

# Early Eocene palynofossils from subsurface of Mannargudi Area, Tamil Nadu, India

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Palynofossils obtained from B.H. No. MII 128 drilled by the MECL at Mannargudi Area, Tamil Nadu are dominant in angiospermic pollen and the pteridophytic spores are rare in the assemblage. The common species are: *Piladiporocolpites caratinii*, *Matanomadhiasulcites maximus*, *Ctenolophonidites costatus*, *Pellicieropolis langenheimii*, *Retitribrevicolporites matanomadhensis*, *Tricolporopilites robustus*, *Meliapollis ramanujamii*, *Meliapollis navalei*, and *Lygodiumsporites lakiensis*. The assemblage favours an Early Eocene age for the sediments.

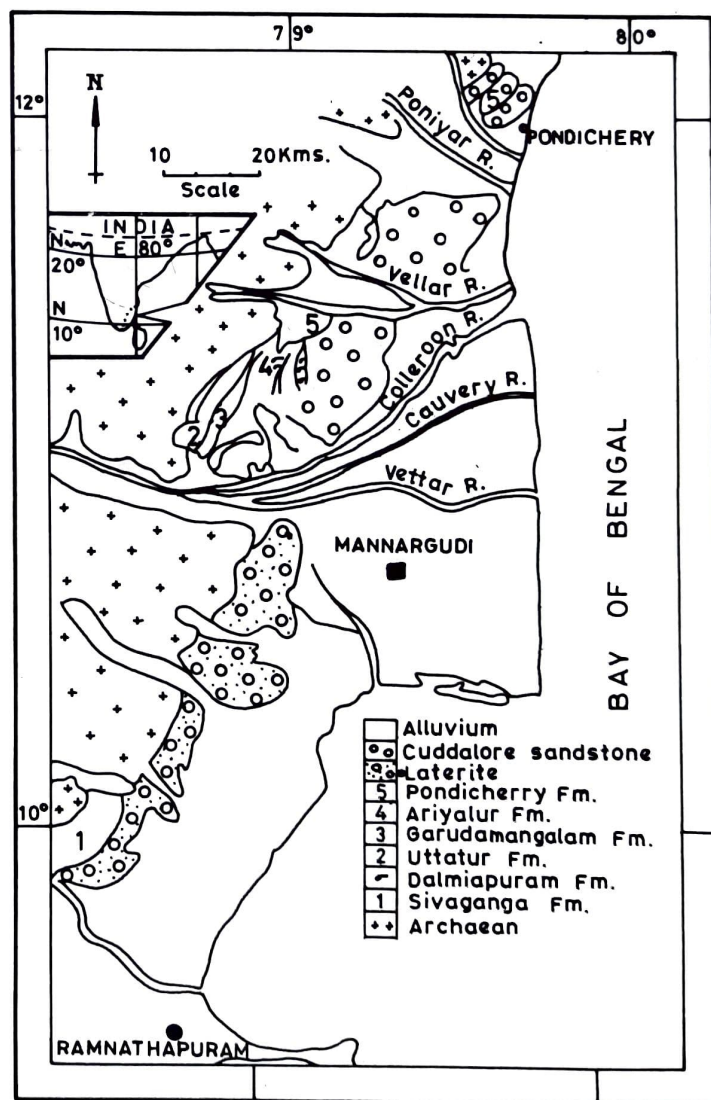
**Key-words**—Palynology, Tertiary, Early Eocene, Mannargudi, Tamil Nadu, India.

## INTRODUCTION

CAUVERY basin is one of the largest sedimentary basins on the east coast of India. It occupies a large area of coastal and adjoining land surface in the state of Tamil Nadu and Pondicherry onshore, the basin encompasses an area of 25,000 sq km and extends offshore along the Coromandal Coast, the Palk Bay between India and Sri Lanka and the Gulf of Mannar, having an area of more than 35,000 sq km.

The Tertiary sediments in Cauvery Basin are very well developed in subsurface. Many palaeobotanists worked on various aspects of Cauvery basin. Jacob and Jacob (1950), Navale (1961), Navale and Misra (1979), Thiergart and Frantz (1963), Ramanujam (1966, 1967, 1982), Deb (1972), Deb *et al.* (1973), Venkatachala (1973), Ramanujam *et al.* (1984, 1985), Siddhanta (1986), Singh and Misra (1991a, 1991b), Saxena (1992) worked on Neyveli lignites. Venkatachala and Rawat (1984) worked on the subsurface sediments occurring in Karaikal, Madanam and Mannargudi wells. They considered this subsurface sediments as Palaeocene-Eocene.

The present paper deals with the palynological studies B.H. No. MII 128 drilled by the MECL at Mannargudi Area, Tamil Nadu. Mannargudi (Map1) is situated on the southern part of the Cauvery Basin (latitude 10°40' and longitude 79°30') in the district of Thanjavure, Tamil Nadu.



**Map 1.** Geological map of Cauvery Basin showing the location of Mannargudi, Tamil Nadu.

Table 1 : Details of samples investigated from Bore hole MII 128, Mannargudi area, Cauvery Basin.

