SPOROLOGICAL SUCCESSION IN KOTA AND TURRA SEAMS, SINGRAULI COALFIELD (M.P.), INDIA

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ABSTRACT

Quantitative analysis of miospore genera in Kota and Turra seams of Singrauli Coalfield has revealed that zonate trilete genera *Indotriradites* and *Dentatispora*, along with *Sulcatisporites*, *Callumispora* and *Brevitriletes* form the dominant association in the former while *Sulcatisporites*, in association with *Indotriradites*, *Parasaccites* and *Brevitriletes* contributes maximum to the assemblage in the latter seam. That the two miofloras show closer alliance with the Lower Barakar Stage, is evident by the prominence of zonate trilete genera. The frequency behaviour of various generic groups in successional coal deposits of Singrauli Coalfield has been also discussed.

INTRODUCTION

RECENTLY, Bharadwaj and Sinha (1969) have studied the palynological succession in Jhingurdah coalseam — the topmost seam of Singrauli Coalfield, Madhya Pradesh (23°47′ to 24°12′ N — 81°45′ to 82°48′ E) — and opined that miofloristically it belongs to the Upper Barakar Stage. To the Jhingurdah seam, successively underlying coalseams are Panipaheri, Khadia, Purewa, Turra and Kota; the spore contents of the first two seams are not known so far. The Purewa seam contains a rich mioflora which differs substantially from that of the Jhingurdah seam (TIWARI, 1969). As a sequel to these investigations, the quantitative analysis of miospore genera in Turra and Kota seams is being communicated in the present paper.

The Kota seam (1.50 to 2.70 m thick) represents the lowermost coal deposition in Singrauli Coalfield; one overall representative coal sample of this coal seam was obtained from the core (about 2.5 m thick) in Bore-hole No. U.P. B-5, Singrauli Block. Turra seam (12 to 41 m thick) overlies the Kota seam with a partition of sandstone varying from 59 to 74 meters in thickness. The three overall samples from Turra seam, representing the top, middle and bottom sections, have been prepared from the core (19.50 m thick) in Bore-hole No. NCSM-3, Moher Block (Table 1).

TABLE 1

TURRA SEAM

Bore hole No. NCSM-3 Moher Block

Over all Sample No.	Bore hole Sample No.	Depth from Surface	Remarks
Top — 0·07 m. of med. grained carbonaceous sandstone removed			
3	NCSM-3/29 to NCSM-3/37	112·46 M. to 119·51 M.	Coal and thin shale bands
2	NCSM-3/38 to NCSM-3/46	119·51 M. to 127·46 M.	Coal and thin shale bands
1	NCSM-3/47 to NCSM-3/55	127·46 M. to 131·96 M.	Coal and thin shale bands
Bottom — 0·30 m. of sandy shale removed			

KOTA SEAM

Bore hole No. UP B-5 Singrauli Block

One overall sample prepared out of 2·5 m. thick seam

The samples have been macerated by conventional method, using commercial Nitric acid and five per cent Potassium hydroxide. Two hundred and fifty specimens have been counted at random from each sample to determine the generic percentage frequency.

MIOFLORAL DISTRIBUTION

1. *Kota Seam Assemblage* — The mioflora of Kota seam comprises 28 spore genera. Genus *Dentatispora* Tiwari (1964) is the most dominant in this assemblage, being 20·4 per cent.

Other prominent genera are :

Indotriradites Tiwari (1964) 17·6%

Sulcatisporites (Lesch.) Bharad. (1962)	9·1%
Callumispora Bharad. & Sriv. (1969)	6·8%
Brevitriletes Bharad & Sriv. (1969)	6·8%

Following genera, though relatively lesser in incidence, contribute singificantly to the total percentage.

Leiotriletes (Naum.) Pot. & Kr. (1954)	6·4%
Parasaccites Bharad. & Tiwari (1964)	4·9%
Faunipollenites Bharad. (1962)	4·0%
Striatopodocarpites (Soritsch. & Sed.) Bharad. (1962)	3·0%
Microbaculispora Bharad. (1962)	3·2%
Illinites (Kos.) Pot. & Kr. (1954)	2·8%
Lophotriletes (Naum.) Pot. & Kr. (1954)	2·4%
Ginkgocycadophytus Samoil. (1953)	2·4%
Cyclogranisporites Pot. & Kr. (1954)	1·6%
Microfoveolatispora Bharad. (1962)	1·6%
Hennellysporites Tiwari (1967)	1·2%
Latosporites Pot. & Kl. (1954)	1·2%

The genera listed below also occur in this assemblage but are quantitatively insignificant, being less than 1 per cent in occurrence.

