CHAPTER-IV

CHAPTER - IV

4.1 SYSTEMATIC PALYNOLOGY :

In the following description fossil spore and pollen grains identified by the author have been arranged according to the classification system proposed by Potonie and Kremp (1954, 1955, 1966) and Potonie (1956, 1958, 1960). Microplankton have been arranged according to the system of the nomenclature adopted in classification proposed by Downie, Evitt and Sarjeant (1963). This study is according to the international Code of Botanical Nomenclature (Lanjow, 1964). The descriptive terminology adopted by the author is essentially those which have been used by earlier authors Kremp(1968), Erdtman (1952), Iverson and Troelessmith (1950) and Wodehouse (1933).

The author has identified 293 Palynospecies belonging to 144 genera of 35 families. Out of these 59 species belong to 23 genera and 10 families of pteridophytes; 76 genera and 163 species of 22 families of angiosperms; one species of one genera and one family of Gymnosperms; 23 genera and 43 species of dinoflagellate cysts, three genera and three species of Acritarchs and 18 genera and 24 species of fungal spores have been fully identified and documented from the Paleogene subsurface sequence, Broach Depression. Systematic description of all these with their microphotographic details are presented in the preceding pages, and the plates (1-31) containing microphotographswith explanationsare appended at the end.

4.1.1 PTERIDOPHYTIC SPORES

Anteturma : Proximigerminates Pot. 1970

Turma : Triletes (Reinsch 1981) Pot. and Kar 1954

Subturma : Azonotriletes Luber 1953

Infraturma : Laevigati (Bennie and Kidston 1886) Pot. 1956

Genus ; Cyathidites Couper, 1953

Type species: Cyathidites australis Couper 1953

Cyathidites minor Couper

pl.1, figs. 1-4, 8

1953 Cyathidites minor Couper, p. 28, pl. 2, fig. 13.

Description : Spore subtriangular in shape, 38.4-39.6x46.8-48.5 µm, sides concave and angles rounded, trilete, laesurae distinct, rays well developed reaching about more than half of the spore radius and tapering towards equator. Exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-1, 2235-2240 m, slide no.1, coordinates 99/57.

Remarks : Psilate trilete spores, triangular to subtriangular with rounded amb with concave sides are included in the genus cyathidites Couper (1953).
In this study the designation of Cyathidites is used for spores with slightly concave sides.

Botanical Affinity : Cyatheaceae.

Previously Reported Occurrence : Pliocene, Middle Siwalik, Andhra Pradesh (Nandi,

(1972); Paleocene, Barmer sandstone, Rajasthan (Jain.et al.,1973); Paleocene (Tura Formation) Garro hills, Meghalaya (Singh,1977a); Early to Middle Eocene,(Naredi and Harudi formations), Kutch (Kar,1978); Paleocene - Eocene (Akali Formation) Rajasthan (Naskar and Bakshi, 1978); Paleocene, (Matanomadh Formation) Kutch (Saxena,1978); Middle Miocene-Early Pleistocene, Siwalik Group, Himachal Pradesh (Nandi , 1980); Paleocene-Miocene, Cambay Basin (Shanmukhappa , 1991); Miocene, Tipam Sandstone and Girujan Clay, Assam (Sah et al., 1980); Oligocene, Barail Group, Assam (Singh et al., 1985); Paleocene-Eocene, (Matanomadh, Naredi and Harudi formations), Kutch (Kar , 1985).

Cyathidites sp. cf.C.clarus Mathur and Chopra

pl. 1, fig. 5

1982 Cyathidites clarus Mathur and Chopra, p.53, pl.1, fig.2

Description : Spores, subtriangular with broadly rounded angles, 50.4x55.2μm, trilete, laesurae open, extending upto 3/4 of the spore radius, exine 1.2 μm thick, psilate, surface faintly sculptured.

Principal Material Studied : BDG-1, 2215-2220 m, slide no.1, coordinates 109/68.4.

Remarks : The present species originally reported from Late Miocene-Early Pliocene sediments of Bay of Bengal and slightly having bigger size.

Botanical Affinity : Cyatheaceae.

Previously Reported Occurrence : Late Miocene - Early Pliocene, offshore well, Bay of Bengal, (Mathur and Chopra,1982).

Cyathidites sp.cf.C.australis Couper

pl.1, fig. 7, pl.5, fig.9

1953 Cyathidites australis Couper, p.27, pl.2, fig.11

Description : Miospore triangular, sides slightly concave with rounded apices, 48 x 54 µm, trilete mark distinct, uniformly broad extending upto two-thirds of the spore radius. Exine 1.2 µm thick, folded and psilate.

Principal Material Studied : BDG-1, 2885-2890 m, slide no.2,coordinates 101.4/62.6

Remarks : The present species described here is closely comparable to Cyathidites australis Couper (1953), however, it slightly varies in size.

Botanical Affinity : Cyatheaceae.

Previously Reported Occurrence : Lower Eocene of Assam, Jurassic and Cretaceous of Australia.

Anteturma : Proximigerminates Pot. 1970

Turma : Triletes (Reinsch, 1981) Pot and Kar 1954

Subturma : Azonotriletes Luber 1953

Infraturma : Laevigati Benn & Kid 1886, Pot. 1956

Genus : Lygodiumsporites (Pot.Thomson and Thiergart 1950) emend. Potonie 1956

Type species: Lygodiumsporites adriensis (Potonie and Gelletich) Potonie, Thomson and Thiergart 1950

Lygodiumsporites sp.cf.L.lakiensis Sah and Kar

pl. 1, fig.6, 9

1969 Lygodiumsporites lakiensis Sah and Kar, p.22,pl.1,fig.3

Description : Miospore roundly subtriangular, 50.4 x 55.2 µm, trilete, Y mark distinct, extending upto two-third of spore radius, exine 1 µm thick, psilate.

Principal Material Studied : BDG-2,CC-7 (2874.60-2892.60 m), 600-602 m, slide no.1, coordinates 98.8 / 51.2

Remarks : The present specimen is closely comparable to Lygodiumsporites lakiensis Sah and Kar (1978) but slightly varies in having a smaller size.

Botonical Affinity : Schizeaeceae

Previously Reported Occurrence : Early Middle Eocene (Naredi and Harudi formations), Kutch District (Kar, 1978); Paleocene Matanomadh, Kutch District (Saxena, 1978); Oligocene (Maniyara Fort Formation), Kutch District (Kar, 1979); Late Miocene-Pliocene (Siwalik Group-Units B.C.) Kameng District, Arunachal Pradesh (Singh, 1980); Miocene (Tipam Sandstone Foramtion and Girujan Clay) Assam (Sah

et al., 1980); Paleocene - Early Eocene (Mikir Formation) Garampani, North Cachar Hills, Assam (Mehrotra, 1983a); Late Eocene (Kopili Formation), Jaintia Hills, Meghalaya (Trivedi, 1985); Oligocene - Early Miocene (Barail and Surma Groups) Jaintia Hills, Meghalaya and Cachar District, Assam (Rao and Singh, 1987).

Lygodiumsporites sp.cf.L.pachyexinus Saxena

pl. 1, fig. 10

1978 Lygodiumsporites pachyexinus Saxena, p.449, pl.1, figs.5,6

Description : Miospore triangular, with broadly rounded apices, 51 x 51µm, Y mark distinct extending upto two third radius, exine 2.5µm thick, laevigate.

Principal Material Studied : BDG-2, CC-7 (2874.60-2892.60 m), 600-602 cm, slide no.1, coordinates 98.8/51..

Remarks : Specimen similar to Lygodiumsporites pachyexinus reported by Saxena (1978) and similar species reported by Kar (1985) from Paleocene, Kutch.

Previously Reported Occurrence : Paleocene (Matanomadh Formation); Matanomadh, Kutch District (Saxena, 1978); Paleocene (Matanomadh Formation), Kutch District (Kar, 1985); Eocene (Subathu Formation), Sirmaur District (Sarkar and Singh, 1988).

Lygodiumsporites sp.cf.L.eocenicus

pl.1, fig. 11

1977a Lygodiumsporites eocenicus Dutta and Sah p.12,pl.2,fig.32,35.

Description : Miospore subtriangular, sides convex with broadly rounded angles, 51.6x49. um, trilate mark distinct, rays extending upto half of the spore exine less than 1 um, folded and psilate.

Principal Material Studied : BDG-2,CC-5 (2839-2856.60 m),970-975 cm, slide No.5, coordinates 112.4/38.

Remarks : The specimen described here closely resembles to L.eocenicus Dutta and Sah (1978) and it has smaller size than type species.

Previously Reported Ocurrence : Paleocene (Tura Formation), Garo hills, Meghalaya (Singh, 1977a); Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977) Paleocene (Matanomadh Formation), Matanomadh Kutch District (Saxena,1978); Paleocene-Early Eocene (Mikir Formation)North Cachar Hills, Assam (Mehrotra,1983a); Neogene (Girujan Clay), Assam (Singh and Saxena,1984); Paleocene and Late Eocene (Therria and Kopili formations), Jaintia Hills, Meghalaya (Tripathi and Singh, 1985); Oligocene (Barail Group), Assam and Meghalaya (Singh et al.,1985); Early Middle Oligocene and Early Miocene (Laisang, Jenam and Bhuban formations), Jaintia Hills, Meghalaya and Cachar District (Rao and Singh,1987); Eocene (Subathu Formation), Sirmur District, Himachal Pradesh (Sarkar and Singh, 1988).

Anteturma : Proximigerminates Pot. 1970

Turma : Zonales (Benn.and Kid.1866) Pot.1956

Infraturma : Apliculati (Benn.and Kid.1986) R.Pot.1956

Subturma : Nodati Dybova and Jacho. 1957

Genus : Osmundacidites Couper 1953

Type species: Osmundacidites wellmanii couper 1953

Osmundacidites sp. cf. O.kutchensis Sah and Kar

pl.1, figs. 18, 19

1969 Osmundacidites kutchensis Sah and Kar in Kar,Jain,1981,113,pl.2,fig.28

Description : Miospores triangular to subtriangular, 31.2 x 32.4µm, trilete Y mark is distinct, rays extending almost upto the margin, exine less than 1 µm thick, granulate.

Principal Material Studied : BDG-1, 2865-2870 m, slide no.1,coordinates 111.5/66.2

Remarks : The present specimen is closely comparable to Osmundacidites kutchensis Sah and Kar (1969).

Botanical Affinity : Osmundaceae

Previously Reported Occurrence : Early Eocene (Kadi Formation); Cambay Basin (Rawat et al., 1977); Early-Middle Eocene (Naredi and Harudi formations); Kutch District (Kar,1978); Neogene, around Quilon and Varkala, Kerala (Kar and Jain, 1981).

Osmundacidites sp.

pl.1, fig. 20

Description : Miospore subcircular, 33.4x34.5 µm, trilete mark distinct, rays extending upto three-fourth of the spore radius. Exine less than 1 µm thick, granulate.

Principal Material Studied : BDG-1, 2865-2870 m, slide no.2, coordinates 11.6/66.2

Remarks : The present specimen is comparable to Osmundacidites cephalus from the later differs in size and in morphological characters.

Botanical Affinity : Osmundaceae.

Anteturma : Sporites H. Pot.1893

Turma : Triletes (Rein) Pot.and Kremp 1954

Subturma : Azonotriletes, Luber 1935

Infraturma : Laevigati (Ben.& Kid) Pot. 1956

Genus : Punctatisporites(Ibrahim) Pot.and Kramp 1954

Type species: Punctatisporites punctatus Ibrahim 1933

Punctatisporites sp.

pl.2, fig.1,3, pl.5,fig. 7

Description : Miospores triangular to subtriangular, 30-43.2 x 32-46.8 µm, trilete distinct, rays extending upto three-fourth of the spore radius, exine less than 1 µm, punctate, rarely folded.

Principal Material Studied : BDG-1, 2245-2250 m,slide no.1, coordinates 107.6/50.5

Remarks : The specimen described here differs from Punctatisporites sarangwarensis Kar (1979a) in having a smaller size.

Botanical Affinity : Unknown.

Genus : Verrucosisporites (Ibrahim) Potonie and Kremp 1954

Type species: Verrucosisporites verrucosus (Ibrahim)

Potonie and Kremp 1955

Verrucosisporites sp.

pl.2, fig.4

Description : Miospore triangular with broadly rounded apices , 36 x 38.4 µm, trilete, rays extending upto three-fourth of spore radius, exine about 1 µm thick, verrucate, verrucae very low.

Principal Material Studied : BDG-2,CC-9 (2839-2856 m), 857-858 cm, slide no.4, coordinates 96.5/40.6.

Remarks : The present species distinguished from Verrucosisporites longiletus Mathur and Mathur (1969) by its slightly bigger size and low Verrucae.

Botanical Affinity : Unknown.

Genus : Biretisporites (Delcourt and Sprumont) Delcourt, Dettmann and Hughes 1963

Type species: Biretisporites potonie Delcourt and Sprumont 1955

Biretisporites sp.cf.B.convexus Sah and Kar

pl.2, fig.5

1969 Biretisporites convexus Sah and Kar, p.21,pl.1,fig.9

Description : Miospore subtriangular, measuring 79.2x80.4 µm,trilete mark distinct, rays raised with divided ends, extending upto two-thirds of the spore radius, exine 2.4 µm thick, laevigate.

Principal Material Studied : BDG-1,2245-2250 m,slide no.2,coordinates 110.8/44.3.

Remarks : The specimen recorded here closely resembles to Biretisporites convexus Sah and Kar (1969) however it differs in having a bigger size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Early Eocene (Naredi Formation), Kutch District (Kar, 1978); Oligocene (Maniyara Fort Formation), Kutch District (Kar, 1979); Neogene around Quilon and Varkala, Kerala (Kar and Jain,1981); Middle to Late Eocene near Rataria (Kar and Saxena,1981).

Anteturma : Sporites H.Potonie 1893

Turma : Trilete (Reinsch 1881) Potonie & Kremp 1954

Subturma : Azonotriletes Luber, 1953

Infraturma ; Laevigati (Benn.and Kidston 1886)Potonie 1956

Genus : Deltoidospora Minor 1935

Potonie 1956

Type species: Deltoidospora hallii (minor 1935)

Potonie 1956

Deltoidospora sp.cf.D.grandis

pl. 2, fig. 14

1982 Deltoidospora grandis Mathur and Chopra, p.54, pl.1, fig.7

Description : Trilete spore, with subtriangular amb, 24x27.6 µm, sides slightly concave, Y mark distinct, rays reaching three-fourths of the spore radius. Exine 1 µm thick, psilate.

Principal Material Studied : BDG-1, 3310-3315 m, slide no.2, coordinates 104/44.8.

Remarks : The specimen described here is closely comparable to Deltoidospora grandis Mathur and Chopra (1982). It has smaller size and different laesurae characters in comparison to the type species.

Botanical Affinity : Unknown

Previously Reported Occurrence : Pleistocene,Bengal Basin (Mathur and Chopra,1982)

Anteturma : Proximigerminates Pot. 1970

Turma : Zonales (Benn.and Kid.1886) Pot. 1956

Subturma : Zonatriletes Waltz 1935

Infraturma : Cingulati Pot and Klus. 1954

Genus : Polypodiaceoisporites Pot. 1951

Type species: Polypodiaceoisporites speciosus (Pot.), Pot.1951

Polypodiaceoisporites sp.

pl.2, fig.6

Description : Miospore triangular with rounded amb, sides straight to slightly concave, cingulate, trilete, 37.2 x 40.8 µm, Y mark distinct, rays reaching almost upto periphery, exine 1.4 µm thick, irregularly verrucate, cingulum psilate upto 4 µm thick.

Principal Material Studied : BDG-1, 2665-2670 m, slide no.1,coordinates 106.4/68.3

Remarks : The species recorded here is distinguished by its bigger size from other known species of this genus.

Botanical Affinity : Polypodiaceae.

Polypodiaceoisporites sp.cf.P.speciosus potonie

pl. 3, fig. 4,5

1951 Polypodiaceoisporites speciosus (Pot.)Pot.inMathur and Jain 1980,p.60,pl.1, fig.2.

Description : Microspore with triangular amb, angles rounded sides slightly concave, cingulate, trilete, 33.6 x 34.8 um, Y mark distinct,rays reaching upto periphery. Exine ± 1.2 um thick, cingulum smooth upto 3.6 um thick.

Principal Material Studied : BDG-2, CC 5 (2839-2856.60 m), 970-9765 cm, slide no.22, coordinates 109.4/65.

Remarks : The specimen is closely compares with Polypodiaceoisporites speciosus Potonie (1951)but slightly varies in size.

Previously Reported Occurrence : Paleocene (Dras Volcanics), near Shergol, Ladakh District, Jammu and Kashmir (Mathur and Jain,1980); Miocene (Patna-Giri Beds); Ratnagiri District, Maharasthra (Phadtre and Kulkarni, 1984b).

Genus : Intrapunctisporis Krutzsch 1959

Type species: Intrapunctisporis intrapunctis Krutzsch 1959

Intrapunctisporis sp.cf.Intrapunctisporis Intrapunctis Krutzsch and Saxena pl.2, fig.7

1978 Intrapunctisporis intrapunctis Krutzsch and Saxena p.450,pl.1,fig.18.

Description : Miospores triangular with broadly rounded, apices, 44.4 x 46.8 µm, trilete mark distinct, extending upto half of the spore radius, exine 1.2 µm thick with intrapunctate.

Principal Material Studied : BDG-1, 2215-2220 m,slide no.1, coordinates 104.2/56.1

Remarks : The specimen recorded here closely resembles to Intrapunctisporis intrapunctatus Tripathi and Singh (1985), however, it differs in having a smaller size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene (Matanomadh Formation), Matanomadh, Kutch District (Saxena, 1978); Neogene around Quilon and Varkala Kerala (Kar and Jain, 1981); Eocene (Mayyanad Formation); Alleppey District, Kerala (Raha et al., 1986b); Eocene (Subathu Formation), Sirmaur District, Himachal Pradesh (Sarkar and Singh, 1988).

Anteturma : Sporites H. Potonie 1893

Turma : Triletes (Rein) Pot. and Kre. 1954

Subturma : Azonotriletes Luber 1935

Infraturma : Laevigati (Bennie and Kidston 1886) Potonie 1956

Genus : Dictyophyllidites (Couper) Dettmann 1963

Type species: Dictyophyllidites harrisii Couper 1958

Dictyophyllidites sp.

pl.2, fig. 8, 9

Description : Miospore broadly triangular, 50.4 x 54 µm, apices rounded, trilete mark distinct, rays extending upto three-fourths of the spore radius, exine 1.4 µm thick, laevigate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.2, coordinates 106.6/53.2.

Remarks : The present specimen described here differs from Dictyophyllidites laevigatus Kar (1985) having a small size and different shape.

Botanical Affinity : Dipteridaceae

Anteturma : Proximigerminates Pot.1970

Turma : Triletes (Reinsch 1981) Pot.and Kremp 1954

Subturma : Azonotriletes Luber 1953

Infraturma : Murornati Pot. and Kremp 1954

Genus : Magnastriatites Germeraad, Hoping and Muller 1968

Type species: Magnastriatites howardii Germeraad, Hoping and Muller 1969

Magnastriatites howardii Germeraad, Hoping and Muller

pl.2, fig.11-13

1969 Magnastriatites howardii Germeraad, Hoping and Muller in Nandi,p .198, 734, pl.1 fig.3,10.

Description : Miospore triangular with broadly rounded apices, trilete, 4.8 x 98.4 µm, Y mark distinct, rays extending three-fourths of the spore radius, exine 2.4 µm thick, contact area of proximal face smooth granulate surrounded by a circular ridge, remaining wall coarsely striate, striae 3.6-4.8 µm,thick.

Principal Material Studied : BDPJ-1, 1640-1645 m, slide no.3,coordinates 99/59.

Remarks : It is identical with Magnastriatites howardii Germeraad, Hoping and Muller (1969).

Botanical Affinity : Parkeriaceae.

Previously Reported Occurrence : Oligocene, Barail Group, Assam and Meghalaya (Singh et al., 1985); Early Miocene, Boldamgiri Formation, Garo hills, Meghalaya (Nandi and Sharma, 1984), Oligocene-Lower Miocene, South Cambay Basin(Shanmukhappa, 1991).

Magnastriatites sp.

pl.3, fig.3

Description : Miospore subtriangular with rounded apices, 48 μm diameter, trilete mark distinct, rays reaching upto three-fourth of spore radius, exine 3.6 μm thick, striated, striations running from angle to angles with projections at the angles.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.2,coordinates 108.8/71.5

Remarks : The present species described here differs from Magnastriatites howardii Germeraad et al.,(1969) in having a smaller size.

Botanical Affinity : Parkeriaceae.

Anteturma : Sporites H. Potonie 1893

Turma : Triletes (Reinsch, 1881), Potonie and Kremp 1954

Subturma : Azonotriletes Luber 1935

Infraturma : Murornati Pot. and Kremp 1954

Genus : Cicatricosisporites Potonie and Gelletich 1933

Type species: Cicatricosisporites dorogenesis Potonie and Gelletich 1933

Cicatricosisporites sp.cf.C.macrocostatus Bakshi,Sah and Dutta

pl.3, fig.1

1968 Cicatricosisporites macrocostatus (Baksi,1962) emended Sah and Dutta 1968 pl.1, fig.6-7.

Description : Miospore subtriangular with broadly rounded apices, 46.5 x 44.3 µm, sides are straight to slightly convex, trilete distinct, rays extending upto three-fourths to spore radius, exine about 1.5 µm thick, striate, striations are closely placed.

Principal Material Studied : BDG-1, 2205-2210 m, slide No.4, coordinates 43.1/111.

Remarks : The specimen closely compares with Cicatricosisporites macrocostatus Bakshi , Sah and Dutta(1968).

Botanical Affinity : Parkeriaceae.

Previously Reported Occurrence : Oligocene-Miocene, Cauvery Basin, Tamil Nadu (Venkatchala and Rawat , 1973a); Eocene-Oligocene (Kopili Formation), Jaintia hills, Meghalaya (Sen and Sah, 1974); Paleocene (Tura Formation), Garo hills, Meghalaya (Singh, 1977a); Miocene (Tipam Sandstone Formation) Assam (Sah et al.,

(1980); Early Oligocene (Upper Baratang Formation), Middle Andaman and Nicobar Islands (Mathur and Mathur, 1980); Neogene, Moran and Nahorkatiya wells, Assam (Nandi, 1981); Early Miocene (Boldamgiri Formation), Garo hills, Meghalaya (Nandi and Sharma, 1984).

Infraturma : Murornati Potonie and Kremp 1954

Genus : Januasporites Pocock 1962

Januasporites sp.cf.J.indicus Mathur and Chopra

pl.3, fig.2

1982 Januasporites indicus Mathur and Chopra,p.63, pl.2,fig.41.

Description : Miospore subtriangular with broadly rounded angles, sides are convex, diameter 45.6 x 50.4 µm, a nonfunctional conspicuous tetrad scar present, laesurae extending upto the periphery, proximal side covered with reticulations, 4.8 x 7.2 µm wide lumina and thin muri.

Principal Material Studied : BDG-1,2675-2680 m, slide no.2,coordinates 104/41.7.

Remarks : The present specimen closely resembles to Januasporites indicus Mathur and Chopra (1982) and slightly differs in having a smaller size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Pleistocene, Bengal Basin.

Anteturma : Proximimarginates Pot.1970

Turma : Myrornati Pot.and Kar.1954

Subturma : Azonotriletes Luber 1953

Infraturma ; laevigati (Benn.and Kid.1886) Pot.1956

Genus : Lycopodiumsporites (Thiegart,1938)

Delcourt and Sprumont 1955

Type species: lycopodiumsporites agathoecus

Potonie and Thiergart, 1938

lycopodiumsporites bellus Sah and kar

pl.1, figs.12-15,17; pl.5,fig.11; pl.2, fig.10

1969 Lycopodiumsporites bellus Sah and kar, p.28, pl.1, fig.14.

Description : Miospore trilete, triangular, size range 34.8-38.4 x 36-38.4 μm, trilete distinct, ray extending upto three-fourth of the spore radius, exine 2.4 μm thick, coarsely reticulate, reticulum formed of regular meshes with angular lumina of varying shapes.

Remarks : The present specimen is identical with Lycopodiumsporites bellus Sah and kar (1969).

Botanical Affinity ; Lycopodiaceae.

Previously Reported Ocurrence ; Lower Eocene, Kutch (Kar 1985).

Lycopodiumsporites sp.

pl. 1, fig. 16

Description : Miospore broadly circular, 44.4 um, trilete, Y mark distinct extending upto three-fourths of the spore radius, exine about 2.4 μm thick, reticulate, reticulum irregular, muri 1.2 μm thick, lumina irregular of various sizes.

Principal Material Studied : BDG-1, 2830-2835 m, slide no.3,coordinates 106.4/44.5

Remarks : The species can be readily distinguished from all the other known species of the genus in having a thick muri and thick exine.

Botanical Affinity : Lycopodiaceae.

Lycopodiumsporites cf.L.bellus Sah and Kar

pl.5, fig. 13

1969 Lycopodiumsporites bellus Sah and kar, p.28, pl.1, fig. 14

Description : Microspore triangular with broadly rounded angles and slightly convex sides, 39.6 x 43.2 µm, rays distinct with thickened margin, extending three-forths of the spore radius, exine 2.4 µm thick, reticulate.

Principal Material Studied : BDG-2, 3275-3280 m, slide no.3,coordinates 105.4/38.5

Remarks: The specimen recorded in this study closely resembles to Lycopodiumsporites bellus Sah and Kar (1969) however, it slightly varies in size and having a thickened margin of the rays.

Botanical Affinity : Lycopodiaceae.

Previously Reported Occurrence : Lower Eocene, Kutch (Kar, 1985).

Anteturma : Proximimarginates Pot. 1970

Turma : Monoletes Ibrahim 1933

Subturma : Azonomonoletes Luber 1935

Infraturma : Laevigatomonoleti Dybova & Jachowitz 1957

Genus : Polypodiaceaesporites Thiergart 1940

Polypodiaceaesporites tertiarus Dutta and Sah

pl.3, fig.6, pl.4, fig. 12

1968 Polypodiaceaesporites tertiarus Dutta and Sah, p.21, pl.3, figs.18-19.

Description : Spores bean shaped, 37.2 x 27.6 µm, monolete, proximal side slightly concave, distal side convex, laesura thin, more than half of the longer axis, exine less than 1 µm thick, scabrate to faintly discernible verrucoid pattern.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, coordiantes 103.2/69.8.

Remarks : The specimen recorded here is similar to Polypodiaceaesporites tertiarus Sah and Dutta (1968) however it slightly varies in size.

Botanical Affinity ; Polypodiaceae.

Previously Reported Occurrence : Paleocene, Nongwal Bibra, Garohills, Meghalaya (Singh et al., 1976), Early Eocene, Kadi Formation, Cambay Basin (Rawat et al., 1977); Miocene-Pliocene, Lower-Middle Siwalik, Punjab (Nandi, 1980); Paleocene-Early Eocene, Mikir Formation, Garampani, North Cachar Hills, Assam (Mehrotra, 1983a); Oligocene Barail Group, Assam and Meghalaya (Singh et al., 1985); Oligocene, (Laisang and Jenam formations) Jaintia Hills, Meghalaya (Rao and Singh, 1987).

Polypodiaceaesporites cf.P.tertiarus Dutta and Sah

pl.4, fig.1,6,13.

1968 Polypodiaceaesporites tertiarus Dutta and Sah, p.21, pl.3, fig.18-19.

Decription : Miospore monolete, bilateral, 28.8 x 45.6 µm, proximal side slightly concave and distal side distinctly convex, laesura narrow, distinct, extending three-fourth of the spore radius, exine 1.2 µm thick, sculpture scabrate to faintly discernible verrucoid pattern.

Principal Material Studied : BDG-1, 3040-3045 m, slide no.1, coordinates 111.1/42.

Remarks : The present specimens recorded in this study closely resembles to Polypodiaceaesporites tertiarus Dutta and Sah (1968) but slightly differs in having a smaller size.

Botanical Affinity : Polypodiaceae.

