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GONDWANA PLANT MICROFOSSILS FROM THE TETHYAN SEDIMENTS, MALLA JOHAR AREA, UTTAR PRADESH

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ABSTRACT

The paper deals with the palynological studies of the Tethyan succession of Malla Johar area, Kumaon Himalaya, exposed in the Tethys-Himalayan Zone. The Pre-Permian samples treated so far have not yielded any miospores. The Permian samples contain a fairly diversified assemblage which shows a close affinity with the Gondwana mioflora, thus suggests its provenance from the southern side, i.e., the Peninsular India. The Triassic miopore components, although fewer in kind, are also indicative of the same relationship. A few miospores from the younger horizon (Jurassic) have also been recorded but no relationship of mioflora could be established for this horizon.

INTRODUCTION

The Kumaon Himalaya, trending approximately north-west—south-east shows development of four different physiographic-lithotectonic zones. The northern most zone is the Tethys-Himalayan Zone and is made up of a thick pile of almost uninterrupted sequence of sedimentary rocks from Precambrian to early Eocene whose provenance is a matter of much speculation. Recently, a southerly source for the sediments has been suggested on the basis of palaeocurrent analysis (Kumar *et al.*, 1977). The present paper reports a definite Gondwana micro-biota assemblage from the Permian-Triassic succession of the Tethyan Zone which also suggests its provenance from the southern side, i.e., from the Peninsular side of India.

The samples of the Tethyan succession were collected by three of us (S. K., I. B. S., & S. K. S.) during an expedition to Malla Johar area in 1974, organised by the Department of Geology, Lucknow University. The traverses were taken along the Sumna-Yong mule-track and Sumna-Laptal mule-track (Sumna : Lat. 30°40′20″N, Long. 80°1′18″ E ; Laptal : Lat. 30°39′5″ N, Long. 80°8′30″ E). The stratigraphic sequence of a part of this succession is given in Table 1, together with the characteristic spores recovered from the different stratigraphic horizons.

METHOD

Miospores were difficult to extract and almost always poorly preserved. After maceration with HCl and HF, treatment of the macerate with five per cent KOH followed by a few drops of HCl has helped in cleaning the turbid, jel-like fluorides from the material. The miospore specimens, in many cases, are distorted, blackened and disorganised.

PLANT MICROFOSSILS

The palynological study has been done for the entire Tethyan successionexposed in the Malla Johar area.

The Pre-Permian samples surprisingly did not yield any miospores. This absence is rather difficult to explain. Perhaps during diagenesis, these might have been destroyed, as megafossils are moderately well preserved and quite abundantly recorded.

The following miospore assemblages were recovered from the several formations of the Rawalibagar Group and Sancha Malla Group of Malla Johar area (Table 1). The age given in parenthesis is after Heim and Gansser (1939).

KULING SHALE (Permian)

Hennellysporites Tiw., 1968 ; *Callumispora* Bharad. & Sriv., 1969 ; *Lacinitriletes* Venkatach. & Kar, 1968 ; *Apiculatisporis* (Ibr.) Pot. & Kr., 1956; *Laevigatosporites* Ibr., 1933 ; *Densipollenites* Bharad., 1962 ; *Alisporites* Daugh. emend. Nilsson, 1958 ; *Scheuringipollenites* Tiw., 1973; *Striatopodocarpites* Sed., 1956; *Faunipollenites* Bharad., 1962 ; *Crescentipollenites* Bharad., Tiw. & Kar, 1974.

KUTI SHALE (Norian ; Upper Triassic)

Fungal and other alete spores ; disaccate non-striate pollen.

PASSAGE FORMATION

Tetraporina Naum., 1950 ; cf. *Platysaccus* Naum. ex Pot. & Kl., 1954 ; *Klausipollenites* Jansonius, 1962 ; disaccate non-striate pollen ; alete spores.

KIOTO LIMESTONE (Rhaetic ; Upper Triassic)

Callumispora ; *Maculatasporites* Tiw., 1965; *Alisporites ; Lundbladispora* Balme emend. Playf., 1965 ; *Parasaccites ;*

Table—1. Modified by Kumar *et al.* 1977, after Heim and Gansser, 1939.

