, fig. 50

Description — Golden yellow; oval, size $44{\cdot}6 \times 39{\cdot}8$ μ; dicolpate, colpi 4·5-6·2 μ deep; exine ±1·5 μ thick, distinctly reticulate, muri 1·2-1·5 μ thick with ±1·5 μ wide lumina.

Comparison — *Dicolpopollis proprius* recorded by Salujha *et al.* (1971; Pl. 3, figs. 57-58) is smaller in size with faintly reticulate structure.

Botanical affinity — Palmae.

Subturma — Triptyches Naum. 1937, 1939
Genus — Tricolpites (Erdt. 1947, Cooks. 1947, Ross, 1949, Coup. 1953) Pot. 1960

Lectogenotype — *Tricolpites reticulatus* Cooks. 1947

Tricolpites gracilis Sal., Kind. & Reh. 1971.

Pl. 2, fig. 51

Tricolpites iniquus sp. nov.

Pl. 2, figs. 52-53

Holotype — Pl. 2, fig. 52.

Type locality — Jenam Formation, Haflong-Silchar road traverse, District Cachar.

Diagnosis and description — Golden yellow, roundly triangular to subcircular, size $19{\cdot}8\text{-}34{\cdot}6 \times 18{\cdot}2\text{-}28{\cdot}6$ μ; tricolpate, colpi 5·2-9·6 μ wide, extending to almost 1/2 the radial distance; exine over 1 μ thick, smooth to sparsely foveolate, uneven, giving a mat like appearance.

Comparison — *Tricolpites levis* recorded by Sah and Dutta (1966; Pl. 2, figs. 9-10) has longicolpate furrows. *T. longicolpus* (Sah and Dutta, 1966; Pl. 2, figs. 11-12) differs in having a thicker exine with long, tenuimarginate colpi. *T. brevis* (Sah and Kar, 1970; Pl. 1, figs. 5-6) is bigger in size with colpi placed in interapical margin. *T. minutus* also recorded by these authors (Sah and Kar, 1970; Pl. 1, fig. 7) has a thicker exine with narrow and uniformly broad colpi. In *T. gracilis* (Salujha *et al.*, 1971; Pl. 3, figs. 59-60) exine is ornamented with closely set grana.

Botanical affinity — Uncertain.

Tricolpites horridus sp. nov.

Pl. 2, figs. 54-55

Holotype — Pl. 2, Fig. 54.

Type locality — Oligocene, Mupa-Langting traverse, Haflong area.

Diagnosis and description — Brown, roundly triangular with three prominent slits, size 25·6-33·6 μ; tricolpate, colpi 3-6·5 μ deep; exine 2-2·5 μ thick, pilate, pila 2·5-3 μ long with globular heads, closely spaced; occasionally coalescing to give a reticulate appearance.

Comparison — The present species distinguishes from all other species recorded earlier in having pila for exine ornamentation. Dutta and Sah (1970; Pl. 6, Figs. 7-8) have assigned comparable specimens to *Retitrescolpites minor* but they have longer colpi and exinal layers are clearly distinguished.

Botanical affinity — Uncertain.

Tricolpites strigosus sp. nov.

Pl. 2, figs. 56-57

Holotype — Pl. 2, Fig. 56.

Type locality — Kopili Formation, Prang river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow subcircular, measuring $24\text{-}35{\cdot}2 \times 22{\cdot}4\text{-}30{\cdot}8$ μ; occasionally bearing folds; tricolpate, colpi 2·5-4·5 μ deep with a 2-3 μ wide thickening; exine ±1·2 μ thick, finely granulate, grana ±1 μ in diameter.

Comparison — *Tricolpites strigosus* differs from *T. gracilis* (Salujha *et al.*, 1971; Pl. 3, figs. 59-60), *T. horridus*, *T. brevis* and *T. minutus* (Sah and Kar, 1970; Pl. 1, figs. 5, 6, 7) in having a wide thickening along the colpi.

Botanical affinity — Uncertain.

Tricolpites ovatus sp. nov.

Pl. 2, figs. 58-59; Pl. 3, fig. 60

Holotype — Pl. 2, fig. 58.

Type locality — Disangs, Bali-Chara nadi traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, oval, size 30·6-38·4×21·2—27·8 μ; occasionally bearing folds; tricolpate, colpi 2-3·5 μ wide extending almost from one pole to the other; exine ±1·5 μ thick, granulose, grana ±1 μ wide, closely spaced.

Comparison — *Tricolpites longicolpus* (Sah and Dutta, 1966; Pl. 2, figs. 11-12) has a thicker exine with tenuimarginate colpi. *T. levis* also recorded by these authors (Sah and Dutta, 1966; Pl. 2, figs. 9-10) has thinner furrows.

Botanical afflnity — Uncertain.

Tricolpites sp.

Pl. 3, fig. 61

Description — Brown, triangular with lobed angles, size 46·4 μ; tricolpate, colpi inter-angular, 5-5·5 μ deep; exine ±1·5 μ thick, reticulate, muri over 1·5 μ thick, lumina of irregular shapes, muri 2-2·5 μ broad, usually protruding at the margin, angles lobed.

Comparison — *Tricolpites brevis* recorded by Sah and Kar (1970; Pl. 1, figs. 5-6) resembles the present specimen in having colpi at the interapical margin but differs in having laevigate-finely scrobiculate exine without any angular lobes.

Botanical afflnity — Uncertain.

Genus — Meyeripollis Baksi & Venkat. 1970

Genotype — *Meyeripollis naharkotensis*, Baksi & Venkat. 1970.