Turma : Monoletes Ibrahim 1933

Subturma : Azonomonoletes Luber 1935

Infraturma : Sculptatomonoleti Dybova and Jackowitz 1957

Genus : Polypodiisporites potonie 1934

Type species: Polypodiisporites favus (Pot 1934)Pot.1934

Polypodiisporites minor Sah and Dutta

pl.3, fig. 7,8

1967 Polypodiisporites minor Sah and Dutta in Shanmukhappa, 1991, pl.1, figs. 14, 20.

Description : Spores bilateral, almost plano convex laterally, 34.8 x 40.8 µm, monolete, laesura narrow, extending upto three-fourths of the spore radius, exine 3.6 µm thick, verrucate, verrucae, flattened forming a negative reticulum in surface.

Principal Material Studied : BDG-1, 2830-2835 m,slide no.4,coordinates 102.2/70.5.

Remarks : The present species identical with Polypodiisporites minor.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence: Neogene sediments of Rusizi valley (Burundi) Sah (1967).

Polypodiisporites sp.cf.P.perverrucatus

pl.3, figs. 9, 10, 12, 14, pl.5, fig.2

1971 Polypodiisporites perverrucatus (Couper) Khan and Martin in Nandi 1973, p.379, pl.2, fig.24.

Description : Miospores planoconvex laterally, 38.4 x 27.2 µm, monolete, laesura short, margins thin, exine ± 2 µm thick, verrucate, verrucae varies in size,

distributed sparsely all over the spore wall.

Principal Material Studied : BDG-1, 3290-3295 m,slide no.1,coordinates 98.5/33.3

Remarks : The specimen described here closely compares to Polypodiisporites perverrucatus (Couper) Khan and Martin (1971).

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Miocene (Quilon Beds), Kerala (Rao and Ramanujam, 1975); Early-Middle Miocene (Warkalli Beds), Kerala (Rao and Ramanujam, 1978).

Polypodiisporites sp.cf.P.impariter Potonie and Sah

pl.3, fig.11, pl.5, fig.14

1958 Polypodiisporites impariter Potonie and Sah, p.126,pl.1, Figs. 9,10

Description : Miospore bean shaped, measuring 31.2x50.4 µm, monolete, laesura long, margins slightly thickened, extending three-fourths of the spore radius. Exine 1.2µm thick, verrucate, verrucae 2.4 µm wide and closely placed forming negative reticulum on surface view.

Principal Material Studied : BDG-2 , CC-5 ,(2839-2856.60 m), 970-975 cm, slide no.5, coordinates 109/60.7.

Remarks : The specimen described here is closely comparable to Polypodiisporites impariter Potonie and Sah (1958) but it differs in having a slightly bigger size and verrucae height.

Botonical Affinity : Polypodiaceae.

Previously Reported Occurrence : Miocene (Quilon beds), Kerala (Rao and Ramanujam 1975).

Polypodiisporites sp.cf.P.favus (Potonie) ex Potonie

pl.3, fig. 21

1956 Polypodiisporites favus (Potonie) ex potonie in Rao and Singh.(1987),p.273 pl.2, fig.23.

Description : Spore bean shaped, bilateral, 36 x 55.2 µm, monolete, laesura long, thin, exine 2.4 µm thick, verrucate, verrucae flat, closely placed, forming an appearance of negative reticulum.

Principal Material Studied ; BDG-1, 2255-2260 m, slide no.2, coordinates 93.5/61.2

Remarks : The present specimen is closely comparable to Polypodiisporites favus (Potonie, 1931) ex potonie (1956).

Botanical Affinity : Polypodiaceae.

Polypodiisporites formosus Salujha, Kindra and Rehman

pl.3, figs. 22-24

1972 Polypodiisporites formosus Salujha et al.,p.275, pl.2,figs.39-40.

Description : Miospores bilateral, 28.8 x 44.4 µm, monolete, laesura extends about three-fourth of the spore radius, exine ± 2 µm thick, verrucate, verrucae 2.4 µm high and 2 µm broad at the base, protruding at the margin, closely placed gives a negative reticulate appearance.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.2,coordinates 109.7/48.8

Remarks : The present specimen is similar to Polypodiisporites formosus Salujha et al.,(1972).

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Paleogene, Garohills, Meghalaya (Salujha et al.,1972b); Early Oligocene, Upper Baratang Formation, Andaman and Nicobar Islands (Mathur and Mathur, 1980); Paleocene, Langpar Formation, Khasi Hills, Meghalaya, (Salujha and Kindra, 1981); Oligocene-Miocene, Cachar District, Assam (Salujha and Kindra, 1986); Early Miocene, Umkiang Member Bhuban Formation, Jaintia Hills, Meghalaya (Rao and Singh, 1987).

Polypodiisporites sp.cf. P. mawkmaensis Dutta and Sah

pl.3, fig.15

1970 Polypodiisporites mawkmaensis Dutta and Sah, p.23, pl.3, figs.29-30.

Description : Miospores plano-convex laterally, 31.2 x 50.4 µm, monolete, laesura narrow extended three-fourths of spore radius, exine 2.4 µm thick, verrucate, verrucae very low with flat tops about 2.4 µm wide at the base.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m) 970-975 cm, slide no.5, coordinates 109.1/60.6.

Remarks : The specimen recorded here is closely comparable to Polypodiisporites mawkmaensis Dutta and Sah (1970).

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Lower Eocene, Therria stage,Jaintia Series,Assam

Polypodiisporites sp.1

pl.3, fig.25, 26

Description : Microspores ellipsoidal, 36 x 44.4 µm, monolete, laesura narrow, extends three-fourths of the spore radius, exine 3 µm thick, verrucate, verrucae low with flattened top, closely spaced, shows coarsely reticulate appearance in surface view.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.2,coordinates 100/58.5.

Remarks ; The present specimen differs from Polypodiisporites repandus Takahashi (1964), in having thick exine and coarsely reticulate appearance in surface view.

Botanical Affinity : Polypodiaceae.

Genus : Polypodiidites Potonie 1966

Type species: Polypodiidites senonicus Potonie 1966

Polypodiidites sp.cf.P.oligocenicus Sah and Dutta

pl.3, figs.13,16,18,19

1966 Polypodiidites oligocenicus Sah and Dutta in Nandi, 1981, pp.31-32, pl.1, figs.2.

Description : Miospores elliptical, 30 x 40.8 µm, monolete, laesura distinct, extends upto three-fourths of the spore radius, exine ± 2 µm thick, verrucate, verrucae 2.4 µm high, sparsely distributed all over spore wall.

Principal Material Studied : BDG-1, 2675-2680 m,slide no.1,coordinates 108.6/71.5.

Remarks : The specimen described here closely resembles to Polypodiidites oligocenicus Sah and Dutta (1966).

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Neogene, Assam (Sah and Dutta, 1981); Early Miocene (Boldamgiri Formation), Garohills, Meghalaya (Nandi and Sharma, 1984).

Polypodiisporites sp.cf.P.repandus Takahashi

pl.5, fig.8, pl.3, fig. 17

1964 Polypodiisporites repandus Takahashi, p.217, pl.30, figs.1,14.

Description : Miospore broadly elliptical, planoconvex, 32.4 x 46.8 µm, monolete, laesurae narrow, distinct, extending upto three-fourths of the spore radius, Exine 2.4 µm thick, verrucate, verrucae very low, closely spaced and separated by a negative reticulum on surface view.

Principal Material Studied : BDG-1,3040-3045 m,slide no.1, coordinates 104/35.7.

Remarks : The present specimens recorded in this study closely resembles to Polypodiisporites repandus Takahashi but slightly varies in size.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Campanian and Maestrichtian of Ooyubari, yubari-Konlenfeld and Lower Eocene of Assam (Dutta and Sah, 1968).

Polypodiisporites sp.cf.P.ornatus Sah

pl.5, fig.17

1967 Polypodiisporites ornatus Sah pl.3, fig.19.

Description : Miscrospores bilateral, 28.6 x 38.2 µm, monolete, laesura distinct,

narrow, extending three-fourths of the spore radius, exine about 2.4 um thick, verrucate, verrucae low, closely spaced and gives a coarsely reticulate appearance in surface view.

Principal Material Studied : BDG-2,CC-5 (2839-2856.60 m), 970-975 cm, slide no.2, coordiantes 98/52.5.

Remarks : The present specimens recorded in this study closely resembles to Polypodiisporites ornatus, Sah (1967).

Botanical Affinity : Polypodianceae.

Previously Reported Occurrence: Oligocene-Miocene, Cauvery Basin, (Venkatachala and Rawat 1971)

Polypodiisporites sp.cf.P.inangahuensis (Couper 1953) potonie

pl.5, fig.5

1956 Polypodiisporites inangahuensis (Couper 1953) Potonie

Description : Microspore monolete, bilateral, profile, concavo-convex, 28.8 x 45.6 um, proximal side slightly concave, distal side distinctly convex, laesura narrow, thin, extending half of the spore radius, exine 1.2 um thick,sculpture closely spaced verrucate patter.

Principal Material Studied :BPD-1,3040-3045m, slide No.1, coordinates 111.1/42.

Remarks : The present specimen is closely resembles to Palypodiisporites inangahuensis (Couper 1953), Potonie (1956) but slightly differs in having a bigger size

Botanical Affinity : Polypodiaceae.

Polypodiisporites sp. 2

pl.5, fig.3

Description : Microspore elliptical, 20.4 x 32.4 μm, monolete, laesura not clearly visible due to bad preservation, exine 2.3 μm thick, verrucate, verrucae 2.4 μm wide at the base and flat tops, sparsely spaced, folded.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.1, coordinates 56/106.

Remarks : The present specimens studied here differs from other known species by its shape and verrucoid pattern.

Botanical Affinity : Polypodiaceae.

Anteturma : Sporites H.Potonie 1893

Turma ; monoletes ibrahim 1933

Subturma : Azonomonoletes Luber 1935

Infraturma ; Laevigatomonoleti Dubova and Jachowitz 1957

Genus : laevigatosporites Ibrahim 1933

Type species: Laevigatosporites vulgaris (Ibrahim) Ibrahim 1933

Laevigatosporites ovatus Wilson and Webster,

pl.4, figs.7,8

1946 Laevigatosporites ovatus Wilson and Webster, p.27,fig.5.

Description : microspore elliptical to oval shape, bilateral, planoconvex 36 x 48 µm, monolete, laesura extends three-fourths of the spore radius, exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-2, CC-9 (2910-2928 m) 200-205 cm, slide no.1, coordinates 92.8/5.9.

Remarks : The fossil spore studied here has slightly bigger size in comparison to Laevigatosporites oratus Wilson and Webster (1946) recorded from the Tertiary coal of Montana, USA.

Botanical Affinity ; Polypodiaceae.

Previously Reported Occurrence : Mesozoic and Tertiary strata (Dettman 1963, Ramanujam 1966, 1967, 1972); Tertiary coal of Montana USA (Wilson and Webster 1963); Tertiary sediments of Weaverrillae Formation, North Western California, USA (Jeanie Barnett 1989); Miocene, Warkalli lignite, Kerala (Ramanujam 1972); Pliocene, Middle Siwalik, Uttar Pradesh (Nandi, 1972); Miocene, Quilon Beds,

Kerala (Rao and Ramanujam, 1978); Miocene, Ratnagiri Beds, Maharashtra (Phadtare and Kulkarni, 1980a); Pliocene-Early Pliostocene, Middle-Upper Swalik Punjab (Nandi, 1980); Oligocene-Miocene, Dharamsala Beds, Himachal Pradesh (Dogra et al., 1985), Miocene, Tonakkal clay mine, Kerala (Varma, 1987).

Laevigatosporites copiosus Salujha et al.

pl.4, fig.9, pl.5, figs. 6,16

1972b Laevigatosporites copiosus Salujha et al, p.274, pl.2, figs.35-36

Description : Microspore bean shaped, 33.6 x 49.2 µm, monolete, laesura thinly lipped, exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-2, (2839-2856.60 m) 970-975 cm, slide no.5, Coordinates 97.5/61.

Remarks : The present specimen studied here slightly varies in size in comparison to Laevigatosporites copiosus Salujha et al.(1972) recorded from the Tertiary sediments of Assam.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Paleogene, Garohills, Meghalaya, Salujha et al.,(1972b); Paleogene, Khasi and Jaintia Hills, Meghalaya, Salujha et al.,(1974); Paleocene (Langapur Formation), Khasi Hills, Meghalaya(Salujha and Kindra,(1981); Oligocene-Miocene, Cachar District, Assam,(Salujha and Kindra, 1986); Miocene, Neyveli lignite, Neyveli, Tamilnadu(Sharma and Ramnujam, 1988).

Laevigatosporites sp.cf.L.cognatus Sah and Kar

pl.4, fig. 10, 14, 15

1969 Laevigatosporites cognatus Sah and Kar,p.117, pl. 2, figs. 19,20.

Description : Microspore broadly oval in shape, 27.6 x 40.8 μm, monolete,laesura thin, extending three-fourths of the spore radius, exine less than 1 μm thick, psilate.

Principal Material Studied : BDG-1, 2675-2680 m, slide no.3, coordinates 108.6/63.

Remarks : The present specimen studied has a slightly smaller size in comparison to Laevigatosporites cognatus Sah and Kar,1969 recorded from the Laki series of Kutch.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Early Eocene (Palanalignite), Palana, Bikaner District, Rajasthan (Sah and Kar, 1974); Early-Middle Eocene (Naredi and Harudi foramtions), Kutch District, Gujarat (Kar,1978); Miocene, Atharmura Anticline, Tripura (Salujha and Kindra, 1984); Early-Middle Eocene (Naredi and Harudi formations) Kutch District, Gujarat (Kar, 1985); Eocene, Ambalapuza, Alleppey District, Kerala, (Raha et al.,1986a).

Laevigatosporites sp.cf.L.lakiensis Sah and Kar

pl.4, figs.11, 16, 17

1969 Laevigatosporites lakiensis Sah and Kar in Kar and Jain 1981 p.113, pl.2, figs. 4-41.

Description : Miospore plano-convex, 40.8 x 57.2 um, monolete laesurae short extending less than half of the spore radius, exine 2.4 um thick, psilate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.3,coordinates 101.5/54.

Remarks : The present specimens studied here closely resembles Laevaigatosporites lakiensis Sah and Kar (1969) reported from the laki series of Kutch.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Early Eocene (Palana lignite), Palana, Bikaner District, Rajasthan (Sah and Kar, 1974); Paleocene (Tura Formation), Nongwal Bibra, Garo Hills, Meghalaya (Singh et al., 1977a); Early Eocene (Kadi Formation), Cambay Basin, Gujarat, (Rawat et al., 1977); Early Eocene (Naredi Formation), Kutch District, Gujarat (Kar, 1978); Oligocene (Maniyara Fort Formation), Barkhana Nala cutting near Sarangwara, Kutch Distrct, Gujarat, (Kar,1979); Neogene, around Quilon and Varkala, Kerala (Kar and Jain, 1981); Middle-late Eocene, Kutch District, Gujarat (Kar and Sexana, 1981); Neogene (Girujan clay), Jorajan, Assam, (Singh and Sexana, 1984); Early Eocene-Oligocene (Naredi and Maniyara fort formations) Kutch District, Gujarat, (Kar, 1985); Oligo-Miocene, (Dharamsala Beds), Kangra District, Himachal Pradesh (Dogra et al., 1985); Late Eocene(Kopili Formation), Jaintia hills, Meghalaya, (Trivedi, 1985); Eocene, Ambalapuzha, Alleppey District, Kerala,(Raha et al.,1986a).

Laevigatosporites sp.1

pl.4, fig.18

Description : Spores plano-convex, 31.2 x 43.2 um, monolete, laesura long, extending, three-fourths of the spore radius, exine 1.2 um thick, psilate.

Principal Material Studied : BDG-1, 3090-3095 m, slide no.1, coordinates 95.8/55.3

Remarks : The present species described here is distinguished from Laevigatosporites lakiensis Sah and Kar 1969 by its smaller size and long laesura.

Botanical Affinity : Polypodiaceae.

Laevigatosporites sp.2

pl.5, fig.4

Description : Miospores proximal side slightly concave and distal side convex, monolete, 29.2 x 45.6 µm, laesura extending three-fourths fo the spore radius, exine 2.4 µm, thick, laevigate.

Principal Material Studied : BDG-1, 3290-3295 m, slide no.2,coordinates 111.9/44.7

Remarks : The present specimens described here differs in size in comparison to Laevigatosporites lakiensis Sah and Kar (1969).

Botanical Affinity : Polypodiacae.

Laevigatosporites cf.L.distinctus Kar

pl.5, fig.10

1985 Laevigatosporites distinctus Kar, pp.143,148,pl.34,figs.10-11.

Description : Mipspore elliplical in shape, 57.6 x 72 µm, monolete, laesura extending more than half of the spore radius, exine 2.4 µm thick, psilate.

Principal Material Studied : BDG-1, 3470-3475 m, slide no.2,coordinates 100.7/51.8

Remarks : The present specimen is closely comparable to Laevigatosporites distin-

ctus Kar (1985). It is smaller in size.

Botanical Affinity : Polypodiaceae.

Previously Reported Occurrence : Early miocene (Khari Nadi Formation), Aida, Kutch District, Gujarat, (Kar 1985).

Laevigatosporites sp.3

pl.5, fig.15

Description : Miospore bean shaped, monolete, 25.2 x 39.6 µm, laesura narraw, extending three-fourths of the spore radius, exine 1.2 µm thick psilate.

Principal Material Studied : BDG-1, 2205-2210 m, slide no.1,coordiantes 106.4/59.2

Remarks : The present species distinguished from Laevigatosporites lakiensis Sah and Kar,(1969) by its smaller size and different shape.

Botanical Affinity : Polypodiaceae.

Anteturma : Sporites Potonie 1893

Turma : Monoletes Ibrahim 1933

Subturma : Azonomonoletes Luber 1935

Infraturma : Sculptatomonoleti Dybova and Jachovitz 1957

Genus : Schizaeoisporites (Potonie 1951) Potonie 1960

Type species : Schizaeoisporites eocenicus Selling 1944

Schizaeoisporites sp.

pl.4, fig.3

Description : Miospore bean shaped, 28.8 x 40.8 µm, monolete, laesura narrow, extends three-fourths of the spore radius, exine 1.2 µm thick, striated, striae numerous, running parallel to one another along the longer axis, simple, straight to slightly slanting.

Principal Materials Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 m, slide no.5, coordinates 97.5/61.

Remarks : The present specimen is distinguished from Schizaeoisporites crassimurus Dutta and Sah (1970) by its relatively smaller size and less striae.

Botanical Affinity : Schizaeceae.

Laevigatosporites sp. 6

pl. 5, fig. 12

Description : Miospore broadly elliptical 432x62.4 µm, monolete, Laesura not well discernible. Exine 1.2 µm thick, Laevigate.

Principal Material Studied : BDG?1, 2650-2655 m, slide no.3, 93.5/38.5.

Botanical Affinity : Polypodiaceae.

Monoletes sp

pl.5, fig. 1

Description : Miospore bean shaped, 44.4 x 64.8 µm, Monolete, proximal size slightly concave, distal side convex. Exine I 2.3 µm thick verrucate, verrucae varies in size from 1.2 µm to 2.4 µm and sparesely distributed all over the spore surface.

Principal Material Studied : BDG-1, 3310-3315 m, slide no.1, coordiantes 94.5/62.3

Botanical Affinity : Unknown.

Genus : Monolites (Erdtman 1947) Potonie 1956

Type species : Monolites majar cookson 1947

Monolites majar Cookson ex potonie

pl.4, figs. 19,20

1947 Monoletes majar Cookson ex.potonie, p.135,pl.15, fig.56

Description : Miospores broadly oval shape, 50.4 x 70.8 µm, monolete, laesura narrow, extends upto half of spore radius, exine upto 1.2 µm thick, psilate.

Principal Material Studied : BDG-1, 2225-2230 m, slide no.1,coordinates 106.9/48.8

Remarks : The recorded specimens are identical to Monolètes major Cookson, ex Potonie (1947).

Botanical Affinity : ? Polypodiaceae.

Previously Reported Occurrence : Neogene, around Quilon and Varkala, Kerala (Kar and Jain,1981); Oligocene-Miocene, Dharamsala Beds, Kangra, Himachal Pradesh (Dogra et al., 1985); Early Miocene, Bhuban Formation, Meghalaya, Assam (Rao and Singh, 1988).

Monolites sp.1

pl.4, fig.4

Description : Miospore elliptical 28.8 x 40.8 µm monolete, laesura extends half of the spore radius, exine 1.2µm thick, appears like rugulate sculpture.

Principal Material Studied : BDG-2, CC-5, (2839-2856.60 m), 970-975 cm, slide no.5, coordinates 97.5/61.

Botanical Affinity : Unknown.

Monolites sp. 2

pl.4, fig.5

Description : Miospore bean shaped, 30 x 39.6μ m, laesura distinct, extending three-fourths of the spore radius, exine 1.2 μm thick, scabrate.

Principal Material Studied : BDG-1, 2215-2220 m, slide no.1,coordinates 96.2/55.

Botanical Affinity : Unknown.

Monolites sp.cf.M.mawkmaensis Sah and Dutta

pl. 4, fig.2

1966 Monolites mawkmaensis Sah and Dutta, p.75, pl.1, figs.14.

Description : Miospore oval in shape, 32.3 x 46.2 μm, monolete, laesura not clearly visible, exine less than 1 μm thick, scabrate.

Principal Material Studied : BDG-1, 3290-3295 m,side no.2, coordinates 112/44.6.

Remarks : The present specimens studied here is closely resembles to Monolites mawkmaensis but varies in size and shape.

Previously Reported Occurrence : Late Eocene (Kopili Formation), Jaintia hills, Meghalaya, (Sah and Dutta, 1974); Paleocene, (Tura Formation), Nongwal Bibra, Garohills, Meghalaya (Singh,1977a); Paleocene (Therria Formation), Jaintia hills, Meghalaya (Singh, 1985).

4.1.2 ANGIOSPERMOUS POLLEN

Turma : Plicates (Naumova 1937) Potonie 1960

Subturma : Monocolpates Iverson and Troels Smith 1950

Infraturma : Retectines (Malvakina 1949) Potonie 1960

Genus : Palmaepollenites Pot.1951

Type species: Palmaepollenites tranquillaus (Pot.) Pot.1951

Palmaepollenites kutchensis Venkatachala and Kar

pl. 6, figs. 1 and 2

1968 Palmaepollenites kutchensis Venkat.and Kar, p.159, pl.1, figs.9-10.

Description : Pollen grains, oval with broadly pointed ends 24.2 x 30.5 µm, monocolpate, colpus distinct, generally broder at middle region and tapering at ends, boat shaped, never reaching margins. Exine upto 1.5 µm thick, laevigate to slightly granulose.

Principal Material Studied : BDG-1, 2830-2835 m, slide no.2, coordinates 112/37.8.

Remarks : The diagnostic characteristic features of this species is oval shape with equally broad lateral ends, monocolpate, colpus broad, boat shaped not reaching upto margins.

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin, (Venkatachala and Rawat,1972); Early Eocene, (Kadi Formation) Cambay Basin (Rawat et al.,1977); Early-Middle Eocene, Naredi and Harudi formations, (Kar 1978); Paleocene-Eocene, (Matanomadh Formation) Kutch basin (Kar,1985).

Palmaepollenites ovatus Sah and Kar

pl.6, fig.3

1965 Palmaepollenites ovatus Sah and Kar in Kar 1985, p.37, pl.12, fig.2.

Description : Pollen grains broadly subrounded to oval, 34.8 x 35.2 µm monocolpate, colpus distinct and restricted in middle region. Exine less than 1 µm thick, intragranulose.

Pricipal Material Studied : BDG-1, 3185-3190 m, slide no.1,Coordinates 101.2/60.4.

Remarks : The present species is identical with Palmaepollenites ovatus Sah and Kar 1965.

Botanical Affinity : Palmae

Previously Reported Occurrence : Early-Middle Eocene(Naredi and Harudi formations)) (Kar 1978), Paleocene (Matanomadh Formation) of Kutch (Kar,1978); Paleocene Eocene (Neyveli Formation) South Arcot,Tamilnadu (Siddhanta,1986);Eocene, nala sections around Yinking and Dalbuing, Arunachal Pradesh.

Palmaepollenites eocenicus (Biswas) Sah and Dutta

pl. 6, figs. 4,5,6,7 and 8

1966 Palmaepollenites eocenicus (Biswas) Sah and Dutta, in Rao and Ramanujam, p.412, pl.3, fig.38.

Description : Pollen grains oval with broadly rounded ends, 37.2-46.8 x 26.4-46.8 µm, monosulcate, sulcus long, slightly constricted in the middle. Exine 1.2 µm thick, psilate to intragranulose.

Principal Material Studied : BDG-2,CC-8 (2892.60-2910.60 m), 1100-1105 cm, slide no.1, coordinates 112/43.6.

Remarks : The species recorded here is identical with Palmaepollenites eocenicus (Biswas) Sah and Dutta (1966).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene, (Tura Formation) Garohills, (Sah and Dutta, Singh 1977a); Paleocene - Early Eocene (Mikir Formation), Cachar hills, Assam (Mehrotra 1983a).

Palmaepollenites sp.cf.P.kutchensis Venkatachala and Kar

pl. 11, fig. 11

1969 Palmaepollenites kutchensis Venkatachala and Kar,p.159,pl.1,fig.9-10.

Description : Pollen grain oval in shape, with broadly rounded lateral ends, 21.6 x 34.8 µm, monocolpate, colpus broad at middle region and tapering at ends, boat shaped, not reached margins, exine 1.2 µm thick, laevigate, surface granulate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60), 1100-1105 cm,slide no.2, coordinates 102.8/48.

Remarks : The present species described here is closely resembles to Palmaepollenites kutchensis, Venkatachala and Kar (1969) but it differs in having a bigger size.

Botanical Affinity : Palmae.

Palmaepollenites sp.cf.P.keralensis Rao and Ramanujam

pl. 11, figs. 15, 17, 18

1978 Palmaepollenites keralensis Rao and Ramanujam,p.411,pl.3,fig.36

Description : Pollen grains elliptical in shape, with narrow towards one end roundly broader towards other end, 24 x 32.4 µm, monosulcate, sulcus long not reaching equatorial margin club shaped, narrow at one end and wide at another end, exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.80 m), 970-975 cm, slide no.2, coordinates 104/43.2

Remarks : The specimen described here is closely resembles to Palmaepollenites keralensis Rao and Ramanujam(1976)but it slightly varies in size.

Botanical Affinity : Palmae

Previously Reported Occurrence : Miocene (Quilon beds), padappakkara, Kerala (Rao and Ramanujam 1978); Miocene (Neyveli lignite), Neyveli, South Arcot District Tamilnadu (Sharma et al.,1984).

Palmaepollenites sp.cf.P.nadhamunii Venkatachala and Kar

pl.6, fig.15, pl.11, figs.9, 18

1969a Palmaepollenites nadhamunii Venkatachala and Kar,p.159,pl.1,figs.11-12.

Description : Pollen grains elliptical,spindle in shape, 43.2 x 32.4 um, monocolpate colpus narrow, running from one margin to other, exine 1.2 µm, thick,psilate

Principal Material Studied : BDG-2, CC-6 (2856.60-2878.60 m), 300-302 cm slide no.2 coordinates 110.7/61.8.

Remarks : Palmaepollenites nadhamunii Venkatachala and Kar, (1969a) closely resembles the present species in shape, nature of apertures and ornamanetation but it is distinguished by its larger size.

Botanical Affinity : Palmae

Previously Reported Occurrence : Paleocene (Barmer Sandstone) near Barmer Hill, Barmer District, Rajasthan (Jain et al., 1973); Early Eocene (Palana lignite), Palana Bikaner District, Rajasthan (Sah and Kar, 1979); Early Eocene (Naredi Formation) Kutch District, Gujarat (Kar, 1978); Paleocene (Matanomadh Formation), Matanomadh, Kutch District, Gujarat (Saxena, 1979a); Middle-Late Eocene, bore core no.27, near Rataria, Kutch District (Kar and Saxena, 1981); Paleocene-Eocene (Matanomadh and Naredi formations) Matanomadh, Kutch (Kar, 1985).

