

Palynology of subsurface Permian sediments in Koyagudem Area, Godavari Graben, Andhra Pradesh*

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The present palynological studies in Koyagudem Area of Godavari Graben have revealed the occurrence of two palynozones. The older palynozone represents the Upper Karharbari biozone in the older sediments which are lithologically classified as Barakar Formation. The younger palynozone represents the Lower Barakar which is distributed in the upper part of the bore holes. In this palynozone the Queen Seam is characterised by the association of *Primuspollenites* and *Scheuringipollenites* and is correlatable with the known palynoflora of the Queen Seam from Yellandu Area. In Koyagudem Area this seam is present in all the bore holes studied here and occurs in workable thickness.

Key-Words: Palynostratigraphy, Early Permian, Koyagudem, Godavari Graben, India.

INTRODUCTION

KOYAGUDEM Area is located on the south western margin of Godavari Sub-basin in Godavari Graben, Andhra Pradesh, India. The drilling operations in Koyagudem Area of Mulug south belt was carried out by the Geological Survey of India with an objective to assess the areas for detailed exploration and mine feasibility of the Queen Seam. The lithological succession in this area as established by the Geological Survey of India is as follows:

Kamthi Formation

Barakar Formation

Talchir Formation

———Unconformity———

Archaeans/Pakhals

The Lower Gondwana Sequence in Koyagudem Area represents part of a synformal structure and the area is traversed by repeated faults to the extent that sediments are extremely silicified and brecciated thus making the correlation difficult. Archaean Gneisses form the basement on the southern margin while Pakhal metamorphic form the basement on the western and southwestern flank (Map 1). The existence of Lower Gondwana sediments belonging to Talchir, Barakar

and Kamthi (*sensu* Raja Rao, 1982) formations have been established from surface and subsurface data both. However, the presence of Karharbari and Barren Measures (Kulti) sediments are not recognised in Koyagudem Area. The coal seams in Barakar Formation occur at considerably shallower depths as a result of a number of strike and oblique faults (Bhattacharjee & Sabale, 1990). There is no record of palaeobotanical remains from Koyagudem Area, hence, the present palynological studies were undertaken in order to date and correlate the strata, particularly the coal seams. The details of the samples studied are given in table-1. Only the samples marked with an asterisk have yielded the spores and pollen grains.

PALYNOZONATION

The palynotaxa identified in the present investigation includes 42 genera and 62 species from Koyagudem Area which are listed below:

