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Palynological correlation of coal seams in Godavari Graben, Andhra Pradesh, India

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The palynological study of various coal seams from Yellandu, Kothagudem, Belampalli, Ramakrishnapuram and Ramagundam coalfields of Godavari Graben has been done. The distributional pattern of various palyno-taxa has suggested the occurrence of six miospore assemblages. Miospore Assemblage E is marked by the association of *Parasaccites* and *Scheuringipollenites*. Assemblage D is characterised by the dominance of *Brevitriletes*. In assemblages C1, C2 and C3, *Brevitriletes* is associated with *Hennellysporites*. *Indotriradites*, although rare, occurs only in this assemblage. *Horriditriletes* and *Latosporites* characterise Assemblage B in association with *Brevitriletes*. *Primuspollenites* gains significance only at this stage of palynofloral succession. In the youngest Assemblage A all the triletes decrease appreciably giving way to nonstriate-disaccates, *Scheuringipollenites*, so as to take up the dominance. The sporological succession shows only one change after Assemblage E (Upper Karharbari) was deposited. Miospore assemblages D to A represent the Lower Barakar palynoflora.

Key-words—Palynology, Coal seams, Correlation, Godavari Graben, Lower Barakar (India).

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सारांश

आँध्र प्रदेश (भारत) में गोदावरी द्रोणिका के कोयला-सीमों का परागाणविक सहसम्बन्ध

सुरेश चन्द्र श्रीवास्तव

गोदावरी द्रोणिका के येल्लान्डु, कोठागुदेम, बेलमपल्ली, रामकृष्णपुरम एवं रामागुंडम् नामक कोयला-क्षेत्रों से प्राप्त विभिन्न कोयला-सीमों का परागाणविक अध्ययन किया गया है। विभिन्न वर्गकों के वितरण के ढंग से छः मिओबीजाणु समुच्चयों की उपस्थिति प्रस्तावित होती है। मिओबीजाणु समुच्चय ई० में पैरामेक्काइटिस एवं श्यौरिंजीपोलिनाइटिस का साहचर्य है। सी-1, सी-2 एवं सी-3 समुच्चयों में ब्रेविट्राइलिटीस तथा हेनेलिस्पोराइटिस साथ-साथ विद्यमान हैं। इंडोट्राइरेडाइटिस, यद्यपि अत्यल्प है, केवल इसी समुच्चय में मिलता है। होरिडीट्राइलिटीज़ एवं लाटोस्पोराइटिस ब्रेविट्राइलिटीज़ के साहचर्य में समुच्चय-बी० को अभिलक्षणित करते हैं। प्राइमसपोलिनाइटिस परागाणुवनस्पतिजातीय अनुक्रम के केवल इसी चरण पर अपना महत्व प्रदर्शित करता है। अल्पतम् आयु वाली समुच्चय ए० में सभी त्रिअरीय परागकण काफ़ी कम हो जाते हैं तथा इनके स्थान पर अरेखीय-द्विकोष्ठीयों एवं श्यौरिंजीपोलिनाइटिस की बाहुल्यता बढ़ जाती है। समुच्चय ई० (उपरि करहरबारी) के निक्षेपण के पश्चात् बीजाणविक अनुक्रम केवल एक परिवर्तन प्रदर्शित करता है। मिओबीजाणु समुच्चय (डी० से ए० तक) अधरि बराकार परागाणुवनस्पतिजात का निरूपण करते हैं।

THE Godavari Graben forms a south-eastward extension of the large stretch of Gondwana formations of the Wardha Valley coalfields. It extends in total length of about 350 km and 55 km in breadth. This tract includes many small and important coal-bearing areas which crop out from below the Kamthi Formation. Thus, the coal measures are met with to a small extent and only at intervals, chiefly along the western margin of the main stretch of Gondwana sediments. The areas north of the Godavari River, known as North Godavari coalfields, include Tandur, Mandamari-Somagundum and Ramakrishnapuram coalfields. The main coalfields south of the Godavari River are Ramagundam, Yellandu, Manuguru and Kothagudem.

The discovery of coal in Godavari Valley dates back to 1872 by King near Yellandu and since then extensive surveys have been done with the result a number of coal seams have been proved. However, the study of miospores from these areas attracted the

attention of geoscientists in recent years. Ghosh (1962, 1963) studied the palynological contents of different coal types of Tandur area. Chatterjee *et al.* (1964) studied the petrographic characters of the coals from this area, while Banerjee (1964) studied the petrographic characters of the Queen Seam in Yellandu area. Ramana Rao and his associates (1965, 1966) studied the chemical characters of the coals from Kothagudem Coalfield. Moiz and Rao (1968) have described in short the sporae dispersae of the Kothagudem Coalfield. Tiwari and Moiz (1971) have described five new genera of miospores from the coal-bearing horizons of the Godavari Graben. Recently, Navale, Misra and Anand-Prakash (1983) have also studied the petrographic constituents of the working coal seams of the Godavari Graben. Although a number of coal seams have been proved in different areas of the Godavari Basin, little attempt has been done to correlate them. As the coal seams are occurring so widely apart, palynology seems to be the only possible means to attempt their correlation. In the present investigation the palynofloral assemblages in the coals of different areas of Godavari Graben has been studied with a view to establish a palynological succession and a possible correlation of the coal seams.

GEOLOGY

The Lower Gondwana sediments in Godavari Graben stretch in a north-west to south-east linear belt and are exposed along both the margins of the graben. The general stratigraphic setting of the Lower Gondwana sediments in the mainland area is shown in Table 1.

The basement for the deposition of Gondwana sediments has been provided by the Archaeans in the southern part while Pakhals and Sullavai group of rocks constitute the basement north of Mailaram High. The Barakar Formation, overlying Talchir and underlying the Barren Measures formations, occurs as discontinuous patches along the basin margins. The continuity of these sediments has been proved along the western limb of the basin and shows considerable variation in its thickness. However, the continuity of coal seams in axial region has yet to be proved. The coal horizons are restricted to limited number of sub-basins each having its own depositional history. A brief description of the coal-bearing areas investigated is as follows:

Yellandu area—This area is named after the village Singareni and is 22.5 km long and 3.2 km wide aligned in NNW-SSE direction. The area is formed of a Gondwana outlier and workable coal seams occur in the northern part of the area below the Kamthi sandstones. Two prominent coal seams, viz., King Seam (2.4 m) and Queen Seam (9.7-30.4 m), are being worked in this area. The Queen Seam overlies the King Seam with a parting of about 61 m. The Queen Seam varies in thickness from 9.7 to 30.4 m but only the lower 3 meters are extensively developed and are being worked in Polampalli Incline and 20 and 22 Inclines. The King Seam splits into top (0.9 m) and bottom (1 m) towards the northern part of the coalfield.

Table 1—Showing stratigraphic succession of Lower Gondwana sediments in the mainland basin area of Godavari Valley Coalfields

Age	Group	Formation	Thickness (m)	Lithology
Upper Permian to Lower Triassic	LOWER GONDWANA	Kamthi	500 m	*Upper Member*: Coarse grained sandstone with clay clasts and pebbles and subordinate violet cherty siltstones and pebbly beds.
			600 m	*Middle Member*: Alternating sequence of medium-grained white to greenish grey white sandstones and buff to greenish grey clays.
			200 m	*Lower Member*: Medium to coarse-grained, greenish white calcareous sandstones with a few coal seams.
Upper Permian		Barren Measures	500 m	Medium to coarse grained greenish grey to greenish white felspathic sandstone with subordinate variegated clays and micaceous siltstones.
Upper part of Lower Permian		Barakar	300 m	*Upper Member*: Coarse white sandstone with subordinate shale and coal seams.
				Lower Member: Coarse-grained sandstones with lenses of conglomerates subordinate shales/clays and few thin bands of coal.
Lower Permian		Talchir	350 m	Fine-grained sandstone, splintery green clays, shales, chocolate coloured clays, pebble beds and tillite.
				.....Unconformity.....
Upper Proterozoic				Sullavai/Pakhal

Kothagudem area—The area is located nearly 39 km east of Yellandu Coalfield. The Barakar sediments containing the coal seams are mostly concealed below the Barren Measures. The Kothagudem coal belt stretches to about 18 km from Kothagudem in the north to Pengadapa in the south. The exploration of the coal is confined only to the King Seam, of which the average thickness ranges from 2.1 to 31.3 m. The seam is being worked up to 3.33 m in Incline no. 2 but the thickness of the seam increases towards south splitting into two and depending upon the local conditions it is being worked in convenient sections with the names of 'Red', 'Blue' and 'Green'.

The general sequence of coal seams in the area as established by Kothagudem Collieries Co. Ltd., is as follows:

Top (Queen) Seam	6.7 to 13.5 m
Parting	42 m
King Seam	2.1 to 31.3 m
Parting	0.91 to 6.3 m
Bottom (Green) Seam	4.2 to 8.4 m

Ramagundam area—This area is situated south of the Godavari River extending up to Ladnapuram in the south for about a stretch of 16 km and forms the most important coal bearing part of the Godavari Graben. The sequence of coal seams established (Ramanamurty, 1977) in the area is as follows:

Strata	*Thickness*
Barren Measures Formation	
Sandstone	11.71-30.12 m
No. 1A seam (highly shaly coal)	0.45- 6.15 m
Sandstone	24.39-34.28 m
No. I seam	5.09- 9.71 m
Sandstone	14.73-26.35 m
No. II seam	1.75- 6.17 m
Sandstone	32.72-62.77 m
No. II/A seam	0.75- 3.00 m
Sandstone	46. 5-73.00 m
No. III seam	4.65-10.35 m
Sandstone	0.00-15.10 m
No. IV seam	1.06- 3.81 m
Sandstone	35.98-76.59 m
No. IV A seam	0. 5- 1.00 m
Sandstone	71.24 m
Talchir Formation	

Out of the seven coal seams, No. I, II, III and IV are being worked as they are persistent and economically significant while the rest three coal seams are either developed mostly to a local extent or contain low grade coal.