Meyeripollis laudabilis Sal., Kind. & Reh. 1971

Pl. 3, fig. 62

Genus — Marginipollis Clarke & Frederik. 1968

Genotype — *Marginipollis concinnus*, Clarke & Frederik. 1968.

Marginipollis grandis Sal., Kind. & Reh. 1971.

Pl. 3, fig. 63

Subturma — *Polyptyches* (Naum. 1937, 1939) Pot. 1960

Genus — *Stephanocolpites* (V. d. Hamm. 1945, 1956) Pot. 1960

Lectotype — *Stephanocolpites costatus* V. d. Hamm. 1954.

Stephanocolpites emendatus sp. nov.

Pl. 3, figs. 64-66

Holotype — Pl. 3, fig. 64.

Type locality — Kopili Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, circular to oval, measuring 25·6-45.6×24·2-35·4 μ; tetracolpate, colpi 2·5-3 μ deep, 1·5-2 μ wide; exine ±1·5 μ thick, finely granulose, grana ±1 μ wide.

Comparison — *Stephanocolpites optabilis* described by Salujha *et al.* (1971; Pl. 3, figs. 69-71) is bigger in size with wider colpi and smooth to foveolate exine. S. *minutus* also recorded by the above authors (Salujha *et al.*, 1971; Pl. 3, figs. 72-73) is smaller, hexacolpate and the exine is smooth. *Polycolpites ornatus*, *P. multirimatus* (Dutta and Sah, 1970; Pl. 6, figs. 27-28; Pl. 7, figs. 1-3; Figs. 18-20) *P. granulatus* and *P. flavatus* (Sah and Kar, 1970; Pl. 2, figs. 41, 42, 47) differ in having 6-8, 8-10, 7-8 and 9-10 colpi respectively and exine is coarsely reticulate or sub-reticulate or granulose. *P. speciosus* also recorded by Dutta and Sah (1970; Pl. 6, figs. 24-25) has a granulose exine but is hexacolpate.

Stephanocolpites sp. A

Pl. 3, fig. 67

Description — Light brown, oval to subcircular, size 30×33·6 μ; hexacolpate, colpi 1·5-2 μ wide, prominently seen in the centre; exine ±2 μ thick, finely reticulate, muri over 1 μ thick, with an equally broad lumina in the centre.

Comparison — The present species differs from *Polycolpites obscurus, P. cooksonii* (Sah and Dutta, 1966; Pl. 2, figs. 13-14, 17-18), *P. speciosus* (Dutta and Sah, 1970; Pl. 6, figs. 24-25), *Stephanocolpites optabilis* and *S. minutus* (Salujha *et al.*, 1971; Pl. 3, figs. 69-70, 72-73) in having a distinctly reticulate exine.

Botanical affinity — ?Rubiaceae.

Stephanocolpites sp. B

Pl. 3, fig. 68

Description — Light brown, subcircular, size 32·8×30·2 μ; septacolpate, colpi 2·5-3 μ wide; exine ±1·5 μ thick, coarsely foveolate, foveola ±1·5 μ broad, sparsely arranged.

Comparison — *Stephanocolpites optabilis* (Salujha *et al.*, 1971; Pl. 3, figs. 69-70), though having foveola for exine ornamentation, is much bigger in size with only 4-5 colpi. *Polycolpites ornatus* recorded by Dutta and Sah (1970; Pl. 6, figs. 27-28; Pl. 7, figs. 1-3) differs in having a coarsely reticulate exine.

***Botanical affinlty* — ? Rubiaceae**

Subturma — *Ptychotriporines* (Naum. 1937, 1939) Pot. 1960

Infraturma — *Prolati* Erdt. 1943

Genus — *Favitricolporites* Sah, 1967

Genotype — *Favitricolporites eminens* Sah, 1967.

Favitricolporites usitatus Sal., Kind, & Reh. 1971.

Pl. 3, fig. 69

Remarks — The specimen illustrated here measures 64·5 μ, whereas the size range already mentioned for this species is 20·6-57·6 μ. Thus size range of the specimens included under this species may be taken as 20·6-64·5 μ.

Botanical affinity — Rubiaceae

Genus — *Nyssapollenites* Thierg. 1937

Genotype — *Nyssapollenites pseudocruciatus* (Pot. 1931) Thierg. 1937.

Nyssapollenites laudabilis sp. nov.

Pl. 3, figs. 70-72

Holotype — Pl. 3, fig. 70.

Type locality — Kopili Formation, Umiew river traverse, Khasi-Jaintia hills.

Diagnosis and description — Brown, roundly triangular to oval, size 24-42·4×18·2-33·6 μ; tricolporate, colpi 2·2-2·6 μ wide, pores 1·5-2 μ in diameter; exine ±1·5 μ thick, smooth to faintly structured.

Comparison — The solitary specimen of *Nyssapollenites* sp. illustrated by Sah and Dutta (1966; Pl. 2, fig. 8) is spheroidal with a finely pitted to reticulate sculpture. *N. barooahii* also described by Sah and Dutta (1968; Pl. 2, fig. 9) has lalongate pores and a distinct thickening at the apertural region.

Botanical affinity — ?Nyssaceae.

Genus — *Talisiipites* Wodehouse, 1933

Genotype — *Talisiipites fischeri* Wodehouse, 1933.

?*Talisiipites* sp.