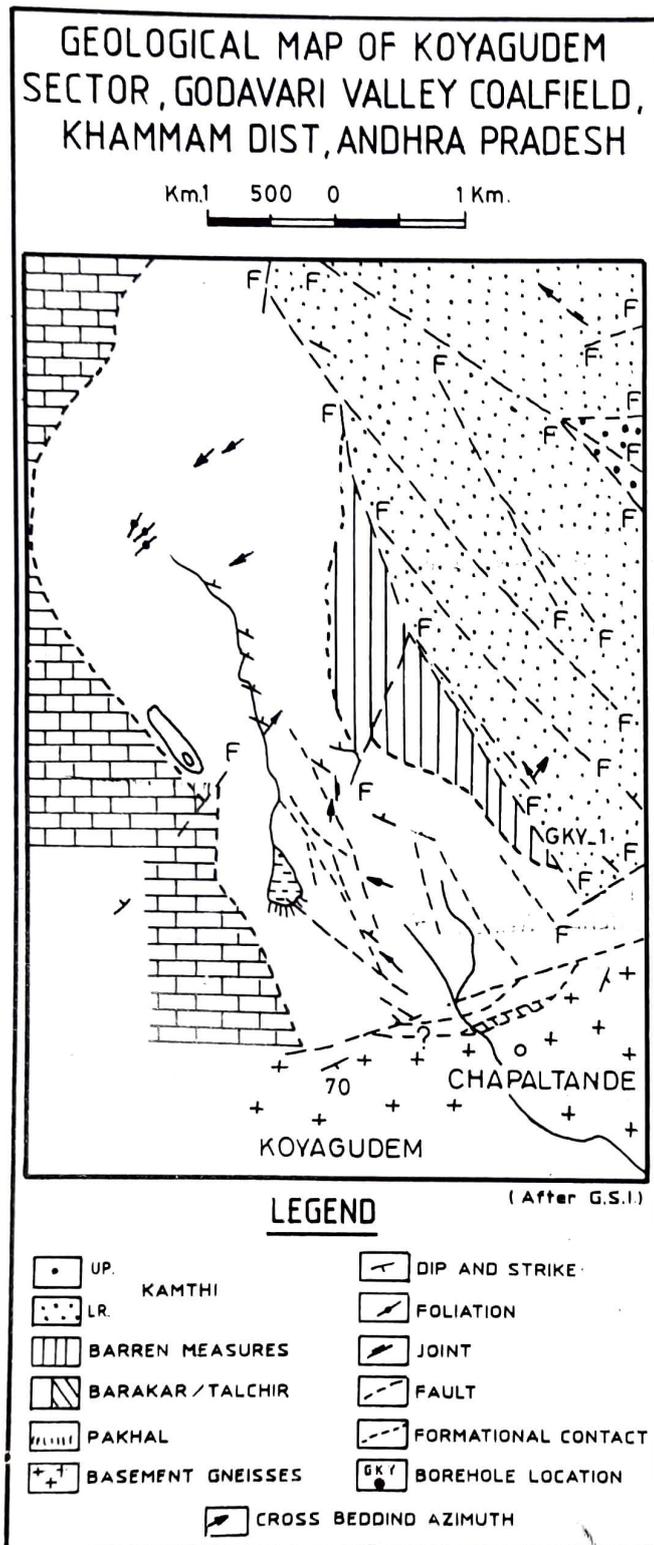
Leiotriletes rectus Bharadwaj & Salujha 1964

L. rarus Singh 1964

Lophotriletes rectus Bharadwaj & Salujha 1964

Callumispora barakarensis Bharadwaj & Srivastava, emend Tiwari *et al.* 1989

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Map-1. Geological map of Koyagudem area, showing location of bore core GK-1

C. gretensis Bharadwaj & Srivastava emend Tiwari et al. 1989

Lacinitriletes sp.

Brevitriletes unicus (Tiwari) Bharadwaj & Srivastava emend Tiwari & Singh 1981

B. communis (Tiwari) Bharadwaj & Srivastava emend Tiwari & Singh 1981

Horriditriletes ramosus (Balme & Hennelly) Bharadwaj & Salujha 1964

H. rampurcensis Tiwari 1968

Microbaculispora tentula Tiwari, 1965

M. gondwanensis Bharadwaj 1962

Microfoveolatispora foveolata Tiwari emend Tiwari & Singh 1981

Indotriletes korbaensis Tiwari 1965

I. sparsus Tiwari 1965

Jayantisporites indicus Lele & Makada 1972

J. pseudozonatus Lele & Makada 1972

Laevigatosporites colliensis (Balme & Hennelly) Venkatachala & Kar 1968

Parasaccites korbaensis Bharadwaj & Tiwari emend Tiwari et al. 1989

P. obscurus Tiwari 1965

P. bilateralis Tiwari 1965

P. ovatus Kar 1968

Striomonosaccites sp.

Plicatipollenites indicus Lele 1964

P. diffusus Lele 1964

Virkkipollenites sp.

Divarisaccus lelei Venkatachala & Kar 1966

Stellapollenites talchirensis Lele 1965

Potonieisporites neglectus Potonie & Lele 1961

Crucisaccites indicus Srivastava 1970

Densipollenites invisus Bharadwaj & Salujha 1964

Platysaccus papillionis Potonie & Klaus 1954

P. densicarpus Anand-Prakash 1972

Alisporites sp.