Belampalli area—The area is situated north of Godavari River and extends over a strike length of about 45 km from Khairagura in the north-west up to Belampalli in the south-east. The Barakars in the area are overlain by Barren Measures Formation and include four coal seams but at present only two coal seams, the Salarjung Seam and Ross Seam, are being worked out.

The general sequence of the coal seams in the area is as follows:

Strata	*Thickness*
Barren Measures Formation	
Parting	30.00- 40.00 m
No. I Seam	0.02- 4.35 m
Parting	10.00- 46.90 m
No. II Seam	1.00- 6.03 m
Parting	70.00- 80.00 m
Salarjung Seam/No. III Seam	1.05- 12.00 m
Parting	24.00- 40.00 m
Ross Seam/No. IC Seam	0.5 - 5.07 m
Sandstone	95.00-110.00 m

The lowermost coal seam is named as Ross Seam in Belampalli area while in other areas it is known as No. IV Seam. In the southern part around Shanti Khani it splits into two with a parting of 5.5 m sandstone.

Seam no. III or the Salarjung Seam remains almost uniform in Belampalli area but in Golet area it splits up into two sections.

Mandamari-Ramkrishnapuram area—The coal measures of this area form a part of the Somagudem-Mandamari - Ramkrishnapuram - Srirampur - Indaram coal belt traceable from Somagudem in the north to Indaram in the south. The sequence of coal seams as established by Ramana, Ramanamurthy and Dawood (1974) is as follows:

Strata	*Thickness*
Barren Measures Formation	
Parting-Sandstone	10.00- 20.00 m
No. I A seam with shale band	3.06- 5.04 m
Parting	15.00- 20.00 m
No. I seam with shale band	2.01- 5.05 m
Parting	9.45- 16.08 m
No. II B Seam	1.6 - 2.13 m
Parting	10.00- 14.6 m
No. II A Seam	1.1 - 3.4 m
Parting	8.00- 10.00 m
No. II Seam	1.2 - 6.9 m
Parting	22.7 - 33.8 m
No. III A	1.5 - 1.8 m
Parting	12.1 - 24.2 m
No. III Seam	0.7 - 12.2 m
Parting	6.1 - 29.17 m
No. IV Seam	1.5 - 5.7 m
Parting	8.00- 10.00 m
No. V Seam	0.3 - 1.8 m
Parting	8.7 - 18.00 m
No. VI Seam	0.61- 1.22 m

Parting 80.00-100.00 m
Talchir Formation

In general, the Barakars of Tandur area are believed to have been repeated due to south westerly down throw fault and No. III and No. IV seams are correlatable with Salarjung and Ross seams of Belampalli area respectively.

PALYNOFLORAS

The sporae dispersae distributed among the coal seams investigated (Table 2) from Godavari Graben has been assigned to 48 genera (*sensu* Bharadwaj, 1962; Bharadwaj & Salujha, 1964; Bharadwaj & Srivastava, 1969; Tiwari, 1964; Tiwari & Moiz, 1971) which are listed below:

Leiotriletes, Callumispora, Hennellysporites, Cyclogranisporites, Lophotriletes, Brevitriletes, Lobatisporites, Horriditriletes, Godavarisporites, Microbaculispora, Lacinitriletes, Pseudoreticulatispora, Indotriradites, Calamospora, Latosporites, Parasaccites, Crucisaccites, Divarisaccus, Caheniasaccites, Potonieisporites, Virkkipollenites, Cuneatisporites, Platysaccus, Lueckisporites, Striatites, Primuspollenites, Labirites, Striatopodocarpites, Faunipollenites, Striapollenites, Distriatites, Illinites, Vesicaspora, Scheuringipollenites, Ibisporites, Tiwariasporis, Kingiacolpites, Distriomonocolpites, Maculataporites, Pilasporites, Hemisphaerium, Peltacystia, Brazilea, Balmeella, Tetraporina, Greinervillites, Leiosphaeridia and *Globulisphaeridium*.

The percentage distribution of various miospore genera is given in Table 3a and b in which the genera, viz., *Hennellysporites, Brevitriletes, Horriditriletes, Parasaccites* and *Scheuringipollenites* are characteristically present among all the samples and hence form the dominant components of palynoflora of the different coal seams in Godavari Graben.

Besides, the genera—*Leiotriletes, Indotriradites, Latosporites, Striatites, Labirites, Striatopodocarpites, Faunipollenites, Illinites, Vesicaspora* and *Ibisporites*—are also associated significantly with the dominant components.

The other genera are rather inconsistently present but in very low percentages. The behaviour of alete miospores is also not consistent throughout the palynofloral spectrum although in some samples they are present in significant amounts. However, their presence among the mioflora have been ignored as their affinity, occurrence and significance in the stratigraphy is not precisely known. The

Table 2—Showing details of coal samples investigated from Godavari Valley coalfields, Andhra Pradesh

Coal seam	Colliery	Location
King Seam	Kothagudem Collieries	No. 2 Incline
King Seam (Red)	Khammam District	Venkatesh Khani Incline 6 & 7
King Seam (Blue)	Khammam District	Venkatesh Khani Incline 6 & 7
Bottom Seam (Blue)	Khammam District	Venkatesh Khani Incline 6 & 7
Blue Seam	Khammam District	No. 9 and 10 Incline
Green Seam	Khammam District	No. 9 and 10 Incline
Top 1 Seam	Khammam District	No. 9 and 10 Incline
Top 2 Seam	Khammam District	No. 9 and 10 Incline
Queen Seam	Yellandu Collieries	Pollampalli Incline
King Seam	Yellandu Collieries	No. 20 Incline
D Seam	Yellandu Collieries	No. 20 Incline
Queen Seam	Yellandu Collieries	No. 22 Incline
D Seam	Yellandu Collieries	No. 22 Incline
Seam 3	Ramagundam Collieries, Karim Nagar District	No. 1 Incline
Seam 4	Ramagundam Collieries, Karim Nagar District	No. 1 Incline
Seam 1	Ramagundam Collieries, Karim Nagar District	Godavari Khani Incline No. 3
Seam 2	Ramagundam Collieries, Karim Nagar District	Godavari Khani Incline No. 3
Seam 3	Ramagundam Collieries, Karim Nagar District	No. 7 Incline
Seam 3	Ramakrishnapuram Collieries, Adilabad District	Ramkrishna Khani
Seam 3	Ramakrishnapuram Collieries, Adilabad District	Ramkrishna Khani
Seam 4	Ramakrishnapuram Collieries, Adilabad District	Ramkrishna Khani
Seam 2	Ramakrishnapuram Collieries, Adilabad District	Motilal Khani
Seam 3	Mandamari area	Kalyani Khani
Seam 4	Mandamari area	Kalyani Khani
Top Seam	Belampalli area	Shanti Khani Incline
Middle Seam	Belampalli area	Shanti Khani Incline
Bottom Seam	Belampalli area	Shanti Khani Incline
Salarjung Seam	Belampalli area	Morgan pit
Ross seam	Belampalli area	Morgan pit
Salarjung Seam	Belampalli area	85 Dip
Ross Seam	Belampalli area	85 Dip

Table 3a—Percentage composition of various palynotaxa in different coal seams of Godavari Graben

