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PALYNOLOGICAL DATING OF SUBSURFACE TRIASSIC STRATA NEAR DURGAPUR, WEST BENGAL

R. S. TIWARI

Birbal Sahni Institute of Palaeobotany, Lucknow-226 007, India

ABSTRACT

Palynological analysis of samples in Bore-hole RD-1 near Durgapur, district Burdwan has suggested the presence of Triassic rocks in this region. In this eastern region of the Raniganj Coalfield no Lower Gondwana sediments are exposed and so far their presence was only conjuctured, but the present study confirming the presence of Triassic sediment, opens a probability of Permian deposition, an extension of the Raniganj Formation, beneath them. Two palynological assemblages, late Lower and the early Middle Triassic in age, have been identified — the latter with a so-far-unknown composition having cf. *Striomonosaccites* dominance, besides the usual Triassic palynomorphs.

Key-words — Palaeopalynology, Palynomorphs, Triassic, West Bengal (India).

सारांश

दुर्गापुर, पश्चिम बंगाल के समीपवर्ती अधस्तल ट्रायेसिक स्तरों का परागाणविक काल निर्धारण–
रामशंकर तिवारी

दुर्गापुर, बर्धवान जनपद के पास वेध-छिद्र आर डी – 1 के नमूनों का परागाणविक विश्लेषण इस क्षेत्र में ट्रायेसिक चट्टानों की उपस्थिति व्यक्त करता है। रानीगंज कोयला-क्षेत्र के इस पूर्वी क्षेत्र में कोई भी अधर गोंडवाना अवसाद प्रकट नहीं है तथा अभी तक उनकी उपस्थिति केवल कल्पित ही थी। परन्तु प्रस्तुत अध्ययन ट्रायेसिक अवसादों की उपस्थिति की पुष्टी के साथ-साथ परमियन निक्षेपण की संभावना को भी इंगित करता है, जो कदाचित् इन अवसादों के नीचे रानीगंज शैल-समूह का विस्तरण हो। दो परागाणविक समुच्चय, अन्तिम अधर तथा प्रारम्भिक मध्य ट्रायेसिक कालीन, अभिनिर्धारित किये गये हैं। उत्तर समुच्चय में, जिसका संघटन अभी तक अज्ञात था, साधारण ट्रायेसिक परागाणुओं के अतिरिक्त **स्ट्रायोमोनोसेकाइटिस** का बाहुल्य है।

INTRODUCTION

DURING the last decade, the Triassic palynology has attracted the attention of Indian workers; consequently a number of workers have studied the Permo-Triassic and Triassic strata of Indian Gondwana. The significant contributions are by Shrivastava and Pawade (1962), Chandra and Satsangi (1965), Satsangi, Chandra and Singh (1968, 1972), Bharadwaj and Srivastava (1969), Kar (1970a, 1970b), Venkatachala and Rawat (1974), Banerji and Maheshwari (1974, 1975), Maheshwari and Banerji (1975), Bharadwaj and Tiwari (1977), Tiwari (1977) and Bharadwaj, Tiwari and Anand-Prakash (Ms).

In sequel to such studies, a bore core from East Raniganj Coalfield, West Bengal was investigated for its spore and pollen content. The samples were sent by the Coal Division II of the Geological Survey of India.

Raniganj Coalfield has a unique position in the coal resources of India because it is the oldest place for mining industry and still produces about one-third of the total coal produce of the country. It is situated at about 200 km north-east of Calcutta, and is bounded by Archaeans on the north, west and south; towards the eastern end, the Gondwana rocks dip under the younger formations which in their turn are covered by alluvium. Therefore the eastern boundary of the coalfield is speculative one. On the hitherto known evidences, however, the west to east limits of the coalfield are between 86° 36′ E to 87° 12′ E longitudes

along the southern area (Gee, 1932; Fox, 1934).

The palynological dating of the subsurface strata near Durgapur (23° 30′: 87° 20′) has not been done so far; the significance of the present communication is therefore obvious because it provides the biostratigraphic data about the rocks whose age has not been determined so far and there is every possibility of an extension of coal-bearing horizons of the Raniganj Formation below them.