Primuspollenites levis Tiwari 1964

Lueckisporites crassus Sinha 1972

Lunatisporites crassus Sinha 1972

Lunatisporites diffusus Bharadwaj & Tiwari 1977

Corisaccites alutas Venkatachala & Kar 1966

Faunipollenites varius Bharadwaj 1962

F. singrauliensis Sinha 1972

F. parvus Tiwari 1965

Striatopodocarpites labrus Tiwari 1965

- S. decorus* Bharadwaj & Salujha 1964
S. subcircularis Sinha 1972
Striatites communis Bharadwaj & Salujha 1964
Verticopollenites debilis Venkatachala & Kar 1968
Verticopollenites crassus Bharadwaj & Salujha 1964
Rhizomaspora indica Tiwari 1965
Schizopollis extremus Venkatachala & Kar 1964
Vesicaspora luteus Salujha 1965
Scheuringipollenites maximus (Hart) Tiwari 1973
S. barakarensis (Tiwari) Tiwari 1973
S. tentulus (Tiwari) Tiwari 1973
Ibisporites diplosaccus Tiwari 1968
Crescentipollenites gondwanensis (Maheshwari) Bharadwaj, Tiwari & Kar 1974
Tiwariasporis simplex (Tiwari) Maheshwari & Kar 1967
Marsupipollenites fasciolatus Balme & Hennelly 1956
Ginkgocycadophytus sp.
Leiosphaeridia sp.
Balmeella sp.

The percentage distribution of various genera in each bore hole is described here and are also diagrammatically represented in histogram-1:

Bore hole GKY-1

On the basis of quantitative and qualitative association two palynozones have been demarcated in 272.25 m thick sequence of bore core GKY-1 which was drilled close to the north of Koyagudem village.

Palynozone 1: The carbonaceous shale present at 253 m in bore core GKY-1 has yielded a palynoassemblage dominant in radial monosaccate pollen, chiefly *Parasaccites* (35%). The trilete spores represented by *Leiotriletes*, *Callumispora*, *Microbaculispora* and *Microfoveolatispora* together total upto 13 percent. Striate disaccate pollen grains viz. *Faunipollenites* (4%) and *Striatopodocarpites* (4%) are rare while nonstriate disaccate pollen are nearly absent. The dominance of *Parasaccites* continues upto 206.5 m but the percentage of disaccate pollen increase appreciably viz. *Scheuringipollenites* (9%), *Striatopodocarpites* (10%), thus indicating the incoming of nonstriate disaccate. At this level the triletes are also better represented (32%) both quantitatively as well as qualitatively. The presence of *Jayantisporites*, *Indotriradites* and *Brevitriletes* denotes a younger aspect to palynozone. Thus the carbonaceous sediments be-

Table-1 : Showing details of samples investigated from Koyagudem area Godavari Graben. Asterisks denote yielding samples.

Sl. nos	Depth (in meters)	Lithology
<i>Bore core GKY-1</i>		
*1.	13.95	White clay
2.	16.00	Yellow sandstone
3.	78.50	White Clay
*4.	99.25	Carbonaceous intercalations in white sandstone.
*5.	114.15	Shaly sandstone
6.	158.59	Shale sandstone intercalations
*7.	178.90	Carb shale
*8.	197.50	Carb shale
*9.	206.50	Carb shale
*10.	253.00	Carb shale
11.	261.80	Carb shale
12.	272.25	Carb shale
<i>Bore core KYG-19</i>		
*1.	126.95	Coal
2.	130.25	Coal
3.	135.86	Coal
4.	141.45	Coal
<i>Bore core KYG-20</i>		
*1.	119.00-130.80	Coal

tween 252-206.50 m containing *Parasaccites* dominance alongwith incoming of *Scheuringipollenites* is considered here to represent the *Parasaccites korbaensis* Palynozone designated by Tiwari and Tripathi (1992).