Super Group	Group	Formation	Lithology	Age	Important miospores
		Exotic Formation	White oolitic limestone		
— — —	— — —	— — —	—THRUST—	— — —	— — —
Malla Johar Supergroup	Sancha Malla Group	Balcha Dhura Formation	Basic volcanic rocks interbedded with reddish brown and grayish green shales and radiolarian cherts.	Upper Cretaceous to ?Lower Eocene	
		Jhangu Formation.	Dark gray, black, green, and red shales, grayish green graywacke and foraminiferal limestone.	Upper Cretaceous	
		Giumal Sandstone	Glauconitic sandstone, siltstone and shale	Lower Cretaceous	
		Spiti Shale	Black friable shales and siltstone with abundant nodules containing ammonites	Portlandian Oxfordian	*Callialasporites* *Cycloverrutriletes*
	Rawalibagar Group	Ferruginous Oolite Formation	Ferruginous oolitic limestone and shale with abundant ammonite.	Callovian	
		Laptal Formation	Shell limestone, limestone, oolitic limestone, marls and shales.	Liassic	
		Kioto Limestone	Oolitic limestone, shell limestone, nodular limestone, limestone and shale	Rhaetic	*Lundbladispora*, *Callumispora*, *Lunatisporites*, *Striatopodocarpites*.
		Passage Formation	Shell limestone, limestone, silty shale and orthoquartzite	Noric	*Klausipollenites* non-straite disaccate
		Kuti Shale	Sandy and shaly limestone, silty shale and grayish to black shale.	Noric	Non-striate disaccate
		Kalapani Limestone	Limestones, shell limestone and shales with abundant megafossils (ammonites)	Anisic to Carnic	
		Chocolate Formation	Limestone, shell limestone and black shale	Scythic	
		Kuling Shale	Black shales and subordinate siltstone with calcareous nodules.	Permian	*Callumispora*, *Striatopodocarpites*, *Crescentipollenites*, *Densipollenites*
	Sumna Group	Muth Formation	Calcareous orthoquartzites, orthoquartzites, shaly sandstone and siltstone.	Devonian	

Lophotriletes (Naum.) Pot. & Kr., 1954 ; *Lunatisporites* Lesch. emend. Scheur., 1970 ; *Striatopodocarpites ;* aletes.

SPITI SHALE (Portlandian ; Upper Jurassic)

Callialasporites Dev emend. Pot., 1966 ; *Cycloverrutriletes* Schulz, 1964 ; *Deltoidospora* Weyl. & Krieg. emend. Dettm., 1963 ; *Platysaccus ;* disaccate non-striate pollen.

GIUMAL SANDSTONE, JHANGU FORMATION AND BALCHA DHURA FORMATION

No recognisable miospores could be recovered.

DISCUSSION

The Kuling Shale mioflora (Permian) corresponds with the assemblages known from the Lower Gondwana deposits of the Indian Peninsula (Bharadwaj, 1974). The characteristic genera are : *Densipollenites*, *Parasaccites*, *Callumispora*, *Lacinitriletes*, *Scheuringipollenites*, *Faunipollenites* and *Striomonosaccites* which are definite indicators of a close relationship between Tethyan sediments under study and the Indian mainland Upper Permian sequence. There is little resemblance with the Euromerican or the Angara mioflora (Hart, 1970) because in the former the genera *Leuckisporites*, *Nuskoisporites*, *Illinites*, *Limitisporites* and *Jugasporites* are common in general, and in the latter the *Cordaitina*-complex, alongwith *Vittatina* and monocolpates, are dominant. It has been proved beyond doubt that *Cordaitina* and *Parasaccites* groups of pollen are morphologically dissimilar (*pers. obser.*) and hence the difference is all the more established.

The Kuti Shale and Passage Formation assemblages did not yield sufficient number of genera, therefore not much can be commented upon them, although the Triassic age is evident from the presence of typical *Klausipollenites* and other non-striate disaccate pollen grains. The genus *Klausipollenites* is very rarely recorded from the Upper Permian sediments of the Indian subcontinent in contrast to the European Permian where it is quite dominant. On the other hand, its definite occurrence is on record from the Triassic rocks of Damodar, Son and Mahanadi Valleys in North and Central India (Bharadwaj & Srivastava, 1969 ; Bharadwaj & Tiwari, 1977). Therefore, it indicates a Triassic age for these beds, in relation to the Gondwanic deposits.

As regards the Kioto Limestone, the Rhaetic age given to it by Heim and Gansser (1939) does not correspond with the palynological dating. The totality of the assemblage, having *Callumispora*, *Alisporites*, *Lundbladispora*, *Parasaccites*, *Lunatisporites* and *Striatopodocarpites*, indicates an older affinity—probably early to middle Triassic. However, detailed work should throw more light on possibility of reworking, or other factors.

