PALYNOLOGY OF THE PANCHET GROUP EXPOSED IN THE NONIA NALA, NEAR ASANSOL, WEST BENGAL

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ABSTRACT

The *Sporae dispersae* of the Maitur Formation (Panchet Group) exposed in the Nonia Nala, East of Kumarpur, near Asansol comprises 40 genera and 60 species of miospores. The beds just above the Raniganj-Panchet contact have abundance of striate bisaccate pollen as in the underlying Raniganj beds. In the beds farther above the contact, the number of trilete forms gradually increases while the bisaccate pollen decrease in frequency. The characteristic miospore genera of the Maitur Formation are *Verrucosisporites, Decisporis, Playfordiaspora* (*Guthoerlisporites*) and *Lunatisporites* (*Taeniaesporites*). There is a definite, though insignificant, miofloral change above the Raniganj-Panchet boundary, but whether this change took place in the late Palaeozoic or at the Permian-Triassic boundary is still not clearly known.

INTRODUCTION

THE Panchet Group was established for a series of rocks overlying the coal-bearing Damuda Group, and exposed in the Panchet Hill, Raniganj Coalfield, Bengal. The original Panchet of Blanford is now divided and the lower part retains the name, the upper part has been considered as representing the Mahadeva Group (Fox, 1931). The strata are slightly unconformable to the Raniganj Formation, especially in the Bokaro Coalfield. With the exception of occasional included coaly fragments, they are completely devoid of coal and carbonized plant remains.

The Panchet Group in the type area is divided into two formations, viz., the Maitur and the Hirapur formations. The Maitur Formation (90-120 m), comprising thick khaki-green silty shales and greenish-brown mudstones, is well-developed in and around Nonia Nala to the East of Kumarpur and North-West of Asansol, and at Junut, North of Damodar. The Hirapur Formation consists of yellow-grey, soft, micaceous sandstones, alternating with dark-red and occasional light-coloured mudstones.

Not much information is available on the palaeontology and palaeobotany of the Panchet Group in the Raniganj Coalfield. *Estheria mangaliensis*, a fresh water crustacean, is very abundant in places.

Almost all the Panchet plant fossils known from the Raniganj Coalfield, were found in the Maitur Formation near Asansol. The Maitur megaflora has almost the same elements as that of the upper part of the Raniganj Formation except for the presence of *Cladophlebis concinna, Cyclopteris pachyrachis, Podozamites* sp., and *?Dicroidium/Lepidopteris*.

Palynology of the Panchet Group is known through the works of Shrivastava and Pawde (1962), Kar (1970a), Satsangi, Chandra and Singh (1972) and Sarbadhikary (1972). The present study deals with the *Sporae dispersae* of the Maitur Formation exposed in the Nonia Nala, near Asansol.

MATERIAL AND METHODS

Material for the present study comprised samples collected from the Raniganj-Panchet section exposed in the north-western branch of the Nonia Nala, East of Kumarpur and North-West of Asansol in Burdwan District, West Bengal. Microfossils were recovered from the greenish-brown mudstones and shales. First sporiferous Maitur sample (NP-1) is from a bed about 5 metres above the Raniganj-Panchet contact. Other samples are from still higher beds. Sample NR-1 is from the last carbonaceous shale band below the contact.

QUANTITATIVE ANALYSIS

The palynological assemblage of the Maitur Formation (Panchet Group) exposed in the Nonia Nala comprises 60 species belonging to 40 genera of pollen and spores. Fifteen new species of megaspores belonging to 8 genera were also recovered but they are not discussed here.

A miospore count at the generic level has been shown in Table 1. The characteristic miospore genera of the assemblage are: *Punctatisporites, Verrucosisporites, Decisporis,*

