Palynological and palaeoecological studies of Palaeocene coal seams in Jarain and Laitrymbai areas, Jaintia Hills, Meghalaya, India

Madhav Kumar

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007

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Palynological assemblage recovered from coal seams associated with Lakadong Sandstone in Jarain and Laitrymbai areas compries 33 genera belonging to 47 species of spores and pollen. The pteridophytic spores are dominant in the lower coal seams. Their frequency gradually decreases in the upper seam of both the areas. Angiospermic pollen show reverse trend with pteridophytic spores and gradually dominate in the upper coal seam and upper shale bands. The palynological assemblage indicates that the coal seams were deposited during Palaeocene under tropical to subtropical climates.

Key-words—Palynology, Palaeoecology, Palaeocene, Jaintia Hills, Meghalaya,India.

INTRODUCTION

PALAEOCENE sediments are very well developed in Meghalaya. Nagappa (1959) and Samanta (1971) made meaningful palaeontological contributions, while Biswas (1962), Bose and Sah (1964), Sah and Dutta (1966, 1974), Dutta and Sah (1970), Tripathi and Singh (1985), Kar and Kumar (1986), Mandal (1986) and others worked on various aspects of palynology in this region.

The present study deals with palynological investigation of Jarain and Laitrymbai coal seams. The coal seams and associated shale are rich in palynological fossils which have been systematically analysed both qualitatively and quantitatively. The palynomorphs from these coal seams are very similar to each other and also with those known from various coal seams of Khasi and Jaintia Hills (Dutta & Sah, 1970; Kar & Kumar, 1986; Mandal, 1986). Some distinct palynotaxa are dealt here whose botanical affinities are known and which possess unique combination of morphological characters. The habitat and palaeoecology of these taxa have also been discussed (Table 2).

GEOLOGICAL SETTING

The coal seams in Jarain and Laitrymbai areas are associated with Lakadong Sandstone Formation of Jaintia Group. The generalized stratigraphic sequence in these areas is as follows (after Raja Rao, 1981).

Table 1

Age	Formation and lithology
Upper Eocene	**Kopili Formation**
	Alternation of shale and hard sandstone with a few limestone bands
	Sylhet Limestone Formation
	Prang Limestone - Fossiliferous argillaceous limestone
Middle Eocene	*Nurpuh Sandstone* - Sandstone with subordinate calcareous bands
Lower Eocene	*Umlatdoh Limestone* - Foraminiferal limestone containing a few sandsone bands
	Lakadong Sandstone - Coal bearing quartzitic sandstone
	Lakadong Limestone - Fossiliferous Limestone
Palaeocene	*Therria Sandstone* - Medium to coarse grained ferruginous sandstone containing coal seams, carbonaceous shale and clay
----------	Unconformity ----------
Precambrian	Granite and gneisses

In Jarain (Lat. 25° 19' 18" : Long. 92° 09' 00"), the coal seams are exposed near the Umpliang River, 20 Km southwest of Jowai on Jowai Dawki road. In Laitrymbai (Lat. 25° 22' 14" : Long. 92° 21' 15"), coal seams are

exposed 3 km southwest of Khlieriat on Jowai - Badarpur road, Meghalaya (Map 1). These seams are sandwitched between the upper and lower sandstone with varying thickness. The lithostratigraphical sequence of Jarain is as follows (after Raja Rao, 1981).

Sandstone	1.5-30 m
Top Shale	0.9 m
Sandstone	1.0-2.0 m
Coal	0.05-0.08 m
Shale	1.5 m
Massive Sandstone	3.0-4.5 m
Coal	0.3-1.0 m
Carbonacous Shale	0.9 m
Sandstone	Base not exposed

