

Palynological dating of Lower Gondwana sediments in Sattupalli area, Chintalpudi sub-basin, Andhra Pradesh, India

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The palynological study of bore-cores GSS-1, GS-1, 2, 3 and 4 from Sattupalli area, Chintalpudi sub-basin, reveals the presence of Talchir, Barakar and Raniganj palynoassemblages. The coal seams and associated sediments present between 74.40 to 152.70 m in bore-core GSS-1, at 99.50 m in GS-1, at 371 m in bore-core GS-2, at 46-74 m in GS-3 and 181-230 m in bore-core GS-4 contain Raniganj palynoflora alongwith early appearance of Early Triassic taxa, viz., *Lunatisporites*, *Klausipollenites*, *Lundbladispora*, *Densosporites*, *Vitreisporites* and *Chordasporites*. Talchir and Barakar palynofloras have been marked at 402 and 356.51 m in bore-core GSS-1, respectively.

Key-words—Palynology, Stratigraphy, Lower Gondwana (India).

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सारांश

औंध्र प्रदेश (भारत) में चिंतलपुडी उपद्रोणी के सत्तुपल्ली क्षेत्र में अधरि गोंडवाना अवसादों का परागाणावक कालानेधारण

सुरेश चन्द्र श्रीवास्तव एवं नीरजा झा

चिंतलपुडी उपद्रोणी में सत्तुपल्ली क्षेत्र की जी-एस-एस-1 तथा जी-एस 1, 2, 3 एवं 4 नामक वेध-क्रोडों के परागाणावक अध्ययन से इनमें तलचीर, बराकार एवं रानीगंज परागाणाविक-समुच्चयों की उपस्थिति प्रेक्षित की गई है। वेध-क्रोड जी-एस-एस 1 में 74.40 से 152.70 मीटर के मध्य, जी-एस 1 में 99.50 मीटर पर, वेध-क्रोड जी-एस 2 में 371 मीटर गहराई पर, जी-एस 3 में 46 से 74 मीटर के मध्य तथा जी-एस 4 में 181-230 मीटर के मध्य विद्यमान कोयला सीमों एवं सहयुक्त अवसादों में प्रारंभिक त्रिसंधी वर्गकों का प्रारंभिक प्रादुर्भाव रानीगंज परागाणावनस्यतिजात के साथ-साथ प्रेक्षित किया गया है। प्रारंभिक त्रिसंधी कालान वर्गकों में *त्युनाटस्याराइटिस*, *क्लासिपोलिनाइटिस*, *लुन्ब्लाडिस्पूरा*, *डेन्सोस्पोराइटिस*, *विट्रीस्पोराइटिस* एवं *कोर्डोस्पोराइटिस* मुख्य वर्गक हैं। वेध-क्रोड जी-एस-एस 1 में 402 एवं 356.51 मीटर गहराई पर क्रमशः तलचीर एवं बराकार परागाणावनस्यतिजात प्रेक्षित किये गये हैं।

THE Lower Gondwana sediments representing Talchir, Barakar, Barren Measures (Kulti) and Raniganj formations are well developed in Godavari and Kothagudem sub-basins but in Chintalpudi sub-basin Kamthi Formation directly overlies the Archeans or at some places the Talchirs (Raja Rao, 1982). Recently, Lakshminarayana and Murti (1990) have described the stratigraphy of the Gondwana Sequence in Chintalpudi sub-basin, where Barakar Formation is unconformably overlain by Upper Member of the Kamthi Formation (*sensu* Ramanamurty, 1985), thus a considerable gap in the stratigraphic sequence is evident. Srivastava and Jha (1993) have already demarcated the presence of Talchir, Karharbari and Raniganj palynofloras in Ayyanapalli-Gompana area (bore-core GAG-1) and Talchir palynoflora in Chintalpudi area (bore-core GCH-4) of this sub-basin. Therefore, the present palynological investigation was undertaken in order to understand the stratigraphy in Sattupalli area of Chintalpudi sub-basin.

