Palynological changes across subsurface Palaeocene-Eocene sediments at Barmer, Rajasthan, India

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Palynofloras recovered from core samples from two bore-holes MK 327 and MK 332 drilled near Kapurdi, Barmer, Rajasthan are rich and diversified. Restricted occurrence of *Matanomadhiasulcites maximus* and *Triangulorites pachyexinus* alongwith other long-ranging taxa demarcates the Palaeocene sediments from those of Eocene. Presence of Eocene sediments in the studied bore-holes is indicated by the restricted occurrence of *Meliapollis pachydermis, M. symplex, Lygodiumsporites lakiensis* and *Foveotricolporites reticuloidus*. Two palynological zones, Assemblage Zone A indicating Late Palaeocene age and Assemblage Zone B indicating Early Eocene age, have been identified in the bore-hole sequences and sediments representing these zones have been correlated with Akli and Mataji Ka Dungar formations, respectively of the Barmer Basin.

Key-words—Palynology, Palaeocene, Eocene, Rajasthan, India.

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सारांश

राजस्थान (भारत) में बाड़मेर के समीपस्थ उपसतही पेलियोसीन-ईओसीन अवसादों में परागाणविक परिवर्तन

सूर्यकान्तमणि त्रिपाठी

राजस्थान में बाड़मेर के समीप कपूर्डी से एम.के. 327 एवं एम.के. 332 नामक दो वेध-छिद्रों के नमूनों से प्राप्त परागाणुवनस्पतिजात सघन एवं विविधता युक्त हैं। अन्य दीर्घकालिक वर्गकों सहित *मातानोमढ़ियासल्फाइटिस मेक्सिमस* एवं *ट्राएंगुलोराइटिस पेकिएक्साइनस* की सीमित उपस्थिति से पेलियोसीन एवं ईओसीन अवसादों को सीमाबद्ध किया जा सका है । *मिलियापोलिस पेकिडर्मिस, मि. सिम्पलेक्स, लाइगोडियमस्पोराइटिस लाकीयेन्सिस* एवं *फोवियोट्राइकॉल्पोराइटिस रेटिकुलोइड्स* की सीमित उपस्थिति से वेध-छिद्रों में ईओसीन कालीन अवसादों की उपस्थिति व्यक्त होती है। दो परागाणविक मंडल--समुच्चय मंडल ए. एवं समुच्चय मंडल बी., जो क्रमशः अनंतिम पेलियोसीन तथा प्रारम्भिक आदिनूतन आयु इंगित करते हैं, अभिनिर्धारित किये गये हैं तथा अकली एवं माताजी का डुंगर शैल-समूहों से इन अवसादों की तुलना की गई है।

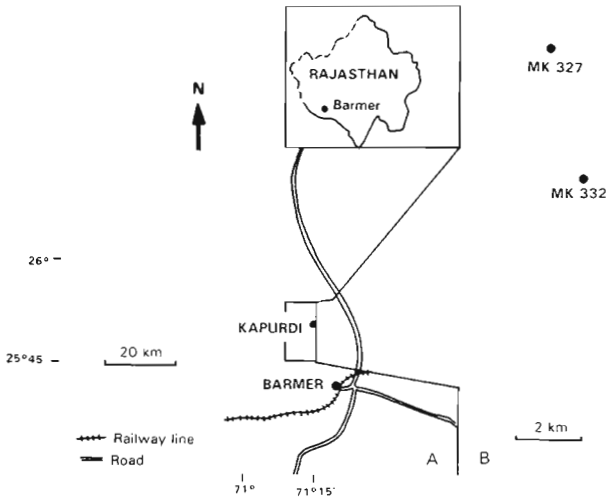
PRESENT paper deals with the critical assessment of palynofloral assemblages recorded from two bore-hole sections situated near Kapurdi, Barmer District, Rajasthan (Text-figure 1). These bore-holes were drilled by Mineral Exploration Corporation Limited. Lithocolumn of the bore-holes alongwith position of samples is given in Text-figure 2. The palynofloras are rich and diversified and comprise algal cysts, fungal remains, pteridophytic spores and angiospermous pollen. Taking into consideration the distribution pattern and frequency of different palynotaxa the studied sequences were dated as Palaeocene-Eocene in age (Tripathi, 1994, 1995).

