

## LOWER MIOCENE (GAJ) FAUNA FROM TRAVANCORE-COCHIN, SOUTH INDIA.

M. R. SAHNI and M. V. A. SASTRY

Geological Survey of India, Calcutta, India.

**ABSTRACT.**—This paper records a fossil assemblage from certain beds at Edavai about three miles N. N. W. of Varkala on the Travancore coast, considered to be homotaxial with the Quilon Limestone. The assemblage includes the following: *Antillia miocenica* sp. nov., *Calamophyllia quilonica* sp. nov., *Breynia carinata* d'Archiac and Haime, *Discors triforme* (J. de C. Sow.) and *Tectus loryi* (d'Archiac and Haime).

*Antillia miocenica* has a simple, turbinate, slightly curved corallum; it possesses thin dentate septa disposed in six systems and five incomplete cycles, and a columella. *Calamophyllia quilonica* has a cylindrical corallite with mural thickenings, and few wavy, thin, rounded costae; the septa are wide apart and there is no distinct columella.

Besides the new species, the fossils recorded above are reported for the first time from this part of Peninsular India. Among the fossils already known from this region are: *Archaias malabaricus* (Carter), *Operculina bartschi* Cushman, and a number of smaller foraminifera.

The fossil assemblage, particularly the presence of *Breynia carinata*, *Discors triforme*, and *Tectus loryi* finally confirms that the Quilon beds are of Gaj (Lower Miocene) age.

### INTRODUCTION

**D**URING the field season 1953-54, A. Damodaran, Assistant Geologist, Geological Survey of India, collected certain



fossil material while engaged in systematic mapping in Travancore-Cochin, South India. The fossiliferous beds outcrop at Edavai (Sheet No. 58D/9, 8°46' : 76°41' 30") a hitherto unrecorded locality, about three miles N. N. W. of Varkala. These beds apparently consist of sandy limestone weathering to a soft, greyish rock containing profuse remains of comminuted mollusca and other shells. Many of the fossils, however, weather out in an exceptionally fine state of preservation owing to the sandy nature of the rock, enabling detailed studies to be made.

The assemblage consists of fossils representing the following groups: foraminifera, anthozoa, echinoidea, pelecypoda and gastropoda. This paper deals mainly with the study of the megafossils collected so far.

The fossils represent an assemblage hitherto unrecorded from this part of Peninsular India and, as will appear presently, are of Miocene age. Their closest allies occur in the Gaj (Lower Miocene) beds of Sind, Cutch, Kathiawar and Ceylon. The Edavai fauna manifestly represents the great Miocene transgression which, apart from its wide extent on the Western Coastal areas of India resulting in large scale deposition of marine sediments, brought about the physical separation of this continent from Ceylon, so that the Island "became a separate geographical entity and began to pursue its own course of evolution." (Wadia 1941).



## REVIEW OF PREVIOUS WORK

The age of the Quilon fauna with which the one under study is considered to be homotaxial, has been discussed previously by several workers and may be reviewed here briefly. According to Carter (1853) and Douvillé (1902) the Quilon fauna represents the Pliocene. Later, Carter (1857) correlated them with the Gaj beds and referred them to the uppermost Aquitanian. A. M. Davies (1923) equated the Quilon fauna with that of southern Ceylon and referred both to the Vindobonian. Subsequently (1935) he placed them in the Middle Miocene, though in his explanation of plates relating to the same text he assigns a Lower Miocene age to them which, as Eames (1950) has pointed out, is probably a printer's error.

T. W. Vaughan (1928) assigns the *Archaias malabaricus* horizon in Travancore and Ceylon to Miocene (Vindobonian or later). After a detailed study of a large fauna consisting of mega-fossils collected from two localities—Chattannur (8°51'45" : 76°43') and Nedungulam (8°50'8" : 76°41'15") Kumar and Pichamuthu (1933) assigned the Quilon fauna to the Gaj.

Furon and Lemoine (1939) place the containing beds in the Tortonian, while, F.R.S. Henson (1950) referring *Archaias malabaricus* (Carter) to the genus *Taberina*, assigns them a Middle Miocene age.

On the whole, all the subsequent work, (F. E. Eames (1950) and K. Jacob and V. V. Sastri (1951 and 1952) points to the uppermost part of the Lower Miocene as the age of these occurrences in Ceylon and the Indian continent.

