

Palynological findings from the mud volcanoes of Baratang Island (Andaman and Nicobar Islands), India

J. Mandal, A. Chandra & R.K. Kar

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow-226007

Mandal, J., Chndra, A. & Kar, R.K. 1996. Palynological findings from the mud volcanoes of Baratang Island (Andaman and Nicobar Island), India. *Geophytology* 25: 77-81.

A rich palynological assemblage of pollen/spores ranging in age from Late Cretaceous to Oligocene is recorded for the first time from the mud volcanoes of Baratang Island. The assemblage is represented by 50 genera belonging to 56 species. A few dinoflagellate cysts are observed in one sample. Occurrence of Oligocene elements eg. *Meyeripollis* in the assemblage is significant.

Key-words- Palynology, Mud volcanoes, Baratang Island, Andaman-Nicobar.

INTRODUCTION

MUD volcanoes are cone shaped mounds built around a spring by mud brought from the subsurface by slowly escaping natural gas. Mud volcanoes are accumulation of dried mud in the form of a crater or a cone. The mud is derived from the disintegration of the rocks lying beneath the sub-surface in close association with the gas bearing strata. In size, mud volcanoes are generally 10-15 m high and may acquire the shape of a basin with a central vent or remain like a volcanic cone. Soft liquid mud is erupted gently through the vents. Examples of violent eruptions of thick mud and fragments of country rocks are also known. The friction caused due to the eruption may sometimes be sufficient to ignite the accompanying hydrocarbon gas. The mud volcanoes are seen to be more active during rains. Perhaps, the rain water helps to soften the mud and thus hasten the pressure on the imprisoned gas. Eruptions of mud volcanoes have been observed during earthquakes if they are present in the earthquake effected areas. It is expected that the crustal disturbance would favour the eruption of gas in mud volcanoes.

In the Indian sub-continent, mud volcanoes are well known from the Irravady valley and Arakan coast of Burma and at the other end of the Himalayan arc in the Mekran Coast of Baluchistan. Besides, we have also mud volcanoes in Baratang Island (Andaman group),

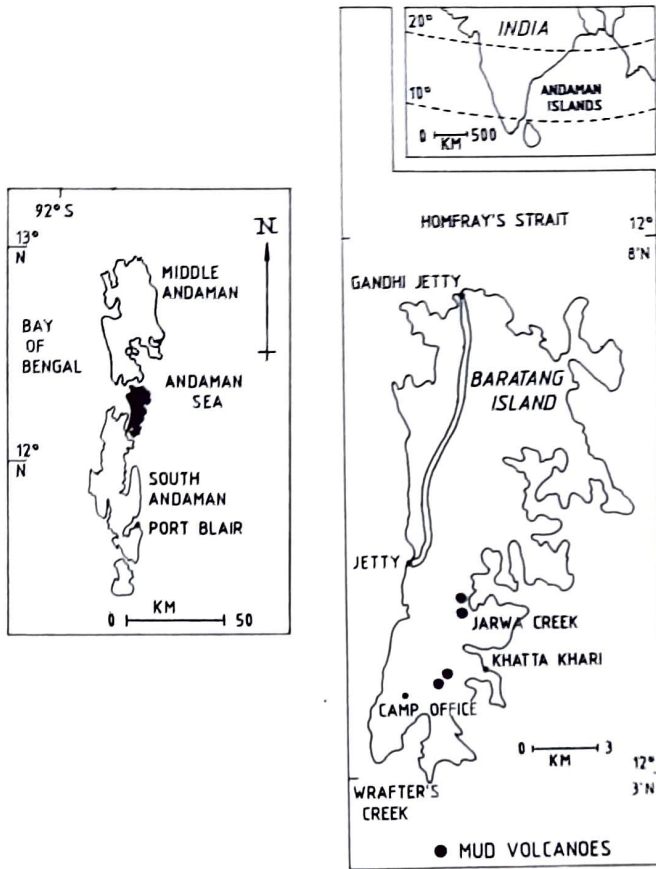
India which was first reported by Poddar (1954). There is also a stray report of mud volcano in Assam (in Medlicott & Blanford 1879-1887, p. 729).

