

Use of Microfossils to Decipher the Paleo-environment of tertiary Sediments of Ratnagiri, Maharashtra, India

Suryawanshi R.A.^{1*} and Golekar R.B.²

¹Department of Geology, Yashwantrao Chavan College of Science Karad, 415124, MS, INDIA

²Department of Civil Engineering, Shri Chhatrapati Shivaji College of Engineering, Rahuri, Dist. Ahmednagar – 437006, MS, INDIA

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Abstract

The present study area is a part of coastal track, belongs to Ratnagiri district, Maharashtra (INDIA). The geological setting of the area, Deccan basalt are invariably capped by laterite and in subordinate amount of bauxite. The Tertiary sediments are sandwiched between the laterite, while in some sections, they overly directly on the basaltic lava flow. The lignite, shale and carbonaceous shales of these deposits are very rich of leaf cuticles along with the pollens and spores. In present work emphasis has given to decipher environment of deposition of these sediments with the help of microfossils. Hence collect the lignite sample ourselves from well sections of Ratnagiri district. In present study three types of Leaf cuticles recovered from lignite samples as *Nypa palm*, *Diospyros microphylla* and *Sonneratia* type. Ecological distribution of the modern equivalents of these microfossils clearly indicates that these sediments may possibly have deposited in deltaic to estuarine environment.

Keywords: Lignite, microfossils, deltaic to estuarine environment, tertiary sediments Ratnagiri, Maharashtra (India)

Introduction

The coastal track of Maharashtra, delineated by shore line of the Arabian sea and lofty scrap face of Western Ghats have always attracted the attention of geoscientists. After the eruption of Deccan volcanism in Upper Cretaceous to Lower Eocene period this part of the earth remained non depositional except few patches of Tertiary sediments along the coast, which are studied by Rajguru and Marathe¹, Suryawanshi². A preliminary report on the microfossils of Ratnagiri lignite has been given by Phadtare and Kulkarni³; Dalvi and Kulkarni⁴. The lignite, shale and carbonaceous shales of these deposits are very rich of leaf cuticles along with the pollens and spores. Well preserved leaf impressions are also observed in lignite.

Geology of Study area: The study area is a coastal tract which lies between Jaigarh creek in the North (Latitude 17° 10' N and Longitude 73° 25' E) to Pavas creek in the south (Latitude 16° 50' N and long. 73° 10' E). This area lies in Toposheet number 7 G/3, G/7, G/8 and H/5. The area is composed of Deccan basalts, which are invariably capped by laterite and in subordinate amount of bauxite⁵. The Tertiary sediments are found to be sandwiched between the laterite, while in some sections, they overly directly on the basaltic lava flows. The microfossil bearing tertiary sediments are 50-60 m amsl and 500m from sea. Well preserved leaf impressions are observed in the lignite (figure 1) from Ratnagiri area of Maharashtra (India).

Material and Methods

The lignite samples were collected from well sections of Ratnagiri which containing numerous compressed and dried up

leaves served as a source material for this investigation. The cuticles were recovered from lignite by treating the sample with the concentrated nitric acid solution followed by 10% KOH solution for ten minutes. The cuticles covered were thoroughly washed by distilled water and have been mounted in canada balsam. The slides so prepared, are studied under Leitz microscope, by using both high power and power objectives.



Figure -1
Well preserved leaf impressions in the lignite from Ratnagiri, Maharashtra

Results and Discussion

The present study three types of Leaf cuticles recovered from lignite samples as *Nypa palm*, *Diospyros microphylla* and *Sonneratia* type.

Palm/ Nypa type: The epidermis of leaf cuticle is hypostomatic with hair base characteristic stomatas. The stomatas are present both the surfaces, but more common on the abaxial epidermis, than on the adaxial epidermis. As has been seen in (figure 2), each stomata is with a pair of heavily cutinised sunken cells. It has also been observed that the adaxial epidermis is uniform and cannot be differentiated coastal and inter-coastal regions. The cells of adaxial epidermis of leaf cuticles are rectangular in shape, transversely extended and are found to be arranged in longitudinal files (figure 3).