MATERIAL AND METHODS

The following samples from bore hole RD-1 near Durgapur, district Burdwan, West Bengal, were macerated.

Sample No.	Depth from the surface in m	Lithology
RD-1/1	148.62	Light grey, course sst. with coal streaks
RD-1/2	150.32	,, ,,
RD-1/3	530.00	,, ,,
*RD-1/4	532.48	,, ,,
*RD-1/5	600.58	Dark greenish-grey silt-stone
RD-1/6	645.00	Chocolate shale
RD-1/7	653.25	Light grey, medium sst. with lenses of green and chocolate-green silt-stone

Out of seven samples listed above, only two, viz., sample no. RD-1/4 and RD-1/5 (marked with*) yielded the miospores.

The maceration was done by usual method, treating the samples with hydrofluoric acid, nitric acid and then cleaning them with 5 per cent KOH solution.

In order to determine the percentage frequency at generic level, 200 specimens were counted at random from each sample. The miospore genera are identified on the lines followed by Balme (1970) and Bharadwaj and Tiwari (1977).

MIOFLORAS

The two samples under discussion contain fairly well-preserved miospores, the sample no. RD-1/5 being relatively better. The common types as well as some forms having morphographic and stratigraphic values — although rare in occurrence, have been illustrated in Plate 1 and 2. These samples are separated from each other by a 68·10 m thick stratum. The terminology of expression indicating the relative abundance of various genera has been used as: *dominant* — 25 per cent or more; *abundant* — 11 to 24 per cent; *common* — 1 to 10 per cent; *rare* — 0.1 to 0.9 per cent; *very rare* — less than 0.1 per cent.

The details of two assemblages are given below :

1. *Lunatisporites-Lundbladispora* Assemblage — zone (Sample no. RD-1/5, depth level 600.58 m; Histogram 1).

Dominant

Lunatisporites (30%).

Common

Lundbladispora (8.5%); *Osmundacidites* (7%); *Indotriradites* (7.5%); *Verrucosisporites* (6.5%); *Striatopodocarpites* (6.70%); *Nevesisporites* (4.5%); cf. *Striomonosaccites* (4%); cf. *Cedripites* (3.0%); *Alisporites* (3.0%); *Chordasporites* (3.0%); *Playfordiaspora* (2.5%); *Cyathidites* (2.5%); *Falcisporites* (2.0%); *Callumispora* (1.5%); *Cyclogranisporites* (1.5%).

Other genera — *Inaperturopollenites*, *Klausipollenites*, *Pretricolpipollenites*, *Faunipollenites* (each 1.0%).

Rare

Densoisporites, *Cuneatisporites*, *Parasaccites* (each 0.5%).

Presence recorded

Platysaccus, *Crescentipollenites*, *Scheuringipollenites*, cf. *Granulatisporites* (not found in counting).

The above analysis reveals that this mioflora contains significant sculptured, non-cavate as well as cavate trilete genera. The taeniate genus *Lunatisporites* is at its maximum and is more diversified in nature. The striate-disaccate pollen are ebbing.

Qualitatively important genera are: *Pretricolpipollenites*, *Playfordiaspora*, *Fal-*

cisporites, *Chordasporites*, *Callumispora*, *Densoisporites*, *Parasaccites*, *Klausipollenites*, *Inaperturopollenites;* these forms are rare but, at the same time, diagnostic for the mioflora.

2. *Striomonosaccites — Pretricolpipollenites* Assemblage-zone (Sample no. RD-1/4; depth level 532.48 m; Histogram 1).

DOMINANT

Cf. *Striomonosaccites* (37.5%).

COMMON

Striatopodocarpites (7.0%); *Pretricolpipollenites* (6.0%); spore type A (5.0%); *Ephedripites* (5.5%); *Klausipollenites* (5.0%); *Alisporites* (4.5%); *Nevesisporites* (3.5%); *Cycadopites* (3.0%); *Granulatisporites* (3.0%); cf. *Cedripites* (2.0%); *Densoisporites* (2.0%); *Lunatisporites* (1.5%); *Weylandites* (1.5%).

Other genera — *Callumispora*, *Lophotriletes*, *Parasaccites*, *Cuneatisporites* (each 1%).

