Palynofossils from the Kadamtala coal, Middle Andaman, India

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Palynofossils recovered from the coal beds exposed around Kadamtala are described. The assemblage is more or less equally dominated by pteridophytic spores and angiospermic pollen. Two new genera, viz., *Retitrisyncolpites* and *Baculimonocolpites* are proposed. The assemblage does not compare with any of the known assemblages from the Indian mainland; but it compares well with *Tricolpites* Type A - *Tricolpites* Type B assemblage zone of Reimann and Thaung (1981) described from the Kalemyo-Kalewa-Thetkegyin traverse, Chindwin basin, Burma. On this basis, an Early Eocene age is assigned to the present assemblage.

Key-words—Palynofossils,Coal, Kadamtala, Andaman, Early Eocene.

INTRODUCTION

THE Andaman and Nicobar Islands are part of an Indo-Burman arc System extending into south eastern Asia comprising Sumatra, Bali, Java, etc. This arc system is believed to be the result of the scarping off of the Bengal fan sediments situated on the subducting Indian plate. Acharyya *et al.* (1989), Hutchison (1982), Gee (1926), Karunakaran *et al.* (1968), Bandyopadhayaya *et al.* (1973), Mukherjee (1982), Srinivasan (1986, 1988) and many others have worked on the geology of these islands.

The oldest rock unit found so far is the Ophiolite suite exposed on the eastern part of the main Andaman Island. On the basis of *Globotruncana* species occurring on the overlying cherty-pelagic radiolarian limestone, the age of the Ophiolite is supposed to be older than Early Campanian (Acharyya *et al.* 1989). Chatterjee (1967) divided the terrigenous flysch sediments of the main Andaman Island into Baratang and Port Blair formations. Gee (1926), Chatterjee (1964), Guha & Mohan (1965), Pandey (1972) reported foraminifera, and Badve *et al.* (1984) described Ichnofossils from Baratang Formation. Marine palynofossils comprising dinoflagellate, radiolaria, planktonic foraminifera and nannofossils are reported by Sharma and Mehrotra (1984), Sharma and Sarjeant (1987), Kumar (1990), Mehrotra and Sarjeant (1990), Gupta and Mohan (1965) and others.

Reworked and fragmentary vegetal matter comprising thin lenses of coal are occasionaly found in carbonaceous shales and gritty graywacke - sandstone of Baratang Formation. Banerjee (1966, 1967) reported for the first time palynotaxa from the Andaman Island. Mathur and Mathur (1980) recorded palynofossils from the Baratang Formation. Awasthi and Jafar (1990) described a carbonised wood belonging to *Laurinoxylon* Felix (1883) from Baratang Island and discussed the provenance and depositional environment of the vegetal matter.

The present palynological investigation is based on 17 samples, collected from a nala about 3 km. north of Kadamtala (92°49' 18" : 12°20' 24") (Text-fig.1) and adjacent regions. Thin lenses of coal occasionally of 15 - 25 cm thickness are exposed. The overlying and the underlying sediments are made up of grey - carbonaceous shale and the total thickness of the exposure is about 3 m. The material was treated with 40% HNO_3 and followed by a wash of 5% KOH solution. The material is quite rich in palynofossils and some of the forms including three new taxa are detailed here. The slides are deposited at the repository of the Birbal Sahni Institute of Palaeobotany, Lucknow.

