

Occurrence of palynofossils from the Tirap River section (Disang Group), Tinsukia District, Assam

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ABSTRACT

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Disang shale exposed on the Tirap River section yielded 23 genera and 24 species of palynomorphs. The palynoassemblage is dominated by pteridophytic spores and angiospermic pollen grains, whereas gymnospermic elements are rare. The presence of *Sriatrilites*, *Polypodiisporites*, *Schizaeisporites*, *Striacolporites*, *Lakiapollis*, *Tricolpopollenites*, *Phragmothyrites* and *Inapertisporites* suggests an Eocene age to the assemblage.

Key-words—Disang, Palynomorphs, Flysch, Eocene, Assam.

सारांश

असम के तिनसुकिया जनपद के तिराप नदी परिच्छेद (डिसांग समूह) में परागाणु पादपाश्र्मों की उपस्थिति

भगवानदास दोमाजी मण्डावकर

तिराप नदी परिच्छेद पर डिसांग शैलों के अनावरण से परागाणुसंरूप के 23 वंश तथा 24 जातियाँ प्राप्त हुई। परागाणु समुच्चय में टेरिडोफाइट वीजाणुओं तथा आवृतबीजी परागकणों की प्रधानता है, जबकि अनावृतबीजी तत्व प्रायः नगण्य हैं। स्ट्रायट्रायलिटिज़, पॉलीपोडाइस्पोराइटीज़, शीजियोस्पोराइटीज़, स्ट्रायकोलपोराइटीज़, लेकियापॉलिस, ट्राइकोलपोपोलेनाटीज़, फ्रैग्मोथिराइटीज़ तथा इनेपरटिसपोराइटीज़ की उपस्थिति से समुच्चय का इओसीनयुगीन होना प्रस्तावित हुआ है।

INTRODUCTION

PALYNOLOGICAL studies on the Tertiary sediments of Assam and adjoining regions go back to almost half of the century. Such studies were linked to the oil exploration activity in the region. A large number of surface, subsurface and road cutting samples were studied by ONGC. Evans (1932, 1964), Mathur & Evans (1964), Dasgupta (1977), Raja Rao (1981) and Rao (1983) worked on the geology of Assam and adjacent regions. Sah and Dutta (1966, 1968) and Dutta and Sah (1970) also worked on this area. Kar (1990) reported palynotaxa from Silchar- Haflong road section. Kumar (1994)

described marine palynofossils comprising dinoflagellate cysts, acritarchs and reworked palynomorphs from the same sections.

The Disang shale is about 4000 m thick and so far generated insufficient palynological data. The purpose of this study is to decipher the age of this thick clastic Tertiary section of eastern Assam by using reliable palynological fossils. The investigation is mainly concerned with Disang deposits which are spread in southern part of Makum Coalfield, Assam. Thirty-five samples of dark grey, black, splintery, greyish shales, siltstone, fine grained sandstone, brownish clay and tough grey

sandstone were collected from Disang shale, a section ideally exposed on eastern bank of the Tirap River (Text-figure 1). The overlying and underlying sediments are made up of grey carbonaceous shale and total thickness of the exposure is about 35.5 m. These samples were chemically processed to isolate pollen-spores following usual maceration technique. The material is quite rich in palynofossils. The slides were prepared in polyvenyl alcohol and mounted in canada balsam. Identification, counting and photodocumentation of specimens were done with BH₂ Olympus Research Microscope.