Palmaepollenites sp. 4

pl.7, fig.1

Description : Pollen grains elliptical with unequally broad rounded ends, 60 x 25.2µm monosulcate, sulcus distinct, broad, extending almost one end to another. Exine less than 1 µm thick, psilate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m) 1100-1105 cm, slide no.2, coordinates 99/47.2

Remarks : The present species differs from all the other known species by its long sulcus and bigger size.

Botanical Affinity : Palmae

Palmaepollenites sp. 1

pl.6, fig. 13

Description : Pollen grains oval with broadly rounded ends, 38.4 x 24 µm, Monosulcate, sulcus long, slightly concave in middle extending from one margin to other. Exine 1 µm thick, psilate.

Principal Material Studied : BDG-1, 3290-3295 m, slide no.2, 103.9/53.5.

Remarks : This species differs from Palmaepollenites eocenicus (Biswas) reported by Sah and Dutta, 1966, 1968 by having a long and centrally concaved sulcus.

Botanical Affinity : Palmae.

Palmaepollenites sp.2.

pl.6, fig. 14

Description : Pollen grains elliptical with slightly flat lateral ends, 43.2 x 25.2 µm, monosulcate, distinct, sulcus constricted in middle and uniformally broad at lateral ends, running entire length of grain. Exine ± 1.2 µm thick, psilate.

Principal Material Studied : BDG-1, 3185-3190 m, slide no.2,coordinates 53.5/103.6

Remarks : This form differs from the known species by its different type of sulcus.

Botanical Affinity : Palmae.

Palmaepollenites sp. 5

pl.24, fig.7

Description : Pollen grains broadly oval in shape, 19.2 x 36 µm, monosulcate, sulcus long but narrow at one end and gradually widening towards other end, exine less than 1 µm, thick finely granulate.

Principal Material Studied : BDG-1, 4040-4045 m, slide no.2, coordinates 108.6/37.

Remarks : The specimen described here differs from Palmaepollenites keralensis Rao and Ramanujam (1976) in having a smaller size and different shape of sulcus.

Botanical Affinity : Palmae.

Palmaeopollenites sp.3

pl.6, figs. 16, 17

Description : Pollen grains subcircular, 31.2 x 33.6µm, monosulcate, sulcus

distinct, subcircular, restricted in centre of the grain and sulcus lips thickened measuring 1.2µm. Exine ± 1.2 µm thick, psilate or weakly granulose.

Principal Material Studied : BDG-2, CC-9, (2910.50-2928 m) 500-505 cm, slide no.1, coordinates 108.9/60.2.

Remarks : This species differs from other known species by its subcircular sulcus with thickened lips.

Botanical Affinity : Plamae.

Genus : Palmidites (Chitaley) Couper, 1953.

Type species: Palmidites maximus Couper, 1953.

Palmidites sp. 1

pl. 7, fig.2

Description : Pollen grains oval to elliptical, 114-49.2 µm, monosulcate, sulcus distinct and long running parallel to the longer axis, extending from one end to another. Exine ± 2.4 µm thick, punctate.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m) 843-845 cm, slide no.1, coordinates 99/40.3

Remarks : The present specimen is closely comparable with the Palmidites granulatus Mehrtora (1983) but differs from the later in having thick exine with punctate ornamentation.

Botanical Affinity : Palmae.

Palmidites sp. 2

pl.7, fig.3, pl.24, fig.6

Description : Pollen grains oval to elliptical, bilateral, 28.8x86.4 um, monosulcate suclus distinct, running parallel to the longer axis, Exine 1.2 um thick, granulose

Principal Material Studied : BDG-1, 2815-2820 m, slide no.2,coordinates 103.5/72.8

Remarks : The present species is not comparable to any known species.

Botanical Affinity : Palmae.

Palmidites sp.cf.P.granulatus Mehrotra 1983a

pl. 7, fig. 4,5, pl.11, fig.19

1983 Palmidites granulatus Mehrotra, p.13, pl.3, figs.14-15.

Description : Pollen grain eliptical, bilateral, 69.4 x 32.4 µm, monosulcate, sulcus long, running parallel to the longer axis. Exine 1.2 µm thick, finely granulate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.2, coordiantes 97.5/52.8

Remarks : The present species is comparable to Palmidites granulatus Mehrotra (1983) but differs from the later by its small size and shape.

Botanical Affinity : Palmae.

Previously Reported Occurrence : This species ranges from Paleocene-Early Eocene (Mikir Formation), Garampani, North Cachar Hills, Assam.

Palmidites sp. 3

pl. 7, fig. 6

Description : Pollen grain elliptical, 180x72 µm, monosulcate, sulcus long, running parallel to the longer axis. Exine less than 1 µm, granulate.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.1,coordinates 94.1/4.6.

Remarks : The present sepcies closely compares with Palmidites punctatus Mehrotra (1983) and Palmidites plicatus Singh (1977), but differs from them in having a bigger size.

Botanical Affinity : Palmae.

Palmidites sp. 4

pl.11, fig.6

Description : Pollen grain elliptical 64.2 x 135.5 µm, monosulcate, sulcus running parallel to the longer axis extending from one margin to another, broader at the lateral ends narrow in the middle, exine about 2.4 µm thick, reticulate.

Principal Material Studied : BDG-1,3205-3210 m, slide no.4,coordinates 64.4/108.3.

Remarks : The present species described here differs from Palmidites plicatus Singh (1967) by having a bigger size and reticulate exine sculpture.

Botanical Affinity : Palmae.

Palmidites sp.cf.P.plicatus Singh

pl.11, fig.7

1977 Palmidites plicatus, Singh in Sah and Singh, 1974,p.96,pl.1,figs.14,19.

Description : Pollen grains elliptical, 24 x 46.8 µm, monocolpate, colpi well developed extending from one margin to another and broader at the lateral ends, narrow in the middle. Exine 1.2 µm thick, psilate, surface finely sculptured.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m) 1100-1105 cm, slide no.2 coordinates 104.9/71.5.

Remarks : The present specimen is closely comparable to Palmidites plicatus Singh (1977), but it differs in having a smaller size.

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene (Tura Formation), Nongwal Bibra, Garohills, Meghalaya (Sah and Singh,1974); Paleocene, Nongwal Bibra, Garohills Meghalaya (Singh et al.,1976); Paleocene-Early Eocene (Mikir Formation); Garampani North Cachar Hills, Assam (Mehrotra,1983a); Oligocene-Miocene (Dharamsala Beds); Dharamsala, Kangra District, Himachalpradesh (Dogra et al., 1985); Paleocene and Late Eocene (Therria and Kopili formations), Jaintia Hills, Meghalaya (Tripathi and Singh, 1985); Paleocene (Lakadong sandstone) Khasi Hills, Meghalaya (Kar and Kumar, 1986); Paleocene (Subathu Formation), Kalka-Kasauli Road Section; Paleocene (Palana Formation), Bikaner District Rajasthan (Singh and Dongra,1988).

Palmidites sp.2

pl. 11, fig. 8

Description : Pollen grain elliptical 56 x 140 µm, monosulcate, sulcus indistinct due to overlaping of folds, folds well developed extending throughout the sulcus,

exine less than 1 um thick, finely granulate.

Principal Material Studied : BDPJ-1, 1805-1810 m, ,slide no.3,coordinates 99.2/29.4

Remarks : The present specimen described here differs from Palmidites granulatus Mehrotra (1983) having a bigger size and different shape of sulcus.

Botanical Affinity : Palmae.

Palmaepollen Type-I

pl.19, fig.12.

Description : Pollen grain elliptical, 21.6 x 45.6 µm, ? monosulcate, sulcus not clearly visible due to fold on the body, exine thin, granulate.

Principal Material Studied : BDG-1, 4060-4065 m, slide no.1, coordinates 95.8/43.

Remarks : The present specimen is not comparable to any known genera of Palmae Palmaepollenites potonie (1951).

Botanical Affinity : Unknown.

Genus : Dracaenoipollis Sah and Kar 1970

Type species: Dracaenoipollis circularis Sah and Kar 1970

Dracaenoipollis circularis Sah and Kar

pl. 6, figs. 9, 10, 11, 12

1970 Dracaenoipollis circularis Sah and Kar, p.130, pl.1, figs. 1-4.

Description : Pollen grain, subcircular 31.2 x 31.2 µm, aperture, circular to sub circular, distinct. Exine 1.2 µm thick, psilate, weakly granulose.

Principal Material Studied : BDG-2,CC-9 (2910-2928), 354-355 cm, slide no.3, coordinates 95/62.8.

Remarks : It is similar to Dracaenoipollis circularis Sah and Kar (1970).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Early-Middle Eocene (Naredi and Harudi formations) Kutch (Kar, 1978); Paleocene (Matanomadh Formation)of Kutch (Saxena, 1979a); Paleocene-Eocene (Neyveli Formation) South Arcot, Tamilnadu(Siddhanta, 1986) Eocene, nala sections around Yinkiong and Dalbuing, Arunachalpradesh (Prasad and Dey,1986).

Pollen type - A

pl.11, fig. 16

Description : Pollen grain elliptical in shape,36 x 61.2 µm, possessing a uniform narrow sulcus extending all along axis of the grain with pore like structure situated in the equatorial margin, exine 2.4 µm thick, finely scabrate.

Principal Material Studied : BDG-1, 3310-3315 m, slide no.1, coordinates 104.1/36.

Botanical Affinity : Uncertain.

? Palmaepollen type - II

pl. 25, fig. 7

Description : Pollen grain elliptical bilateral,92.4 x 15.2 µm, ? monosulcate, sulcus not clearly visible due to bad preservation, exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-1,3110-3115 m, slide no.1, coordinates 110/61.2.

Botanical Affinity : Unknown.

Turma : Plicates (Naumova 1939) Pot. 1960

Subturma : Monocolpate Iverson and Troels Smith, 1950

Infraturma : Retectines Malvakina 1949

Genus : Liliacidites Coup. 1953

Type species: Liliacidites kaitangataensis Couper 1953

Liliacidites sp.

pl. 11, fig. 10

Description : Pollen grain oval shaped, elongate, monosulcate, 24 x 45.6 µm, colpus distinct, long, extending along the whole length of the body, evenly wide, exine 1 µm thick, foveoreticulate.

Principal Material Studied : BDG-2, CC-8,(2892.60-2910.60 m), 1100-1105 m, slide no.2 coordinates 105.6/45.2

Remarks : The present species described here differs from liliacidites kaitangataensis couper(1953)by its size and broad elongate sulcus.

Botanical Affinity : Liliaceae.

Genus : Arecipites,Wodehouse

Type species: Arecipites punctatus,

Arecipites sp.cf.A.indicus Venkatachala and Rawat

pl.11, fig. 12

1972 Arecipites indicus Venkatachala and Rawat, p.298,pl.2,fig.7.

Description : Pollen grains oval in shape with rounded lateral ends. 22.3 x 34.2 µm, sulcus long almost reaching the lateral margins, uniformly broad, exine ± 1 µm thick, psilate.

Principal Material Studied : BDG-1, 3355-3360 m, slide no.2, coordinates 104/67.6.

Remarks : The specimen described here is closely resemble to Arecipites indicus Venkatachala and Rawat(1972).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat 1972); Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977).

Arecipites sp.cf.A.punctatus Wodehouse

pl.7, figs. 13,14, pl.11, figs. 13-14

1933 Arecipites punctatus Wodehouse in Venkatachala and Rawat 1972, p.298,pl.2 fig.7.

Description : Pollen grain oval in shape 36 x 26.4 μm, monosulcate, sulcus long, uniform, narrow extending from one end to the other. Exine 2.4 μm thick,punctate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m), 1271-1272 cm, slide no.1 coordinates 94.3/48.4.

Remarks : The present specimen is closely comparable to Arecipites punctatus Wodehouse (1933) but differs from the later in having a thick exine and bigger size.

Botanical Affinity : Palmae.

Previously Reported Occurrence : Miocene (Quilon Beds), Kerala (Rao and Ramanujam 1975); Paleocene-Eocene (Akli Formation), near Kapurdi, Barmer District, Rajasthan (Naskar and Baksi, 1978).

Arecipites punctatus Wodehouse

pl.7, fig.8

1933 Arecipites punctatus Wodehouse in Naskar and Baksi, 1972, pl.312,pl.2, fif. 20, 21.

Description : Pollen grains oval in shape, 42-43.2 x 31.2-39.6 um, monosulcate, sulcus long almost reaching the lateral marfgins, uniformly broad. Exine about 1 um thick, punctate.

Principal Material Studied : BDG-2, CC-7 (2874.60-2892.60 m), 500-502 cm, slide no.2, coordinates 110.7/69.

Remarks : The present specimen is identical with Arecipites punctatus.

Botanical Affinity : Palmae

Previously Reported Occurrence : Miocene (Quilon beds), Kerala (Rao and Ramanujam 1975); Paleocene to Eocene (Akli Formation) Near Kapurdi, Barmer District, Rajasthan (Naskar and Baksi, 1978).

Arecipites indicus Wodehouse

pl.7, fig. 11, 1

1972 Arecipites indicus Venkat and Rawat, p. 298, pl.2, fig.7.

Description : Pollen grains oval in shape with broadly rounded lateral ends, 34.8-45.6 x 21.6-28.8 um, monosulcate, sulcus long, narrow, almost reaching lateral margins, uniformly broad, slightly broadened at the ends. Exine 1.2 um thick, finely punctate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m) 300-302 m, slide no.4, coordinates 65/111.2.

Remarks : The present specimen recorded here slightly differs in size.

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat, 1972); Early Eocene (Kadi Formation), Cambay Basin, Gujarat (Rawat et al., 1977).

Turma : Plicates (Naumova 1939) Pot 1960

Subturma : Discolates Erdtman 1947

Infraturma : Phaerozonisulcates Venkachala and Kar 1969

Genus : Spinizonocolpites Muller 1968

Type species: Spinizonocolpites echinatus Muller 1968

Spinizonocolpites indicus Singh

pl.8, figs. 1,2,3,4

1990 Spinizonocolpites indicus Singh, p.226, pl.2, fig. 1,2.

Description : Pollen grain broadly, oval, 55.2 x 45.6 µm, exine spinose, spines with bulbous base and pointed tips,6 µm long and 2.3 µm wide at base and uniformly distributed.

Principal Material Studied :BDG-1,2885-2890 m, slide no.2, coordinates 96/36.

Remarks : The present specimen recorded here has smaller size compared to Spinizonocolpites indicus Singh(1990).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene (Tura Formation) Longrin Coal Field, South Shillong Plateau, Meghalaya, Singh(1990).

Spinizonocolpites echinatus Muller

pl.8, figs. 5,6,· · pl.9, figs. 13,15

1968 Spinizonocolpites echinatus Muller in Venkatachala and Rawat 1972, pp.315-316, pl.4, figs. 8,11.

Description : Pollen grains broadly oval to subcircular 30 x 33.6 µm (excluding spines) zonosulcate, exine spinose, spines base swollen with gradually tapering pointed apex, 7.2 µm long and 1.2 µm wide at the base. Exine less than 1 µm thick, intramicroreticulate.

Principal Material Studied : BDG-1, 2530-2835 m, slide no.1,coordinates 103.4/32.8

Remarks : It is identical with Spinizonocolpites echinatus Muller, 1968.

Bitanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene-Middle Eocene of Niniyur stage and Pondichery Formation, Cauvery Basin (Venkat.and Rawat 1972); Eocene, Neyveli lignite, South Arcot (Venkatachala, 1973); Early Eocene, (Kadi Formation) (Rawat et al.,1977), Cambay Basin; Paleocene-Eocene, Narsapur well no.1, West Godavari district (Venkatachala and Sharma, 1984); Paleocene-Oligocene, Matanomadh, Naredi and (Maniyara Fort Formation), Kutch Basin (Kar, 1985); Eocene,nala sections around yinkiong and Dalbuing Arunachal Pradesh (Prasad and Dey, 1986); Paleocene, Godavari - Krishna basin, Andhra Pradesh (Sharma, 1988).

Spinozonocolpites sp.1

pl.8, fig.7

Description : Pollen grain oval in shape, 38.4 x27.6 µm, colpus annulate, exine sculpture spinose, spines 4.8 µm long, 2.4 µm broad, slightly swollen base with tapering apex and sparsely placed. Exine less than 1 µm thick, finely granulate.

Principal Material Studied : BDG-1,2865-2870 m, slide no.2, coordinates 93.2/43.8.

Remarks : The present species differs from Spinizonocolpites indicus Singh (1990) by its size and sparsely placed spines.

Botanical Affinity : Palmae.

Spinizonocolpites sp.2

pl.8, fig.8, pl.9, fig.14

Description : Pollen grain elliptical, 37.2 x 36 µm, colpus distinct, equatorially placed. Exine spinose, spines sparsely placed, 6 µm long with 2.4 µm broad base and tapering distally with pointed tips. Exine in between the spines granulose.

Principal Material Studied : BDG-2, CC-8 (2692.60-2910.60 m) 1271-1272 m, slide no.1 coordinates 94.5-42.7.

Remarks : This species differs from Spinizonocolpites echinatus Muller (1968) having a bigger size and different shape.

Botanical Affinity : Palmae.

Spinizonocolpites sp.3

pl.9, fig.4, pl.8, fig.10

Description : Pollen grains elongate to broadly elliptical, 42 x 46.8 - 48 µm, zonosulcate. Exine sparsely spinose, spines 7 µm long, 2.4 µm wide at the base, granulate between inter spinal space.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m), 843-845 cm, slide no.1 coordinates 103.6/45.

Remarks : The present specimen differs from Spinizonocolpites indicus Singh (1990) by having a smaller size and different shape.

Botanical Affinity : Palmae.

Genus : Spinainaperturites Pier.1961

Type species: Spinainaperturites recurvatus Pier.1961

Spinainaperturites densispinus Venkatachala and Rawat

pl.8, Fig. 9

1972 Spinainaperturites densispinus Venkat and Rawat, pp.299-300, pl.1, figs. 14, 16, 20.

Description : Pollen grain spheroidal, 40.8 x 38.4 µm, inaperturate, spinose, spines are 4.8 µm long with broad base 2.4 µm and densely distributed. Exine less than 1 µm thick, granulose between the spines.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 m, slide no.4, coordinates 107.8/34.6.

Remarks : It is similar to Spinainaperturites densispinus Venkatachala and Rawat (1972).

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene-Eocene sediments, Cauvery Basin (Venkat. and Rawat, 1972); Oligocene-Eocene sediments, Cauvery Basin, (Venkat. and Rawat, 1973a).

Turma : Plicates (Naumova) Potonie 1960

Subturma : Monocolpates Iverson and Troelsmith 1950

Infraturma : Retectines (Malyakina) Potonie 1960

Genus : Couperipollis Venkat. and Kar 1969

Type species: Couperipollis (monosulcites) perspinosus (coup.), Venkat. and Kar, 1969.

Couperipollis echinatus Sah and Kar

pl.8, fig.11,12

1970 Couperipollis echinatus Sah and Kar, p.130, pl.1, figs.8,9.

Description : Pollen grain elongate to oval, 42 x 26.4 µm, monosulcate, sulcus well developed running the whole length of the pollen. Exine ± 1 µm thick, spinose, spines 3.6 µm long and 1.2 µm broad at the base with tapering ends, sparsely distributed, surface in between spines granulate.

Principal Material Studied : BDG-1, 2305-2310 m, slide no.1, coordinates 106.4/51.7

Remarks : It is identical with Couperipollis echinatus Sah and Kar (1970).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Early Eocene, Laki Series, Kutch.

uligocene (Matanomadh, Naredi and Maniyara Fort formations); Matanomadh, Kutch District (Kar, 1985); Paleocene (Lakadong Sandstone), Khasi Hills, Meghalaya (Kar and Kumar 1986); Paleocene, Godavari, Krishna Basin, Andhrapradesh (Sharma 1988).

Couperipollis kutchensis Venkatachala and Kar

pl.9, figs. 1,2,3

1968 Couperipollis kutchensis, Venkat and Kar, p.161, pl.1,fig.16

Description : Pollen grains broadly subcircular in shape, 52.8 x 51.6 µm, monosulcate, sulcus not clearly visible. Exine spinose, spines upto 4.8 µm long with bulbous base and pointed tips, sparsely placed, surface granulate between spines.

Principal Material Studied : BDG-1, 2865-2870 m slide no.1,coordinates 94.5/61.7.

Remarks : It is similar to Couperipollis kutchensis Venkat.and Kar (1968).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Eocene of Laki stage, Kutch (Venkat. and Kar 1969), Tertiary sediments of Palana, Rajasthan (Sah and Kar, 1974), Lower and Middle Eocene sediments of Nerudi and Harudi formations of Kutch (Kar, 1978).

Couperipollis sp.cf.C.cymbatus Venkatachala and Rawat

pl.9, fig.5,6,16

1972 Venkatachala and Rawal, p.296,pl.1,figs.11-12

Description : Pollen grain oval, 32.4 x 56.4 µm, monosulcate, exine less than 1 µm thick, spinose, spines 6 µm long with bulbous at the base, 2.4 µm wide.

Principal Material Studied : BDG-2,CC-4,1215-1220 m, slide no.1,coordinates 95.9/57.3.

Remarks : The present species is comparable to Couperipollis cymbatus Venkat. and Rawat (1972).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene - Eocene, Cauvery Basin, Tamilnadu (Venkatachala and Rawat,1972).

Couperipollis cymbatus

pl.9, figs. 7,8

1972 Couperipollis cymbatus Venkat. and Rawat, p.296, pl.1, figs.11-12.

Description : Pollen grains elongate oval, 28.8 x 57.6 µm, monosulcate, sulcus distinct running the whole lengtn of tne pollen. Exine less than 1 µm thick, spinose, spines having bulbous base and tapering ends. Surface in between spines granulate.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m) 1215-1220 cm, slide no.5, coordinates 105.5/67.6.

Remarks : The presernt species is similar to Couperipollis cymbatus Venkat. and Rawat(1972).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Venkat. and Rawat, 1972 reported this species from Tertiary sediments of Cauvery basin.

Couperipollis rarispinosus Sah and Dutta

pl.9, fig.9, 10

1966 Couperipollis rarispinosus Sah and Dutt., pl.1, fig.8

Description : Pollen grain broadly oval 30 x 43.2 µm, monosulcate distinct extending almost whole length of the pollen grain. Exine thin, spinose, spines are short, less than 2 µm and sparsely distributed with pointed apex.

Pricipal Material Stuided : BDP-1, 1705-1710m, slide no.2, coordinates 104/313.

Remarks : The present species is identical with Couperipollis rarispinosus Sah and Dutta(1966).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Paleocene-Oligocene, Assam (Sah and Dutta, 1966,

1968, 1974, Sah and Singh, 1974, Singh et al., 1975); Paleocene-Eocene, Rajasthan (Naskar and Baksi 1978); Eocene,Bengal (Baksi and Deb, 1980)

Couperipollis brevispinosus Venkatachala and Kar

pl.9, figs.11,12

1962 Couperipollis brevispinosus (Biswas) Baksi, pl.2, fig.22.

1979 Couperipollis brevispinosus(Biswas), Venkatachala and Kar,Saxena, p.131, pl.1, fig.7.

Description : Pollen grain elongate to oval, 27.6 x 43.2 µm, monosulcate, sulcus distinct, running almost whole length of the pollen. Exine, spinose, spines are short and broad at the base.

Principal Material Studied : BDG-1,2675-2680 m, slide no.3,coordinates 108.3/49.2

Remarks : It is similar to Couperipollis brevispinosus (Biswas) Venkatachala and Kar (1979).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Tertiary sediments of South Shillong Front Assam (Baksi,1962); Tertiary sediments of Assam (Sah and Dutta, 1966, 1968); Tertiary sediments of Palana, Rajasthan (Sah and Kar, 1976), (Tura Formation) of Assam (Sah and Singh, 1974), (Matanomadh Formation), Kutch (Saxena, 1979).

Turma : Plicates (Naumova 1934) Pot. 1960

Subturma : Discolates Erdtman 1947

Genus : Longapertites Vanhocken-Klinkenberg 1964

Type species: Longapertites margininatus Van-Hoeken Klinkenberg, 1964

Longapertites Vaneedenburgii Germeraad et al.

pl.10, figs.8, 12, 14

1968 Longapertites Vaneedenburgii Germeraad et al.,in Baksi and Deb 1980,p.202.

Description : Pollen grain generally plano-convex in meridional view, 34.8 µm, monosulcate with extensive sulcus extending over to straight side of the pollen. Exine per reticulate.

Principal Material Studied : BDG-1, 2865-2870 m, slide no.1,coordinates 100.9/66.2

Remarks : The present species is similar to Longapertites vaneedenburgii Germeraad et al.,(1968).

Botanical Affinity : Palmae.

Previously Reported Occurrence: Upper Cretaceous, Nigeria (Germeraad et al., 1968), Paleocene, Venezuela (Germeraad et al.,1968); Lower and Middle Miocene, Borneo (Muller,1981); Paleocene-Lower Eocene, Bengal basin (Bakshi and Deb,1980); Paleocene-Early Eocene (Jalangi Formation), Bengal Basin, West Bengal (Baksi and Deb,1980).

Longapertites sp.2

pl.10, fig. 11

Description : Pollen grains, planoconvex, 31.2 x 32.4 µm, monosulcate, sulcus long extending over to straight side of the pollen, exine 1.2 µm thick, scabrate.

Principal Material Studied : BDPJ-1, 1805-1810 m slide no.3,coordinates 97/29.3.

Remarks : The exine characters and shape distinguish this species from the other known species of the genus.

Botanical Affinity : ? Palmae.

Longapertites sp.cf.L.proxapertoides Vander Hammen and Garcia de Mutis.

pl.10, figs. 9,13

1965 Longapertites proxapertoides Vander Hammen and Garcia de Mutis in Srisailam and Ramanujam 1982, p.128, pl.2, figs.1-5.

Description : Pollen grain planoconvex, 34.8 x 38.4 µm, monosulcate, sulcus extending over to straight side of the pollen, exine 1.2 µm thick, tectate, microreticulate.

Principal Material Studied : BDG-1,2830-2835 m,slide no.2, coordinates 102.3/49.3

Remarks : The present species is closely resembles to Longapertites proxaper-

toides but it slightly differs in having a coarsely reticulate exine.

Botanical Affinity : Palmae.

Previously Reported Occurrence : Miocene (Warkali beds) Cannanore District, Kerala (Srisailum and Ramanujam,1982); Early Eocene K-1 well, Bengal Basin (Mathur and Chopra,1987).

Longapertites sp .1

pl.10, fig. 10

Description : Pollen grains plano-convex laterally, 38.4 µm ,monosulcate, sulcus very long extending along the margin of the pollen. Exine 1.2 µm thick, granulate.

Principal Material Studied : BDG-1, CC-5 (2839-2856.60 m) 970-975 cm, slide no.4, coordinates 96/65.1

Remarks : Size and exine characters distinguish this species from the other known species of the genus.

Botanical Affinity : Palmae.

Genus : Dicolpopollis Pflanzl emend.Potonie 1966

Type species: Dicolpopollis kalewensis Potonie 1966

Dicolpopollis kalewensis (Potonie) Potonie 1966

pl.11, figs. 1,2, 3,4

1966 Dicolpopollis kalewensis (Potonie) Potonie in Mathur and Jain 1980, p.64, pl.1, fig. 15.

Description : Pollen grains elliptical, 28.3-37.2 x 22.8-26.4 µm, dicolpate, colpi small, funnel shaped. Exine 1.2 µm thick, granulate to microreticulate.

Principal Material Studied : BDG-1, 2235-2240 m, slide no.1, coordinates 104/56.1.

Remarks : The recorded species is identical with Dicolpopollis kalewensis Potonie (1960b).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Eocene, Burma (Potonie,1960b); Paleocene, Ladakh (Mathur and Jain,1980); Early Eocene, Cambay Basin (Rawat et al.,1977); Miocene, Kerala (Kar and Jain,1981); Paleocene-Eocene, Cambay Basin (Shanmukhappa,1991).

Dicolpollis sp.

pl. 11, fig. 5

Description : Pollen grain elliptical 31.2 x 26.4 µm, dicolpate, colpi short, exine reticulate.

Principal Material Studied : BDG-1, 2265-2270 m, slide no.1, 99.9/59.2.

Remarks : The present specimen is distinguished from Dicolpopollis kalewensis Potonie (1966) by its reticulate exine.

Botanical Affinity : Palmae.

