

# Reconstruction of Depositional environment of Tertiary deposits occurring along west coast of Maharashtra using paleontological techniques

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## Abstract

Tertiary sediments along west coast of Maharashtra (India) are about 60 m. above the present sea-level and occurrence of lateritic gravel beds and bouldery, pebbly gravels below the sea-level suggest sea level changes around Ratnagiri (Rajguru and Marathe, 1984). Occurrences of lignite bed over laterite, developed on Deccan basalt clearly indicate that the lignite is younger than the laterite of early Tertiary age. Sedimentological and pollen studies reveal creek or estuarine environment of deposition. The angiosperm pollens and their modern equivalent conform non marine environment of deposition.

**Key words:** Tertiary sediments, lignite, pollen.

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## INTRODUCTION

Tertiary sediments are trapped in laterite and basalt, exposed in well sections along west coast of Maharashtra. These sediments are studied for different aspects by Rajguru and Marathe (1984), Suryawanshi (2014), Phadtare and Kulkarni (1984). Area under investigation lies between Jaigarh creek in the north (Lat  $17^{\circ} 30' N$  and  $73^{\circ} 25' E$ ) and Bhatya creek (Lat  $16^{\circ} 55' N$

and  $73^{\circ} 10' E$ ) in south. The lithological sequence of the area is laterite, gray shale, carbonaceous shale, lignite, sandy shale, gravely sandstone and basalt at the base. These sediments are 60 m above MSL and 2-3km away from coast. The detailed investigation of pollens recovered from shale and lignite beds of Golap-Pawans area to interpret climatic conditions and depositional environment prevailing during its deposition.

## MATERIAL AND METHODS

The lignite and shale samples used for investigation were collected from well sections of the area and oven dried samples stored in sterile air tight containers. Lignite samples were subjected to concentrated Nitric acid followed by 10% Potassium Hydroxide for maceration. Pollens were mounted in glycerin jelly and cover slip was sealed with paraffin.

## RESULT AND DISCUSSION

Plate I

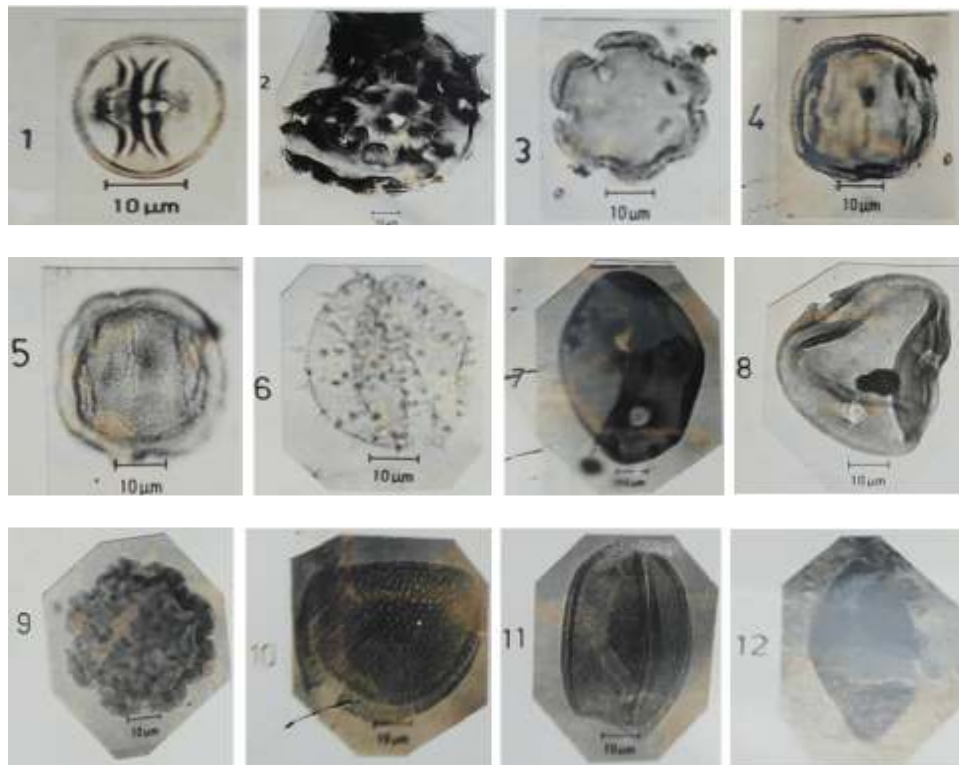
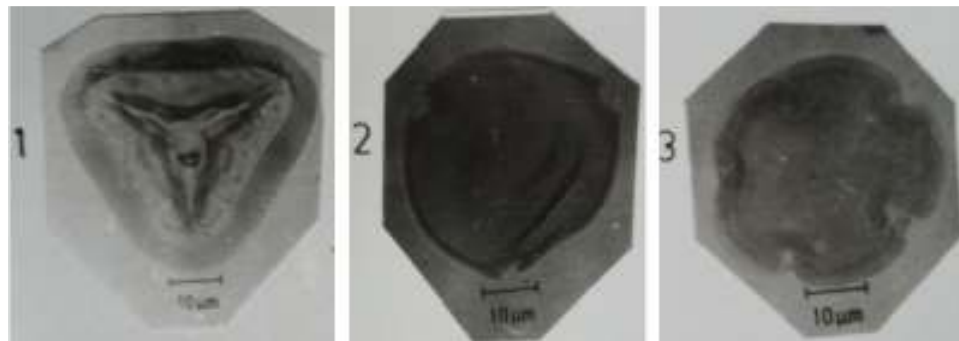