Pl. 3, fig. 73

Description — Brown, roundly triangular to subcircular, size 65·6×56 μ; tricolporate, syncolpate, pores 3·5-4·5 μ in diameter, colpi almost reaching up to the pole; exine ±2 μ thick, reticulate, muri ±1·5 μ thick with 1-1·2 μ wide lumina.

Comparison — *Talisiipites mundus* (Sah and Dutta, 1968; Pl. 2, fig. 6) has a distinctly triangular shape with its colpi distinctly joining at the pole. *T. wodehousei* recorded by Dutta and Sah (1970; Pl. 7, figs. 9-12) has a distinctly triangular amb and smooth to faintly scabrate, exine.

Botanical affinity — Uncertain.

Genus — *Myrtaceidites* (Cooks, & Pike, 1954) Pot. 1960

Genotype — *Myrtaceidites mesonesus* Cooks. & Pike, 1954.

Myrtaceidites pretiosus Sal., Kind. and Rehman, 1971.

Pl. 3, fig. 74

Subturma — *Ptychopolyporines* (Naum. 1937, 1939) Pot. 1960

Genus — *Tetracolporites* Coup. 1953

Genotype — *Tetracolporites camaruensis* Coup. 1953.

Tetracolporites similis Sal., Kind. & Reh. 1971.

Pl. 3, fig. 75

Tetracolporites manifestus sp. nov.

Pl. 3, figs. 76-77

Holotype Pl. 3, Fig. 76.

Type locality — Laisong Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, circular to subcircular, size 30·8-38·2×26-30·4 μ; tetracolporate, colpi 3·5-4 μ wide, pores ±3·8 μ in diameter; exine ±1·5 μ thick, distinctly reticulate, muri over 1·5 μ thick, leaving lumina of varying shapes, usually measuring 1·5-2 μ in width.

Comparison — The present species differs from *T*, *similis* (Salujha *et al.* 1971; Pl. 3, Figs. 82-83) in having a reticulate ornamentation. *T*, *paucus* and *T. onagraceoides* described by Sah and Dutta (1968; Pl. 2, Figs. 14, 16) have pores with a thickened rim alround. *T. longicolpus* (Sah and Dutta, 1968; Pl. 2, Fig. 7) has long colpi extending almost up to the poles and an undifferentiated exine ornamentation.

Botanical affinity — ?Rubiaceae /?Onagraceae.

Genus — *Polygalacidites* Sah & Dutta, 1966

Genotype — *Polygalacidites clarus* Sah & Dutta, 1966.

Polygalacidites putidus sp. nov.

Pl. 3, figs. 78-79

Holotype — Pl. 3, fig. 78.

Type locality — Jenam Formation, Haflong-Silchar road traverse, District Cachar.

Diagnosis and description — Golden yellow, circular to subcircular to oval, size 24-33·6 μ; penta to hexacolporate, colpi 6-8·5 μ deep, pores 3-4 μ in diameter with a faint thickening around them; exine almost 1·5 μ thick, smooth to finely granulate, grana less than 1 μ in diameter.

Comparison — *Polygalacidites clarus* recorded by Sah and Dutta (1966; Pl. 2, figs. 24-25) has longer colpi and faintly discernible ora. *P. insignis* (Dutta and Sah, 1970; Pl. 7, fig. 29) is smaller in size with 8 colpi and smooth to faintly scabrate exine ornamentation.

Botanical affinity — Polygalaceae.

Turma — *Poroses* (Naum. 1937, 1939) Pot. 1960

Subturma — *Monoporines* (Naum. 1937, 1939) Pot. 1960

Genus — *Graminidites* Cooks. 1947

Graminidites sp.

Pl. 3, fig. 80

Description — Brown, circular, flattened on one side, size 26·4 μ; monoporate, pore 2-2·5 μ wide, with an equally wide, dark brown thickening alround; exine up to 2 μ thick, smooth.

Comparison — *Graminidites assamicus* (Sah and Dutta, 1968; Pl. 2, fig. 21) is bigger in size and lacks a thickening around the pore.

Botanical affinity — Gramineae.

Subturma — *Diporines* (Naum. 1937, 1939) Pot. 1960

Genus — *Diporites* V. d. Hamm. 1954, 1956

Genotype — *Diporites grandiporus* V. d. 1954.

Diporites sp.

Pl. 3, fig. 81

Description — Brown, oval to longish oval, size 73·4×30·5 μ; diporate, pores 4·5-5·2 μ wide with a 1·8-2 μ wide thickening alround; exine over 1·5 μ thick, finely granulose.

Comparison — Out of the many species of the diporate pollengrains recorded by Varma and Rawat (1963), *Diporisporites anklesvarensis* (Varma and Rawat, 1963; Elsik, 1968; Pl. 1, figs. 11-12) compares well with the present species. It differs in having larger pores with a wider thickening around them and the exine is foveolate. The specimens assigned to a new genus, *Diporopollis* as *D. assamica* by Dutta and Sah (1970; Pl. 8. figs. 21-24) do not compare with any of the known species of diporate pollengrains.

Botanical affinity — Apocynaceae/Proteaceae.

Subturma — *Triporines* (Naum. 1937, 1939) Pot. 1960
Genus — *Triporopollenites* (Pflug, 1952) Thoms. & Pflug, 1953

Genotype — *Triporopollenites coryloides*, Thoms. & Pflug, 1953.

Triporopollenites exactus Sal., Kind. & Reh. 1971.

Pl. 3, figs. 82-83

Subturma — *Polyporines* (Naum. 1937, 1939) Pot. 1960
Infraturma — *Stephanoporiti* (V.d. Hamm. 1954) Pot. 1960
Genus — *Stephanoporopollenites* Pflug in Thoms. & Pflug, 1953

Genotype — *Stephanoporopollenites hexaradiatus* (Thierg. 1940) Thoms. & Pflug, 1953.