The palynoassemblages were compared with those from other contemporaneous sediments and the perceptible change was observed in the distribution of palynotaxa that enables demarcation of the Palaeocene and Eocene strata.

GEOLOGICAL SETTING AND GENERAL LITHO-STRATIGRAPHY OF THE AREA

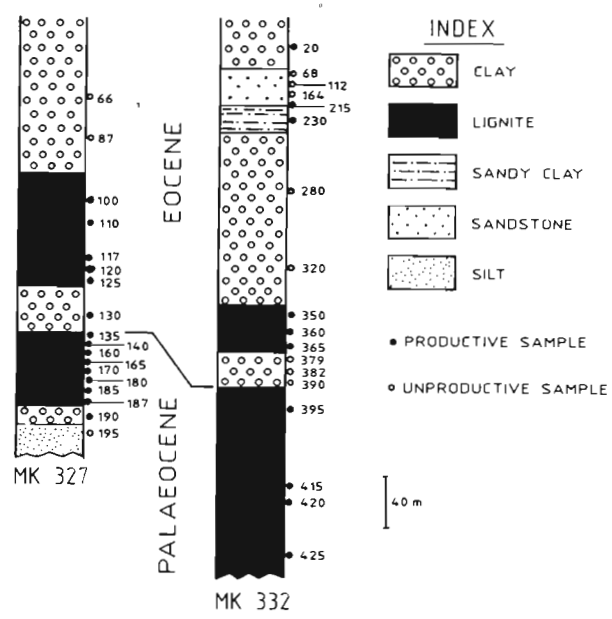
The sedimentary sequences in Rajasthan are predominantly intracratonic type. These sediments, forming a part of western Rajasthan shelf, comprise Middle Jurassic to Early Eocene rocks in a north-south trending graben (Dasgupta, 1977).

Palaeocene-Eocene rocks in Barmer Basin are divided into Fategarh, Barmer, Akli, Mataji Ka Dungar and Kapurdi formations, in ascending order. Fategarh Formation is made up of sandstone mixed with clay



Text-figure 1—A, Map showing the area of investigation; **B,** location of bore-hole sections.

bands and gastropod casts at the top. Based on lithological similarity this formation is correlated with nonmarine sandstone member of subsurface Sanu Formation of Jaisalmer Basin (Dasgupta, 1977). The lower part of the overlying Barmer Formation is represented by fluviatile sediments, whereas its upper part is marine in nature. Based on palynological studies the lower part of Barmer Formation is dated as Palaeocene in age. The Akli Formation unconformably overlies the Barmer Formation. Lower part of this formation is made up of a sandstone-lignite sequence whereas the upper part is a



Text-figure 2—Lithosuccession of studied bore-hole sections and sample position.

volcanogenic bentonite sequence. Mataji Ka Dungar Formation is dominantly represented by coarse and ferruginous sandstone with pisolite and pebbly sandstone. The Kapurdi Formation is constituted by Fuller's Earth deposits interbedded with marine bioclastic limestone.