RARE

Faunipollenites, *Cyathidites*, *Crescentipollenites*, *Chordasporites*, *Vitreisporites* (each 0.5%).

PRESENCE RECORDED

Cyclogranisporites, *Platysaccus*, *Striatites* (not found in counting).

The above listed mioflora is unusual in having cf. *Striomonosaccites* as the dominant pollen genus. This is unusual in the sense that this genus has never been reported to be so abundant in any of the so-far-known Permian or Triassic assemblages from India. Structurally, this group does not represent true *Striomonosaccites* Bharadwaj, 1962 hence conferred to it.

In this mioflora, the colpates and non-striate-disaccates are quite outstanding in their incidences. The triletes-cavate and non-cavate are less abundant while the taeniate genus *Lunatisporites* has declined considerably.

COMPARATIVE ASSESSMENT

A perusal at the Histogram 1 reveals that the two assemblages are different from each other by virtue of the relative abundance of the various miospore genera.

The lower sample-RD-1/5 has a *Lunatisporites*-dominant composition with zonate, cingulate and apiculate trilete genera. The upper sample-RD-1/4 contains very little of *Lunatisporites*, much declined zonate-cingulate and apiculate genera, but a sudden proliferation of the genus cf. *Striomonosaccites*. Beside these differences, the colpate genera *Cycadopites* and *Pretricolpipollenites* show noteworthy incoming.

The genera exclusively and restrictedly recorded in each sample are :

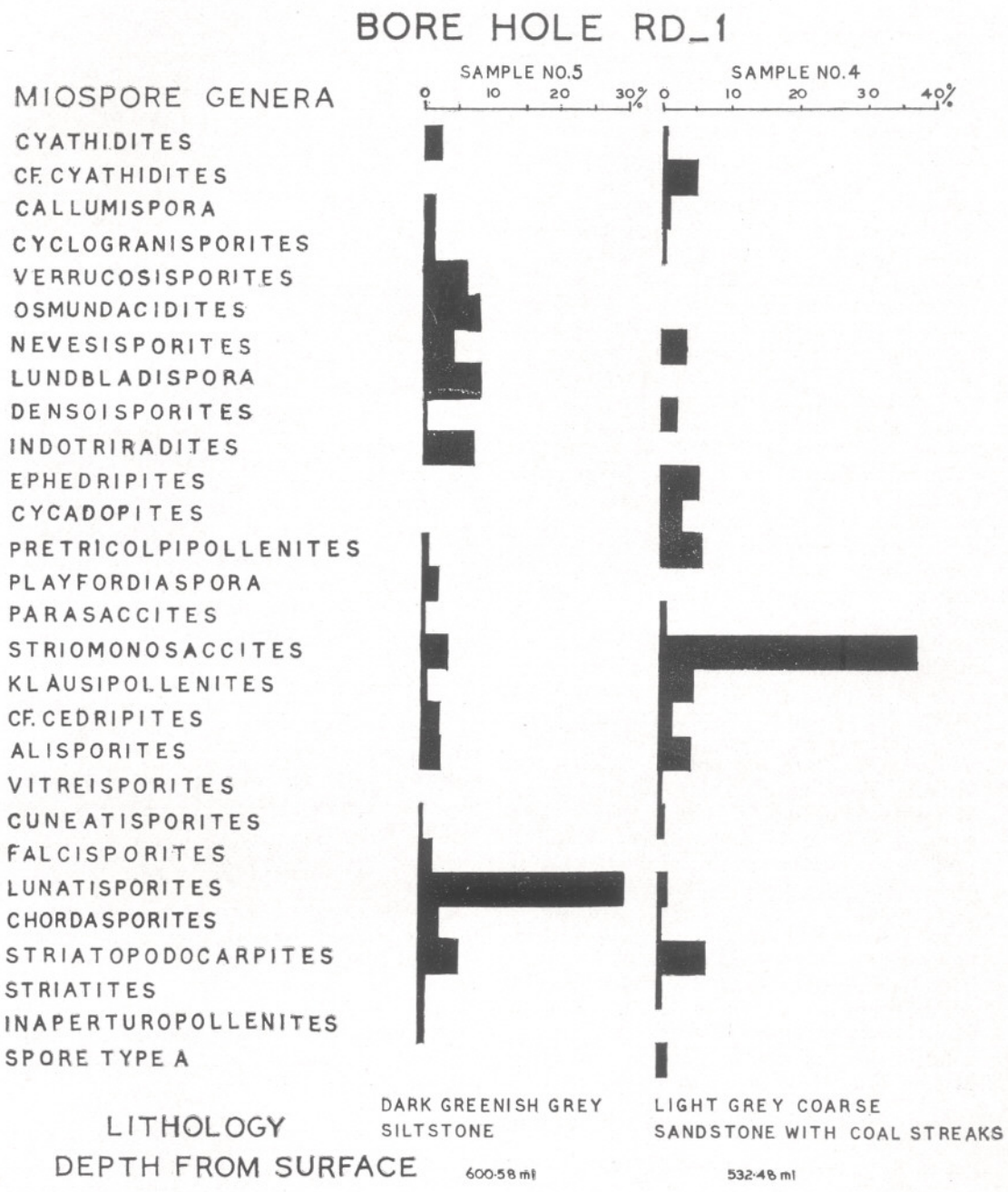
Sample no. RD-1/5	Sample no. RD-1/4
Verrucosisporites	Cf. *Cyathidites*
Osmundacidites	*Ephedripites*
Lundbladispora	*Cycadopites*
Indotriradites	*Vitreisporites*
Playfordiaspora	Spore type A
Falcisporites	
Inaperturopollenites	