Genera/Overall sample no.	1	2	3	5	6	6B	6+6B	7	7C	7+7C	8	9	10C	11	12	13A
PTEROPSIDS																
Lieotriletes	2.5	3.0	3.5	3.0	1.0	2.0	1.5	2.0	0.5	1.4	4.0	3.5	—	5.0	2.5	3.0
Callumispora	1.5	—	3.0	3.0	8.0	10.0	9.0	—	—	—	3.0	—	5.0	2.0	2.0	1.0
Hennellysporites	4.0	2.0	2.0	0.5	2.0	6.0	4.0	1.5	1.0	1.4	1.5	7.0	1.0	10.0	0.0	2.0
Cyclogranisporites	—	—	—	—	1.0	0.5	0.8	—	—	—	1.0	—	—	—	0.5	—
Verrucosisporites	—	—	—	0.5	—	—	—	—	—	—	—	—	—	—	—	—
Lophotriletes	3.0	—	1.5	0.5	—	—	—	1.5	—	0.9	1.0	—	0.5	0.5	2.0	3.0
Brevitriletes	24.5	28.0	29.5	34.0	40.0	29.0	34.5	20.0	25.0	22.5	15.0	14.0	13.5	10.0	19.0	11.0
Lobatisporites	1.0	—	1.5	2.0	—	—	—	0.5	0.5	0.5	—	—	—	—	—	—
Horriditriletes	4.0	4.0	11.0	3.0	4.0	7.0	5.5	3.0	4.0	3.5	7.0	2.5	—	1.0	25.0	17.0
Godavarisporites	0.5	7.5	—	4.0	3.0	4.0	3.5	—	—	—	1.0	1.0	—	3.0	3.0	—
Pseudoreticulatispora	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.0	—
Lacinitriletes	—	—	—	—	—	—	—	—	—	—	—	—	—	1.5	2.0	—
Microbaculispora	—	—	1.0	—	—	—	—	—	—	—	—	—	—	—	—	—
Calamospora	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Latosporites	1.5	—	—	—	—	—	—	1.5	1.0	1.4	13.0	7.5	0.5	—	5.5	9.0
LYCOPSID																
Indotriradites	—	—	0.5	—	—	—	—	—	—	—	—	—	—	—	—	1.0
GYMNOSPERM																
Parasaccites	5.5	6.0	6.5	15.0	8.0	11.0	9.5	4.0	2.0	3.0	5.5	2.0	24.0	8.0	0.5	4.0
Crucisaccites	—	—	—	—	—	—	—	—	—	—	—	—	0.5	—	—	—
Divarisaccus	—	—	—	0.5	—	—	—	—	—	—	0.5	—	—	0.5	—	—
Cabeniasaccites	—	—	0.5	—	—	—	—	—	—	—	—	—	—	0.5	—	—
Potonieisporites	—	—	2.0	2.0	—	—	—	1.0	—	0.5	—	—	—	0.5	—	—
Cuneatisporites	—	—	—	—	—	—	—	—	—	—	—	—	—	2.5	0.5	0.5
Platysaccus	1.0	2.0	2.0	—	—	—	—	8.0	9.0	8.5	2.5	3.5	0.5	1.0	4.0	8.5
Lueckisporites	—	—	—	—	—	—	—	—	0.5	0.4	—	—	—	—	—	—
Striatites	3.0	2.0	1.0	—	2.0	—	1.0	2.0	2.0	2.0	1.5	0.5	0.5	1.0	1.5	4.0
Primuspollenites	—	—	—	—	—	—	—	—	—	—	3.0	8.0	—	0.5	2.0	1.0
Labirites	7.0	5.0	2.0	2.0	2.0	—	2.0	5.0	3.0	4.0	6.0	3.0	2.5	2.0	2.5	1.0
Striatopodocarpites	6.0	5.0	5.0	1.5	2.0	2.0	2.0	1.0	5.0	3.0	6.0	10.0	6.5	5.0	1.0	3.0
Striapollenites	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Faunipollenites	8.0	3.0	6.0	2.5	3.0	3.0	3.0	2.0	2.0	2.0	3.5	4.5	2.0	7.0	2.0	2.0
Distriatites	—	—	—	—	—	—	—	—	0.5	0.4	—	—	—	—	—	—
Illinites	7.0	2.0	—	1.0	2.0	3.0	1.5	—	—	—	1.0	4.5	5.5	10.0	—	1.0
Vesicaspora	2.0	3.0	1.5	1.0	—	—	—	0.5	0.5	0.5	—	1.0	4.0	4.0	1.5	5.0
Scheuringipollenites	11.0	7.5	12.0	10.0	5.0	2.0	3.5	25.0	25.0	25.0	10.0	14.0	18.5	12.0	12.5	12.0
Ibisporites	0.5	—	0.5	0.5	1.0	—	0.5	—	4.0	2.0	0.5	3.0	3.0	2.0	0.5	1.0
Tiwariasporis	1.0	2.0	1.0	1.0	1.0	—	0.5	5.5	3.0	4.4	9.0	0.5	3.5	0.5	2.0	3.0
Kingiacolpites	—	2.0	2.0	1.5	—	1.0	0.5	1.0	1.5	0.9	—	3.0	1.5	2.0	—	2.0
Distriomonocolpites	—	—	0.5	—	—	1.0	0.5	—	—	—	—	—	—	—	—	—
PHYTOPLANKTON																
Maculatasporites	—	—	—	—	0.5	—	0.5	—	—	—	—	0.5	—	—	0.5	—
Pilasporites	2.5	5.0	2.5	4.0	3.0	5.0	4.0	4.0	1.5	2.7	1.0	1.5	3.0	4.0	1.5	1.0
Hemisphaerium	—	3.0	—	0.5	2.0	5.0	3.5	3.5	0.5	2.0	—	0.5	—	2.0	—	—
Brazilea	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balmeella	0.5	2.0	—	0.5	—	0.5	0.2	—	—	—	0.5	—	1.0	—	—	—
Leiosphaeridium	2.0	5.0	1.0	6.0	9.0	8.0	8.5	5.0	7.0	6.0	4.0	4.0	1.0	2.0	4.0	4.0
Greinervillites	—	—	—	—	—	—	—	—	0.5	0.4	—	—	—	—	—	—
Globulisphaeridium	—	1.0	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—
Tetraporina	—	—	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—
Peltacystia	—	—	—	—	—	—	—	1.0	1.5	0.7	—	—	1.0	—	—	—

Kothagudem Collieries: No. 2 Incline—1. King Seam; Nos. 6, 7 Incline—2. King Seam (red), 3. King Seam (blue); Nos. 9, 10 Incline—5. Blue Seam, 6, 6B. Green Seam; 6×6B. Average; 7, 7C. Top Seam; 7×7C. Average. *Yellandu Collieries*: Polampalli Incline—9. Queen Seam; 20 Pit Incline—10C. King Seam, 11. D Seam; 22 Pit Incline—12. Queen Seam, 13. A, D Seam

Table 3b—Percentage composition of palynotaxa in different coal seams in Godavari Graben

Genera Samples nos.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
PTEROPSIDS																	
Leiotriletes	6.0	3.0	3.0	6.0	3.0	3.0	1.0	0.5	—	2.0	0.5	4.0	1.0	6.0	11.0	2.0	4.0
Callumispora	1.0	1.5	1.0	—	1.0	4.0	6.0	2.0	—	—	1.0	—	0.5	1.0	2.5	—	—
Hennellysporites	11.0	12.0	2.0	4.0	4.0	6.0	4.0	4.0	3.0	3.0	3.0	8.0	14.5	1.0	24.0	4.0	21.0
Cyclogranisporites	1.0	3.0	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lophotriletes	—	0.5	—	—	—	—	—	—	—	—	—	2.0	—	—	—	—	—
Brevitriletes	14.5	25.0	10.0	11.0	12.0	21.0	26.0	25.0	16.0	18.0	16.0	21.0	23.0	20.0	16.0	15.0	16.5
Horriditriletes	5.0	3.0	5.0	2.0	3.5	0.5	2.0	2.0	—	1.0	1.5	2.0	1.0	5.0	4.0	6.0	5.0
Godavarisporites	0.5	3.0	2.0	1.0	0.5	0.5	5.0	2.0	1.0	1.0	—	5.0	4.0	5.0	3.0	1.0	0.5
Pseudoreticulatispora	—	—	—	—	—	—	—	—	—	—	—	0.5	—	—	—	—	—
Lacinitriletes	—	2.5	0.5	0.5	—	—	—	0.5	—	—	—	—	—	—	—	—	—
Microbaculispora	—	—	—	—	—	—	—	—	—	—	—	—	0.5	—	—	1.0	0.5
Latosporites	0.5	—	3.0	6.0	1.0	0.5	1.5	1.0	—	—	—	1.5	0.5	—	—	—	—
LYCOPSID																	
Indotriradites	—	4.5	—	—	—	0.5	—	0.5	—	—	—	0.5	0.5	5.0	6.5	1.0	0.5
GYMNOSPERMS																	
Parasaccites	5.0	5.0	0.5	1.5	6.0	9.0	8.0	4.0	4.0	6.0	1.0	6.0	9.5	3.0	4.5	2.0	4.5
Divarisaccus	—	—	—	—	—	0.3	—	—	—	—	—	—	—	—	—	—	0.5
Potonieisporites	—	—	—	—	—	—	—	—	2.0	—	—	0.5	—	—	—	—	—
Cuneatisporites	3.5	—	—	1.0	0.5	—	—	—	1.5	1.5	0.5	—	—	2.0	0.5	—	—
Platysaccus	2.5	1.0	3.0	5.0	3.0	—	—	1.5	2.0	1.5	4.5	1.0	0.5	3.0	2.0	4.0	2.0
Lueckisporites	—	—	0.5	1.5	—	—	—	—	—	—	—	—	—	—	—	—	—
Striatites	3.0	1.0	3.5	1.5	2.0	2.0	0.5	1.5	4.0	2.0	1.0	1.5	1.0	6.0	1.5	7.0	1.0
Primuspollenites	—	0.5	3.0	6.5	—	—	—	—	—	—	0.5	1.5	—	—	—	0.5	—
Labirites	5.5	0.5	5.0	3.0	6.0	—	—	3.0	8.0	6.0	3.0	6.0	3.0	6.0	1.0	5.0	2.5
Striatopodocarpites	5.5	5.5	5.0	3.0	7.0	6.0	5.0	5.0	4.0	4.0	2.0	6.5	7.0	3.0	3.0	3.0	4.0
Striapollenites	—	—	—	—	—	—	—	—	0.5	—	—	—	—	—	—	—	—
Faunipollenites	5.5	1.0	7.0	4.0	4.0	4.5	0.5	8.0	9.0	8.0	4.0	1.5	4.0	2.0	0.5	5.0	3.0
Distriatites	—	—	—	—	—	—	—	—	—	0.5	—	—	—	—	—	—	—
Illinites	6.5	2.0	2.5	4.0	3.0	2.0	3.0	3.0	2.0	8.0	—	3.5	2.0	3.0	1.0	8.0	5.0
Vesicaspora	5.0	1.0	1.0	2.0	8.0	7.0	0.5	4.0	5.5	7.0	3.5	3.5	1.0	6.0	3.0	4.0	3.0
Scheuringipollenites	9.5	12.0	23.0	23.0	18.0	11.0	12.0	16.0	22.5	14.0	29.0	8.5	10.0	8.0	6.0	15.0	7.0
Ibisporites	2.5	—	2.0	4.0	5.0	1.5	2.0	2.0	7.5	1.0	6.5	2.5	1.0	—	1.0	2.0	1.0
Tiwariasporis	2.2	2.0	3.0	5.0	1.5	1.0	3.0	1.0	2.5	3.0	4.5	6.0	1.5	3.0	0.5	5.5	0.5
PHYTOPLANKTON																	
Kingiacolpites	2.0	2.0	3.0	0.5	4.0	3.0	1.0	0.5	2.5	—	0.5	0.5	0.5	—	0.5	0.5	3.0
Maculatasporites	—	—	1.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pilasporites	1.5	3.0	3.0	1.0	3.0	8.0	8.0	6.5	2.0	9.5	5.0	4.0	7.0	4.0	7.0	2.5	10.0
Hemisphaerium	—	2.0	2.0	—	1.0	0.5	6.0	2.5	—	0.5	2.0	—	4.0	—	—	—	1.0
Brazilea	—	—	—	—	—	—	—	—	—	—	1.0	—	—	—	—	—	—
Balmeella	—	—	0.5	—	—	1.5	—	—	—	0.5	—	1.0	1.0	—	—	—	—
Leiosphaeridium	1.0	3.5	4.0	2.0	3.0	6.0	5.0	3.0	1.0	1.5	6.0	2.0	2.0	2.0	1.0	1.0	4.0
Tetraporina	—	—	0.5	—	1.0	0.5	—	1.5	—	—	1.0	0.5	—	—	—	—	—

Ramagundam Collieries : No. 1 Incline—14. Seam 3, 15. Seam 4; No. 3 Incline—16. Seam 1, 17. Seam 2, No. 7 Incline—18. Seam 3. *Ramakrishnapuram Collieries* : Ramkrishna Khani 1-19. Seam 3, 20. Seam 4; Motilal Khani 1-21. Seam 2. *Mandamari Area* : Kalyani Khani—22. Seam 3, 23. Seam 4. *Belampalli Collieries* : Shanti Khani—24. Top Seam, 25, Middle Seam, 26. Bottom Seam; Morgan Pit—27. Salarjung Seam, 28. Ross Seam; 85 Dip—29. Salarjung Seam, 30. Ross Seam.

qualitative association of palynospores as well as their quantitative representation in different areas of the Godavari Graben has been discussed separately as each of them are situated wide apart and as such their mutual relationships are unknown. The assemblages bear the same designation.