Stephanoporopollenites sollemnis Sal., Kind, and Reh. 1971.

Pl. 3, fig. 84

Stephanoporopollenites sp.

Pl. 3, fig. 85

Description — Golden yellow, circular with a wavy margin, size 36·6 μ; octaporate, pores located below each furrow, 3-3·5 μ in diameter, with a ±1·5 μ wide thickening around each pore; exine ±1·2 μ thick, finely granulate, grana less than 1 μ wide, closely spaced.

Comparison — The grains assigned to *Stephanoporopollenites solitus* by Salujha *et al.* (1971; Pl. 3, figs. 96-97) seem to compare closely with the present species but differ in being hexaporate with a prominent thickening in between the pores. *Polyporina excellens* (Dutta and Sah, 1970; Pl. 8, figs. 10, 12) differs in having 50 pores and finely punctate ornamentation on the exine.

Botanical affinity — ?Chenopodiaceae.

Group — *Acritarcha* Evitt, 1963

Subgroup — *Polygonomorphitae* Dow., Evitt & Sarj. 1963
Genus — *Simsangia* Baksi, 1962

Genotype — *Simsangia trispinosa* Baksi, 1962.

Simsangia magna Sal., Kind. & Reh. 1971.

Pl. 3, fig. 86

Simsangia rustica sp. nov.

Pl. 3, figs. 87-89

Holotype — Pl. 3, fig. 87.

Type locality — Kopili Formation, Umsohryngkew traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow, triangular with slightly convex sides, size 28·8-34·6 μ (including processes), one process at each corner; processes 4-4·5 μ long, 3-3·5 μ broad uniformly from base to the top, with blunt tips; exine ±1 μ thick, smooth.

Comparison — *Simsangia trispinosa* (Baksi, 1962; Pl. 3, fig. 34) and *S. magna* (Salujha *et al.* 1971; Pl. 3, figs. 99-101) differ in having longer processes with pointed tips.

Botanical affinity — Uncertain.

Subgroup — *Acanthomorphitae* Dow., Evitt. & Sarj. 1963
Genus — *Baltisphaeridium* (Eis. 1958) Dow. & Sarj. 1963

Genotype — *Baltisphaeridium longispinosum* (Eis. 1931) Dow. & Sarj. 1963.

Baltisphaeridium sp.

Pl. 3, fig. 90

Description — Golden yellow, circular to subcircular, size 36·4×31·8 μ (excluding processes), folded; exine over 1 μ thick bearing 4-4·8 μ long, 1·5-2 μ broad (at the base) processes with pointed tips, processes sparsely arranged, exine inbetween the processes finely granulate, grana ±1 μ in diameter.

Comparison — *Baltisphaeridium* sp. recorded by Sah *et al.* (1970; Pl. 2, fig. 26) has many, longer and closely spaced processes. The present species distinguishes in having grana inbetween the spine-like processes.

Genus — *Micrhystridium* (Defl. 1937) Dow. & Sarj. 1963

Genotype — *Micrhystridium inconspicuum* Defl. 1935.

Micrhystridium modestus Sal., Kind. & Reh. 1971.

Pl. 3, figs. 91-92

Micrhystridium proprium sp. nov.

Pl. 3, figs. 93-95

Holotype — Pl. 3, fig. 93.

Type locality — Kopili Formation, Lubha river traverse, Khasi-Jaintia hills.

Diagnosis and description — Golden yellow normally circular, subcircular in folded condition, measuring 14·4-32 μ (excluding processes); exine ±1 5 μ thick, bearing sparsely arranged, 2-3·5 μ long and 1·5-2 μ broad (at the base) processes with pointed tips, 9-15 processes observed at the margin; area inbetween the processes smooth.

Comparison — *Micrhystridium modestus* recorded by Salujha *et al.* (1971; Pl. 3, figs. 102-103) differs in having longer processes, a distinct thin, circular area in the centre and granulose exine inbetween the processes.

Genus — *Hystrichosphderidium* (Defl. 1937) Eis. 1958

Genotype — *Hystrichosphaeridium tubiferum* (Ehren. 1938) Eis. 1958.

Hystrichosphaeridium sp.

Pl. 3, fig. 96

Description — Golden yellow, subcircular, size 45·6×38·8 μ (including processes); processes needle like, 8-8·5 μ long, 1·5-2 μ broad at the base, occasionally furcating into two or three branches; exine ±1·2 μ thick, area inbetween the processes faintly structured.

Comparison — *Hystrichosphaeridium scaffoldi* recorded by Baksi (1962; Pl. 2, fig. 25) differs in having longer processes joining with one another to form a scaffolding structure. *H. sylheti* also recorded by the above author (Baksi, 1962; Pl. 2, fig. 26) has longer but simple, unbranched processes. *H. robustum* and *H. assamicum* recorded by Sah *et al.* (1970; Pl. 2, figs. 16-17, 20-21) are bigger in size, bearing tubular processes and laevigate exine.

Incertde Sedis

Phycopeltis iucundus sp. nov.

Pl. 3, fig. 97

Holotype — Salujha *et al.*, 1971; Pl. 3, Fig. 106.

Type locality — Jenam Formation, Haflong-Silchar road traverse, District Cachar.