| Sl. No. | Bore hole & Sample No. | DEPTH (m) |        | Thick-ness | Litho unit           |
|---------|------------------------|-----------|--------|------------|----------------------|
|         |                        | From      | To     |            |                      |
| 1.      | MII-128/L-1            | 119.5     | 119.8  | 0.3        | Sandy Clay           |
| 2.      | MII-128/L-2            | 122.6     | 122.9  | 0.3        | Clay                 |
| 3.      | MII-128/L-3            | 123.5     | 123.6  | 0.1        | Lignite              |
| 4.      | MII-128/L-4            | 123.75    | 123.85 | 0.1        | "                    |
| 5.      | MII-128/L-5            | 123.9     | 124    | 0.1        | "                    |
| 6.      | MII-128/L-6            | 124.1     | 124.2  | 0.1        | "                    |
| 7.      | MII-128/L-7            | 124.3     | 124.4  | 0.1        | "                    |
| 8.      | MII-128/L-8            | 124.5     | 124.6  | 0.1        | Contaminated lignite |
| 9.      | MII-128/L-9            | 124.7     | 124.8  | 0.1        | Lignite              |
| 10.     | MII-128/L-10           | 124.9     | 125    | 0.1        | "                    |
| 11.     | MII-128/L-11           | 125.1     | 125.2  | 0.1        | "                    |
| 12.     | MII-128/L-12           | 125.3     | 125.4  | 0.1        | "                    |
| 13.     | MII-128/L-13           | 125.5     | 125.6  | 0.1        | "                    |
| 14.     | MII-128/L-14           | 125.7     | 125.8  | 0.1        | "                    |
| 15.     | MII-128/L-15           | 125.9     | 126    | 0.1        | "                    |
| 16.     | MII-128/L-16           | 126.1     | 126.2  | 0.1        | "                    |
| 17.     | MII-128/L-17           | 129.2     | 129.5  | 0.3        | Sandy Clay           |
| 18.     | MII-128/L-18           | 132.25    | 132.3  | 0.05       | Lignite              |
| 19.     | MII-128/L-19           | 132.5     | 132.6  | 0.1        | "                    |
| 20.     | MII-128/L-20           | 133.85    | 132.9  | 0.05       | Contaminated Lignite |
| 21.     | MII-128/L-21           | 133.1     | 133.2  | 0.1        | Contaminated Lignite |
| 22.     | MII-128/L-22           | 133.25    | 133.3  | 0.05       | Lignite              |
| 23.     | MII-128/L-23           | 133.4     | 133.5  | 0.1        | "                    |
| 24.     | MII-128/L-24           | 133.6     | 133.7  | 0.1        | "                    |
| 25.     | MII-128/L-25           | 133.9     | 134    | 0.1        | "                    |
| 26.     | MII-128/L-26           | 134.45    | 134.5  | 0.05       | Contaminated Lignite |
| 27.     | MII-128/L-27           | 134.65    | 134.7  | 0.05       | Lignite              |
| 28.     | MII-128/L-28           | 134.9     | 135    | 0.1        | "                    |
| 29.     | MII-128/L-29           | 135.2     | 135.25 | 0.05       | "                    |
| 30.     | MII-128/L-30           | 135.5     | 135.6  | 0.1        | "                    |
| 31.     | MII-128/L-31           | 135.8     | 135.9  | 0.1        | "                    |
| 32.     | MII-128/L-32           | 140.6     | 140.7  | 0.1        | "                    |
| 33.     | MII-128/L-33           | 140.9     | 141    | 0.1        | "                    |
| 34.     | MII-128/L-34           | 141.2     | 141.25 | 0.05       | "                    |
| 35.     | MII-128/L-35           | 141.45    | 141.5  | 0.05       | Lignite              |
| 36.     | MII-128/L-36           | 142.5     | 142.75 | 0.25       | Clay, Carb. matter.  |

### MATERIAL AND METHOD

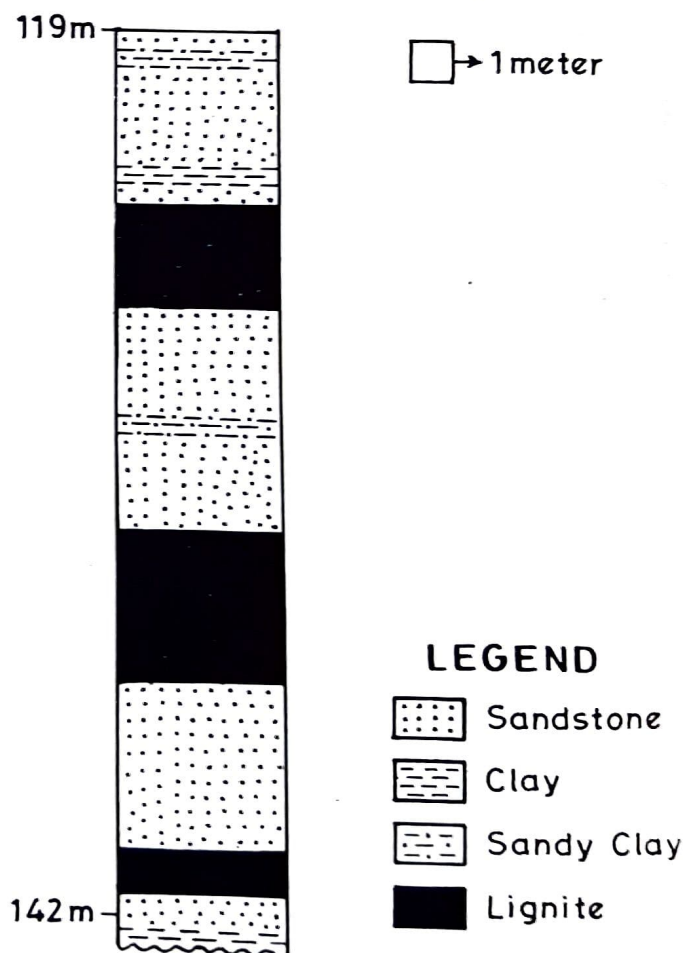
Mannargudi Area is covered by alluvium and no outcrop is visible in the neighbourhood. The lithology of the B.H. No. MII 128 comprises mostly sandstone, clay and lignite and is 142.75m deep (Text-fig. 1).

For palynological investigation 36 samples were collected (Table 1). Out of these palynological fossils were recovered from 10 samples (141.45-141.50m, 141.20-141.25m, 129.20-129.50m, 125.90-126.00m, 125.70-125.80m, 124.90-125.00m, 124.70-124.80m, 124.10-124.20m, 123.90-124.00m, 122.60-122.90m). Palynofossils are very poor at 125.70-125.80m, 124.70-124.80m, and in 123.90-124.00m.

### GEOLOGY

Tertiary sediments consisting of Palaeocene (Pondicherry) and Mio-Pliocene (Cuddalore) are exposed in patches on the western part of the basin, while most of the eastern part is mainly covered by alluvium.

The Palaeocene sequence unconformably overlies that of Late Cretaceous which is locally designated as Pondicherry Formation and is well exposed in narrow



Text-fig. 1. Showing the lithology of B.H.No. MII 128, Mannargudi, Tamil Nadu.

strips in Vridhachalam, Ariyalur and Pondicherry areas. This consists of limestones, sandy clays and sandstone. The Eocene and Oligocene marine sequence is not exposed. However, it is very well developed in subsurface where it comprises shales, sandstones and minor limestones.

The Oligocene sediments are overlain by those of Miocene age which dominantly consist of non-marine sandstones in the outcrops. The subsurface Miocene sequence is marine and adequately fossiliferous. This sequence is divided into Early, Middle and Late Miocene on the basis of fossil fauna and flora. The sequence comprises sandstone, shales, clays and limestones.

The Pliocene and Pleistocene subsurface sequences are generally arenaceous and poor in fossil contents.

The exposed sedimentary sequences, mainly con-

finied to the western part of the basin are marked by several sedimentary breaks. There are many geologists who worked on Cauvery Basin such as Ramanathan and Rao (1965), Ramanathan (1968), Banerjee (1968), Dutta and Bedi (1968), Singh *et al.* (1969), Sastri *et al.* (1977).