Yellandu area

The general behaviour of the dominant components and their variation in individual coal seams is shown in Table 3a. *Parasaccites* is present up to its maximum only in the King Seam of No. 20 Incline while in the leader 'D' seam lying above it decreases considerably. On the contrary *Hennellysporites* records a reverse trend, i.e. it is low in the King Seam but becomes high in the 'D' seam of No. 20 Incline and also in the Queen Seam of Polampalli Incline. In No. 22 Incline the Queen and the 'D' seams are marked by the dominance of *Horriditriletes, Scheuringipollenites* and *Parasaccites* continues to decrease from No. 20 to Polampalli to No. 22 Inclines. *Latosporites* increases steadily in the same direction. *Primuspollenites* and *Illinites* are present significantly in Queen Seam of Polampalli Incline.

The distinctive distribution of all the dominant constituents and their percentage frequency suggests segregation of the samples into sporologically three different assemblages. The percentage of inconsistently occurring genera have been merged into those occurring consistently in order to represent the pollen spectrum more uniformly rather than irregularly.

Assemblage E—This assemblage is characterised by the dominance (Table 4a) of *Parasaccites* (18%) and *Scheuringipollenites* (16%). *Brevitriletes* (12%) occur subdominantly and is associated with *Hennellysporites* (6%), *Striatopodocarpites* (6%) and *Illinites* (8%). The total percentage of laevigate + apiculate triletes amounts to 14 per cent (Table 5), varitriletes 12 per cent, monosaccate 18 per cent, nonstriate-disaccate 32 per cent and striate disaccate up to 15 per cent. Thus the overall percentage is largely shared by the nonstriate disaccate pollen grains. Such an assemblage is present in the King Seam and D Seam of No. 20 Incline (sample Nos. 10 & 11).

Assemblage B1—The Queen Seam of Pollampalli Incline contains Assemblage Bl. This is characterised by the combined dominance of *Brevitriletes* (14%) and *Scheuringipollenites* (14%). *Striatopodocarpites* (10%) closely follows along with *Primuspollenites* (8%) and *Hennellysporites* (7%). Monosaccates have reduced to 2 per cent. Thus the Queen Seam of Polampalli Incline contains mioflora quite different from the Assemblage E of King Seam. The total percentage of laevigate + apiculate triletes amounts to 14 per cent and the varitriletes 14 per cent. Nonstriate-disaccate (26%) show a slight decrease in their percentage. The monolete miospores (8%) and reticuloid disaccate (8%) record their appearance for the first time in this assemblage.

Assemblage B2—Horriditriletes dominates the assemblage up to 21 per cent. The dominant components of Assemblage E reduce to subdominance. *Latosporites* increases to 7 per cent. The average total of laevigate + apiculate triletes rises to the maximum (32%). Nonstriate-disaccates are present up to 23 per cent. Such a mioflora is contained in the Queen Seam and D Seam (sample nos. 12 & 13) of No. 22 Incline. This coal seam shares its resemblance with the Queen Seam of Pollampalli Incline in respect of *Latosporites* and *Primuspollenites* but differs in having high percentage of *Horriditriletes* and *Striatopodocarpites*. In Polampalli Incline Queen Seam is being worked out only partly and such differences may occur due to incomplete representation of the entire thickness of the coal seam. It may also indicate variations in the lateral extension of the same seam. Keeping in view the above facts the palynofloras of the Queen Seam from two inclines are described in the same but a different sub-assemblages.

Kothagudem area

The main working coal seam in this area is the King Seam which is being worked out partly in convenient sections of Red and Blue. This coal seam has been collected from Venkatesh Khani Group of inclines Nos. 6 and 7. From Nos. 9 and 10 Inclines Blue Seam and Green Seam have been collected along with Top 1 and Top 2 seams. King Seam in this area is marked by the dominance of *Brevitriletes*. This character is in sharp contrast with the King Seam of Yellandu area. The genera *Parasaccites* and *Sheuringipollenites* which were dominant in the latter, have reduced considerably in Kothagudem area. *Parasaccites* decreases steadily in the younger coal seams of No. 9 and 10 Inclines while *Scheuringipollenites* becomes maximum in Top 1 Seam. *Latosporites* and *Primuspollenites* attains significance in Top 2 Seam only. Thus the eight samples collected from the Kothagudem area can be segregated into three distinct miospore assemblages.

Assemblage D—This assemblage is characterised by the dominance of *Brevitriletes* (30%) in the King Seam (Red & Blue) of No. 6 Incline, Blue and Green Seams of No. 9 and 10 Inclines, and King Seam of No. 2 Incline. *Parasaccites* (10%), and *Sheuringipollenites* (9%) are present subdominantly. The laevigate + apiculate triletes total up to 19 per cent, varitrilete 30 per cent, nonstriate-disaccate and striate disaccate are present up to 14 per cent each. The variations among different genera in the lateral extension of the King Seam in Kothagudem area are negligible. Monosaccate and varitrilete are highest in 9 and 7 Incline to No. 2 Incline. Striate and nonstriate-disaccates occur in the reverse order.

Table 4a—Showing percentage composition of different assemblages in various collieries of Godavari Graben

Genera	Assemblages	E			D									
	Collieries	Yellandu			Kothagudem								Ramakrishnapuram	
	Incline/Pits	20			2		6&7		9&10				Ramakrishna Khani	
	Coal Seam	King	D	Aver-age	King	King Red	King Blue	Aver-age	Blue	Green	Aver-age	Aver-age	Seam 4	Seam 3
	Sample no.	10	11	10+11	1	2	3	2+3	5	6	5+6	1+(2+3)+(5+6)	20	19
Leiotriletes		0.8	7.0	4.0	3.2	4.7	4.3	4.5	4.3	3.5	4.5	4.2	5.1	2.0
Hennellysporites		1.8	11.0	6.5	4.6	3.7	3.8	3.5	1.8	5.0	3.5	3.2	7.4	6.0
Horriditriletes		0.8	2.0	1.5	5.6	5.7	11.8	8.5	6.3	7.5	7.0	7.6	2.1	4.0
Brevitriletes		14.4	11.0	12.5	25.2	29.7	30.3	30.0	35.3	36.5	35.5	31.6	22.4	28.0
Latosporites		1.4	1.0	1.5	2.2	1.7	1.1	1.5	1.3	2.0	1.5	1.8	2.1	3.5
Parasaccites		25.4	11.0	18.0	6.2	7.7	7.8	7.5	16.5	11.5	14.0	9.9	10.4	10.0
Platysaccus		1.4	5.0	3.0	1.6	2.7	2.8	3.5	1.3	2.0	1.5	1.8	2.1	3.5
Striatites+Labirites		4.6	5.0	5.0	11.4	9.7	4.5	7.0	4.6	7.0	5.5	7.6	5.2	4.5
Striatopodocarpites		7.4	6.0	6.5	6.6	6.7	5.8	6.5	2.8	4.0	3.5	5.8	7.6	7.0
Faunipollenites		2.8	8.0	5.5	8.6	4.7	6.8	5.5	3.8	5.0	4.5	5.8	5.8	2.5
Illinites		6.4	11.0	8.5	7.7	3.7	2.8	3.5	4.3	3.5	4.0	4.6	3.6	5.0
Vesicaspora		4.8	5.0	5.0	2.5	4.7	2.3	3.5	2.3	2.0	2.0	1.8	8.4	2.5
Scheuringipollenites		19.4	13.0	16.0	12.7	9.2	12.8	11.0	11.3	5.5	8.5	10.5	12.6	14.0
Ibisporites		4.3	3.0	3.5	1.2	1.7	1.3	1.5	1.8	2.5	2.0	1.5	3.1	4.0
Tiwariasporis		4.3	1.0	3.0	1.7	3.7	1.8	2.5	2.3	2.5	2.5	1.5	2.6	5.0

Assemblage B1—Brevitriletes though reduced considerably in To 2 seam of No. 9 and 10 Inclines yet it dominates the assemblage. *Latosporites* distinguishes this seam by its presence up to 13 per cent. *Scheuringipollenites* (10%) and *Horriditriletes* (7%) closely follow the above genera. *Primuspollenites* is present up to 3 per cent. In this respect it shows resemblance with the Queen Seam of Polampalli Incline in Singareni area. The total percentage of laevigate + apiculate trilete miospores remain at 19 per cent but varitrilete and nonsaccate-decrease persistently. Striate disaccate increase to 26 per cent. In this manner the Top 2 Seam shows a palynoflora distinctly different from the King Seam.