The mud volcanoes of Baratang Island (Andaman) are cone type and they effuse light grey plastic clay with saline water, gas and traces of hydrocarbons.

The present paper records the result of the palynological investigation of mud ejected from the mud volcanoes of the Baratang Island. This is the first report of the occurrence of palynofossils although Late Cretaceous to Early Cenozoic foraminifera, nannofossils and coccoliths are known from the same sediments by Badve *et al.* (1984), Rajsekhar (1989) and Jafar (1985, 1994), respectively. Even otherwise, we have very few palynological fossil records from Andaman and Nicobar Islands (Banerjee, 1966, 1967; Mathur & Mathur, 1980; Sharma & Mehrotra, 1984; Mandal *et al.* 1994).

The samples for the present work were collected by R.K. Kar followed by Anil Chandra and J. Mandal during different field seasons from mud volcanoes of Baratang Island situated between latitudes 12°3"N and 12°8"N in the Jarwa creek and camp office areas (Map 1). These samples were chemically processed to isolate pollen/spores following usual maceration technique. Temporary slides were prepared for the present study.

The negatives are preserved at the repository of the Birbal Sahni Institute of Palaeobotany, Lucknow.



Map 1. Showing the location of mud volcanoes from Baratang Island.

OBSERVATION

The spores, pollen, fungal remains and specks of coaly macerals are quite common in all samples. There are 50 genera and 56 species in the assemblage and quantitatively spores are dominant. A few dinoflagellate cysts are also observed in one sample. Recovered palynofossils are mostly dark coloured. About 10% of the taxa could not be identified because they are either

badly preserved or seems to be new (Pl. 1, figs 19 & 20). The following is the list of identified palynotaxa:

- Cyathidites australis* Couper, 1953 (Pl. 1, fig. 1)
Gleicheniidites senonicus Ross, 1949
Callialasporites trilobatus (Balme) Sukh-Dev, 1961
Dictyophyllidites dulcis (Kar) Kar, 1985
Alsophilidites psilatus Kumar, 1973 (Pl. 1, fig. 10)
Lycopodiumsporites speciosus Dutta & Sah, 1970
Lygodiumsporites sp. (Pl. 1, fig. 9)
Densoisporites mesozoicus Singh, Srivastava & Roy emend. Bharadwaj & Kumar, 1972
Striatriletes susannae van der Hammen emend. Kar, 1979 (Pl. 1, fig. 5)
S. paucicostatus Kar, 1985
Osmundacidites wellmanii Couper, 1953 (Pl. 1, fig. 3)
Todisporites major Couper, 1958
Cooksonites variabilis Pocock, 1962
Dandotiaspora dilata Sah, Kar & Singh, 1971 (Pl. 1, fig. 2)
D. telonata Sah, Kar & Singh, 1971
Laevigatosporites cognatus Sah & Kar, 1969, (Pl. 1, fig. 6)
Crassoretitriletes vanraadshovenii Germeraad, Hopping & Muller, 1968
Pteridacidites sp. (Pl. 1, fig. 27)
Sterisporites assamensis Sah & Dutta, 1968
Contignisporites dettmannii Singh & Kumar, 1966
Deltoidospora plicata Singh, 1977
Aequitriradites dubius Delcourt & Sprumont emend. Delcourt, Dettmann & Hughes, 1963 (Pl. 1, fig. 28)
Verrudandotiaspora verrucata (Kar & Saxena) Kar, 1985
Cicatricosisporites australiensis (Cookson) Potonié, 1956

Plate 1

(All figures are magnified x 500)