Diagnosis and description — Brown, circular to subcircular, measuring 30·3-36·8 ×28·8-33·6 μ; margin wavy, each wave bifurcating, below each notch a ±1·5 μ wide pore with equally wide thickening alround present; exine ±2 μ thick, faintly structured.

Remarks — This is the first record of *Phycopeltis* from the Palaeogene sediments of Assam.

Fusiformisporites foedus sp. nov.

Pl. 3, figs. 98-99

Holotype — Pl. 3, fig. 98.

Type locality — Disangs, Bali-chara nadi traverse, Khasi-Jaintia hills.

Diagnosis and description — Brown, oval with pointed ends, size 43·2-46·4× 24·5-27·2 μ; on the equator a 2-2·5 μ wide disc with a wavy margin present, exine ±1·2 μ thick, ridged, ridges 10 in number, ±1·5 μ wide, running from one pole to the other.

Comparsion — A comparable specimen under *Fungus striata* is illustrated by Baksi (1962; Pl. 4, fig. 50)

Fungal spores

Pl. 3, figs. 100-101

DISCUSSION

The present paper incorporates results of a palynological study of the Palaeogene sediments along the southern edge of the United Khasi and Jaintia hills. The palynoflora recovered here is assigned to 41, genera and 67 species. It is observed that Pteridophytes and Angiosperms were the main constituents of the flora during the Palaeogene times. Gymnosperms were rather rare represented by comparatively fewer species. Microplankton were poorly represented.

Out of the five traverses studied here, two of them i.e. Umsohryngkew and Lubha river traverses are studied in detail including both qualitative and quantitative analysis. Most of the samples studied from the Umsohryngkew traverse belong to the Kopili formation. Besides this one sample is from the lower most part of the Barails and two samples from the Langpars. The solitary sample from the Barails has yielded a very poor assemblage. The Kopilis on the other hand show a richer assemblage but the complete representation is indicative of a single zone. All other samples studied from the Sylhet Limestone Formation are devoid of palynological fossils. Samples from the Langpar Formation show an abundance of hystrichosphaerids. The Lubha river traverse shows an excellent distribution of palynofossils in the Barails. The Renji and Jenam Formations have yielded a rich assemblage of palynofossils. The Laisong Formation, on the other hand, has palynomorphs poor both in quality and quantity.

A comparison of palynofossils from the Barails of Garo hills and Khasi and Jaintia hills shows that most of the genera represented in the two assemblages are common. Considering the qualitative aspect further, there are a few genera which are present in the Barails of Garo hills but do not show up in the Khasi and Jaintia hills, while there are still others which are present in assemblage of the Khasi and Jaintia hills but absent in the Garo hills. All these genera have a very poor occurrence, represented by stray specimens which are at times not encountered in the countings. Thus on the whole the Barails of Garo hills compare closely with the Barails of Khasi and Jaintia hills. The assemblage obtained from the Kopilis of Garo hills also shows a close resemblance to that from the Kopili counterpart in the Khasi and Jaintia hills.

The Therria and Langpar sediments are studied only from the Khasi and Jaintia hills whereas their equivalents from the Garo hills have not been studied due to non-availability of samples. Thus their comparison with similar sediments in the Garo hills cannot as yet be attempted.

Palynological study of both shelf and geosynclinal sediments is dealt with above. Out of two traverses studied in detail, Umsohryngkew traverse represents the shelf facies whereas Lubha river traverse represents the geosynclinal facies. The Barails of shelf facies show a richer assemblage as compared to that of the geosynclinal facies. It is interesting to note that the Disangs which were hitherto reported to be barren have yielded a diversified assemblage of palynofossils but it is comparatively poorer than that obtained from the Jaintia Series of the shelf facies. Thus relationship of the Disangs with the richly fossiliferous Jaintia Series still remains a problem.

A perusal of the assemblages shows that the Langpar Formation has dominance of microplankton followed by angiosperms and pteridophytes. Gymnosperms on the other hand are poorly represented. Abundance of microplankton in this formation indicates its deposition under shallow marine conditions. The paucity of microplankton in assemblages of the Barail, Kopili and Therria Formations indicates that their deposition took place under terrestrial conditions with brackish to marine influence.

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EXPLANATION OF PLATES

(All magnifications × 500)

PLATE 1

1. *Cyathidites* (*Leiotriletes*) *dehiscensi* (Baksi) Sal., Kind. & Reh. 1971; Photo no. 21/4.

2-3. *Cyathidites magnanimus* sp. nov.; Photo nos. 27/16, 27/5.

4. *Cyathidites* sp.; Photo no. 22/10.

5-6. *Stereisporites formosus* sp. nov.; Photo nos. 27/18, 21/6.

7. *Biretisporites singularis* sp. nov.; Photo no. 21/13.

8. *Foveosporites spectabilis* sp. nov.; Photo no. 19/30.

9. *Lycopodiumsporites parvireticulatus* Sah & Dutta, 1966; Photo no. 7/11.

10-11. *Lycopodiumsporites rarus* sp. nov.; Photo nos. 7/8, 18/11.

12. *Lycopodiumsporites* sp. A; Photo no. 27/20.

13. *Lycopodiumsporites* sp. B; Photo no. 27/13.

14-15. *Lycopodiumsporites insignis* sp. nov.; Photo nos. 17/26, 19/29.

16. *Magnastriatites venustus*, Sal., Kind. & Reh., 1971; Photo no. 21/25.

17. *Cicatricosisporites* sp.; Photo no. 22/21.

18. *Corrugatisporites* sp.; Photo no. 18/6.

19. *Polypodiaceoisporites idoneus* Sal., Kind. & Reh. 1971; Photo no. 21/24.

