

POROSTROMATA ALGAE FROM THE CRETACEOUS OF SENDURAI, TIRUCHIRAPALLI DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Calcareous fossils belonging to the Porostromata are described here for the first time from the Cretaceous of Sendurai, Tiruchirapalli District, Tamil Nadu. The biota consists of: *Rivularia lissaviensis*, *R. pia*, *R. theodori*, *Rivularia* sp. cf. *R. diana* and *Garwoodia toomeyi*.

INTRODUCTION

The Porostromata is an artificial algal group erected by Pia (1927) for tubiform microfossils which were not assignable to extant groups. Johnson (1961) removed *Hedstroemia*, *Ortonella*, *Bevocastria*, *Cayeuxia* and *Garwoodia* from the Porostromata and placed them in the Codiaceae. Riding (1975) commented that Johnson's transfer is not proper as no calcified codiaceans are known to resemble these genera. According to Monty (1967) and Riding (1977a) *Ortonella* Garwood and *Girvanella* Nicholson & Etheridge represent calcified sheaths of filamentous Cyanophyceae, as shown by recent analogues. Riding (1977b) suggested that several other Porostromata genera have a similar affinity, although this has still to be established, but some of the larger complexly-branched forms may represent other types of filamentous algae. He further suggested that conveniently these morphologically similar forms can be retained in one group, Porostromata, until their af-

finities are better known. Consequently, Riding (1977b) placed *Hedstroemia* Rothpletz, *Ortonella* Garwood, *Bevocastria* Garwood, *Cayeuxia* Frollo and *Garwoodia* Wood in the Porostromata. Recently, Dragastan (1989) opined that the genera provisionally now included in Porostromata may not be directly related to the algal families belonging to Cyanophyta, Chlorophyta or Rhodophyta.

So far, forms belonging to the Porostromata have not been described from India. They are described here for the first time from the Cretaceous of Sendurai, Tiruchirapalli District, Tamil Nadu.

GENERAL GEOLOGICAL SETTING AND PREVIOUS WORK

The sedimentary rocks of the Tiruchirapalli area were first recognised and elaborately described by Blanford (1862). He has stratigraphically classified the Cretaceous rocks of the Tiruchirapalli District into three stages. Starting from the oldest, these are the (a) Utatur (b) Trichinopoly and (c) Ariyalur. The Ariyalur stage was further subdivided into lower, middle and upper, of which the lower and upper subdivisions are highly fossiliferous and the middle one is practically unfossiliferous. Rama Rao and Prasannakumar (1934) considered that in describing the highly fossiliferous rocks of the Upper Ariyalur Division found near Sendurai, Niniyur, Yellakudumbur etc., Blanford has drawn the attention to the occurrence of two bands of flints and cherts associated with the limestones of this area. Rama Rao (1940) stated that by far the most interesting of the Cretaceous rocks of the Tiruchirapalli area are the youngest beds seen near Sendurai and Niniyur, constituting the well known Niniyur Division. Previously, Rama Rao and Pia (1936) have shown that these beds must have been deposited during an independent post-Senonian marine transgression of this area, and have thus established the identity of the Niniyur Division as a distinct stratigraphical unit, overlying the Ariyalur. According to their view the best exposures of the rocks of the Niniyur Group are those found to the north-east, east and south-east of the village of Sendurai. Later on, Rama Rao (1942) opined that the Cretaceous rocks of the

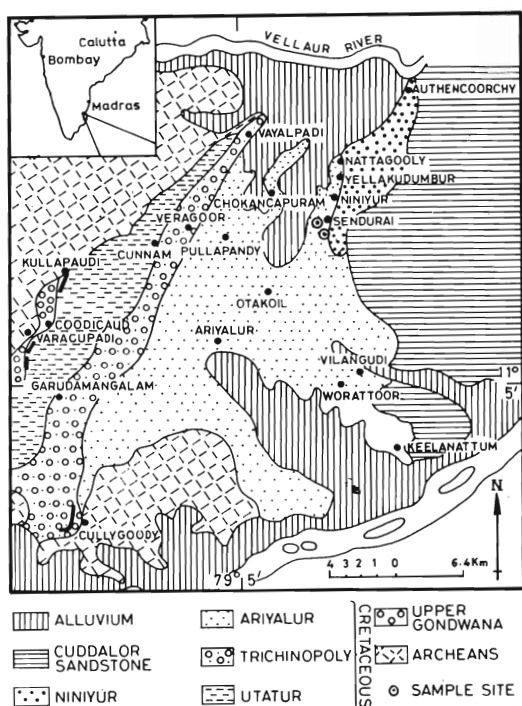


Fig. 1. A geological map of the locality.