DESCRIPTION

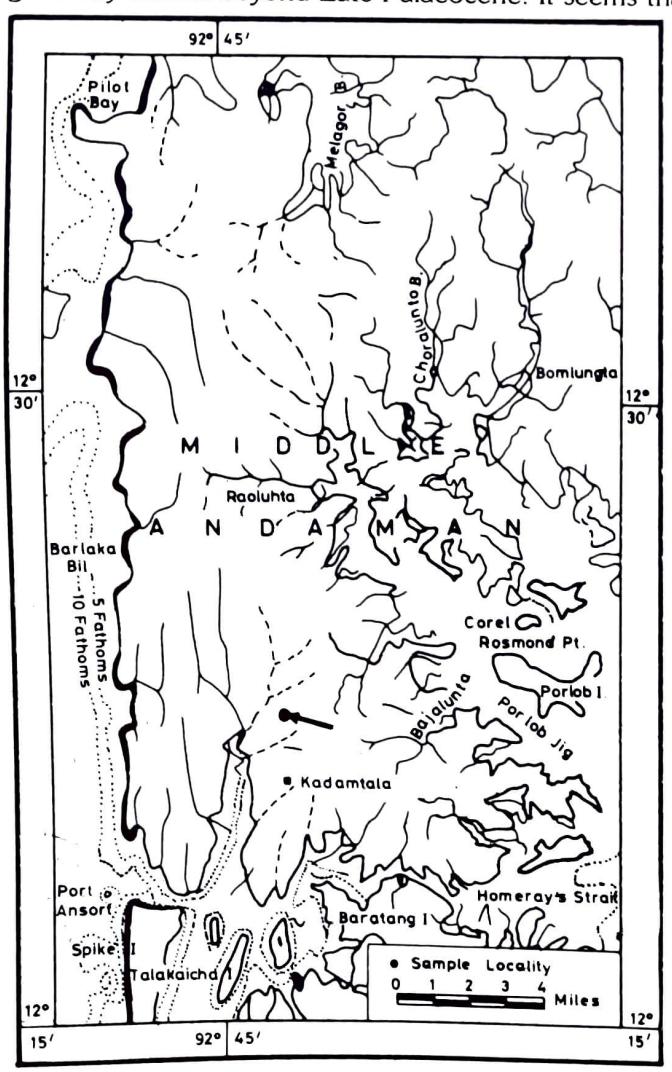
Genus - *Dandotiaspora* Sah, Kar & Singh 1971

Type species - *Dandotiaspora dilata* (Mathur) Sah, Kar & Singh 1971

Dandotiaspora cf. *D. dilata* (Mathur) Sah, Kar & Singh 1971
Pl. 1, fig. 8

Description – Spores subtriangular, trilete, 53-70 µm, laesurae distinct extending up to three-fourth radius. Exine 2 µm thick, imperfectly thickened on distal side opposite to ray end.

Remarks – The thickening on the distal side opposite to ray end is not observed at all places so the specimens have only been compared with *D.dilata*. Reimann and Thaung (1981) reported *Dandotiaspora dilata* Sah, Kar Singh, (1971) and *D. telonata* Sah, Kar & Singh (1971) in *Tricolpites* Type A-*Tricolpites* Type B assemblage zone which according to them is of Early Eocene age. In India, *Dandotiaspora dilata* and *D. telonata* do not generally extend beyond Late Palaeocene. It seems that this genus migrated from India to Burma during Early Eocene.



Text-figure 1. Map showing the location of samples (after Guha & Mohan, 1965).

Genus - *Cicatricosisporites* Potonié & Gelletich emend. Dettmann & Clifford 1991

Type species-*Cicatricosisporites dorogensis* Potonié & Gelletich, 1954.

Cicatricosisporites sp.
Pl. 1, fig. 4

Description-Spore triangular-subtriangular with rounded apices and convex inter apical margins, size range 55-63 µm. Trilete mark distinct, laesurae extending upto margin. Exine costate, three sets of costi present on each inter-apical region running more or less parallel to each other.

Comparison-Cicatricosisporites hughesii Dettmann (1963) approximates *Cicatricosisporites* sp. described here in size range and disposition of the costi. However, the costi in *C.hughesii* is closely placed and apices are acutely angular.

Genus - *Baculimonocolpites* gen. nov.

Type species - *Baculimonocolpites andamanensis* sp. nov.

Diagnosis-Pollen grains oval, monocolpate, colpus sometimes obscure, extending generally half of the longitudinal axis. Exine thick, sexine thicker than nexine, columellate, columella long and compactly arranged. Surface baculate, bacula short, closely placed on both surfaces; granular on top focus.