20. *Polypodiaceoisporites* sp.; Photo no. 18/27.

21. *Laevigatosporites copiosus* Sal., Kind. & Reh. 1971; Photo no. 21/21.

22-24. *Laevigatosporites caecus* sp. nov.; Photo nos. 22/1, 16/12, 19/32.

PLATE 2

25. *Schizaeoisporites* sp.; Photo no. 27/21.

26-28. *Polypodiisporites speciosus* Sah, 1967 Photo nos. 24/4, 14/25, 18/28.

29. *Polypodiisporites splendidus* Sal., Kind. & Reh. 1971; Photo no. 17/22.

30. *Podocarpidites classicus* Sal., Kind. & Reh 1971; Photo no. 27/14.

31. *Alisporites* sp ; Photo no. 24/5.

32-34. *Inaperturopollenites mirabilis* sp. nov.; Photo nos. 19/10, 19/3, 12/13.

35-38. *Peltandripites fastidiosus* sp. nov.; Photo nos. 16/27, 20/12, 19/4, 8/9.

39. *Ephedripites* sp. A.; Photo no. 16/21.

40. *Ephedripites* sp. B.; Photo no. 17/1.

41-42. *Monocolpites infrequens* sp. nov.; Photo nos. 7/16, 15/11.

43. *Monocolpites* sp.; Photo no. 27/19.

44-45. *Couperipollis exsertus* sp. nov.; Photo nos. 19/5, 17/23.

46. *Monosulcites* sp.; Photo no. 26/26.

47. *Palmaepollenites subtilis* Sal., Kind. & Reh. 1971; Photo no. 17/20.

48. *Palmaepollenites* sp.; Photo no. 18/30.

49. *Dicolpopollis fragilis* Sal., Kind. & Reh. 1971; Photo no. 20/33.

50. *Dicolpopollis* sp.; Photo no. 27/10.

51. *Tricolpites gracilis* Sal., Kind. & Reh. 1971; Photo no. 21/19.

52-53. *Tricolpites iniquus.* sp. nov.; Photo nos. 27/15, 21/9.

54-55. *Tricolpites horridus* sp. nov.; Photo nos. 21/23, 12/19.

56-57. *Tricolpites stupidus* sp. nov.; Photo nos. 18/19, 18/22.

58-59. *Tricolpites ovatus* sp. nov.; Photo nos. 26/18, 8/4.

PLATE 3

60. *Tricolpites ovatus* sp. nov.; Photo no. 7/21.

61. *Tricolpites* sp.; Photo no. 18/21.

62. *Meyeripollis laudabilis* Sal., Kind. & Reh. 1971; Photo no. 21/3.

63. *Marginipollis grandis* Sal., Kind. & Reh. 1971; Photo no. 20/8.

64-66. *Stephanocolpites emendatus* sp. nov.; Photo nos. 12/14, 22/3, 16/14.

67. *Stephanocolpites* sp. A; Photo no. 7/22.

68. *Stephanocolpiles* sp. B; Photo no. 7/26.

69. *Favitricolporites usitatus* Sal., Kind. & Reh. 1971; Photo no. 27/4.

70-72 *Nyssapollenites laudabilis* sp. nov.; Photo nos. 17/18, 22/7, 17/15.

73. *Talisiipites* sp.; Photo no. 18/24.

74. *Myrtaceidites pretiosus* Sal., Kind. & Reh. 1971; Photo no. 22/15.

75. *Tetracolporites similis* Sal., Kind & Reh. 1971; Photo no. 22/22.

76-77. *Tetracolporites manifestus* sp. nov.; Photo nos. 22/17, 7/15.

78-79. *Polygalacidites putidus* sp. nov.; Photo no. 27/3, 27/8.

80. *Graminidites* sp.; Photo no. 26/29.

81. *Diporites* sp.; Photo no. 16/13.

82-83. *Triporopollenites exactus* Sal., Kind. & Reh. 1971; Photo nos. 7/9, 26/28.

84. *Stephanoporopollenites sollemnis* Sal., Kind. & Reh. 1971; Photo no. 24/6.

85. *Stephanoporopollenites* sp.; Photo no. 21/7.

86. *Simsangia magna* Sal., Kind. & Reh. 1971; Photo no. 22/5.

87-89. *Simsangia rustica* sp. nov.; Photo nos. 18/17, 11/13, 10/13.

90. *Baltisphaeridium* sp.; Photo no. 18/9.

91-92. *Micrhystridium modestus* Sal., Kind. & Reh. 1971; Photo nos. 11/6, 19/22.