Assemblage A—It is found in the Top 1 Seam of No. 9 and 10 Inclines. This is marked by the dominance of *Scheuringipollenites* (25%). *Brevitriletes* (22) also rises to subdominance. *Platysaccus* increases to 9 per cent. The total percentage of laevigate + apiculate triletes (8%), monoletes (1%), monosaccates (3%) and striate-disaccate decreases considerably while the nonstriate-disaccate share the maximum percentage (37%) of the palynoflora. In this respect the Top 1 Seam differs from all the underlying coal seams.

Ramagundam area

Five samples from three different inclines were collected. The genus *Hennellysporites* is present significantly in the two older coal seams but reduces in the younger ones. *Parasaccites* and *Brevitriletes* also behave likewise (Table 3b). *Indotriradites*, although rare, is present in Seam 4 only. *Latosporites* and *Primuspollenites* are present in very small amounts in Seam 3 and 4 while in Seam 2 and 1 they are present significantly. *Scheuringipollenites* increases gradually in the younger coal seams reaching its maximum in Seam 1 of No. 3 Incline.

The quantitative distribution of various miospores genera distinguishes two distinct miofloral assemblages as follows:

Assemblage C1—Seam No. 4 of No. 1 Incline contains the dominance of *Brevitriletes* (26%, Table 4a). *Hennellysporites* (12%) and *Scheuringipollenites* (12%) occur next to it. *Indotriradites* (4.5%) is characteristically associated with this seam only which indicates an older aspect of the coal seam to which it is associated. The total percentage of laevigate + apiculate trilete (25%) and varitrilete (26%) characterise the assemblage in close association with nonstriate-disaccate (23%).

Assemblage C2—The genus *Brevitriletes* (15%) reduces considerably in this assemblage while *Scheuringipollenties* (15%) increases slightly. Their combined dominance is associated with *Hennellysporites* (8%), *Latosporites* (5%), *Parasaccites* (6%), *Striatites* (9%) and *Striatopodocarpites* (7%). *Indotriradites*, which was

(Table 4a contd.....)

			C											
			C1			C2						C3		
		Manda-mari	Ramagundam			Belampalli								
Motilal Khani		Kalyani Khani	1	7		Mor-gan Pit	85 Dip		Shanti Khani	85 Dip	Mor-gan Pit		Shanti Khani	
Seam 2	Aver-age	Seam 4	Seam 4	Seam 3	Seam 3	Aver-age	Ross Seam	Ross Seam	Aver-age	Bot.	Salar-jung	Salar-jung	Aver-age	Midd-le	Total Aver-age
21		23	15	14	18	14+18	28	30	28+30	26	29	27	27+29	25	C1+C2 +C3
1.2	2.7	2.8	7.0	6.0	3.3	5.0	12.0	5.0	8.5	2.5	2.7	7.0	4.8	5.0	5.5
5.2	6.2	4.0	13.5	11.5	4.7	8.0	25.8	22.0	23.9	15.5	9.0	8.0	8.5	9.0	13.0
13.2	3.1	2.0	4.5	5.5	4.4	5.0	5.3	6.0	5.6	2.5	6.0	6.0	6.2	3.0	4.5
26.2	25.5	18.8	26.0	15.0	12.7	15.0	17.2	18.2	17.6	24.5	15.7	21.0	18.2	22.0	20.5
2.2	2.6	1.0	1.5	1.0	1.8	1.3	1.0	1.2	1.1	1.5	0.7	1.0	1.1	2.5	1.5
6.0	8.8	7.0	6.5	5.5	6.8	6.0	5.8	6.0	5.9	10.5	2.0	4.0	3.0	7.5	6.5
1.2	1.8	3.8	2.5	6.0	4.4	5.0	3.8	3.0	3.4	1.5	4.7	6.6	5.3	2.5	3.4
7.0	5.5	9.6	4.5	9.5	9.8	9.0	5.0	6.9	5.9	6.5	13.4	14.0	13.7	9.5	8.2
6.2	6.9	4.8	7.0	6.0	7.7	6.7	4.3	5.0	4.1	8.5	3.7	4.0	3.8	7.5	6.2
9.2	5.8	8.8	2.5	6.0	4.7	5.0	1.8	4.0	4.9	5.0	5.0	3.0	4.0	2.5	3.9
4.2	4.2	8.8	3.5	7.0	3.7	5.0	2.3	6.0	4.1	3.0	8.0	4.0	6.0	5.0	4.4
5.2	5.3	8.0	2.5	5.5	8.7	7.0	4.3	4.0	4.1	2.0	4.7	7.0	5.8	4.5	4.3
17.2	14.6	14.8	13.5	10.0	18.7	15.0	7.3	8.0	7.1	11.5	15.7	10.0	12.8	8.5	11.4
3.2	3.4	2.0	1.5	3.0	5.8	4.0	2.3	2.5	2.4	2.5	2.7	1.0	1.8	3.5	3.0
2.2	3.6	3.8	3.5	2.5	2.4	3.0	1.8	2.2	2.0	2.5	6.0	4.0	5.0	7.5	4.0

present in Assemblage C2 is absent in this assemblage. The total percentage of laevigate and apiculate trilete amounts to the tune of 18 per cent and nonstriate-disaccate to 37 per cent. Varitrilete and striate-disaccate are present in 15 per cent and 20 per cent respectively. The coal seam 3 of No. 1 Incline and Seam 3 of No. 7 Incline, in which Assemblage C2 is distributed, compare very closely to each other in the distribution pattern of their palynoflora. However, the trend of variation of the dominant components in Seam 3 of No. 7 Incline shows a slight increase in the percentage of *Scheuringipollenites* thus increasing the total representation of nonstriate-disaccate slightly higher than those of Seam 3 of No. 1 Incline. *Hennellysporites* is also slightly reduced in No. 7 Incline while it increases in No. 1 Incline. Although the differences are marked out only slightly yet the general behaviour of rest of the genera compare very closely with that of Seam 3 of No. 1 Incline and hence it is preferred to retain the same in Assemblage C2. The differences, however, represent only the lateral variations within the same seam.

Assemblage A—Seam 2 and Seam 1 of Godavari Khani Incline No. 3 is marked by the dominance of *Sheuringipollenites* (23%, Table 4b). *Brevitriletes*, which was dominant in Assemblage C1, has reduced considerably along with *Hennellysporites* and *Parasaccites*. On the other hand, *Latosporites* and *Primuspollenites* mark a slight increase in their percentage. This character is in sharp contrast with the older assemblage described above. While the total representation of laevigate and apiculate trilete (13%), varitrilete (10%) and monosaccates (1%) have reduced considerably, the monolete miospores (5%), nonstriate, reticuloid and striate-disaccate (37%, 5%, 20% respectively) mark a significant increase in their percentages.

Ramkrishnapuram area

As shown in Table 3b the three coal seams collected from two different Inclines (Seam nos. 2, 3, 4) show a close similarity in qualitative as well as quantitative occurrence of various miospore genera. In view of their similarities all the three coal seams have been grouped together to represent the same miospore Assemblage D (Table 4a) of the Ramkrishnapuram area.

Assemblage D—Brevitriletes (25%) in general dominates over the genus *Scheuringipollenites* (13%) and thus characterises the assemblage. These two genera continue to increase in their percentage from oldest to the youngest seam while *Hennellysporites* and *Parasaccites* record a reverse trend. The overall representation of laevigate and

Table 4b—Showing percentage composition of different assemblages in various collieries of Godavari Graben

Assemblages	B						A							
	B1			B2										
Collieries	Yellandu	Kothagudem	Average	Yellandu	Average	Total Average	Kothagudem	Mandemari	Belampalli	Ramagundam				
Incline/Pits	Polampalli	9 & 10		No. 22				9 & 10	Kalyani Khani	Shanti Khani		Godavari Khani	Average	Total Average
Coal Seam	Queen	Top 2		Queen	D		B1+B2	Top 1	Seams 3	Top	Seam 2	Seam 1		
Genera / Samples nos.	9	8	9+8	12	13	12+13		7	22	24	17	16	16+17	7+22+24 +16+17
Leiotriletes	4.7	5.0	4.6	5.0	4.0	4.5	4.5	2.3	0.4	1.5	7.0	4.8	5.9	2.5
Hennellysporites	8.3	2.0	5.0	2.2	3.0	2.6	4.0	2.3	3.4	6.5	4.5	3.3	3.9	4.5
Horriditriletes	3.7	8.0	5.6	26.0	18.0	22.0	14.0	4.8	0.4	2.5	4.5	5.3	5.5	3.3
Brevitriletes	15.3	16.0	15.6	20.0	12.0	16.0	16.0	23.3	16.4	17.0	11.0	11.3	11.3	17.0
Latosporites	8.7	14.0	11.3	6.6	10.0	8.3	10.0	2.3	0.4	1.0	6.5	4.3	5.5	2.3
Parasaccites	3.3	7.0	5.3	1.6	5.0	3.3	4.0	3.8	6.4	2.0	2.0	1.8	1.9	3.5
Platysaccus	4.3	3.0	3.5	5.6	9.0	7.3	5.4	9.8	3.4	5.5	8.0	4.8	6.5	6.3
Striatites+ Labirites	4.9	9.0	7.0	6.2	7.0	6.6	7.5	7.6	12.6	6.0	7.5	11.1	9.5	8.9
Striatopodocarpites	11.3	7.0	9.0	2.0	4.0	3.0	6.0	3.8	4.4	3.5	3.5	6.3	4.9	4.0
Faunipollenites	5.7	4.0	4.8	3.0	3.0	3.0	4.0	3.3	9.4	5.5	4.5	8.3	6.5	6.0
Illinites	5.7	2.0	5.3	1.0	1.0	1.0	3.0	1.4	4.4	1.5	4.5	3.8	4.4	3.0
Vesicaspora	2.3	1.0	1.5	2.6	6.0	4.3	3.0	1.4	5.9	4.5	2.5	2.3	2.5	3.6
Scheuringipollenites	15.3	11.0	13.0	13.6	13.0	13.3	13.1	25.8	22.7	30.0	23.5	24.0	23.7	25.5
Ibisporites	4.3	1.0	2.7	1.6	2.0	1.8	2.0	2.3	7.4	7.5	4.5	3.3	3.9	5.1
Tiwariasporis	1.7	10.0	5.8	3.0	3.0	3.0	3.0	5.3	2.4	5.5	5.5	4.3	4.9	4.5

apiculate triletes totals to 14 per cent whereas varitrilete and nonstriate-disaccate are present up to 24 per cent and 22 per cent respectively. The percentge of monosaccate pollen is still maintained on an average up to 7 per cent.