PREVIOUS PALYNOLOGICAL WORK

Palynological data from Rajasthan Basin are available from Barmer (Bose, 1952; Jain *et al.*, 1973; Naskar & Baksi, 1978; Tripathi, 1994, 1995), Bikaner (Singh & Dogra, 1988; Ambwani & Singh, 1996; Kar, 1996a) and Palana beds (Rao & Vimal, 1950, 1952; Sah & Kar, 1974). Inter-relationship of these sequences is not clearly understood. Singh and Dogra (1988) reviewed the Palaeocene and Early Eocene spore/pollen assemblages from Indian sedimentary sequences and identified five palynological zones, viz., Zones SP-1 and SP-2 representing Early Palaeocene, SP-3 and SP-4 representing Late Palaeocene and SP-5 representing Early Eocene. These Palynological zones were correlated with planktonic foraminiferal zones and were found to persist in Meghalaya, West Bengal, Cauvery and Kutch basins (Singh & Dogra, 1988). The SP-3 Zone (Singh & Dogra, 1988) marks the beginning of Upper Palaeocene in India. This zone is characterised by the dominance of *Dandottaspora* spp., subdominance of *Proxapertites* spp., *Triangulorites* spp., and restricted occurrence of *Retipilonapites cenozoicus* and *Palaeosantalaceaepites dinoflagellatus.* SP-4 Zone is distinguished by the predominance of near-shore pollen and dinoflagellate cysts. Persistent occurrence of arecaceous pollen assignable to *Palmidites, Spintzonocolpites* and *Neocouperipollis* in high frequency is noticed in Late Palaeocene sediments of Meghalaya, Assam, Himalayan foot-hills, Kutch and Rajasthan. SP-5 Zone is characterised by the dominance of tricolpate, tricolporate and triporate pollen and rare occurrence of *Proxapertites, Dandottaspora, Lycopodiumsporites* and polycolpate grains.

PRESENT STUDY

Angiosperm pollen in general dominate the assemblage recorded from bore-holes MK 327 and MK 332. Pollen having affinities with the families Arecaceae, Liliaceae, Oleaceae, Bombacaceae,

Caesalpiniaceae, Proteaceae, Rubiaceae, Onagraceae, Caprifoliaceae, Clusiaceae and Lamiaceae have been documented in the assemblage in fairly good number. Pteridophytic spores assignable to the families Osmundaceae, Matoniaceae, Polypodiaceae, Lycopodiaceae, and Schizaeaceae are well-represented. Distribution of stratigraphically significant spore/ pollen taxa is given in Table 1. These two sections show almost similar patterns with regard to distribution and frequency of different palynotaxa. Salient features of the assemblages are: good representation of *Proxapertites* spp., *Matanomadhiasulcites kutchensis, Spinizonocolpites echinatus, Tricolpites retibaculatus, Liliacidites microreticulatus, Granustephanocolpites sahii, Dandotiaspora* spp., *Lycopodiumsporites* spp., *Triangulorites bellus* and *T. pachyexinous* and comparatively less representation of *Kielmeyerapollenites eocenicus* and *Tricolpites retibaculatus*. Distribution and frequency of palynotaxa enable identification of two zones in the assemblage which are informally designated as Assemblage Zone A and Assemblage Zone B. Assemblage Zone A is characterised by the dominance of *Dandotiaspora dilata, Lycopodiumsporites* spp., *Proxapertites* spp., *Triangulorites bellus, Liliacidites microreticulatus, Granustephanocolpites sahii* and *Palmidites* spp. and restricted occurrence of *Matanomadhiasulcites maximus* and *Triangulorites pachyexinus*. In bore-hole MK 327 depth 135 to 190 m and in bore-hole MK 332 depth 395 to 425 m represent Assemblage Zone A. The palynofloral composition and palynotaxa frequency indicate that this zone can be correlated to SP-3 and SP-4 zones proposed by Singh and Dogra (1988). The assemblage Zone B is marked with increased frequency of *Tricolporopollis rubra, Spinizonocolpites echinatus, Kielmeyerapollenites eocenicus* and *Matanomadhiasulcites kutchensis* and restricted occurrence of *Meliapollis pachydermis, M. simplex, Foveotricolporites reticuloidus, Lygodiumsporites lakiensis* and *Bombacacidites* sp.