Some plant microfossils have also been recovered from the younger horizon, i.e., the Sipti Shale, which shows the presence of *Callialasporites* along with non-striate disaccate pollen. Although the Jurassic age of this bed is supported by the miospore contents presently discovered, the affinities with Gondwanic or non-Gondwanic assemblages cannot be exclusively established because, firstly, the recovery of miospores is poor, and secondly, the Jurassic miofloras of the world have more or less similar elements in common. No identifiable miospore could be recovered from the Cretaceous sediments, i.e., Giumal Sandstone, Jhangu Formation and Balcha Dhura Formation.

The theory of Plate Tectonics envisages the existence of Indian Plate whose northern boundary is a matter of much speculation. Some workers have suggested Main Central Thrust or Indus Suture as the Plate boundary (Powell & Conaghan, 1973; Le Fort, 1975 ; Gansser, 1966) while others have argued in favour of Indian Plate boundary beyond Tibet in Tien Shan (Crawford, 1974; Kaila & Narain, 1976). The present finding of Gondwana mioflora from Tethyan sediments supports the position of Indian Plate boundary beyond Tibet as the Tethyan sediments appear to be the part of Indian Plate.

The approximate position of India (i.e., the Indian Plate) in relation to other continents during Permian-Triassic times is given in Fig. 1 (After Bharadwaj, 1976). The mioflora recovered in the present work from the Permian and Triassic of Malla Johar Tethyan sediments (marked in Fig. 1, as a dot on the Himalayan line of Indian Plate) clearly indicates an Indian Peninsular affinity. It is, therefore, concluded that the Tethyan sediments of the Himalaya—the Permian and Triassic in particular, have genetic relationship with the Gondwana sediments of India rather with that of Europe or Angaraland.

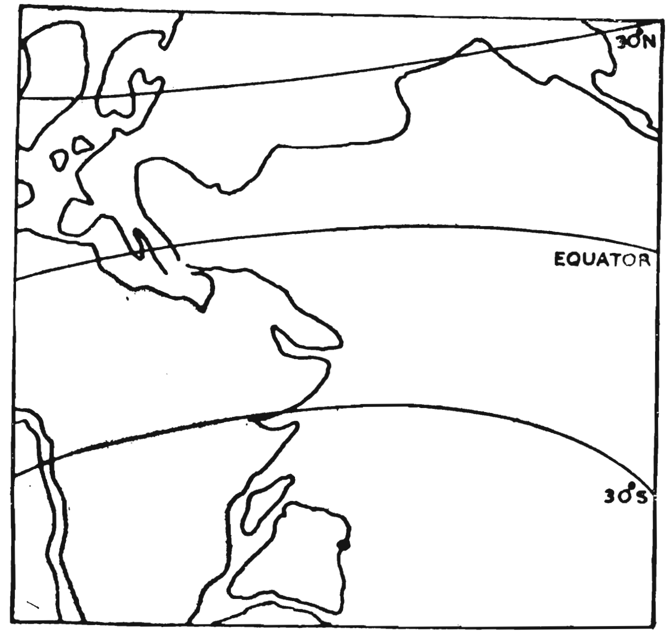

Fig. 1. Position of Indian Plate during Permian times (after Bharadwaj, 1976). Latitudes adopted after Seyfert & Sirkin, 1973. The dot on the Himalayan line of India shows the approximate location of Malla Johar Tethyan sediments studied here.

