

OCCURRENCE OF THE GENUS *AQUILAPOLLENITES* IN THE UPPER CRETACEOUS KALLAMEDU FORMATION OF VRIDDHACHALAM AREA, CAUVERY BASIN, SOUTHERN INDIA

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ABSTRACT

The presence of triprojectate pollen in the Upper Cretaceous of Cauvery Basin is confirmed. The pollen belong to the species *Aquilapollenites bengalensis* Baksi & Deb. From comparative palynology it is deduced that *Aquilapollenites* yielding bed in Baksi's Bengal Palynological Zone I, i.e. Biswas' *Chara*—Ostracod Facies Zone, could not be older than Maestrichtian in age.

Key-words—Triprojectacites, *Aquilapollenites*, Upper Cretaceous, Kallamedu Formation, India.

सारांश

कावेरी द्रोणी (दक्षिणी भारत) में वृद्धाचलम् क्षेत्र के ऊपर क्रीटेशस युगीन कलामेडु शैल-समूह से अँक्वीलापोलिनाइटिस प्रजाति—हरि कृष्ण माहेश्वरी एवं कृष्ण प्रसाद जैन

कावेरी द्रोणी के ऊपर क्रीटेशस अवसदों में त्रिप्रवर्द्धीय (ट्राइप्रोजेक्टेट) परागकणों की उपस्थिति का समर्थन किया गया है। ये परागकण अँक्वीलापोलिनाइटिस बंगालेन्सिस बक्सी व देब जाति के हैं। तुलनात्मक परागाणविक दृष्टि से यह निष्कर्ष निकाला गया है कि बक्सी के बंगाल परागाणविक मंडल 1 में अँक्वीलापोलिनाइटिस-धारक संस्तर अर्थात् विश्वास का कारा-ओस्ट्रेकोड संलक्षणी मंडल, आयु में मेस्ट्रिचियन से पुराना नहीं हो सकता।

INTRODUCTION

THE genus *Aquilapollenites* was established by Rouse (1957) to incorporate certain peculiar palynomorphs recovered from the Upper Cretaceous Brazeau and Oldman formations of Alberta, Canada. Since then more than 80 species of this genus (*sensu lato*) have been identified and described from Albian to Eocene beds. According to Srivastava (1978) while the Albian and Cenomanian records of the genus are unreliable, the Palaeocene and Eocene occurrences of the genus may mostly be due to reworking. However, *Aquilapollenites* specimens found in the Upper Palaeocene Porter Creek Clay Formation of Tennessee do not seem to be reworked as several clumps, each made up of a number of specimens, have been found (Herrick & Tschudy, 1967).

Majority of the species of *Aquilapollenites* are confined to late Campanian-early Maestrichtian of the circum-Pacific region (western United States of America, western Canada, Alaska, Japan and Siberia). Several species of the genus are also now known from the Maestrichtian of Scotland (Martin, 1968; Srivastava, 1975). Only a few species are known from other areas, e.g. Brazil (Herngreen, 1975), Africa (Jardiné & Magloire, 1963; Belsky, Boltenhagen & Potonié, 1956), India (Banerjee & Misra, 1968; Baksi & Deb, 1976) and Malaysia (Muller, 1969).

From India, so far three species of the genus *Aquilapollenites* have been reported. Banerjee and Misra (1968, p. 102, pl. 4, fig. 58) were first to report the genus in India. The solitary specimen recovered from the samples of Karaikal well-2 was placed under *A. quadrilobus* Rouse, 1957. Though the specimen was illustrated, no

description was given. Baksi and Deb (1976, p. 404) have cast doubts on the identification of this specimen with *A. quadrilobus*. The specimen has since been lost (Venkatachala, 1978) and hence one can only surmise about its characters from the illustration. Venkatachala and Jain (1970) did not find any examples of *Aquilapollenites* or other angiosperm pollen in the Karaikal well sediments studied by them. The two other species known from India are *A. indicus* and *A. bengalensis* which have been reported by Baksi and Deb (1976) from the Upper Cretaceous of the Jalangi well-drilled in West Bengal.

In the present communication the occurrence of the genus *Aquilapollenites* in the Upper Cretaceous of southern India is confirmed. The specimens agree in toto with *Aquilapollenites bengalensis* Baksi & Deb (1976). However, no specimen even remotely resembling the illustration of Banerjee and Misra has been found.