Horriditriletes Bharad. & Salujha (1964), *Plicatipollenites* Lele (1964), *Platysaccus* Pot. & Kl. (1954), *Ibisporites* Tiwari (1968), *Primuspollenites* Tiwari (1964), *Rhizomaspora* Wils. (1962), *Potonieisporites* (Bhard.) Bharad. (1966), *Striatites* (Pant) Bharad. (1962), *Vesicaspora* (Schem.) Wils. & Venkat. (1964), *Vittatina* (Luber) Wils. (1962) and *Pilasporites* (Balme & Henn.) Tiw. & Navale (1967).

The above analysis reveals that zonate-triletes made the dominant group while the laevigate and the apiculate triletes follow the sequence of prominence. Although *Sulcatisporites*, a nonstriated bisaccate genus, stands third in order of numerical representation, the group of non-striated disaccates as a whole comes after the apiculate trilete group.

The monosaccates and striated disaccates are fairly well represented while the monolete and colpates are rare.

2. *Turra Seam Assemblage* — Three overall representative samples covering the whole width of the seam have been analysed. A perusal of Histogram I (Sample Nos. 1, 2, 3) suggests that these three sections of the seam exhibit palynological homogeneity. The behaviour of individual genus in Bottom-Middle-Top regions of the seams, however, shows some variation, e.g. apiculate triletes and *Sulcatisporites* tend to increase a bit while *Parasaccites* and *Striatopodocarpites* gradually decrease. *Dentatispora* is maximum in the middle section of the seam. But these fluctuations are so minor as well as constant that no miofloral break or any change in depositional conditions can be suggested. Based on this uniform pattern of distribution, the average percentage frequency has been calculated which has been referred to in the following account (*see* Histogram I : Turra AVR).

The Turra Seam Assemblage consists of 32 genera. The average percentage reveals that the genus *Sulcatisporites* is the most dominant, being 17 per cent.

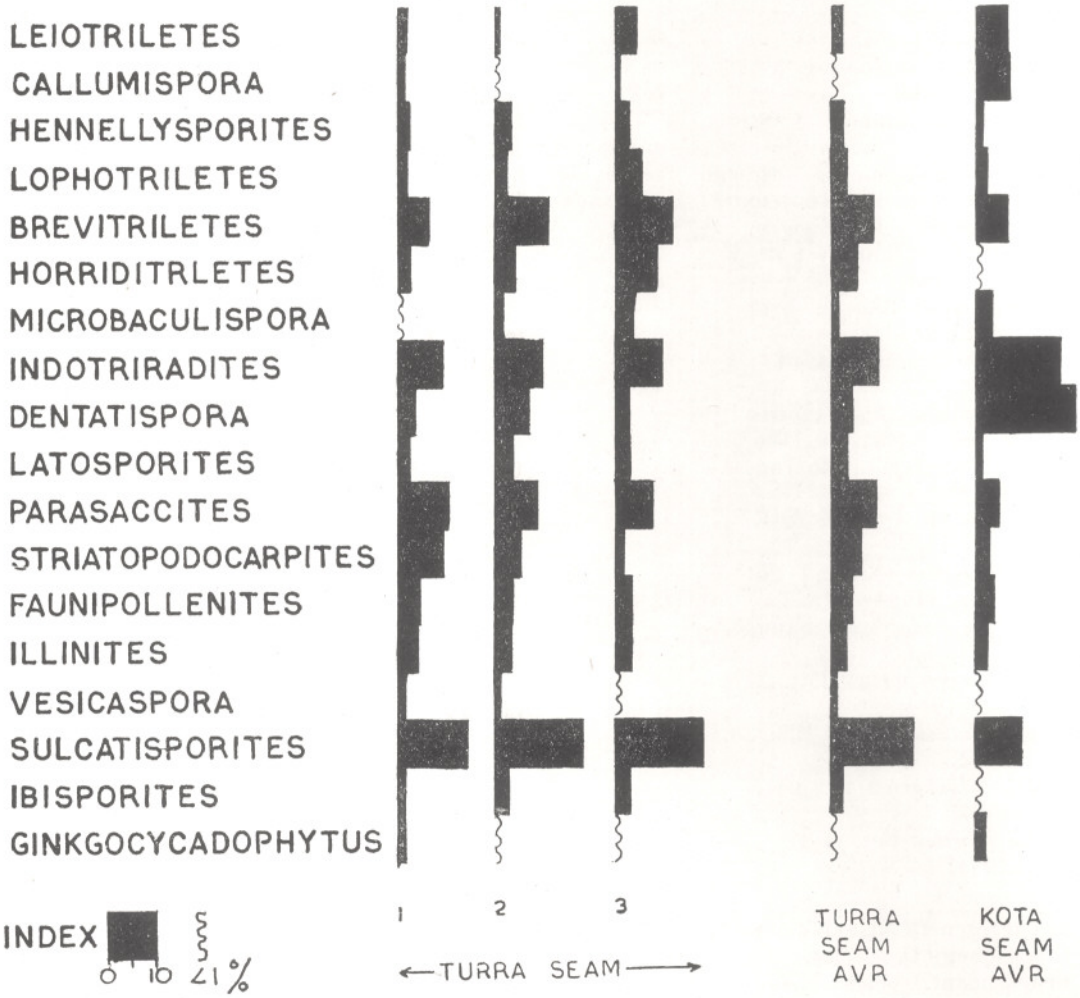
Next to this, the following genera contribute maximum to the total dominant percentage of the assemblage.