Tiruchirapalli District must be considered as composed of four subdivisions - (a) Utatur (b) Trichinopoly (c) Ariyalur and (d) Niniyur, with the best exposures of the Niniyur Group being seen near Sendurai, Niniyur, Yellakudumbur, Nattagooly and Authencoorchy. The most outstanding feature of the Niniyur beds from the palaeontological point of view is the occurrence of numerous fossil algae.

Rama Rao and Prasannakumar (1932) described *Lithothamnium* from the Cullygoody limestone mines of Utatur Group. Later on, Narayan Rao (1944, 1946) reported two new species, namely *Solenopora coromandelensis*, *S. jurassica*, and Rama Rao and Gowda (1954) described *Solenopora sahnii* and *Archaeolithothamnium lugeonii* from the same beds of the Utatur Group. Mammgain, Gururaja and Sastry (1968) have reported *Archaeolithothamnium* sp., *Lithothamnium* sp., and *Mesophyllum* sp. from the south - west of Ariyalur town. In the Niniyur Group, fossil algae were first noticed by Rama Rao (1931) while examining some of the nodular limestones at the base of the series, and it was soon found that almost all the rocks of the Niniyur Group from top to bottom contain abundant algae. From the Niniyur beds Rama Rao and Pia (1936) described 11 taxa belonging to Dasycladaceae, Chaetophoraceae, Solenoporaceae and Corallinaceae. Rama Rao (1938, 1953, 1956, 1958) reported some dasycladacean algae from the Niniyur beds. Gowda (1953, 1954, 1959, 1978) further added *Holosporella*, *Piania niniyurensis*, fossil Holothuroids, *Solenopora* and *Amphiroa* to the algal flora of this group. Pal (1971) reported *Archaeolithothamnium pondicherriensis*, *A. zonatum* and *Distichoplax raoi* from the Palaeocene of the Niniyur Group. In recent years, Sastry and Gururaja (1980), in their catalogue of Indian fossil algae, have given a list of taxa known from South India. Misra and Kumar (1988) have described 31 species of fossil algae belonging to 17 genera of Cyanophyceae, Chlorophyceae and Rhodophyceae from the limestone deposits of the Varagur area, pertaining to the Trichinopoly Group in the Tiruchirapalli District, Tamil Nadu.

MATERIALS AND METHODS

The present study is based on rock samples collected from two localities around Sendurai (fig. 1). Lithologically the rocks are greyish brown, ochreous calcareous sands and shales, in which there are fragments of flints and cherts containing algae. Thin sections were prepared from the limestones by using conventional methods. All the slides have been deposited in the Museum of the Birbal Sahnii Institute of Palaeobotany, Lucknow.

SYSTEMATIC DESCRIPTION

The following taxa of Porostromata belonging to the family Rivulariaceae (Cyanophyta) and Codiaceae (Chlorophyta) are identified (*Sensu* Dragastan, 1985, 1993):

Division Cyanophyta

Order Nostocales

Family Rivulariaceae Rabenhorst 1865

Genus *Rivularia* (Roth) Agardh 1824

Rivularia lissaviensis (Bornemann, 1887) Dragastan, 1985

(Pl. I, fig. 6)

Description: Thallus fan like, 1.0 X 2.0 mm - 1.8 X 4.1 mm in size; thallus crossed by filament - like pseudobifurcate cells; branching of filaments sympodial, V - shaped, with an angle of divergence of 10°; inner structure of the thallus compact, filaments joined, tight and parallel; inner diameter of filaments at base of branches varies from 30 - 40µ; growth zones not visible.

Remarks: *Rivularia lissaviensis* (Bornemann, 1887) Dragastan, 1985, instituted by Dragastan (1985) shows a varied morphology of thallus. The studied specimens resemble those figured by Dragastan (1985, plate IV, figs. 2, 4 - 6 and 1993, plate II, fig. 1) from the Tithonian, Bicajel, Bicz Gorges, East Carpathians.

Rivularia piae (Frollo, 1938) Dragastan, 1985

(Pl. I, figs. 2-3)

Description: Thallus more or less hemispherical, 1.6 X 2.0-2.0 X 3.1 mm; thallus crossed by V - shaped pseudobifurcate filaments; diameter of filaments 40 to 60 µ and angle of divergence 10°; coarsely crystalline filaments forming a similar inner structure.