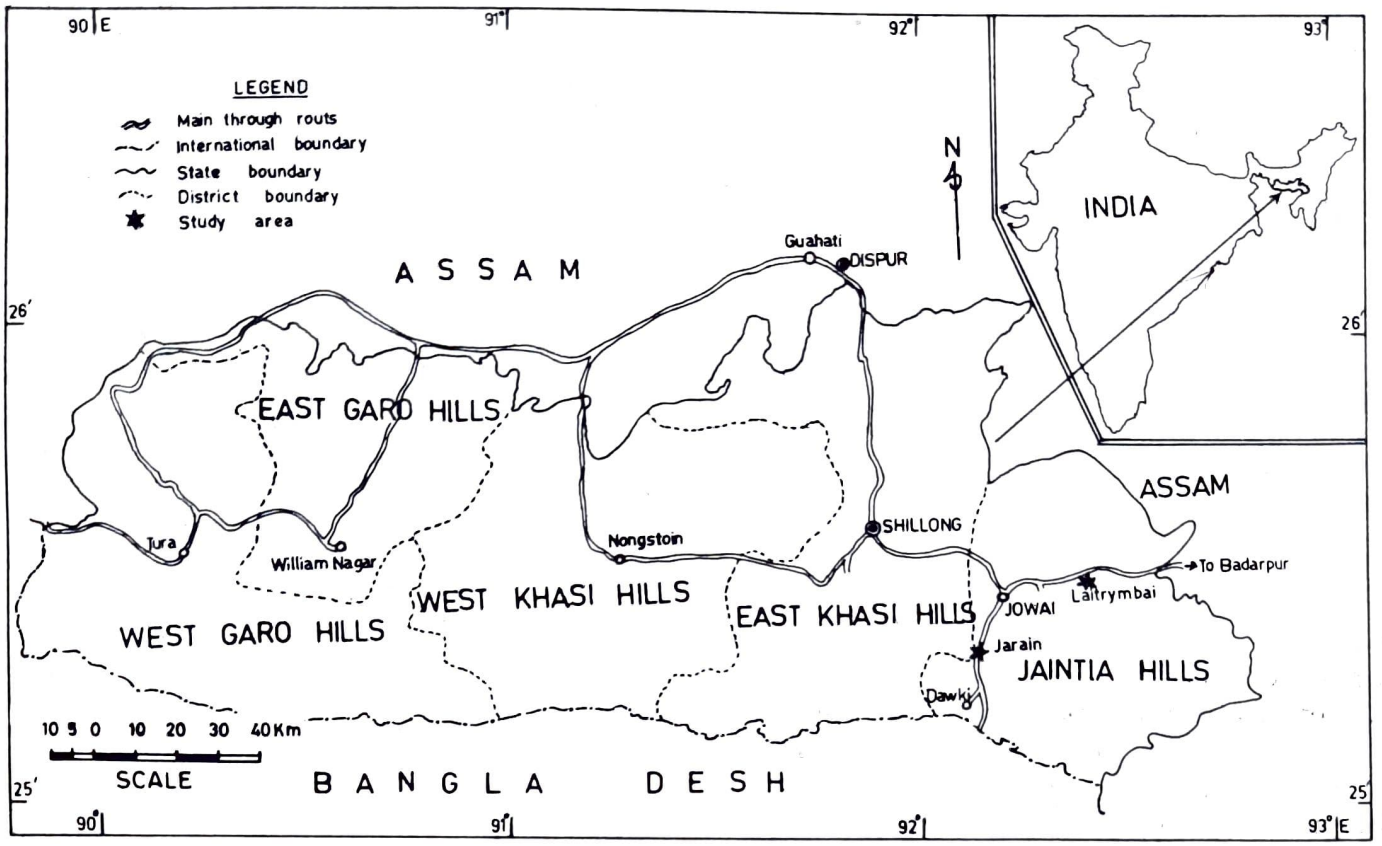
MATERIAL AND METHOD

The palynofossils were obtained from coal, carbonaceous shale and clayey shale beds exposed in Jarain and Laitrymbai areas. About 50 grams of samples were crushed and treated with 40% Nitric acid for 5-6 days. The oxidised material was then treated with 10% KOH solution for 2-3 minutes. The residue of the productive samples were finally collected by using 400 mesh sieve. The slides were prepared and mounted in Canada Balsam.