The general stratigraphic succession of Cauvery Basin is in Table 2.

### PALYNOLOGICAL ASSEMBLAGE

The palynological assemblage recovered from this core is quite varied and represented by pteridophytic spores and angiospermic pollen. Gymnospermic pollen are totally absent. Fungal elements are present in all samples but they are not reported here.

The palynoassemblage consists of 29 genera and 35 species : pteridophytic spores represented by 2 genera and 3 species and angiospermic pollen by 27

Table 2 : Geological succession in Cauvery Basin (after Sastri *et al.* 1977).

| Age                             | Formation                 | Gross Lithology  | Maximum thickness (meters) |         | Environment surface  | Remarks                                  |
|---------------------------------|---------------------------|--|----------------------------|---------|--|--|
|                                 |                           |  | Outcrop                    | Subcrop |  |  |
| Holocene to Pleistocene         | Alluvium and Recent sands | Alluvium sands and clays, lateritic<br>-----Unconformity-----  | 100                        | 95      | Continental in outcrops, continental to brackish in subsurface |  |
| Late Miocene to Pliocene        | Cuddalore Sandstone       | Sandstone, Claystone in outcrops, Sandstone, Claystone, Limestone, and traces of Lignite in subsurface<br>-----Unconformity----- | 600                        | 300+    | Continental in outcrops, marine in subsurface                  | Exposed in western part of the basin     |
| Early Miocene to Middle Miocene |                           | Sandstone, Claystone Limestone, Shale and traces of Lignite in subsurfaces<br>-----Unconformity-----                             |                            | 1190+   | Marine   | Not exposed in western part of the basin |
| Oligocene                       |                           | Claystone, Shale, Sandstone & Limestone in subsurface<br>-----Unconformity-----  |                            | 340     | Marine   | Not exposed                              |
| Eocene                          |                           | Shale, Claystone, Sandstone, Lignite, and Bioclastic Limestones in subsurface<br>-----Unconformity-----                          |                            | 1150+   | Marine   | Not exposed                              |
| Palaeocene                      | Pondicherry               | Shale, Sandstone, and Limestone in outcrops, Shale, Limestone and minor Sandstone in subsurface                                  | 230+                       | 700+    | Marine   | Exposed only in northern part of basin   |

genera and 32 species. From this assemblage one new genus and four new species (all angiosperm) are reported here:

*Tamilnaduapollis reticulatus* gen. et sp. nov.

*Verrualetes excellensus* sp. nov.

*Tricolporopilites magnus* sp. nov.

*Crotonipollis mannargudensis* sp. nov.

The rest all other taxa are listed below :

**Pteridophytes** : *Lygodiumsporites lakiensis* Kar 1985, *Schizaeoisporites eocenicus* Potonie' 1956, *Schizaeoisporites* sp.

**Angiosperms** : *Matanomadhiasulcites maximus* Kar 1985 , *Acanthotricolpites bulbospinosus* Kar 1985, *Dipterocarpuspollenites retipilatus* (Kar & Jain) Kar 1993, *Bombacacidites traingulatus* Kar 1985, *Ctenolophonidites costatus* van Hoeken-Klinkenberg 1966, *Retistephanocolpites granulatus* Kar 1985, *Piladiporocolpites caratinii* Kar 1995, *Cuddaloripollis complexa* Singh & Misra 1991, *Sastripollenites trilobatus* Venkatachala & Kar 1969, *Pellicieripollis langenheimii* Sah & Kar 1970, *Lonagiopollis arcotense* Singh (unpublished), *Marginipollis kutchensis* Kar 1985, *Pilatetradites meghalayensis* Kumar 1995, *Margocolporites tsukadai* Ramanujam 1966, *Retitribrevicolporites matanomadhensis* Kar 1985, *Tricolporopilites robustus* Kar 1985, *Tricolporopilites pseudoreticulatus* Kar 1985, *Dermatobrevicolporites dermatus* Kar 1985, *Angulocolporites* sp., *Meliapollis raoi* Sah & Kar 1970, *Meliapollis ramanujamii* Sah & Kar 1970, *Meliapollis navalei* Sah & Kar 1970,

*Jacobipollenites distinctus* Singh & Mishra 1991, *Trilatiporites erdtmani* Ramanujam 1966, *Trilatiporites noremi* Ramanujam 1966, *Triangularites bellus* Kar 1985, *Neocouperipollis kutchensis* Venkatachala & Kar 1969, *Spinizonocolpites echinatus* Muller 1986.

The description of new genera and species are given below:

**Genus - *Tamilnaduapollis* gen. nov.**

**Type species-** *Tamilnaduapollis reticulatus* sp. nov.

**Generic Diagnosis-** Pollen grains subtriangular-subcircular, 31-46 x 24-30µm, tricolpate, exine broadly reticulate.

**Description** - Pollen grains generally subtriangular in polar view, apices broadly rounded, interapical margin convex, pollen grains oval in equatorial view. Tricolpate, brevicolpate, in equatorial view colpi appears as slit. Exine 3-4µm thick, reticulation broad, meshes broad, lumina shallow.

**Comparison** - *Retipollenites* Guzman (1967) closely resembles the present genus in broad reticulation of the exine but the former is easily differentiated by its inaperturate condition. *Cheilanthoidspora* Sah & Kar (1974) is also broadly reticulate but has monolete or trilete mark. *Spirosyncolpites* Guzman (1967) is syncolpate.

*Tamilnaduapollis* proposed here is differentiated from all other genera by its broad reticulation.

***Tamilnaduapollis reticulatus* sp. nov.**

Pl. 1, figs 1,4 & 6

**Holotype** - Pl. 1, fig. 6, Slide No. 11932, Q17/4

## PLATE-1

( All photomicrographs are enlarged ca x 1000 unless otherwise mentioned )

- |             |  |   |
|-------------|--|---|
| Figs 1 & 6. | <i>Tamilnaduapollis reticulatus</i> gen. et sp. nov. 11931, P. 30; 11932, Q 17/4 (x1500) | 11937, L 39/3; 11937, J1714   |
| Figs 2 & 8. | <i>Verrualetes excellensus</i> sp. nov. 11933, Q 42/2 (x 1500); 11934, V42/3             | Fig. 7. <i>Sastripollenites trilobatus</i> Venkatachala & Kar, 11939, G13/2 (x2000) |
| Fig.3.      | <i>Crotonipollis mannargudensis</i> sp. nov. 11935, H50 (x 2000)                         | Fig. 10. <i>Ctenolophonidites costatus</i> van Hoeken-Klinkenberg 11938, (x20/1)    |
| Fig.4.      | Tetrad of <i>Tamilnaduapollis reticulatus</i> gen. et sp. nov. 11936, T15                | Fig. 11 & 13. <i>Tricolporopilites magnus</i> sp. nov. 11939, P 16/4; 11940, K38    |
| Figs 5 & 9. | Tetrad of <i>Crotonipollis mannargudensis</i> sp. nov.                                   | Fig. 12. Same specimen of fig. 9 showing the ornamentation.                         |