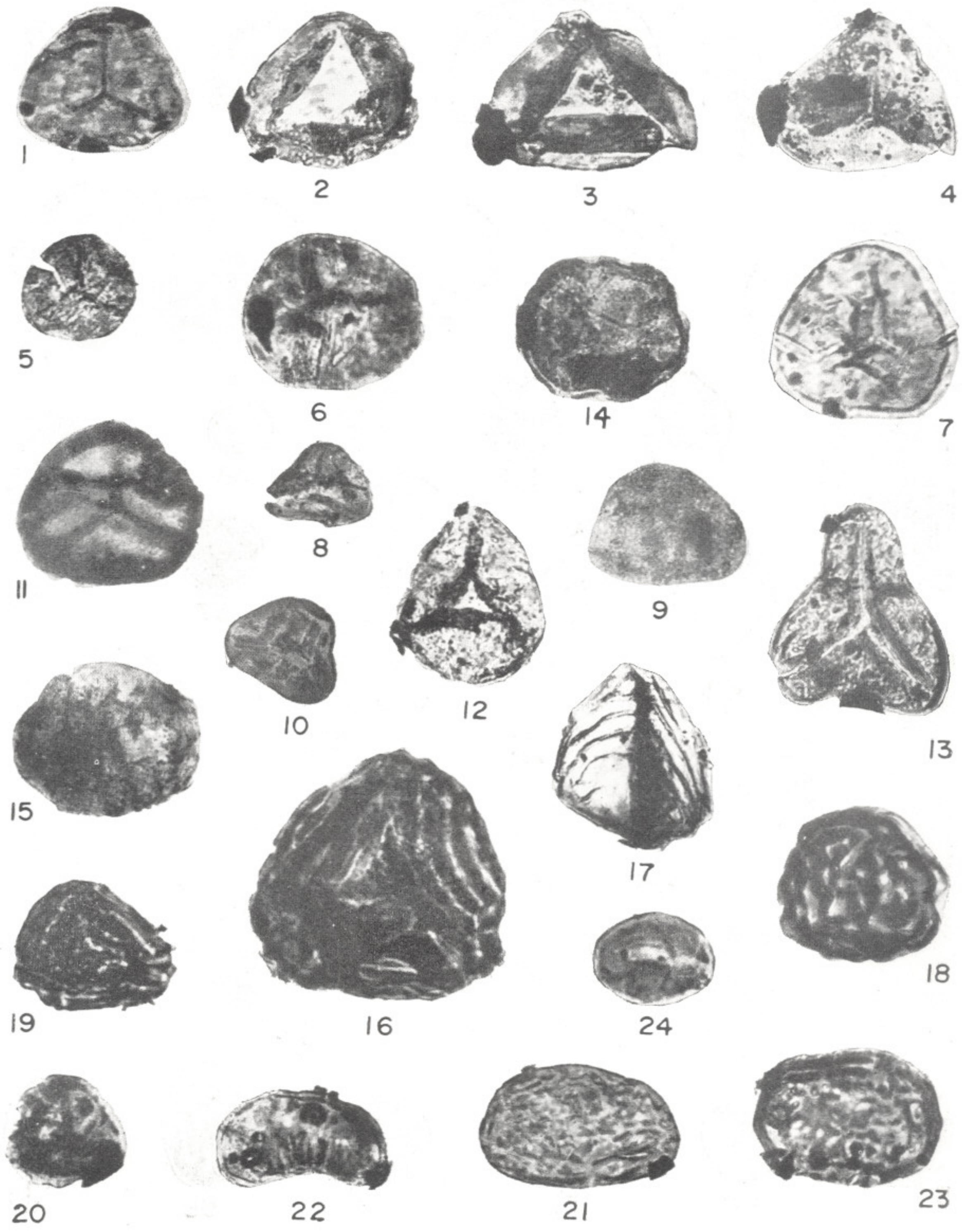
93-95. *Micrhystridium proprium* sp. nov.; Photo nos. 16/22, 16/11, 17/9.

96. *Hystrichosphaeridium* sp.; Photo no. 18/16.

97. *Phycopeltis iucundus* sp. nov.; Photo no. 27/17.

98-99. *Fusiformisporites foedus* sp. nov.; Photo nos. 26/27, 26/21.