Table 1—Palynotaxa distribution in bore-hole sections

TAXA	ASSEMBLAGE ZONE A	ASSEMBLAGE ZONE B
Matanomadhiasulcites maximus	----------	
Triangulorites pachyexinous	----------	
Dandotiaspora dilata		----------
D. telonata	----------	----------
Lycopodiumsporites palaeocenicus	----------	----------
L. umstewensis	----------	----------
Proxapretites assamicus		----------
P. cursus		----------
P. microreticulatus		----------
Liliacidites microreticulatus		----------
L. major	----------	----------
L. magnus	----------	----------
Palmidites plicatus		----------
P. naviculus	----------	
P. excellens		----------
Triangulorites bellus		----------
Granustephanocolpites sahii		----------
Spinizonocolpites echinatus	----------	
Tricolporopollis rubra	----------	----------
Kielmeyerapollenites eocenicus	----------	
Matanomadhiasulcites kutchensis	----------	
Meliapollis pachydermis		----------
M. simplex		----------
Foveotricolporites reticuloides		----------
Lygodiumsporites lakiensis		
Bombacacidites sp.		----------

— Frequent
---- Rare

In bore-hole MK 327 depth 100 to 130 m and in bore-hole MK 332 depth 20 to 365 m represent Assemblage Zone B. This zone is correlatable to SP-5 Zone of Singh and Dogra (1988).

DISCUSSION

Demarcation of Palaeocene and Eocene sediments based on palynotaxa distribution is rather difficult as most of the taxa are long ranging. However, the change in frequency of some palynotaxa plays a crucial role in determining the boundary.

In India, the Early Palaeocene assemblage is characterised by the dominance of *Proxapertites operculatus, P. cursus, Matanomadhiasulcites maximus, Spinizonocolpites echinatus, Saturna enigmaticus* and *Terscissus grandis*. The Late Palaeocene assemblage shows the dominance of *Dandotiaspora* spp., *Lycopodiumsporites* spp., *Palmaepollenites eocenicus, Neocouperipollis* spp., *Spinizonocolpites* spp., *Palmidites* spp., *Pstlastephanocolporites* spp., *Retistephanocolporites* spp. and *Granustephanocolpites*. These forms either disappear or are rarely found in Early Eocene (Kar, 1996b). The Palaeocene palynotaxa continuing in Early Eocene are: *Matanomadhiasulcites,*

Triangulorites, Lakiapollis, Tricolporopollis, Palmaepollenites and *Neocouperipollis.*

The Early Eocene assemblage is marked with increased frequency of *Tricolporopollis matanomadhensis, Meliapollis ramanujamii, M. pachydermis, M. simplex, Umbelliferoipollenites ovatus, Pellicieroipollis langenheimii* and *Lygodiumsporites lakiensis.* In bore-hole MK 327, in the samples from the depth 135 to 190 m, largely representing the lignite sequence, the dominant taxa are: *Proxapertites, Matanomadhiasulcites, Liliacidites, Dandotiaspora, Triangulorites* and *Granustephanocolpites.* The assemblage belongs to Assemblage Zone A and sediments yielding these forms have been dated as Palaeocene. Samples from the depth 100 to 125 m of this bore-hole, representing clay and lignite, have yielded an assemblage identifiable as Assemblage Zone B and is characterised by the presence of *Meliapollis pachydermis, Meliapollis simplex, Foveotricolporites reticuloidus* and *Lygodiumsporites lakiensis.* These palynotaxa are restricted to Early Eocene. Low frequency of *Dandotiaspora, Lycopodiumsporites* and *Proxapertites* is also noticed in this assemblage which again indicates Early Eocene age. Similar pattern of palynotaxa distribution is observed in the samples of bore-hole MK 332 in which samples from the depth 395 to 425 m have yielded a palynoflora matching that of Assemblage Zone A indicating Palaeocene age whereas, samples from depth 20 to 365 m have yielded an assemblage similar to that recorded from Assemblage Zone B indicating Early Eocene age.

Considering the stratigraphical distribution of palynotaxa and their frequency Palaeocene and Eocene sediments have been demarcated in two bore-holes MK 327 and MK 332 and the boundary is marked at the top of a lignite sequence (Text-figure 2) and sediments representing Assemblage Zone A have been correlated with Akli Formation whereas, those representing Assemblage Zone B are correlated with Mataji Ka Dungar Formation.

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