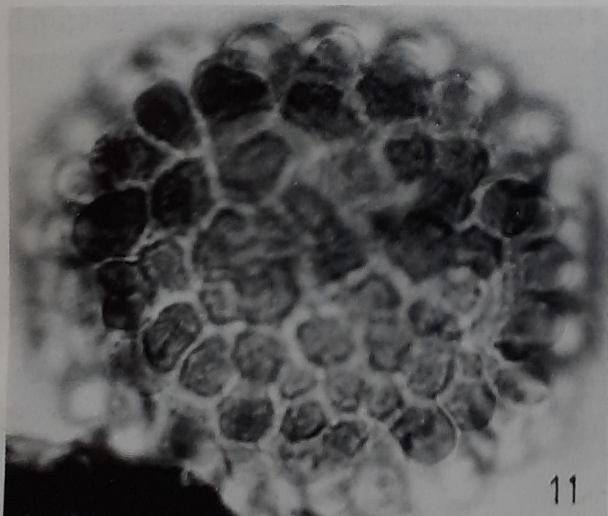
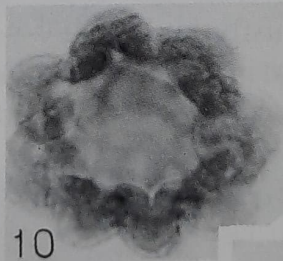
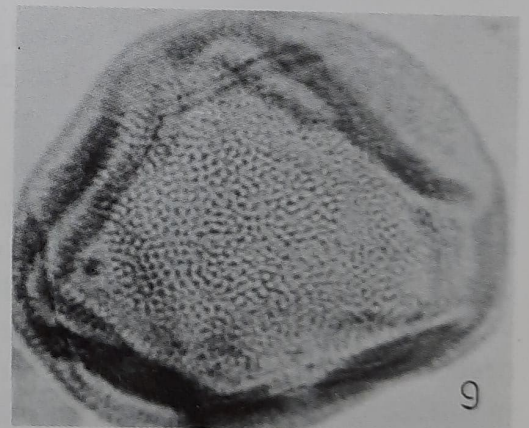
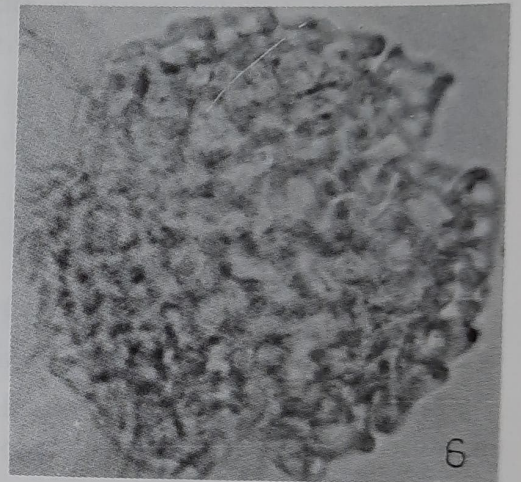
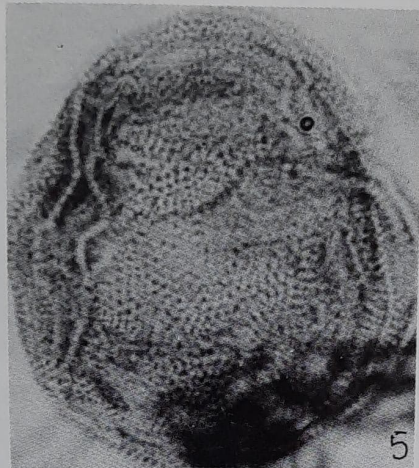
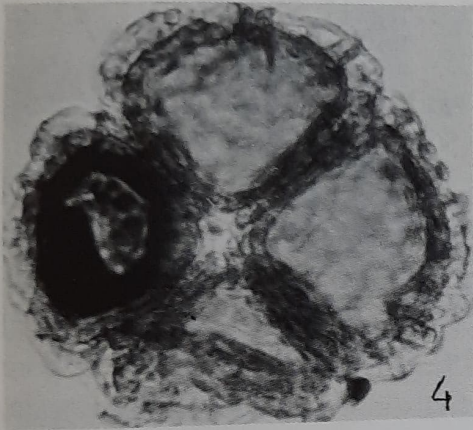
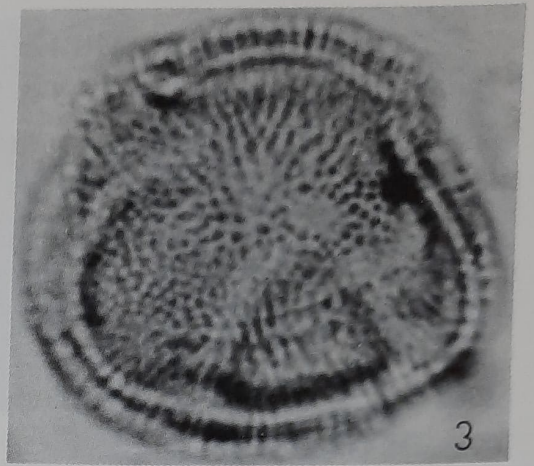
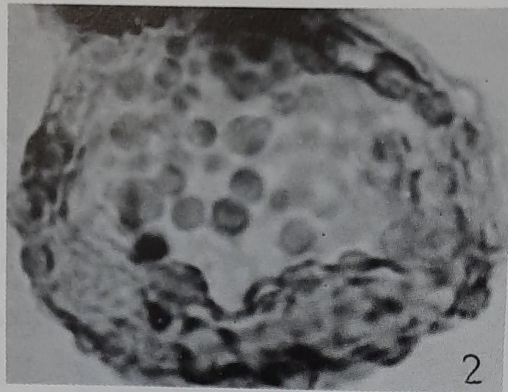
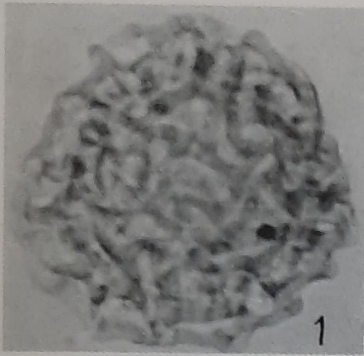


PLATE I

*Type locality* - B.H. No. MII 128, Mannargudi, depth 141.20m-141.25m, Cauvery Basin.