TABLE 1 — PERCENT FREQUENCY OF MIOSPORE GENERA IN DIFFERENT SAMPLES

Sample nos. / Genera	NR-1	NP-9	NP-1	NP-2	NP-8	NP-4 + NP-7	1358	1359
Cyathidites	—	0·8	—	—	—	0·4	—	0·4
Punctatisporites	—	2·0	4·4	2·0	14·8	4·0	8·4	1·2
Eupunctisporites	—	—	1·2	—	0·4	2·4	4·4	—
Biretisporites	1·0	—	1·2	0·8	—	—	0·4	0·8
Brevitriletes	2·4	2·8	3·6	5·6	0·8	1·2	1·6	—
Cyclogranisporites	—	—	0·4	0·4	1·2	—	—	—
Verrucosisporites	—	4·0	1·2	3·6	15·6	39·2	29·2	1·2
Decisporis	—	14·8	9·2	19·6	8·4	2·4	—	—
Kraeuselisporites	—	0·8	0·4	2·4	0·4	1·2	—	—
Lundbladispora	—	—	—	—	0·8	—	—	—
Playfordiaspora	—	4·8	4·0	4·8	—	2·0	—	—
Densipollenites	13·2	—	1·6	0·8	0·8	0·4	2·4	3·6
Podocarpidites	4·4	5·2	11·2	7·6	7·2	3·2	8·4	1·2
Klausipollenites	4·0	1·6	2·4	2·0	1·6	0·4	—	2·0
Alisporites	6·8	9·6	14·8	20·4	10·8	12·0	19·2	40·4
Chordasporites	0·4	0·8	5·2	2·0	0·4	—	—	0·8
Falcisporites	0·8	—	0·8	0·8	—	0·4	1·6	4·4
Limitisporites	—	2·0	—	—	—	—	—	0·4
Jugasporites	—	0·4	0·4	—	—	—	0·4	—
Rhizomaspora	—	—	0·8	1·2	2·8	0·4	1·2	0·4
Lahirites	11·6	6·0	3·6	3·2	1·6	—	3·6	2·8
Gondwanipollenites	18·8	20·4	14·8	11·6	14·8	19·2	8·8	14·4
Protohaploxypinus	26·4	16·4	8·8	7·6	13·6	10·4	9·2	12·8
Striatites	5·8	0·4	0·8	0·8	1·6	—	—	3·2
Lunatisporites	—	4·8	8·4	1·2	2·4	0·8	—	—
Others	4·4	2·4	0·8	1·6	—	1·0	1·2	5·6

Notes:

1. In this table percent frequencies of following genera have been considered together: (i) *Brevitriletes* + *Horriditriletes*. (ii) *Podocarpidites* + *Cuneatisporites* + *Platysaccus*. (iii) *Alisporites* + *Sulcatisporites*. (iv) Radial monosaccates + aletes — under *others*.
2. *Lunatisporites* is used *sensu stricto*.
3. *Gondwanipollenites* also includes *Lunatisporites* of Bharadwaj.

Alisporites, *Gondwanipollenites* and *Protohaploxypinus*. On the basis of miospore frequency the samples fall into 4 groups which correspond to the four different exposures of the section from where the samples were collected.

Sample group 1 comprising NP-1, NP-2 and NP-9 is dominated by the genera *Decisporis*, *Alisporites*, *Lunatisporites*, *Gondwanipollenites* and *Protohaploxypinus*. The genera *Punctatisporites*, *Brevitriletes*, *Verrucosisporites*, *Playfordiaspora*, *Cuneatisporites*, *Chordasporites*, and *Lahirites* are generally less than 5 per cent. *Playfordiaspora* is the characteristic element of this group.

Sample group 2 consisting only of sample no. NP-8 is characterized by a significant increase in the frequency of the genera *Punctatisporites* and *Verrucosisporites*. The genus *Densipollenites* is common but the genera *Decisporis* and *Brevitriletes* start declining. There is not much change in the frequency of the genera *Alisporites*, *Gondwanipollenites* and *Protohaploxypinus*. *Playfordiaspora* is absent.

Sample group 3 comprising samples NP-4 +NP-7 and 1358 is characterized by a very significant increase in the frequency of the genus *Verrucosisporites*. The genera *Punctatisporites* and *Decisporis* decline further. The striate-bisaccates are also on the decline.

Sample group 4 consisting of only sample no. 1359 is very interesting as here the triletes reach their lowest ebb while the non-striate bisaccates, represented mostly by *Alisporites*, are at their peak. The striate bisaccates do not show much change.

The azonate-triletes are lowest (20 per cent) in sample NP-1 which is the oldest of

fossiliferous Maitur samples. The frequency gradually increases till it reaches its maximum (50 per cent) in the composite sample NP-4+NP-7. However, this group is meagrely represented in sample no. 1359 which probably is the topmost fossiliferous Maitur sample studied here.