Comparison-Palmaepollenites Potonié (1951) and *Palmidites* Couper (1953) resemble the present genus in monocolpate nature but are laevigate. *Dracaenoipollis* Sah & Kar (1970) is also monocolpate but psilate and circular-subcircular in shape. *Arecipites* Wodehouse (1933) is reticulate to foveo-reticulate. *Arengapollenites* Kar (1985) is spinose and spines are situated on the margins of the colpus in alternate fashion. *Neocouperipollis* (Venkatachala & Kar) Kar & Kumar (1986) is also echinate, the spines are swollen at the base and pointed at the tip. *Baculimonocolpites* proposed here is distinguished from all the monocolpate genera by its closely placed baculate sculpture and thick sexine.

Baculimonocolpites andamanensis sp. nov.
Pl. 1, figs 5,6,12

Holotype-Pl.1, fig.12, slide no. B.S.I.P. 11002, Size-39 x 45.5 µm.

Type Locality-Kadamtala, Andaman Island, Early Eocene.

Number of specimens studied-12

Diagnosis-Pollen grains bilateral, 35-37.5 x 36.5-46 µm, monocolpate, colpus distinct to indistinct, extending upto half of longitudinal axis. Exine 2-3 µm thick, sexine thicker than nexine, nexine ± 0.5 µm, columellate, columella 1-2.5 µm long, slender and closely placed.

Surface baculate on both sides, bacula 0.5 μm long, crowded, granular on top view.

Genus - *Retitrisyncolpites* gen. nov.

Type species - *Retitrisyncolpites reimannii* sp. nov.

Diagnosis-Pollen grains trisyncolpate, sometimes colporoidate, triangular-subtriangular in shape. Colpi distinct, long, occasionally funnel shaped or bifurcated at tips. Exine thick, sexine thicker than nexine; tectate, tectum perforated; infratectum columellar, columella either of same size or coarser at polar and inter-apertural areas. Surface reticulate.

Comparison-*Trisyncolpites* Kar (1979) is comparable to *Retitrisyncolpites* in having trisyncolpate condition, but is readily separated by its thickened margocolpi providing the appearence of a triradiate ridge and pilate-baculate ornamentation. *Retisyncolporites* Guzmán (1967) is distinctly trisyncolporate with thickened pore margin and thus is easily distinguished. *Myrtacidites* (Cookson & Pike) Potonié (1960) is trisyncolpate but has laevigate to granulose exine. *Marginipollis* Clarke & Frederiksen (1968) is also trisyncolpate but has thickened colpi margin which protrude like beaks in equatorial view. *Racemonocolpites trichotomosulcatus* Mandal (1990) differs in having exine ornamented with clava, bacula and gemmae. The genus *Retitrisyncolpites* proposed here is differentiated from all the trisyncolpate genera by its reticulate and perforate exine.

Remarks-Reimann and Thaung (1981) worked out the palynology of the Tertiary sequence in the Chindwin basin, northwestern Burma. From Kalemyo-Kalewa-Thetkegyin traverse they proposed *Tricolpites* Type A -*Tricolpites* Type B assemblage zone. *Tricolpites* Type A (Reimann and Thaung, 1981, Pl.2, fig.25) and *Tricolpites* Type B (Pl.2, fig. 27) closely resemble *Retitrisyncolpites* in trisyncolpate condition and nature of reticulation. Since *Tricolpites reticulatus* Cookson ex Couper emend. Potonié (1960) is not trisyncolpate so these specimens have been transferred and accommodated in the present genus

Retitrisyncolpites reimannii sp. nov.
Pl.1, figs 1,2,15

Holotype-Pl. 1, fig. 15; slide no. B.S.I.P. 11007, size - 43 x 45.5 μm

Type locality-Kadamtala, Andaman Island, Early Eocene.

