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Occurrence of *Anonidium*-like pollen in the Tura Formation (Palaeocene) of Meghalaya, India

K. AMBWANI AND R.K. KAR

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

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ABSTRACT

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Anonidium-like pollen of the family Annonaceae was recovered from the Nangwalbibra section of Tura Formation (Palaeocene), Meghalaya. LM and SEM studies of living and fossil pollen reveal that they are closely similar in apertural disposition and ornamentation pattern. *Anonidium* is confined to West Africa at present. The probable route of migration of this genus to India from elsewhere is discussed.

Key-words—*Anonidium* pollen, Annonaceae, Palaeocene, Meghalaya, India.

भारत के मेघालय प्रान्त के पेलियोसीन युगीन तूरा शैलसमूह में *एनोनीडियम* की भाँति के परागकणों की उपस्थिति

कृष्ण अम्बवानी एवं रंजीत कुमार कर

सारांश

मेघालय के पेलियोसीन युगीन तूरा शैलसमूह के नांगवलबिबरा परिच्छेद से एनोनेसी कुल के *एनोनीडियम* की भाँति के परागकण खोजे गए हैं. जीवित एवं अश्मित परागकणों का सूक्ष्मदर्शी एवं क्रमवीक्षण इलेक्ट्रॉन सूक्ष्मदर्शी द्वारा अध्ययन करने से ज्ञात हुआ कि ये द्वारक व्यवस्था एवं अलंकरण विन्यास की दृष्टि से निकटस्थ समरूपता प्रदर्शित करते हैं. वर्तमान समय में *एनोनीडियम* पश्चिमी अफ्रीका में परिरूद्ध हैं, जो भारत तथा अन्य स्थानों पर इस वंश के प्रवास का संभावित पथ है, के विषय में भी चर्चा प्रस्तुत शोध पत्र में की गई है.

संकेत शब्द—*एनोनीडियम*, परागकण, पेलियोसीन, मेघालय, भारत.

INTRODUCTION

ANNONACEOUS pollen grains are quite common in the Palaeocene-Eocene sediments of India, Africa, South and North America. In India, they are confined to Palaeocene and Early Eocene and are regarded as one of the marker fossils for those periods. They have been described under the following names: *Longapertites brasilensis* González Guzmán (1967), *Schizosporis palaeocenicus* Elsik (1968), *Liliacidites baculatus* Venkatachala & Kar (1969), *Annona (?) paleocenica* Elsik (1970), cf. *Liliacidites* Sah & Kar (1970), *Liliacidites microreticulatus* Dutta & Sah (1970), *Liliacidites kutchensis* Saxena (1979), *Longapertites* sp. 3 Boudouresque (1980), *Vermifoveopollenites proxapertitoides* Salami (1984),

Matanomadhiasulcites maximus Kar (1985), cf. *Liliacidites* sp. B Muller *et al.* (1987), *Proxapertites maracaiboensis* Muller *et al.* (1987), *Periretisyncolpites nigericus* Sonuga (1987), *Proxapertites* cf. *cursus* van Hoeken-Klinkenberg (1964), *Matanomadhiasulcites* spp. Venkatachala *et al.* (1989), etc. Kar (1985) & Venkatachala *et al.* (1989) placed some of the above mentioned species under *Matanomadhiasulcites maximus* Kar (1985) as they have oval-elliptical shape, monosulcate aperture and retipilate-retibaculate ornamentation. This species is found commonly in the Palaeocene sediments of Meghalaya and Kutch. Besides this species some other forms of annonaceous pollen were also recovered from the Nangwalbibra section, Garo Hills, Meghalaya. These pollen are described here. The slides were deposited at the repository of the Birbal Sahni Institute of Palaeobotany, Lucknow.

GEOLOGY

The Nangwalbibra section belongs to the Tura Formation, which comes under the Jaintia Group. According to Sah and Singh (1974) there are three coal seams that alternate with white-grey shale or kaolinitic clay. A coarse grained white clayey sandstone with thin pebble band generally occurs at the base. The annonaceous pollen were recovered from the middle coal seam, which is the thickest seam in the locality.

Sah and Singh (1974) worked out the palynology of this seam and placed it in the *Dandotiaspora telonata* Cenozone. The characteristic palynofossils of this cenozone are: *Dandotiaspora telonata, D. pseudoreticulata, D. plicata, Polycolpites speciosus, P. cooksoniae, Lycopodiumsporites palaeocenicus, Proxapertites microreticulatus, Matanomadhiasulcites maximus, Retitribrevicolporites matanomadhensis, Tricolpites levis, Neocouperipollis rarispinosus, N. brevispinosus*, etc. The assemblage indicates a Late Palaeocene age.