In conclusion, it may be stated that except for Carter and Kumar and Pichamuthu, who studied fairly large faunas, the determination of the age of the Quilon beds by others was based mainly on the evidence of a single foraminifer, *Archaias malabaricus* (Carter).

## SYSTEMATIC DESCRIPTION

## FORAMINIFERA

OPERGULINA BARTSCHI Cushman  
(Pl. 41, fig. 1)

Six specimens of this species were recovered from the matrix. Test compressed, except

in the central region, where it is slightly raised. The surface is characterised by numerous well defined bosses and sutures. Our specimens compare well with Cushman's description (1921).

*Figured specimen* :—G. S. I. Type No. 17673.

ARCHAIAS MALABARICUS (Carter)  
(Pl. 41, fig. 2)

Two specimens of *Archaias* were found attached to the only specimen of *Tectus loryi* in our collection, but it was not possible to detach them. However, such examination as has been made leaves no doubt that they should be assigned to *A. malabaricus* (Carter). Our study of the material was not sufficiently detailed to confirm Henson's conclusion (1950) that *A. malabaricus* should be assigned to *Taberina*.

*Figured specimen* :—G. S. I. Type No. 17674.

## ADDITIONAL MATERIAL

Besides the above, the following genera of smaller foraminifera occur in our material: *Clavulina*, *Triloculina*, *Pyrgo*, *Nonion*, *Elphidium* (two species), *Bolivina*, and *Rotalia* (two species). The authors propose to deal with these separately in due course.

## ANTHOZOA

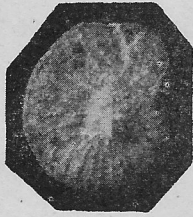
Family ASTREIDAE  
Genus ANTILLIA, Duncan 1863.  
ANTILLIA MIOGENICA sp. nov.  
(pl. 41, figs. 3-5)

This species is represented by a single, exceptionally well preserved example in our collection.

Corallum simple, turbinate, slightly curved; calice sub-circular; septa, thin, straight and dentate, disposed in six systems and five incomplete cycles. The majority of septa reach far in towards the axial space. Septal thickening found near the margin of the calice; columella large, formed by twisting of the septa; dissepiments numerous, and inclined; costae thin, over 80 in number corresponding to the number of septa. Epitheca not preserved.

## DIMENSIONS

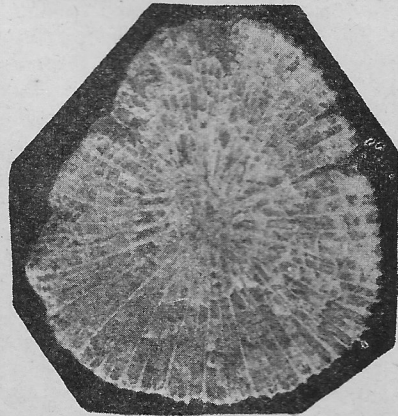
Corallum :	maximum height	57 mm.
Calice :	length	51 mm.
	breadth	45 mm.



