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Palynological study of Sutunga coal seam, Jaintia Hills, Meghalaya

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Palynological fossils recovered from Sutunga Colliery, Jaintia Hills, Meghalaya consist of 27 genera and 39 species. Pteridophytic spores and angiospermic pollen are more or less equally represented in the assemblage. The dominant species are: *Lycopodiumsporites parvireticulatus, Cyathidites minor, Lygodiumsporites lakiensis, Todisporites kutchensis, Proxapertites microreticulatus, Couperipollis brevispinosus* and *Tricolpites minutus*. A Palaeocene age is attributed to this assemblage.

Key-words—Palynology, Pteridophytes, Angiosperms, Sutunga Coal seam, Palaeocene (India).

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सारांश

मेघालय की जयन्तिया पहाड़ियों में स्थित सुतुंगा कोयला-सीम का परागाणविक अध्ययन

जगन्नाथ प्रसाद मंडल

मेघालय की जयन्तिया पहाड़ियों में स्थित सुतुंगा कोयला-खान से उपलब्ध परागाणविक समुच्चय मंडल में 27 प्रजातियाँ एवं 39 जातियाँ हैं। टेरीडोफ़ाइटी बीजाणु एवं आवृतबीजी परागकण प्रायः समान मात्रा में मिलते हैं। लाइकोपोडियमस्पोराइटिस पाविरिटिकुलेटस, स्याथिडाइटिस माइनर, लाइगोडियमस्पोराइटिस लाकीयेन्सिस, टोडिस्पोराइटिस कच्छेन्सिस, प्रोक्सापर्टाइटिस माइक्रोरेटिकुलेटस, काउपेरिपॉलिस ब्रेविस्पाइनोसस एवं ट्राइकॉल्पाइटिस माइन्यूटस प्रभावी जातियाँ हैं। इस समुच्चय की पुरानूतन आयु प्रस्तावित की गई है।

SOME of the Tertiary sedimentary deposits of Assam and Meghalaya have rich coal deposits. The coal comprises high sulphur content and is well known for its physio-chemical properties. The coalfields of Khasi, Jaintia and Garo Hills are known to be formed along the southern fringe of Shillong Plateau on platform areas under stable shelf condition. In Jaintia Hills, a number of small coal bearing outliers are formed within the Lakadong Sandstone Member (Member of Sylhet Limestone Formation) and this coal is superior in rank to any other Tertiary coals of north-east India (Raja Rao, 1981).

Palynology of Palaeocene-Lower Eocene rocks of north-east India has been worked out by Biswas (1962), Baksi (1962), Sah and Dutta (1966), Dutta and Sah (1970), Sâlujha, Kindra and Rehman (1972), Singh (1977), Mehrotra (1983), etc. The present paper describes the results of palynological investigation of a coalfield situated on the left side of Jowai-Khleriaht Road (National Highway no. 44) near the village Sutunga. The coal seams extend over an area of one square kilometer, well exposed towards east and north of the village. Of the two coal seams, the top one varies from 0.1 to 0.2 m while the bottom one ranges from 0.3 to 1.07 m in thickness. In all, 30 samples were collected and macerated.

The assemblage comprises following 27 genera and 39 species:

Lycopodiumsporites parvireticulatus Sah & Dutta
L. umstewensis Dutta & Sah
L. palaeocenicus Sah & Dutta
Cyathidites minor Couper
Lygodiumsporites lakiensis Sah & Kar
Biretisporites bellus Sah & Kar
Intrapunctisporis apunctis Krutzsch
Dandotiaspora dilata (Mathur) Sah, Kar & Singh
D. telonata Sah, Kar & Singh
Todisporites kutchensis Sah & Kar
Schizaeoisporites phaseolus Delcourt & Sprumont
S. crassimurus Dutta & Sah
Polypodiisporites mawkmaensis Dutta & Sah
Laevigatosporites lakiensis Sah & Kar
Polypodiaceaesporites levis Sah