Mandamari area

The two coal seams, viz., Seam 4 and Seam 3, collected from Kalyani Khani in Mandamari Division show distinctly different palynofloras with each other (Table 3b). *Brevitriletes* decreases from below to become maximum in the youngest seam. On this basis both the seams have been placed in two different miospore assemblages (Table 4a, b).

Assemblage D—Coal Seam 4 of Kalyani Khani Incline shows the dominance of *Brevitriletes* (18%) while *Scheuringipollenites* (14%) along with *Faunipollenites* and *Illinites* (8% each) and *Vesicaspora* (7%) are represented subdominantly. The average percentage of laevigate and apiculate triletes total up to 7 per cent; varitrilete ranges up to 18 per cent; nonstriate and striate disaccate are present up to 33 per cent and 23 per cent respectively.

Assemblage A?—The dominant genus *Brevitriletes* of Assemblage D declines to subdominance in Assemblage A? *Scheuringipollenites* rises to dominance being represented up to 23 per cent. *Faunipollenites* (9%), *Parasaccites* (6%) and *Ibisporites* (7%) occur next to the subdominant genus *Brevitriletes*. The laevigate and apiculate triletes as well as varitriletes as compared to Assemblage D, declines to 4 per cent and 6 per cent respectively while the population of nonstriate and striate-disaccates increases to 43 per cent and 28 per cent respectively. This assemblage is associated with coal seam No. 3 of Kalyani Khani Incline.

Belampalli area

The Tandur collieries, situated 2.5 km north-east of Belampalli Railway Station, comprises a large group of collieries. Coal samples were collected from the working faces of the coal seams in Shanti Khani Incline, Morgan pit and 85 Dip. Salarjung Seam and Ross Seam is being worked out in the latter two inclines while in Shanti Khani Incline the Top, Middle and Bottom Seams are being worked. *Hennellysporites* is associated with all the older seams of the above inclines but it reduces in the younger coal seams. *Leiotriletes* and *Parasaccites* (Table 3b) behave similar to *Hennellysporites*. *Brevitriletes* occurs uniformly in the Salarjung and Ross seams but in Shanti Khani Incline it reduces from older to younger seams. Similarly *Indotriradites* is uniformly present in all the coal seams of Morgan pit, 85 Dip and older two coal seams of Shanti Khani Incline. *Scheuringipollenites*, on the other hand, increases from the older towards the younger seams. Such a distribution of the above taxa segregates the palynoflora into three distinct miofloral assemblages.

Assemblage C2—The Ross Seam of Morgan pit and 85 Dip contain Assemblage C2 in which *Hennellysporites* is represented to its maximum of 23 per cent (Table 4a). *Brevitriletes* follows next to it. *Leiotriletes* and *Scheuringipollenites* occur next to *Brevitriletes*. *Indotriradites* is present in the Ross Seam but only lowly. The average percentage of the laevigate and apiculate triletes total up to 38 per cent, varitrilete 16 per cent and zonate trilete 4 per cent. The nonstriate-disaccate like varitrilete are present up to 16 per cent but striate-disaccate (9%) are present in low amounts.

However, the mioflora of the Bottom Seam of Shanti Khani Incline shows a different picture. The general dominance is marked by the genus *Brevitriletes* unlike that of Ross Seam palynoflora. On the contrary, *Hennellysporites* (14%) shows a slight decrease in its percentage. The total representation of laevigate and apiculate trilete (21%) and zonate trilete (1%) show a slight decline from the normal trend whereas varitrilete (23%), monosaccate (9%) and striate-disaccate (16%) tend to increase. Thus, the differences in the Bottom Seam become quite apparent yet the higher presence of *Hennellysporites* closely alienates it with Ross Seam mioflora. The trend of variation of rest of the taxa from Bottom Seam to Middle Seam in Shanti Khani Incline also bears a great parallelism with that observed in Ross Seam to Salarjung Seam. In view of the above facts it has been preferred to retain the Bottom Seam of Shanti Khani Incline in Assemblage C2.

Assemblage C3—The Assemblage C3 of the Salarjung Seam in Morgan pit and 85 Dip is marked by the dominance of *Brevitriletes* (18%) and *Scheuringipollenites* (12%) while *Hennellysporites*, which was a dominant genus of Assemblage C2, has reduced to subdominance. The percentage of *Indotriradites* is almost similar to Assemblage C2. Although the general behaviour of the important constituents of Assemblage C3 compare very closely to Assemblage C2, the differences increases manyfolds when their overall representation of the group of miospores is taken into account. The laevigate and apiculate triletes reduces to 21 per cent while the percentages of varitrilete and zonate trilete remain almost similar to Assemblage C2. The percentage of nonstriate and striate-disaccate increases significantly (28% & 23% respectively) thus distinguishing the Salarjung Seam from Ross Seam.

The Middle Seam of Shanti Khani Incline is marked by the dominance of *Brevitriletes* (21%) similar to the Salarjung Seam of Morgan pit. In this respect it also shares its resemblance with the underlying Bottom Seam except the lower percentage of *Hennellysporites* (8%). *Indotriradites* is also slightly reduced. While the percentage of laevigate and apiculate trilete, varitrilete and zonate trilete spores in Middle Seam resembles with the Bottom Seam, the total representation of striate and nonstriate-disaccate pollen grains remain similar to Salarjung Seam. Thus, the lower percentage of *Hennellysporites* and the general dominance of *Brevitriletes* coupled with higher amounts of striate-disaccate pollen emplaces the Middle Seam into the palynospore Assemblage C3.

Assemblage A—The Top Seam of Shanti Khani Incline contains Assemblage A which is characterised by the dominance of *Scheuringipollenites* (29%). *Brevitriletes* (16%) which was dominant in Assemblage C1 has reduced to subdominance. The average total of laevigate and apiculate triletes reduces to 8 per cent. Varitrilete spores also have reduced to 16 per cent. The striate-disaccate pollen grains (20%) increases only slightly but the nonstriate-disaccates (40%) rise appreciably. Thus, the palynoflora in the Top Seam of Shanti Khani Incline is quite different from the Middle Seam.

CORRELATION

The variation of different genera, qualitative and quantitative both, in coal seams of different areas of Godavari Graben, has been discussed already. The correlation of coal seam based on their quantitative variance within each area is discussed hereunder separately.

Yellandu area—The oldest coal seam of the Singareni Coalfield is the King Seam of No. 20 Incline as it contains the maximum percentage of radial monosaccates, chiefly *Parasaccites*. Radial monosaccate pollen grains occur right from the glacial phase of the Talchir Stage and continue up to the Upper Karharbari Stage (Bharadwaj & Srivastava, 1973) of the Lower Gondwanas of India. This is a transitional zone which is marked by the dying phase of *Parasaccites* and other radial monosaccates while *Scheuringipollenites* continues to rise so as to gain dominance in the younger sediments. In other words it represents the end of the monosaccates rich palynaflora of Talchir Series.

Palynologically Queen Seam of No. 22 Incline is different from King Seam and represents a much younger stage in the miofloral succession. The seam is characterised by the dominance of apiculate triletes mainly *Horriditriletes* and a good percentage of monolete miospores. In Queen Seam of Polampalli Incline, however, the apiculate spores declines suddenly while reticuloid and striate-disaccate pollen compensate the loss. Barring these the other groups tend to cohere the two seams more closely. Assemblage B of Sohagpur Coalfield (Bharadwaj & Srivastava, 1971) resembles with Queen Seam of No. 22 Incline in view of the dominance of *Horriditriletes* + *Brevitriletes* but tends to differ in having more monolete spores. This assemblage has been placed in the Middle Barakar Stage of the Sohagpur Coalfield. It is therefore, evident that the King Seam and Queen Seam were deposited at two different levels significantly differentiated from each other. The succession of palynoflora in Yellandu area is as follows:

Assemblage B2	D Seam Queen Seam	No. 22 Incline
Assemblage B1	Queen Seam	Polampalli Incline
Assemblage E	King Seam	No. 20 Incline

Kothagudem area—The King Seam of this area contains abundance of varitriletes (*Brevitriletes*) and laevigate + piculate triletes (Assemblage D). As compared to the King Seam of Yellandu area, the monosaccate pollen grains tend to decline slightly. Nonstriate-disaccate pollen are also higher in Yellandu area comparatively. Thus the King Seam of the above two areas share only few points in common rather their marked differences. Palynofloral assemblages dominant in *Brevitriletes* are known in Sohagpur Coalfield (Assemblage E) but the same is differentiated by its association with *Microbaculispora* and *Indotriradites*. In Mohpani Coalfield (Bharadwaj & Anand-Prakash, 1972) *Brevitriletes* is associated with high *Scheuringipollenites* and *Indotriradites*. Assemblage-D of Bisrampur (Bharadwaj & Srivastava, 1970) and Assemblage A of Talcher Coalfield (Bharadwaj & Srivastava, 1969) also contains the dominance of *Brevitriletes* but in all these assemblages *Parasaccites* is present in very small percentages. In this respect the palynofloral assemblage of King Seam shows an older aspect.