Some annonaceous pollen which were not recorded by Sah and Singh (1974) were isolated and studied under LM and SEM. The pollen of various extant species of Annonaceae were also studied in LM and SEM to determine whether any of them shows similarity to the fossil ones. It was observed

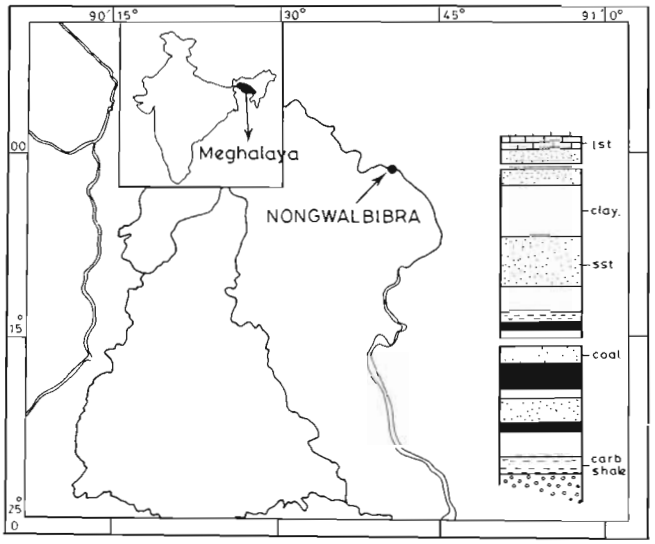

Fig. 1—Showing the lithological section at Nangwalbibra, Tura Formation, Garo Hills, Meghalaya.

that the pollen of *Anonidium mannii* Engl. and Diels closely resembles the fossil pollen in monosulcate nature, bilateral symmetry and reticulate ornamentation (Pl. 1, Figs 1-6). The meshes in both are flat and broad due to complete fusion of the columellae. The polliniferous material of *A. mannii* was kindly supplied by Dr C. Caratini, French Institute, Pondicherry.

DISCUSSION

The presence of *Anonidium*-like pollen in the Tura Formation of Garo Hills, Meghalaya poses many problems. This genus at present is mostly confined to the western parts of Africa. According to Doyle *et al.* (1979) pollen grains similar to Annonaceae are present in the pre-Albian sediments of Gabon, which shows its existence in the region since its presumed inception. If the cradle of the Annonaceae was in western Africa, then *Anonidium* would have to come to India during the Palaeocene. However, the Cretaceous palynological assemblages of West Africa are more similar to those of South America than those of India. The juxtaposition of the two

PLATE 1 →

1. Fossil monosulcate, reticulate pollen. Slide no. 12435 M/28. x 1000 (LM).
2. *Anonidium mannii* showing monosulcate, reticulate pattern. x 1000 (LM).
3. Fossil monosulcate pollen showing distal ornamentation. x 1200 (SEM), (bar = 100 μm).
4. *Anonidium mannii* showing distal reticulation. x 1600 (SEM), (bar = 100 μm).
5, 6. *A. mannii* showing monosulcate nature. x 1200 (SEM), (bar = 100 μm).
7, 8. Exine reticulation enlarged to show lumina and muri in fossil pollen. x 4000 and 8000 (SEM), (bar = 10 μm).
9, 10. Exine reticulation enlarged to show lumina and muri in extant pollen. x 4000 and 8000 (SEM), (bar = 10 μm).