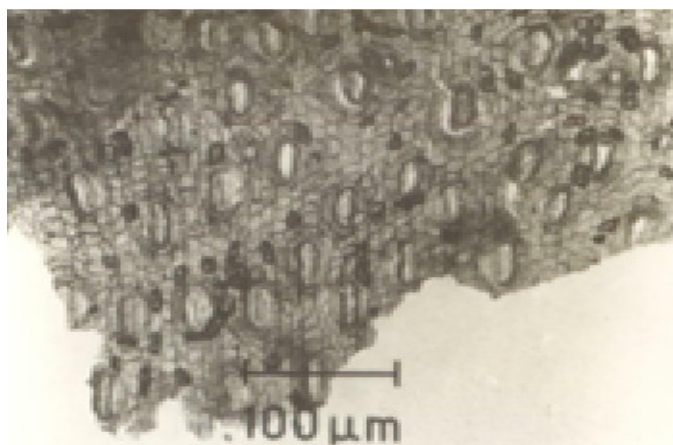


Figure – 2

Stomata is with a pair of heavily cutinised sunken cells
(Palm/ Nypa type)



Figure – 3

Cells of adaxial epidermis of leaf cuticles are rectangular in
shape (Palm/ Nypa type)

The cells surrounding hair basis are irregularly arranged. The abaxial epidermis can be differentiated into narrow coastal and very inter-coastal regions. The coastal cells are rectangular in shape and are oriented in longitudinal fashion, whereas, inter-coastal cells are squares to rectangular in shape and somewhat transversely extended. These are arranged in longitudinal rows with typical wavy pattern. Stomatas are observed to be restricted to the abaxial inter-coastal regions. Similar

observations have been made by Dilcher 1965 by using the paratrachytic terminology⁶. The subsidiary cells rectangular, transversely oriented, short and wide, partially overarching the guard cells. The lateral subsidiary cells are oval shaped guard cells with thin walls. The guard cells are much larger than the other epidermal cells. Each cell is characterised with small cutinised horizontal ledges, which are seen in the form of fine transverse lines in the surface view on many stomatas. The outer walls of the stomatas are cutinized, whereas, inner walls are none cutinised.

Diagnostic features: Following are the most diagnostic features exhibited by epidermis. These cuticles are hypostomatic in nature with presence of peculiar stomata like sunken hair bases on both surfaces. Adaxial epidermis is with transversely extended cells. These are arranged in longitudinal rows. The abaxial epidermis with narrow coastal and very wide inter-coastal bands. The inter-coastal cells are arranged in some what wavy longitudinal files, and stomatas are of paratrachytic, which are restricted to inter-coastal bands. The terminal subsidiary cells are short, wide and slightly overarching the guard cells and lateral subsidiary cell. The guard cells are much larger than other epidermal cells with many horizontal ledges. On the basis of the characteristic features described above, it is clearly seen that these leaf cuticles are belonging to Palm variety. The caryotoid palm and Nypa type aim are characterised by transverse bands of guard cells. However, the caryotoid palms have cylindrical hair base, composed of several sclerotic cells surrounding one or more walled cells. But in Nypa palm variety peculiar stomata hair base, consisting only of two cutinised cells are found to be observed.

Diospyros Microphylla: The epidermis of leaf cuticle of diospyros microphylla is hypostomatic and it is differentiated into coastal and inter-coastal areas. The coastal bands are found to be narrow branching pattern. The coastal cells are rectangular in shape with thick walls and are extended longitudinally. While inter-coastal areas are broader with squarish to polygonal cells, having straight cells walls, and are arranged random fashion with stomatas restricted to inter-coastal only. The stomatas are of sunken type with kidney shaped guard cells. The contact of all the walls shows typical 'T' shape with thicker inner walls and outer walls are comparatively thin. The hair bases are restricted to the abaxial surface only. They are common and observed on coastal as well as inter-coastal areas. Each hair base is characterized thin walled basal cell surrounded by a ring of highly cutinised cells (figure-4).