The quantitiative analysis of the spore-pollen assemblage was done by the frequency count of atleast 200 per sample.

Table 2. Ecological requirements and geographical ranges of some modern taxa which are very similar to those of the fossil palynotaxa from the Jarain and Laitryabai coal seams, Jaintia Hills, Meghalaya (based on Thanikaimony *et al.*, 1984; Croizat, 1958; Good, 1953; Willis, 1966; Tryon & Tryon, 1982; Frederiksen, 1985).

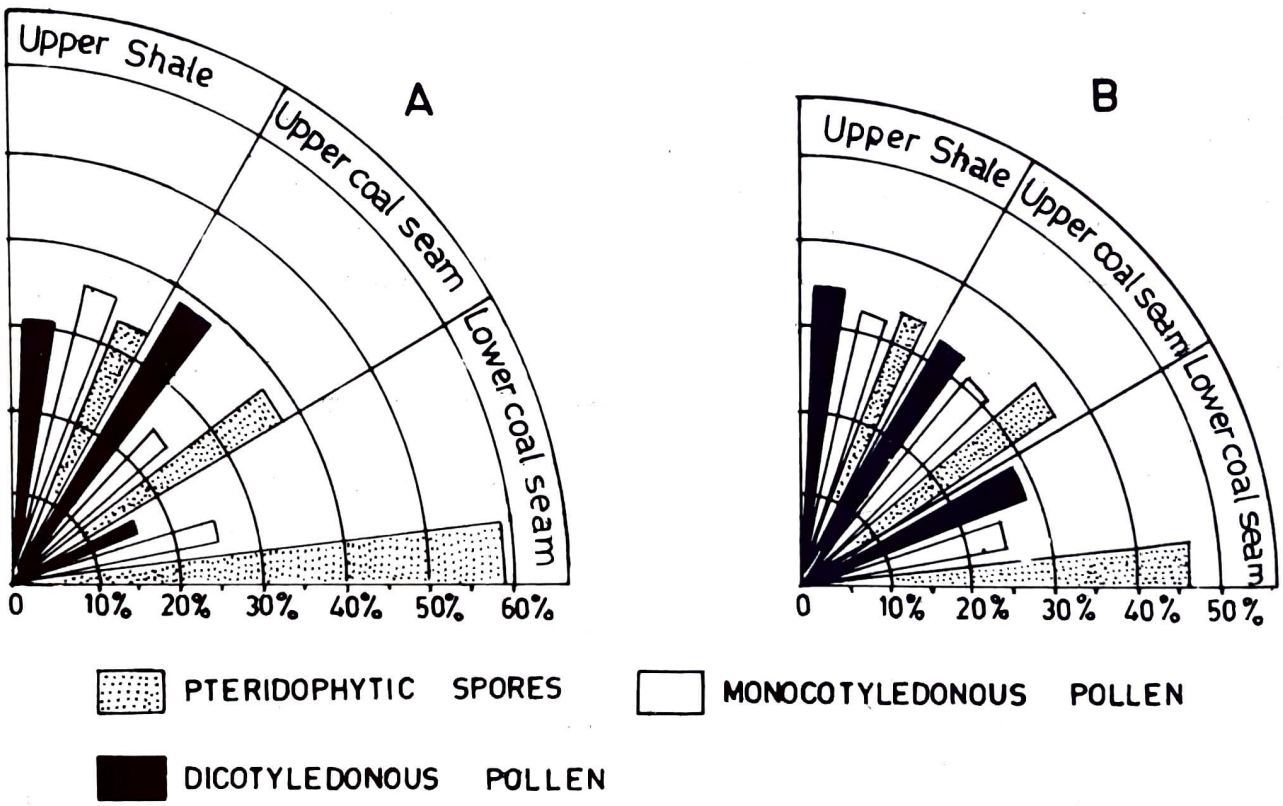
Taxa	Affinity	Habitat	Climate	Geographical range
1	2	3	4	5
Cyathidites	Cyatheaceae	Wet montane forest	Tropical to temperate	Widely distributed in oceanic and islands, forest of tropical mountains
Lycopodiumsporites	Lycopodiaceae	Moist places, occasionaly epiphytic	Tropical	Cosmopolitan
Polypodiaceaesporites	Polypodiaceae	Rain Forest	Tropical to boreal	Cosmopolitan
Schizeoisporites	Schizeaceae	Mostly moist forest	Tropical to warm temperate	Mostly southern hemisphere
Dictyophillidites	Glecheniaceae	Variable	Tropical to subtropical	Cosmopolitan
Neocouperipollis	Arecaceae	Various habitat but grow chiefly in peninsular region	Tropical to subtropical	Cosmopolitan
Proxapertites	Arecaceae	Evergreen forest	Tropical	Southeast Asia
Palmidites	Arecaceae	Costal evergreen and swamp forest	Tropical to subtropical	Cosmopolitan
Matanomadhiasulcites	Annonaceae	Lowland evergreen forest	Tropical	North America, New Zealand, Australia, Africa and South-East Asia
Liliacidites	Liliaceae	Variable	Variable	Cosmopolitan
Tricolpites reticulatus	Gunneraceae	Lowland, near streams	Tropical and southern temperate excessive humid environment	South East Asia, Southeast Africa, Madagascar and New Zealand
Rhoipites	Anacardiaceae	Variable	Tropical to subtropical	Mostaly North America and Asia
Palaeosantalaceapites	Santalaceae	Lowland forest	Tropical to subtropical	Mostly South Asia, India, South Africa and Australia
Lakiapollis	Bombacaceae	Evergreen and swamp forest	Tropical to subtropical	Mostly South East Asia
Meliapollis	Meliaceae	Variable	Tropical to subtropical	Cosmopolitan
Triangulorites	Protiaceae	Variable	Tropical	South America, South Asia, South Africa and Australia
Kielmeyerapollenites	Clusiaceae	Uncertain	Tropical	Brazil
Ericipites	Ericaceae	Variable	Subtropical to tropical	Cosmopolitan
Polygalacidites	Polygalaceae	Evergreen forest in the plains and low altitudes	Temperate	Cosmopolitan