Plate II



### Angiosperm pollens

**GENUS: Florschuetzia** Germeraad *et al.* 1968

Florschuetzia Germeraad *et al.* 1968 Plate I Photo 1

**Description:** Pollen grains isopolar, prolate, triporate; pores almost circular, about 2µm in diameter., exine 1.5 µm thick, sexine and nexine are of almost same thickness in mesocolpial area While, sexine is slightly thicker than nexine in apocolpial areas, psilate.

**Remarks:** All the species of Florschuetzia are closely comparable with pollen found in modern mangrove genus Sonneratia. It grows profusely along the Western Coast of India.

**GENUS: Malvacearumpollis** Nagy1962

Malvacearumpollis rudis Kar Plate I Photo 2

**Description :** Pollon grains spheroidal, 60 - 85µm in diameter, pantoporato, pores almost circular, about 4µm in diameter, tenuimarginate; exine distinctly echinate; sexine thicker than nexine, spines 8-10µm long, with bulbous base; eurenticulate, infracturn collumellate columellae about 4 µm under the spines and 1 µm between the spines.

**Remarks:** This fossil pollen is closely comparable with those found in many genera of Malvaceae. In Indian Tertiary sediments, this fossil genus is so far reported from the Oligocene to Miocene (Tharnkaimoni *et al.* 1984). The plants of Malvaceae are commonly found in the low altitude open forests.

**GENUS: Retistephanocolpites** Leidelmeyer, 1966  
 Retistephanocolpites Williamsi Germeraad *et al.* 1968  
 Plate I Photo 3, 4, 5

**Description :** Pollen grains isopolar , circular in polar view, 28 - 35µm in diameter, hexacolporate, colpi about 6µm long, slightly crassimarginate, ends pointed; ora endexinous almost indistinct , slightly lalongate ; exine about 3µm thick, semitectate sexine thicker than nexine, reticulate to srobiculate . homobrochate , simplibaculate .

**Remarks:** In all the morphologic features, this palynomorph is closely comparable with the pollen of *Ctenolophon parvifolium* (Germeraad *et al.* 1968). This plant generally found in the swamp forests, is presently confined exclusively to Malesia (Van der Ham, 1989). Though presently extinct in India, it is well documented by its fossil pollen from many Tertiary deposits ranging in age up to Miocene ( Saxena 1991) .

**GENUS: Spinizonocolpites** Muller 1968

*Spinizonocolpites prominatus* (Mc Intyre) Stover and Evans., 1973. Plate I Photo 6

**Description:** Pollen grains spheroidal to subspheroidal, 40 - 65 µm in diameter, zonosulcate; salcus bordered by a narrow indistinct margin of thinning ectosexine forming a cutinuous meridonal furrow dividing the grain into two unequal halves, generally open, tenuimarginate; exine about 1.5µm thick, intectate, echinate; spines 3-6µm long with bulbous base, tips generally pointed, often curved, rarely straight, inter-spinal exine microreticulate Spines evenly distributed all over the surface.

**Remarks:** The fossil pollen attributed to *Spinizonocolpites prominatus* is closely comparable to that of a monotypic palm *Nypa fruticanes* (Kulkarni and Phadtare, 1981) which grows exclusively in mangrove habitat. Presently it is extinct from both western and eastern coasts of south India. However, it is still found in Sunder ban delta and Nicobar Islands. It is most dominating amongst, not only those of palmae but also of all the monocotyledonous morphotypes from this locality. Abundance of these pollen indicate warm humid tropical climate and estuarine depositional environments for these beds.

**GENUS: Lakiapollis** Venkatachala and Kar 1969

*Lakiapollis ovatus* Venkatachala A Kar Plate I Photo 7, 8

**Description:** Pollen grains isopolar, sub-spheroidal, often folded; 55 - 70 µm in diameter, tricolporate; brevicolpate, colpi distinctly elliptic, about 10 µm long and 6µm wide, with rounded ends, tenuimarginate, straight: ora endexinous, circular to slightly lalongate, crassimarginat, about 8µm in diameter; exine about 2 µm thick, exine is very thin or almost undistinguishable along the mesocolpial area and gradually increase in thickness towards aperture, psilate to very minutely ingrastructured.

**Remarks:** This fossil pollen is closely comparable with Duriotype pollen found in some genera such as *Durio* and *Cullenia* of Bombacaceae (Thanikamoni *et al.* 1984). Amongst these *Cullenia exarillata* is presently found in the humid evergreen forest of South India (Pascal, 1983).