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EXPLANATION OF PLATE

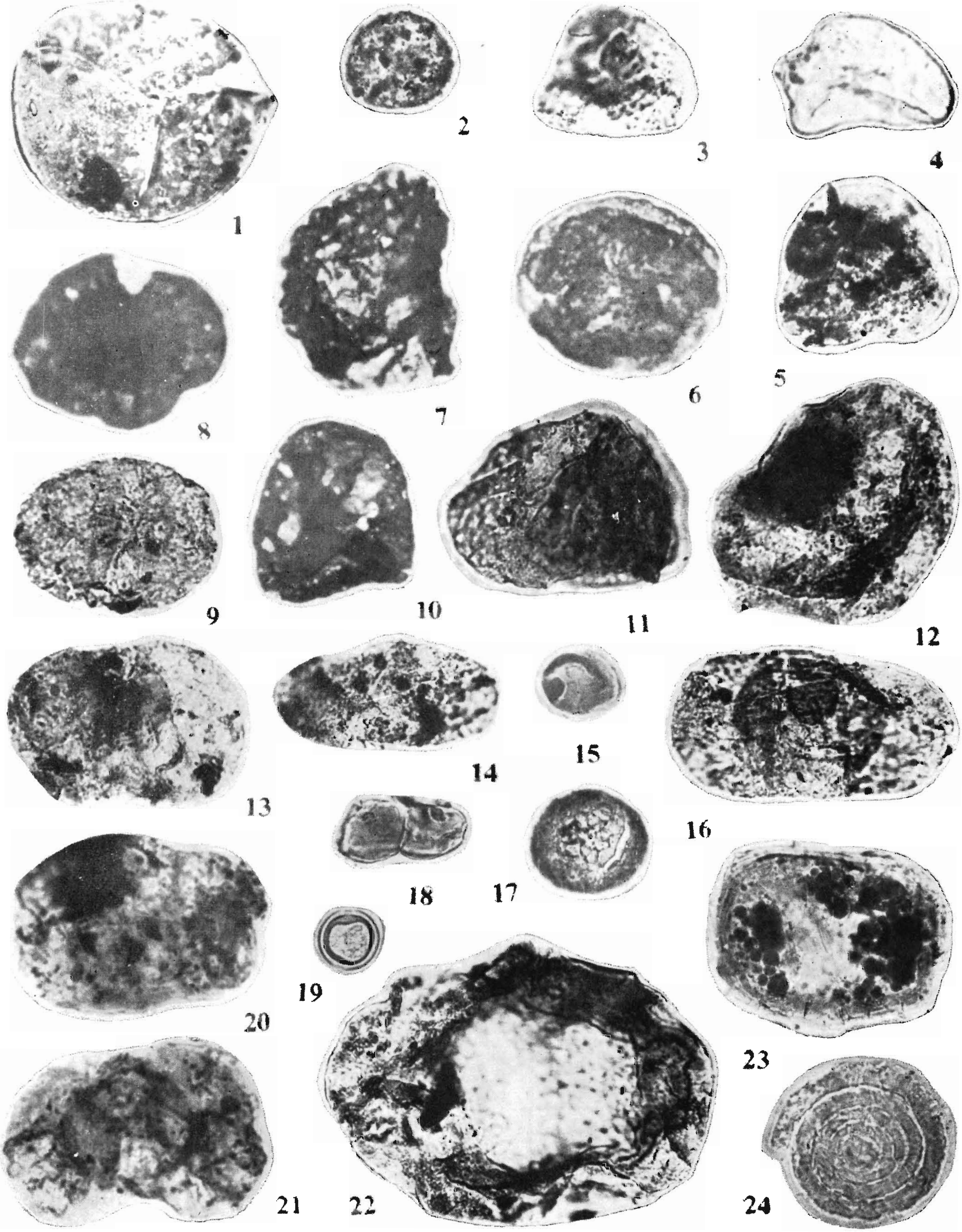
PLATE I

Important palynomorphs recovered from Permian to Jurassic sediments of Tethyan sequence of Malla Johar area, U. P.

1. *Callumispora*, Slide no. BSIP 6093
2. *Apiculatisporis*, Slide no. BSIP 6088
3. *Lophotriletes*, Slide no. BSIP 6090
4. *Lacinitriletes*, Slide no. BSIP 6083
5. *Densoisporites*, Slide no. BSIP 6090
6. *Callialasporites*, Slide no. BSIP 6099
7. *Cycloverrutriletes*, Slide no. BSIP 6097
8. *Callialasporites*, Slide no. BSIP 6098
9. *Scheuringipollenites*, Slide no. BSIP 6086
10. cf. *Deltoidospora*, Slide no. BSIP 6100
11. *Alisporites*, Slide no. BSIP 6082
12. *Densipollenites*, Slide no. BSIP 6086
13. *Striatopodocarpites*, Slide no. BSIP 6086
14. *Klausipollenites*, Slide no. BSIP 6092
15. Alete miospore, Slide no. BSIP 6082
16. *Crescentipollenites*, Slide no. BSIP 6085
17. *Maculatasporites*, Slide no. BSIP 6094

18-19. Alete miospores (diad) Slide nos. BSIP 6081, 6096

20. *Faunipollenites*, Slide no. BSIP 6084
21. Striate disaccate, Slide no. BSIP 6087
22. *Parasaccites*, Slide no. BSIP 6091
23. *Tetraporina*, Slide no. BSIP 6095
24. Miospore—A, Slide no. BSIP 6089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