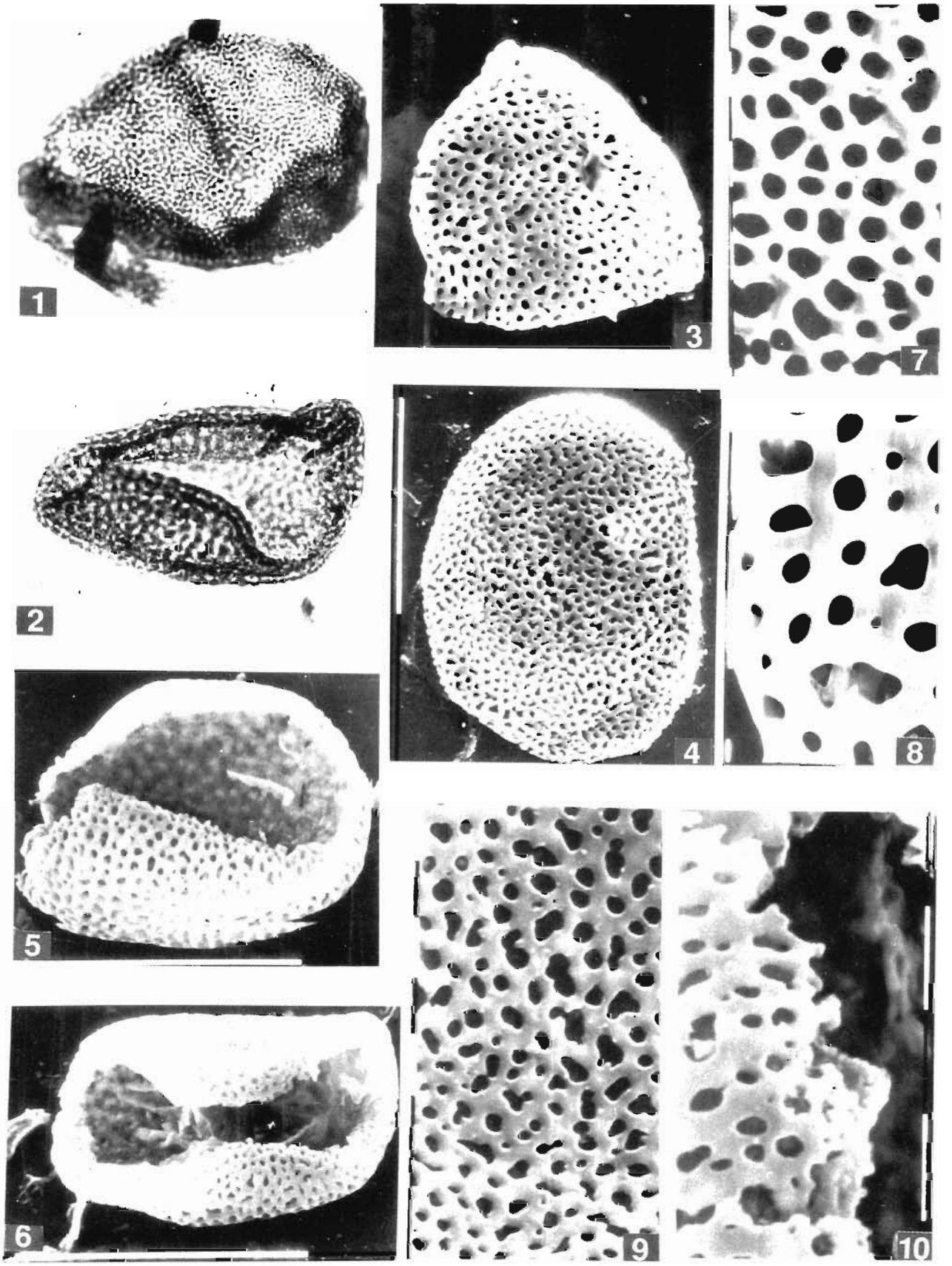

PLATE 1

continents in the Cretaceous time also would have assisted in mutual migration. [Doyle *et al.* (1976), Wolfe *et al.* (1975), Doyle (1977, 1978), Hickey and Doyle (1977) and Dilcher (1979)]. The work of Jardiné *et al.* (1975), Herngreen (1975), Brenner (1976) and Doyle *et al.* (1977) confirms this observation.

Takhtajan (1969) however, considered that southeast Asia was the centre of origin of the Annonaceae. Smith (1973) also supported this view. Walker (1971), on the basis of palynological investigation, suggested that the Amazon basin of South America could be the original homeland of Annonaceae though he did not rule out the possibility of African origin. Raven and Axelrod (1974) and Schuster (1976) emphasized a West Gondwana origin of Annonaceae.

A southeast Asian origin of Annonaceae seems to be doubtful because fossil pollen similar to Annonaceae are known from the Barremian-Aptian in Africa and South America. In India, however, the earliest record of annonaceous pollen comes from the Early Palaeocene (Kar, 1992). So the migration route seems to have been eastward from West Africa. Besides annonaceous pollen, Venkatachala *et al.* (1989) observed that *Retistephanocolpites williamsii, Spinozonocolpites* spp., *Ctenolophonidites costatus, Tricolpites reticulatus, Striacolporites cephalus, Neocouperipollis* spp., *Proxapertites* spp., *Anocolosidites luteoides, Marginipollis* spp. and *Margocolporites* spp. were common to both Africa and India during the Tertiary Period. Kar (1992) reported spores assignable to *Acrostichum* from the Palaeocene of Meghalaya. Similar spores were reported by Caratini *et al.* (1991) from the Palaeocene of Senegal.

The shared presence of these common forms can only be explained if the ancestors of these plants were already in existence in different continents before the continental drift.

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