

POLYSTRATA ALBA FROM THE NINNIYUR FORMATION OF THE CAUVERY BASIN, SOUTH INDIA

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ABSTRACT

The sediments of the Ninniyur formation (Palaeocene) are characterized by exceptionally rich of calcareous algae. The present paper deals morphotaxonomical, palaeoecological and palaeogeographical aspects of the *Polystrata alba* (red algae). *Polystrata alba* (Pfender) Denizot is belonging to the family Peyssonneliaceae of the class Rhodophyceae. It is extant taxa, wide geographic distribution and known from Early Cretaceous-Recent of the different part of the world.

Key words: *Polystrata alba*, Palaeocene, Ninniyur Formation, Cauvery Basin.

INTRODUCTION

Present investigation is carried out from the Ninniyur Formation of the Ariyalur-Pondicherry depression of the Cauvery Basin. The Ariyalur-Pondicherry depression is a part of the Cauvery Basin which forms the southernmost portion of the Coromandel Shelf regime of India. It is largest in terms of area and also extends offshore which delimits its eastern boundary. This depression is located in the northern part of the basin and is bounded on the west by the granites and gneisses of the Dharwar supergroup (Archaean) and, on the south-east, by the subsurface ridge, referred to as Kumbhakonam-Shiyali ridge which extends as a surface feature in the form of Archaean Crystalline massif south-west of this depression. Most of the sedimentary sequence over the ridge is of tertiary age. Tertiary sequence is not developed extensively as outcrops but is well represented in the subsurface. The village Ninniyur (11°16'15" : 79°10'45"), after which the Ninniyur Formation has been named, comes under the district Ariyalur. The rocks of the Ninniyur Formation have a very limited distribution, being confined to a narrow strip, about 19.2 km long and 4.8 to 6.4 km wide, at the Ariyalur area (Fig. 1). The Ninniyur Formation is exposed as isolated outcrops over the

Ariyalur group along a NNE-SSW strike between Vellar river in the north and Coleroon river in the south. It represents mainly a carbonate sequence with several marl and clay interbeds.

Lithologically, Ninniyur Formation can be divided into three distinct units: lower unit (exposed in Adanakkurichchi, Tamaraipundi); middle unit (exposed in Ninniyur, Mattur, Periyakurichchi); and the upper unit (Sendurai, Anandavadi) (Govindan *et al.* 1998). The Palaeocene limestone of the Ninniyur Formation contains abundant well-preserved calcareous algae. Earlier, Rao and Pia (1936), Rao and Gowda (1953), Gowda (1953) and Varma (1952, 1954) have described red and green algae from this area.

Recently, Misra *et al.* (2000; 2001; 2003), Kishore *et al.* (2003), Kishore and Singh (2004) and Kishore (2004a, b) have described rich calcareous algae from the Ninniyur Formation and they also provide useful information about palaeoenvironmental and palaeogeographical aspects of Ninniyur area. All the thin sections and samples are deposited at the Algology Laboratory, Botany Department, University of Lucknow, Lucknow.

