



PALAEOCLIMATIC SIGNIFICANCE OF THECAMOEBIANS FROM YELLANDU COALFIELD AREA, GODAVARI GRABEN, TELANGANA STATE

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ABSTRACT

The present preliminary palynological study deals with the first record of thecamoebians from sub-surface sediments of bore hole Q-563 of Yellandu coalfield area (Jawahar Khani-5 coal block), kothagudem sub-basin, Telangana State and used to determine the Palaeoclimatic significance and depositional environment of the study area. Total sixty samples were analyzed from the Jawahar khani-5 for the palynological investigation thoroughly. About one taxon protist (thecamoebian) *Arcella artocrea* belongs to the family Arcellidae was recorded. During palynological investigation, the dominance of non striate bisaccates pollen grains followed by striate bisaccates and the other stratigraphically significant palynomorphs, viz., *Scheuringipollentites*, *Faunipollenites*, *Rhizomospora*, *Ibisporites*, *Striatites* and *Microbaculispora* etc. in the sediments shows Barakar Formation of Early Permian affinity. The thecamoebian was recorded along with the palynostratigraphic markers of Permian sediments of the study area also shows the Early Permian affinity. Presence of these microfossils indicates the freshwater habitat and cooler climatic conditions prevailed at the time of deposition in the study area.

KEYWORDS: Thecamoebians, Palaeoclimate, Yellandu coalfield, Godavari graben and Telangana State.

INTRODUCTION

Thecamoebians (testate amoebae) are eukaryotic heterotrophic microfauna (protists) that are polyphyletic in origin. In modern environments, they colonize fresh to brackish water aquatic environments (Van Hengstum, P.J., 2008) and they form a simple secreted or agglutinated test or shell that can be preserved in the sediments under favourable conditions along with their organic remain. A large number of these microfossils recorded in pollen preparations (Farooqui *et al.*, 2012) provide information to be useful in a multiproxy approach to palaeoenvironmental reconstruction (Payne *et al.*, 2012). The oldest record of thecamoebians was described from the Neoproterozoic sediments of Grand Canayon, USA (Porter *et al.*, 2003), Early Permian sediments from Manjir Formation of the Himalayas of India (Kumar *et al.*, 2011) and Late Permian sediments of Raniganj Formation from Godavari graben (Farooqui *et al.*, 2014). Some important contributions on palynology of Godavari basin done by D.C. Bharadwaj *et al.*, 1986, Srivastava (1986, 1992), Srivastava and Jha (1987, 1989, 1990, 1992, 1993), Jha (2008), Jha and Aggarwal (2010, 2011, 2012), Jha *et al.* (2011) and Sabina and Jha (2014). The present palynological study is aimed to provide information regarding the first record of thecamoebians from sub-surface sediments of bore hole Q-563 of Yellandu coalfield area (Jawahar Khani-5 coal block), Kothagudem sub-basin, Telangana State (Figure. 1) and used to determine the Palaeoclimatic significance, relative age and depositional environment of the study area.

Geology of Study area

Indian Gondwana basins occur in the form of linear belt along the present day river systems viz. Damodar, Wardha-Godavari, Son-Mahanadi Basins and Pech-Kanhan Tawa Valley coalfields *etc.* The Godavari Basin is further divided into four sub-basins, viz., from NW-SE Godavari sub-basin, Kothagudem sub-basin, Chintalapudi sub-basin and Krishna-Godavari sub-basin (coastal tract) (fig-1). The Gondwana deposition in Godavari valley represents a rift valley having a NNW-SSE trend between 16° 38' and 19° 32' latitudes and 79° 12' and 81° 39' longitudes. The Singareni coal fields of Godavari valley are one of the largest coal deposits of India, in which the Yellandu area is one of the coal belts of Kothagudem sub-basin under Pranahita-Godavari basin. Yellandu coalfield an elongate, NNW-SSE trending basin parallel to the trend of Pranhita-godavari basin to the east. It is a graben bounded by faults along the eastern and western margins. Yellandu coal field area (Jawahar Khani-5 coal block) situated about 40 km west of Kothagudem, outside the western margin of Pranahita-Godavari basin. The Yellandu coal belt is bounded by northern latitude 17°29' 55" to 17°33' 59" and eastern longitude 80°19' 04" to 80°32' 45" and falls in Survey of India toposheet no 65C/6/SW. The entire coal block (JK-5) is covered by Barakar formation. This formation consists of 6 coal seams in B. H. Q-563 namely E/King Seam, seam D, seam C, seam B, A/Queen seam and index seam in descending order (Table 1). The Gondwana rocks (Permian sediments) of the Yellandu coal field area overlie the Archaean-proterozoic basement of Pakhal formation unconformably.