*Diagnosis* - Pollen subcircular to subtriangular, tricolpate, exine broadly reticulate.

*Description* - Pollen found both in individual and tetrad condition. Individual pollen subcircular to subtriangular, 35-40 x 28-26µm, tricolpate, exine 3-4µm thick, tectate, broadly reticulate, meshes 4-5µm broad, forming subcircular to rhomboidal shaped meshes, muri 2-3 µm thick.

**Genus - *Verrualetes* Singh & Saxena 1984**

*Type species* - *Verrualetes assamicus* Singh & Saxena, 1984

***Verrualetes excellensus* sp. nov.**

Pl. 1, figs 2 & 8

*Holotype* - Pl. 1, fig.2, Slide No. 11933, Q 42/2

*Type locality* - B.H.No. MII 128, Mannargudi, depth 124.90-125.00m, Cauvery Basin.

*Diagnosis* - Subcircular to oval, inaperturate, exine finely microreticulate, pilate to verrucate, not uniformly distributed.

*Description* - Subcircular to oval in shape, 35-40 x 45-52 µm, inaperturate, exine 2-3 µm thick, finely microreticulate, pilate to verrucate, not uniformly distributed.

*Comparison* - In *Verrualetes assamicus* Singh and Saxena (1984), verrucae are robustly built, densely placed and form pseudoreticulum in surface view. But in the present described species verrucae neither densely placed nor they form pseudoreticulum in surface view. In *Verrualetes kalarakodensis* Rao (1995) there is no microreticulation. But in the present

specimen besides pila and verrucae exine is finely microreticulate.

**Genus - *Tricolporopilites* Kar 1985**

*Type species* - *Tricolporopilites (Retitrescolpites) robustus* (Kar & Saxena) Kar 1985

***Tricolporopilites magnus* sp. nov.**

Pl. 1, figs 11 & 13

*Holotype* - Pl. 1, fig. 11, Slide No. 11939, P16/4

*Type locality* - B.H. No. MII 128, Mannargudi, depth 129.20-129.50m, Cauvery Basin.

*Diagnosis* - Subcircular to oval, tricolporate, pila heavily built, size of pila 5-12 µm, base of the pila fused.

*Description* - Subcircular to oval in equatorial view, 50-64 x 45-85µm, tricolporate, colpi long, pore and colpi not much distinct due to heavily built pila, size of pila 5-12 µm, base of the pila fused.

*Comparison* - In the present species the size of the pila is very big as compared to *Tricolporopilites robustus* Kar, 1985 and *Tricolporopilites pseudoreticulatus* Kar, 1985. In both of them size of the pila is 2-4 µm but in the present one it is 5-12µm.