Infraturma : Sphaerozonisulcates Venkatachala and Kar 1969

Genus : Proxapertites v.D.Hammen 1956 and Singh 1975

Type species: Proxapertites operculatus v.d.Hammen 1956

Proxapertites operculatus v.d. Hammen

pl.10, figs. 1,2

1956. Proxapertites operculatus, Vander Hammen in Venkatachala 1974, p.147, pl.1, figs. 57-58.

Description : Pollen grain subcircular in shape, 30-48.2x38.5-58.4 μm, sulcus parallel to margin splitting the pollen into more or less equal halves. Exine tectate, granulate.

Principal Material Studied : BDG-2,CC-5 (2839-2856.60 m) 970-975 cm, slide no.5, coordinates 103.7/44.7.

Remarks : The present species is similar to Proxapertites operculatus Vander Hammen, (1956).

Botanical Affinity : Palmae.

Previously Reported Occurrence : Eocene, (Neyveli lignite) South Arcot District, Tamilnadu (Venkatachala,1973); Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977); Paleocene-Eocene (Akli Formation) near Kapurdi, Barmer District, Rajasthan (Naskar and Baksi,1978); Paleocene-Eocene (Jalangi and Sylhet limestone formations), Bengal Basin, West Bengal (Baksi and Deb, 1980); Paleocene (Dras volcanics) near Shergol Ladakh District (Mathur and Jain,1980); Paleocene-Eocene (Neyveli Formation), Neyveli, South Arcot District (Siddhanta,1986); Paleocene, Godavari- Krishna Basin (Sharma,1988).

Proxapertites cursus Van-Hoenken Klinkenberg

pl. 10, figs. 3,4,5,6

1966 Proxapertites cursus Van-Hoeken-Klinkenberg in Naskar and Baksi 1978,p.319,pl.2,fig.24

Description : Pollen grains broadly sub-circular in meridional view and elliptic in polar view, 36.4-46.6 x 38.3-57.6 µm, meridionosulcate, pollen grain generally separated by continuous equatorial aperture into two slightly unequal parts. Exine 1.2µm thick, exine slightly thicker than nexine, tectate, coarsely reticulate.

Principal Material Studied : BDG-1, 2830-2835 m,slide no.3, coordinates 96.2/52.

Remarks : The recorded species is identical with Proxapertites cursus Van-Hoeken -Klinkenberg(1966).

Botanical Affinity : Palmae

Previously Reported Occurrence : Paleocene-Early Eocene, Carribean, Borneo (Germeaad et al.,1968); Early Eocene, Bengal Basin,(Baksi, 1962., Baksi and Deb, 1980); Early Eocene, Cambay basin,(Rawat et al.,1977); Paleocene-Eocene, Kutch Rajasthan basins,(Sah and Kar, 1972, Sah and Singh,1977a, b, Naskar and Baksi,1978); Paleocene-Eocene,Assam,Meghalaya (Sah and Dutta, 1966, 1977, Dutta and Sah,1970, Singh, 1975, 1982).

Proxapertites sp.

pl.10.fig.7

Description : Pollen grain subcircular,34.4 x 37.2 µm, zonosulcate, sulcus parallel to the equatorial margin splitting the pollen into two equal parts. Exine about 2.3 µm thick, tectate,surface coarsely reticularte with psilate appearance in the equatorial margin.

Principal Material Studied : BDG-1, 2865-2890 m, slide no.1,coordinates 105.2/51.3

Remarks : Proxapertites cursus Van Heokenberg (1966) closely resembles the present species in shape but it differs in having a thickened exine with psilate appearance in the equatorial margin.

Botanical Affinity : Palmae.

Subturma : Polyptyches (Naumova) Pot. 1960

Genus : Polycolpites Couper 1935

Type species: Polycolpites flavatus Coup. 1935

Polycolpites flavatus Sah and Kar

pl.12, figs. 1,2,3,4

1970 Polycolpites flavatus Sah and Kar, p.137, pl.2, figs.42,47.

Description : Pollen grains subcircular in polar view, 24-34.8 x 25.2-34.4 µm, 9-10 colpate, colpi about 4.8 to 7.2 µm deep in the polar view. Exine upto 2.4 µm thick tectate, per reticulate.

Principal Material Studied : Well BDG-2,CC-5 (2839-2856.60m) 970-975 cm,slide no.3, coordinates 97.3/69.3.

Remarks : The recorded species is similar to Polycolpites flavatus, Sah and Kar (1970).

Botanical Affinity : Pedaliaceae.

Previously Reported Occurrence : Lower and Middle Eocene Kutch (Sah and Kar, 1970, Kar, 1978); Lower and Middle Eocene, Cambay Basin (Shanmukhappa, 1991).

Polycolpites pedaliaceoides Sah

pl. 12, figs. 5,6,7

1967 Polycolpites pedaliaceoides Sah pl.7, fig.10.

Description : Pollen grains subcircular in polar view, 30-33.8x32.4-37.2 µm, 8-10 colpate, breviocolpate, exine 1.2 µm thick, micro-reticulate.

Principal Material Studied : Well BDG-2, CC-4 (2821-2839 m) 1100-1105 cm,slide no.1, coordinates 109.2/52.2.

Remarks : It is identical in the Polycolpites pedalaceoides Sah (1967).

Botanical Affinity : Pedaliaceae.

Previously Reported Occurrence : Lower Eocene, cambay (Rawat et al.,1977); Lower and Middle Eocene, Cauvery (Venkatachala and Rawat,1972); Lower and Middle Eocene Cambay (Shanmukhappa, 1991).

Polycolpites granulatus Sah and Kar

pl.12, figs. 14, 15

1970 Polycolpites granulatus Sah and Kar, p.137, pl.2, fig.41.

Description : Pollen grains subcircular in polar view, 32.4-33.6x33.4-36.6 µm, 8-9 colpate,colpi long, distinct. Exine 1.2 to 2.4 µm thick, granulate.

Principal Material Studied : Well BDG-1, 2925-2930 m slide no.1, coordinates 103.2/58.9.

Remarks : The recorded species is similar to Polycolpites granulatus Sah and Kar (1970).

Botanical Affinity : Pedaliaceae.

Previously Reported Occurrence : (Naredi Formation), Lower Eocene Kutch (Sah and Kar 1969a); Lower and Middle Eocene, Cambay Basin (Shanmukhappa, 1991).

Polycolpites sp.cf.P.flavatus Sah and Kar

pl.22, fig.13

1967 Polycolpites flavatus, p.137, pl.2, figs. 42, 47.

Description : Pollen grain subcircular in polar view octacolpate, 31.2 x 32.4 µm, colpi short, exine upto 3.6 µm thick, sexine thicker than nexine, finely reticulate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m) 970-975 cm, slide no.3, coordinates 98.2/69.3.

Remarks : The present specimen resembles Polycolpites flavatus Sah and Kar (1970) described from Lower Eocene of Kutch but differs from the later in having a thicker exine.

Botanical Affinity : Pedaliaceae.

Polycolpites sp.1

pl.13, fig.1

Description : Pollen grains subcircular in polar view, 40.8x38.4 µm, septacolpate,

colpi long. Exine 2.4 um thick, granulate.

Principal Material Studied : Well BDG-2, CC-9 (2839-2856 m) 857-858 cm, slide no.3, coordinates 106.3/63.1.

Remarks : The present specimen resembles to Retistephanocolpites medicolpus, Mathur and Chopra (1987) but differs from later in having longer colpi.

Botanical Affinity : ? Pedaliaceae.

Genus : Polybrevicolpites, Deb 1972

Polybrevicolpites sp.
pl.22, fig.14

Description : Pollen grain subcircular in polar view 30x31.2 µm, septacolpate, colpi about 4.8 µm deep. Exine about 2.5 µm thick, finely granulate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.4, coordinates 110.3/60.

Remarks : The present specimen resembles Retiseptacolpites medicolpus Mathur and Chopra (1987) but differs from the later in having finely granulate exine and with short colpi.

Botanical Affinity : Uncertain.

Genus : Polybrevicolpites neyveli Deb

pl.12, fig.8

1972 Polybrevicolpites neyveli Deb, p.223, pl.1, figs.6,7,9,10.

Description : Pollen grains subcircular in polar view, 40.8x43.2 µm, Polybrevicolpites, hexabrevicolpites, colpi short, narrow. Exine upto 3.6 µm thick, tectate, granulate.

Principal Material Studied : Well BDG-2,CC-9 (2839-2856 m) 500-505 cm, slide no.1, coordinates 98/67.7.

Remarks :The recorded species is identical with Polybrevicolpites neyveli Deb(1975).

Botanical Affinity : Unknown

Previously Reported Occurrence : Miocene, Neyveli lignite Pilot Quary, Neyveli Tamilnadu (Deb,1972), Oligocene, Barail Group Assam(Singh et al.,1985).

Genus : Polybrevicolporites Venkat, and Kar 1969

Type species: Polybrevicolporites cephalus Venkat. and Kar 1969a

Polybrevicolporites cephalus Venkat.and Kar.

pl. 12, figs. 10,11,12

1969a Polybrevicolporites cephalus Venkatachala and Kar, p.171,pl.2,fig.55-56.

Description : Pollen grains subcircular in polar view, 28.8-33.6x28.8-36 μm, distinctly lobed, pentacolporate, brevicolporate, colpi short, extending upto inner limit of the pore, pores distinct, exine 3.6 μm thick, intrabaculate.

Principal Material Studied : Well BDG-2,CC-11,(2946-2951.30), 626-627 cm, slide no.1,coordinates 103/61.8.

Remarks : The present species is identical with Polybrevicolporites cephalus Venkatachala and Kar (1969a).

Botanical Affinity : Unknown.

Previously Reported Occurrence : Lower Eocene (Naredi Formation), Kutch (Venkatachala and Kar, 1969a); Lower Eocene, Cambay Shale, Cambay Basin (Shanmukhappa, 1991); Early Eocene (Palana lignite), palana, Bikaner District, Rajasthan (Sah and Kar,1974).

Polybrevicolporites sp.cf.P.cephalus

pl.12, fig. 13

1969 Polybrevicolporites cephalus, Venkatachala and Kar, p.171, pl.2, figs.55-56.

Description : Pollen grain mostly subcircular in polar view, 28.8x28.8 μm, distinctly lobed, polycolporate, pentacolporate, brevicolpate, pores well developed, sexine thicker than nexine, exine 3.6 μm thick, granulate.

Principal Material Studied : Well BDPJ-1, 1805-1810 m, slide no.4, coordinates 104.6/42.8.

Remarks : The species recorded here is closely comparable to Polybrevicolporites cephalus, Venkatachala and Kar (1969a)but it differs from the later in having a smaller size.

Botanical Affinity : Unknown.

Polybrevicolporites sp.1

pl.22, fig.9

Description : Pollen grains broadly subcircular in polar view, 29.2 x 30.4 µm, pentacolporate, brevicolpate , pores not clearly visible due to bad preservation, exine 3.2 µm thick, granulate.

Principal Material Studied : BDG-1, 4040-4045 m, slide no.2,coordiantes 99/42.6.

Botanical Affinity : Unknown

Genus : Retihexacolpites Mathur 1966

Retihexacolpites sp.cf.R.medicolpus

pl.12. fig.9

1987 Retihexacolpites medicolpus Mathur and Chopra, p.116,pl.2,fig.30.

Description : Pollen grains subcircular in polar view, 32.4x33.6 um,hexacolpate, colpi wedge shaped, extending about half way towards poles. Exine 2.4 um thick, coarsely reticulate.

Principal Material Studied : BDG-1, 2945-2950 m, slide no.2,coordinates 53.5/95.3.

Remarks : The specimens described here is closely comparable to Retihexacolpites medicolpus Mathur and Chopra (1987) in general morphological features but it differs in having a coarsely reticulate exine.

Botanical Affinity : Fraxinus.

Previously Reported Occurrence : Middle Eocene, Bengal Basin Mathur and Chopra (1987).

Retihexacolpites sp.

pl.12, fig.16

Description : Pollen grains subcircular, 45.6x45.6 µm, hexacolpate, colpi, medium sized, distinct, wedge shaped, exine about 2.4 µm thick, punctate.

Principal Material Studied : Well BDG-2, CC-5, (2839-2856.60) 970-975 cm, slide no.4, coordinate 103.1/54.5

Remarks : The present specimen differs from Retihexacolpites medicolpus Mathur and Chopra (1987) in having a bigger size and punctate ornamentation.

Bontanical Affinity : Unknown.

Subturma : Plychopolyporines(Naum) Pot.1960

Genus : Stephanocolpites (V.D.Ham) Pot.1960

Type species: Stephanocolpites costatus V.D.Ham.1954

Stephanocolpites globatus Venkatachala and Kar

pl.13, fig.2, pl.22, fig.3,4

1969 Stephanocolpites globatus Venkatachala and Kar, p.169,pl.2,figs.51-52.

Description : Pollen grains subcircular with four lobes at polar view, 25.2-30x25.2-31.2µm, tetracolpate, colpi short, well developed. Exine 2.4 µm thick, intrabaculate.

Principal Material Studied : Well BDG-2,CC-5(2839-2856.60 m),970-975 cm ,slide no.2,coordinates 99.1/56.3.

Remarks : The present species recorded here is identical with Stephanocolpites globatus Venkatachala and Kar(1969).

Botanical Affinity : Unknown.

Previously Recorded Occurrence : Tertiary sediments (Laki Stage) of Kutch (Venkatachala and Kar,1969a).

Stephanocolpites nadhamunii Venkatachala and Kar

pl.22, fig.7,8

1969 Stephanocolpites nadhamunii Venkatachala and Kar, p.170, pl.2, fig.53.

Description : Pollen grains subcircular in polar view, 36x38.4 µm, pentabrevicolpate, colpi narrow, 7.2 µm long. Exine 3.6 µm thick, sexine thicker than nexine.

Principal Material Studied : BDG-2,CC-4 (2821-2839 m), 843-845 cm,slide no.2, coordinates 102.5/49.

Remarks : It is similar to Stephanocolpites nadhamunii Venkatachala and Kar (1969)in size.

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Tertiary sediments (Laki stage) of Kutch.

Stephanocolpites sp.1

pl.13, fig. 3

Description : Pollen grains subcircular in polar view, 25.2x26.4 µm, pentacolpate, colpi upto 4.8 µm deep, exine 1 µm thick, finely granulate.

Principal Material Studied : Well BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, coordinates 99.8/53.1.

Botanical Affinity : Unknown.

Stephanocolpites granulatus Venakatachala and Kar

pl.22, figs. 1,2,5

1968 Stephanocolpites granulatus Venkatachala, p.170, pl.2, figs. 57-58.

Description : Pollen grain subscircular in polar view 34.8 um, tetracolpate, colpi well developed, narrow, about 8.4 um long. Exine 2.4 um thick, intergralate.

Principal Material Studied : BDD-1,2205-2210 m,slide no.4, coordinates 100.5/50.8.

Remarks : The specimens of pollen grains studied here identical with Stephanocolpites granulatus Venkatachala and Kar (1968).

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Tertiary sediments of Kutch (Venkatachala and Kar 1968).

Genus : Granustephanocolpites saxena

Granustephanocolpites sp.

pl. 23, fig. 11

Description : Pollen grain, subcircular in polar view, 32.4 x 33.6 um, hexacolpate colpi short, fairly wide in the equatorial region. Exine 3.6 um thick, psilate surface granulate.

Principal Material Studied : BDG-1, 2650-2655 m,lide no.1,coordinates 103.4/37.2.

Remarks : The present species closely resembles Granustephanocolpites Sah and Saxena but it differs in having hexacolpate.

Botanical Affinity : Uncertain.

Stephanocolpites sp.2

pl. 22, fig.6

Description : Pollen grains subcircular polar view, 30 x 31.2 um, tetracolpate, colpi short and narrow. Exine about 3.6 um thick, intragranular.

Principal Material Studied : BDG-2, CC-9 (2910.5-2928 m) 1200-1205 cm, slide no.2, coordinates 99.4/57.8.

Remarks : Stephanocolpites flavatus Venkatachala & Kar 1968 closely resembles the present species but varies by its thicker exine and slightly bigger size.

Botanical Affinity : Uncertain.

Subturma : Polyptyches (Naumova) Pot. 1960

Genus : Retistephanocolpites Leidelmeyer 1966

Type species: Retistephanocolpites angeli Leidelmayer 1966

Retistephanocolpites Williamsi Germeraad et al.

pl.23, fig.2,3, pl.22, figs.10,11,12.

1968 Retistephanocolpites williamsi, Germeraad et al.,in Baksi and Deb, 1980, p.205, pl.2, fig.17, pl.4, fig.35.

Description : Pollen grains subcircular in polar view, 30 x 31.2 µm, septacolpate, colpi 4.8 µm long, exine 2.4µm thick, finely reticulate.

Principal Material Studied : BDG-1, 3290-3295 m, slide no.2,coordinates 111/48.8.

Remarks : The present species is identical with Retistephanocolpites williamsi(1968)

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Early Eocene (Kadi Formation), Cambay Basin (Rawat et al., 1977); Paleocene-Eocene (Akli Formation), near Kapurdi, Barmer District, Rajasthan (Naskar and Baksi,1978); Paleocene-Eocene (Jalangi and Sylhet Limestone Formations),Bengal Basin (Baksi and Deb,1980); Paleocene-Eocene (Neyveli Formation) Neyveli South Arcot District, Tamilnadu (Siddhanta,1986).

Subturma : Trichotriporines (Naumova) Pot.1960

Infraturma : Prolati Erdtman 1943

Genus : Margocolporites Ramanujam 1966

Type species: Margocolporites tsukadai, Ramanujam 1966

Margocolporites tsukadai Ramanujam

pl.17, figs.2,3,4, pl.23, fig.9.

1966 Margocolporites tsukadai Ramanujam, pp.149-203, pl.4,fig.64

Description : Pollen grains trilobate in polar view, 36-39.6x39.6-46.8 µm, tricolporate, margocolpus. Exine 2.5 µm thick, coarsely reticulate.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m), 843-845 cm,slide no.5, coordinates 107.2/29.7

Remarks : The specimen recorded here is identical with Margocolporites tsukadai Ramanujam (1966).

Botanical Affinity : Caesalpiniaceae.

Previously Reported Occurrence : Miocene, Quilon Beds (Rao and Ramanujan,1975). Middle Miocene, Warkallibeds, Kerala (Ramanujam and Rao , 1977); Paleocene, Tura Formation, Garo Hills Meghalaya (Singh , 1977a); Early Eocene, (Naredi Formation), Kutch (Kar , 1978); Paleocene-Upper Eocene, Cambay Basin (Shanmukhappa , 1991); Oligocene, Ambalapuzha bore hole, Kerala (Rana et al.,1987).

Margocolporites sp.1

pl.17, figs. 5,6,7

Description : Pollen grains oval in equatorial view, 36 x 46.8 µm, tricolporate, margocolporate. Exine 2.2 µm thick, reticulate.

Principal Material Studied : BDP-1, 3470-3475 m, slide no.3,coordinates 103/64.5.

Remarks : The present species recorded here differs from Margocolporites tsukadai Ramanujam (1966)by its different shape and exine ornamentation.

Botanical Affinity : Caesalpiniaceae.

Margocolporites sp.2

pl.16, fig.11

Description : Pollen grains subcircular in polar view, 27.6x28.8 µm, trizonocolporate, anguloaperturate, colpi long almost reaching the polar area, margo well developed or lalongate margin thickened, exine 2.4 µm thick, reticulate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m),970-975 cm, slide no.5, coordinates 98.4/47.1.

Remarks : The specimen resembles to Margocolporites foveolatus Venkatachala and Sharma in size but differs in exine ornamentation.

Botanical Affinity : Caesalpiniaceae.

Subturma : Polyporines (Naum) Pot.1960

Genus : Pseudonothofagidites Venkatachala and Kar 1969a.

Type species: Pseudonothofagidites kutchensis Venkatachala and Kar 1969

Pseudonothofagidites kutchensis Venkatachala and Kar

pl.13, figs. 4,5

1969 pseudonothofagidites kutchensis Venkatachala and Kar, p.173,pl.3,figs.72-73.

Description : Pollen grains subcircular with regular lobed margins in polar view, 28.8x33.6-36 µm,polyporate, pores 5-6 numbers situated in depressed parts, well developed, rimmed at the invagination of the lobes, exine granulose.

Principal Material Stuided : Well BDG-1, 3355-3360 m, slide-1A, coordinates 94.3/63.9.

Remarks : It is similar to Pseudonothofagidites kutchensis Venkatachala and Kar(1969).

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Paleocene-Eocene, Kutch (Venkatalachala and Kar 1969a, Saxena,1979); Lower Eocene, Cambay (Rawat et al.,1977); Eocene, Cambay Basin (Shanmukhappa,1991); Paleocene-Lower Eocene, Assam (Singh,1977a); Eocene, Cauvery Basin (Deb, Baksi and Ghosh,1973), Early Eocene (Palana lignite) Palana, Bikaner District (Sah and Kar, 1974); Paleocene (Tura Formation), Nongwal Bibra

Garo hills, Meghalaya (Singh, 1977a); Paleocene (Matanomadh Formation), Kutch District (Saxena,1979a); Paleocene-Middle Eocene (Matanomadh, Naredi and Harudi formations), Kutch District (kar, 1985).

Pseudonothofagidites cerebrus Venkatachala and Kar

pl.13, figs.6,7

1969 Pseudonothofagidites cerebrus Venkatachala and Kar, p.174,pl.3,fig.74.

Description : Pollen grains more or less broadly subcircular with broadly lobed margins, pores 7 in number, situated at the intermarginal area of the lobe, uniformly thickened, 38.4 x 39.6 um, exine granulate.

Principal Material Studied : Well BDG-2, CC-8 (2892.60-2910.50m) 1100-1105 cm, slide no.2, coordinates 111.3/39.8

Remarks : The present species recorded here is identical to Pseudonothofagidites kutchensis Venkatachala and Kar(1969).

Botanical Affinity : Unknown.

Previously Reported Occurrence : Early Eocene (Naredi Formation); Kutch District, (Kar,1978); Early Eocene (Naredi Formation) near Matanomadh and Panandhro, Kutch District (Kar, 1985).

Genus : Anacolosidites (Cooks. and Pike) Pot. 1960

Type species: Anacolosidites luteoides Cooks. and Pike 1954

Anacolosidites trilobatus Venkatachala and Rawat

pl.13, fig.8

1972 Anacolosidites trilobatus, Venkatachala and Rawat, p.316, pl.4, figs.12-13.

Description : Pollen grains triangular with broadly rounded angles with concave sides, trilobed, 16.6 x 18 µm, 6 pores 3 on each side of the equator, pores distinct, simple, oval shaped. Exine sculptured.

Principal Material Studied : Well BDG-1, 3155-3160 m, slide no.3, coordinates 96/53.8.

Remarks : The present species recorded here is identical to Anacolosidites trilobatus Venkatachala and Rawat (1972).

Botanical Affinity : Olacaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery (Venkat. and Rawat 1973); Early Eocene, Cambay (Rawat et al., 1977); Eocene, Neyveli lignite, south Arcot district, Tamilnadu (Venkatachala, 1973); Early Eocene, Kadi Formation, Cambay Basin (Rawat et al., 1977); Middle Eocene, Narsapur well No.1, West Godavari District, Andhra Pradesh (Venkatachala and Sharma, 1984); Middle Eocene, Cambay Basin (Shanmukhappa, 1991).

Subturma : Ptychopolyporines (Naumova 1937, 1939) Pot.1961

Genus : Tetracolporites Coup. 1953

Type species: Tetracolporites camaruensis coup.1953

Tetracolporites onagraceoides Dutta and Sah

pl.13, fig.9.

1967 Tetracolporites onagraceoides Dutta and Sah, p.43, pl.7, fig.20.

Description : Pollen grains spheroidal in polar view, 62.4x58.8 µm, tetracolporate colpi short wide, pores rimmed with exine thickening. Exine about 2.4 µm thick, finely reticulate.

Prinipal Material Studied : Well BDG-2,CC-8 (2692.60-2910.50 m), 205-207 cm, slide no.1, coordinates 110.6/63.5

Remarks : The specimen recorded here is identical to Tetracolporites onagraceoides Dutta and Sah (1967).

Botanical Affinity : Meliaceae.

Tetracolporites longicolpus Sah and Dutta

pl.13, fig.10.

1967 Tetracolporites longicolpus Sah and Dutta, p.191,pl.2,fig.7.

Description : Pollen grain broadly rectangular in polar view, 36x33.6 µm, tetra-

colporate, colpi long narrow almost extending to the poles. Exine 2.4 um thick reticulate.

Principal Material Studied : Well BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.2, coordinates 96.5/44.2.

Remarks : The present species recorded here is identical to Tetracolporites longicolpus, Sah and Dutta (1967) but slightly varies in having a bigger size.

Bottanical Affinity : Meliaceae

Previously Recorded Occurrence : Oligocene, Baragolai stage, Barail series, Assam.

Genus : Iugopollis Venkatachala and Rawat 1972

Type species: Iugopollis tetraporites Venkatachala and Rawat 1972

Iugopollis sp.cf.I.tetraporites Venkatachala and Rawat

pl.13, figs.11,12

1972 Iugopollis tetraporites Venkatachala and Rawat, p.322,pl.4,figs.26,27,28.

Description : Pollen grain broadly rectangular with rounded corners, 28.8x36 µm, tetraporate, pores equatorial, annulate, equatorial band distinct, exine 1.2 µm thick, granulate.

Principal Material Studied : Well BDG-1, 2885-2890m, slide no.3,coordinates 64/101

Remarks : The present specimen is closely comparable to Iugopollis tetraporites Venkat. and Rawat (1972) but differs from later in having a bigger size and exine sculpture.

Botanical Affinity : Sonneratiaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin, Tamilnadu (Venkatachala and Rawat, 1972); Eocene (Neyveli lignite), South Arcot District, Tamilnadu (Venkatachala,1973); Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977); Middle-Late Eocene, Narsapur well no.1, West Godavari District, Andhra Pradesh(Venkatachala and Sharma,1984); Eocene (Cambay and Ankleshwar formations Cambay Basin (Shanmukhappa,1991).

Iugopollis sp

pl.13, fig.13

Description : Pollen grain broadly oval in equatorial view, 43.2x34.8 µm, tetraporate, pores simple, annulate, exine less than 1 µm thick, finely granulate.

Principal Material Studied : Well BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.4, coordinates 103.6/64.5.

Botanical Affinity : Sonneratiaceae.

Turma : Porosa (Naumova) Pot.1960

Subturma : Triporines Naumova 1969 and Emend.Pot.1960

Genus : Triporopollenites pflug and Thom.1953

Type species: Triporopollenites robustus

Triporopollenites sp.

pl.14, figs. 1,2,3,4

Description : Pollen grains subtriangular in polar view, 31.4-44.4 x 32.4-45.6 µm, triporate, pores margin slightly thickened. Exine 1.2 µm thick finely granulate.

Principal Material Studied : BDP-1, 3155-3160 m, slide no.1, coordinates 94.9/64.2

Botanical Affinity : Unknown.

Genus : Myricaceoipollenites Pot.1951

Type species: Myricaceoipollenites megagraniter Potonie 1951

Myricaceoipollenites cf.M.dubius

pl.14, figs.5,6,7

1972 Myricaceoipollenites dubius Venkat. and Rawat,P.320, pl.4,figs.24,32-36.

Description : Pollen grains roundly triangular, 20.2 x 24.5 µm, triporate anguloaperturate, pores broadly circular, pore margin thickened. Exine 1.3 µm thick, scabrate.

Principal Material Studied : Well BDG-1, 2205-2210 m, slide no.1,94.5/66.5.

Remarks : The specimen recorded here is closely comparable to Myricaceoipollenites dubius venkat.and Rawat(1972)but slightly varies in size.

Botanical Affinity : Myricaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat , 1972); Eocene (Neyveli lignite) Neyveli south Arcot District; Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977); Paleocene-Eocene and Miocene, West Godavari District,Andhra Pradesh (Venkatachala and Sharma,1984); Early Miocene (Boldamgiri Formation), Garohills, Meghalaya (Nandi and Sharma, 1984).