They include lower to upper Permian of Talchir, Barakar, Barren Measures and upper Permian to lower Triassic Kamthi Formations. Godavari valley coalfield is well known for the preservation of terrestrial, marine deposits, besides some important signatures of floral, faunal and also the tectonic events of the entire span of Gondwana

Period by King (1872, 1872a, 1881), Fox (1931, 1931a), Qureshy *et al.* (1968), Bhaskar Rao *et al.* (1970), Ramanamurthy (1976), Raja Rao (1982). The pioneering geological work has been done by King (1872, 1872a, 1873, 1877, 1881), Blanford (1871, 1871a).

TABLE 1. Lithological succession in B.H. - Q563, Jawahar Khani-5 coal block, Yellandu coalfield area, Kothagudem Basin, Telangana State.

Coal seam	Thickness of coal seams with parting (m)	Formation
I seam	25-50	Kamthi Formation
Index Seam	1.10-4.40	Barakar Formation
A/Queen Seam	1.50-21.60	"
B Seam	0.25-2.25	"
C Seam	0.25-4.25	"
D Seam	0.30-6.10	"
E/King Seam	0.15-4.10	"

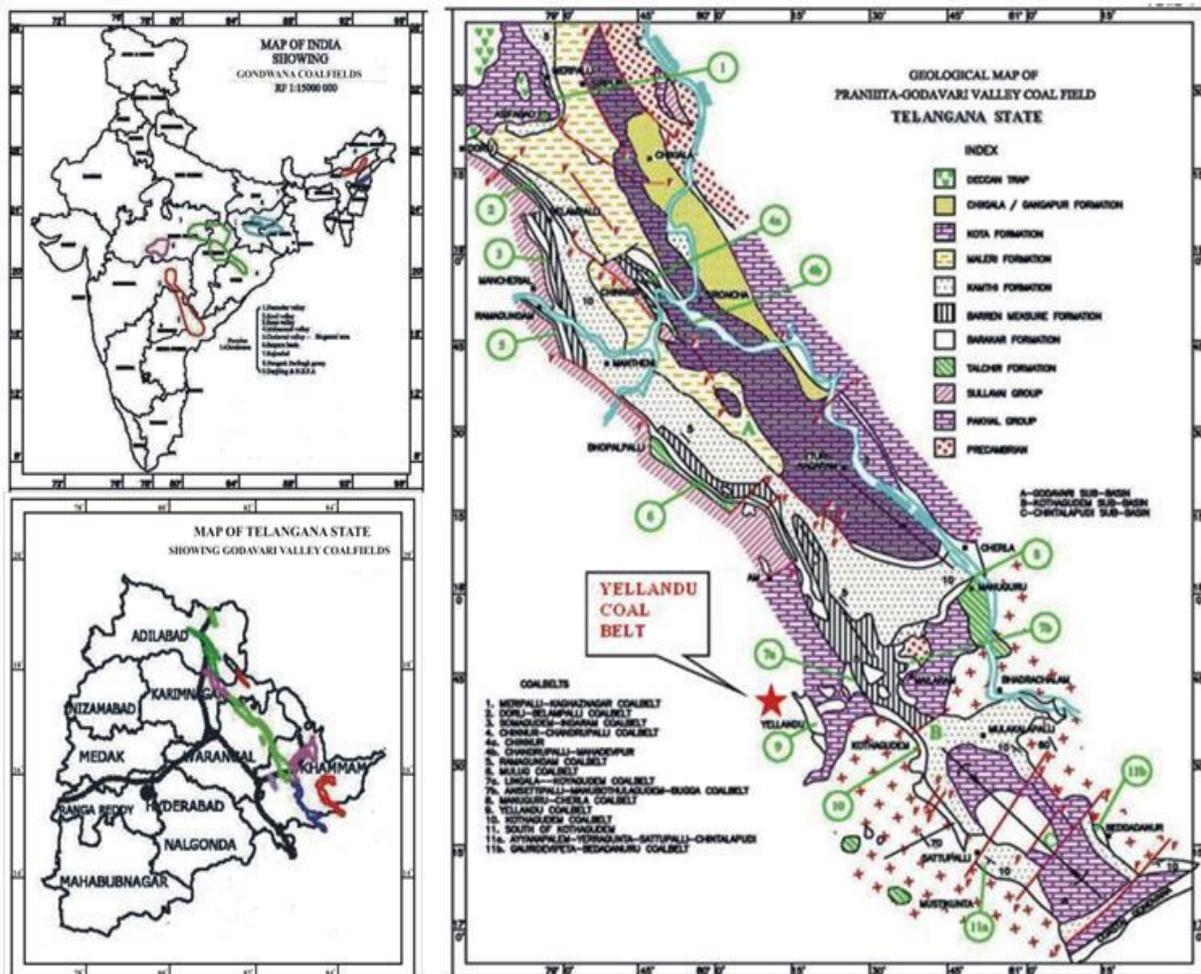


FIGURE 1. Geological map of Pranhitha-Godavari basin along with Yellandu coal belt area (B.H. - Q563, Jawahar Khani-5 coal block) of Kothagudem sub-basin, Telangana State.

MATERIAL & METHODS

The coal samples for the present study have been collected from Borehole No. Q - 563, Jawahar Khani-5 coal block near Yellandu village. A total of 60 bore core samples were collected from the Bore Hole no: Queen Seam – 563 for palynological investigation. The lithology of samples

viz. coal, shaly coal, carbonaceous shale and dark grey shales and sand stones. The samples were processed by standard palynological method (Traverse. A, 1988) using acids like hydrochloric acid (HCL) for 1-2 days, hydrofluoric acid (HF) for 3-4 days, followed by concentrated nitric acid (HNO3) for 2-5 days, followed by

10% alkali (KOH) treatment. The materials were sieved through 150 and 400 meshes and palynological slides were prepared using DPX as mounting medium for the recovery of palynomorphs from the coal samples. For the palynological investigation 5 slides were prepared for each

sample and microscopic observation has been made under Olympus microscope. The prepared slides were kept and stored in the Palaeobotany & Palynology Research Laboratory, Department of Botany, University College of Science, Saifabad, Osmania University, Hyderabad.