**Genus - *Crotonipollis* Baksi, Deb & Siddhanta 1979**

*Type species* - *Crotonipollis burdwanensis* Baksi, Deb & Siddhanta, 1979

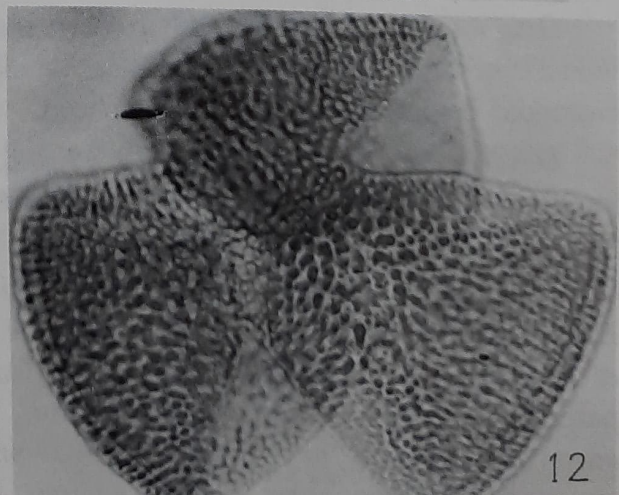
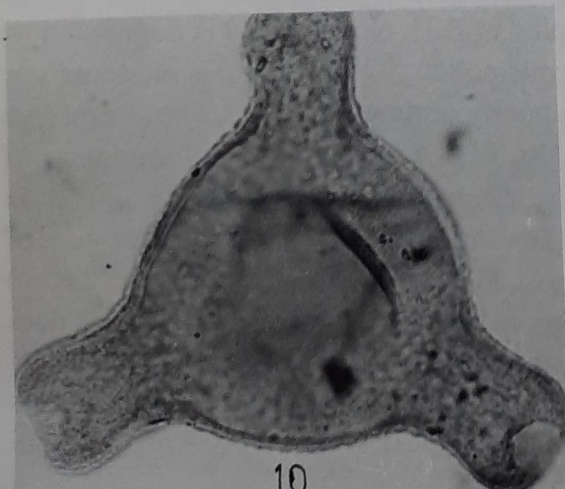
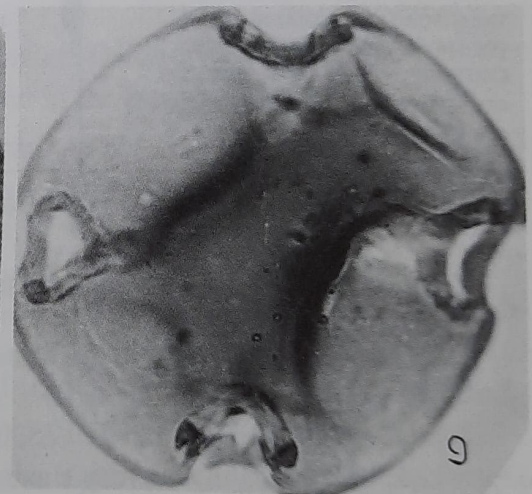
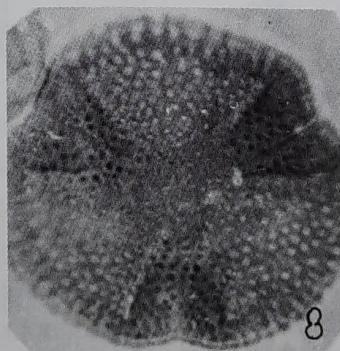
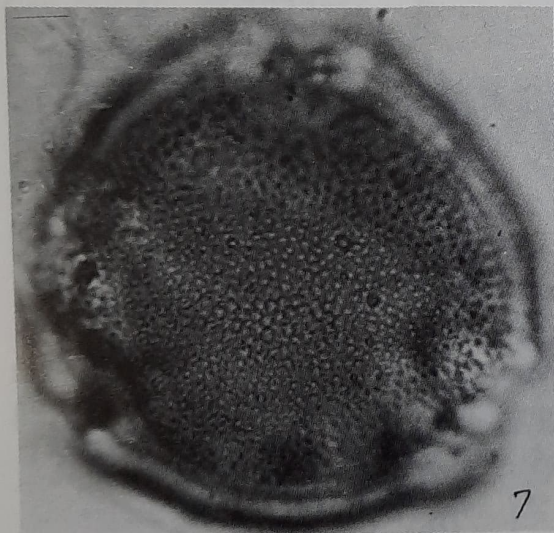
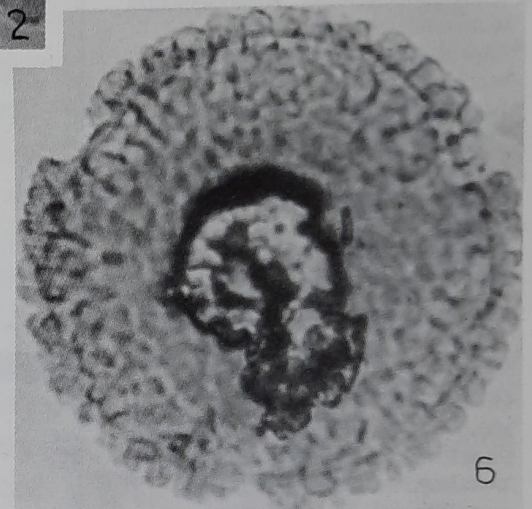
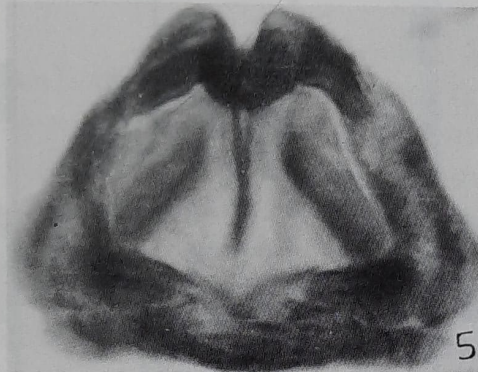
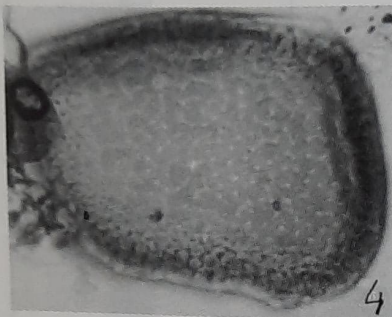
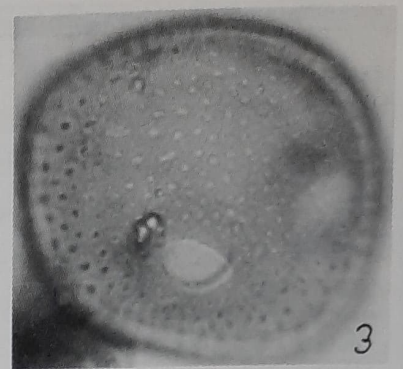
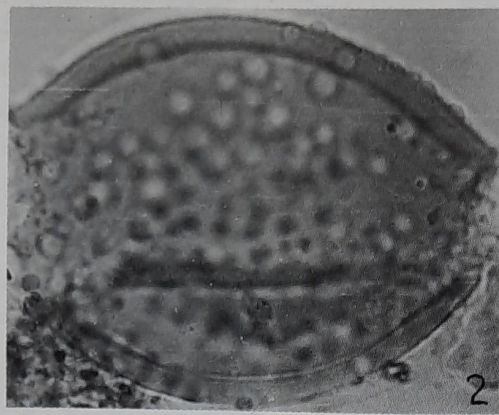
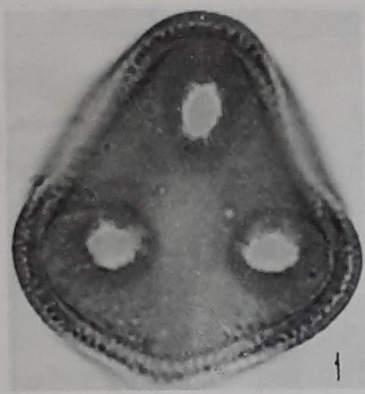
*Remarks* - This genus is named after the distinct "croton pattern". Baksi *et al.* (1979) described this genus as inaperturate. But by seeing the photograph of the type species (Baksi *et al.* 1979, fig. 1) it seems to be tricolpate.