MATERIAL AND METHOD

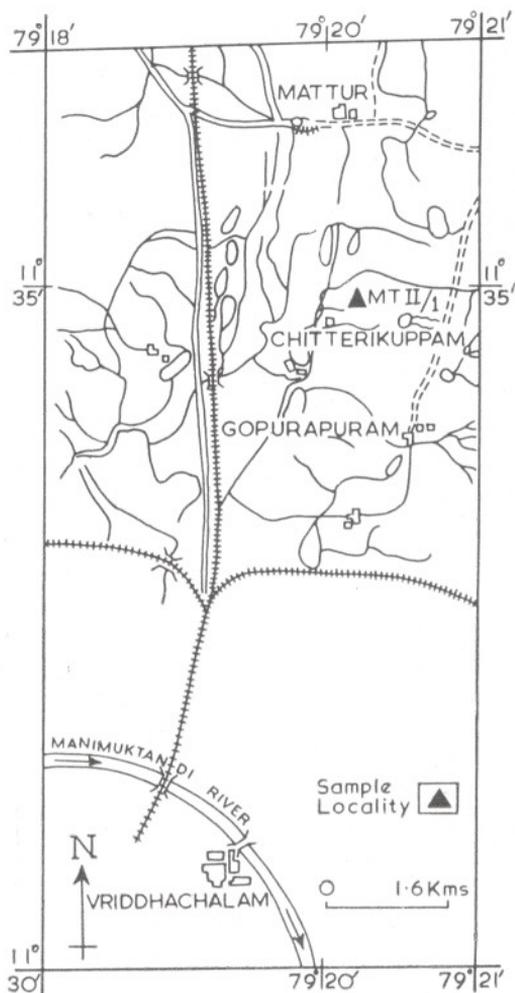
The samples were collected from a well cutting about 3 km due south of Matur Village in Vriddhachalam area (Map 1). The lithological succession in the well (MT-II/1) is as follows:

3. Medium-to coarse-grained sandstone,
2. Sandy clays,
1. Calcareous sandstones with no apparent fossils but with carbonaceous streaks.

The *Aquilapollenites* pollen were recovered from the calcareous sandstone. The palynological assemblage of the sample comprises spores, pollen, dinoflagellates and acritarchs. Dinoflagellates and acritarchs have already been described earlier (Jain, 1978).

The lithology of the productive sample is similar to that of the Cullmoad Sandstone Member which represents the upper part of the Cullmoad Formation of Srivastava and Tewari (1967). Sastry, Mamgain and Rao (1972) consider the sandstone member to represent a formation in itself, which they named as the Kallamedu Formation. However, Banerji (1973) placed the sandstone member in his Kallankurchi Formation.

The sample was first treated with dilute hydrochloric acid to remove the carbonates. It was then demineralized in hydrofluoric acid and again treated with dilute hydrochloric acid to remove the fluorides that might have formed. The palynomorphs so



MAP 1 — Geographic set up of Vriddhachalam area showing location of sample.

obtained were stained with Safranin O in water. Polyvinyl alcohol and canada balsam were used to prepare the slides.

DESCRIPTION

Turma — *Projectoaperturites* Mtchedlishvili, 1961

Subturma — *Triprojectacites* Mtchedlishvili, 1961 emend. Stanley, 1970

The group *Triprojectacites* as emended by Stanley (1970, p. 10) includes iso- or heteropolar pollen with three equatorial projections which characteristically have meridionally oriented colpoids at the distal ends of the

projections. Mtchedlishvili (1961) included six genera, viz., *Triprojectus*, *Aquilapollenites*, *Integricorpus*, *Mancicorpus*, *Parviprojectus* and *Projectoporites*, in the group Triprojectacites. Khlonova (1961) described several genera of triprojectate pollen, e.g. *Tricerapollis*, *Translucentipollis*, *Fibulapollis* and *Accuratipollis*. Stanley (1970) reviewed the above genera and found only five genera to be distinct enough for retention. Tschudy and Leopold (1971) opined that all the above genera intergrade into one another and therefore, they recognized only the genus *Aquilapollenites*. Srivastava (1978), however, retains the genera *Mancicorpus* and *Mtchedlishvilia* besides *Aquilapollenites*. Though our specimens correspond to the genus *Integricorpus* as restated by Stanley (1970), we have retained the original taxonomic assignment of Baksi and Deb (1976) because of the obvious difficulty in studying the variations due to paucity of specimens.

Genus — *Aquilapollenites* Rouse, 1957
emend. Srivastava, 1968

Type Species — *Aquilapollenites quadrilobus* Rouse, 1957.

Aquilapollenites bengalensis Baksi & Deb

Pl. 1, figs 1-5

Aquilapollenites bengalensis Baksi & Deb, 1976, *Pollen Spores*, vol. 18, no. 3, p. 402, pl. 1, figs 3-5.