Palynozone 2: The nature of dominance gradually changes at 197 m where nonstriate disaccate pollen grains, chiefly *Scheuringipollenites* attains overall dominance over monosaccate pollen grains and continues so up to 13.95 m. The subdominance is shared by striate disaccates (*Faunipollenites* and *Stiatopodocarpites*). However, *Parasaccites* continues to persists in good percentage in this palynozone too.

The trilete spores are present in fairly good percentages (upto 8%) in the older sediments but reduce considerably upwards. In view of the dominance of *Scheuringipollenites* the sediments between 197-13.95 m are considered to represent the *Scheuringipollenites maximus* palynozone pertaining to Lower Barakar palynozone (Tiwari & Tripathi, 1992). However, *Primuspollenites* (6%) gets associated at 99.25 m alongwith rare amounts of *Verticypollenites* and *Schizopollis* suggesting a younger aspect within the palynozone 2. Thus the coal seam at 99.25 m is separable from the underlying ones.

Bore hole KYG-19

Four coal seam samples have been studied in bore hole KYG-19 but only one coal sample at 126.95 m has yielded palynofossils in countable numbers which shows dominance of *Scheuringipollenites* (28%) and subdominance of striate disaccates chiefly *Faunipollenites* (15%). *Primuspollenites* is also present upto 8 percent. Among the trilete spores (23%) the presence of *Lacinitriletes* (9%) is significant.

Bore hole KYG-20

In this bore hole only one coal seam sample was studied which shows dominance of *Scheuringipollenites* in association with *Primuspollenites* between 119-130.8 m. This assemblage is closely comparable with the assemblage at 99.25 m in bore hole GKY-1 and at 126.95 m in bore hole KYG-19.

CORRELATION

The drilling of bore hole GKY-1 was closed at 313.40 m in Talchir Formation. Only 272.25 m thick sequence of Barakar Formation was cored. Lithologically the Talchir-Barakar contact was marked at 300.05 m and six coal seams were recorded in Barakar Formation

amongst which Queen Seam (14.90 m thick) was demarcated at 99.25-114.15m (Fig.1).