Genus : Pistillipollenites Rouse 1962

Type species: Pistillipollenites macgregorii Rouse 1962

Pistillipollenites sp

pl.14, fig. 8,9

Description : Pollen grain broadly traingular, triporate, pores poorly defined 54x63.6 µm. Exine thick, gemmate, gemmae sparsely distributed.

Principal Material Studied : BDG-1, 2650-2655 m,slide no.1,coordinates 106.2/44.5.

Remarks : The specimen recorded here differs from pistillipollenites microverrucates Mathur and Chopra(1987) in having a bigger size.

Botanical Affinity : Not known.

Turma : Poroses (Naumova 1939) Pot. 1960

Subturma : Monoporines (Naumova 1939) Pot. 1960

Genus : Graminidites Cookson,ex Potonie emend. Krutzch 1970

Type species: Graminidites annulatus (V.D.Hammen) Potonie 1960

Graminidites sp.1

pl.14, fig.10

Description : Pollen grains broadly oval to triangular outline, 43.2x50.4 µm, monoporate, pore simple with thickened rim and situated at the lateral end. Exine thin, smooth folded with finely granulate sculpture.

Principal Material Studied : Well, BDG-2, CC-11 (2946-2961.30 m), 536-532 cm, slide no.2, coordinates 101.5/57.3.

Botanical Affinity : Unknown.

Graminidites sp.2

pl.14, fig.11

Description : Pollen grains subspherical, 46.8 x 48 µm, monoporate, distinct, pore rim surrounded by slightly thickened rim. Exine thin folded,finely granulate.

Principal Material Studied : BDG-2,CC-11 (2946-2961.30 m) 536-537 cm, slide no.2, coordinates 112.7/59.2.

Botanical Affinity : Unknown.

Genus : Psilodiporites Varma and Rawat emend. Venkatachala and Rawat 1963

Type species: Psilodiporites hammenii Varma and Rawat 1963

Psilodiporites hammenii Verma and Rawat

pl.14, figs. 12,13,15

1963 Psilodiporites hammenii Varma and Rawat in Venkatachala and Rawat, 1972, p.301, pl.2, figs. 8,9.

Description : Pollen grain barrel shaped, 31.2x44.4 µm, diporate, equatorial, simple, distinct, exine 1.2 µm thick, psilate.

Principal Material Studied : BDG-2, CC-11 (2946-2961.30 m) 536-537 cm, slide no.2, coordinates 99.1/97.4.

Remarks : It is similar to Psilodiporites hammenii Varma and Rawat(1963).

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Lower and Middle Eocene sediments of Cambay Basin, (Varma and Rawat,1963);Paleocene-Eocene sediments of Cauvery Basin (Venkatachala and Rawat,1972); Eocene, Neyveli lignite, south Arcot district, Tamilnadu (Venkatachala, 1973); Early Eocene (Kadi Formation) Cambay Basin (Rawat et al., 1977); Paleocene-Eocene, Narsapur well no.1, West Godavari, Andhra Pradesh (Venkatachala and Sharma,1984); Early to Middle Eocene Cambay Basin (Shanmukhappa, 1991); Paleocene, Bengal Basin (Mathur and Chopra,1987); Paleocene, Godavari-Krishna Basin (Sharma, 1988).

? Monoporate pollen

pl. 24, fig.5

Description : Pollen grains elliptical in shape, 37.2 x 54 um, monoporate,pore margin thickened, exine 1.2 um thick, granulate.

Principal Material Studied : BDG-1, 4040-4045 m, slide no.2, coordinates 47.7/94.7

Botanical Affinity : Uncertain.

Psilodiporites erdilmanii (Verma and Rawat) emend and VVe Venkatachala and Rawat.

pl. 14, fig. 16

1963 Psilodiporites erdtmanii, Varma and Rawat, p.135, fig.13

1972 Psilodiporites hammenii (Varma and Rawat 1963) emnded Venkatachala and Raat, 1972.

Description : Pollen grains diporate, bilateral, barrel shaped, 39.6x40.8 um, pores simple sunken, broadly circular, exine thin granulate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.2,coordinates 104.5/40.8

Remarks : The present specimen recorded here is identical with psilodiporites erdtmanii, Verma and Rawat (1963).

Botanical Affinity : Apocynaceae.

Previously Reported Occurrence : Upepr Eocene and Oligocene sediments of Cambay Basin (Varma and Rawat, 19630. Paleocene-Eocene, Cauvery Basin, (Venkatachala and Rawat, 1972).

Psilodiporites sp.

pl.14, fig. 14, pl. 24, fig. 9

Description : Pollen grain barrel shaped, 36x33.6 µm, diporate, pores are simple, equatorial with thickened rim. Exine 1.2µm thick,finely granulate.

Principal Material Studied :BDG-2,CC-11 (946-2961.30 m) 536-537 cm,slide no.2, coordinates 63/107.2

Remarks : The present specimen recorded here is comparable to Psilodiporites hammenii but slightly varies in having a smaller size and finely granulate exine.

Botanical Affinity : Uncertain.

Genus : Araliaceoipollenites Pot. 1951

Type species: Araliaceoipollenites euphorii (Pot) Pot.1951

Araliaceoipollenites mannargudii Venkatachala and Rawat

pl. 17, fig.8

1972 Araliaceoipollenites mannargudii Vankat. and Rawat, p.312, pl.3, fig.11.

Description : Pollen grains broadly oval in polar view, 39.6x34.8 µm, tricolporate, colpi long, reaching almost to the poles. Uniformly broad, slightly wide at the equatorial region, ora lolongate. Exine 2.4µm thick, tectate, punctitegillate.

Principal Material Studied : BDG-2, CC-9 (2839-2856 m), 675-676 cm, slide no.1, coordinates 104.1/51.2.

Remarks : The present species is identical with Araliaceoipollenites mannargudii Venkatachala and Rawat (1972).

Botanical Affinity : Araliaceae.

Previously Reported Occurrence : Oligocene-Miocene, Cauvery Basin (Venkatachala and Rawat (1973a).

Genus : Cupanieidites cooks.and Pike 1954

Type species: Cupanieidites orthoteichus Cooks. and Pile 1954

cupanieidites cf.C.flaccidiformis Venkatachala and Rawat

pl.17, figs, 9, 10

1972 cupanieidites flaccidiformis Venkatachala and Rawat,p.321,pl.2,figs.11,12,14.

Description : Pollen grain with broadly triangular amb, sides convex, 24x25.2 µm, trisyncolporate, pore aspidate. Exine less than 1 µm thick, sexine thicker than nexine, finely reticulate.

Principal Material Studied : BDG-1, 4040-4045 m, slide no.4, coordinates 100/60.5.

Remarks : Present specimen recorded here is closely comparable to cupanieidites flaccidiformis Venkatachala and Rawat (1972) but it differs in having a bigger size and finely reticulate exine.

Botanical Affinity : Sapindaceae.

Cupanieidites flaccidiformis Venkatachala and Rawat

pl.16, fig.13

1972 Cupanieidites flaccidiformis Venkatachala and Rawat,p.321,pl.2,fig.11,12

Description : Pollen trizonosyncolporate, roundly triangular in polar view, 28.8x28.8 µm, arci prominant not forming a polar island pore aspidate, exine 1.2 µm thick, finely granulate.

Principal Material Studied : BDPJ-1, 1705-1710 m, slide no.3, coordinates 105.8/56

Remarks : It is identical with cupanieidites flaccidiformis Venkatachala and Rawat (1972).

Botanical Affinity : Sapindaceae.

Previously Reported Occurrence : Paleocene-Eocene sediments of Cauvery basin (Venkatachala and Rawat,1972); Eocene, Neyveli lignite, Neyveli, Tamilnadu (Venkatachala,1973); Eocene, (Kadi Formation), Cambay Basin (Rawat et al.,1977); Eocene, West Godavari district, Andhra Pradesh (Venkatachala and Sharma , 1984).

Genus : Symplocoipollenites Pot. 1951

Type species: Symplocoipollenites vestibulum (Pot) Pot . 1951

Symplocoipollenites gracilis Venkatachala and Rawat

pl.17, fig. 11

1972 Symplocoipollenites gracilis Venkat. and Rawat, PP .315-316, pl.4,figs.8,11.

Description : Pollen grain triangular in polar view, sides concave, angulaperturate, 27 µm, tricolporate, colpi obscure to short, brevicolpate, ora lalongate. Exine about 2.4µm thick, psilate.

Principal Material Studied : BDG-2, CC-8 (2890.60-2910.60 m) 1100-1105 m, coordinates 100.8/58.

Remarks : It is identical with Symplocoipollenites gracilis Venkat.and Rawat(1972).

Botanical Affinity : Symplocaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin, Tamil Nadu, (Venkatachala and Rawat,1972).

Genus : Rhoipites Wodeh.1933

Type species: Rhoipites bradleyi Wodeh.1933

Rhoipites sp

pl. 17, Figs. 12,'13

Description : Pollen grain oval in equatorial view, 30x21.6 µm, tricolporate, colpi long reaching almost to the poles, ora lalongate. Exine less than 1 µm thick, sexine thicker than nexine, granulate.

Principal Material Studied : BDG-1, 2275-80, slide no.3,coordinates 109/73.9.

Botanical Affinity : Unknown.

Subturma : Tryptyches (Naumova) Pot.1960

Genus : Marginipollis Clarke and Fred.1968

Type species: Marginipollis concinnus Clark and Fred.1968

Marginipollis kutchensis Venkatachala and Kar

pl.17, figs. 14,15

1969 Marginipollis kutchensis Venkatachala and Kar,P.336,pl.1,figs.9-11.

Description : Pollen grains ellipsoidal, 28.8x48 µm, syntricolporate, ectoaperture, narrow, fused at the poles, margin more or less smooth,width 1.5 µm except at the poles where they are emerged into cushions, broadly a row of big meshes towards the non-apertural side.

Principal Material Studied : BDG-1, 2205-2210 m, slide no.1,coordinates 101.9/42.2

Remarks : The present species is similar to Marginipollis kutchensis Venkatachala and Kar(1969).

Botanical Affinity : Lacethidaceae.

Previously Reported Occurrence : Early-Middle Eocene,(Naredi and Harudi formations),Kutch (Kar , 1978); Eocene,(Jalangi and sylhet limestone formations),Bengal Basin (Baksi and Deb , 1980); Miocene, Ratnagiri Beds, Maharashtra (Phadtare and Kulkarni , 1980a); Middle-Late Eocene, near Rataria, Kutch (1981); Eocene sediments of Cambay (Shanmukhappa , 1991); Paleocene-Eocene,(Neyveli Formation), South Arcot, Tamilnadu (Siddhanta, 1986).

Marginipollis sp.

pl.17, fig.16

Description : Pollen grain elipsoidal, 25.2x42 µm, trisyncolporate, ectoaperture narrow, fused at the poles, margin more or less smooth, bordered by a row of big meshes towards the equator. Exine about 1.2 µm thick, smooth.

Principal Material Studied : BDG-2,CC-5,2839-2856.60 m, 970-975 cm, slide no.3, coordinates 108.2/47.3.

Botanical Affinity : Lecethidaceae

Subturma : Plychopolyporines (Naumova, 1937, 1939) Pot.1961

Genus : Striacolporites Sah and Kar 1970

Type species: Striacolporites striatus, Sah and Kar 1970

Striacolporites ovatus

pl.17, figs. 17,18,19

1979 Striacolporites ovatus, Sah and Kar, p.136, pl.2, figs.56-57.

Description : Pollen grains oval in equatorial view, 43.2x27.6 µm, colporate, sexine thicker than nexine, striato-reticulate.

Principal Material Studied : BDG-2,CC-12 (2967-2984 m), 400-402 cm, slide no.4, coordinates 105.6/55.

Remarks : It is identical with striacolporites ovatus, Sah and Kar(1979)..

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Early Eocene,(Naredi Formation),Kutch (Kar,1978); Paleocene (Matanomadh Formation) Kutch (Saexna,1979a); Middle-Late Eocene, Rataria Kutch (Kar and Saxena,1981); Paleocene-Eocene, Matanomadh (Naredi and Harudi formations), Near Baranda Kutch (Kar, 1985); Oligocene, Ambalapuzha borehole, Kerala (Raha et al.,1987).

Striacolporites cephalus Sah and Kar

pl.17, figs.20,21.

1979 Striacolporites cephalus Sah and Kar, p.136,pl.2,figs.68-69.

Description : Pollen grains subcircular in polar view, 38.4x39.6 µm,tricolporate,

colpi medium sized. Exine striatoreticulate.

Principal Material Studied : BDG-1,2885-2890 m, slide no.2,104.3/44.2.

Remarks : The specimens studied here are smaller in size than those originally described by Sah and Kar (1979) from the (Naredi Formation), Lower Eocene, Kutch.

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Early Eocene (Naredi Formation),Kutch District,Gujarat (Kar, 1978) ; Paleocene (Matanomadh Formation), Kutch District Gujarat (Saxena, 1979a); Middle-Late Eocene, Kutch District, Gujarat (Kar and Saxena,1981); Paleocene Eocene (Matanomadh, Nardi and Harudi formations), Kutch District, Gujarat, (Kar, 1985); Eocene (Mayanad Formation) Alleppey District, Kerala (Raha et al., 1986b).

Genus : Striatopollis Krutzch 1959b

Type species: Striatopollis sarstedtensis Krutzch 1959

Striatopollis bellus Salard Cheboldaeff

pl.18, figs.1,2

1977 Striatopollis bellus Salard-Cheboldaeff in Venkatachala and Rawat, 1972, p.302, pl.2, fig.25.

Description : Oval in equatorial view, 22.8-37.2x38.4-48 µm, tricolporate, exine striatoreticulate.

Principal Material Studied :BDG-1, 2650-2655 m, slide no.1,coordinates 102.8/35.

Remarks : It is similar to striatopollis bellus, salard-Cheboldaeff(1977).

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin, (Venkatachala and Rawat, 1973a); Middle to Late Eocene, West Godhavari district, (Venkatachala and Sharma ,1984); Early Miocene, (Boldamgiri Formation), Garohills, Meghalaya (Nandi and Sharma, 1984).

Genus : Zoncostites Germeraad, Hopping and Muller 1968

Type species: Zonocostites ramonae Germeraad, Hoping and Muller 1968

Zonocostites ramonae Germeraad et al.

pl.18, figs.4,5,6, pl.19, fig.5

1968 Zonocostites ramonae Germeraad et al.,in Venkatachala and Rawat, p.248, pl.5, fig.6.

Description : Pollen grains oval in equatorial view, 25.2x30 µm, tricolporate, well developed equatorial zonorate bands,exine thin,psilate.

Principal Material Studied : BDG-1, 2295-2300 m,slide no.3,coordinates 103.2/43.4.

Remarks : The present specimen is identical to Zonocostites ramonae Germeraad et al.,(1968).

Botanical Affinity : Rhizophoraceae.

Previously Reported Occurrence : Eocene, Neyveli lignite, Tamilnadu (Venkatachala, 1973); Oligocene-Miocene, (Cauvery Basin) Tamilnadu (Venkatachala and Rawat, 1973a); Early Eocene, (Kadi Formation) Cambay Basin (Rawat et al.,1977); Paleocene-Miocene, West Godavari,Andhra Pradesh (Venkatachala and Sharma, 1984).

Genus : Sastripollenites Venkat.and Kar 1968

Type species: Sastripollenites trilobatus Venkatachala and Kar 1968

Sastripollenites sp.cf.S.trilobatus Venkatachala and Kar

pl.18, figs.7,8

1968 Sastripollenites trilobatus ,Venkatachala and Kar,p. 169, pl.3, figs. 68-69.

Description : Pollen grains, trilobed, 50.4x52.8 µm, tricolporate, colpi long well developed margocolpate, ora district, lolongate, exine about 2.4 µm thick, intrabaculate, appearing finely reticulate in surface view.

Principal Material Studied : BDP-1, 3890-3895 m, slide no.1,coordinates 62.4/100.

Remarks : The present species closely resembles to Sastripollenites trilobatus Venkatachala and Kar (1968) originally described from the Tertiary sediments of Kutch but it differs in having a bigger size.

Botanical Affinity : Not known.

Previously Reported Occurrence : Early Eocene (Naredi Foramtion), Kutch District, Gujarat (Venkatachala and Kar, Kar,1978); Early Eocene (Naredi Formation) Kutch District, Gujarat (Raha et al.,Kar 1985); Eocene (Mayyanad Formation), Alleppey District, Kerala (Raha et al.,1986b); Paleocene,Khasi hills, Meghalaya (Kar and Kumar, 1986).

Tricolporites sp.1

pl.18, fig.9

Description : Pollen grain subcircular in polar view,50.4x55.2 µm, tricolporate, brevicolpate, colpi surrounded by wide margo. Exine about 3.6 µm thick, finely reticulate.

Principal Material Studied : BDG-2,CC-4 (2821-2839 m), 1215-1220 cm, slide no.4, coordinates 94.7/59.5.

Botanical Affinity : Unknown.

Tricolporites sp.2

pl.18, fig.10

Description : Pollen grains broadly triangular with convex amb, in polar view , 37.2x38.4 um, tricolporate. Exine 1.2 µm thick granulate.

Principal Material Studied : BDG-1, 2830-2835 m, slide no.3,coordinates 98.5/60.4.

Remarks : The present specimen recorded here differs from type species in having a bigger size.

Botanical Affinity : Unknown.

Tricolporites sp.3

pl.18, fig.12

Description : Pollen grains with roundly triangular amb in polar view , 26.4 x 27.6 µm, tricolporate, brevicolpate, colpi 2.4µm deep, tapering towards poles, pores thickened. Exine less than 1 µm thick, psilate.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.3, coordinates 107.7/55.9

Botanical Affinity : Unknown.

Genus : Sapotaceoidaepollenites Pot. Thoms. and Thierg. 1950

Type species : Sapotaceoidaepollenites manifestus (Pot) Pot. Thoms. and Thierg. 1950

Sapotaceoidaepollenites sp.

pl.18, fig.13

Description : Pollen grain oval in equatorial view 32.4 x 54 um, tricolporate, colpi long but not reaching poles, ora lalongate, exine about 2.4 um thick, tectate, exine thicker than nexine.

Principal Material Studied : BDG-1, 2675-2680 m, slide no.3, coordiantes 95/60.8.

Remarks : The present species differs in having a bigger size than thetype species.

Botanical Affinity : Sapotaceae.

Tricolporites sp. 4

pl. 18, fig. 14

Description : Pollen grains with roundly triangular amb in polar view, 28.8 x 30 µm thick, Tricolporates, colpi 9.6 µm deep. Exine less than 1 µm thick, granulate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.1, coordinates 95.6/60.

Botanical Affinity : Unknown.

Tricolporites sp.5

pl.18, fig.15

Description : Pollen grain roundly triangular, 45.6x45.6 µm, tricolporate, colpi distinct, ora lolongate, exine 3.6 µm thick, sexine thicker than nexine, tectate, surface foveoreticulate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m), 1271-1272 cm, slide no.1, coordiantes 95/44.8.

Botanical Affinity : Unknown.

Tricolporites sp. 6

pl.23, fig.6

Description : Pollen grains broadly triangular in polar view, tricolporate, 38.2 x 40.3 µm, colpi distinct, wide in the equatorial region, ora not clearly visible due to bad preservation, exine 1.2 µm thick, reticulate.

Principal Material Studied : BDPJ-1, 1510-1515 m,slide no.3,coordinates 108.6/35.8

Botanical Affinity : Uncertain.

Genus : Dermatobrevicolporites Kar 1985

Type species: Dermatobrevicolporites (Triorites) dermatus (Sah and Kar) comb.nov .1985

Dermatobrevicolporites exaltus Kar

pl.23, fig.8

1985 Dermatobrevicolporites exaltus Kar p.90,pl.15,figs.11-12.

Description : Pollen grains subtriangular in polar view,40.8x40.8 µm,tricolporate, brevicolpate, pore distinct, margin thickened,4.8 µm diameter, exine 3.6 µm thick, psilate.

Principal Material Studied : BDG-2,CC-12 (2967-2984), 515-516 cm,slide no.4, coordinates 107/37.3.

Remarks : Sah and Kar (1970) described the same specimen as Genus Triorites. The same specimen was reinvestigated by Kar (1985) and it was renamed as Genus Dermatobrevicolporites by him. The specimen described here slightly differs in size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Early Eocene (Naredi Formation), Near Baranda, Kutch (Kar, 1985); Eocene, borehole near Ambalapuzha, Alleppey District, Kerala (Raha et al., 1986a).

Genus : Favitricolporites Sah 1967

Type species : Favitricolporites eminaens Sah 1967

Favitricolporites sp.cf.F.magnus Sah

pl.19, fig.6

1967 Favitricolporites magnus Sah in Venkatachala and Rawat,1972, p.311,pl.3, fig.9.

Description : Pollen grains roundly triangular in polar view, 22.8x22.6 µm, colpi moderately wide at the equator, ends acute, ora broadly circular, exine less than 1 µm thick, granulate, grana arranged to form somewhat an irregular reticulation on the surface.

Principal Material Studied : BDG-1, 4060-4065 m, slide no.2,coordinates 110.5/41.4

Remarks : The specimens described here is close to Favitricolporites magnus Sah (1967)but they differ from the later in having smaller size.

Botanical Affinity : ? Rubiaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat, 1972); Late Eocene, West Godavari District,Andhra Pradesh (Venkatachala and Sharma, 1984); Eocene, Nala Sections around Yinkiong and Dalbuing East Siang District, Arunachal Pradesh (Prasad and Dey,1986).

Favitricolporites sp.cf.F.grandis

pl.19, fig.14

1972 Favitricolporites grandis Venkatachala and Rawat, p.310, pl.3,fig.3.

Description : Pollen grains roundly triangular in polar view, 55.2x60µm, colpi short, pore circular, pore margin slightly thickened ,Exine 3.6 µm thick, tectate, surface finely reticulate.

Principal Material Studied : BDG-2,CC-6 (2856.60-2874.60 m) 300-302 cm, slide no.3, coordinates 101/69.5.

Remarks : The specimen closely resembles to Favitricolporites grandis Venkatachala and Rawat (1972) but slightly differs in its exine ornamentation.

Botanical Affinity : ? Rubiaceae.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat, 1972).

Genus : Favitricolporites Sah 1967

Type species: Favitricolporites eminens Shah 1967

Favitricolporites sp.1

pl. 24, fig. 1

Description : Pollen grains roundly triangular in polar view, 44.4 x 45.6 um, tricolporate, colpi 8.4 um deep in poler view, pore rounded with thickened margin. Exine 2.4 um thick, tectate, surface distinctly reticulate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.60 m), 1271-1272 um, coordinates 95.2/44.9.

Remarks : This species closely comparable to Favitricolporites grandis Venkatachala and Rawat (1972). However, it differs from the later by having a smaller size and exine thickness.

Botanical Affinity : ? Rubiaceae.

Favitricolporites sp.2

pl.23, fig.7

Description : Pollen grain broadly triangular in polar view, 30x31.2 um, tricol-

porate, colpi short, pore not clearly visible, exine 1.2 um, thick, surface reticulate, lumina irregular in shape and size.

Principal Material Studied : BDG-1, 2975-2980 m, slide no.2,coordinates 95.2/46.5.

Remarks : Favitricolporites magnus Sah (1967) is comparable to the present species but differs from later by its smaller size.

Botanical Affinity : ? Rubiaceae.

Genus : Retitricolporites Vander Hammen and Wigmstra

Retitricolporites sp.

pl.19, fig.13

Description : Pollen grains roundly triangular in polar view, 26.4x27.6 µm, tricolporate, colpi upto 8.4 µm deep, slightly thickened, exine 3.6 µm thick, sexine thicker than nexine, reticulate.

Principal Material Studied : BDG-1, 2305-2310 m, slide no.2,coordinates 109/70.5.

Remarks : The specimen recorded here resembles to Retitricolporites crassioratus Rao and Ramanujam (1982) but it differs from the later in having smaller size and slightly thickened exine.

Botanical Affinity : Uncertain.

Genus : Intragranulitricolporites Kedves 1978

Intragranulitricolporites sp.

pl.18, figs.16,17

Description : Pollen grain elliptical in equatorial view, 19.2x28.8 μm, tricolporate, pores are circular, thickened, colpi long, reaching almost to the pole, the outer colpi are parallel to the outline, curved into an arch. Exine less than 1 μm thick, intragranulate.

Principal Material Studied : BDG-1, 1640-1645 m, slide no.2, coordinates 104/52.3.

Remarks : The present species resembles to Intragranulitricolporites indicus Mathur and Chopra (1987) but differs in having a smaller size and morphological characters.

Botanical Affinity : Unknown.

Tricolporites sp. 7

pl. 23, fig. 5

Description : Pollen grain roundly triangular in polar view, tricolporate, 36x37.2 μm, colpi distinct fairly wide in the equatorial region, tapering gradually towards the poles, 12 μm deep in the polar view, nearly reaching the pole area, ora lolongate. Exine 1.2 μm thick finely reticulate.

Principal Material Studied : BDG-1, 3185-3190 m, slide no.1, coordiantes 98/60.5.

Botanical Affinity : Uncertain.

Genus : Tricolporopilites Kar 1985

Type species: Tricolporopilites robustus (Kar and Saxena)Kar,1985

Tricolporopilites sp.8

pl.23, fig.12

Description : Pollen grain subcircular in polar view, 35.2x36.3 µm, tricolporate, colpi short, pore well developed, margin thickened. Exine 2.4 µm thick, coarsely reticulate.

Principal Material Studied : BDG-1, 2245-2250 m,slide no.3, coordinates 104.2/44.6

Remarks : The specimen included here under the genus Tricolporopilites Kar, 1985 resembles closely Tricolporopilites robustus (Kar and Saxena) Kar (1985)but differs in having coarsely reticulate exine.

Botanical Affinity : Uncertain.

Genus : Psilatricolporites V.D.Ham. 1956

Type species: Psilatricolporites operculatus V.D.Ham.and Wijm.,1964

Psilatricolporites sp.cf.P.operculatus Van der Hammen and Wijm.

pl.19, fig.8

1964 Psilatricolporites operculatus, V.D.Ham.and Wijm.,pl.1,fig.13.

Description : Pollen grain oval in equatorial view, 24 x 28.8 µm in size, tricolporate, colpi long not reached the pole. Exine 1.2 µm, thick, psilate.

Principal Material Studied : BDG-1,2205-2210 m, slide no.1,coordinates 108/41.7.

Remarks : The present species closely resembles to Psilatricolporites operculatus Vander Ham.and Wijm,(1964) but differs from later having a smaller size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin (Venkatachala and Rawat, 1972); Middle to Late Eocene, West Godavari,Andhra Pradesh (Venkatachala and Sharma, 1984); Micoene, Warkali beds, Kerala (Ramanujam,1987).

Subturma : Dicolporites (Erdtman) v.d.Ham. 1956.

Infraturma : Subprolati infraturma Venkat.and Kar 1969

Genus : Umbelliferoipollenites Venkat. and Kar - 1969

Type species: Umbelliferoipollenites ovatus, Venkat.and Kar 1969

Umbelliferoipollenites ovatus Venkat.and Kar 1969

pl.18, figs. 20,21.

1969 Umbelliferoipollenites ovatus Venkatchala and Kar,p.165,pl.2,figs.29-32.

Description : Pollen grains oval in shape, with equally broad lateral ends, 19.2 x 37.2µm, colpi two in number, distinct, parallel to each other, pores two in number placed in the middle of the colpus, lolongate. Exine ± 2.4 µm thick, exine thicker than nexine.

Principal Material Studied : BDG-2, CC-4, (2821-2839 m) 1215-1220 cm,slide no.4, coordinates 106.2/54.

Remarks : The present specimen recorded here is identical to Umbelliferoipollenites ovatus Venkatachala and Kar(1969).

Botnical Affinity : Umbelliferae.

Previously Reported Occurrence : Paleocene-Eocene, Kuar Bet Hill Point 113; Kutch (Mathur, 1972); Paleocene-Eocene, Kutch District (Mathur and Pant, 1973); Early Eocene (Kadi Formation), Cambay Basin (Rawat et al.,1977); Early Eocene, (Naredi Formation) Kutch (Kar, 1978); Middle to Late Eocene, near Rataria, Kutch (Kar and Saxena, 1981); Eocene (Naredi and Harudi formations), near Matano-

madh, Kutch (Kar, 1985), Miocene, Tonakkal clay mine, Trivendrum, Kerala (Verma, et al.,1986).