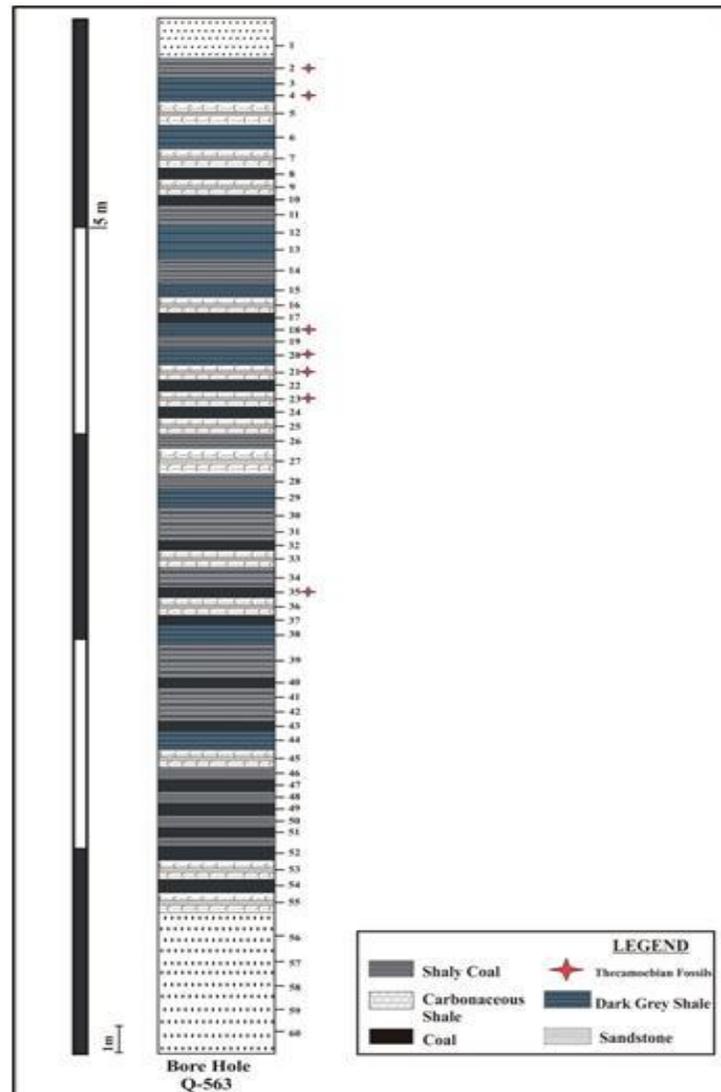
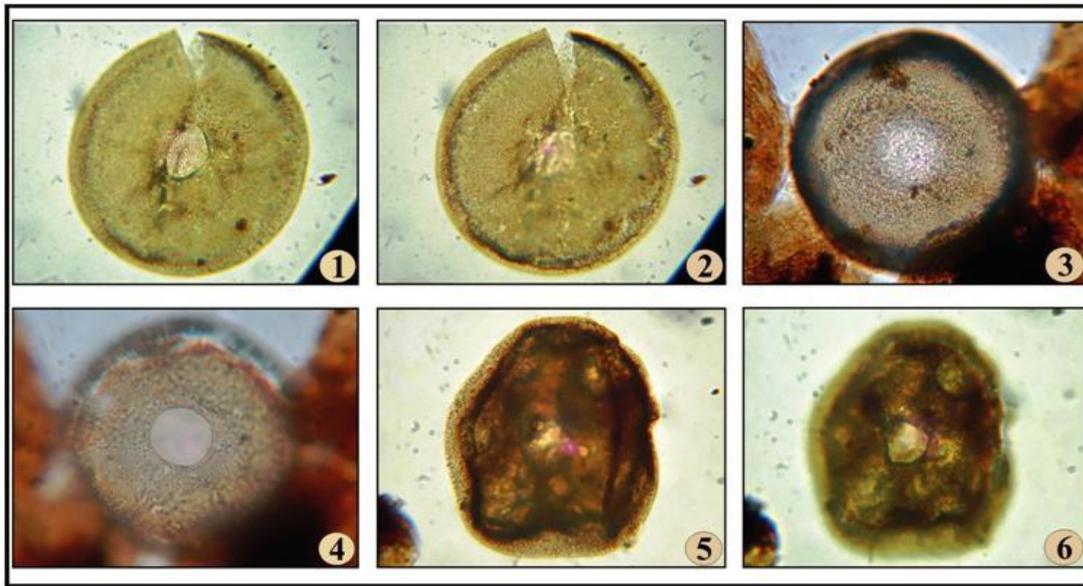


FIGURE 2: Lithological details and Thecamoebians of B. H. No. Q-563, Jawahar Khani – 5, Yellandu area, Kothagudem sub-basin, Godavari valley coalfield, Telangana State.

RESULTS

Sixty samples were analyzed from the Jawahar khani-5 for the palynological investigation. About one taxon protist (the camoebian) *Arcella artocrea* was recorded from the

sample no's 2, 4, 18, 20, 21, 23 and 35 respectively (Fig 2). Figure 3 shows the light microscopic photomicrographs of thecamoebians recorded from of JK-5 coal block of Yellandu Coalfield.



1-4 *Arcella artocrea*, 5-6 Unidentified

FIGURE 3: Lithological details of B. H. No. Q-563, Jawahar Khani – 5, Yellandu area, Kothagudem sub-basin, Godavari valley coalfield, Telangana State.

Palynological analysis

During palynological investigation, the dominance of non striate bisaccates pollen grains followed by striate bisaccates and the other stratigraphically significant palynomorphs, viz., *Scheuringipollenites*, *Faunipollenites*, *Rhizomospora*, *Ibisporites*, *Striatites*, *Crucisaccites*, *Striatopodocarpites*, *Parasaccites* and *Microbaculispora* etc. in the sediments shows Barakar Formation of Early Permian affinity. Thecameobians were also recorded along with the palynostratigraphic markers of Barakar Formation from Jawahar Khani-5 coal block of Yellandu coal belt; Godavari Graben also shows the Early Permian affinity.