The zonate-triletes are fairly well represented in the lower samples (NP-1, NP-2, NP-9), decrease in NP-4+NP-7 and are totally absent in sample nos. 1358 and 1359.

The monosaccates though present in all the samples are not well represented.

The striate bisaccates gradually decline from older to younger samples studied till they are only 23 per cent in sample no. 1358. Their maximum frequency (48 per cent) is in sample NP-9.

The non-striate bisaccates range between 15 and 35 per cent except for sample no. 1359 where they suddenly shoot up to 53 per cent.

The important elements of each sample group are as follows: (i) Group-1, *Decisporis*, *Playfordiaspora* (= *Guthoerlisporites* p.p.) and *Lunatisporites* (= *Taeniaesporites*); (ii) Group-2, *Punctatisporites*, *Verrucosisporites* and *Decisporis*; (iii) Group-3, *Verrucosisporites*, *Punctatisporites* and *Eupunctisporites*; and (iv) *Alisporites* and *Falcisporites* for Group-4. Sample no. 1359 is interesting as here the triletes are at their minimum whereas the non-striate bisaccates are at their maximum in the section.

COMPARISON

A comparison of the Maitur Formation samples with one of the topmost fossiliferous samples (NR-1) of the Raniganj Formation (Table 1) shows that the azonate-triletes which are scanty in the latter, gradually increase in frequency from older to younger Maitur samples. The zonate-triletes are absent in the Raniganj sample but are not uncommon in the Maitur samples. The monosaccates which are 18 per cent in NR-1 are never more than 5 per cent in the Maitur samples. The monosaccates in the Raniganj sample belong all to one genus — *Densipollenites*,— whereas in the Maitur samples a new monosaccate form × *Playfordiaspora* — comes up. The striate bisaccates which are 65 per cent in the Raniganj sample, gradually become reduced in numbers. The non-striate bisaccates which are about 14 per cent in the Raniganj are as much as 53 per cent in one of the Maitur samples (1359).

Satsangi, Chandra and Singh (1972) described a mioflora obtained from the Panchet beds exposed in the Nonia Nala. They report the abundance of bisaccate pollen in the assemblage, as we have also found in our samples. Some of the characteristic elements such as, *Punctatisporites*, *Verrucosisporites*, *Decisporis*, *Playfordiaspora*, *Lunatisporites* (= *Taeniaesporites*) etc. were, however, not observed by them. While we agree that the rich mioflora of the Raniganj Formation gradually declined during the Maitur times, we also find coming up of some new elements such as, *Decisporis* and *Playfordiaspora* in the Maitur Formation.

Shrivastava and Pawde (1962) described the *Sporae dispersae* of the Raniganj and Panchet beds occurring in the borecore no. R.O. 1(B) from the Ondal area of West Bengal. The range table given by them shows a significant change in the mioflora at 349 metres below ground level, at the point of Raniganj-Panchet contact. This indicates an appreciable gap in sedimentation as was also earlier reported by Gee (1932, pp. 365-366). This mioflora from R.O. 1(B) is definitely much younger than the Nonia Nala mioflora.

Pollen and spores were described by Kar (1970a) from the rocks of the Panchet Group in the borehole no. RE-9 in the eastern part of the Raniganj Coalfield. This mioflora has about 80 per cent trilete spore forms, the two dominant genera being *Decisporis* and *Divaripunctites*. Bisaccate pollen are comparatively less. From the very high percentage of the trilete spores, low percentage of the bisaccate pollen and the absence of the genera *Verrucosisporites*, *Playfordiaspora*, and *Lunatisporites* (= *Taeniaesporites*), we presume that the RE-9 mioflora is younger as compared to the Maitur mioflora.

Sarbadhikary (1972) has described a palynoflora from two samples of 'Panchet Formation' in the borehole no. RE-1, Raniganj Coalfield. The mioflora is almost exclusively composed of triletes, which is in sharp contrast to the striate bisaccate rich Raniganj mioflora obtained from the same borehole. The Panchet assemblage of this borehole is quite different from the Maitur assemblage but agrees with the Panchet assemblage from borehole RE-9. We, therefore, have concluded that in

boreholes RE-1 and RE-9 the Maitur Formation is unrepresented and that the Upper Panchets rest directly on the Raniganj as is generally the case in the area (Gee, 1932).