The samples for the present study were collected from the bore-core GSS-1 (17°13', 80°49'45"), GS-1 (17°12'53", 80°53'19"), GS-2 (17°09'55", 80°51'30"), GS-3 (17°12'13", 80°53'35") and GS-4 (17°10'04", 80°53'40") of Sattupalli area which lies on the western margin of the Chintalpudi sub-basin and is further south to the Ayyanapalli-Gompana area. Location of above bore-cores is already published by Chaudhuri, Nagasasidhar and Gangopadhyay (1993). The lithological details of bore-core GSS-1, drilled up to a depth of 422.60 m, have been summarised by Lakshminarayana (1989). The details of samples investigated among the above bore-holes and their palynoflora have been shown in Table 1.

PALYNOZONATION AND CORRELATION

Following five distinct palynozones have been demarcated after careful and critical qualitative and

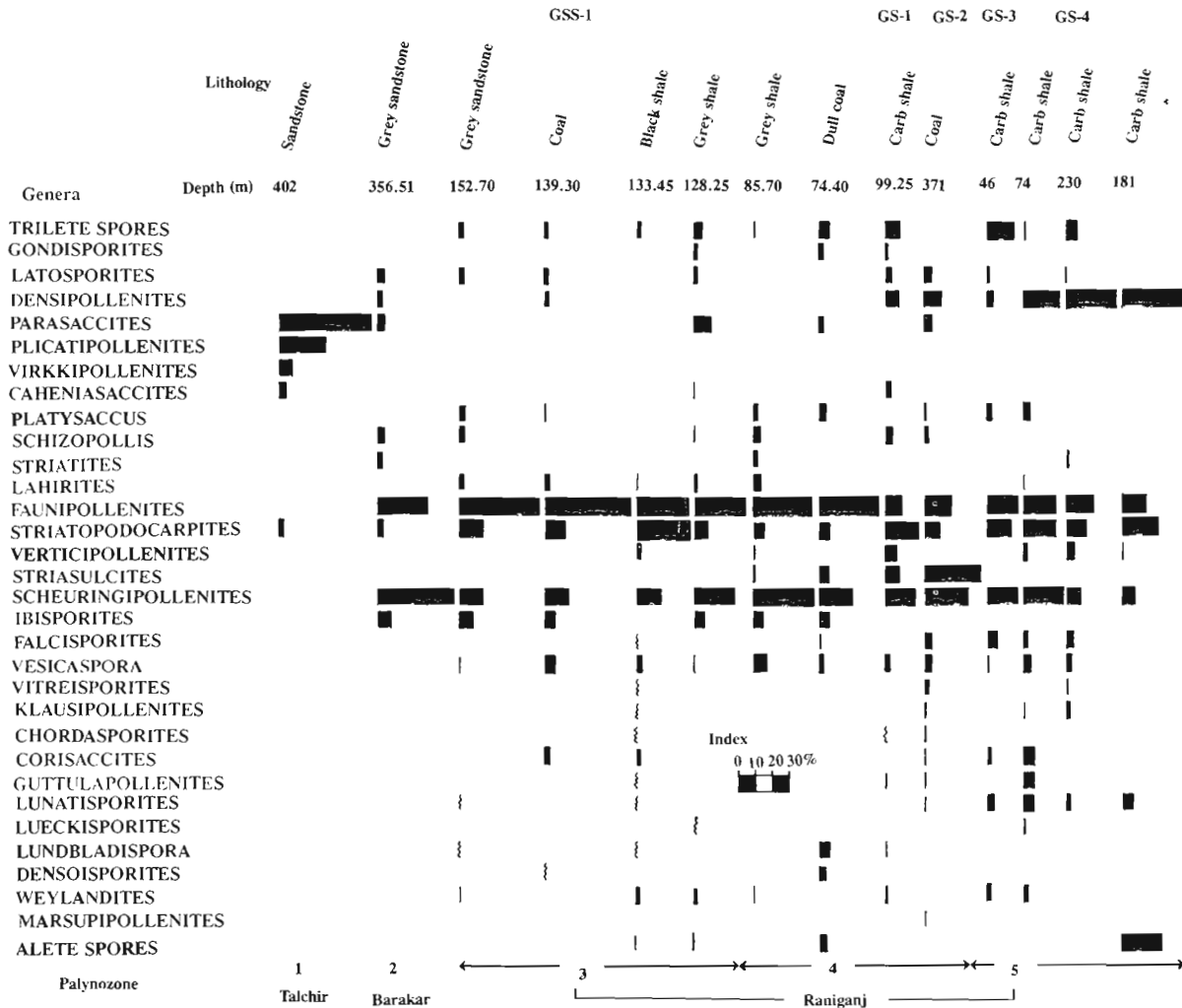
Table 1—Details of samples and their palynofloral composition in the bore-cores GSS-1, GS-1, 2, 3 and 4, Sattupalli Area, Godavari Graben