Gernus : Plumbaginacipites Navale and Misra 1979

Types species: Plumbaginacipites neyvelii Navale and Misra 1979

Plumbaginacipites sp.cf.P.neyvelii Navale and Misra

pl.19, fig. 3

1979 Plumbaginacipites neyvelii Navale and Misra, p.227, pl.1, fig.4-6.

Description : Pollen grain subcircular in equatorial view, 58.8 µm in size, tricolpate, colpi long and do not reach the poles. Exine 3.5 µm thick, sexine thicker than nexine with distinct rod layer, rods are long papilate with showing micro-granulate pattern on surface with minor folds.

Principal Material Studied : BDG-1,2215-2220 m, slide no.1,coordinates 108.2/59.9.

Remarks : The present species closely comparable to Plumbaginacipites neyvelii Navale and Misra (1979)but differs in having a smaller size and minor folds.

Previously Reported Occurrence : Miocene, Neyveli lignite, Tamilnadu (Navale and Misra,1979); Pleistocene, Bengal Basin (Mathur and Chopra, 1987).

Genus : Bombacacidites bombaxoides Couper 1960.

Bombacacidites sp.cf.Bombacacidites inausus Venkatachala and Rawat 1973.

pl.19, fig.4

1973 Bombacacidites inausus Venkatachala and Rawat, p.245,pl.4,fig.14.

Description : Pollen grains broadly triangular in polar view,30 µm, tricolporate, amb trilobate, lobes not elongated, colpi short, situated midway between sides. Exine less than 1 µm thick, reticulate, reticulum broader in middle and shorter in apices.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.4,coordinates 98.7/49.8

Remarks : The present species is closely comparable to Bombacacidites inausus Venkatachala and Rawat (1973)but differs from later in having a smaller size and less elongated lobes.

Botanical Affinity : Bombacaceae.

Previously Reported Occurrence : Oligocene-Miocene, Cauvery Basin (Venkatachala and Rawat,1973).

Genus : Triatriopollenites pflug in Thomson and pflug 1953

Triatriopollenites sp.cf.T.bengalensis Mathur and Chopra

pl.19, fig.11

1987 Triatriopollenites bengalensis Mathur and Chopra,p.125,pl.4,fig.80.

Description : Pollen grains triporate, amb rounded triangular, anguloaperaturate, 27.6x28.8 µm, pollen with atrium and annulus, exine less than 1 µm thick, reticulate.

Principal Material Studied : BDG-2,CC-5 (2839-2856.60 m) 970-975 cm, slide no.4, coordinates 100.1/62.3.

Remarks : The present specimen is closely comparable to Triatriopollenites bengalensis Mathur and Chopra (1987) but it differs from later in having a smaller size and reticulate exine sculpture.

Botanical Affinity : Unknown.

Previous Recorded Occurrence : Middle-Late Miocene, Bengal Basin, West Bengal (Mathur and Chopra,1987).

Genus : Maculoporites Venkatachala and Rawat 1973

Type species: Maculoporites reticulatus Venkatachala and Rawat 1973

Maculoporites sp.cf.M.reticulatus Venkatachala and Rawat

pl.19, fig.2

1973 Maculoporites reticulatus Venkatachala and Rawat,p.253,pl.5,fig.28

Description : Pollen grains isopolar, amb rounded,triangular, sides convex, 34.8x 36 µm, triporate, pores distinct with conspicuous anuli, exine 2.4 µm, thick, finely reticulate.

Principal Material Studied : BDG-2,CC-8,(2892.60-2910.60 m)1100-1105 cm, slide no.1, coordinates 109/57.8.

Remarks : The present specimen is closely comparable to Maculoporites reticulatus Venkat.and Rawat (1973) however, it is having a slightly bigger size and thick exine.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Oligocene-Miocene, Cauvery Basin (Venkatachala and Rawat, 1973).

Genus : Tricolporopollis Dutta and Sah 1970

Type species: Tricolporopollis decoris Dutta and Sah 1970

Tricolporopollis sp.1

pl.16, fig.12

Description : Pollen grains spheroidal, 56.4x66 µm, folded, tricolporate, brevicoplate, pores distinct with thickened margin,pore diameter 12 x 15.6 µm,exine 1.2 µm thick, psilate, surface finely granulate.

Principal Material Studied : BDG-2,CC-4 (2821-2834 m), 843-845 cm, slide no.2, coordinates 104.7/59.6.

Remarks : The specimen described here differs from Tricolporopollis decoris Dutta and Sah (1970) in having a bigger size and finely granulate exine ornamentation.

Botanical Affinity : Euphorbiaceae.

Turma : Porosa (Naumova) Potonie 1960

Subturma : Triporines Naumova 1960 emend.Potonie 1960

Genus : Triporopollenites Pflug and Thomson 1953

Triporopollenites sp.2

pl.19, fig.7

Description : Pollen grain roundly subtriangular in polar view, 38.4 x 39.6µm, triporate, spore margin thickened, exine ± 1.2 µm thick, sparsely verrucate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.1,coordinates 103.7/38.3

Remarks : Triporopollenites robustus Kar and Jain (1983) described from the Edvai, Kerala coast is distinguished from the present species by its verrucate exine and slightly smaller size.

Botanical Affinity : Uncertain.

Triporopollenites sp.1

pl.19, fig.1

Description : Pollen grains subtriangular in polar view, 39.6x43.2 µm, triporate, pore margin thickened, exine 2 µm thick, laevigate.

Principal Material Studied : BDG-1, 4040-4045 m, slide no.2,coordinates 111.6/53.

Remarks : The present species described here differs from Triporopollenites robustus Kar and Jain (1981) by its smaller size and less thickened exine.

Botanical Affinity : Uncertain.

Genus : Angulocolporites Kar 1985.

Type species: Angulocolporites microreticulatus, Kar 1985

Angulocolporites sp.cf.A.microreticulatus Kar

pl.24, fig.4

1985 Angulocolporites microreticulatus p.59, 76, pl.16, fig.3, 6-9.

Description : Pollen grain triangular in polar view, 34.8 x 37.2 µm, tricolporate, anguloaperturate, colpi long upto 14.4µ m, funnel shaped, margin considerably thickened, pore generally indistinct. Exine 2.4 µm thick, sexine thicker than nexine, laevigate and microreticulate.

Principal Material Studied : BDG-1, 4080-4085 m, slide no.1, coordinates 110/59.5.

Remarks : The present specimen is closely comparable to Angulocolporites microreticulatus Kar (1985).

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Early Eocene (Naredi Formation), Kutch District, Gujarat (Kar, 1985).

Genus : Triangulorites Kar 1985

Type species: Triangulorites bellus (Sah and Kar) comb.Kar 1985.

Triangulorites sp.

pl.25, fig.10.

Description : Pollen grains triangular with radiating arms in polar view, 80.4 x 69.4 µm, margin convex, tetraorate, ora circular measuring 6 µm diameter, length of arms about 13.2 µm. Exine 1.2 µm thick, granulate.

Remarks : The specimen resembles to Triangulorites bellus Kar (1985) but it differs from the later in possessing tetraorate.

Botonical Affinity : Uncertain.

Genus : Ghoshiacolpites Sah and Kar 1970.

Type species: Ghoshiacolpites globatus Sah and Kar 1970.

Ghosiacolpites sp.cf.G.globatus Sah and Kar

pl.23, fig.1

1970 Ghoshiacolpites globatus Sah and Kar, p.134,pl.2, fig.31.

Description : Pollen grains subcircular in polar view, 39.6x28.2 µm, hexacolpate, Mesocolpia thickened to form star shaped appearance. Star shaped appearance not clearly visible due to bad preservation. Exine 2.4 µm thick, laevigate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 um), 970-975 cm, slide no.4, coordinates 103.1/54.5.

Remarks : The present specimen is closely comparable to Ghosiacolpites globatus Sah and Kar (1970), but it differs from the later in having a smaller size and in other morphological characters.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Early Eocene (Naredi Formation), Kutch District, Gujarat State (Kar,1978); Paleocene (Matanomadh Formation), Kutch District, Gujarat (Saxena, 1979a); Paleocene-Early Eocene (Matanomadh and Naredi formations), Kutch District, Gujarat (Kar,1985); Oligocene, Barail group, Assam and Meghalaya (Singh et al.,1985)

Genus : Ghoshiadites Nandi 1981

Type species: Ghosiadites reticulatus Nandi 1981

Ghosiadites sp.cf G.reticulatus Nandi

pl.16, figs. 1,6

1981 Ghoshiadites reticulatus Nandi pp.33-34, pl.2,fig.47.

Description : Pollen grains spheroidal in polar view, 49.2-50.4 x 51.6-56.4 µm in size, tricolporate, colpi 15.6 µm deep, pore large, lalongate. Exine ± 3.6 µm thick, sexine thicker than nexine, reticulate and simply baculate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.3,coordinates 101.4/44.6

Remarks : The present specimen is closely comparable with Ghoshiadites reticulatus Nandi (1981) but it differs from the later in having a smaller size and different morphological characters.

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Neogene, Moran and Nahorkatiya wells, Assam (Nandi,1981)

Genus : Tiliaepollenites (Potonie) Potonie and Venitz 1934

Type species: Tiliaepollenites instructus (Potonie) Potonie and Venitz 1934

Tiliaepollenites sp.

pl.16, fig.3

Description : Pollen grains trizonocolporate, roundly triangular in polar view, 34.8 x 38.4 µm, colpi short, ends acute, ora ± circular margin thickened, exine 1.2 µm thick and coarsely reticulate.

Principal Material Studied : BDG-1, 2885-2890 m, slide no.1,coordinates 109/64.4.

Remarks : These specimens are distinguished from the other known species by having a coarsely reticulate exine.

Botanical Affinity : Tiliaceae.

Genus : Meliapollis Sah and Kar 1970

Type species: Meliapollis ramanujamii Sah and Kar 1970,

Meliapollis sp.cf.M.quadrangularis (Ramanujam) Sah and Kar

pl.16, fig. 7.

1979 Meliapollis quadrangularis (Ramanujam) Sah and Kar in Saxena, p.136,pl.3, fig. 48.

Description : Pollen grains quadrangular in polar view, 37.2x38.4 µm, tetrazonicolporate, colpi 13.2 µm deep, tenuimarginate, ends acute, ora lolongate with thickened margin, exine 2.4 µm thick, sexine thicker than nexine, tectate, columellae not distinct, surface psilate, weakly intrastructured.

Principal Material Studied : BDG-2, CC-7 (2874.60-2892.60 m) 600-602 m, slide no.2, coordinates 105/64.8.

Remarks : The present species described here is closely comparable to Meliapollis quadrangularis Sah and Kar (1970).

Botanical Affinity : Meliaceae.

Previously Reproted Occurrence : Early Eocene (Naredi Formation), Kutch District, Gujarat(Kar, 1978); Paleocene (Matanomadh Formation), Kutch District, Gujarat, (Saxsena,1979a), Miocene, Ratnagiri District, Maharashtra.

(Phadtare and Kulkarni, 1984b); Paleocene-Early Eocene (Matanomadh and Naredi foramtions), Kutch District, Gujarat (Kar, 1985); Eocene (Mayyanad Formation), Alleppey District, Kerala (Raha et al.,1986b); Paleocene - Eocene (Neyveli Formation), Neyveli, South Arcot District, Tamilnadu (Sidhanta,1986).

Meliapollis sp.1

pl.16, fig. 4.

Description : Pollen grain subrectangular, 32.4x33.6 µm, tetracolporate, brevicolpate, pore circular lolongate margin thickened, exine 1.2 µm thick, granulate.

Principal Material Studied : BDG-1, 2305-2310 m, slide no.2,coordinates 106.3/55.8

Remarks : The specimen recorded in the present study is smaller in size and exine shows granular ornamentation as compared to type species Meliapollis ramanujamii Sah, Kar and Saxena (1979).

Botanical Affinity : Meliaceae.

Meliapollis sp.cf.M.navalei

pl.16, fig.8

1970 Meliapollis navalei Sah and Kar, p.47, pl.14, fig.13.

Description : Pollen grain subcircular, 38.4 x 43.2 µm, pentacolporate, colpi 13.2 µm deep, pore distinct with thickened margin, exine 1.2 µm thick, sexine thicker than nexine tectate, finely reticulate.

Principal Material Studied : BDG-2, CC-8 (2892.60-2910.50 um), 437-439 cm, slide no.4, coordinates 68.6/99.

Remarks : The specimen described here is closely comparable to Meliapollis navalei Sah and Kar (1970) but slightly differs from the later in having smaller size and longer colpi.

Botanical Affinity : Meliaceae.

Previously Reported Occurrence : Early Eocene (Naredi Formation), Kutch District, Gujarat State · Kar,1978); Paleocene (Matanomadh Formation), Kutch District, Gujarat (Saxena, 1979a); Miocene (Neyveli lignite), Neyveli lignite field, South Arcot District, Tamilnadu (Navale and Misra, 1979); Paleocene-Early Eocene (Matanomadh and Naredi formations), Kutch District, Gujarat (Kar, 1985); Paleocene, Khasi Hills, Meghalaya (Kar and Kumar, 1986).

Meliapollis sp.2

pl.16, fig.5

Description : Pollen grain subcircular in polar view, 31.2x36 µm, pentacolporate, brevicolpate, pore distinct with thickened margin, exine 1.2 µm thick, finely granulate.

Principal Material Studied : BDG-2,CC-7 (2874.60-2892.60 m), 500-502 cm, slide no.2, coordinates 96.4/70.8.

Remarks : Present specimen described here differs in having a smaller size and brevicolpate compared to Meliapollis navalei Sah and Kar (1970).

Botanical Affinity : Meliaceae.

Meliapollis sp.cf.M.ramanujamii

pl.23, fig.4

Description : Pollen grains 4 zonocolporates, broadly subcircular in polar view, 30.5x34.2 µm, tetracolporate, colpi short, wide at the equator, tenuimarginate, ora lolongate with thickened margin. Exine about 1.2 µm thick, granulate.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m), 843-845 cm, slide no.1, coordinates 110.7/40.9.

Remarks : The specimen is closely comparable to Meliapollis ramanujamii but it differs from the later in having a smaller size.

Botanical Affinity : Meliaceae.

Previously Reported Occurrence : Early Eocene,(Palana lignite), Palana,Bikaner, Rajasthan (Sah and Kar,1974); Paleocene, Garo Hills, Meghalaya (Singh et al., (1976); Early Eocene (Naredi Formation), Kutch District,Gujarat (Kar,1978); Paleocene (Matanomadh Formation), Kutch District, Gujarat (Saxena,1979a); Miocene (Neyveli lignite), South Arcot District, Tamilnadu (Navale and Misra,1979); Oligocene (Barail Group) Assam and Meghalaya (Singh et al.,1985); Paleocene (Palana

Formation) Bikaner District, Rajasthan (Singh and Dogra, 1988).

Genus : Kindopollis Mathur and Jain 1980

Type species: Kindopollis magnificus Mathur and Jain 1980

Kindopollis sp.cf.K.decoris Mathur and Chopra

pl.19, fig.9.

1987 Kindopollis decoris Mathur and Chopra, p.134, pl.6, fig.125

Description : Pollen grains oval in equatorial view, 26.4x32.4 µm, tetracolporate, colpi short, almost confined to the thick equatorial band, pores distinct, lolongate, exine less than 1 µm thick, finely granulate.

Principal Material Studied :BDG-3,CC-7(2874.6-2892.6 m) 600-602 cm, slide no.1, coordinates 106.2/58.4.

Remarks : The present species recorded here is closely comparable to 'Kindopollis decoris Mathur and Chopra (1987) but it differs from later in having a slightly bigger size.

Botanical Affinity : ? Sapotaceae.

Previously Reported Occurence : Middle Eocene, Bengal Basin, West Bengal (Mathur and Chopra,1987).

Genus : Subtriporopollis Sah 1967

Type species: Subtriporopollis tenuis Sah 1967

Subtriporopollis sp.2

pl.24, fig.10

Description : Pollen grain subspherical in shape, triporate, diameter 33.6 x 39.6 μm, pores distinct, subcircular in shape, measuring 6 μm in diameter with thickened margin, spines simple 2•4 μm in length, without bulbous base, sparsely distributed, exine surface between the spines granulate.

Principal Material Studied : BDG-1, 2240-2245 m, slide no.1, coordinates 102/57.7.

Remarks : The specimen recorded here is distinguished from other known species of the genus by having a different exine characters.

Botanical Affinity : Unknown.

Subtriporopollis sp.cf.S.reticulata Dutta and Sah

pl.16, fig.10.

1968 Subtriporopollis reticulata Dutta and Saha, p.50, pl.8, figs.25-26.

Description : Pollen grains subcircular 51.2x52.8 μm, triporate, pores distinct, circular, diameter 9.6 x 10.8 μm with thickened margin exine ± 1.2 μm thick distinctly reticulate, reticulum formed of thick muri and various shape meshes appears foveoreticulate in surface.

Principal Material Studied : BDG-2, CC-11 (2946-2961.30 m), 203-204 m, slide

no.1, coordinates 95.3/54.2.

Remarks : The present specimen described here is having smaller size and foveo-reticulate sculpture in surface as compared to subtriporopollis reticulata Dutta and Sah (1967).

Botanical Affinity : Uncertain.

Previously Reported Occurrence : Cherra sandstone stage of the South Shillong Plateau, Assam (Dutta and Sah,1968).

Subtriporopollis sp.1

pl.16, fig.9, pl.24, fig.8

Description : Pollen grain subcircular, 32.4x37.2 μm, triporate, pores distinct, oval to subcircular in shape with thickened margin, pore diameter 3.6 x 7.2 μm, exine 1.2 μm thick, psilate.

Principal Material Studied : BDG-2, CC-7 (2874.6-2892.6 m), 600-602 m, slide no.2, coordinates 96/59.8.

Remarks : The present specimen described here differs from the other known species by its psilate exine.

Botanical Affinity : Uncertain.

Inaperturate

Genus : Retipollenites Gonzalez Guzman 1967

Retipollenites confusus Gonzalez Guzman

pl.19, figs. 15-18,

1967 Retipollenites confusus Gonzalez Guzman in Rawat et al.,1977,pl.3,figs. 108-109.

Description : Pollen grains broadly subspherical, 66-72x72-73.2 µm, inaperaturate, sexine broadly reticulate, meshes 9-14.4 µm, broad, forming subcircular, various shaped meshes, muri 2.4-3µm thick,displaying prominent attachment to the nexine, lumina 5-12 µm wide.

Principal Material Studied : BDG-1, 2845-2850 m, slide no.1,102.6/71.1.

Remarks : The species is identical with Retipollenites confusus, Gonzalez Guzman 1967 but it has slightly bigger size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Lower to Middle Eocene, Kutch (Kar 1985); Lower to Middle Eocene, Cambay Basin (Rawat et al.,1977).

Retipollenites sp.

pl.24, fig.11

Description : Pollen grains subspheroidal in shape, 50.4x51.6 um, inaperturate,

exine tectate, sexine coarsely reticulate, meshes various shaped, muri 2 µm thick, lumina 6 µm wide the reticulate pattern is loose to strictly adhered to the body.

Principal Material Studied : BDG-2, CC-4 (2821-2839m), 1215-1220 cm, slide no.2, coordinates 97/70.6.

Remarks : The specimen decribed here differs from Retipollenites confusus Gonzalez Guzman (1967) by its different morphological characters.

Botanical Affinity : Unknown.

Genus : Triangulorites Kar, 1985

Type species: Triangulorites bellus(Sah and Kar) Kar 1985

Triangulorites bellus Sah and Kar

pl.14, fig.17, pl.23, fig .13

1985 Triangulorites bellus(Sah and Kar), Kar 1985, pl.19, figs. 7,8.

Description : Pollen grain subtriangular in polar view, 54x56.4 µm, margin convex, triorate, ora present on radiating arms. Exine fairly thin, surface finely reticulate.

Principal Material Studied : BDG-1, 3145-3150m, slide no.3,coordianates101.4/41.

Remarks : Sah and Kar (1970) originally reported from (Naredi Formation), Lower Eocene, Kutch.

Botanical Affinity : ? Onagraceae.

Previously Reported Occurrence : Paleocene-Early Eocene (Matanomadh and Naredi formations), Kutch (Kar, 1985); Paleocene-Eocene (Neyveli Formation), Tamilnadu (Siddhanta, 1986a); Eocene, borehole near Ambalapuzha, Kerala (Raha et al.,1986a); Paleocene, Lakadong sandstone, Khasi Hills Meghalaya (Kar and Kumar, 1986); Lower Eocene, Rajasthan (Sah and Kar, 1974).

Turma : Porosa (Naumova) Pot. 1960

Subturma : Triporines Naumova 1969 emend. Pot. 1960

Genus : Proteacidites Cook ex.Coup. 1953

Type species: Proteacidites adenanthoides Cookson 1950

Proteacidites triangulus Kar and Jain

pl.14, fig.18

Description : Pollen grain triangular in polar view with slightly convex sides, 43.2x44.4 µm, triporate, pores distinct not protruding, margin not thickened. Exine 2.4 µm thick, reticulate, tegillate, sexine thicker than nexine, retipilate.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.1, coordinates 107.7/60.8.

Remarks : The present species recorded here is identical with Proteacidites triangulus Kar and Jain(1981).

Botanical Affinity : Proteaceae.

Previously Reported Occurrence : Neogene, around Quilon and Varkala, Kerala

(Kar and Jain, 1981), Eocene, Mayyanand Formation, Kerla (Raha et al.,1986b), Miocene, Tonakkal clay mine, Trivendrum, Kerala (Varma et al., 1986) .

Proteacidites retusus Anderson

pl. 14, fig. 19

1960 Proteacidites retusus Anderson in Rao and Ramanujam 1982,p.85,pl.4,fig.74.

Description : Pollen grain triangular in polar view, 21.6x22.8 um, triporate, pores distinct, margin thickened not protruding. Exine 1.2 um thick, retipilate.

Principal Material Studied : BDG-1, 3065-3070 m, slide no.2,coordinates 96.1/49.3.

Remarks : The present species is identical with Proteacidites retusus Anderson (1960).

Botanical Affinity : Proteaceae.

Previously Reported Occurrence : Miocene, Quilon Beds, Kerala (Rao and Ramanujam, 1982); Miocene,Ratnagiri Beds, Maharashtra (Phadtare and Kulkarni, 1984b); Late Eocene, Bengal Basin (Mathur and Chopra, 1987).

Triangulorites sp.

pl. 23, fig.10

Description : Pollen grains triangular with radiating arms in polar view, 80.4 x 69.4 um, margin convex, tetraorate, oracircular measuring 6 um diameter, length of arms about 13.2 um. Exine 1.2 um thick, granulate.

Remarks : The specimen resembles to Triangulorites bellus Kar 1985 but it differs in possessing tetraorate.

Botanical Affinity : Uncertain.

Infraturma : Sphaerozonisulcates Venkat.and Kar 1969

Subturma : Tryptyches (Naumova) Pot. 1960

Genus : Tricolpites (Erd tman, Cookson,Ro ss) Couper 1953

Type species: Tricolpites reticulatus Cookson 1947

Tricolpites sp.cf.T. fissilis Venkatachala and Rawat

pl.15, fig.1.

1960 Tricolpites fissilis Couper in Venkatachala and Rawat,1972, p.302,pl.2, fig.26-27.

Description : Pollen grain broadly triangular in polar view, sides straight to convex, 43.2x42 µm, tricolpate, colpi moderately long. Exine about 1.2 µm, thick, finely reticulate.

Principal Material Studied : BDG-1, 3090-3095 m,slide no.1,coordinates 98.7/59.7.

Remarks : The specimens recorded in this study are closely comparable to Tricolpites fissilis couper (1969) in size but they distinguished by having a longer colpi.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene-Eocene, Cauvery Basin, Tamilnadu (Venkatachala and Rawat, 1972).

Tricolpites sp.cf.T.crossisexinus Venkatachala and Rawat

pl.15, fig.4.

1973a Tricolpites crossisexinus Venkatachala and Rawat,p.244,pl.4,fig.9.

Description : Pollen broadly triangular in polar view, 40.8 µm, tricolpate, colpi moderartely long, prominant, wide in polar view. Exine upto 1.2 µm, thick, sexine thicker than nexine, finely reticulate.

Principal Material Studied : BDG-1, 3155-3160 m, slide no.2, coordinates 110.4/32.1

Remarks : The present species is closely comparable to Tricolpites sp.cf.T.crossisexinus but it differs from the later in having a bigger size and different morphological characters.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Oligocene - Miocene, Cauvery Basin, Tamilnadu (Venkatachala and Rawat, 1973a).

Tricolpites minor Sah

pl.15, figs.2,3

1967 Tricolpites minor Sah in Venkatachala 1973, pl.147, pl.1, fig.7.

Description : Pollen grains roundly triangular in polar view, 26.4 µm, tricolpate, colpi prominent, moderately long, exine about 1.2 µm thick, finely granulate.

Principal Material Studied : BDG-2, CC-5 (2839 - 2856.60 m), 970-975 cm, slide no.5, coordinates 110/58.6.

Remarks : The present specimen recorded here is identical with Tricolpites minor Sah(1967).

Botanical Affinity : Unknown.

Previously Reported Occurrence : Eocene, Neyveli lignite, Neyveli, Tamil Nadu, (Venkatachala, 1973); Oligocene, Barail Group, Assam and Meghalaya (Singh et al.,1985).

Tricolpites microreticulatus Belesky et al.

pl.15, fig.5

1965 Tricolpites microreticulatus Belesky et al.,in Venkatachala 1973, p.147.

Description : Pollen grains subcircular in polar view, 27.6x30 µm, tricolpate, colpi moderately long. Exine about 2.4 µm, thick, microreticulate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.2, coordinates 103.1/50.6

Remarks : Present speices recorded here is identical with Tricolpites microreticulatus Belesky et al.,1965.

Bottanical Affinity : Unknown.

Previously Reported Occurrence : Eocene, Neyveli lignite, Tamilnadu (Venkatachala 1973); Early Eocene, Kadi Formation, Cambay Basin (Rawat et al.,1977); Oligocene, Barail group, Assam (Singh et al.,1985).

Tricolpites sp.1

pl.15, fig.8

Description : Pollen grains roundly triangular in polar view, 44.4x49.2 µm, tricolpate, colpi long, 20 µm deep in polar view reaching almost to the poles. Exine 2.4 µm thick, reticulate.

Principal Material Studied : BDG-2, CC-4 (2821-2839 m), 1215-1220 cm, slide no.4, coordinates 52/108.3.

Remarks : The present specimen recorded here differs in having a smaller size in comparison with Tricolpites longicalpatus Venkatachala and Rawat (1972).

Botanical Affinity : Unknown.

Tricolpites sp.2

pl.15, fig.9

Description : Pollen grain broadly triangular with three lobes, 31.2 µm, tricolpate, colpi well developed. Exine 1.2 µm thick, scabrate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m), 970-975 cm, slide no.3, coordinates 108.6/66.3.

Botanical Affinity : Unknown.

Tricolpites sp.3

pl.15, fig.7

Description : Pollen grain broadly subcircular with three lobes, 37.2x38.4 µm, colpi long reaching almost to the poles. Exine about 2 µm thick, reticulate.

Principal Material Studied : BDG-2, CC-5 (2839-2856.60 m) 970-975 cm, slide no.4, coordinates 98/61.3.

Botanical Affinity : Unknown.

Genus : Pellicieroipollis Sah and Kar 1970

Type species: Pellicieroipollis langenheimii Sah and Kar 1970.

Pellicieroipollis langenheimii

pl.15, figs.6,10,11,12,13, pl.24, fig.2

1970 Pellicieroipollis langenheimii Sah and Kar,p.133,pl.2, figs.58-60.

Description : Pollen grains subtriangular in polar view, 55.2-64.8x56.4-68.4 µm, distinct, tricolporate, brevicolpate, pore distinct lolongate with thickened margin. Exine about 3.6 µm thick, tectate, bacula forming negative reticulum in surface view.

Principal Material Studied : BDG-2, CC-12 (2967-2984 m), 151-152 cm, slide no.1, coordinates 97.3./58.

Remarks : The present species recorded here is identical with Pellicieroipollis langenheimii Sah and Kar (1970).