**GENUS: Pseudonothofagidites** Venkatachala and Kar, 1969

*Pseudonothofagidites* sp. Plato I Photo. 9

**Description:** Pollen grains isopolar, almost circular in polar view, 35-40 µm in diameter polyporate, pores general six in number, placed between the depressions of pseudocolpi , circular crassimarginate exine about 2µm thick, semitectate, regulate to eurugulate, sexine slightly thicker than nexine in mesocolpial area; around pores however the nexine is thicker than sexine.

**Remarks:** This palynomorph apparently resembles the pollen of *Nothofagus*. It generally grows in dense evergreen forests of the Western Ghats.

**GENUS: QUILONIPOLLENITES EUGESSONA**

*Oullonipollenites, tranguiformis* (Phadtare , 1982) Plate I Photo. 10

**Description:** Pollen grains are heteropolar. Triangular with rounded ends. Proximal side plane and others distinctly convex. Monosulcate, sulcus equal to 2/3 the circumference, extended type. The pollen grains tend to split along salcus which gives bivalve appearance in polar view. Sexine 2 µm thick which is thicker than nexine. Exine 3.6 µm thick, coarsely rectangular Muri simplibaculate, Lumina smooth, angular to frequently circular, decrease in size towards salcus margin.

**Remarks:** This pollen is good in number in the lignite beds. This palm genus vigorously grows along estuarine conditions. It has close similarity to Malaysian Palm.

**GENUS: QUILONIPOLLENITES**

*Quilonipollenites Ornutus* (Rao and Ramanujam., 1976) Plate I Photo. 11

**Description:** These pollen grains are heteropolar, distalliaperturate , planoconvex laterally bioconvex in distally polar view. It is monosulcate, sulcus about 2/3 the circumference along the convexity in lateral plane of extended type, tenuimarginate, sexine thicker than nexine, exine about 3 µm thick, distinctly retipilate to reticulate. The reticulum is heterobrochate , decreasing in size towards proximal side , murisimplibaculate , lumina small, angular to circular and smooth.

**Remarks:** This morphotype is abundantly represented in Ratnagiri lignites. This type is also reported from Quilon (Rao and Ramanujam 1976) Warkalli (Srisailam and Ramanujam 1982) and Neyvelli (Reddy 1981) exposures.

**GENUS: CLAVAPALMAEDITES** (Rao and Ramanujam, 1976)

*Palmaepollenites elonuatatus* (Phadtare and Kulkarni 1980) Plate I Photo 12

**Description:** Palmaepollenites elongatus is characterized by peroblate nature. It is heteropolar and biconvex laterally pollens are monosulcate and salcus is slightly opened, longisulcate. The crassimarginate salcus extended more than three-fourth of the longest axis. Exine is 1.6 µm thick, psilate type.

**Remarks:** P. elongatus is monocotyledon type of palm. These pollens are in abundance in Ratnagiri Tertiary sediments .

**GENUS: Cingulatisporites** Potoniae (1970)

Cingulatisporites Sp. Plate II Photo .1

**Description:** Spore is trilate, trigonous type, which is distinctly singulate. The lateral arms are slightly convex, and ends are rounded. The trilate mark is prominent and open. Crassimarginate laesura extending to 3/4 with radius. The surface is with or without spilate. In cingulate spores laesural tips are bifurcated. However, in present, specimen the tips are not bifurcated.

**GENUS: Psilatirporites** Nova

Psilatirporites Sp. Plate II Photo 2

**Description:** The pollen grains are isopolar, spheroidal in polar view, angular aperture with 2 or 3 colpi, colpi slightly crassimarginate, slightly sunken. Exine is thick.

**Remarks:** This genus has affinity with Malaysian palm. Eugleissona which grows in estuarine condition.

**GENUS: Polybrevicolporites Cephalus** (Venkata Chala and Kar, 1968)

Plate II Photo 3

**Description:** Pollen grains are isopolar with pollen compression. It is spherical in shape with amb circular colpi are six in number, colpi is small with rounded end. Exine is finely reticulate. Exine is thicker than hexine and intrabaculate surface.

**Remark:** Polybrevicolporites Cephalus has so far been reported only from Tertiary sediments of Kutch by Venkatachala and Kar (1968). This has affinity with modern clenolophon pulvifollus (Germerrade et. al. 1968) only few pollen grains of this type have been recovered in the lignite samples.

## CONCLUSIONS

Pollens of Florschuetzia species are close to modern mangrove genus Sonneratia which is flourishing along the Western Coast of India and Malvaceae are commonly found in the low altitude open forests suggests western Ghat as a source of these rocks which are basalt and laterite The fossil pollen of Spinizonocolpites prominatus grows exclusively in mangrove habitat. Abundance of

these pollen indicate warm humid tropical climate and estuarine depositional environments for these beds. All these angiosperm pollen suggest non marine depositional environment with source rock as basalt and laterite.

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