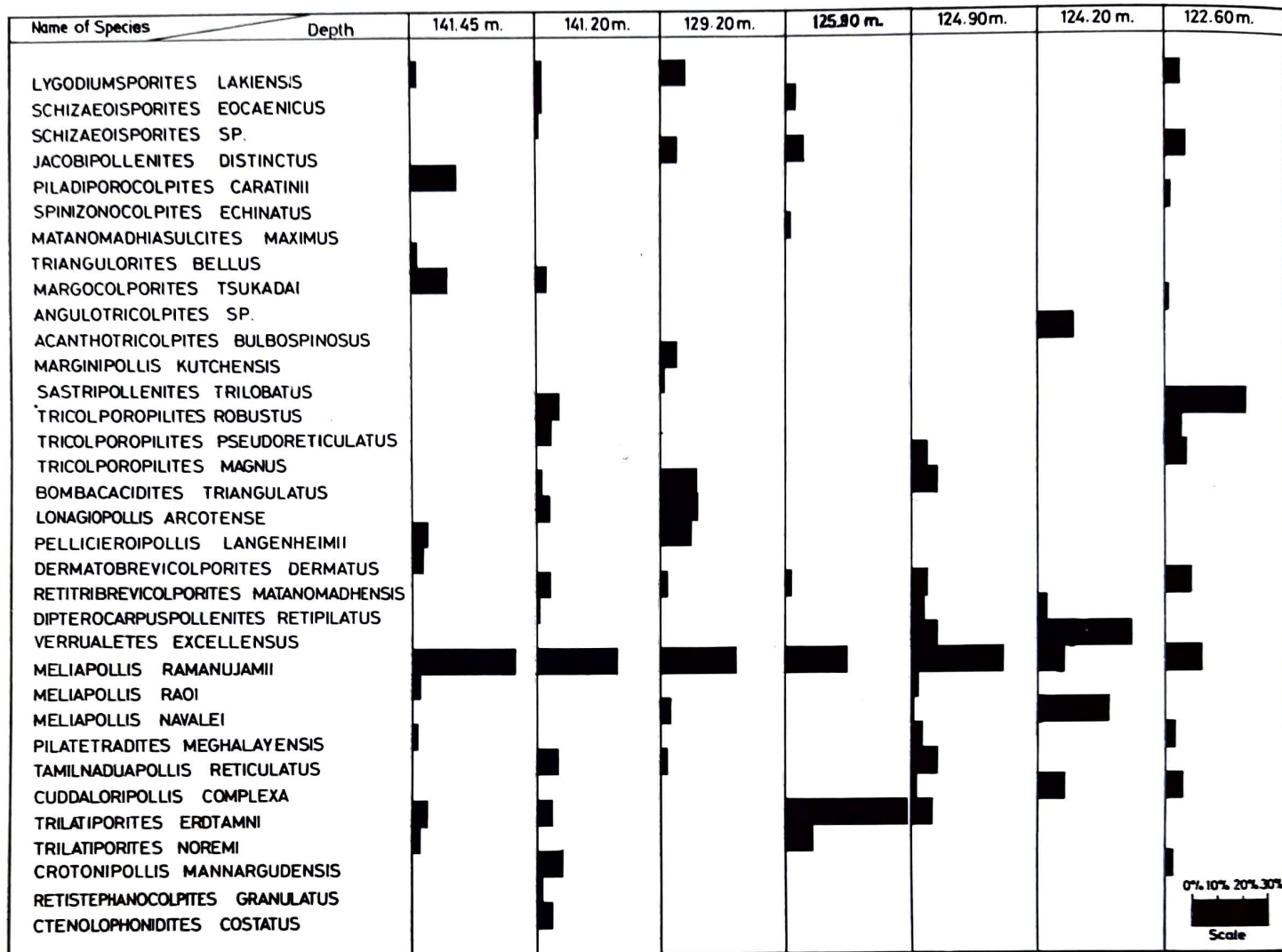
**PLATE-2** →

( All photomicrographs are enlarged ca x 1000 unless otherwise mentioned )

- Fig. 1. *Trilatiporites endtmani* Ramanujam, 11938, R44  
 Fig. 2. *Piladiporocolpites caratinii* Kar, 11941, M47/3  
 Fig. 3. *Retitribrevicolporites matanomadhensis* Venkatachala & Kar, 11942, P29  
 Fig. 4. *Matanomadhiasulcites maximus* Kar, 11943, T18/3 (x450)  
 Fig. 5. *Dermatobrevicolporites dermatus* Kar, 11944, J26/2 (x1500)  
 Fig. 6. *Tricolporopilites robustus* Kar, 11945, V41

- Fig. 7. *Pellicieropollis langenheimii* Sah & Kar, 19946, M10  
 Fig. 8. *Bombacacidites triangulatus* Kar 11947, R26/1  
 Fig. 9. *Meliapollis ramanujamii* Sah & Kar, 11944, V40  
 Fig. 10. *Triangulorites bellus* Kar, 11948, D 32  
 Fig. 11. Same specimen of fig. 2 showing the diporocolpate condition  
 Fig. 12. *Dipterocaruspollenites retipilatus* Kar, 11938, M34/3





Text-fig. 2. Showing the frequency of different species present in B.H.No. MII 128, Mannargudi area, Tamil Nadu.

### *Crotonipollis mannargudensis* sp. nov.

Pl. 1, figs 3, 5 & 9

*Holotype* - Pl. 1, fig.3, Slide No. 11935, H 50

*Type locality* - B.H. No. MII 128, Mannargudi, depth 124. 10-124.20m, Cauvery Basin.

*Diagnosis* - Pollen found both in tetrad and individual condition, tricolporate, exine pilate, arranged in crotonoid fashion which looks like pin head.

*Description* - Tricolporate, 33 x 35  $\mu$ m, colpi long, exine 2-3  $\mu$ m, thick, pilate, pila heads fused to form crotonoid pattern. Tetrads 43-64 x 65 x 55-75 $\mu$ m.

*Comparison* - *Crotonipollis burdwanensis* Baksi *et al.* (1979) and *Crotonipollis neyvelii* Baksi *et al.* (1979) are bigger in size (55 x 60 $\mu$ m) as compared to the present species (33 x 35 $\mu$ m). In *C. burdwanensis* and *C. neyvelii* the crotonoid patterns are rhomboidal/triangular in shape whereas in the

present specimens it looks like pin head. In the present study both tetrad and monad conditions are found. But Baksi *et al.* (1979) reported only monad condition.

### DISCUSSION

The palynological assemblage recovered from different depths of B.H. No. MII 128 is dominated by angiospermic pollen (97%) while the pteridophytic spores are poorly represented (3%). The assemblage of B.H. No. MII 128 shows the dominance of *Meliapollis ramanujamii* followed by *Trilatiporites erdtmani* (Text-fig.2). From the relative percentage of the species at different depths (141.45m to 122.60m) it was observed that the palynological succession does not differ much. The whole assemblage could be accommodated in palynological subzone *Meliapollis ramanujamii* proposed by Kar (1985) from Naredi Formation, Kutch.



**Age** - The palynological taxa recorded from the bore hole core comprise *Meliapollis ramanujamii*, *Meliapollis navalei*, *Matanomadhiasulcites maximus*, *Acanthotricolpites bulbospinosus*, *Ctenolophonidites costatus*, *Piladiporocolpites caratinii*, *Pellicieroipollis langenheimii*, *Retitribrevicolporites matanomadhensis*, *Sastripollenites trilobatus*, *Tricolporopilites robustus*, *Tricolporopilites pseudoreticulatus*, *Triangulorites bellus*, *Trilatiporites erdtmani* and *Spinizonocolpites echinatus*.

Most of these taxa indicate an Early Eocene age for the assemblage except *Tricolporopilites robustus* and *Tricolporopilites pseudoreticulatus* which are so far known only from the Middle Eocene sediments of western and eastern India. *Dipterocarpuspollenites retipilatus* is also known so far from the Miocene sediments Kerala. Otherwise, as has already been said, the present assemblage closely approximates *Meliapollis ramanujamii* subzone of the *Lakiapollis ovatus* Cenozoone of Kar (1985) proposed for the Naredi Formation (Early Eocene) of Kutch. Since there are also some typical Middle Eocene palynotaxa in the assemblage it may be assumed that the sediments belong to the upper part of the Early Eocene

**Palaeoclimate and Palaeoecological condition of deposition**—The presence of spores and pollen of Schizaeaceae (*Lygodiumsporites*, *Schizaeoisporites*), Caesalpiaceae (*Margocolporites*), Meliaceae (*Meliapollis*), Ctenolophonaceae (*Ctenolophonidites*) in the assemblage is indicative of prevalence of tropical climate at the time of deposition. In most of the samples, fungal spores are found in abundance. The presence of fungal spores and tropical rain forest elements confirm high degree of rainfall. Thus, a humid and tropical climate with high rainfall is believed to have existed.