Map 1. Location of the studied area.

QUANTITATIVE ANALYSIS

(a) *Jarain coal seams*- –Text-figures. 1 A and 2 depict the frequency of spore and pollen taxa in the coal seams of Jarain area. The percentage count of individual taxon indicate that the occurrence of pteridophytic spores in the lower seam is 58%. Their frequency decreases in upper seam (38%) and dwindles in the top shale band (33%). Angiospermic pollen show their occurrence by 42%, 62% and 67% respectively from base to top of the section where



Text-figure 1. Angular histogram of palynoflora recovered from (A) Jarain and (B) Laitrymbai, coal seams, Jaintia Hills, Meghalaya.

the assemblage is mostly represented by the abundance of monocotyledons.

(b) *Latrymbai coal seams* — The frequency of pollen and spores is shown in the Text-figures 1B and 2. The pteridophytic spores are dominant in lower seam (47%), while in upper coal seam and top shale band their frequency gradually decreases. The angiospermic pollen represent 53% to 64% in lower and upper coal seams and 66% in shale band.

Thus in both the areas, the angiospermic pollen and pteridophytic spores have more or less same frequency.

DISCUSSION

The palynological assemblage of Jarain and Laitrymbai coal seams are more or less similar. The lower coal seams of both the places are overwhelmingly dominated by the pteridophytic spores, viz., *Dandotiaspora dilata, D.telonata, Lycopodiumsporites speciosus, Lygodiumsporites lakiensis, Dictyophyllidites* sp. and *Polypodiaceaesporites* sp. Angiospermic pollen are rare and mostly contributed by *Palmidites plicatus, Matanomadhiasulcites maximus, Neocouperipollis kutchensis* and *Spinizonocolpites echinatus*.