Except a few among the above list, most of the genera are in good representation, hence their absence in one sample and presence in other is noteworthy. Notwithstanding this fact, both the miofloras have comparable elements which qualify to make them assignable to the Triassic age. Such forms are *Cyathidites*, *Nevesisporites*, *Densoisporites*, *Pretricolpipollenites*, *Klausipollenites*, *Lunatisporites* and *Chordasporites*. The assemblages are not related closely but fundamentally have a continuity.

POSITIONING WITHIN TRIASSIC

The close of Raniganj Stage (Upper Permian) is marked by the striate-disaccate and *Densipollenites* dominance (see Tiwari, 1977), and the advent of the Lower Triassic is characterized by the incoming of *Klausipollenites*, *Alisporites*, *Playfordiaspora*, *Verrucosisporites* and *Lunatisporites* (Bharadwaj & Tiwari, 1977).

The presence of *Lunatisporites* (taeniate-disaccate) alongwith cingulate-zonate miospore in significant representation is the marker of late Lower Triassic mioflora (Tiwari, 1977) because at the beginning of the Lower Triassic the taeniate forms are very rare and the mioflora shows a continuity with the Upper Permian assemblage. The genus *Verrucosisporites* also


BORE HOLE RD_1
MIOSPORE GENERA
SAMPLE NO.5
0 10 20 30%
SAMPLE NO.4
0 10 20 30 40%
CYATHIDITES
CF. CYATHIDITES
CALLUMISPORA
CYCLOGRANISPORITES
VERRUCOSISPORITES
OSMUNDACIDITES
NEVESISPORITES
LUNDBLADISPORA
DENSOISPORITES
INDOTRIRADITES
EPHEDRIPITES
CYCADOPITES
PRETRICOLPIPOLLENITES
PLAYFORDIASPORA
PARASACCITES
STRIOMONOSACCITES
KLAUSIPOLLENITES
CF. CEDRIPITES
ALISPORITES
VITREISPORITES
CUNEATISPORITES
FALCISPORITES
LUNATISPORITES
CHORDASPORITES
STRIATOPODOCARPITES
STRIATITES
INAPERTUROPOLLENITES
SPORE TYPE A
LITHOLOGY
DEPTH FROM SURFACE
DARK GREENISH GREY SILTSTONE
600·58 mt
LIGHT GREY COARSE SANDSTONE WITH COAL STREAKS
532·48 mt

HISTOGRAM 1

shows its prominence at this level (Maheshwari & Banerji, 1975; Kar, 1970). Therefore, broadly speaking the *Lunatisporites*, *Densoisporites*, *Lundbladispora* and *Verrucosisporites* assemblage is diagnostic for the late Lower Triassic. The *Lunatisporites- Lundbladispora* Assemblage zone discovered presently in the older sample of the bore core, in all probability, seems to be the variation manifestation of the latter assembly. Here the taeniate forms are in dominance with all those elements which qualify the younger aspect of the Lower Triassic. Qualitatively this assemblage is in continuation with the Panchet mioflora (top assemblage of Bharadwaj & Tiwari, 1977) but there is a differentiation in the percentage frequency composition.