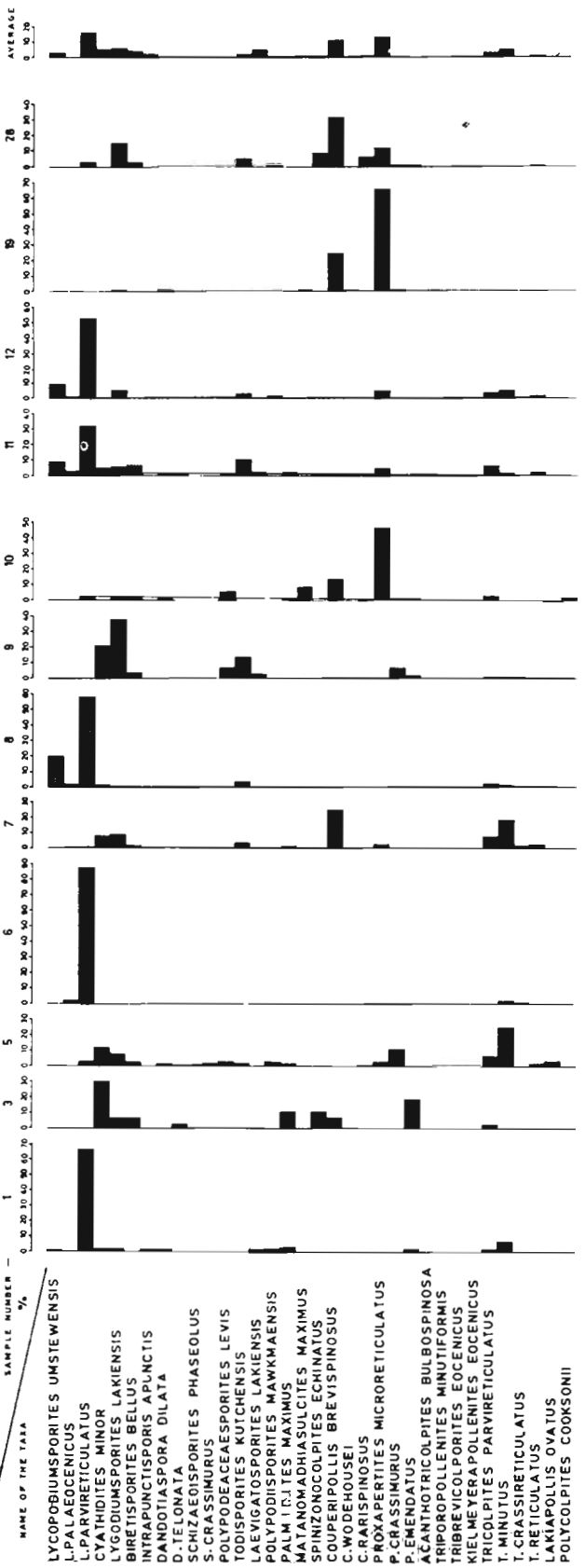
Palmidites maximus Couper
Matanomadhiasulcites maximus (Saxena) Kar
Spinizonocolpites echinatus Muller
Couperipollis brevispinosus (Biswas) Venkatachala & Kar
C. rarispinosus (Sah & Dutta) Venkatachala & Kar
C. wodehousei (Biswas) Venkatachala & Kar
Proxapertites microreticulatus Jain, Kar & Sah
P. emendatus (Singh) Kar & Kumar
P. crassimurus (Sah & Dutta) Jain, Kar & Sah
Acanthotricolpites bulbospinosa Kar
Triporopollenites minutiformis (Ramanujam) Saxena
Triorites bellus Sah & Kar
Polyadopollenites sp.
Tricolpites parvireticulatus Sah
T. minutus Sah & Kar
T. crassireticulatus Dutta & Sah
T. reticulatus Cookson
Lakiapollis ovatus Venkatachala & Kar
L. matanamadhensis Venkatachala & Kar
Kielmeyerapollenites eocenicus Sah & Kar
Retitrescolpites splendens Sah
Rhoipites kutchensis Venkatachala & Kar
Tribrevicolporites eocenicus Kar
Polycolpites cooksonii Sah & Dutta

GENERAL ASSESSMENT OF THE ASSEMBLAGE

The assemblage consists of 16 species and 11 genera of pteridophytes and 16 genera containing 23 species of angiospermic pollen. In the assemblage, both pteridophytic and angiospermic grains show more or less equal dominance. Gymnospermous grain and microplanktons are totally absent. The result of the qualitative analysis has been plotted in the Histogram 1.

The monolete is represented by four taxa, i.e. *Polypodiisporites, Polypodeaceaesporites, Laevigatosporites* and *Schizaeoisporites*. The significant trilete spores in the assemblage are *Lycopodiumsporites parvireticulatus* (16.3%), *L. umstewensis* (2.5%), *L. palaeocenicus* (1.7%), *Lygodiumsporites lakiensis* (9.8%), *Cyathidites minor* (6.3%), *Biretisporites bellus* (2.1%) and *Todisporites kutchensis* (4.6%); *Lycopodiumsporites* complex has the highest representation.