Remarks: The taxon is widely distributed in the Lower Jurassic, Karaburun, Turkey; Middle Jurassic, Saratii Valley, Persani Mountain, Romania; Haifa bore holes, Israel; Upper Jurassic, Oxfordian - Tithonian; Lower Cretaceous, Berriasian - Aptian, and Upper Cretaceous, Senonian - Altamura limestones, Italy (Dragastan, 1985). The specimens described here are very closely comparable to those of Dragastan (1985, Pl. IX, fig. 2) from the Neocomian of Suhard.

Rivularia theodori Dragastan, 1985

(Pl. I, fig. 1)

Description: Fan-shaped small thallus, width 0.4 - 1.2 mm and height 1.4 - 1.8 mm; thallus crossed by large, coarsely crystallized filaments in groups of two; diameter of the filament ranges from 40 - 60µ, the angle of divergence is 3° - 10°.

Remarks : The specimens recovered from the Sendurai Limestones in all morphographic features resemble the holotype of *Rivularia theodori* Dragastan, 1985 (PL. XIV, fig. 1) described from the Lower Cretaceous (Neocomian, Fagetul Cincului, East Carpathianus) strata.

Rivularia sp. cf. *R. diana*e (Dragastan & Bucur, 1978)
Dragastan, 1985

(Pl. I, figs. 4-5)

Description : Pseudobifurcate filaments forming a more or less fan like thallus, 3.0 - 5.6 mm wide and 2.0 - 4.5 mm high; filaments showing coarsely microcrystalline lumen having diameter of $\pm 17 \mu$; angle of divergence of filaments $\pm 4^\circ$.

Remarks : The presently described forms are comparable to the filaments of *Rivularia diana*e (Dragastan & Bucur, 1978) Dragastan, 1985 (Pl. XV, figs. 2-3) described from the Tithonian - Berriasian (Upper Jurassic - Lower Cretaceous), Piatra Craiului, East Carpathians. However, in the presently studied specimens the growth zones, as revealed by the microscopic observations are not clearly visible. But in gross morphographic features, and in having pseudobifurcate filaments with microcrystalline lumen, these are comparable to those of *Rivularia diana*e (Dragastan & Bucur, 1978) Dragastan, 1985.

Division Chlorophyta

Family Codiaceae (Trevisan) Zanardini, 1843

Genus *Garwoodia* Wood, 1941

Garwoodia toomeyi Dragastan, 1989

(Pl. I, fig. 7)

Description : Thallus with dichotomic filaments, 1.2 - 2.0 mm wide and 1.0 - 1.2 mm high; filaments branched laterally at an angle of about 90° , the main filament possesses a diameter of about 40μ and the parallel branches reach 70μ ; the wall is microcrystalline and about 10μ thick.

Remarks : Stratigraphically, the taxon is distributed in the Upper Jurassic, Kimmeridgian - Tithonian. Specimens of *Garwoodia toomeyi* described here resemble those of Dragastan (1989, Pl. X, fig. 3), described from the Tithonian (Upper Jurassic) of the Bicajel, Bicaz Gorges, East Carpathians.

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EXPLANATION OF PLATE

Plate I

1. *Rivularia theodori* Dragastan, 1985, axial-vertical section, thallus with V-shaped robust "filaments". X 50, Slide No. BSIP 11398.
- 2,3. *Rivularia piae* (Frollo, 1983) Dragastan, 1985, 2. Axial-vertical section, thallus with V-shaped pseudobifurcate "filaments". X 50, 3. A magnified portion of the same thallus showing filaments. X 100, Slide No. BSIP 11396.
- 4,5. *Rivularia* sp. cf. *R. diana* (Dragastan & Bucur, 1978) Dragastan, 1985, 4. Thin section showing pseudobifurcate "filaments". X 50, 5. A magnified portion of the filaments showing microcrystalline lumen. X 100, Slide No. BSIP 11395.
6. *Rivularia lissaviensis* (Bornemann, 1887) Dragastan, 1985, axial-vertical section, thallus with V-shaped pseudobifurcate "filaments". X 50, Slide No. BSIP 11397.
7. *Garwoodia toomeyi* Dragastan, 1989, axial-oblique section, thallus with dichotomic filaments laterally branched at an angle of about 90°. X 100, Slide No. BSIP 11399.