Sample No.	Depth (in m)	Lithology	Dominant	Sub-dominant	Qualitatively significant taxa	Palyno- assemblage	Age
Bore-core GS-4							
1	46.45	Carb. shale	Striate-disaccates chiefly <i>Striatopodocarpites</i> and <i>Faunipollenites</i>	<i>Densipollenites</i>	<i>Lunatisporites</i> <i>Falcisporites</i> <i>Gondisporites</i> <i>Klausipollenites</i> <i>Guttulapollenites</i> <i>Osmundacidites</i>	5	Kamthi
2	74.90	Carb. shale	Not yielded spores and pollen				
Bore-core GS-4							
1	181.00	Carb. shale	Striate disaccates chiefly <i>Striatopodocarpites</i> and <i>Faunipollenites</i>	<i>Densipollenites</i>	<i>Falcisporites</i> <i>Lunatisporites</i> <i>Klausipollenites</i> <i>Vitreisporites</i> <i>Osmundacidites</i>	5	Kamthi
2.	230.00	Carb. shale					
Bore-core GS-2							
1	70.00	Carb. shale	Not yielded spores and pollen				
2.	371.00	Coal	Striate disaccates chiefly <i>Faunipollenites</i> and <i>Striatopodocarpites</i>	<i>Striasulcites</i>	<i>Klausipollenites</i> <i>Guttulapollenites</i> <i>Falcisporites</i> <i>Lunatisporites</i> <i>Weylandites</i> <i>Chordasporites</i>	4	Kamthi
Bore-core GS-1							
1	99.50	Carb. shale	Striate disaccates chiefly <i>Striatopodocarpites</i> and <i>Faunipollenites</i>	<i>Striasulcites</i>	<i>Falcisporites</i> <i>Crescentipollenites</i> <i>Lundbladispota</i> <i>Weylandites</i>	4	Kamthi
2.	187.70	Carb. shale	Very poor yield.			2	Barakar
3.	201.45	Coal	<i>Scheuringipollenites</i> and <i>Faunipollenites</i>				
4.	477.00	Coal	present.				
5.	478.00	Carb. shale					
6.	578.50	Sandstone	Not yielded spores and pollen				
Bore-core GSS-1							
1	74.40	Dull coal	Striate disaccates chiefly <i>Faunipollenites</i> and <i>Striatopodocarpites</i>	<i>Scheuringipollenites</i> <i>Striasulcites</i>	<i>Lundbladispota</i> <i>Falcisporites</i> <i>Weylandites</i>	4	Kamthi
2.	85.70	Grey shale					
3.	128.25	Grey shale	Striate disaccates chiefly <i>Faunipollenites</i> and <i>Striatopodocarpites</i>	<i>Scheuringipollenites</i>	<i>Lunatisporites</i> <i>Vitreisporites</i> <i>Klausipollenites</i> <i>Guttulapollenites</i> <i>Chordasporites</i> <i>Lundbladispota</i> <i>Densoisporites</i> <i>Gondisporites</i>	3	Kamthi
4.	133.45	Black shale					
5.	139.30	Coal					
6.	152.70	Grey sandstone					
7.	201.00	Grey shale	Not yielded spores and pollen				
8.	356.51	Grey sandstone	<i>Scheuringipollenites</i>	<i>Faunipollenites</i>	<i>Striatites</i> <i>Rbizomaspora</i> <i>Striatopodocarpites</i>	2	Barakar
9.	402.00	Sandstone	<i>Parasaccites</i>	<i>Plicatipollenites</i>	<i>Virkkipollenites</i> <i>Cabenuasaccites</i>	1	Talchir

quantitative analyses of palynoflora in five different bore-cores from Sattupalli area.