- | | |
|--|--|
| 1. <i>Cyathidites australis</i> , | 14. <i>Spinizonocolpites baculatus</i> , |
| 2. <i>Dandotiaspora dilata</i> , | 15. cf. <i>Pelliceroipollis langenheimii</i> , |
| 3. <i>Osmundacidites wellmanii</i> , | 16. <i>Striacolporites</i> sp., |
| 4. <i>Retitrisyncolpites reimannii</i> , | 17. <i>Spinizonocolpites echinatus</i> , |
| 5. <i>Striatriletes susannae</i> , | 18. <i>Neocouperipallis kutchensis</i> , |
| 6. <i>Laevigatosporites cognatus</i> , | 19.&20. Unidentified pollen, |
| 7. <i>Neocouperipollis brevispinosus</i> , | 21. <i>Minutitricolporites minutus</i> , |
| 8. <i>Polypodiisporites mawknaensis</i> , | 22. <i>Retimonosulcites ellipticus</i> , |
| 9. <i>Lygodiumsporites</i> sp., | 23. <i>Alisporites grandis</i> , |
| 10. <i>Alsophyllidites psilatus</i> , | 24. <i>Neocouperipollis</i> sp., |
| 11. <i>Retitrisyncolpites thaungii</i> , | 25.&26. Unidentified forms, |
| 12. <i>Baculimonocolpites andamanensis</i> , | 27. <i>Pteridacidites</i> sp. |
| 13. <i>Meyeripollis naharkotensis</i> , | 28. <i>Aequitriradites dubius</i> . |