100-101. Fungal spores; Photo nos. 26/25, 27/12.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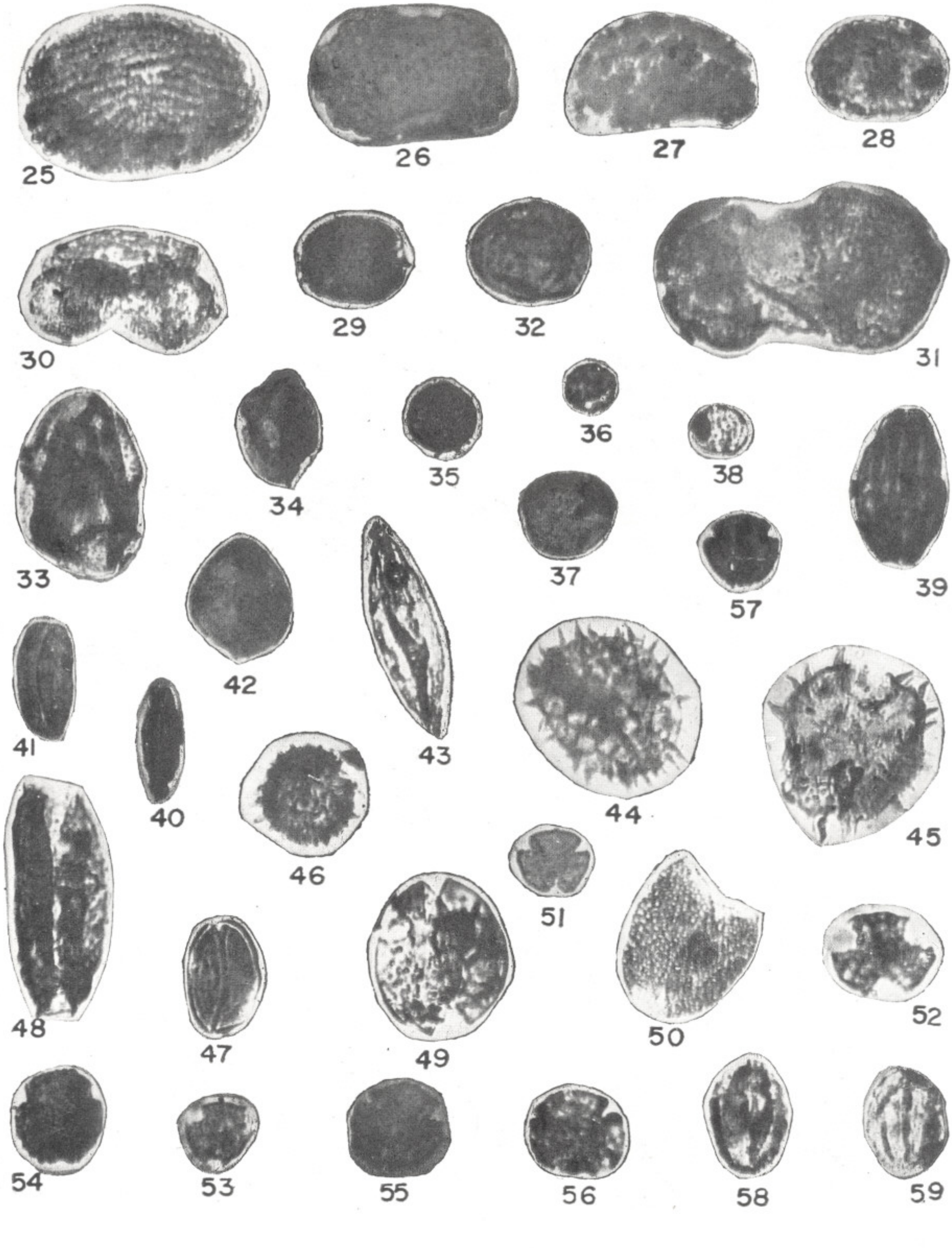
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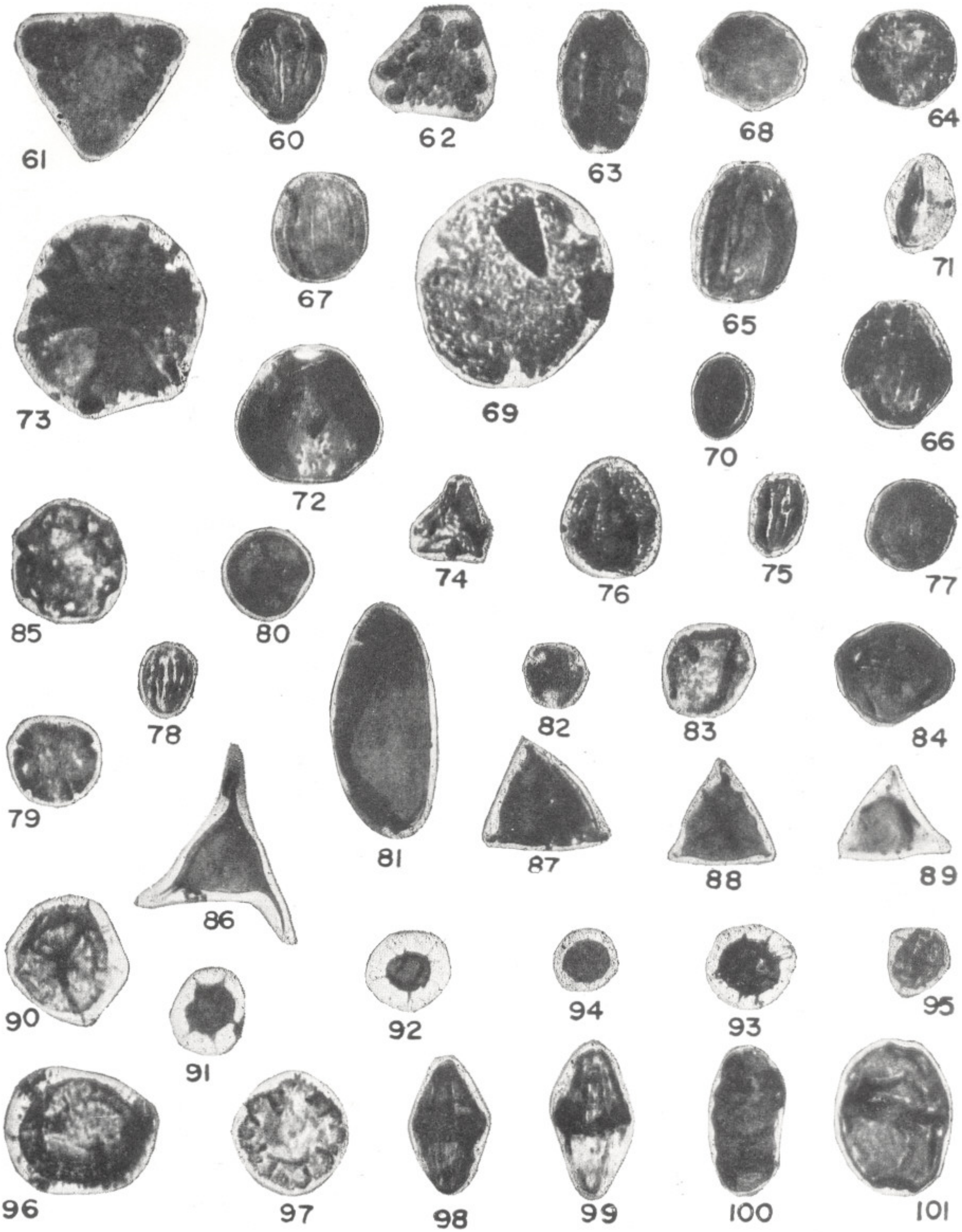
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