Top 2 Seam of No. 9 and 10 Inclines shows further decline in *Parasaccites* and *Brevitriletes* which were the characteristics of the King Seam. Instead, *Latosporites* and striate-disaccate rise significantly. The palynoflora differs entirely from the King Seam. On the other hand, Top 2 Seam compares microfloristically very closely with Queen Seam of Yellandu area (Pollampalli Incline) in view of monolete and striate-disaccate pollen although *Horriditriletes* is too low. The overall behaviour of all the genera compares with the assemblage B1.

Top 1 Seam, overlying the Top 2 Seam, represents another phase of palynofloral succession.

Table 5—Showing percentage of miospore groups in different assemblage in Godavari Valley Coalfield

Group of miospores	Collieries	Yellandu		Kothagudem			Rama-gundam		Ramakri-shanpuram		Manda-mari	Belampalli				
												Morgan Pit		Shanti Khani		
	Assemb-lage	E	B1	B2	D	B1	A	C1	C2	A	D	D	C2	C3	C2	C3	A
Laevigate + Apiculate trilete		14.5	13.5	32.0	19.0	18.5	8.0	25.0	18.0	13.5	14.2	7.3	38.0	21.0	20.5	21.0	8.0
Varitrilete		12.5	13.5	15.0	30.0	15.0	22.0	26.0	15.0	10.5	24.0	18.0	16.0	17.5	23.0	21.0	16.0
Zonate		—	—	0.5	—	—	—	—	—	—	0.5	—	3.5	3.5	1.0	1.0	—
Monolete		0.5	7.5	7.0	0.5	13.0	1.5	1.5	1.3	4.5	1.0	—	—	—	0.5	1.5	—
Monosaccate		17.5	2.5	2.5	10.0	6.0	3.0	6.5	6.0	1.5	7.0	6.0	4.5	2.5	9.0	6.5	1.0
Nonstriate Disaccate		32.0	26.5	23.5	14.5	14.0	37.0	23.0	37.0	36.5	21.6	33.0	15.5	28.0	14.5	19.5	43.5
Reticuloid Disaccate		—	8.5	2.0	—	3.0	—	—	—	4.5	—	0.5	—	—	—	—	0.5
Striate Disaccate		15.5	18.5	10.5	14.0	26.0	16.0	20.0	20.7	13.1	—	23.5	28.0	22.5	16.5	21.5	15.5
Alete		7.5	9.5	7.0	12.0	4.5	12.0	—	—	9.0	18.6	12.0	13.5	5.0	15.0	8.5	14.5

This is characterised by assemblage A in which *Brevitriletes* rises once again and *Scheuringipollenites* attains its maximum development. Compositely the assemblage is characterised by the abundance of varitrilete spores and nonstriate-disaccate pollen. Striate-disaccate pollen and monolete spores decline sharply. This character is in sharp contrast with the underlying Top 2 Seam. Three stages of the palynoflora succession have been recognised in Kothagudem area.

Assemblage A	Top 1 Seam	No. 9 and 10 Incline
Assemblage B1	Top 2 Seam	No. 9 and 10 Incline
Assemblage D	Blue and Green Seams	No. 9 and 10 Incline
	King Seam	No. 6 and 7 Incline
	King Seam	No. 2 Incline

Ramagundam area—The oldest coal seam of Ramagundam area (Seam No. 4) contains Assemblage C1 in which the dominance of *Brevitriletes* is associated with *Hennellysporites*. In this way the pteridophytic spores form the bulk of the total percentage. In younger Seam 3 of No. 1 Incline *Brevitriletes* decreases appreciably. *Hennellysporites* remains almost similar to Seam 4 and thus shows its older affiliation. However, the total percentage of nonstriate-disaccate increased to distinguish it separately. In the mioflora of Seam 3 of No. 7 Incline (Assemblage C2) the percentage of nonstriate disaccate increases further high and in this respect the Coal Seam 3 of both the Inclines have been put in one assemblage (Assemblage C2). Both the assemblages described here appear more quantitative rather than qualitative and resemble very closely to each other in view of its association with *Hennellysporites*. The flora of Seam 3 of No. 1 Incline represents a transition in between Seam 4 of the same Incline and Seam 3 of No. 7 Incline. Assemblage C of Chirimiri Coalfield (Bharadwaj & Srivastava, 1969) contains *Hennellysporites* in similar percentages as has been observed here but in Chirimiri they are associated with the dominance of *Microbaculispora*. In Sohagpur Coalfield *Hennellysporites* occurs alongwith *Brevitriletes* (Assemblage E, Bharadwaj & Srivastava, 1969) and compares very closely to the Assemblages C1 and C2 of Ramagundam area. However, in Sohagpur Coalfield it is associated with *Indotriradites* and *Microbaculispora*.

In Seam 1 and Seam 2 of No. 3 Incline *Scheuringipollenites* rises to its maximum while *Brevitriletes* reduces next to it. This assemblage (Assemblage A) is quite distinct from the older seams described above. Similar dominance is described from Giridih Coalfield (Srivastava, 1973), Korba Coalfield (Bharadwaj & Tiwari, 1964—Assemblage E; Bharadwaj & Srivastava, 1973—older subzone of Zone no. 3). However, the coal seams marked by the dominance of *Scheuringipollenites* in the Giridih Coalfield are associated appreciably with reticuloid and striate-disaccate pollen. In Korba Coalfield the older phase of Zone No. 3 resembles very closely with Seam 1 of Ramagundam area. Thus the collation of these three assemblages in this area is as follows:

Assemblage A +	Coal Seam 1	No. 3 Incline
	Coal Seam 2	
Assemblage C2 –	Coal Seam 3	No. 7 Incline
	Coal Seam 3	No. 1 Incline
Assemblage C1 +	Coal Seam 4	No. 1 Incline

Ramkrishnapuram area—Coal seams 2, 3 and 4 of this area show a very coherent palynoflora (Assemblage D) being characterised by the dominance of *Brevitriletes*. *Scheuringipollenites* occurs as

Table 6—Absolute percentage frequency of gymnospermous pollen grains in various coal seams of Godavari Graben

Genera	Sample no.	1	2	3	5	6	7	8	9	10	11	12	13	14
Parasaccites		10.5	15.7	21.2	45.5	38.8	6.0	12.2	3.4	33.7	16.1	1.6	8.4	8.6
Cuneatisporites		—	—	—	—	—	—	—	—	—	4.2	1.6	1.0	6.2
Platysaccus		1.9	5.0	4.8	—	—	15.0	5.2	4.4	0.6	1.7	13.5	17.7	4.3
Striatites		5.7	5.0	2.4	—	4.4	4.0	3.0	1.8	0.6	1.7	4.9	8.4	5.1
Primuspollenites		—	—	—	—	—	—	6.2	13.9	—	0.8	6.5	2.0	—
Labirites		13.4	12.7	4.8	5.5	8.1	7.0	12.2	5.2	3.6	3.4	8.2	2.0	9.5
Striatopodocarpites		11.0	12.7	11.8	3.5	8.1	5.3	12.2	17.4	8.9	8.4	3.2	6.3	9.5
Faunipollenites		15.0	7.6	14.2	6.5	12.2	4.5	7.2	7.8	3.7	11.8	6.5	4.5	9.5
Illinites		13.4	5.0	—	2.5	6.1	—	2.0	7.8	7.6	16.9	—	2.0	11.2
Vesicaspora		3.7	7.6	3.6	2.5	—	0.9	—	1.7	5.5	7.0	4.9	10.4	8.6
Scheuringipollenites		21.0	18.9	28.2	25.5	15.3	44.0	21.4	24.4	25.5	20.4	41.0	25.0	16.4
Ibisporites		1.0	—	1.0	2.5	2.0	4.2	—	5.2	4.3	3.4	1.6	2.0	4.3
Tiwariasporis		1.9	5.0	2.3	2.5	2.0	7.6	18.4	1.8	4.8	0.8	6.5	6.2	3.4
Kingiacolpites		—	5.0	5.8	3.5	3.0	1.5	—	5.2	2.4	3.4	—	4.1	3.4

Kothagudem Collieries: No. 2 Incline—1. King Seam; Nos. 6,7 Incline—2. King Seam (red), 3. King Seam (blue); Nos. 9, 10 Incline—5, Blue Seam, 6. Green Seam, 7. Top 1 Seam, 8. Top 2 Seam. *Yellandu Collieries*: Polampalli Incline—9. Queen Seam; 20 Pit Incline—10. King Seam, 11. D Seam; 22 Pit Incline—12. Queen Seam, 13. D Seam. *Ramagundam Collieries*: No. 1 Incline—14. Seam 3, 15. Seam 4; No. 3 Incline—16. Seam 1, 17. Seam 2; No. 7 Incline—18. Seam 3. *Ramakrishnapuram Collieries*: Ramakrishna Khani 1—19. Seam 3, 20. Seam 4; Motilal Khani 1—21. Seam 2. *Mandamari Area*: Kalyani Khani—22. Seam 3, 23. Seam 4. *Belampalli Collieries*: Shanti Khani—24. Top Seam, 25. Middle Seam, 26. Bottom Seam; Morgan Pit—27. Salarjung Seam, 28. Ross Seam; 85 Dip—29. Salarjung, 30. Ross Seam.

subdominant genus closely followed by *Parasaccites*. The variation in different genera within different coal seams both vertically and laterally are rather negligible and all the three coal seams contain nearly identical palynofloras.

Assemblage D
- Seam 2 Motilal Khani
- Seam 3 Ramkrishna Khani
- Seam 3 Kalyani Khani
- Seam 4 Ramkrishna Khani

Mandamari area—Palynoassemblage D characterises the Coal Seam 4 of Kalyani Khani Incline. The dominance is marked by *Brevitriletes* and is subdominantly associated with *Scheuringipollenites*. In coal Seam 3 of the same incline *Brevitriletes* decreases only slightly but *Scheuringipollenites* records a significant increase till it reaches the dominance. However, the general trend of variation of rest of the components compare each other, except the above two genera. The cause of such differences could not be ascertained. The coal seams are being worked in partly convenient sections and the entire thickness of the coal seams is usually not available. Such factors may cause such abnormal variations. As has been observed in other area, *Scheuringipollenites* has a tendency to increase in the younger coal seams. Keeping in view the above factors Coal Seam 3 has provisionally been placed along with Coal Seam 4.