*Trilatiporites* [Arecaceae (*Sclerosperma*)], which is a coastal flora, is found abundantly in the present samples. The palynoflora is also characterised by some swamp dwellers such as fossil pollen corresponding to *Barringtonia* (*Marginipollis*), *Nypa* (*Spinizonocolpites*) of Arecaceae.

## COMPARISON WITH OTHER KNOWN PALYNOLOGICAL ASSEMBLAGES

A comparison of the present assemblage with other important assemblages from different sedimentary sequences of India is discussed below:-

**Cauvery Basin** — Thiergart and Frantz (1963) described some spores and pollen from Tertiary brown coal of Neyveli. They got *Trilatiporites* type of pollen which is also found in the present assemblage.

Ramanujam (1966) studied the palynology of the lignite of South Arcot District, Tamil Nadu. In both angiospermic pollen are found in dominance. But very few palynotaxa such as *Margocolporites tsukadai*, *Trilatiporites erdtmani* and *T. noremi* are common in both assemblages. However, *Retipilonapites arcotense*, *Longapertites cuddalorese*, *Tricolpites thomasii*, *Cupuliferoipollenites oratus*, *Nothofagidites couperi*, *Nothofagidites densum* which are very rich in his assemblage are not found in the present one.

Deb *et al.* (1973) described some *Margocolporites*, *Trilatiporites* type of pollen which are also found in the present assemblage.

Siddhanta (1986) recovered some palynotaxa viz., *Schizaeoisporites eocenicus*, *Marginipollis kutchensis*, *Ctenolophonidites costatus*, *Retistephanocolpites granulatus*, *Meliapollis ramanujami* and *Triangulorites bellus*. These taxa are also found in the present assemblage. Many palynotaxa such as *Polypodiisporites rapandus*, *Crotonipollis neyveli*, *Palmaepollenites eocenicus*, *Proxapertites operculatus*, *Polybrevicolporites cephalus* and *Spirapollis assamensis* reported by Siddhanta (1986) are not found in the present assemblage.

Saxena (1992) described three cenozones from Neyveli Formation which are in ascending order as follows:-

- (i) *Neocouperipollis* sp. Cenozoone
- (ii) *Triangulorites bellus* Cenozoone
- (iii) *Trilatiporites sellingi* Cenozoone

None of these cenozones are closely similar to the present one. But palynotaxa viz., *Neocouperipollis*

*kutchensis*, *Spinizonocolpites echinatus*, *Trilatiporites erdtmani*, *T. noremi*, *Margocolporites tsukadai*, *Meliapollis ramanujamii*, *M. raoi*, *M. navalei*, *Pellicieropollis langenheimii* and *Triangulorites bellus* are common in both.

The palynological studies on Palaeocene-Eocene sediments of Karaikal, Madanam and Mannargudi wells, Cauvery Basin were carried out by Venkatachala and Rawat (1984). They described 61 genera and 110 species, out of which only 4 genera viz., *Lygodiumsporites*, *Schizaeoisporites*, *Spinizonocolpites* and *Margocolporites* and only one species i.e. *Spinizonocolpites echinatus* are common in both.

Singh and Misra (1991) described four new pollen genera and seven new species from the subsurface of Neyveli lignite. Out of these only one species viz., *Cuddaloripollis complexa* is also reported from present bore core.

**Kerala Basin** - Raha *et al.* (1987) studied the Eocene palynofossils in the subsurface Tertiary sediments of Kerala. The palynofossils common in both the assemblages are : *Dermatobrevicolporites dermatus*, *Triangulorites bellus* and *Meliapollis ramanujamii*. But *Palmaepollenites kutchensis*, *Laevigatosporites cognatus*, *Retistephanocolpites kutchensis*, *Tribrevicolporites eocenicus* and *Lakiapollis ovatus* are absent in the present bore core.

Rao (1995) studied the palynostratigraphic zonation and correlation of the Eocene- Early Miocene sequence in Alleppey District, Kerala. Out of 18 species of pteridophytes recorded by him one species i.e. *Lygodiumsporites lakiensis* and out of 44 species of angiospermic pollen only 7 species such as *Dermatobrevicolporites dermatus*, *Triangulorites bellus*, *Sastripollenites trilobatus*, *Tricolporopillites pseudoreticulatus*, *Margocolporites tsukadai* and *Neocouperipollis kutchensis* are common between the two assemblages.

**Palana, Rajasthan** - Rao and Vimal (1950, 1952), Sah and Kar (1974) and Kar (1995) made palynological studies on the Palana lignites, Rajasthan. The taxa common between Palana and the present bore

core are : *Schizaeoisporites*, *Margocolporites*, *Meliapollis*, *Retistephanocolpites*, *Neocouperipollis* and *Piladiporocolpites*. Only three species are common in both. There are : *Neocouperipollis kutchensis*, *Meliapollis ramanujamii* and *Piladiporocolpites caratinii*. The Palana Formation contains the following palynotaxa which are absent in the present bore core : *Kielmeyerapollenites*, *Cheilanthoidspora*, *Calophyllumpollenites* and *Ocimumpollenites*.

**Kutch Basin**-The palynological assemblage from Naredi Formation was divided by Kar (1985) into two cenozones- the lower *Lakiapollis ovatus* Cenozone and the upper *Lygodiumsporites lakiensis* Cenozone. The *Lakiapollis ovatus* Cenozone was further divided into three subzones: *Tricolpites reticulatus* subzone, *Meliapollis ramanujamii* subzone, *Inapertisporites kedvesii* subzone.

In *Meliapollis ramanujamii* subzone the significant species are *Dermatobrevicolporites dermatus*, *Meliapollis quadragularis*, *Pellicieropollis langenheimii*, *Neocouperipollis ovatus* and *Palmaepollenites nadhamunii*. In the present bore core *Dermatobrevicolporites dermatus*, *Pellicieropollis langenheimii* and different species of *Meliapollis* are also found. In Naredi Formation *Meliapollis ramanujamii* contributes 25% to the assemblage, while the present one contributes 29% to the assemblage.

## CONCLUSION

The present investigation leads us to the following conclusions :

1. The angiospermous pollen are qualitatively and quantitatively dominant in the B.H. No. MII 128.
2. The palynoassemblage can be placed in one palynozone, i.e. *Meliapollis ramanujamii* subzone.
3. The palynoflora suggests a humid and tropical climate with plenty of rainfall during the deposition of these sediments.
4. The environment of deposition has been inferred as coastal swamps.
5. On the basis of palynological data, the age of sediments in B.H. No. MII 128 is assigned to Early Eocene.

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