Bharadwaj and Srivastava (1969) described a mioflora from grey micaceous shales exposed in the Gopad River, near Nidhpuri, Sidhi District. The assemblage is dominated by the non-striate bisaccates and the triletes are extremely rare. The almost total lack of the genera *Punctatisporites*, *Verrucosisporites*, *Decisporis*, *Playfordiaspora* and *Lunatisporites*, and the paucity of striate bisaccates differentiate this assemblage from the Maitur mioflora. The above Nidhpuri mioflora is younger even than the RE-1 or RE-9 miofloras and may probably belong to the Mahadeva Group.

Trivedi and Misra (1970) also described a 'Triassic' mioflora from the sandy shales, exposed in the Gopad River, 4 km N. of Nidhpuri. This mioflora has a dominance of striate-bisaccates, triletes are few and monosaccates are also not very common. This Nidhpuri assemblage is most probably homotaxial with the Upper Raniganj strata in the Nonia Nala section and hence may not be Triassic in age. It is definitely older than the Maitur mioflora described by us.

Balme (1970) has recently described the Triassic pollen and spores from the Salt Range, Pakistan. The Maitur Formation and the Mianwali Formation (Kathwai member), both have a dominance of bisaccate pollen in the basal part and then show a gradual increase in the frequency of the triletes. On the generic level the two formations, however, differ in composition; further in the Mianwali Formation the acritarchs are fairly common.

The palynology of the upper beds of the Raniganj Formation has been studied by Shrivastava and Pawde (1962), Maheshwari (1967) and Kar (1970b). In these beds the striate bisaccates dominate the mioflora and the triletes are only meagrely represented. *Densipollenites* is sometimes present in significant percentage (Maheshwari, 1967, Table 1 in the present paper). Quite a few of the miospore genera are found to be common between the Raniganj and Maitur samples presently studied. Some characteristic forms of the Raniganj Formation, viz., *Indospora*, *Gondisporites*, *Microbaculispora*, *Microfoveolatisporites* and *Vittatina* etc. are absent in both the upper Raniganj and the Maitur samples. At the same time the characteristic Maitur forms, *Decisporis* and *Playfordiaspora* have so far not been found in the Raniganj Formation.

It is thus seen that the Raniganj mioflora suffered a gradual decline in quality and quantity, the basal Maitur mioflora retained its Raniganj affinities in having a preponderance of striate bisaccate pollen. Only gradually the triletes increased in frequency. However, some new elements did appear in the Maitur Formation.

AGE OF THE MAITUR FORMATION

The age of the Maitur Formation, and in fact of whole of the Panchet Group, has generally been accepted to be Lower Triassic (see Tripathi and Puri, 1961), but sometimes an Upper Permian relationship has also been suggested for the formation (Das-Gupta, 1928). The latter view relies upon the occurrence of the fish *Amblypterus* in the basal Panchets. The fish has also been found in the Raniganj Formation (Mukherjee and Ghosh, 1973). *Lystrosaurus*, which is usually accepted as a marker of the Lower Triassic in the southern continents also does not occur in the Nonia Nala Maiturs. Cosgriff (1965) thinks that the *Lystrosaurus* Zone of South Africa should be assigned to the Upper Permian.

Glossopteris conspicua and *G. retifera*, which have been found in some Maitur beds also do not go beyond the Lower Beaufort (Upper Permian). Further no characteristic Triassic plant, e.g. *Dicroidium* is definitely known from the Maitur Formation. Singh and Shah (1972) and Maheshwari (1974) are of the opinion that if the Permo-Triassic boundary in India is taken as fixed on lithological evidences, then the flora of the Upper Permian and Lower Triassic is very akin but for minor differences. On the other hand, if the boundary is considered on the floral contents alone, it should be extended into the Maitur Formation. According to Chaloner (1969) the principal floral changes took place at different levels within the Upper Permian, and not at the Permian-Triassic boundary.

The strong Permian affinities of the basal Maitur mioflora are indicated by the preponderance of bisaccate pollen (particularly the striate ones). Of the charac-

teristic Maitur miospore genera, *Lunatisporites* (= *Taeniaesporites*) and *Playfordiaspora* (= *Guthoerlisporites* p.p.), though not known from the Raniganj Formation of peninsular India, are, however, known from the Permian of Salt Range (Balme, 1970). *Decisporis* is, however, a characteristic Panchet genus.

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