GEOLOGICAL SETTING

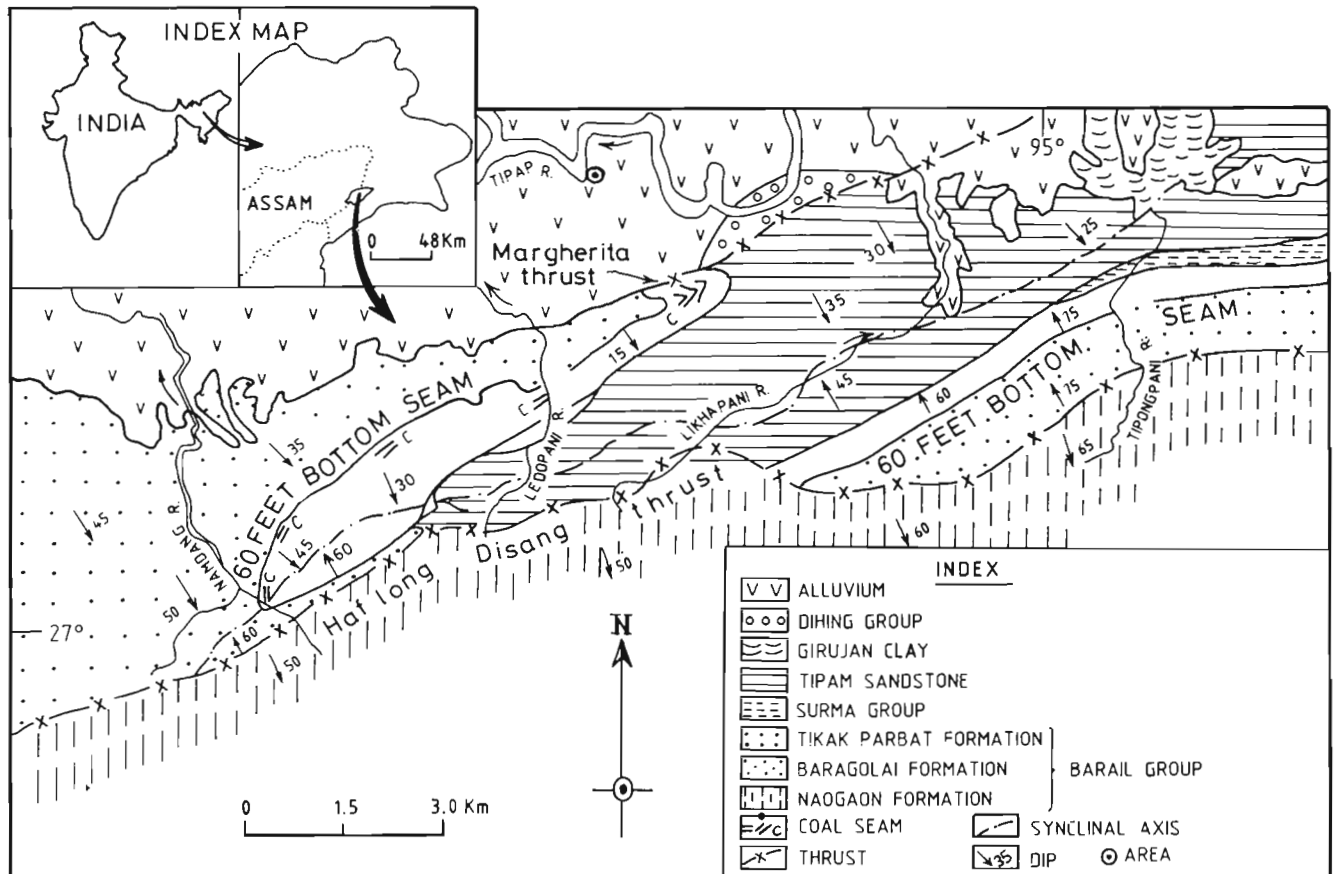
The members of this group are seen in the section of Khasi Hills, Meghalaya and Tirap River southern part of the Makum Coalfield, Assam (Text-figure 1). The uninterrupted Disang sediments were studied on the Tirap River section in an open cast quarry. This field lies between the latitudes 27° 17' and longitudes 95° 52'. It is along the outermost flank of the Patkoi ranges. The outcrop of the Tirap River section is a long narrow arm like extension over 160 km in length con-

tinuing south west ward along the foot hills of Barail range. The sediments comprises unfossiliferous, grey slaty sandstone and slaty arenaceous shales dipping at about 45° and apparently cover by Barail Group. The slaty cleavage being almost invariably parallel to Patkoi range. One of the shale was observed to be carbonaceous and a few poorly preserved unidentifiable lamellibranches were found. The Disang sediments are described to be similar to those of Kopili Formation. The contact between Disang Group and overlying Barail Group is gradational. The regional framework of the Tertiary sediments as indicating by Raja Rao (1981) is tabulated below.