Botanical Affinity : Alangium

Previously Reported Occurrence : Early Eocene (Naredi Formation), Kutch, Dist. Gujarat (Kar, 1978); Paleocene, Dras volcanics, near shergol, Ladakh (Mathur and Jain, 1980); Middle-Late Eocene, near Rataria, Kutch (Kar and Saxena, 1981);

Genus : Matanomadhianiasulcites Kar. 1985

Type species: Matanomadhianiasulcites maximus & Saxena

Matanomadniasulcites spcf.M.maximus

pl.7, fig. 9, 10

Description : Pollen grains elliptical in shape 590180x45-130 m monosulcate, sulcus distinct, broad almost extending upto lateral marginals. Exine retipilate-reticulate.

Principle Material Studied : BDG-2, CC-4 (2821-2839 m), 843-845 m, slide no.2, coodinates 106.7/72.6

Remarks : The present specimen recorded here closely comparable to Matanomadhiasulcites maximus (Saxena) Kar 1885 but differs in having a smaller size.

Botanical Affinity : Annonaceae.

Monocolpopollenites sp, pflug and Thomson

pl. 7, fig. 7

Description : Pollen grain oval with rounded lateral ends, 46.8 x 44.4 um, monosulcate, sulcus distinct narrow not reaching upto margins. Exine 1.2 um thick reticulate.

Principal Material Studied : BDG-2, CC-9, (2910-2928 m), 200-205 cm, slide no.2, coordinates 110.8/50.2.

Remarks : The present specimen recorded here differs from Monocolpopollenites bengalensis, Baksi and Deb (1980) in size and morphological characters.

Botonical Affinity : Uncertain.

Late Eocene (Kopili Formation), Jaintia Hills, Meghalaya (Trivedi, 1985); Early Eocene, Cambay Basin (Shanmukhappa, 1991).

Pellicieroipollis sp.cf.P.langenheimii Sah and Kar

pl.16, fig.2

1970 Pellicieroipollis langenheimii Sah and Kar.

Description : Pollen grains subcircular in polar view, 56.4x57.6 µm, tricolporate, brevicolpate, Pore rounded with thickened margin, exine 3.6 µm thick, tectate, bacula forming negative reticulum, reticulum irregular.

Principal Material Studied : BDG-2, CC-9 (2839-2856 m) 857-858 cm, slide no.1, coordinates 95.2/66.

Remarks : The present specimen is closely comparable to Pellicieroipollis langenheimii Sah and Kar (1970).

Botanical Affinity : Alangium.

Pellicieroipollis sp.

pl. 24, fig. 3, pl. 17, fig.1

Description : Pollen grains broadly triangular in polar view, sides convex, 50.4 x 54 µm, tricolporate, brevicolpate, pore lolongate with thickened margin. Exine 2.4 µm thick, punctate.

Remarks : The present species described here is closely comparable to Pellicieroipollis langenheimii Sah and Kar (1970) but varies in having a less thickness of exine with punctate sculpture.

4.1.3 GYMNOSPERMOUS POLLEN

Anteturma : Variegerminates Pot. 1970

Turma : Saccites Erdtman 1947

Infraturma : Podocarpidites Potonie, Thomson and Thiergart 1950

Type species: Podocarpidites ellipticus Cookson 1947

Podocarpidites sp.

pl.18, figs.18,19

Description : Pollen grains bisaccate, bilaterally symmetrical, 25.2x48µm, central body distinct, 20.4x24 µm, exine thin less than 1 µm, sacci, semicircular, 20.4x 22.8um, reticulate.

Principal Material Studied:BDG-2,CC-9 (2839-2856 m), 857-858cm,slide No.1,coordinates 100.8/37.2

Botanical Affinity : Podocarpaceae.

4.1.4 F U N G I

Genus : Fusiformisporites (Rouse) Elsik 1968

Type species: Fusiformisporites crabii Rouse 1960

Fusiformisporites sp.cf.F.keralensis Ramanujam and Rao

pl.20, figs.1,2

1978 Fusiformisporites keralensis Ramanujam and Rao, p.300,pl.3,fig.43.

Description : Spore inaperturate, fusiform, 56.4x21.5 µm, dicellate, transverse septate, septum conspicuous, two layered upto 6 µm thick, striate, striae are

longitudinal and numbering about ten on each side.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.1, coordinates 96.1/51.

Remarks : The species proposed here is closely comparable to Fusiformisporites keralensis (1978) but it differs from its size.

Botanical Affinity : Ascomycetes.

Genus : Diporisporites (Vander Hammen) Elsik 1968

Type species: Diporisporites elongated Vander Hammen 1954

Diporisporites sp.cf.D.conspicua Ramanujam and Rao

pl.20,figs.3,4,pl.21, fig.17

1978 Diporisporites conspicua Ramanujam and Rao, p.295,pl.1,fig.7.

Description : Spores diporate, elliptical, 48x27.6 µm. A single conspicuous pore present on each end of the spore along its vertical axis. Pores with thickened margin and distinct atria. Spore wall thin less than 1 µm, folded, surface punctate.

Principal Material Studied : BDG-1, 2235-2240 m, slide no.1,coordinates 96.2/45.1.

Remarks : The species proposed here is closely comparable to Diporisporites conspicua Ramanujam and Rao (1978) but it differs from the later in having punctate ornamentation.

Previously Reported Occurrence : Miocene, Kerala (Ramanujam and Rao, 1978); Micoene, Tonnakal Clay Mine,Trivendrum District, Kerala (Varma and Patil, 1985).

Fusiformisporites sp.

pl.20, fig.5

Description : Spores inaperturate, spindle shaped, 86.4x34.8 µm, hexacellate, transverse, septum conspicuous, two layered upto 4.8µm thick, spore wall less than 1 µm thick with very thin longitudinal striations, striae not continuous, ends up at the septum.

Principal Material Studied : BDPJ-1, 1670-1675 m,slide no.4,coordinates 103.2/31.8

Remarks : The specimen of Fusiformisporites sp.recorded in the present study are characterised by hexacellate with striated spore wall.

Botanical Affinity : Unknown.

Genus : Diporicellaesporites Elsik 1968

Type species: Diporicellaesporites stacyi Elsik 1968

Diporicellaesporites sp.1

pl.20, figs. 6,7

Description : Spores elongate, slightly curved, dicellate, 62.4x24 µm, spore wall less than 1 µm thick, psilate, septa distinct,1.2 µm thick with minor folds, cells of the either ends bluntly rounded with single septal pore. Pore simple broadly rounded.

Principal Material Studied : BDG-1, 2215-2220 m,slide no.1,coordinates 102.9/54.6.

Botanical Affinity : Unknown.

Diporicellaesporites pluricellus Kar and Saxena

pl.20, figs.8,9

1976 Diporicellaesporites pluricellus Kar and Saxena,pp.11-12, pl.3, figs.35,36.

Description : Fungal spores diporate, 8 to 10 celled,27.6-30x68.4-73.2 µm, ellipsoidal, transverse, septa straight to curved. A single pore at each end along long axis of spore. Spore wall less than 1 µm thick,psilate.

Principal Material Studied : BDG-1, 2675-2680 m, slide no.4,coordiantes 110.4/61.

Remarks : Kar and Saxena (1976) originally described from the Paleocene sediments of Kutch, Gujarat.

Previously Reported Occurrence : Paleocene (Matanomadh Formation), Matanomadh, Kutch District (Kar and Saxena, 1976); Miocene, Kerala (Ramanujam and Rao,1978); Neogene around Quilon and Varkala, Kerala (Jain and Kar, 1979); Miocene (Warkalli beds) Cannanore Distirct, Kerala (Ramanujam and Srisailam,1980); Neogene (Geabdat sandstone), Darjeeling District, West Bengal (Pathak and Banerjee,1984); Miocene, Tonakkal clay mine Trivendrum District, Kerala (Varma and Patil,1988, Varma,1987).

Diporicellaesporites sp.2

pl. 20, fig. 10

Description : Spores dicellate, diporate, barrel shaped, 37.2x56.4 µm, septa

distinct, 1.3 μm thick end of cells broadly rounded with single slit like septal pore. Pore simple and rounded.

Principal Material Studied : BDG-1, 2245-2250 m, slide no.3,coordinates 109.5/67.8

Botanical Affinity : Unknown.

Genus : Dicellaesporites (Elsik) Sheffy and Dilcher 1971

Type species: Dicellaesporites popovii Elsik 1968

Dicellaesporites sp.cf.D.popovii Elsik

pl.20, fig.11

1968 Dicellaesporites popovii Elsik, p.295, pl.1,fig.8.

Description : Spores inaperturate, dicellate, fusiform, 21.6x43.2 μm. Spore wall 1 μm thick, psilate, transverse septa distinct, 1.2 μm thick.

Principal Material Studied : BDG-1, 2650-2655 m,slide no.3,coordinates 108.4/49.3.

Remarks : This species is closely comparable to Dicellaesporites popovii Elsik (1968) but differs from later in having bigger size and fusiform shape.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Paleocene (Matanomadh Formation), Matanomadh, Kutch District, Gujarat (Kar and Saxena ,1976); Miocene, Kerala(Ramanujam and Rao,1978); Early Eocene (Deccan Intertrappean series) Kotta Bommuru near Rajmundry east Godavari District, Andhra Pradesh (Ambwani, 1982).

Genus : Circulisporites de Jers 1962

Type species: Circulisporites parvus de Jers 1962

Circulisporites sp.

pl.20, figs. 12, 13, 14, 15

Description : Spores circular to subcircular, 30x33.6 µm, inaperturarte, bearing concentric bands, concentric bands closely spaced. Body wall less than 1 µm thick, punctate.

Principal Material Studied : BDG-1, 2928-2930 m,slide no.1,coordiantes 99.5/49.2.

Botanical Affinity : Unknown.

Fungal spore type - A

pl.20, figs. 16,17 , pl.21, fig.14

Description : Tricelled fungal spore, nonaperturate 26.4x52.8 µm, triseptate, cells unequal size, basal cell dome shaped with pointed end. Apical cell hemispherical with broadly rounded end. Spore wall 1 µm thick, punctate.

Principal Material Studied : BDG-1,2278-2280 m, slide no.3,coordinates 108.2/56.7.

Genus : Phragmothyrites Edw.1922

Type species: Phragmothyrites eocaenica Edwards 1922

Phragmothyrites sp.cf.P.eocenica Edwards 1922

pl.20, figs. 18,19

1922 Phragmothyrites eocenica Edw. emend.Kar and Saxena, 1976,p.9,10,pl.3,fig.20.

Description : Perithecium subcircular in shape 74.4 μm, hyphae radially arranged, interconnected, forming pseudoparenchymatous tissue throughout the perithecium, cells are squarish to rectangular.

Principal Material Studied : BDG-1, 2675-2680 m,slide no.1,coordinates 107.5/56.2

Remarks : The present specimen is closely comparable to Phragmathyrites eocaenica Edw.(1922) but slightly differs in having a smaller size.

Botanical Affinity : Microthyriaceae.

Previously Reported Occurrence : Paleocene (Matanomadh Formation),Kutch District(Kar and Saxena,1976); Oligocene, (Maniyara Fort Formation), Kutch District (Kar,1979); Neogene, around Quilon and Varkala, Kerala (Jain and Kar,1979); Late Miocene-Pliocene (Siwalik Group Units B-C) Kameng District,Arunachal Pradesh(Dutta and Singh, 1980); Paleocene-Early Eocene (Mikir Formation), Garampani, North Cachar Hills, Assam (Mehrotra, 1983); Paleocene-Eocene (Neyveli Formation), Neyveli, south Arcot District, Tamilnadu (Siddhanta, 1986).

Parmathyrites sp.

pl.20, figs. 20,21,22

Description : Dimidiate, ascostromata with processes 42 μm, pseudoparenchymatus in middle region dark, non ostiolate, marginal cells spinose, spines radiating.

Principal Material Studied : BDG-1, 2255-2260 m,slide no.1,coordinates 97.8/69.3.

Botanical Affinity : Microthyriacae.

Genus : Notothyrites cookson 1947

Notothyrites sp.cf.N.padappakarensis

pl.21, fig.1

1970 Notothyrites padappakarensis Jain and Gupta, p.1, fig.3.

Description : Ascomata flattened, rounded, margin uneven, 56.4x60 µm, ostiolate, ostiola centric, cells are squarish to rectangular in shape, radially arranged.

Principal Material Studied : BDG-1,2675-2680 m,slide no.3,coordinates 108.7/67.

Remarks : Present species closely resembles to Notothyrites padappakarensis Jain and Gupta (1970) but differs in its size.

Botanical Affinity : Microthyriaceae.

Previously Reported Occurrence : Paleocene (Tura Formation), Garo Hills, Meghalaya (Kar et al., 1972).

Genus : Callimothallus Dilcher 1965

Callimothallus sp.

pl.21, fig.2

Description : Ascomata flattened, subcircular, margin denticulate, 36 x 37.2µm in diameter, nonostriolate, cells forming the ascomata radiating from angular central cell.

Principal Material Studied : BDG-1, 3175-3180 m, slide no.1,coordinates 96.2/57.1.

Remarks : The present specimen is closely comparable to Callimothallus assamicus kar et al.,(1972) but it differs from later in having a smaller size.

Fungal spore type-I

pl.21, fig.3

Description : Unicelled fungal spore, spindle shaped, inaperturate, 20.4x70.8 µm, spore wall less than 1 µm thick, psilate.

Principal Material Studied : BDG-1, 2255-2260 m, slide no.3,coordiantes 111.1/45.8

Botanical Affinity : Unknown.

Genus : Multicellaesporites (Elsik)Sheffy and Dilcher 1971

Type species: Multicellaesporites nortonii Elsik 1968

Multicellaesporites sp.

pl.21, fig. 18

Description : Fungal spores, 6 celled, uniseriate, inaperturate, 33.6x58.8 µm, fusiform, cells of either ends smaller,central two cells larger, broadly rectangular, folded,spore wall less than 1 µm thick, psilate.

Principal Material Studied : BDG-1,2675-2680 m,slide no.1,coordinates 112/40.7.

Botanical Affinity : Unknown.

? Fungal spore type-II

pl.21, figs.4,5,6,7

Description : Fungal spores spherical to subcircular, 28.8-31.2x34.8-36 µm in diameter, central portion of the spore is having spherical to subcircular, large opening with or without thickening at the margin of the opening. Spore wall 2.4 µm thick, psilate to faintly ornamented.

Principal Material Studied : BDG-1, 3185-3190 m,slide no.1,coordinates 45.6/96.8.

Botanical Affinity : Unknown.

Fungal hyphae type-I

pl.21, fig.10

Description : Fungal hyphae unicelled, inaperturate, non septate, 37.2x142.8µm, terminal end tapering, basal portion of the hyphae larger,almost ellipsoidal, hyphae wall less than 1 µm thick, psilate.

Principal Material Studied : BDG-1,3365-3370 m,slide no.2,coordinates 108/47.6

Botanical Affinity : Unknown.

? Fungal spore type-III

pl.21,figs. 8,9

Description : Specimens subcircular in shape, 31.2x32.4 µm, in diameter, central portion of the spore is having circular opening with thickened margin, spore wall ± 1.2 µm thick, psilate, surface granulate.

Principal Material Studied : BDG-1, 3760-3765 m, slide no.1, coordinates 99/38.8.

Remarks : The specimen described here is doubtfully placed under fungal spore group.

? Fungal spore type - IV

pl.21, fig.12

Description : Specimens broadly subcircular with undulating periphery, 56.4x66µm diameter, inaperturate, hyphae like bands radially arranged and striated.

Principal Material Studied : BDG-2, CC-11 (2946-2961.30 m), 405-406 cm, slide no.2A, coordinates 98.1/39.1.

Fungal spore type -C

pl.21, fig.13.

Description : Fungal spore subcircular in shape, 40.8x43.2 um, hyphae length 25.2µm with pointed tips, radially arranged, interconnections are not visible due to bad preservation.

Principal Material Studied : BDG-2, CC-11 (2945-2961.30 m), 536-537 m, slide no.1, coordiantes 99/45.3.

Diporisporites sp.cf.D.conspicua

pl.21, fig.16.

1978 Diporisporites conspicua Ramanujam and Rao, p. 295, pl.1, fig. 7.

Description : Spore elliptical in shape, 61.2x32.4µm, diporate pore conspicuous situated at each end of the spore along its vertical axis. Pore with thickened margins with distinct atria, spore wall less than 1 µm thick, psilate.

Principal Material Studied : BDG-1, 2275-2280 m, slide no.3, coordiantes 108.8/57.

Remarks : The specimen described here closely resembles to Diporisporites conspicua Ramanujam and Rao (1978) but slightly differs in size.

Botanical Affinity : Unknown.

Previously Reported Occurrence : Miocene, Tonakkal clay Mine, Trivandrum District, Kerala (Ramanujam and Rao, 1978).

? Foraminifera

pl.24, figs.12,13

Description : Test free , small, plain spiral involute compressed 6-8 chambers which are gradually increasing in size, final chamber is broader and subtriangular in shape depressed in the central portion, sutures distinct, curved with smooth surface, measuring 60.5 x 43.3 um in size.

Principal Material Studied : BDG-1,2235-2240 m,slide no.1, coodiantes 94.3/61.4.

Fungal spore type - B

pl.21, figs.11,15.

Description : Fungal spore 6 celled, inaperturate, elliptical 21.6x42 µm, boat shaped structure situated longitudinally in the centre of the body and reaches upto the apex.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.1, coordinates 111.4/52.

Botanical Affinity : Unknown.

4.1.5 MICROPLANKTON

ALGAE

Genus : Pediastrum Meyen 1829

Pediastrum sp.cf.P.boryanum

pl. 25, figs.4,5

1840 Pediastrum boryanum (Turpin) Meneghini in Fernandez 1993, p.194,pl.3,figs.1,2

Overall size of colonies : 80.4 x 85.2 µm, length of spines 4.8 µm.

Description : Coenobia subcircular in shape, composed of polyhedral and marginal cells without or with very few perforations in between. Outer face of marginal cells with deep emergination to form two projected, tapering spine like projections, colonies bearing 17-35 cells without intercellular spaces and which are arranged in several concentric series.

Principal Material Studied : BDP-1, 3135-3140 m, slide no.2, coordinates 98.7/39.5

Remarks : The present specimen described here closely comparable to Pediastrum boryanum (Turpin) Maneghini (1840) but it has more number of cells from the later.

Botanical Affinity : Hydrocharitaceae.

Previously Reported Occurrence : Fernandez (1993) reported this species from Holocene bottom sediments of Chascomus Lake, Argentina, Philipose (1987) from Bihar and Orissa, Patel and George (1977) reported from Gujarat.

Pediastrum sp.

pl.25, figs. 1,2,3,6

Overall size of colonies : 66-72x 79.2-96 µm, length of spines 13.2-34.8 µm.
Description : Colonies subcircular in shape, internal cells compact, without any internal space, cells hexagonal in shape, surface granulate each outer cell has two long tapering processes.

Principal Material Studied : BDG-1, 2945-2950 m,slide no.3,coordinates 109/54.3.

Remarks : The specimen described here differs from Pediastrum boryanum (Turpin) Meneghini (1840) in the sculptural pattern and having long slender processes.

Botanical Affinity : Hydrocharitaceae.

4.1.5a

DINOFLAGELLATES

Class : Dinophyceae

Family: Hystrichosphaeridaceae

Genus : Polysphaeridium Davey and williams 1966 b

Type species: Polysphaeridium subtile Davey and Williams 1966b

Polysphaeridium subtile

pl.26, figs. 6,10, pl.31, figs. 4,12

1966b Polysphaeridium subtile Davey and Williams,p.92,pl.11,fig.1.

Dimensions : Overall size of cyst 58.8 x 49.2 µm, size of central body 39.6 x 52.6 µm, length of processes 6 µm.

Description : Central body subspherical, bearing numerous processes with granular surface, processes hollow, open distally with serate margin. Archaeopyle probably epitractal.

Principal Material Studied : BDG-1, 3155-3160 m, slide no.3,coordinates 111.4/48.5

Remarks : The specimen are identical with Polysphaeridium subtile Davey and Williams (1966b). However,they are of bigger size.

Previously Reported Occurrence : Lower, Middle, Upper Eocene of Bracklesham beds of the isle of wight, southern England (Eaton,1976); Paleocene and Lower Eocene of Northern Spain (Caro,1973); Lower Eocene of the London Basin in southern England (Davey and Williams) 1966b, Granus-Cavagnetto,1970 C). Lutetian-Bartonian (Kalol Formation), Cambay Basin (Mathur,1980); Late Cretaceous (Longpar Formation) Meghalaya (Sah, Kar and Singh,1970); Paleocene (Subathu Formation), Jammu Hills (Kumar, Sarkar and Singh, 1984); Oligocene (Laisang Formation),Meghalaya (Saxena

and Rao, 1984);Paleocene-Eocene (Therria and Kopili formations),Meghalaya, (Singh and Tripathi,1987); Paleocene (Therria Formation),Meghalaya (Tripathi, 1989).

Polysphaeridium ornamentum Jain and Tondon

pl.26, figs.1,3,8,9, pl.27, fig.1

1981 Polysphaeridium ornamentum Jain and Tondon, p.12,pl.2,fig.35.

Dimension : Overall size of cyst 63.6 x 80.4 μm, size of central body 50.4 x 54 μm, length of processes 14.4 μm.

Description : Cyst spherical to subspherical, bearing numerous processes with coarsely granular surface, processes simple, slender hollow, curved, open distally with serrate. Archaeopyle probably epitractal.

Principal Material Studied : BDG-1, 2830-2835 m, slide no.3, coordinates 99.1/36.1

Remarks : The specimen studied here have a slightly smaller size.

Previously Reported Occurrence : Middle Eocene (Harudi Formation), Kutch (Jain and Tondon, 1981); Late Eocene (Kopili Formation), Meghalaya (Singh and Tripathi, 1987).

Polysphaeridium sp.A

pl.26, fig.4

Dimension : Overall size of cyst 45.6x70.8 μm, size of central body 60 μm, length of processes 7.2 μm.

Description : Cyst body oval to elliptical in outline with finely granular surface, processes numerous, short, simple, slender, hollow, open distally Archaeopyle not clearly visible probably apical.

Principal Material Studied : BDG-1, 2865-2870 m,slide no.1,coordinates 91.7/59.

Remarks : This species differs from other known species in its elliptical shape.

Polysphaeridium sp.B

pl.26, fig.5

Dimensions : Overall size of cyst, 45.6 x 48 μm, size of central body 30x 32.4 μm length of processes 9.6 μm.

Description : Cyst body subspherical, surface granular, processes numerous, variable in width, long, simple, hollow, distally open. Archaeopyle not clearly visible probably epitractal.

Principal Material Studied : BDG-1, 2815-2820 m,slide no.1,coordinates 102.6/59.5.

Remarks : This species differs from other known species in its smaller size.

Polysphaeridium sp.C

pl.25, fig.9, pl.26, fig.7, pl.27, fig.3

Dimensions : Overall size of cyst : 48-49.2x52.8 μm, size of central body 40.8-42x42 -44.4 μm, length of processes 4.8-6 μm.

Description : Cyst, subspherical with granular surface, processes numerous, short, simple, hollow, open distally. Archaeopyle probably apical.

Principal Material Studied : BDG-1, 3250-3255 m,slide no.4,coordinates 105/72.7.

Remarks : The present specimen differs from Polysphaeridium subtile in having a small size and other morphological characters.

Polysphaeridium sp.cf.P.pastielsii Davey and Williams

pl. 25, fig. 8, pl. 27, fig.2.

1966 Polysphaeridium pastielsii Davey and Williams in Jain and Tondon, 1981, p.13, pl.1, fig.11.

Dimensions : Overall size of cyst : 56.4 x 84 µm size of central body : 39.6 x 69.4, length of processes : 38.4 µm.

Description : Cyst body, subspherical with coarsely granular surface, processes numerous, simple, open distally with serrate margin. Archaeopyle probably apical.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.1,coordinates 103.6/67.

Remarks : The present species closely compares with Polysphaeridium pastielsii Davey and Williams (1966) but differs from the later in having a smaller size and coarsely granular surface.

Polysphaeridium sp.D

pl. 29, fig.9

Dimension : Overall size of cyst : 86.4 x 90 µm, size of central body 54 x 52.8 µm length of processes 24 µm.

Description : Cyst body subspherical with finely granular surface, processes numerous, simple, slender, tubular, hollow, distally opened with serrate terminations Archaeopyle probably apical.

Principal Material Studied : BDG-1, 3205-3210 m,slide no.2,coordinates 112/34.3.

Remarks : The present species described here differs from Polysphaeridium subtile

Davey and Williams (1966b) in having a slightly bigger size and longer processes.

Genus :Cleistosphaeridium Davey, Downie, Sarjeant and Williams 1966

Type species: Cleistosphaeridium diversispinosum Davey, Downie, Sarjeant and Williams 1966

Cleistosphaeridium sp.A

pl. 27, fig. 4

Dimensions : Overall size of cyst : 67.2 x 102 µm size of central body : 42 x72 µm, length of processes 9.6 µm

Description : Ellipsoidal cyst body bearing numerous processes with finely granulate surface. Processes simple, solid, slender, closed distally showing no definite alignment. Archaeopyle has not been recorded.

Principal Material Studied : BDG-1, 2650-2655 m, slide no.1,coordinates 100.6/50.9

Remarks : Cleistosphaeridium diversispinosum Davey, Downie, Sarjeant and Williams (1966) comes close to this species but it differs from the later in having a bigger size and shape.

Cleistosphaeridium diversispinosum Davey, Downie, Sarjeant and Williams

pl. 27, figs. 5,6, pl. 29, fig.8

1966 Cleistosphaeridium diversispinosum Davey, Downie, Sarjeant and Williams, p.167, pl.10, fig.7.

Dimensions: Overall size of cyst : 60x70.8 µm, size of central body 48 x 58.8 µm,

length of processes 9.6 μm.

Description : Cyst body subspherical with granular surface. Processes numerous, simple, solid, closed distally showing no definite alignment, presence of archaeopyle has not been recorded

Principal Material Studied : BDG-1, 2650-2655 m,slide no.1,coordiantes 109.6/70.2.

Remarks : The present specimen recorded here is identical with cleistosphaeridium diversispinosum Davey, Sarjeant and Williams (1966).

Previously Reported Occurrence : Late Paleocene-Late Eocene (Subathu Formation), Simla Hills, Himachal Pradesh (Singh, Khanna and Sah, 1979); Albian (Dalmiapuram Formation), Cauvery Basin (Venkatachala and Kumar, 1980); Early Eocene (Lakhpat borehole-1), Kutch (Kar, 1985); Middle Eocene (Garampani Limestone Formation), North Cachar Hills, Assam (Mehrotra, 1981); Late Paleocene, Vriddachalam area, Cauvery Basin (Jain and Kar, 1986b).

Cleistosphaeridium sp.B

pl. 27, fig. 9

Dimension : Overall size of cyst, 46.6 x 46.8 μm, size of central body : 31.2 x 36 μm, length of processes 8.4 μm.

Description : Cyst body subcircular, bearing numerous processes with granular surface, processes simple, solid, slender, closed distally with pointed tips.

Principal Material Studied : BDP-1, 3135-3140 m,slide no.2,coordinates 105.4/66.9.

Remarks : The present specimen is closely comparable to Cleistosphaeridium heterocantnum (Deflandrea and Cookson) Devey, Downie, Sarjeant and Williams (1966), but it differs from the later in having a smaller size and other morphological variations.

Cleistosphaeridium sp.C

pl.27, fig. 7

Dimensions : Overall size of cyst 39.6 x 40.8 μm, size of central body : 30 x 31.2 μm, length of processes : 6 μm.

Description : Subspherical cyst body bearing numerous processes with coarsely granular surface, processes simple, solid, closed distally, showing definite alignment. Archaeopylehas not been recorded.

Principal Material Studied : BDG-1,4060-4065 m, slide no.2,coordinates 104.1/72.5

Remarks : The present specimen differ from the so far known species of the genus in having a different shape and shorter processes.

Cleistosphaeridium sp.D

pl. 27, fig.8

Dimensions : Overall size of cyst : 45.6 x 73.2 μm, size of central body 36 x 69.6 μm, length of processes 7.2 μm.