Sonneratia type: The leaf cuticle of sonneratia type of palm is also recorded in the lignite beds of Ratnagiri area. The leaf cuticle of sonneratia type is isobilateral. Abaxial epidermis provided with cuticle ridges. The epidermal cells are pentagonal to polygonal in shape and are not differentiated into coastal and inter-coastal area. The cells walls are thick present in a straight line. The cells are randomly arranged. The stomatas are frequent on both the surfaces, but common on the abaxial epidermis than

adaxial epidermis. The stomata are deeply sunken type, subsidiary cells are rectangular, transversely oriented, thin and elongated, overarched the guard cells. The guard cells are smaller than epidermal cells. The central portion of stomata consists of aqueous tissue containing branched sclerenchymatous idioblasts. The stomata are arranged in irregular fashion on abaxial and adaxial epidermal surfaces (figure 5).

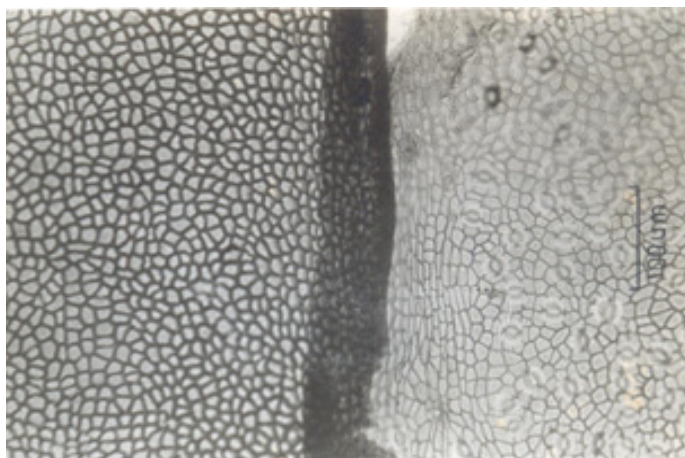


Figure – 4
Thin walled basal cell surrounded by a ring of highly cutinised cells (Diospyros Microphylla)

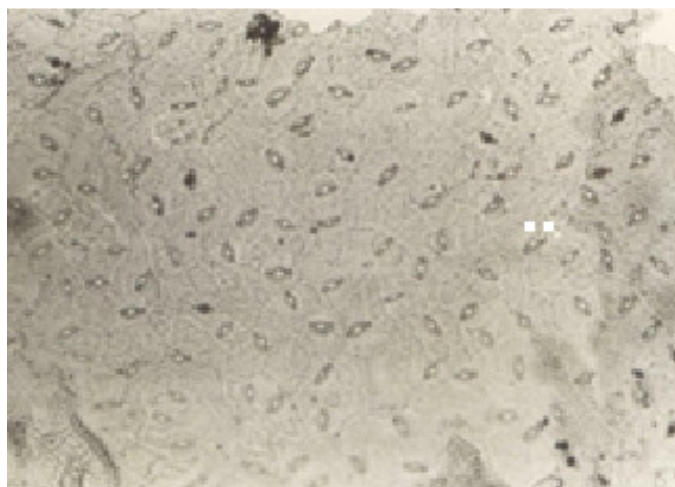


Figure – 5
Stomata are arranged in irregular fashion on abaxial and adaxial epidermal surfaces (Sonneratia type)

Conclusion

The Nypa palm and Sonneratia species inhabit mangrove. They are provided with vertical branches of root projecting into air or water above the mud. These ecological habitats can be found in the range of deltaic to fresh water swamps to estuarine depositional environment and at low altitude ever green to open forests. Ecological distribution of the modern equivalents of these microfossils clearly indicate that these sediments could have deposited in deltaic to estuarine environment which are 60m above present sea level and 500m from sea coast.

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