Protists

Systematic description:

Phylum: PROTOZOA Goldfuss, 1818
 Subphylum: SARCODINA Schmarada, 1871
 Class: RHIZOPODA von Siebold, 1845
 Subclass: LOBOSA Carpenter, 1861
 Order: ARCELLINIDA Kent, 1880
 Family *Arcellidae* Ehrenberg, 1843
 Genus: *Arcella artocrea*.

***Arcella artocrea* Leidy, 1876:** The shell diameter of fossil specimens varied from 9–34 microns (Fig 3). The surface is mammillated or pitted, with a distinct and firm border, circular with a conical aboral region. The basal collar is generally distinct and smooth. The shell aperture ranges from 3–12 micron in diameter, invaginated, circular, has a small lip which is surrounded by many small pores. These pores are circular to slightly lalongate, arranged in systematic line around the apertural lip. The ratio of shell diameter and apertural diameter is 2.8–3 (Fig 3).

DISCUSSION

Palaeoclimate

During Lower Gondwana sedimentation, the Gondwana basins of India witnessed varied climatic conditions due to its latitudinal position, continentality and relief. During the Permian period, the palaeo-latitudinal position of India

was between 20° and 45° S (Smith *et al.*, 1981). As in other basins of the Gondwana land, even in India initial sedimentation took place due to melting of glaciers. The glaciers on the Indian peninsula were not of continental sheet types, but of isolated lobe type (Datta *et al.*, 1983) originating from ice caps existing on highlands which favoured floral components to thrive on open lands which were free of ice. The Lower Barakar Formation in India has been equated with these deposits (Mukhopadhyay *et al.*, 2010) and hosts the major coal deposits. Therefore, cool temperate condition with high humidity may have persisted during the early phase of Lower Barakar Formation.

Thecameobians were testate protists that occur in a variety of freshwater habitats and brackish environments. Thecameobians are proving to be useful proxies for a variety of new environmental and climatic parameters also (Roe *et al.*, 2010). Neville *et al.* (2010a) showed that they can also be used to monitor seasonal environmental changes. Presence of Arcellenids indicate the low humidity, low precipitation cooler conditions. Recently, it has been recorded that Arcellenids dominates in the low-humidity, low-precipitation cooler climatic conditions in tropical and sub-tropical areas experiencing high seasonality (Farooqui *et al.*, 2012). The palynoassemblage is characterized by the dominance of nonstriate bisaccate genus *Scheuringipollenites* and subdominance of striate bisaccate genus *Faunipollenites* which typify the palynoassemblage of Early Permian sediments of Barakar Formation. The age for the sequence at Q-563 is inferred as Early Permian age by comparison of the recorded flora from JK-5 with other Gondwana palynofloras (Sabina and Jha, 2014). The present borehole Q-563 shows the sub dominance morphology of big saccus and radial arrangement of *Parasaccites* and *Plicatipollenites* were also found from the study area indicating cooler climatic conditions.

CONCLUSION

Palynological data reveals an interesting point to note that the Jawahar Khani -5 of Yellandu coalfield of Godavari graben suggest very rich diverse assemblage prevailed during the deposition of sediments. The palynoassemblage is characterized by the dominance of nonstriate bisaccates and subdominance of striate bisaccates pollen grains which typify the palynoassemblage of Barakar Formation. The geological age for the sequence at Q-563 is inferred as Early Permian. The sub dominance of monosaccate pollen grains were also found from the study area indicating cooler climatic conditions. Presence of Arcellenids also indicates the freshwater habitat and low humidity, low precipitation cooler climatic conditions prevailed at the time of deposition in Yellandu coalfield area.

ACKNOWLEDGEMENTS

Authors are thankful to Mr. Ravishankar, GM, HRD and Mr. K. K. Sharma, GM Exploration, Singareni Collieries, Co. Ltd (SCCL), Kothagudem, Telangana State, who has granted permission to visit and collect samples from the Yellandu coalfield and Mr. D. N. Sharma, DGM (Exploration) and Pedda Raju, Geologist, SCCL, who gave all support and facilities to carry out the field investigation. Thanks are also due to the head of the Dept. and Principal of University College of Science, Saifabad, O.U. for providing all facilities to carry out this research work. Finally to acknowledge the University Grants Commission for providing financial support under RGNF fellowship to D.S. Seetharam.

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