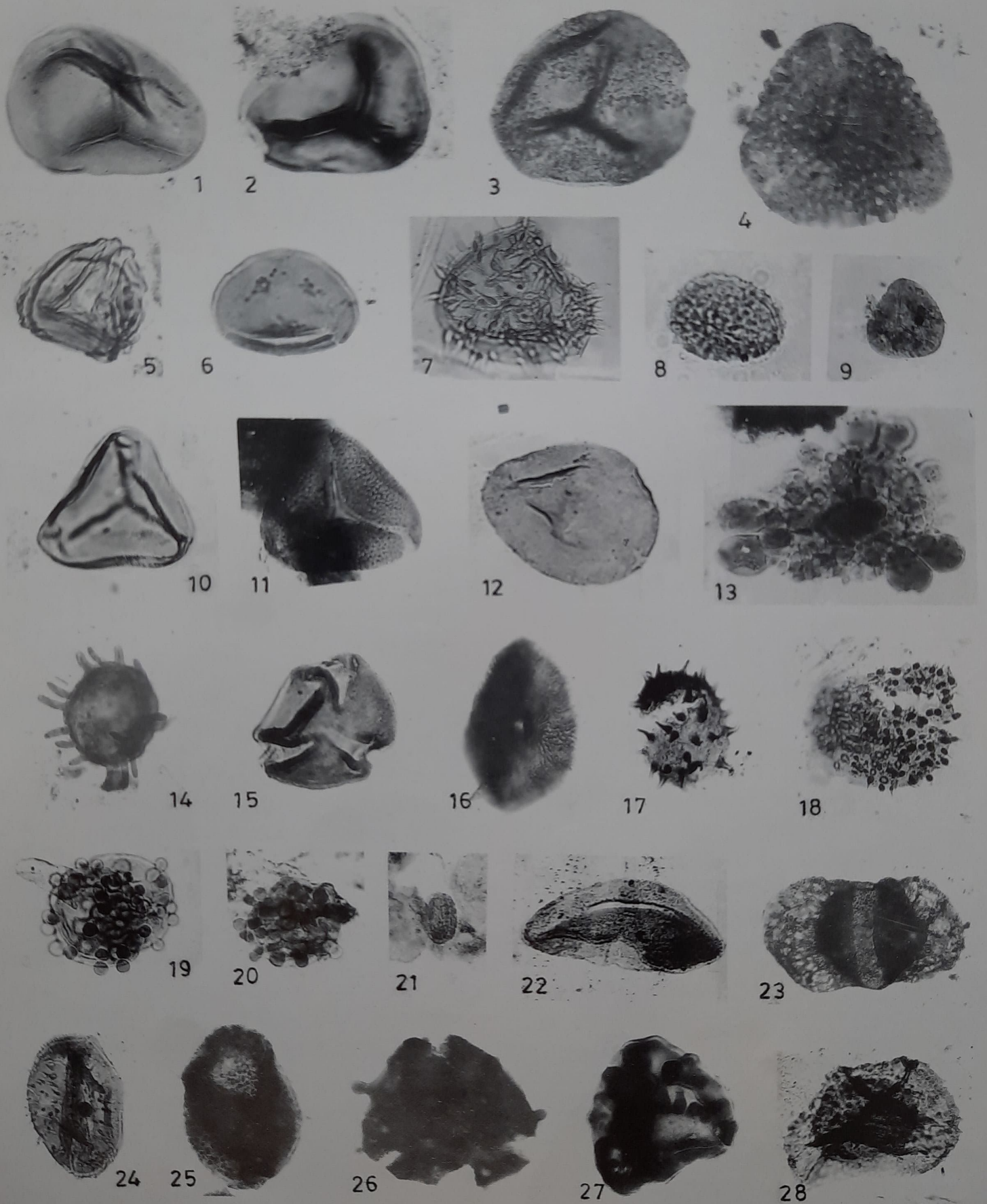


Plate 1

- Falcisporites stabilis* Balme, 1970
- Polypodiisporites mawkmaensis* (Dutta & Sah) Mathur & Chopra, 1982 (Pl.1, fig. 8)
- P. repandus* Takahashi, 1964
- Polypodiaceasporites levis* Sah, 1967
- Schizaeisporites phaseolus* Delcourt & Sprumont, 1955
- Psiloschizosporis psilata* Kar & Saxena, 1981
- Araucariacites australis* Cookson, 1947
- Podocarpidites khasiensis* Dutta & Sah, 1970
- Alisporites grandis* (Cookson) Dettmann, 1963 (Pl. 1, fig. 23)
- Klausipollenites decipiens* Jansonius, 1962
- Neocouperipollis brevispinosus* (Biswas) Sarkar & Singh, 1988 (Pl. 1, fig. 7)
- N. kutchensis* (Venkatachala & Kar) Kar & Kumar, 1986 (Pl. 1, fig. 18)
- Neocouperipollis* sp. (Pl. 1, fig. 24)
- Retimonosulcites ellipticus* (Venkatachala & Kar) Kar, 1985 (Pl. 1, fig. 22)
- Matanomadhiasulcites maximus* (Saxena) Kar, 1985
- Proxapertites crassimurus* (Sah & Dutta) Singh, 1975
- P. assamicus* (Sah & Dutta) Singh, 1975
- Retitrisyncolpites reimannii* Mandal, Chandra & Kar, 1994 (Pl. 1, fig. 4)
- R. thaungii* Mandal, Chandra & Kar, 1994 (Pl. 1, fig. 11)
- Retitrisyncolpites* sp.
- Baculimonocolpites andamanensis* Mandal, Chandra & Kar, 1994 (Pl.1, fig. 12)
- Minutitricolporites minutus* Kar, 1985 (Pl. 1, fig. 21)
- Operculosculptites globatus* Kar, 1990
- Spinizonocolpites echinatus* Muller, 1968 (Pl. 1, fig. 17)
- S. baculatus* Muller, 1968 (Pl. 1, fig. 14)
- cf. *Pelliceroipollis langenheimii* Sah & Kar, 1970 (Pl. 1, fig. 15)
- Longapertites retipilatus* Kar, 1985
- Pseudonyssapollenites kutchensis* (Venkatachala & Kar) Kar, 1985
- Lakiapollis ovatus* Venkatachala & Kar, 1969
- Dermatobrevicolporites triangulus* Kar, 1985
- Striacolporites* sp. (Pl. 1, fig. 16)
- Meyeripollis naharkotensis* Bakshi & Venkatachala, 1970 (Pl. 1, fig. 13)
- Tricolporopilites robustus* (Kar & Saxena) Kar, 1985
- Sastripollenites trilobatus* Venkatachala & Kar, 1969
- Phragmothyrtes eocenicus* Edwards emend. Kar & Saxena, 1976
- Cucurbitacidites bellus* Kar, Singh & Sah 1972
- The above mentioned assemblage contains mixed palynoflora of various ages. The important palynotaxa of particular age is listed below:
- Late Cretaceous**
- Alisporites grandis* (Cookson) Dettmann, 1963
- Klausipollenites decipiens* Jansonius, 1962
- Podocarpidites khasiensis* Dutta & Sah, 1970
- Densoisporites mesozoicus* Singh *et al.*, emend. Bharadwaj & Kumar, 1972
- Callialasporites trilobatus* (Balme) Sukh-Dev, 1961
- Araucariacites australis* Cookson, 1947
- Cicatricosisporites australiensis* (Cookson) Potonié, 1956
- Cooksonites variabilis* Pocock, 1962
- Aequitriradites dubius* Delcourt & Sprumont emend. Delcourt, Dettmann & Hughes, 1963
- Contignisporites dettmanni* Singh & Kumar, 1966
- Late Palaeocene**
- Dandotiaspora dilata* Sah, Kar & Singh, 1971
- D. telonata* Sah, Kar & Singh, 1971
- Late Palaeocene-Early Eocene**
- Matanomadhiasulcites maximus* (Saxena) Kar, 1985
- Proxapertites crassimurus* (Sah & Dutta) Singh, 1975
- P. assamicus* (Sah & Dutta) Singh, 1975
- Spinizonocolpites echinatus* Muller, 1968
- Lakiapollis ovatus* Venkatachala & Kar, 1969
- Dermatobrevicolporites triangulus* Kar, 1985
- Neocouperipollis brevispinosus* (Biswas) Sarkar & Singh, 1988
- N. kutchensis* (Venkatachala & Kar) Kar & Kumar, 1986
- Sastripollenites trilobatus* Venkatachala & Kar, 1969
- Longapertites retipilatus* Kar, 1985
- Lycopodiumsporites speciosus* Dutta & Sah, 1970
- Minutitricolporites minutus* Kar, 1985
- Middle to Late Eocene**
- Retitrisyncolpites reimannii* Mandal, Chandra & Kar, 1994
- R. thaungii* Mandal, Chandra & Kar, 1994