Indotriradites	9·7%
Parasaccites	9·4%
Brevitriletes	9·0%
Striatopodocarpites	6·4%

The following genera, though relatively lesser in abundance, are also significant in frequency and come next in order to the above.

Horriditriletes	5·2%
Faunipollenites	4·9%
Dentatispora	4·6%
Illinites	3·9%
Lophotriletes	3·3%
Latosporites	3·3%
Hennellysporites	2·9%
Ibisporites	2·6%
Leiotriletes	2·5%
Microbaculispora	1·9%
Vesicaspora	1·2%
Cyclogranisporites	1·1%

The genea listed below are sporadic in occurrence (less than 1 per cent) and



HISTOGRAM 1 — Percentage frequency of important miospore genera in Kota and Turra seams: 1, 2, 3 — Bottom, Middle and Top sections of Turra Seam. Turra AVR — Average percentage in samples 1, 2 and 3 of Turra Seam. Kota AVR — Average percentage in Kota Seam.

do not contribute significantly to the population.

Microfoveolatispora, *Thymospora* Wils. & Venkat. (1963), *Plicatipollenites*, *Crucisaccites* Lele & Maithy (1965), *Cuneatisporites* Lesch. (1955), *Platysaccus*, *Striatites*, *Primuspollenites*, *Rhizomaspora*, *Lunatisporites*, *Tiwariasporis* Maheshw. & Kar (1967), *Ginkgocycadophytus*, *Potonieisporites*, *Callumispora*, *Pilasporites*.

Thus, in the Turra Seam Assemblage, non-striated disaccates dominate closely followed by apiculate trilete genera. Zonate triletes, striated bisaccates and monosaccates stand in order of decreasing representation while the rest are still lesser in frequency.

Comparison — The preceding account clearly reveals that the Kota Seam Assemblage is different from the Turra Seam Assemblage. In Kota seam zonate-trilete miospore genera in association with apiculate and laevigate triletes constitute the prominent group. In Turra seam the dominance is replaced by non-striated bisaccate pollen grains; the apiculate triletes

more or less remain constant but the zonate-trilete become third in the rank and laevigate triletes are reduced considerably. The change in the dominant genus reveals a significant alteration in the miofloral to identify these two seams but at the same time, qualitatively as well as in the quantity of the subdominant genera the two assemblages do not represent entirely different phases of deposition.