Palynozone-1—This palynozone is identified at 402.0 m in bore-core GSS-1 and is characterised by the dominance of radial monosaccates chiefly *Parasaccites*

and *Plicatipollenites*. This marks the Talchir palynoflora which is correlatable to Assemblage I of bore-core GAG-1 (Ayyanapalli-Gompana block) and palynoassemblage of bore-core GCH-4 (Chintalpudi area) of Chintalpudi sub-basin (Srivastava & Jha, 1993). Palynozone-1



Text-figure 1—Histogram showing distribution of various palynotaxa in Sattupalli area, Chintalpudi sub-basin.

demarcated in bore-core GRK-1 (Srivastava & Jha, 1989) and GRK-24 (Srivastava & Jha, 1992) of Rāmakrishnapuram area of main Godavari Graben also compares with this palynozone of Sattupalli area in having dominance of radial monosaccates. However, the percentage of leiosphaerids is too high (30%) in bore-core GRK-24.

Palynozone-2—The dominance of *Scheuringipollenites* and subdominance of *Faunipollenites* demarcating Lower Barakar palynoflora has been marked at 365.51 m in bore-core GSS-1. In bore-core GS-1 the sediments at 187-201.45 m have yielded poor amount of palynofossils but whatever taxa are present they show Lower Barakar affinity. This palynozone is comparable to Palynozone-4 of Ramagundam (Srivastava & Jha, 1989), Ramakrishnapuram area (Srivastava & Jha, 1992) and Zone 3 of Manuguru area (Srivastava & Jha, 1992).

Palynozone-3—This is identified in bore-core GSS-1 at 152.70-128.25 m and shows the dominance of striate-disaccates chiefly *Faunipollenites* and *Striatopodocarpites*.

The dominance of striate disaccates is also observed in Upper Barakar and Barren Measures palynofloras. But the appearance of some younger forms like *Lunatisporites*, *Lundbladispora*, *Falcisporites*, *Densoisporites*, *Klausipollenites*, *Chordasporites* recorded at this level is significant as it shows younger aspect of the palynoflora. Palynozone-3 resembles Lower Raniganj palynoflora of Ramagundam, Ramakrishnapuram and Bhopalpalli area (Srivastava & Jha, 1988), Mailaram area (Srivastava & Jha, 1990), Chelpur area (Srivastava & Jha, 1987) and Manuguru area (Srivastava & Jha, 1992) in Godavari Graben.

Palynozone-4—It is present in bore-core GSS-1 at 85.70-74.40 m, in bore-core GS-1 at 99.25 m and in bore-core GS-2 at 371 m. In this Palynozone 4 the striate-disaccate pollen grains still continue to dominate the palynoflora, but the higher percentage of *Striasulcites* alongwith the rare occurrence of *Guttulapollenites* differentiates it from Palynozone-3. Palynozone-4 compares well with the Palynoassemblage II recorded