Holotype — Baksi & Deb, 1976, pl. 1, fig. 3; slide no. J-1 10669/2, Palaeontological Laboratory, Department of Geological Science, Jadavpur University, Calcutta; Jalangi Well-1, West Bengal, India; Upper Cretaceous.

Description — Only three well-preserved specimens of the species have been found in the preparations. The pollen grains are isopolar, with three equatorially situated lateral projections. Polar axis is 53 to 79.6 μm long, equatorial width is 38.8 to 44.7 μm , length of equatorial projections is 7.8 to 9.3 μm , width of the equatorial projections (measured at midlength) is 3.0-6.0 μm . The equatorial projections are small, with rounded apices. Distal ends of the projections have a distinct colpoid each. Body exine is tectate, tectum is striate and the striae run concentrically round the equatorial projections, but not encroaching upon them.

REMARKS

Banerjee and Misra (1968) were the first to record the presence of the genus *Aquilapollenites* in India. The well from which they got their specimen was drilled in the same basin from where we have also recorded the genus. However, our specimens do not resemble the one illustrated by Banerjee and Misra (1968, pl. 4, fig. 58), but on the other hand are indistinguishable from *Aquilapollenites bengalensis* Baksi & Deb, 1976 reported from the Upper Cretaceous of Bengal Basin. The identification of our specimens was confirmed by Dr S. K. Srivastava of Chevron Oil in 1977.

In Bengal, *Aquilapollenites* was recorded from Palynological Zone I of Baksi (1972), at a depth of about 3554 metres. This depth is said to be the base of *Chara-Ostracod Facies Zone* of Biswas (cited in Baksi & Deb, 1976, p. 400) which is dated as of basal Upper Cretaceous age.

There seems to be some confusion about the age of Baksi's Palynological Zone I (see Table 1). According to Baksi (1972,

TABLE 1

BAKSI, 1972, P. 190, TABLE 1		BAKSI, 1972, P. 192, TABLE 2		BAKSI, 1972, P. 194, TEXT-FIG. 2	BAKSI & DEB 1976
Lower Eocene	Jalangi Formation	Palynological Zone II	Palaeocene-Lower Eocene	Palaeocene-Lower Eocene	
Palaeocene					
Middle-Upper Cretaceous	Ghatal Formation Bolpur Formation	Palynological Zone I	Middle-Upper Cretaceous	Upper Cretaceous	Upper Cretaceous Palaeocene

p. 191) the zone covers Bolpur, Ghatal and lower part of Jalangi formations and is of Upper Cretaceous age. On the other hand Baksi's table 1 on page 190 denotes that Bolpur, Ghatal and Jalangi formations range from Middle Cretaceous to Lower Eocene thus implying that Palynological Zone I is probably Middle Cretaceous-Palaeocene in age. Baksi's table 2 on page 192 implies a Middle to Upper Cretaceous age, while text-figure 2 on page 194 implies an Upper Cretaceous age for Palynological Zone I. Baksi and Deb (1976, p. 405) date the Bengal Palynological Zone I as of Upper Cretaceous to Palaeocene age. We are therefore, not sure about the exact age of Baksi's Palynological Zone I.

However, in no case it could have been older than the Upper Cretaceous due to the reported occurrence of *Nypa* type pollen in association with massulae of the water fern (not algae as printed in text-figure 2 of Baksi, 1972, p. 104) *Azolla*. The Kallamedu assemblage in which we found *Aquilapollenites* lacks definite *Nypa* type pollen but has a large number of *Azolla* massulae associated with characteristic pollen such as *Cranwellia*, *Scollardia*, *Zlivisporis*, *Bullasporis*, *Proteacidites*, etc. On the basis of these occurrences it is dated to be of Maestrichtian age. The associated dinoflagellate cysts indicate a Maestrichtian-Danian transitional phase (Jain, 1978). It can, therefore, be safely assumed that the *Aquilapollenites bengalensis* yielding bed of

Baksi's Bengal Palynological Zone I is not older than Maestrichtian in age. In other words, the *Chara*-Ostracod Facies Zone of Biswas must lie in the upper part of the Upper Cretaceous.