PALYNOASSEMBLAGE

Palynoassemblage recovered from Disang of the Tirap River section encompasses 24 identifiable species and 23 genera. A check list of 24 different species of pteridophytic, angiospermic, gymnospermic and fungal spores are listed in Table 2.

The genera restricted to Disang shales are usually found



Text-figure 1— Geological map of the Makum Coalfield, Assam.

Table 1—Showing sequence of Cenozoic rocks in Makum Coalfield, Assam (after Raja Rao, 1981)

Group	Formation	Thickness	Rock types
Recent/ Pliocene	Dihing	1800 m	Mostly pebbly sandstone with thin greyish clay beds.
-----Unconformity-----			
Mio/ Pliocene	Namsang Formation	800 m	Fine to coarse grained sandstone with bands of clay.
-----Unconformity-----			
Tipam Group			
Miocene	ii) Girujan clay	1800 m	Mottled clay with greyish soft sandstone.
	i) Tipam Sandstone	2300 m	Ferruginous, fine to coarse grained micaceous to felspathic sandstone.
-----Unconformity-----			
Barail Group			
Oligocene	iii) Tikak Parbat Formation	600 m	Greyish to yellowish white sandstone, sandy shales with coal seams.
	ii) Baragolai Formation	3500 m	Greyish to bluish grey yellowish red mudstone, shale, sandstone, carbonaceous shales and thin coal seams.
	i) Naogaon Formation	2200 m	Compact fine grained, dark grey sandstone with sands of splintery shales.
Eocene	Disang Group	4000 m	Grey to dark grey splintery shales, iron stained and sandy shale with thin partings of compact quartzitic sandstones.

associated with the Eocene assemblages (Sah & Kar, 1970; Sah & Dutta, 1966; Dutta & Sah, 1970; Kar, 1985). Kar (1990), studying the outcrop from Haflong-Silchar road of North Cachar Hill, Assam suggested an Eocene age. *Striatriletes* van der Hammen emend. Kar (1979) reported from the various Tertiary sediments. The oldest record of this taxon is from Middle-Late Eocene of Kutch by Kar & Saxena (1981). Venkatachala *et al.* (1989) reported the distribution of different Palaeocene - Eocene marker palynotaxa in India and Africa. According to them the genus *Lakiapollis* having an affinity to modern pollen of *Durio* is found in Palaeocene -

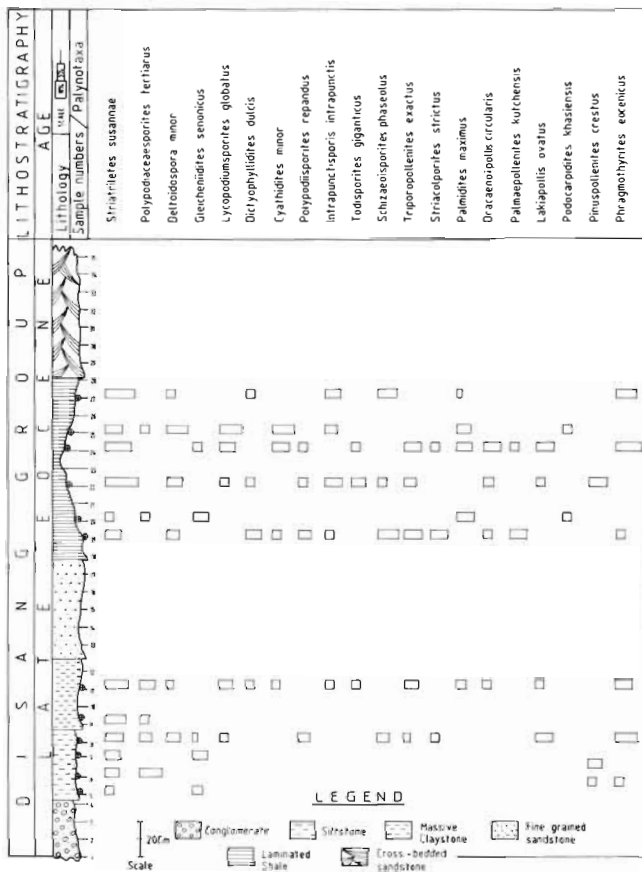
Table 2 — Spores and pollen taxa recovered in the (Disang) Tirap River section Assam