Description : Ellipsoidal cyst body, surface finely granulate, processes slender, solid, closed distally with pin headed tips and showing no definite alignment Archaeopyle has not been recorded.

Principal Material Studied : BDG-1,3005-3010 m,slide no.2,coordinates 111.2/61.8.

Remarks : The present specimen is comparable to cleistosphaeridium diversispinosum Davey, Downie, Sarjeent and Williams 1966 but differs in having a smaller size and distally pin headed tips processes.

Cleistosphaeridium sp.F

pl.29, fig.3

Dimensions : Overall size of cyst 49.2 x 38.4 µm,size of central body 31.4 x 40.3 µm, length of processes 8.2 µm.

Description : Cyst body spherical,bearing small number of processes with granular surface. Processes simple, solid, slender closed distally with pointed tips.

Principal Material Studied : BDG-1, 3205-3210 m, slide no.1,coordinates 111.6/56.7

Genus : Gonyaulacysta Deflandre emend.Stover and Evitt 1978

Type species: Gonyanlacysta jurassica (Deflandre) Norris and Sarjeant 1965

Gonyaulacysta tenuitabulata (Gerlach) De Coninck 1968

pl.27, figs. 10, 12

1961 Gonyaulax tenuitabulata Gerlach,p.159,pl.25,figs.10-11.

1968 Gonyaulacysta tenuitabulata (Gerlach) De Coninck,p.23,pl.5,figs.9-10.

Dimensions : Overall size of cyst : 44.4-60x51.6-62.4μm, length of apical horn upto 2.4 μm.

Description : Cysts proximate, endocyst subspherical in shape, apical horn present and the plate boundaries are marked by low, simple thickenings of the periphragm. Periphragm finely granulate. Archaeopyle precingular.

Principal Material Studied : BDG-1, 2675-2680 m,slide no.4,coordiantes 60x62.1

Remarks : The present species described here is slightly smaller in size as compared to Gonyaulacysta tenuitabulata (Gerlach) Deconinck (1968).

Previously Reported Occurrence: Lower, Middle and Upper Eocene of Isle of Wight souther England; Lower Eocene of Belgium (Deconinck, 1968); Middle Oligocene and Middle Miocene of north Germany (Gerlack,1961).

Genus : Oligosphaeridium Davey and Williams 1964

Type species: Oligosphaeridium complex Davey and Williams in Davey et al.,1966

Oligosphaeridium pulcherrimum Deflandre and Cookson

pl.27, fig.11

1955 Hystrichosphaeridium pulcherrimum Deflandre and Cookson,p.270,pl,1,fig.8, text figs. 21, 22.

1955 Hystrichosphaeridium pulcherrimum Deflandra and Cookson,Valensi, pl.592, pl.4, fig.1.

1960b Oligospheridium pulcherrimum (Deflandre and Cookson), Davey and Williams, pp.75, 76, pl.10, fig.9, pl.11, fig.5

Dimensions : Overall size of cyst 84x102 µm, size of central body 36 x 54 µm, length of processes 28.8 µm.

Description : Cyst body subspherical to ovoidal, bearing small number of tubular, long, open and distally expanded processes.

Principal Material Studied : BDG-1,2650-2655 m,slide no.1,coordiantes 102.3/38.8.

Remarks : The specimen studied here is of slightly bigger size.

Previously Reported Occurrence : London clay, England, (Davey and Willaims, 1966b); Early Albian (Dalmiapuram Formation), Cauvery Basin (Jain,1977b); Late Cretaceous - Middle Eocene (Sangehamala Foramtion) Malla Johar area, Kumoan, Himalaya (Mehrotra and Sinha,1981).

Genus : Areosphaeridium Eaton 1971

Type speices: Areosphaeridium dietyoplokus (Klump 1953) Eaton 1971

Areosphaeridium multicornutum Eaton

pl.28, figs.1,5

1971 Areosphaeridium multicornutum Eaton,p.363,pl.4,figs.1-7,text fig.6.

Dimensions : Overall size of cyst : 57.6-82.8x58.8-104.4 µm, size of central body 30-37.2x38.4-58.8µm, length of processes, 16.8-30 µm.

Description : Cyst body subspherical to ellipsoidal with a finely granulate surface, processes solid, slender, distally expanded with branches bearing arcuate

tips. Archaeopyle probably apical.

Principal Material Studied : BDG-1,2650-2655 m,slide no.1,coordiantes 112.1/35.3.

Remarks : The present species recorded here is identical with Areosphaeridium multicornutum Eaton(1971)

Previously Reported Occurrence : Upper Eocene of the Hampshire Basin southern England.

Genus : Glaphyrocysta Stover and Evitt 1978

Type species: Glaphyrocysta retiintexta (Cookson,1965), Stover and Evitt 1978

Glaphyrocysta exuberans (Deflandre and Cookson,1955) Stover and Evitt

pl.28, figs. 2,6,8, pl.31, fig.1

1948 Mermbranilarnax pterosphaermoides O.Wetzel,Pastiels, p.46,pl.5,figs.11,13,14.

1955 Cyclonephelium exuberans Deflandre and Cookson,p.285 (nom.nud).

1966 Cyclonephelium exuberans Deflandre and Cookson, Williams and Downie,p.225, (in part) not text, fig.61.

1973 Cyclonephelium pastielsi Deflandre and Cookson, Caro,p.352(in part)pl.1,fig.8

1980 Glaphyrocysta exuberans (Deflandre and Cookson) Stover and Evitt,Dutta and Jain, p.69, pl.2, figs.7-8.

Dimensions : Overall size of cyst 30x33.6 µm, size of central body 20.4 x 24µm, length of processes 7.2 µm.

Description : Cyst body dorsoventrally flattened with a granular surface. Processes restricted to the peripheral zone of the cyst body, slender, solid, distally complexly united by trabaculae of variable width. Archaeopyle apical.

Principal Material Studied : BDG-1, 2830-2835 m,slide no.1,coordinates 104.9/49.

Remarks : The specimen studied here is of slightly smaller size as compared to Glaphyrocysta exuberans Stover and Evitt (1980).

Previously Reported Occurrence : Eocene (Ypresian) of Belgium (Pastiels, 1948); Eocene,London clay, white cliff and Enborne (Williams and Downie, 1966C; Paleocene and Lower Eocene of northern spain (Caro, 1973); Lower, Middle and Upper Eocene, southern England (Eaton, 1976); Upper Eocene (Kopili Formation) (Dutta and Jain, 1980).

Genus : Adnatosphaeridium Williams and Downie 1966C

Type species: Adnatosphaeridium vittatum Williams and Downie in Davey et al.(1966).

Adnatosphaeridium sp.

pl.28, figs. 3,4, pl. 29, fig.6

Dimensions : Overall size of cyst 49.2-51.6 µm x 49.2-62.4 µm, size of central body 34-36 x 40-44.4 µm, length of processes 9.6-12 µm.

Description : Cyst body subspherical to ellipsoidal with granular surface. Proce-

sses slender, solid, branched and distally united by trabaculae of variable width. Archaeopyle probably apical.

Principal Material Studied : BDG-2,CC-9 (2839-2856 m), 857-858 cm, slide no.4, coordinates 106/67.

Remarks : The specimen studied here differs in having a smaller size and short processes as compared to Adnatosphaeridium robustum (Morgenroth,1966) Caton,1976.

Genus : Hystrichosphaeridium Deflandre,1937 emend, Davey and Williams 1966b

Type species: Hystrichosphaeridium tubiferum (Ehrenberg,1938) Deflandre, 1937b, emend, Davey and Williams in Davey et al.,1966

Hystrichosphaeridium sp.1

pl. 28, fig.7

Dimensions : Overall size of cyst : 51.6x61.2 µm, size of central body 42x48 µm, length of processes 10.8 µm.

Description : Cyst body subspherical,with granular surface. Processes tubiform, open distally with serrate circular margin. Archaeopyle probably apical.

Principal Material Studied : BDG-1, 3155-3160 m,slide no.1,coordinates 106.1/42.7.

Remarks : The present species closely compares with Hystrichosphaeridium tubiferum (Ehrenberg) Deflandre(1937) emend. Davey and Williams(1966b) but differs in having a slightly bigger size and morphological characters.

Hystrichosphaeridium sp.cf.H.transculentum Sah et al.

pl. 30, fig.1

1969 Hystrichosphaeridium tansculentum Sah et al, p.147, pl. 2, figs. 18, 19.

Dimensions : Overall size of cyst : 62.4 x 67.2 µm, size of central body 39.6 x 48 µm, length of processes 14.4 µm.

Description : Cyst body subciruclar, processes simple, evenly distributed rarely dichotomising at the distal side. Cyst membrane sculptured with closely placed coni evenly distributed forming, negative reticulum in surface view. Archaeopyle probably apical.

Principal Material Studied : BDG-1,3215-3220 m,slide no.1, coordiantes 107/58.

Remarks : The specimen described here is closely comparable to Hystrichosphaeridium transculentum Sah et al.,(1969) but it has a smaller size.

Hystrichosphaeridium tubferum (Ehrenberg) Deflandre, 1937 emend. Davey and Williams, 1966b, pl. 29, fig.4.

1838 Xanthidium tubiferum Ehrenberg pl.1, fig.16

1937 Hystrichosphaeridium tubiferum (Ehrenberg) Deflandre,p.68,

1966b Hystrichosphaeridium tubiferum (Enrenberg) Deflandre emend. Davey and Williams, p.56, pl.6, figs.1-2, pl.8, fig.5

Dimensions : Overall size of cyst 48x66 µm, size of central body 12.4x46.8 µm, length of processes 14.4 µm.

Description : Cyst body has a subcircular outline and a granular surface. Processes about tubular,long, open distally with serrate margin. Apical Archaeopyle usually present.

Principal Material Studied : BDG-1, 2675-2680 m,slide no.3,coordinates 107.2/41.8.

Remarks : The present specimen recorded here is identical with Hystrichosphaeridium tubiferum (Ehrenberg Deflandre emend.Davey and Williams (1966).

Previously Reported Occurrence: Eocene of the Isle of Wight southern England; Eocene-Miocene, Assam and Tripura (Banerjee and Misra 1972); Late Paleocene Late Eocene (Subathu Formation), Simla Hills, Punjab Basin, Himachal Pradesh (Singh, Khanna and Sah,1979); Early Eocene (Subathu Formation); Simla Hills, Himachal Pradesh (Visscher and Gupta,1980); Aliab (Dalmiapuram Formation); Cauvery Basin, Tamilnadu (Venkatachala and Kumar, 1980); Middle-Late Eocene (Rataria bore core no.27); Kutch, Gujarat (Kar and Saxena, 1981); Companian to Mastrichtian Krishna-Godavari Basin (Venkatachala and Sharma, 1982); Eocene (Subathu Formation) Himachal Pradesh (Singh and Sarkar, 1987).

Hystrichosphaeridium sp.

pl.31, fig.9

Dimensions : Size of central body : 46.8x54μm, length of processes 12 μm.

Description : Cyst body has a subspherical out line with granular surface. Processes tabular, slightly expanded distally with denticulate margin.

Principal Material Studied : BDG-2,CC-5 (2839-2856.60 m), 970-975 cm, slide no.2, coordinates 107.4/46.8

Remarks : The present species is comparable to Hystrichosphaeridium tubiferum but differs in having a smaller size and variations in size of the processes.

Genus : Hystrichokolpoma klumpp, 1953 emend. Williams and Downie 1966b

Type species: Hystrichokolpoma oinotum Klumpp, 1953.

Hystrichokolpoma sp.cf.H.granulata Eaton

pl. 26, fig.2

1976 Hystrichokolpoma granulata Eaton, pl. 3, fig. 16.

Dimensions : Overall size of cyst : 56.4x58.8µm, size of central body, 36x38.4µm, length of processes 1.2 µm.

Description : Cyst body subspherical with granular surface bearing two types of granular intratabular processes. Large and broad cylindrical processes restricted to the pre and post cingular are rare. Numerous slender open processes restricted to the cingular and sulcal zones are distally expanded or branched with pinhead tips. Archaeophyle apical.

Principal Material Studied: BDG-1,2845-2850 m,slide no.2,coordinates 103.1/59.

Remarks : The present species described here is closely comparable to Hystrichokolpoma granulata Eaton (1976) but it differs from the later in having a biggersize.

Previously Reported Occurrence : Early-Middle Eocene (Sylhet Formation), Meghalaya (Dutta and Jain, 1980); Eocene (Subathu Foramtion), Himachal Pradesh (Singh and Sarkar,1987).

Hystrichokolpoma rigaudae Deflandre and Cookson

pl.30, figs. 7,11, pl.31, fig.10

1955 Hystrichokolpoma rigaudae Deflandre and Cookson, p.279,pl.6,figs.5,10, text fig.42.

Dimensions : Overall size of cyst : 49.2-60x51-96μm, size of central body 32.4-40.8x42-44.4μm, length of large processes 12-13.2 μm, length of antapical processes 30μm, length of slender processes 10.2 μm.

Principal Material Studied : BDG-2,CC-9 (2910-2928m) 354-355 cm, slide no.3, coordinates 101.7/54.7.

Remarks : The present species described here is identical with Hystrichokolpoma rigaudae Deflandre and Cookson(1955).

Previously Reported Occurrence : Paleocene of Victoria, Australia (Cookson and Eisenack,1967b); Lower Eocene of Belgium (De Coninck 1965, 1967, 1972, Morgenroth, 1966b) of northern France (Gruas, Cavagnetto 1968, 1970b) of north Germany (Morgenroth,1966b) of the Hampshire Basin (Williams and Downie,1966b Graus-Cavagnetto 1970c) and of victoria (Deflandre and Cookson,1955); Middle Eocene of northern France (Gruas-Cavagnetto,1971); Upper Eocene of Victoria (Cookson and Eisenack, 1965); Middle Oligocene of north Germany (Gerlach 1961, Brosins 1963, Benedek

1972); Upper Oligocene of north Germany (Gerlach 1961, Brosins,1963 Benedek 1972); Middle Miocene of north Germany (Maier 1959, Gerlack,1961); Miocene-Pliocene of Italy (Habib,1971); Pleistocene of Israel (Rossingnal 1962, 1964); Lower and Middle Eocene of Bracklesham beds of the Isle of wight southern England (Eaton,1976).

Genus : Cordosphaeridium Eisenack, 1963b emend,Morgenroth 1968.

Type species: Cordosphaeridium inodes (Klumpp, 1953,pl.391, pl.18,figs.1-2) Eisenack, 1963b,p.261.

Cordosphaeridium sp.

pl.29, fig.10, pl. 31, figs. 7,13

Dimensions : Overall size of cyst : 78-80.4 µm,size of central body 57.6x60µm, length of processes 18 µm.

Description: Subspherical central body composed of granular endophragm and fibrous periphragm, processes intratabular, loosely fibrous, distally broad and open. Archaeopyle is not clearly visible due to bad preservation.

Principal Material Studied : BDG-1,2650-2655 m,slide no.1,coordiantes 105.9/36.5.

Remarks : The present species described here has a bigger size and different morphological characters as compared to Cordosphaeridium fibrospinosum Davey and Williams (1966b).

Genus : Operculodinium wall 1967

Type species: Operculodinium centrocarpum (Deflandre and Cookson, 1955, wall 1967

Operculodinium centrocarpum Deflandre and Cookson

pl. 29, fig.1

1955 : Hystrichosphaeridium centrocarpum Deflandre and Cookson, p.272,pl.8,figs.3-4

1967 : Operculodinium centrocarpum (Deflandre and Cookson) Wall,p.111,pl.16, figs. 1-2,5

Dimensions : Overall size of cyst : 63.6x80.4µm, size of central body : 50.4x54µm, length of processes 14.4 µm.

Description : Cyst body subspherical with granular surface, processes numerous, simple, solid, slender, closed distally with small hooklets at the tips. Archaeopyle not clearly visible probably precingular.

Principal Material Studied : BDG-1, 2830-2835m,slide no.3,coordinates 99.1/36.1.

Remarks : The present specimen described here is identical with Operculodinium centrocarpum (Deflandre and Cookson) Wall(1967).

Previously Reported Occurrence : Early-Middle Eocene (Sylhet Formation), Meghalaya (Dutta and Jain,1980); Middle Eocene (Harudi Formation), Kutch (Jain and Tandon, 1981); Middle Eocene (Harudi Formation) and Miocene (Kharinadhi Formation) Kutch (Kar, 1985); Paleocene (Subathu Foramtion) Jammu Hills (Sarkar and Singh,1985); Paleocene-Eocene (Therria and Kopili formations), Meghalaya (Tripathi, 1989).

Genus : Turbiosphaera Archangelsky 1969

Type species: Turbiosphaera filosa (Wilson 1967a,p.66,figs.2,31, 32, 34) Archangelsky, 1969, pp.4081.1

? Turbiosphaera sp.

pl.29, fig.12

Dimensions : Overall size of cyst 78x85.2µm, size of central body 58.8x68.4µm, length of processes 13.2 µm.

Description : Cyst body subcircular, delicate, intratabular processes formed by the fibrous periphragm. Apical horn not visible due to bad preservation. Processes variable in breadth with undulating distal margin. Archaeopyle not clearly visible probably precingular.

Principal Material Studied : BDG-1, 2815-2820 m,slide no.2,coordinates 98.1/38.2.

Remarks : The present species described here is doubtfully placed under genera Turbiosphaera due to bad preservation.

Genus : Heteraulacacysta Drugg and Leoblich 1967

Type species: Heteraulacacysta campanula Drugg and Loeblich 1967 pp 183-4, pl.1, figs. 6-8c, text fig.2.

? Heteraulacacysta sp

pl.29, fig.5

Dimensions : Overall cyst body : 82.8x86.4µm, height of periphragm 20.4µm.

Description : Cyst body has a granular surface and elliptical outline. Periphragm folded, forming low simple crest which define the apical and antapical zones. Cingular zone bordered by membraneous crest with undulating distal margin.

Principal Material Stuidied : BDG-1, 2895-2900 m,slide no.3, coordinates 112/58.7.

Remarks : The species described here is comparable to Heteraulacacysta ?leptalea Eaton (1976) but differs from the later in having slightly smaller size and morphological variations The generic assignment is tentative.

Genus : Impletosphaeridium Morgenroth 1966a

Type species: Impletosphaeridium transrodum Morgenroth 1966a

Impletosphaeridium sp.A

pl.29, fig.11

Dimensions : Overall size of cyst : 69.4x74.4 μm,size of central body 43.2x48μm, length of processes 19.2 μm.

Description : Cyst body subspherical with a granular surface. Processes numerous slender, solid, bifurcate with serrate terminations.

Principal Material Studied :

Remarks : The specimen described here is closely comparable to Impletosphaeridium insolitum Eaton (1976) but differs from later in having bigger size and processes characters.

Dinoflagellate cyst.A

pl.29, fig.2

Dimensions : Overall size of cyst : 63.6x67.2 µm,size of central body 42x43.2µm, length of processes 18 µm.

Description : Cyst body subspherical with granular surface. Processes solid, slender, branched distally with arcuate terminations. Archaeopyle not clearly visible.

Principal Material Studied : BDPJ-1,1805-1810 m, slide no.3, coordiantes 98.2/68.6

Impletosphaeridium sp.B

pl.29, fig.7

Dimensions : Overall size of cyst : 61.2x72µm, size of central body 33.6x51.6µm, length of processes 16.8 µm.

Description : Cyst body elliptical with granular surface. Processes numerous, slender, rarely curved, solid with small bulbous spherical at distal termination.

Principal Material Studied :. BDG-1, 2715-2720 m,slide no.1,cordiantes 56.6/91.6.

Remarks : The present species described here differs from the later in having a bigger size as compared to Impletosphaeridium granulosum Jain and Tondon(1981).

Genus : Spiniferites Mantell,1850 emend Sarjeant 1970

Type species: Spiniferites ramosus (Ehrenberg,1837 p.47) Loeblich and Loeblich 1966,pp. 56-57

Spiniferites ramosus var.multibrevis Davey and Williams

pl.30, figs. 2,4,6,8,9,10

1966a Spiniferites ramosus var.multibrevis Davey and Williams in Eaton,1976, pp.281, pl.14, fig.6.

Dimensions : Overall size of cyst 37.2-51×50.4-56.4 μm, size of central body 24-30 x 33.6-56.4 μm, length of processes 7.2-16.8 μm.

Description : Cyst body subspherical with finely granular periphragm, processes short, solid, branched, trifurcate, distally terminating with small bifurcations, Archaeopyle precingular.

Principal Material Studied : BDG-1, 2830-2835 m,slide no.3,coordiantes 96.6/49.

Remarks : The present specimen is identical with spiniferites ramosus var.multibrevis Davey and Williams(1966a).

Previously Reported Occurrence : Lower Cretaceous (Valangian) to Recent, world wide distribution; Lower and Upper Eocene southern England (Eaton,1976).

Spiniferites monilis (Davey and Williams) Sarjeant emend.Eaton

pl.30, fig.3

1966a Hystrichosphaera monilis Davey and Williams,p.45,pl.5,fig.2

1970 Spiniferites monilis (Davey and Williams) Sarjeant,p.76

Dimensions : Overall size of cyst : 54x60μm, size of central body 45.6μm, length of processes 8.4 μm.

Principal Material Studied : BDG-1,2675-2680 m,slide no.4,coordinates 97.7/46.2.

Remarks : The specimen studied here have slightly bigger size compared to spiniferites monolis emend.Eaton,1976.

Previously Reported Occurrence : Lower Eocene of the Hampshire and London basins in southern England (Davey and Williams,1966a); Lower, Middle and Upper Eocene of the Bracklesham beds of the Isle of wight, southern England; Early Middle Eocene (Sylhet Formation), Jaintia Hills,Meghalaya (Dutta and Jain,1980); Eocene (Subathu Formation), Simla Hills (Singh and Sarkar, 1987).

Genus : Achomosphaera Evitt 1963

Type species: Achomosphaera ramulifera, Deflandre 1937b p.74, pl.14, figs.5-6, pl.17,fig.17), Evitt 1963 p.163.

Achomosphaera sp.

pl.30, fig.5

Dimensions : Overall size of cyst : 46.8x62.4μm, size of central body, 30x39.6μm, length of processes 12 μm.

Description : Cyst body ellipsoidal with granular surface. Processes variable in width, branched, trifurcate, tips bifid like those of spiniferites in distribution but without septa connecting their bases as in that genus Archaeopyle not clearly visible due to bad preservation.

Principal Material Studied : BDG-1,2815-2820 m,slide no.1,coordinates 108.2/34.8.

Genus : Homotryblium Davey and Williams 1966b

Type species: Homotryblium tenispinosum Davey and Williams in Davey et al.,1966.

Homotryblium abbreviatum Eaton

pl.31, fig.5

1968 Hystrichosphaeridium tubiferum brevispinosum, Davey and William, De Coninck, p.37, pl.9, fig.2, 24-25.

1976 Homotryblium abbreviatum Eaton, pl.10, figs.2-4.

Dimensions : Overall size of cyst body 55.2x54µm, size of central body 30 x 31.2 µm, length of processes 13.2 µm.

Description : Cyst body subspherical with a granular surface processes short, tabular and distally expanded with denticulate margin. Archaeopyle epitractal.

Principal Material Studied : BDG-1, 2650-2655 m,slide no.1,coordiantes 111.7/71.1.

Remarks : The specimen described here has slightly bigger size as compared to Homotryblium abbreviatum Eaton (1976).

Previously Reported Occurrence : Lower Eocene of Belgium (De coninck 1968); Lower Middle and Upper Eocene of the Bracklesham beds of the Isle of wight, southern England; Late Paleocene-Late Eocene (Subathu Formation), Shimla Hills, Himachal Pradesh (Singh, Khanna and Sah, 1979).

Homotryblium floripes Bujack et al.

pl.31, fig.2

1980 Homotryblium floripes, Deflandre and Cookson, 1955 (Stover 1975),Bujak et al., pl.16, figs.2-3.

1955 Hystrichosphaeridium floripes Deflandre and Cookson,p.276,pl.7,figs.1,27.

Dimensions : Size of central body : 42x52.8µm, length of processes 20.4µm.

Principal Material Studied : BDG-1, 2650-2655 m,slide no.2,coordinates 105.4/62.

Remarks : The present species recorded here is identical with Homotryblium floripes Deflandre and Cookson, Stover (1975) Bujak et al.

Previously Reported Occurrence : Eocene, southern England (Bujak et al.,1980); Oligocene and Early Miocene (Laisang, Jenam and Bhuban formations), Meghalaya and Cachar Assam (Saxena and Rao, 1984); Eocene (Subathu Formation); Himachal pradesh (Sarkar and Singh, 1988).

Genus : Wetzeliella Eisenack, 1938

? Wetzeliella sp.

pl.31, fig.3.

Dimensions : Overall size of cyst : 44.7x99.2 µm, length of processes 12.4µm.
Description : Circumcavate periodonoid cyst, rhomboidal outline, strongly compressed dorso-ventrally, periphragm bears short, book like sutural processes. Archaeopyle is not clearly visible.

Principal Material Studied : BDG-1, 2830-2835 m,slide no.3,coordinates 111.6/58.4.

Remarks : The present specimen described here is doubtfully placed under genus wetzelialla Eisenack,1938 due to bad preservation and lack of morphological characters.

Genus : Distatodinium Eaton 1976.
Type species: Distatodinium craterum Eaton 1976,pp.263-4,pl.9, fig.1-5.

Distatodinium sp.

pl.31, fig.6

Dimensions : Overall size of cyst : 62.4x78µm, size of central body 22.8x54µm, length of processes 20.4um.
Description : Elongate oval cyst body with granular surface. Processes flattened, distally expanded, terminating with small bifurcation of variable length and width aligned into rows parallel to the long axis of the cyst body.

Principal Material Studied : BDG-1, 2650-2655 m,slide no.3,coordinates 111/68.5.

Remarks : The specimen described here is closely comparable to Distatodinium ellipticum (Cookson,1965) n.comb.but it differs from the later in size and having less number of process.

Genus : Systematophora Klement 1960

Type species: Systematophora areolata Klement 1960

Systematophora sp.

pl.31, fig.8

Dimensions : Overall size of cyst : 66x74.4 µm, size of central body : 45.6x57.6 µm, length of processes 12 µm.

Description : Cyst body subspherical with granular surface processes numerous, simple, slender,open distally, arranged in soleate manner. Archaeopyle not clearly visible probably apical.

Principal Material Studied : BDG-1, 2675-2680 m,slide no.4,coordinates 106/43.3.

4.1.5b ACRITARCHS

Group : Acritarcha Evitt 1963

Sub-group: : Uncertain.

Genus : Cyclopsiella Drugg and Loeblich 1967

Cyclopsiella sp.

pl.31, fig.11

Dimensions : Overall cyst size 84x85.3 µm, aperture diameter 9.5 µm.

Description : Cyst subspherical, wall two layered, endophragm thicker than periphragm, both granular, aperture circular, opening rimmed.

Principal Material Studied : BDG-1, 2435-2440 m, slide no.1, coordiantes 105.7/41.

Remarks : The present specimen differs from Cyclopsiella vieta Drugg and Loeblich (1967) in its size and granular exine.

Genus : Baltisphaeridium Eisenack 1958

Baltisphaeridium sp

pl.31, fig.15

Dimensions : Overall size of body 26.4 x 30 µm, length of processes 1.5 µm.

Description : Vesicle broadly subspherical thin walled, processes short slender, unbranched, numerous, thin, distributed all over the body.

Principal Material Studied : BDG-1, 2235-2240 m,slide no.1,coordiantes 110.5/69.2.

Remarks : The present specimen described here differs from Baltisphaeridium longispinosum, Eisenack (1958)in size and having a short processes.

Subgroup : Sphaeromorphitae, Downie, Evitt and Sarjeant 1963

Genus : Leiosphaeridia(Eisenack, 1958)Downie and Sarjeant 1963

Type species: Leiosphaeridia baltika Eisenack. 1958

Leiosphaeridia sp.

pl.31, fig.14

Description : Vesicle subcircular in outline due to folds,, 60x63.5 µm, wall thin smooth, irregularly folded.

Principal Material Studied : BDG-1, 2275-2280 m,coordinates 94.5/64.5.

Remarks : The present specimen described herediffers from Leiosphaeridia asperata (Naumova) Lindgreu(1982)in size.