At present it is difficult to precisely indicate the route through which *Aquilapollenites* entered India. It is a characteristic and dominant element of the late Upper Cretaceous palynofloras of western North America and Siberia. In the provinces of the former Gondwanaland the genus makes extremely rare appearances. It is known only from north-eastern Brazil, Senegal, Gabon and Egypt. We do not know of any record so far from Australia and Antarctica. Srivastava (1978, p. 92) speculates that *Aquilapollenites* migrated to South America and West Africa from North America. From West Africa the genus reached Egypt and finally India. However, *Aquilapollenites bengalensis* is more akin to the *Integricarpus* group of species. It shows great resemblance with *Integricarpus (Parvi-projectus) striatus* (Mtschedlishvili, 1961) Stanley, 1970 reported from the Maestrichtian-Danian of West Siberia. Another south-east Asia species, viz., *A. wilfordii* Muller, 1968 from the Senonian-Palaeocene of Sarawak, Malaysia is also pretty close to the *Integricarpus* group of species. The *Integricarpus* group of species is so far not known from South America or Africa. Therefore, an Asian route for migration of *Aquilapollenites* to India is equally plausible.

REFERENCES

- BAKSI, S. K. (1972). On the palynological biostratigraphy of Bengal Basin. *Proc. Sem. Paleopalynol. Indian Strat. Calcutta*, 1971, pp. 188-206.
- BAKSI, S. K. & DEB, URMILA (1976). On new occurrence of *Aquilapollenites* from eastern India. *Pollen Spores*, 18 (3): 399-406.
- BANERJEE, D. & MISRA, C. M. (1968). Cretaceous microflora from South India. Seminar on "Cretaceous-Tertiary formations of India". *Mem. geol. Soc. India*, no. 2: 99-104.
- BANERJI, R. K. (1973). Stratigraphy and micropalaeontology of the Cauvery Basin, Part-1. Exposed area. *J. palaeont. Soc. India*, 17: 7-30.
- BELSKY, C. Y., BOLTENHAGEN, E. & POTONIÉ, R. (1965). Spores dispersae der oberen Kreide von Gabun, Äquatoriales Afrika. *Paläont. Z.*, 39: 72-83.
- HERNGREEN, G. F. W. (1975). An Upper Senonian pollen assemblage of borehole 3-PIA-10-AL, State of Alagoas, Brazil. *Pollen Spores*, 17 (1): 93-140.
- JAIN, K. P. (1978). An Upper Cretaceous dinoflagellate assemblage from Vriddhachalam area, Cauvery Basin, South India. *Palaebotanist*, 25: 146-160.
- JARDINÉ, S. & MAGLOIRE, L. (1965). Palynologie et stratigraphie du Crétacé des bassins du Senegal et de Côte d'Ivoire. *Mém. B.R.G.M.*, 32: 187-245.
- KHLONOVA, A. F. (1961). Spores and pollen from the upper half of the Upper Cretaceous of the eastern part of the western Siberia depression. *Trudy Inst. Geol. Geophys. Acad. Sci. U.S.S.R. (Sib. otd.)*, 7: 1-138 (in Russian).
- MARTIN, A. R. H. (1968). *Aquilapollenites* in the British Isles. *Palaebotanist*, 11: 549-553.
- MTSCHEDLISHVILI, N. D. (1961). Triprojectacites, pp. 203-209 in Samoilovich, S. R. (Ed.)—Pollen

- and spores from western Siberia, Jurassic-Palaeocene. *Trudy VNIGRI*, **177**: 1-342 (in Russian).
- MULLER, J. (1968). Palynology of the Pedawan and Plateau Sandstone formations (Cretaceous-Eocene) in Sarawak, Malaysia. *Micropaleontology*, **14** (1): 1-37.
- ROUSE, G. E. (1957). The application of a new nomenclatural approach to Upper Cretaceous plant microfossils from western Canada. *Can. J. Bot.*, **35**: 349-375.
- SASTRY, M. V. A., MAMGAIN, V. D. & RAO, B. R. J. (1972). Ostracod fauna of the Ariyalur Group (Upper Cretaceous), Tiruchirapalli District, Tamil Nadu. *Mem. geol. Surv. India, Palaeont. indica*, n. ser., **40**: 1-48.
- SRIVASTAVA, R. P. & TEWARI, B. S. (1967). Biostratigraphy of the Ariyalur Stage, Cretaceous of Trichinopoly. *J. palaeont. Soc. India*, **12**: 48-54.
- SRIVASTAVA, S. K. (1975). Maestrichtian microspore assemblages from the interbasaltic lignites of Mull, Scotland. *Palaeontographica*, **150B**: 125-156.
- SRIVASTAVA, S. K. (1978). Cretaceous spore-pollen floras: A global evaluation. *Biol. Mem.*, **3** (1): 1-130.
- STANLEY, E. A. (1970). The stratigraphical, biogeographical, paleoautecological and evolutionary significance of the fossil pollen group Triproctacites. *Bull. Georgia Acad. Sci.*, **28**: 1-44.
- TSCHUDY, B. D. & LEOPOLD, E. B. (1971). *Aquilapollenites* (Rouse) Funkhouser — selected Rocky Mountain taxa and their stratigraphic ranges. *Geol. Soc. Am., spec. Pap.* (127): 113-165.
- VENKATACHALA, B. S. (1978). Presidential Address: Palynological stratigraphy and exploration of fossil fuels. *Proc. IV int. palynol. Conf., Lucknow (1976-77)*, **1**: 22-43.
- VENKATACHALA, B. S. & JAIN, A. K. (1970). Fossil spores and pollen from the Lower Cretaceous subsurface sediments near Karaikal, Cauvery Basin. *Palaeobotanist*, **18** (1): 63-66.