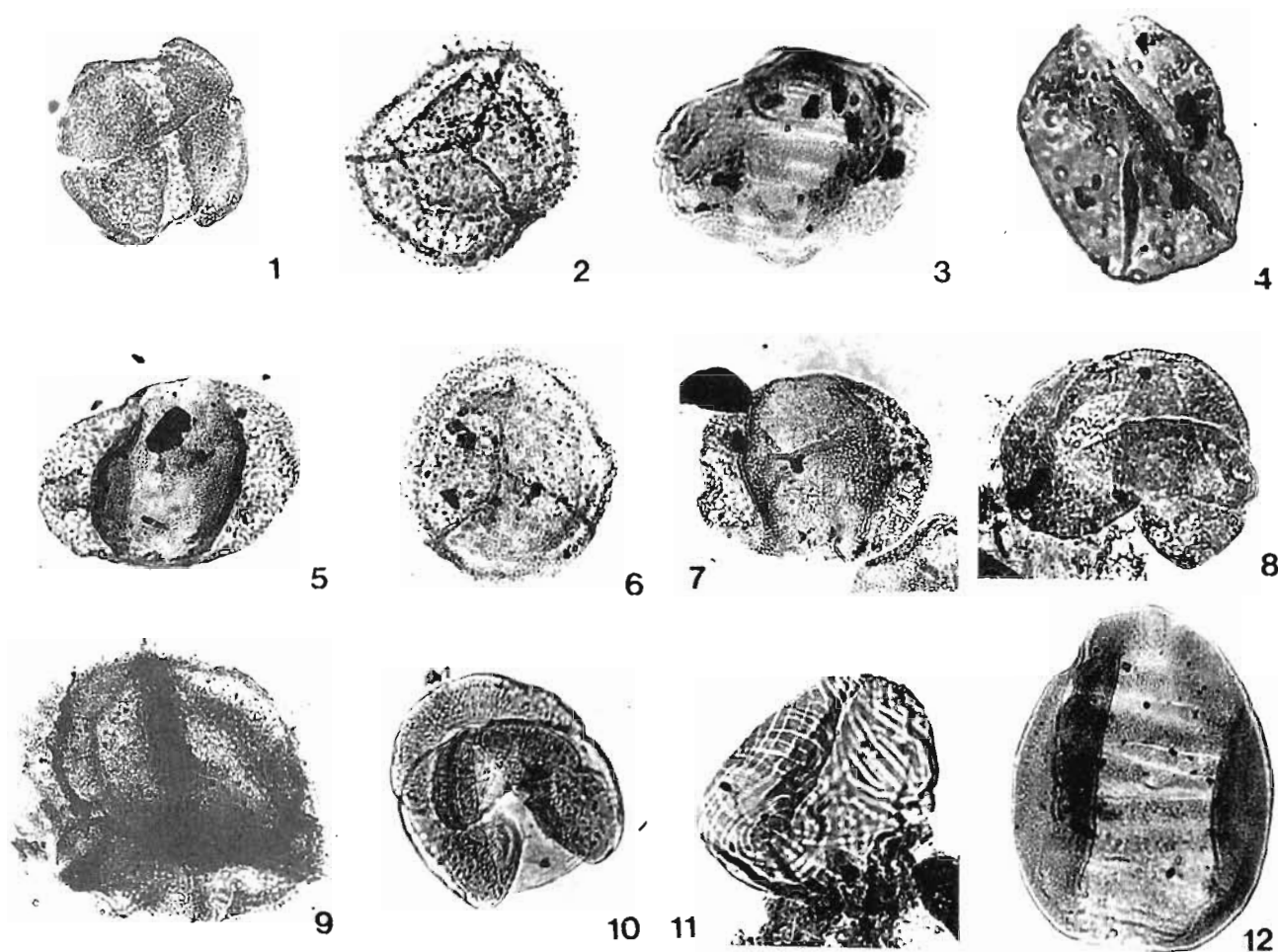


PLATE 1

(All magnifications $\times 500$)

1. *Corisaccites alutus*. Negative no. 73/9; Slide no. BSIP 11036. Coordinates 131.5×15 .
2. *Lundbladispora* sp., Negative no. 74/1; Slide no. BSIP 11033. Coordinates 9.3×131.0 .
3. *Lunatisporites ovatus*. Negative no. 66/4; Slide no. BSIP 11031; Coordinates 99.3×52.8 .
4. *Singraulipollenites finitimus*. Negative no. 74/14; Slide no. BSIP 11035. Coordinates 2.5×145.5 .
5. *Falcisporites stabilis*. Negative no. 73/33; Slide no. BSIP 11032. Coordinates 10.4×134 .
6. *Lundbladispora microconata*. Negative no. 73/1; Slide no. BSIP 11037. Coordinates 126.7×12.8 .
7. *Chordasporites* sp., Negative no. 73/1; Slide no. BSIP 11036. Coordinates 160×3.8 .
8. *Guttulapollenites hannonicus*. Negative no. 73/10; Slide no. BSIP 11036. Coordinates 132×14.2 .
9. *Lundbladispora* tetrad. Negative no. 73/32; Slide no. BSIP 11032. Coordinates 129.2×15.7 .
10. *Guttulapollenites hannonicus*. Negative no. 73/18; Slide no. BSIP 11034. Coordinates 134.3×18.5 .
11. *Weylandites obscurus*. Negative no. 73/11; Slide no. BSIP 11036. Coordinates 134.4×10 .
12. *Striasulcites tectus*. Negative no. 73/35; Slide no. BSIP 11032. Coordinates 14×154 .

from Ramagundam, Khammampalli and Manuguru areas (Srivastava & Jha, 1988) of Godavari sub-basin.