1981 - *Tricolpites* Type A Reimann & Thaung, p.384, Pl.2 fig. 25.

Diagnosis-Triangular-subtriangular pollen, size range 41 - 47 μm. Trisyncolpate, colpi distinct, sometimes open, funnel shaped, rarely seems to be colporoidate. Exine tectate, perforate, size of perforation variable, infratectum columellar, columellae stronger at polar and inter-apertural region. Columella 1-2 μm long and 1-1.5 μm broad; 0.5-0.8 μm long at corners. Exine 1-2μm thick, sexine thicker than nexine, nexine very thin 0.5 μm, always not distinct. Surface reticulate, meshes coarse and irregular, muri ±1 μm high.

Derivation of name-After Dr. K.U.Reimann who first figured and described this type of specimens.

Remarks-Pollen grains of *Pseudophoenix navassana* illustrated by Sowunmi (1972; Pl.1, fig. 8) closely resemble *R. reimannii* in trisyncolpate condition and nature of ornamentation.

Retitrisyncolpites thaungii sp. nov.
Pl. 1, figs 3,9,13

Holotype-Pl.1, fig.9; slide no. B.S.I.P. 11006, size 33.8 x 36.4 μm

Type locality-Kadamtala, Andaman Island, Early Eocene

1981 *Tricolpites* Type B Reimann & Thaung, p. 384, pl. 2, fig.27.

Diagnosis-Trisyncolpate pollen grains with size range of 31.5-45.5 μm, triangular in shape. Colpi distinct, sometimes open at apertural end. Exine 1-0.75 μm thick, tectate, perforate, perforation more or less of same size; infratectum columellar, columella more or less same size, ±0.75 μm high. Sexine and nexine not separable. Surface reticulate, lumina circular, ±0.5 μm, more or less equal in size.

Comparison-The present species resembles *Retitrisyncolpites reimannii* in shape and general organisation but is distinguished by the presence of one type of columellae, uniform reticulation and finer meshes.

Derivation of name-After Dr A. Thaung who along with Dr.Reimann first figured this type of pollen.

Remarks-Pollen grains of *Kentia ramsayi* figured by Sowunmi (1972, pl.1, fig. 6) and *Roscheria melanochaetres* (Sowunmi, 1972, pl.1, fig.4) are comparable to *Retitrisyncolpites thaungii* in having trisyncolpate aperture and perforate reticulate ornamentation.

Retitrisyncolpites sp.
Pl. 1, fig.10

Description–Pollen grains triangular in polar view with rounded apices, 30 x 32.5 μm. Trisyncolpate, colpi distinct. Exine 1.5-2 μm thick, pilate-baculate, columella 1-2 μm long and 1-1.5 μm broad.

Comparison-*Retitrisyncolpites* is perforate whereas the present specimens are pilate-baculate.

Trisyncolporate pollen type - 1
Pl. 1, fig. 11.

Description–Pollen grain subcircular, 25 x 26 μm, trisyncolporate, colpi distinct, pore margin thickened,

thickening semilunar, 3 µm wide. Exine 1 µm thick, more or less laevigate. Sexine and nexine not separtable.

Comparison-*Retitrisyncolporites* Guzmán (1967) resembles the specimen described here by its trisyncolporate condition but is distinguished in possessing reticulate ornamentation and interconnected colpi forming an island in the polar area. *Retitrisyncolpites* is only syncolpate and the exine is perforate. *Trisyncolpites* Kar (1979) is pilate-baculate and the colpi look triradiate ridge.

Remarks-Only one specimen could be recovered.

DISCUSSION

The pteridophytic spores and angiospermic pollen are more or less equally represented in the Kadamtala palynological assemblage. Amongst pteridophyte, various species of *Cyathidites* contribute up to 53% whereas of the angiosperms *Retitrisyncolpites thaungii*, *Retitrisyncolpites reimannii* and *Baculimonocolpites andamanensis* are represented by 29%, 11% and 3% respectively.