To conclude, palynologically the two seams are dissimilar and contain their individualistic dominant association; at the same time the differences are not enormous so as to suggest a sharp miofloral break between the two.

STRATIGRAPHY

In the Lower Gondwana miofloras of India, Zonate-triletes constitute an index group for the Lower Barakar Stage (BHARADWAJ, 1966, TIWARI, 1965). The Kota and Turra seams contain *Indotriradites*, *Dentatispora*, *Sulcatisporites*, *Brevitriletes* (incl. *Apiculatisporis*), *Parasaccites* and *Callumispora* (incl. *Punctatisporites*) as important contributors to the miospore population; this zonate-trilete and apiculate-trilete rich flora closely corresponds with the Lower Assemblage of Korba Coalfield (BHARADWAJ & TIWARI 1964, TIWARI, 1965). Recently comparable zonate-trilete rich, Lower Barakar assemblages have also been reported from the lower seams in Chirimiri and Bisrampur Coalfields (BHARADWAJ & SRIVASTAVA, 1969, 1970). A comparison with these assemblages also suggests Lower Barakar for the Kota and Turra assemblages.

MIOFLORAL SUCCESSION IN SINGRAULI COALFIELD

A comparison of major miospore groups in the coal seams, which are successively deposited in this coalfield, reveals an interesting pattern of miofloral changes in the Barakar Stage. For such a comparison the average percentage frequencies from the assemblages in Kota, Turra (as given in the present paper), Purewa bottom and top (TIWARI, 1969) and Jhingurdah — bottom and top (BHARADWAJ & SINHA 1969) have been calculated and the miospore genera bearing comparable morphographic characters have been put together into supra generic groups.

The trends of variation in the successive assemblages, (Histogram II) are as given below:

1. *Zonate triletes* — (incl. Infraturma — Zonati and Cingulati) — Successively from older to the younger seams, *Indotriradites* and *Dentatispora* are dominatingly maximum in the Kota seam, decline a little in the overlying Turra seam but suddenly go down in the remaining seams.

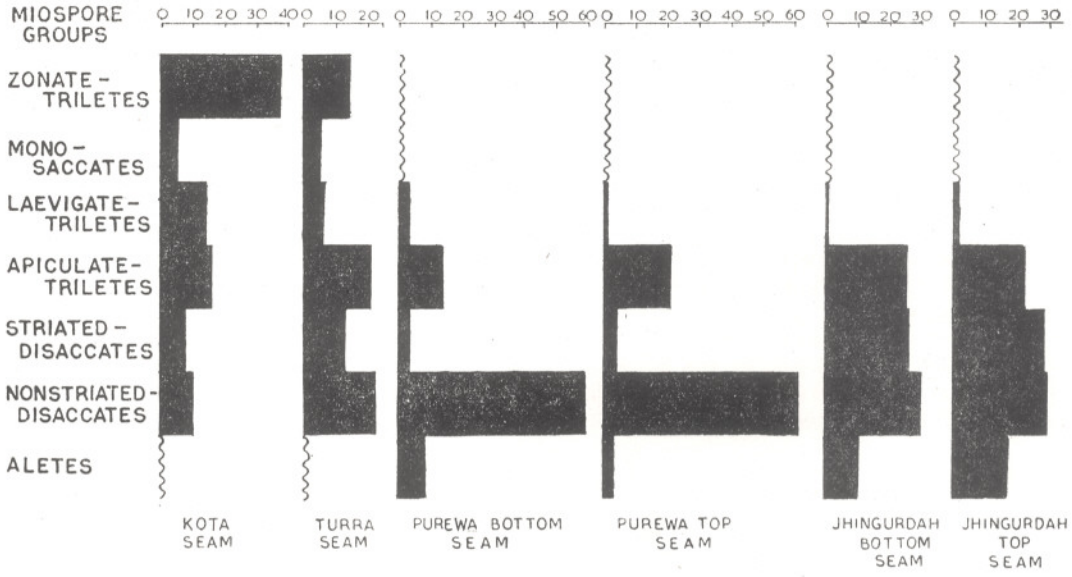
2. *Monosaccates* — (incl. genera with girdling monosaccus) — The monosaccates (mostly *Parasaccites*) are significant (5%) for Kota and Turra seams but in the rest of the seams they do not come in countings.