Baculimonocolpites andamanensis Mandal, Chandra & Kar, 1994

Verrudandotiaspora verrucata (Kar & Saxena) Kar, 1985

Osmundacidites wellmanii Couper, 1953

Tricolporopilites robustus (Kar & Saxena) Kar, 1985

Oligocene

Crassoretitriletes vanraadshovenii Germeraad, Hopping & Muller, 1968

Meyeripollis naharkotensis Baksi & Venkatachala, 1970

Striatriletes susannae van der Hammen emend. Kar, 1979

S. paucicostatus Kar, 1985

Operculosculptites globatus Kar, 1990

DISCUSSION

The previous workers (Badve *et al.*, 1984; Rajsekhar, 1989; Jafar, 1985, 1994) could not ascertain Oligocene elements in the mud ejecta of Baratang Island. However, Mathur and Mathur, 1980 recorded Oligocene palynofossils from the surface samples of the upper part of Baratang Formation. The record of *Meyeripollis naharkotensis* in the present assemblage is significant. This taxon is so far restricted to north east India and is a marker for Oligocene sediments (Meyer, 1958; Baksi & Venkatachala, 1970; Mandaokar, 1993). Moreover, the association of this species with *Crassoretitriletes vanraadshovenii*, *Striatriletes susannae*, *S. paucicostatus* and *Operculosculptites globatus* in this assemblage confirms the occurrence of Oligocene elements in the ejected mud (Kar, 1985).