EXPLANATION OF PLATE

(All photomicrographs $\times 1200$)

Aquilapollenites bengalensis Baksi & Deb, 1976

- 1-4. A specimen in four different foci showing small equatorial projections and tectate-striate exine. Slide no. BSIP 6186, co-ordinates: 115×11.3 .
5. This specimen clearly shows the striate nature of the exine. Slide no. BSIP 6185, co-ordinates: 110.0×15.2 .
- 6, 7. A specimen probably belonging to this species. Slide no. BSIP 6186, co-ordinates: 119.5×16.5 .

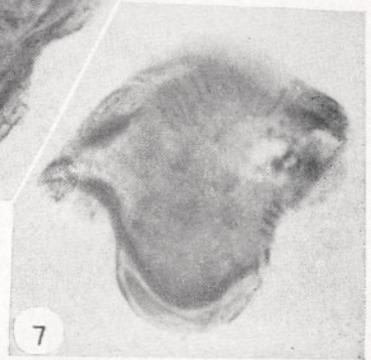
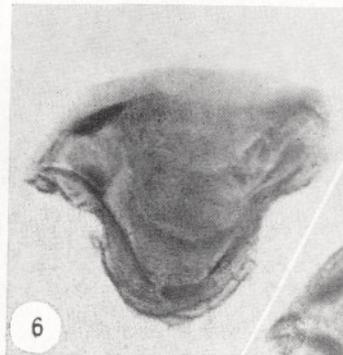
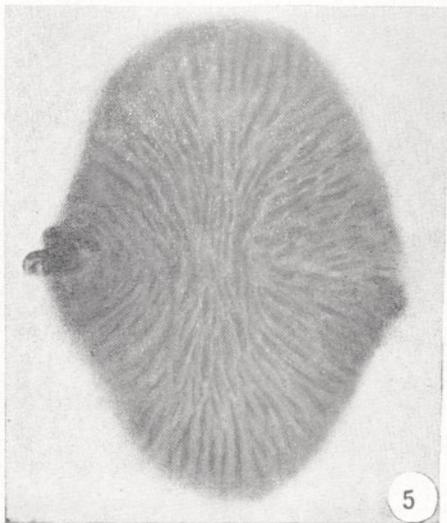
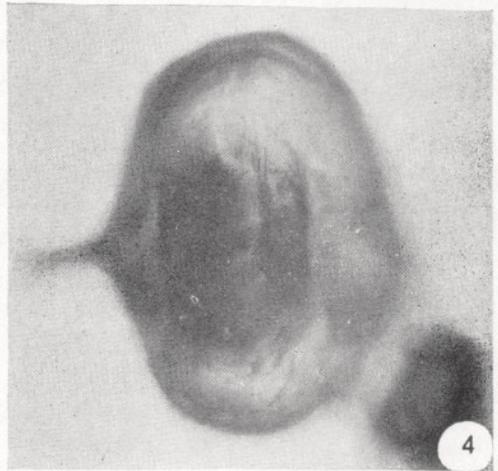
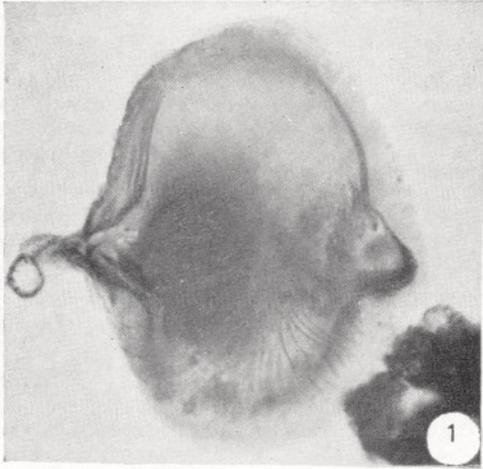


PLATE I