Palynozone-5—The Palynozone-5, demarcated between 46-74 m in bore-core GS-3 and between 181-230 m in bore-core GS-4, is characterised by the dominance of striate-disaccates and significant occurrence of *Densipollenites*, *Klausipollenites*, *Falcisporites*, *Lunatisporites* and *Vitreisporites* which continue to occur in rare percentages. In bore-core GS-4 at 181 m

leiosphaerids are high in percentage (26%). This palynozone compares with the *Striatopodocarpites* + *Densipollenites* Assemblage of Ramakrishnapuram, Jaipuram, Ramagundam, Mantheni and Manuguru areas (Srivastava & Jha, 1988) and Assemblage II of Mailaram area (Srivastava & Jha, 1990). However, the higher percentage of leiosphaerids has been observed only in this area indicating possibly a marine influence during the deposition of these sediments.

DISCUSSION

Chintalpudi sub-basin was known to contain only the Kamthi Formation, except a small patch of Talchir Formation near Chintalpudi and Barakar Formation at Beddadanur (Raja Rao, 1982). However, the present palynological study records the occurrence of Talchir, Barakar and Raniganj equivalent palynofloras in Sattupalli area. The sediments present in bore-cores GSS-1 between 74.40-152.70 m, in GS-1 at 99.50 m, in GS-2 at 371.0 m and in bore-core GS-4 at 181-230 m have been dated as Late Permian on the basis of presence of striate disaccate pollen, *Striasulcites* and a monosaccate pollen *Densipollenites* alongwith some younger forms, viz., *Lundbladispora*, *Falcisporites*, *Klausipollenites*, *Guttulapollenites*, *Vitreisporites*, *Densoisporites*, *Gondisporites* and *Chordasporites* (Plate 1).

The lithological succession in bore-core GSS-1 (Lakshminarayana & Murti, 1990) shows the presence of Talchir Formation at the base which is palynologically supplemented by *Parasaccites* zone representing the youngest Talchir palynoflora. The *Scheuringipollenites* zone at 356.51 m represents the Barakar palynozone while the sediments between 152.70-74.40 m show *Striatopodocarpites* + *Faunipollenites* zone (152.70-128.25 m) followed by *Striasulcites* zone (85-74.40 m) and represent the Raniganj equivalent palynoflora in Chintalpudi sub-basin. The green micaceous sandstone between 310-340 m may be the representative of Barren Measures Formation. The four coal seams, present between 175.90-60 m in bore-core GSS-1, earlier dated as Barakar by Lakshminarayana and Murti (1990), are considered here to occur in Raniganj Formation. The present study reveals that the Lower Gondwana sedimentation in Sattupalli area of Chintalpudi sub-basin commenced with the deposition of Talchir Formation and continued uninterrupted up to Raniganj Formation. The restricted thickness of Barren Measures (Kulti) Formation might be due to subsequent erosion in response to tectonic control of the basin during the deposition in view of the presence of pebbly sandstone bounded by concave-up erosional contacts (Lakshminarayana & Murti, 1990). Critical observation for such signatures is essential in reconstruction of the depositional history of Chintalpudi sub-basin.

The existence of Talchir, Karharbari and Raniganj equivalent sediments has already been proved palynologically in Ayyanapalli-Gompana area (Srivastava & Jha, 1993). This further supports the presence of almost a complete Lower Gondwana sequence similar

to the main Godavari Basin in Chintalpudi sub-basin as well. The present findings are in distinct contrast with the earlier view that Chintalpudi sub-basin was formed during Kamthi period as suggested by Raja Rao (1982), whereas the present study indicates that Chintalpudi sub-basin is coeval with the Lower Gondwana of Kothagudem and Godavari sub-basins. The presence of leiosphaerids (aletes) in high percentage (26% in bore-core GS-4, 181 m) is significant as they indicate marine influence in Late Permian.

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