Assemblage D?
- Coal Seam 3 Kalyani Khani Incline
- Coal Seam 4 Kalyani Khani Incline

Belampalli area—The two workable coal seams, Ross Seam (3 m) and Salarjung Seam (about 8 m) are separated by a sandstone band of about 30 m in thickness in the Morgan pit and 85 dip area. Salarjung Seam is being mined only partly while Ross Seam is being worked in its entire thickness. Ross Seam is characterised by the dominance of *Hennellysporites* while *Brevitriletes* and *Scheuringipollenites* occur next to it (Assemblage C2). In Salarjung Seam *Hennellysporites* decreases to subdominance while *Brevitriletes* rises to dominance (Assemblage C3). The former coal seam is rich in laevigate + apiculate triletes while the latter contains higher amounts of nonstriated and striated-disaccates. In fact, the palynoflora of the Salarjung and Ross seams contains similar group of pollen qualitatively and shows greater resemblance with each other. In view of this fact they have been designated as Assemblage C2 and C3. However, the quantitative variation of individual genera and the total representation of various group of miospores together distinguishes the two coal seams distinctly from each other.

Ghosh (1968) studied the distribution of miospores in the coal types of above coal seams. According to his observations also the Ross Seam and Salarjung Seam bear closer relationship with each other qualitatively and they can only be differentiated quantitatively. He recorded higher occurrence of *Parasaccites* (=*Nuskoisporites*) and *Leiotriletes* in Ross Seam and *Hennellysporites* in Salarjung Seam which, however, differ from our observations.

In Shanti Khani Incline the coal seams of Morgan pit area split into two each. These coal seams are also being worked here in only partly convenient sections. The mioflora similar to Ross

Table 6 contd.....

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
14.4	0.8	2.5	8.8	20.0	22.5	8.0	8.0	9.5	1.6	13.5	23.6	6.0	18.0	3.6	13.5
—	—	1.5	0.7	—	—	—	2.0	2.3	0.8	—	—	4.0	2.0	—	—
3.0	4.9	7.7	4.4	—	—	3.0	2.5	2.4	7.3	3.0	2.2	7.0	8.0	6.5	5.4
3.0	6.4	4.5	3.0	4.3	1.4	3.0	5.0	3.0	1.6	3.0	2.4	13.3	6.0	11.3	2.7
1.4	4.9	10.0	—	—	—	—	—	0.8	2.4	—	—	—	—	0.8	—
1.4	8.0	4.5	8.8	—	—	6.0	10.3	9.5	4.8	12.6	7.3	13.3	4.0	8.1	7.0
16.6	8.0	4.5	10.3	12.6	14.0	10.0	5.0	6.3	3.6	13.5	17.0	7.0	12.0	4.8	10.7
3.0	11.4	6.0	6.0	9.5	1.4	16.0	12.2	13.3	6.5	3.2	9.7	4.1	2.0	8.1	8.0
6.0	4.0	6.0	4.4	4.3	8.5	6.0	2.5	12.7	—	7.2	5.0	7.0	4.0	13.0	13.5
3.0	1.6	3.0	11.7	15.0	1.4	8.0	7.3	11.0	5.7	7.2	2.4	13.3	12.0	6.5	8.0
36.0	37.0	35.4	26.4	23.0	34.0	32.0	29.0	22.8	47.1	18.0	24.4	18.0	24.0	24.4	20.0
—	3.2	6.0	7.3	3.0	5.8	4.0	9.8	1.6	10.5	5.2	2.4	—	4.0	3.6	2.7
6.1	4.9	7.7	2.2	2.0	8.0	2.0	3.2	4.8	7.3	12.6	2.4	7.4	2.0	9.0	1.3
6.1	4.9	0.7	6.0	6.3	3.0	1.0	3.2	—	0.8	1.0	1.2	—	—	0.8	8.0

Seam is found in the Bottom Seam of Shanti Khani Incline. Similarly the Middle Seam is equivalent to Salarjung Seam palynologically. Thus the above two seams extend laterally into the Shanti Khani area, and the behaviour of various palynotaxa in the lateral extent of the each seam is well evident. The mioflora of Salarjung Seam is consistent throughout the entire length of the seam. In Ross Seam *Brevitriletes* increases slightly in the Shanti Khani area and is separated from the Middle Seam by nearly 7 meters sandstone parting. The Top Seam of the Shanti Khani area shows a palynoflora quite different from the above two seams. This coal seam contains the dominance of *Scheuringipollenites* (Assemblage A) and is associated with other nonstriate-disaccate pollen :

Assemblage A	Top Seam	Shanti Khani area
Assemblage C3	Salarjung Seam	Morgan pit
	Salarjung Seam	85 dip
	Salarjung Seam	Shanti Khani
Assemblage C2	Ross Seam	Morgan pit
	Ross Seam	85 dip
	Bottom Seam	Shanti Khani Incline

BIOSTRATIGRAPHY AND INTER-AREA CORRELATION

The oldest palynofloral assemblage is encountered in the King Seam of Yellandu area and is characterised by *Parasaccites* and *Scheuringipollenites* (Assemblage E). The Gondwana sediments of the Yellandu area occur in the form of an outlier from the main Gondwana strata of the Godavari Valley. The equivalence of King Seam of this area is not found in other areas.

The next younger coal seam is accosted in Assemblage D which is characterised by the dominance of *Brevitriletes*. This miofloral assemblage is associated with the King Seam of Kothagudem area. It may be mentioned here that the King Seam is the oldest working coal seam in Yellandu and Kothagudem areas but the palynofloras of the two show a definite discordance. The genus *Parasaccites* decreases from Yellandu to Kothagudem area while *Brevitriletes* increases inversely. Thus the monosaccates and nonstriate-disaccate pollen record sharp decline while varitrilete spores increase proportionately in Kothagudem area. The palynoflora similar to the King Seam of Kothagudem area is also encountered in Seam 2, 3 and 4 of Ramkrishnapuram and Seam 3 and 4 of Mandamari areas.

Assemblages C2 and C3 are associated within the Ross and Salarjung seams of the Tandur area respectively. Their equivalence is also observed in Seam 3 of Ramagundam area (Assemblage C2). Seam 3 and Seam 4 of Ramagundam area are normally correlated with the Salarjung and Ross seams of Belampalli area, which, however, agree only partly palynologically with Seam 4 of Ramagundam area. It shows an intermediate position between the King Seam of Kothagudem area and Ross Seam of Belampalli area.

The Queen Seam of Pollampalli Incline is characterised by a combined dominance of *Brevitriletes* and *Scheuringipollenites* (Assemblage B1) and in this respect it compares Top 2 Seam (No. 9 & 10 Incline) of Kothagudem area.

The seam represented by Assemblage B2, which contains high percentage of *Horriditriletes*, is present in the Queen Seam and D Seam of Yellandu area (No. 22 Incline). The mioflora of Queen Seam has not been encountered in Belampalli and Ramagundam areas.

The youngest palynological assemblage is encountered in Top 1 Seam of Kothagudem area and is characterised by the dominance of *Scheuringipollenites* (Assemblage A). Seam 1 and Seam 2 of

Ramagundam area and Top Seam of Shanti Khani Incline, Belampalli area also contains similar palyoflora. Thus the inter-area correlation of Godavari Valley is summarised as follows:

Assemblage A		Top 1 Seam	Kothagudem area
		Seam 1	Ramagundam area
		Seam 2	Ramagundam area
		Top Seam	Belampalli area (Shanti Khani Incline)
Assemblage B	B1	Queen Seam	Yellandu area
		Top 2 Seam	Kothagudem area
	B2	Queen Seam	Pollampalli Incline, Yellandu area
		Salarjung	Morgan pit, Belampalli area
	C3	Mid. Seam	Shanti Khani
		Ross Seam	Morgan pit, Belampalli area
Assemblage C	C2	Bott. Seam	Shanti Khani
		Seam 3	Ramagundam area
	C1	Seam 4	Ramagundam area
Assemblage D		King Seam	Kothagudem area
		Seam 2, 3, 4	Ramkrishnapuram area
		Seam 3, 4	Mandamari area
Assemblage E		King Seam	Yellandu area

The palynological investigations suggest the occurrence of six palynoassemblages in the Godavari Graben. The average representation of various genera reveal that palynological succession was influenced by one palynofloral change during the course of deposition of the coal seams studied in the present investigation. The oldest palynoflora is associated with the King Seam of Yellandu area containing Assemblage E.

The absolute percentages of gymnospermous pollen grains have been re-calculated after redistributing the percentages of pteridophytic and alete spores and have been shown in table 6. It shows that *Parasaccites* and *Scheuringipollenites* occur either as dominant or subdominant unit throughout the spectrum. In King Seam of Yellandu area the overall dominance of *Parasaccites* documents its comparison with the known Upper Karharbari palynofloras but the additional presence of *Scheuringipollenites* indicates a younger aspect. The overall dominance of *Parasaccites* in King Seam of Kothagudem collieries also allienates it with King Seam of Yellandu area but the presence of apiculate spores in King Seam of Kothagudem area shows a distinct Lower Barakar aspect. In Korba Coalfield (Bharadwaj & Srivastava, 1973) similar transition has been observed at the boundary of Upper Karharbari and Lower Barakar formations obviously subtending the present observation. Assemblages D-B represent various stages of palynological succession within the Lower Barakar palynofloras. The assemblage changes considerably after the deposition of Assemblage B where nonstriate-disaccate become dominant over the pteridophytic spores. Striate-disaccate pollen grains also mark slight increase. Assemblage A represents the Middle Barakar palynoflora.

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