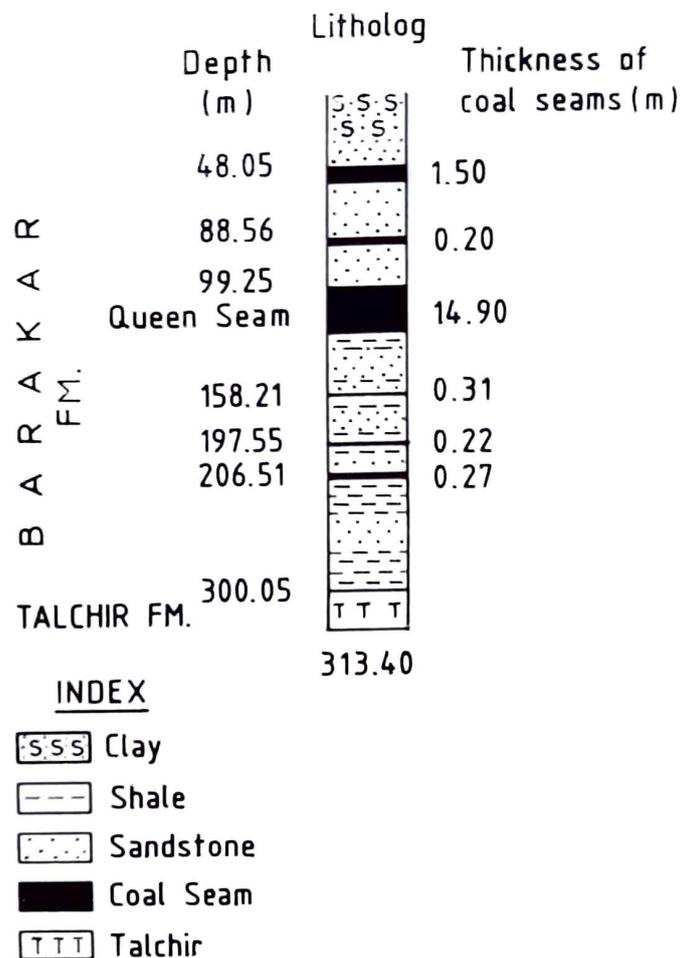


Fig 1. Litholog of bore core GKY-1 showing position of coal seams

The oldest palynozone has been recorded between 253-206.51 m in bore core GKY-1 in which lowermost coal seam at 206.51 m shows dominance of *Parasaccites* alongwith incoming of *Scheuringipollenites*. This association is characteristic of Upper Karharbari palynozone. Similar palynoflora has also been recorded from Seam A (Split seam) of Manuguru Area (Srivastava & Jha, 1992) and King seam of Yellandu Area (Srivastava, 1987) and are correlatable to the lowermost coal seam at 206.51 m in bore hole GKY-1 in Koyagudem area. Karharbari palynoflora has been recognised here in a lithologically undifferentiated Barakar sequence. However, this coal seam (i.e. King seam) has not attained workable thickness in this bore hole but the presence of palynoflora representing King seam opens up new possibility for search of Karharbari coal in Koyagudem Area.

The other younger palynozone (Palynozone 2) occurs between 197.77-13.95 m in bore hole GKY-1. The

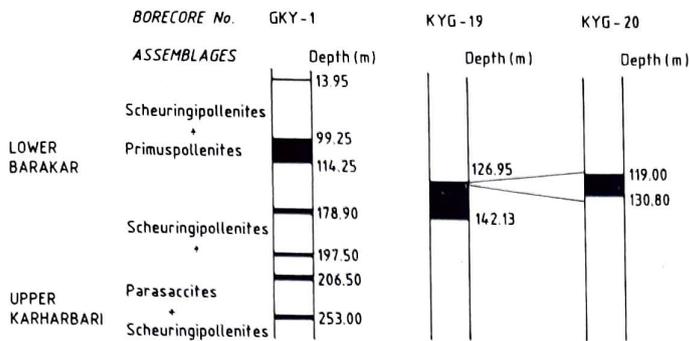
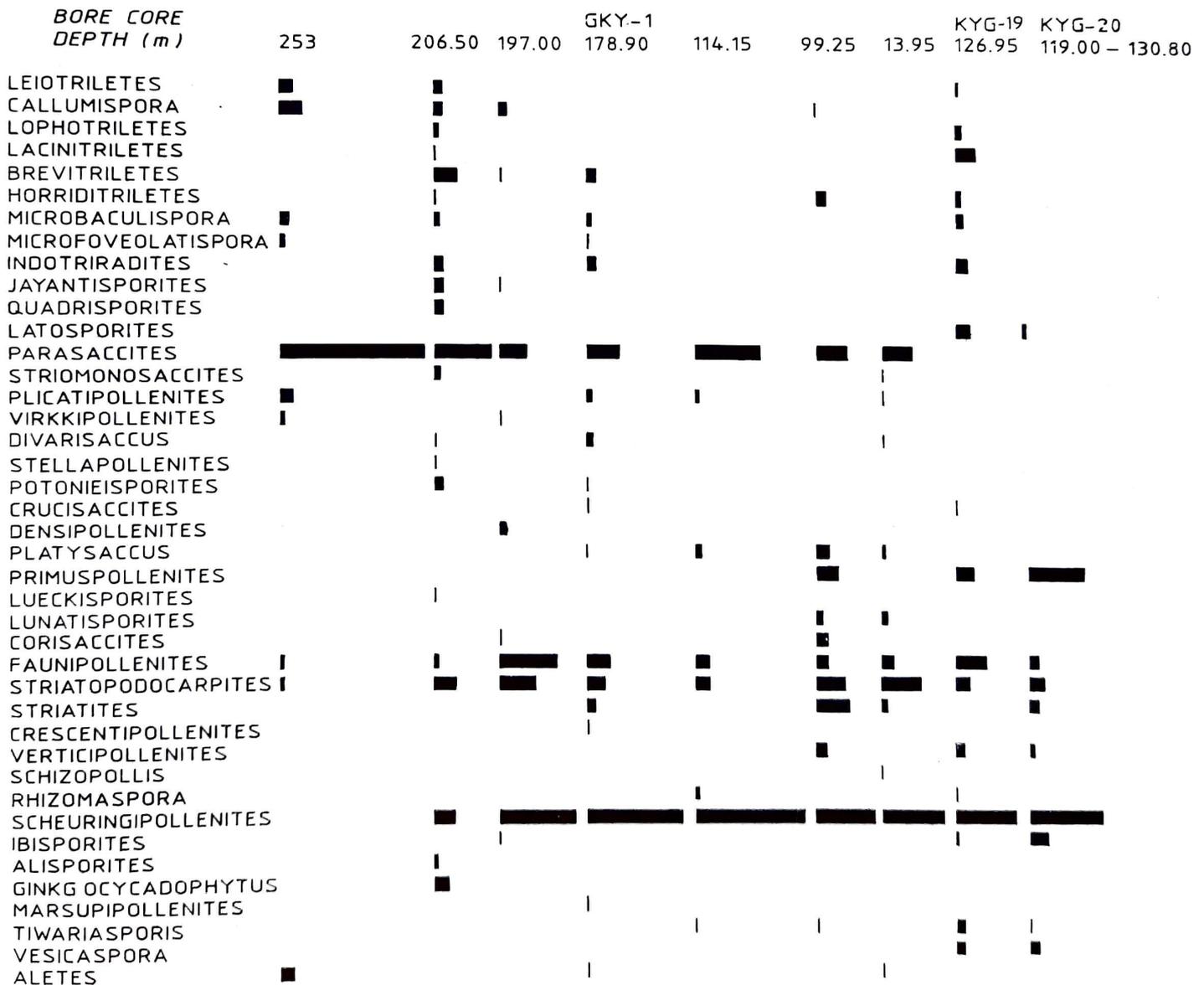