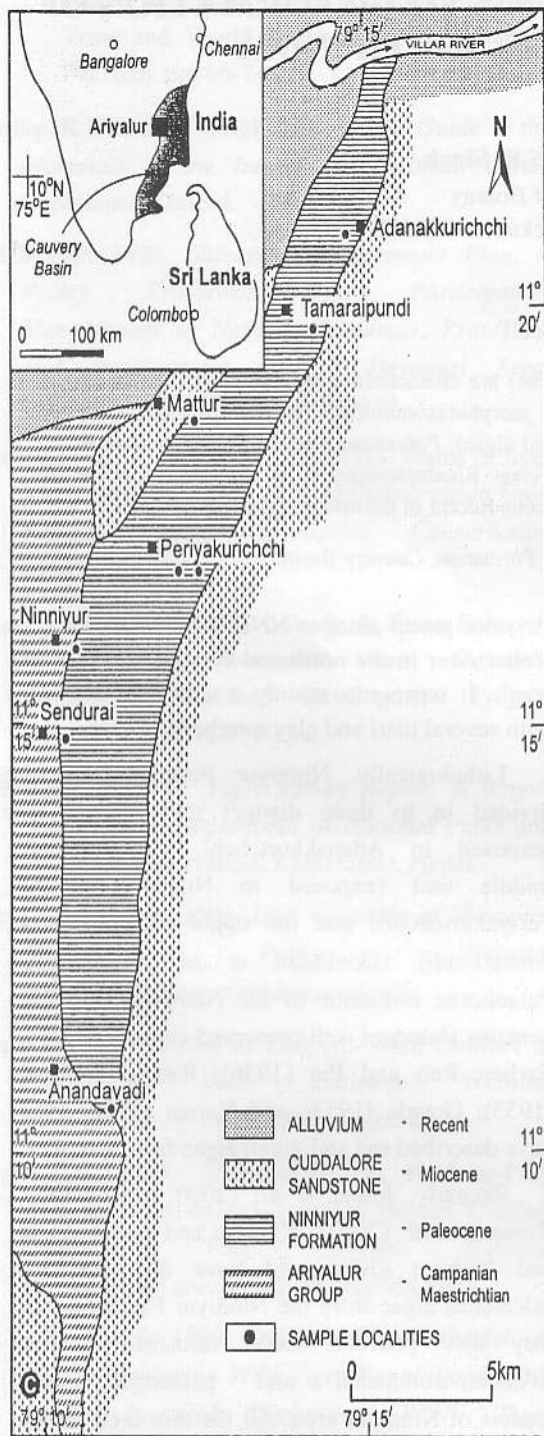


Fig. 1. The geological map of the Ariyalur area showing the sampled localities where the outcrops of the Ninniyur Formation are well exposed (modified after Govindan *et al.* 1998).

SYSTEMATIC DESCRIPTION

Division : Rhodophyta Wittstein, 1901
 Class : Rhodophyceae Rabenhorst, 1863
 Order : Cryptonemiales Schmitz in Engler, 1892
 Family : Peyssonneliaceae Denizot 1968
 Genus : *Polystrata* Heydrich, 1905

Plants epigenous, consisting of thin lamellae forming variously shaped thalli. The thallus pseudoparenchymatous, composed of filaments and organized in a bilateral-radial manner. In longitudinal section, each thallus consists of a single eccentric row of primigenous filaments. Postigenous filaments arise plumosely from the outer surface of the cells of primigenous filaments both upward and downward. Within primigenous filaments, all the successive cells are joined by primary pit-connections. Successive cells of postigenous filaments are not joined by primary pit-connections.

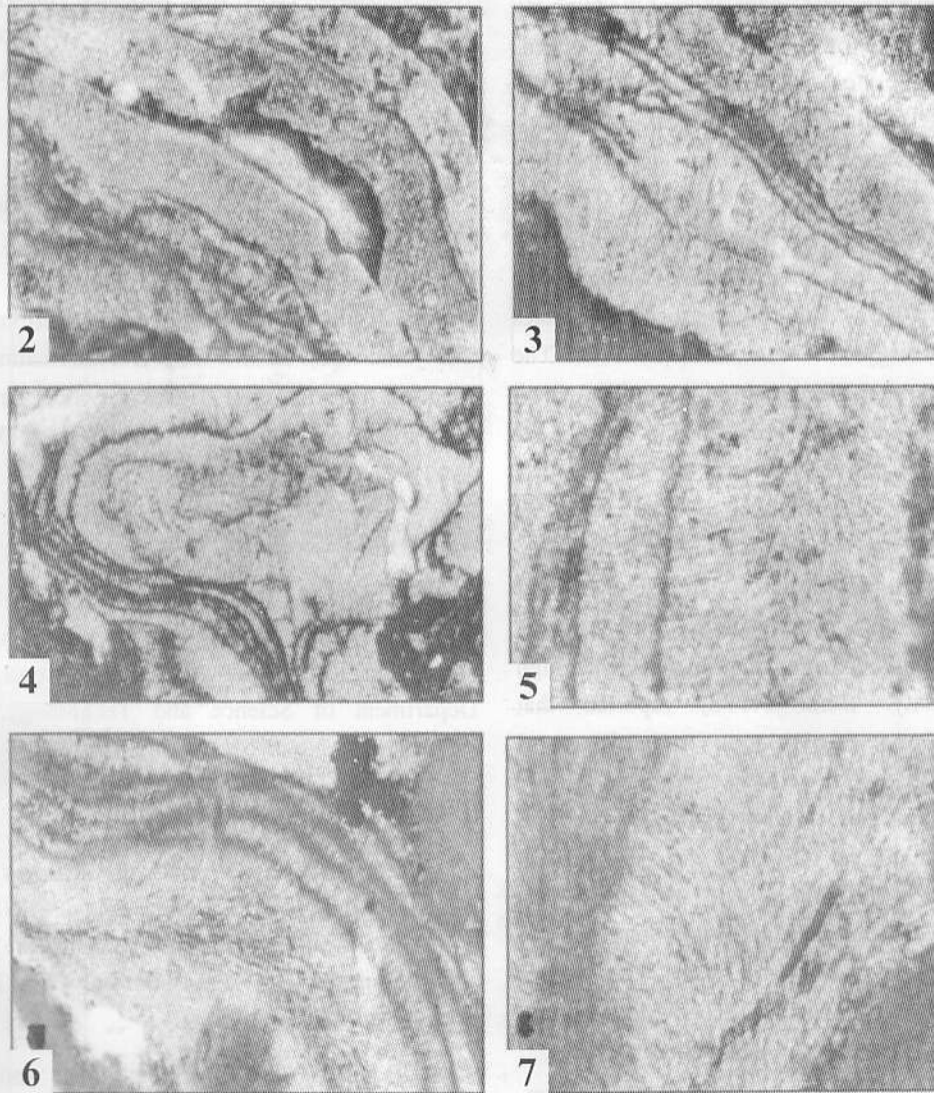
Polystrata alba (Pfender) Denizot, 1968 (Figs. 2-7)