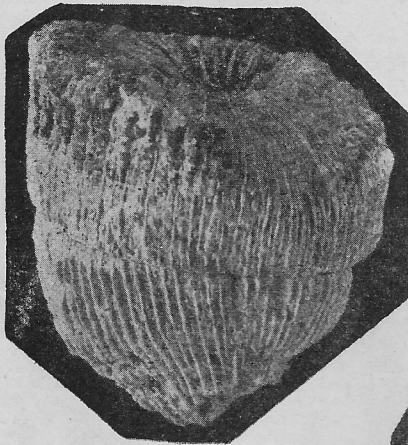
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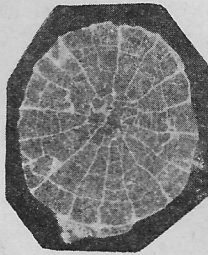
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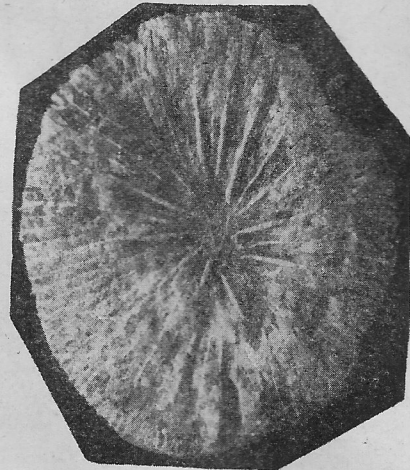
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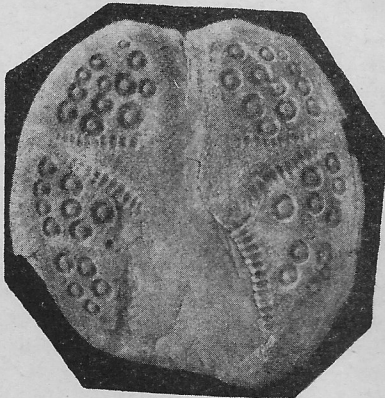
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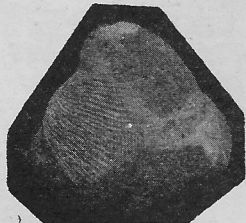
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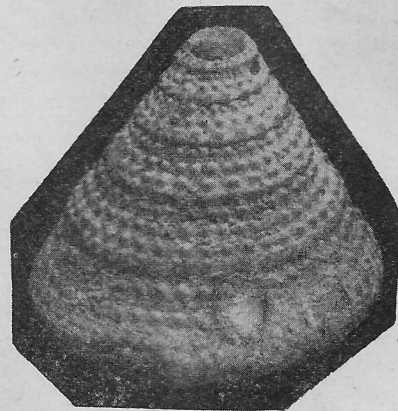
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6



9



10

*Remarks* :—So far only two species of this genus have been described from the Indian continent, namely, *A. plana* Duncan and *A. indica* Duncan both from Sind (Pakistan). The genus is apparently of rather rare occurrence. *A. miocenica* differs from *A. plana* entirely in the form of the corallum which is discoidal in the latter. Our species resembles *A. indica* in general shape, but the septa of the latter which are lobed, are quite different.

*A. miocenica* resembles *A. ponderosa* (M. Edw. and Haime) in general shape, but the latter has a dense membraniferous epitheca. The tuberculate character of the ribs separate *A. dentata* Duncan from our species which lacks this feature.

*Holotype* :—G. S. I. Type No. 17675.

GENUSA CALAMOPHYLLIA, Blainville 1830, emend  
H. Milne Edwards and Jules Haime 1831.  
CALAMOPHYLLIA QUILONICA sp. nov.  
(Pl. 4I, figs. 6, 7)

This species is represented by five specimens in our collection. Corallite cylindrical, slightly compressed, oval in transverse section; mural thickening present at intervals; costae 24 to 28 in number, wavy, thin and rounded, smaller than the intercostal spaces. Intercostal space often raised, possessing occasional small papillae; septa few in number, (18 are seen on one transverse section), wide apart, not reaching the axial space. There is no distinct columella. In the columella section, occasional thickenings occur resulting from the confluence of septa. The dissepiments are disposed at regular intervals resulting in a number of concentric circles. There is no epitheca. The longest specimen in our collection measures as follows:

## DIMENSIONS

Height of corallite	43 mm.
Maximum breadth of corallite	16 mm.

*Remarks* :—*Calamophyllia quilonica* resembles *C. elongata* Duncan (1880) in general characters. However, the presence of subsidiary smaller costae in between the larger costae, which according to Duncan characterises *C. elongata*, is not observed in our species; also the costae are rounded and not so raised as in *C. elongata*. The calice is not contracted.

*Holotype* :—G. S. I. Type No. 17676.

*Paratype* :—G. S. I. Type No. 17677.

## ECHINOIDEA

Genus BREYNIA, Desor

BREYNIA CARINATA d'Archiac and Haime  
(Pl. 4I, fig. 8)

1854. *Breynia carinata* d'Archiac and Haime. *Description des animaux fossiles du groupe Nummulitique de l'Inde*. Pl. XV, fig. 4.
1833. *Breynia carinata* d'Archiac and Haime-Duncan, M. and Sladen, P. *The Fossil Echinoidea of Kachh and Kattywar*. *Pal. Ind. Sr. XIV*, Vol. I, Pt. 4, p. 66.
1885. *Breynia carinata* d'Archiac and Haime-Duncan, M. and Sladen, P. *Echinoidea from the Gaj Series of Western Sind*. *Ibid.* Pt. 3, pp. 229, 343-354.
1930. *Breynia cf. carinata* d'Archiac and Haime-Ethel D. Currie. *The Echinoidea in the McKinnon Wood Collection, Kenya Colony*. *Monog. Geol. Dept., Hunterian Museum, Glasgow University*, IV, Pl. XVI, fig. 2, p. 172.