Fig. 2. Palynological correlation of coal seams in subsurface sediments of Koyagudem area, Godavari Graben.

younger coal seams at 197.55 m (0.22 thick) and 158.21 m (0.31 m thick) contain Lower Barakar palynoflora but are thin and hence nonworkable. The next younger seam at 99.25-114.15m also belongs to Lower Barakar palynozone but is differentiable from the underlying

coal seams in having *Primuspollenites*. This coal seam being in workable thickness (14.90 m) holds better promise for economic exploration. This is designated as Queen Seam by the geologists in the area.

Barakar palynoflora has also been recorded in coal seams present at 126.66 - 142.13 m in bore hole KYG-19 and at 114.70-131.70 m in bore hole KYG-20. Sub-dominance of *Primuspollenites* has been observed in bore hole GK Y-20 from Ramagundam Area in upper part of Upper Karharbari sequence alongwith dominance of *Parasaccites* and Lower Barakar assemblage in association with the dominance of *Scheuringipollenites* (Srivastava & Jha, 1989- Assemblages 1&2, respectively). The Queen Seam of Polampalli Incline in Yellandu Area is also characterised by the association of *Primuspollenites* and *Scheuringipollenites* (Srivastava, 1987; Assemblage B1). However, the trilete spores (*Brevitriletes*) are better



Histogram 1. Showing percentage frequency of different taxa in bore core GK Y-1, KYG-19 and KYG-20 from Koyagudem Area, Godavari Graben.

represented in Yellandu Area. Thus the coal seams in bore hole KYG-19 & 20 studied represent the Queen seam in Koyagudem Area and being in workable thickness at shallower depths can be worked out economically.

The percentage of *Parasaccites* has been observed to continue to be present in appreciable amounts (5-15%) in Lower Barakar palynozone in bore hole GKY-1 between 197-13.9 m which may indicate that cooler conditions prevalent in Upper Karharbari time have persisted even upto the early phases of Barakar sedimentation in Koyagudem Area of Godavari sub-basin.

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