3. *Laevigate triletes* — (incl. Infraturma Laevigati) — This group is maximum (14%) in the Lowest seam and uniformly decline in the other younger seams being minimum (1%) in the Jhingurdah Top seam.

4. *Apiculate triletes* — (incl. Infraturma-Apiculati) — Apiculates are well represented in all the seams and do not show much fluctuations in their frequency. In Kota seam they represent about 17 per cent of the population, increase to become 22 per cent in Turra seam, but decline in the Purewa bottom to become 14 per cent; thereafter again this group increases to 24 per cent in the Jhingurdah seam.

5. *Striated bisaccates* — (incl. genera with simple and reticuloid striations) — This group (mostly dominated by *Faunipollenites* and *Striatopodocarpites*) is characteristic in being well represented in Kota and Turra seams (8%, 13%), declines in Purewa seam (4%, 5%) and profusely rises to become second in dominance in the assemblages of Jhingurdah bottom and top seams (26%, 29%).

6. *Nonstriated bisaccates* — (incl. bisaccates without mark or striations) — This group of pollen grains (mostly comprising *Sulcatisporites* and *Ibisporites*) plays an important role in shaping the different miofloras; in Kota seam this group is represented by 10 per cent; in Turra it increases to become dominant element, being 23 per cent. In the Purewa bottom and top, the nonstriated bisaccates are found in overwhelming dominance being 59 and 62 per cent, and in the subsequent two seams these genera, although dominating the association, decline significantly to become 31 and 30 per cent.



HISTOGRAM 2 — Miofloral succession in Singrauli Coalfield.

7. *Aletes* — Alete miospore genera are very scanty and do not come in countings in the Kota and Turra seams; they are significant in Purewa while increase substantially in Jhingurdah. Thus, alete genera show a more or less increasing trend from older to the younger assemblages.

8. *Other groups* — Remaining groups of miospore genera are very rare and also do not occur consistently.

From the above analysis it is evident that the lower two seams — Kota and Turra — are characterized by the high representation of *Indotriradites* and *Dentatispora*, along with apiculate and laevigate triletes; the occurrence of monosaccates is also significant in this assemblage. After this assemblage, there is a sharp miofloral break which is depicted by the disappearance of zonate triletes and monoasccate genera and by the sudden, overwhelming rise of nonstriated, bisaccate genera in Purewa bottom and top seams; beside this, the lower percentages of striated-bisaccate and the significant appearance of aletes are also noteworthy. Following this nonstriated-bisaccate-rich flora, another miofloral change takes place and in the miofloral assemblage of Jhingurdah bottom and top seams the nonstriated-bisaccates show a 50 per cent decline, while striated-bisaccates as well as aletes rise considerably.

Stratigraphically, the mioflora in Kota and Turra seams corresponds with that of the Lower Barakar Stage (p. 267), and the assemblage in Jhingurdah seam resembles with the Upper Barakar Stage (BHARADWAJ & SINHA, 1969). Although for the Purewa assemblage an Upper Barakar affiliation has been suggested (TIWARI, 1969, p. 96) the present successional analysis of miospore groups has revealed that the outstanding dominance of non-striated bisaccate and low percentages of striated bisaccates in the Purewa assemblage differentiate it from the Jhingurdah (as well as other Upper Barakar) mioflora.

CONCLUSIONS

The quantitative abundance of the zonate genera *Indotriradites* and *Dentatispora* is of great indexing significance for the basal Barakar deposits, as has been demonstrated in Korba and Talchir Coalfields, as well as by the present study. The disappearance of zonate spores and the dominance of non-striated bisaccate pollen are indicative of floral break and correspondingly

the closer of Lower Barakar Stage; this break is further followed by a change of pattern in generic frequency where the non-striated bisaccates, though prominent, decline to almost half than the preceding flora and the striated bisaccates increase manyfold.

In Singrauli Coalfield, Kota and Turra seams contain zonate-rich mioflora, Purewa bottom and top contain nonstriated bisaccate-rich, and striated bisaccate-poor assemblage while Jhingurdah bottom and top exhibit the striated bisaccate and non-striated bisaccate rich mioflora.

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