The pteridophytic spores and angiospermic pollen are equally well represented in the upper coal seam of both the areas. In the upper shale the angiosperms are dominant. The taxa represented are - *Neocouperipollis kutchensis, Matanomadhiasulcites maximus, Kielmeyerapollenites syncolporatus, Lakiapollis ovatus, Triangulorites bellus* and *Tricolpites reticulatus*.

There are, however, some differences between Jarain and Laitrymbai coal seams. *Lycopodiumsporites speciosus*, which is quite common in Jarain is meagerly found in Laitrymbai. *Matanomadhiasulcites maximus* is more common in Laitrymbai than in Jarain. *Kielmeyerapollenites syncolporatus* on the other hand, is common in upper coal seam and shale of Jarain but poorly represented in Laitrymbai.

The dominance of pteridophytic spores in the lower coal seam and the abundance of angiospermic pollen in the upper one indicate change in the floral composition. It seems that the pteridophytic elements were growing luxuriantly in the lower part which gradually subdued by the angiosperms. Perhaps the climatic condition was not congenial for the pteridophytes as before to dominate in the later part.

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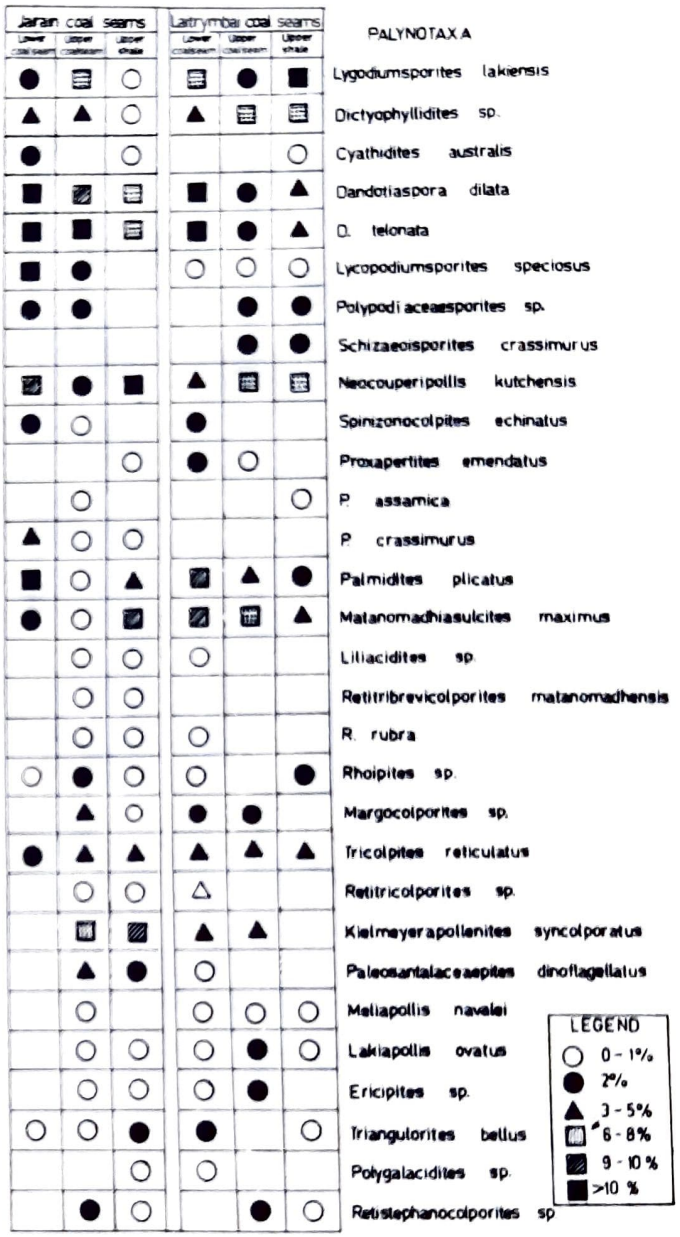

Text-figure 2. Frequency of imortant palynotaxa in Jarain and Laitrymbai coal seams, Meghalaya.

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