Source material of the mud volcanoes could not be definitely identified except Middle Eocene and Oligocene assemblages because characteristic Palaeocene and Early Eocene palynotaxa are more or less pantropical in distribution. *Matanomadhiasulcites maximus*, a significant stratigraphic marker species of Late Palaeocene and Early Eocene, for example, is recorded from Senegal, Niger, Colombia, Cameroon and India. Likewise, the ubiquitous nature of the late Cretaceous elements are well known. *Constantinispores*, *Victorisporis* and *Andreisporis* are found during the Senonian in Brazil, West Africa and India. Some of the characteristic Middle Eocene forms like *Retitrisyncolpites reimannii*, *R. thaungii* and *Baculimonocolpites andamanensis* are known to occur in Middle Eocene sediment of Burma (Reimann & Thaug, 1981). They observed them as dominant species of Middle Eocene in Kalemeyo-Kalewa-Thetkegyin traverse.

These species are not recorded from other countries and hence it seems possible that the sediments during Middle Eocene at least partly came from Burma side. Occurrence of Oligocene microfossils specially *Meyeripollis naharkotensis* in the mud ejecta which is so far confined to north east India indicates that part of the sediments possibly came from the north east India during Oligocene. This hypothesis was also advocated by Mathur and Mathur (1980) when they recovered this taxon from the Upper part of Baratang Formation.

REFERENCES

- Badve, R. M., Ghare, M.A. & Rajshekhar, C. 1984. On the age of the ejected material from mud volcano of Baratang Island, Andaman. *Curr. Sci.* 53(15): 814-816.
- Baksi, S.K. & Venkatachala, B.S. 1970. *Meyeripollis*, a new genus from the Tertiary sediments of Assam. *J. geol. Soc. India* 11(1): 81-83.
- Banerjee, D. 1966. A note on the Tertiary microflora from the Andaman Islands, India. *Pollen spores* 8(1): 205-212.
- Banerjee, D. 1967. Upper Cretaceous microflora from Middle Andaman Isles (India). *Rev. Palaeobot. Palynol.* 5: 211-216.
- Jafar, S.A. 1985. Discovery of mixed coccoliths from mud volcanoes of Baratang Island, Andamans, India. *Curr. Sci.* 54(4): 170-173.
- Jafar, S. A. 1994. Late Maastrichtian calcareous nannofossils from the Lattengebirge (Germany) and the Andaman-Nicobar Islands (India). Remarks on events around the Cretaceous-Tertiary boundary. *N. Jb. Geol. Palaont. Abh.* 191(2): 251-269.
- Kar, R.K. 1985. The fossil floras of Kachchh-IV. Tertiary palynostratigraphy. *Palaeobotanist* 34: 1-279.
- Mandal, J., Chandra, A. & Kar, R.K. 1994. Palynofossils from Kadamtala coal, Middle Andaman, India. *Geophytology* 23(2): 290-214.
- Mandaokar, B.D. 1993. A palynological investigation of the Tikak Parbat Formation (Oligocene) of Dangri Kumari Colliery, Dibrugarh District, Assam, India. *Tertiary Research* 14(4): 127-139.
- Mathur, Y.K. & Mathur, K. 1980. Barail (Laisong) palynofossils and Late Oligocene nannofossils from the Andaman Island, India. *Geoscience Jl.* 1(2): 51-66.
- Meyer, B.L. 1958. Palynological investigations of some samples from Nahorkatiya, Assam. *J. palaeont. Soc. India* 3: 156-157.
- Poddar, M.C. 1954. Mud volcanoes of south Baratang Island (Andaman Group). *Indian Minerals* 8:251-256.
- Rajsekhar, C. 1989. Foraminiferal evidence for sediments of Santonian age occurring on Baratang Island, Andaman, India. *J. geol. Soc. India* 33: 19-31.
- Reimann, K.U. & Thaug, A. 1981. Results of palynostratigraphical investigation of the Tertiary sequence in the Chindwin Basin, North-western Burma. *IVth Int. Palynol. Conf. Lucknow (1976-1977)* 3: 380-395.
- Sharma, J. & Mehrotra, N.C. 1984. Discovery of Late Triassic sediments from Andaman Islands, some new palynological evidences. *Oil nat. gas. Comm. Bull.* 21(2): 69-73.