The striking feature of this assemblage is that it does not resemble any of the known assemblages from the Indian mainland. The angiospermic genera, viz., *Retitrisyncolpites* and *Baculimonocolpites* which are found in abundance in Kadamtala are not so far reported from India. In fact, trisyncolpate forms in Palaeogene of India are very rare. *Racemonocolpites trichotomosulcatus* Mandal (1990) is known from the Palaeocene sediments of Meghalaya. *Marginipollis*, the fossil pollen of *Barringtonia* is occasionaly found in Kutch and northeast India whereas *Trisyncolpites* - an Oligocene index form is generally confined to Gujarat. *Pellicieroipollis* sp. recovered from Kadamtala is also different from the type species *Pellicieroipollis langenheimii* as the pilate - baculate ornamentation observed in the former is weakly developed resulting obscure intrastructure. *Dandotiaspora* sp. recorded from Andaman is also different from the mainland as the exinal thickening is not pronounced.

Trisyncolpate pollen is generally found in many genera of the Arecaceae along with monocolpate forms. Surprisingly in the present assemblage there is hardly any monocolpate form representing the palms. It seems probable that the trisyncolpate forms encountered in Kadamtala were produced by plants other than Arecaceae. These forms which have been accommodated in *Retitrisyncolpites* were described earlier by Reimann and Thaung (1981) as *Tricolpites* Type A and *Tricolpites* Type B from the Chindwin basin, Burma. These two taxa are the characterstic of *Tricolpites* Type B assemblage zone. The other common species of this zone is *Neocouperipollis brevispinosus*. *N. rarispinosus*, *Stereisporites assamensis* are however, not found in the present material. Since, in both the assemblages the trisyncolpate forms are found in plenty, they are correlated with each other. Reimann and Thaung (1981) also obtained microforminifera and dinoflagellate cysts in their assemblage and assigned an Early Eocene age. The Kadamtala assemblage for this reason is also ascribed to be of the same age.

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Plate 1

Location of the specimen (England finder's number) and reference number of samples are put within bracket after the slide number.

1,2. *Retitrisyncolpites reimannii*, Fig.1 x 500, slide no. B.S.I.P. 11008 (Q42; 9/1/7); Fig.2 x 500, slide no. B.S.I.P. 11004 (P 11/3;4/1/1).

3. *Retitrisyncolpites thaungii* x 500, slide no. B.S.I.P. 11000 (x 6;5/1)

4. *Cicatricosisporites* sp. x 500, slide no. B.S.I.P. 11003 (P11/2;6/1/1).

5,6. *Baculimonocolpites andamanensis*, Fig. 5 x 500, slide no. B.S.I.P. 11004 (J35; 4/1/11); Fig.6 x 500, slide no. B.S.I.P. 11001 (F 25; 6/7)

7. *Pellicieroipollis* sp, x 500, slide no B.S.I.P. 11000 (H 41/4; 5/1/4).

8. *Dandotiaspora* cf.*D.dilata*, x 500, slide no. B.S.I.P. 11006 (H 39/1; 7/1/1)

9. *Retitrisyncolpites thaungii*, Holotype, x 1000, slide no B.S.I.P. 11006 (K 52/2; 7/1/3).

10. *Retitrisyncolpites* sp. x 1000, slide no. B.S.I.P. 11009. (L 44, 9/5/3).

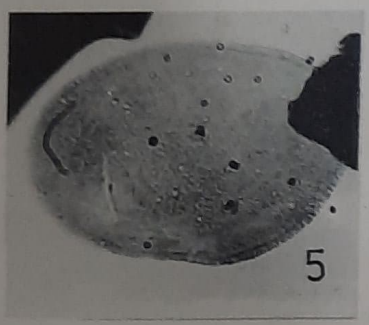
11. Trisyncolporate pollen type - I, x 1000, slide no B.S.I.P. 11010 (E 28/2; 1/3/4).