There are four specimens of which two are fairly complete and well preserved. Our specimens which are rather young individuals compare with G. S. I. Type No. 2791 (Duncan and Sladen Pl. 54. fig. 2).

No further description is necessary.

*Figured specimen* :—G. S. I. Type No. 17678.

## EXPLANATION OF PLATE 4I

- Fig. 1—*Operculina bartschi* Cushman, G. S. I. Type No. 17673; x 8.  
2—*Archaias malabaricus* (Carter), G. S. I. Type No. 17674; x 8.  
3—*Antillia miocenica* sp. nov. Corallum of Holotype; G. S. I. Type No. 17675; x 1.  
4—*Antillia miocenica* sp. nov. Calice of Holotype; x 1.  
5—*Antillia miocenica* sp. nov. Transverse section of Holotype taken at the middle of the corallum showing columella formed by twisting of the septa; x 1.  
6—*Calamophyllia quilonica* sp. nov. Corallite of Holotype; G. S. I. Type No. 17676; x 1.  
7—*Calamophyllia quilonica* sp. nov. Transverse section of Paratype; G. S. I. Type No. 17677; x 2.  
8—*Breynia carinata* d'Archiac and Haime, G. S. I. Type No. 17678; x 1.  
9—*Discors triforme* (J. de C. Sowerby), G. S. I. Type No. 17679; x 1.  
10—*Tectus loryi* (d'Archiac and Haime), G. S. I. Type No. 17680; x 1.

## PELECYPODA

Genus DISCORS, Deshayes

DISCORS TRIFORME (J. de C. Sowerby)  
(Pl. 41, fig. 9)

1840. *Cardium triforme* J. de C. Sowerby—J. de C. Sowerby. Systematic List of Organic remains in Memoir to illustrate a geological map of Cutch by C. W. Grant. *Trans. Geol. Soc. Lond.*, (2) V, Pl. XXV, fig. 11.
1928. *Cardium (Discors) triforme* J. de C. Sowerby-Vredenburg, E. W. Descriptions of Mollusca from the Post-Eocene Tertiary Formation of North-Western India. *Mem. Geol. Surv. Ind.* Vol. 50, Pt. 2, p. 444.
1950. *Discors triforme* (J. de C. Sow.)—Eames, F. E. On the Ages of certain Upper Tertiary beds of Peninsular India and Ceylon. *Geol. Mag.* Vol. 87, No. 4, p. 241.

The species is represented in our collection by a single right valve in which only the posterior part of the shell is preserved. However, the three different types of ornamentation—concentric, cancellate and radial—characteristic of the species are clearly seen here which makes identification easy.

*Figured specimen*:—G. S. I. Type No. 17779.

## GASTROPODA

Genus TECTUS, Montfort

TECTUS LORZI (d'Archiac and Haime)  
(Pl. 41, fig. 10)

1854. *Trochus? lorzi* d'Archiac and Haime. *Description des animaux fossiles du groupe Nummulitique de l'Inde*. d'Archiac and Haime, Pl. XXVI, fig. 17.
- „ *Trochus cognatus* J. de C. Sow?—d'Archiac and Haime. *Ibid.* Pl. XXVI, fig. 18.
1928. *Trochus (Tectus) lorzi* d'Archiac and Haime-Vredenburg, E. W. Descriptions of Mollusca from the Post-Eocene Tertiary Formation of North-Western India; *Mem. Geol. Surv. Ind.* Vol. 50, Pt. 2, p. 406.
1950. *Tectus lorzi* (d'Archiac and Haime)—Eames, F. E. On the Ages of certain Upper Tertiary beds of Peninsular India and Ceylon. *Geol. Mag.* Vol. 87, No. 4, p. 241.