The angiospermic grains, on the other hand, are strongly dominated by sulcate grains represented by 9 species belonging to 5 genera. Other representative of non-sulcate forms are colpate (3 genera and 9 species), colporate (5 genera and 5 species), porate (2 genera and 2 species) and polycolpate by single taxa, viz., *Polycolpites cooksonii*. However, colporate, porate and polycolpate grains are poor in number and variety. The total percentage count of the pollen grains are *Palmidites maximus* (1.1%), *Proxapertites microreticulatus* (13%), *P. crassimurus* (1.7%), *P. emendatus* (2%),



Histogram 1—Histogram showing the pattern of miofloral behaviour in different samples.

Spinizonocolpites echinatus (1.7%), *Couperipollis brevispinosus* (10.6%), *C. rarispinosus* (1%), *Tricolpites reticulatus* (1%), *T. parvireticulatus* (2.6%) and *T. minutus* (4.6%), However, *Lycopodiumsporites*, *Proxapertites* and *Couperipollis* individually records up to 65 per cent in the samples.

DISCUSSION

The qualitative analysis shows that the assemblage is significantly represented by *Lycopodiumsporites parvireticulatus, Cyathidites minor, Lygodiumsporites lakiensis, Todisporites kutchensis* amongst the pteridophytes and *Proxapertites microreticulatus, Couperipollis brevispinosus* and *Tricolpites minutus* of angiospermous affinity.

It is observed that the pteridophytic spores are more dominant in the lower seam than the upper one. However, the behaviour of the pollen is just reverse of the spores. They increase gradually from base and dominate at the upper coal seam.

Comparison—Palynostratigraphic correlation of Lakadong Sandstone sequence with the Therria (=Cherra), Tura and Mikir formations has been discussed by Sah and Kar (1972), Sah and Singh (1974), Mehrotra (1981) and Sah and Dutta (1974). Sah and Dutta (1974) established three biozones in the Therria (=Cherra) Formation and also recorded significant break in between the assemblage of uppermost Cherra biozone (*Tricolpites reticulatus* Cenozone) and overlying assemblage of Lakadong Sandstone. The cenozones of Cherra and Lakadong in ascending order are *Proxapertites crassimurus* Cenozone, *Tricolpites reticulatus* Cenozone and Lakadong palynological zone.

Principal constituents of the Lakadong palynological zone are: *Retialetes dubius, Dandotiaspora* spp., *Couperipollis brevispinosus, C. rarispinosus, Palmaepollenites communis, P. eocenicus, Polycolpites cooksonii, Triorites communis, Cyathidites minor* and some microplanktons. Sutunga assemblage differs from the Cherra Cenozone described by Sah and Dutta (1966) in the total absence of microplankton and by equal dominance of pteridophytic spore and angiospermous pollen. The Lakadong Sandstone assemblage has angiospermous dominance over the pteridophytic remains. Another point of difference is the poor representation of *Dandotiaspora* spp. which has been replaced by *Lycopodiumsporites* in Sutunga.

Tura Formation—Sah and Singh (1974) distinguished four biozones in the Tura Formation of Garo Hills. They equated Cherra biozones with *Assamialetes emendatus* Cenozone, *Dandotiaspora telonata* Cenozone and *Palmidites plicatus* Cenozone respectively in ascending order, the basal three assemblage zones of Tura Formation. However, the uppermost biozone—*Proxapertites assamicus* Cenozone of Tura is characterised by *Proxapertites assamicus, Cicatricosisporites macrocostatus, Stephanocolpites tertiarus, Meliapollis ramanujamii, Polypodiisporites oligocenicus, Foveotriletes palaeocenicus, Palmidites plicatus, Liliacidites major* and *Lycopodiumsporites palaeocenicus*. A comparison with the present assemblage reveals that some of the marker species of Tura are present in Sutunga in insignificant percentage.