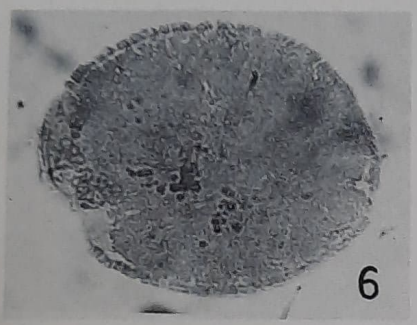
12. *Baculimonocolpites andamanensis*, Holotype, x 1000, slide no. B.S.I.P. 11002 (Y 44/2; 6/3).

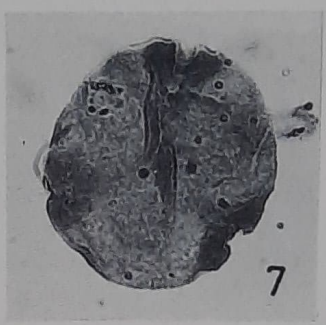
13. *Retitrisyncolpites thaungii* showing in equatorial view, x 500, slide no. B.S.I.P. 11000 (S 31/3; 5/1).

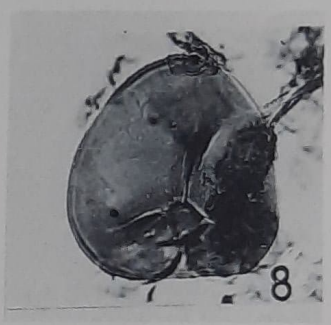
14. *Neocouperipollis wodehousii* x 500, slide no. B.S.I.P. 11005 (T 26; 1/2/3).

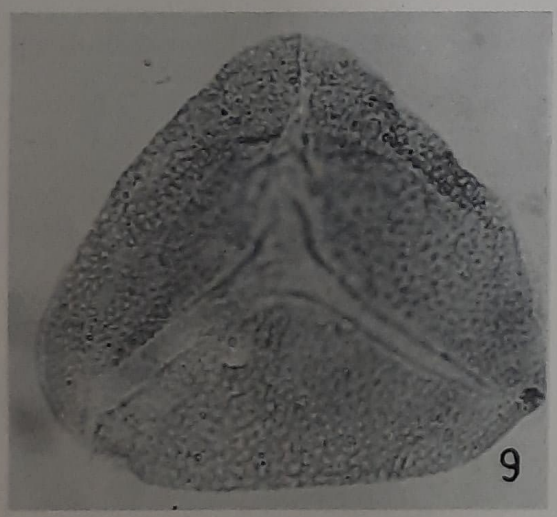
15. *Retitrisyncolpites reimannii*, Holotype, x 1000, slide no. B.S.I.P. 11007 (J 32/4; 3/1/2).

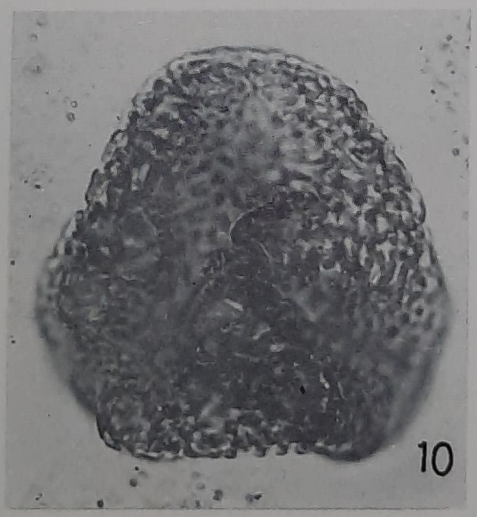












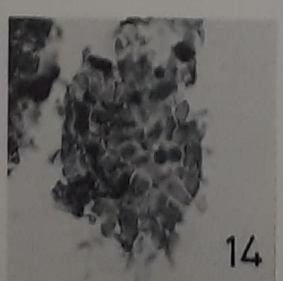


Plate 1

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