There is only one specimen in our collection which, except for the spire, is fairly well preserved. This compares with the description given by Vredenburg for *Trochus (Tectus) lorzi* d'Archiac and Haime. Since the spire is not preserved it is not possible to ascertain the nature of the ornamentation of the earlier whorls.

*Figured specimen*:—G. S. I. Type No. 17680.

Genus CERNINA, Gray

CERNINA CF. CALLOSA (J. de C. Sowerby)

1840. *Natica callosa* J. de C. Sowerby—J. de C. Sowerby. Systematic List of Organic remains in Memoir to illustrate a geological map of Cutch by C. W. Grant. *Trans. Geol. Soc. Lond.*, (2) V, Pl. XXVI, fig. 3.
1928. *Ampullina (Cernina) callosa* J. de C. Sow.—Vredenburg, E. W. Descriptions of Mollusca from the Post-Eocene Tertiary Formation of North-Western India. *Mem. Geol. Surv. Ind.* Vol. 50, Pt. 2, p. 400.
1930. *Cernina callosa* (J. de C. Sow.), Cox, L. R. Miocene Mollusca; Reports of the Geological Collections from the coast lands of Kenya Colony. *Mono. Geol. Dept. Hunterian Museum Glasgow University*. IV, Pl. XII, fig. 11, p. 107.

This genus is represented by a single incomplete cast. It is however sufficiently well preserved for identification. The body whorl which is highly inflated constitutes the major portion of the specimen; the spire is small and low.

Genus TURRITELLA, Lamarck

TURRITELLA SP.

The genus *Turritella* is represented by a single impression in the matrix. The shell is rather slender, about half an inch in length. As far as can be seen, the whorls are angular and characterised by 2 or 3 major spiral ribs. Altogether the specimen is not well enough preserved for specific identification.

The distribution of the various species and their near allies is given in the following table:—

DISTRIBUTION TABLE OF THE EDAVAI SPECIES AND THEIR NEAR ALLIES

QUILON	SIND	CUTCH AND KATHIAWAR	CEYLON
<i>Archaias malabaricus</i> (Carter)	<i>Archaias malabaricus</i> (Carter)	<i>Archaias malabaricus</i> (Carter)	<i>Archaias malabaricus</i> (Carter)
<i>Antillia miocenica</i> sp. nov.	<i>Antillia indica</i> Duncan		
<i>Calamophyllia quilonica</i> sp. nov.	<i>Calamophyllia elongata</i> Duncan and Sladen		
<i>Breynia carinata</i> d'Arch. and Haime	<i>Breynia carinata</i> d'Arch. and Haime	<i>Breynia carinata</i> d'Arch. and Haime	
<i>Discors triforme</i> (J. de C. Sow.)	<i>Discors triforme</i> (J. de C. Sow.)	<i>Discors triforme</i> (J. de C. Sow.)	<i>Discors triforme</i> (J. de C. Sow.)
<i>Tectus lorzi</i> (d'Arch. and Haime)	<i>Tectus lorzi</i> (d'Arch. and Haime)	<i>Tectus lorzi</i> (d'Arch. and Haime)	<i>Tectus lorzi</i> (d'Arch. and Haime)
<i>Cernina cf. callosa</i> (J. de C. Sow.)		<i>Cernina callosa</i> (J. de C. Sow.)	

## CONCLUSION

The evidence afforded by the megafossils in our material shows that the Quilon beds fauna is similar to that of Gaj beds of Sind, Cutch and Kathiawar. The fauna is also comparable to that of Ceylon described by A. M. Davies, which however, Eames considers to be equivalent to the Gaj of Sind.

The assignation of the Ceylon beds to the Middle Miocene by Davies chiefly on the evidence of *Archaias malabaricus* led later authors to include those beds and the Quilon beds into the Vindobonian or later divisions. Recently, F. R. S. Henson records this species from the Middle Miocene of the Persian Gulf area. Eames records the occurrence of *Archaias malabaricus* from the Gaj River section which is the type locality for the Gaj series. Hence the age of the Quilon beds determined on the evidence of this single foraminifer seems to be inconclusive.

Since all the fossils in our material are of typical Gaj age, we have no hesitation in concluding that the Quilon beds are equivalent to the Aquitanian-Burdigalian and, therefore, Lower Miocene age.

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