- 1936 *Pseudolithothamnium album* nov. gen. nov. sp. Pfender, p. 304-308; pl. 19, figs. 1-5.
 1968 *Polystrata alba* (Pfender); Denizot, p. 475-476; pl.9, fig.4.
 1965 *Ethelia alba* Johnson & Kaska, p. 69, pi. 15, figs. 1, 2.
 1973 *Polystrata* Mastorilli, text-fig. 3.
 1997 *Pseudolithothamnium album* Pfender, Bassi, p. 313.

Plants irregularly foliaceous, encrusting layers with little or no space between them that can develop into sub-ellipsoidal and sub-discoidal laminated nodules. Thallus pseudoparenchymatous, composed of filaments and organized in a bilateral-radial manner. In longitudinal section, each thallus consists of a single eccentric row of primigenous filaments composed of tall cells, 40-55 μm in length and 30-35 μm in diameter. The cells of postigenous filaments 30-35 μm in length and 12-18 μm in diameter, dividing outwards and becoming smaller size near the outer part of the thallus. Reproductive structure not preserved.

Remarks: *Polystrata alba* shows a considerable variability in the morphology of the thallus, in its thickness, in both primigenous and postigenous cell sizes and in the degree of calcification. As cited in Bassi (1997), *P. alba* is a widely occurring species in the Palaeocene-Eocene limestone facies consisting predominantly of rhodoliths composed of peyssonneliaceans and non-geniculate coralline

is known from the different parts of Europe. Bassi (1997) re-examined and redescribed the material from the type section (Calcare di Nago Formation, Southern Alps) and pointed out its anatomical analogies with non-geniculate corallines. In the study area, it usually occurs as crusts in association with other corallines such as *Sporolithon* and *Pardchaetetes asvapati*.



Figs. 2 to 7. Different types of growth morphology of *Polystrata alba*. (Figs. 2 and 3. Superimposed thin delicate crusts x 50., Fig. 4. Superimposed thallus x 50., Figs. 5 to 7. Thallus showing primigenous and outwardly postigenous filaments x 100).

DISCUSSION

Polystrata alba (Pfender) Denizot grows on the sea floor from tropics to polar area, tropical forms are generally more calcified. Peyssonneliaceae are common to depths of 50 m in all regions and have been dredged from waters as deep as 120 m (James *et al.* 1988). Present taxa is recorded from different outcrops of the middle unit and absent in lower and upper units of the Ninniyur Formation. Based on the associated planktic and benthic foraminifera, the Ninniyur Formation can be correlated with Zones P2-P4 of the planktic foraminiferal zonation, corresponding to late Danian-Thanelian. In the Ninniyur outcrops (middle unit) *Polystrata alba* occurs as a broken fragments (these broken fragments transported to the site of growth) and low frequency indicates high water energy condition and depth > 5m. The outcrops exposed at Mattur (middle unit) in which the *Polystrata alba* is found as a thin leafy crusts or ribbon like morphology and other calcareous algae indicates moderate energy conditions with depth 20 m. *Polystrata alba* developed into sub-ellipsoidal and sub-discoidal laminated nodules (rhodoliths) and appreciable number at Periyakurichchi outcrops (middle unit) with high algal diversity. Bassi (1998) reported that *Polystrata* forms encrustations on hard or soft substrates, "...either alone or in consortium of non-geniculate corallines and encrusting foraminifera ..." in the mid and the uppermost outer ramp environments of the Lessini Shelf characterized by low-energy conditions present below normal wave base and normal storm wave base. The studied samples of the middle unit also show low amount of miliolids, other non-geniculate coralline algal association (*Lithothamnion*, *Mesophyllum*, *Sporolithon*, *Neogoniolithon*, *Spongites*, *Halimeda* and *Parachaetetes asvapatii*) and presence of carbonate mud supporting a relatively deeper

environment (>50 m) with low-energy conditions. *Polystrata alba* grew on soft calcareous substrates of mid-ramp environment of the Ninniyur Formation. In the present context, the ecological information on the most crustose coralline algae as well as other reef organisms, generally require a solid bottom for fixation, and the presence of a large number of species of *Sporolithon* indicates a firm substrate. According to Ladd (1950), most species of *Sporolithon* appear to grow on firm bottom. This is confirmed by the presence of *Lucina percrasa* which, as indicated above, prefers a firm substrate to a softer, mobile one.

Polystrata alba is an extent taxa and long stratigraphic range recorded from Early Cretaceous- Recent of the different part of the worlds. It has a wide geographical distribution in Tethys and also known from Boreal Realms. It is reported from Belgium (Boreal), Africa, America, Asia and Europe (Tethyan) of the Worlds (Xi-Nan 1993).

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