Mikir Formation—Palynoflora of the Mikir Formation which is the lateral equivalent of Therria (=Cherra) Formation in the Mikir and North Cachar Hills has been studied by Mehrotra (1981, 1983) and Mehrotra and Sah (1982). They have established five cenozones in Mikir Formation, which in the ascending order are *Assamialetes macroluminus* Cenozone, *Dandotiaspora dilata* Cenozone, *Palmidites plicatus* Cenozone, *Foveotriletes palaeocenicus* Cenozone and *Palmaepollenites eocenicus* Cenozone. The Sutunga assemblage compares well with the Mikir Formation in the presence of following common taxa: *Foveotriletes palaeocenicus, Dandotiaspora dilata, D. telonata, Assamiasporites tertiarus, Proxapertites assamicus, Palmidites plicatus, P. maximus, Lycopodiumsporites palaeocenicus* and *Polypodiisporites oligocenicus*. Gymnospermous pollen and dinoflagellates are absent in both the assemblages. The uppermost Mikir Cenozone, the *Palmaepollenites eocenicus* Cenozone, is characterised by *Palmaepollenites eocenicus, P. communis* and microplankton. These forms are totally absent in Sutunga.

Bengal Basin—Baksi (1972) proposed seven palynological cenozones as Bengal Palynological Zones (I-VII) for the Upper Cretaceous—Tertiary sequence. The Bengal palynological zone I ranges from Middle to Upper Cretaceous in age and characterised by frequent occurrence of non-aperturate grains (both tectate and non-tectate), pteridophytic grains particularly by *Lycopodiumsporites*, frequent occurrence of *Mulleripollis bolpurensis;* occurrence of *Spinizonocolpites* is rare and there is also definite occurrence of massulae of *Azolla*. Baksi (1972) noticed some similarity between the constituents of Palynological Zone-I with the Langpar Formation of South Shillong Front. The present assemblage does not closely resemble Palynological Zone I as the characteristic forms like *Mulleripollis* and *Aquilapollenites* are totally absent.

The upper assemblage zone of Baksi (1972) and Baksi and Deb (1981) is *Proxapertites operculatus* zone of Bengal Palynological Zone-II which is characterised by frequent to abundant occurrence of *Proxapertites*, restricted occurrence of probable Lycopodiales, *Granulatisporites, Leiotriletes, Proteacidites* and more frequent presence of *Spinizonocolpites baculatus* and other tricolpate and tricolporate grains. A comparison with the Sutunga assemblage shows that a few genera like *Proxapertites, Spinizonocolpites* and triletes are common but quantitatively they are distinct from one another.

Matanomadh Formation—In Kachchh Basin Matanomadh Formation represents the basal lithostratigraphic unit of the Tertiary succession. Palynology of this unit has been extensively worked out by Mathur (1966), Kar and Saxena (1976) and Saxena (1978, 1979). Sah and Singh (1977) mentioned four distinct biozones and those zones in the ascending order are: Barren Zone, *Dandotiaspora dilata* Cenozone, *Couperipollis brevispinosus* Cenozone and Sponge Zone respectively. However, comparison with the Sutunga assemblage indicates that Matanomadh assemblage is more rich in quality as well as in quantity.

A survey of the literature (Sah & Kar, 1972; Sah & Singh, 1974, 1977; Saxena, 1980; Mehrotra, 1981) shows that the miofloras of Therria (=Cherra) Formation of Khasi and Jaintia Hills, Tura Formation of Garo Hills, Mikir Formation of Mikir and North Cachar Hills and Matanomadh Formation of western India are homotaxial with minor differences probably due to local factor. Sah and Kar (1972) and Sah and Singh (1974, 1977) favoured Lower Eocene age for the coal bearing Lakadong Sandstone Member which overlies the marine Lakadong Limestone on the basis of palaeontological, palynological and geological evidences. However, Sah and Singh (1974) mentioned that the appearance of *Cicatricosisporites, Margocolporites, Stephanocolpites* and *Meliapollis* in Lakadong Sandstone zone is indicative of Lower Eocene age. But none of these forms are present in Sutunga assemblage. Rather the assemblage is characterised by *Lycopodiumsporites, Cyathidites, Lygodiumsporites, Dandotiaspora dilata, Todisporites, Couperipollis, Proxapertites, Palmidites, Tricolpites* and *Polycolpites*. The significant percentage of marker species like *Dandotiaspora dilata, Proxapertites, Triorites, Polycolpites* (with more than 5 colpi) and *Proteacidites* seems to characterise to be Palaeocene assemblage. The Sutunga assemblage compares closely with other known Palaeocene assemblages recovered from India. So it is obvious that this assemblage is also of Palaeocene in age. It may be mentioned here that Jain (1982) also dated Lakadong Limestone Member and Lakadong Sandstone Member as Palaeocene on the basis of dinoflagellate cysts.

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