Fossil taxa
<i>Striatriletes susannae</i> van der Hammen emend. Kar, 1979
<i>Palyodiaceasporites tertiarus</i> Sah & Dutta, 1968
<i>Polypodiaceasporites chatterjii</i> Kar, 1979
<i>Deltoidospora minor</i> Miner, 1935
<i>Gleicheniidites senonicus</i> Saxena, 1978
<i>Lycopodiumsporites globatus</i> Kar, 1985
<i>Dictyophyllidites dulcis</i> Kar, 1985
<i>Cyathidites minor</i> Couper, 1953
<i>Polypodiisporites repandus</i> Takahashi, 1964
<i>Intrapunctisporis intrapunctis</i> Krutzsch, 1959
<i>Todisporites giganticus</i> Mandaokar, 1987
<i>Schizaeoisporites phaseolus</i> Delcourt & Sprumont, 1955
<i>Triporopollenites exactus</i> Salujha, Kindra & Rehman, 1972
<i>Striacolporites striatus</i> Sah & Kar, 1970
<i>Palmidites maximus</i> Couper, 1953
<i>Dracaenopollis circularis</i> Sah & Kar, 1970
<i>Palmaepollenites kutchensis</i> Venkatachala & Kar, 1969
<i>Magnamonocolpites plicatus</i> Kar, 1985
<i>Lakiapollis ovatus</i> Venkatachala & Kar, 1969
<i>Podocarpidites khasiensis</i> Dutta & Sah, 1970
<i>Piceapollenites excellensus</i> Kar, 1985
<i>Pinuspollenites crestus</i> Kar, 1985
<i>Phragmothyrites eocaenicus</i> Kar & Saxena, 1981
<i>Inapertisporites kedvesii</i> Elsik, 1968

Eocene strata from Kerala, Kutch and Meghalaya. Fossil spores showing affinity to lycopodium are generally accommodated in *Lycopodiumsporites* Thiergart ex Delcourt & Sprumont (1955). This genus is one of the most common elements in Palaeocene-Eocene of north-east India and is known to occur since Palaeozoic. The polypodiaceous spores from the Indian Tertiary sediments are mostly known as *Palyodiaceasporites* Thiergart (1940), *Polypodiisporites* (Potonie', 1934). These genera are encountered in Palaeocene-Eocene in good percentage. The palynological assemblage and ratio of the basic groups of pteridophytic, angiospermic, and gymnospermic pollen indicate a Late Eocene age. The majority of the taxa are known from Late Eocene although some of them are known from Palaeocene to Miocene. The presence of *Striatriletes*, *Polypodiisporites*, *Gleicheniidites*, *Lakiapollis*, *Polypodiaceasporites*, *Lycopodiumsporites*, *Striacolporites*, *Intrapunctisporis* together with palm pollen strengthen this assumption.

PALYNOFLORAL COMPARISON

Kar (1990) reported a rich palynoflora consisting of 26 genera and 28 identifiable species from the Silchar-Haflong



Text-figure 2 — Showing spore-pollen frequency tied to lithology of Tirap River section.

road, Assam. The palynotaxa common to Silchar-Haflong road and the present Tirap River section (Disang assemblage) are *Striatriletes*, *Polypodiaceasporites*, *Polypodiisporites*, *Podocarpidites*, *Pinuspollenites*, *Piceapollenites* and *Phragmothyrites*. The palynotaxa present in the Silchar-Haflong but absent from the present palynoassemblage are *Lygodiumsporites*, *Psiloschizosporis*, *Klausipollenites*, *Taeniasporites*, *Hamiapollenites*, *Neocouperipollis*, *Margocolporites*, *Pelliceroipollis*, *Palaeomalvaceapollis*, *Parmathyrites*, *Notothyrites*, *Diporisporites* and? *Sumatradinium* sp. The palynotaxa present in the Tirap River section, Disang shale Assam but absent from the Silchar-Haflong road section are; *Deltoidospora*, *Gleicheniidites*, *Schizaeoisporites*, *Striacolporites* and *Magnamonocolpites*. A comparative study reveals that the Silchar-Haflong road section and the present Tirap River section are mostly comparable qualitatively.

The fragmentary vegetal matter comprising thin lenses of coal are occasionally found in carbonaceous shale and gritty greywacke sandstone of Baratang Formation, Andaman. Chatterjee (1967) divided the terrigenous flysch sediments of main Andaman Island into Baratang and Port Blair forma-

tions. The occurrence of palynofossils from Cretaceous to Early Cenozoic foraminifera, nannofossils and coccoliths are known from the same sediments. Banerjee (1966, 1967), Mathur & Mathur (1980), Mandal *et al.* (1994, 1996) recorded very few palynofossils from these sediments. Only palynotaxa common to the Baratang Formation, Andaman and the Tirap River section are; *Polypodiisporites*, *Cyathidites*, *Dictyophyllidites* and *Gleicheniidites*. A comparative account shows that the Andaman and the present assemblage is not comparable qualitatively and quantitatively, but closely comparable on the basis of lithology as the present outcrop consists of turbidite sequence with dark grey shale, greywacke sandstone and some thin limestone deposited under deep sea water environment.

DISCUSSION

Interpretation on depositional environment is broadly based on the available lithological and palynological information mainly obtained from the Tirap River section. The Disang Group consists of 4000 m thick sequence of greywacke sandstone and shale showing the features of turbidites. Evans (1964) suggested that the provenance of flysch type of sediments might be a land mass lying to the east of longitude $89^{\circ} 30'$ in the eastern Himalayas. Raju (1968) however, suggested that part of detritus derived from the geanticline as well as from peripheral shield area. During this phase of geosynclinal development in the Naga-Lushai belt, submergence of the platform area is a part of Shillong Plateau and Upper Assam gave rise to shelf deposits of the Sylhet Limestone. The palynofloral distribution is intimately linked with lithofacies. The observation pertaining to their palaeoecology are of considerable use but present sediments are not related to the shelf carbonate clastic deposits of Khasi and Jaintia hills.

The Disang Group consists of lenticular bodies of cross bedded sandstones, local lenses of conglomerate and laminated red shale and mudstone exhibiting fining upward cycles. In Priabonian palynoflora predominated by Palm pollen mainly belonging to a riparian communities. These deposits are interpreted to have been laid down in a coastal environment. Rich fern association, viz., *Striatriletes*, *Polypodiaceasporites*, *Dictyophyllidites*, *Gleicheniidites*, *Intrapunctisporis* are present namely in inland basin. There is very little information from the Disang shale. The rocks are almost barren, only dinoflagellate cysts, acritarch and few pollen grains were recovered (Arun Kumar, 1994). Most likely these sediments were deposited in the inner shelf marine environment close to the shore. To the end of Priabonian, the development of conifers like *Piceapollenites*, *Podocarpidites* and *Pinuspollenites* are striking. Thus the change of climate is not only testified by a higher share of conifer but also by their taxonomic composition. These pollen were recorded in

Upper Priabonian/Lower Oligocene sequence in Carpathian Palaeogene (Snopkova, 1980). These taxa imply colder climatic oscillation and the beginning of a gradually cooling trends. The overlying Disang sediments is mainly composed of coarsening upward succession of carbonaceous shales, including thin stringes of coal, interbedded siltstone, shale and white reddish cross bedded sandstone, interpreted to the deposits of delta distributary channel in the proximity of shore line. The overall sequential trend to be transgressive through time and space.

CONCLUSION

- 1) On the basis of palynological assemblage the sequence assigned to Late Eocene age.
- 2) A correlation of the Silchar-Haflong road section was made with the present one situated 240 km south-west ward on the basis of palynofossils.
- 3) Rich fern association is present namely in inland basin. The palynoflora suggests a humid and tropical climate with plenty of rainfall during the deposition of these sediments.
- 4) The terrestrial elements are mainly represented by saccate gymnosperm of Pinaceae and spores of Gleicheniaceae. Angiosperm pollen are mostly corroded.

It seems that these pollen were carried by water currents to a long distance and finally deposited in a deep brackish water (flysch) sediments.

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