The quantitative as well as qualitative change has been established by the differences, enumerated above, between the older (Sample no. RD-1/5) and younger (Sample no. RD-1/4) assemblages. In the latter, the *Striomonosaccites - Pretricolpipollenites* combination indicates a sharp miofloral change at this level. There is a marked difference between the two assemblages found in this bore-hole. The younger mioflora is not comparable with any other Triassic miofloras so far known from India (*refer* Balme, 1970; Tiwari, 1977). The only comparable assemblage containing *Striomonosaccites* is known from the Middle Triassic of Morondava Basin, Madagascar (Goubin, 1965). Here, the same species, i.e. *S. morondavensis* Goubin, 1965 is in dominance; in the occurrence of other miospore genera also, the two assemblages under discussion are comparable. Thus it is evident that, in all probabilities, the younger assemblage discovered in this bore hole belongs to the Middle Triassic. Although in order to establish a sequence from Lower to Upper Triassic strata more data are needed, the late Lower and early Middle Triassic assemblages discussed here exhibit a substantial difference in their constituents.

CONCLUSIONS

Durgapur in West Bengal is situated beyond the eastern limits of the East Raniganj Coalfield, where there are no outcrops of Triassic or Permian, the sedimentary rocks being covered under alluvium. So far, the dating of the subsurface sediments of this region, particularly of the Permo-Triassic, has not been done on the basis of fossils. However, the miofloral assemblage of subsurface Jurassic sediments have been described by Das and Chandra (1972) from Molangdighi near Durgapur, but the Triassic and Permian miofloras are not known. The presence of the latter two horizons are known by the lithology and electric log studies of this region (Das & Biswas, 1968; Das, 1970—referred in: Das & Chandra, 1972). In these reports seven stratigraphic sequences, including Permian, Lower Triassic, Jurassic and the younger formations, have been identified with unconformity between each of them. The dating of subsurface strata on the basis of palynology has now established the occurrence of Triassic beds in this region. This, therefore, implies that the older strata of Permian age, an extension of Raniganj coal-bearing beds, would be met with at deeper reaches in this area and a possibility of striking the coalseams has been enhanced.

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EXPLANATION OF PLATES

(*All figures are.* × 500)

PLATE 1

1. *Cyathidites*; Slide no. 5630.
2. Spore type A; Slide no. 5627.
3. *Callumispora*; Slide no. 5641.
4. *Cyclogranisporites*; Slide no. 5625.
5. *Verrucosisporites*; Slide no. 5645.
6. *Osmundacidites*; Slide no. 5644.
7. *Granulatisporites*; Slide no. 5625.
8. *Nevesisporties*; Slide no. 5636.
9. *Indotriradites*; Slide no. 5636.
10. *Indotriradites*; Slide no. 5630.
11. *Densoisporites*; Slide no. 5636.
12. *Lundbladispora*; Slide no. 5641.
13. *Playfordiaspora*; Slide no. 5650.
14. *Pretricolpipollenites*; Slide no. 5624.
15. cf. *Weylandites*; Slide no. 5623.
16. *Ephedripites*; Slide no. 5622.
17. *Klausipollenites*; Slide no. 5621.
18. *Platysaccus*; Slide no. 5643.
19. *Falcisporites*; Slide no. 5636.

PLATE 2

20. cf. *Striomonosaccites*; Slide no. 5624.
21. *Cuneatisporites*; Slide no. 5632.
22. *Pinuspollenites*; Slide no. 5624.
23. *Lunatisporites*; *Slide no.* 5643.
24. *Striatopodocarpites*; Slide no. 5643.
25. *Alisporites*; Slide no. 5645.
26. *Lunatisporites*; Slide no. 5643.
27. *Striatites*; Slide no. 5645.
28. cf. *Cedripites*; Slide no. 5643.
29. *Inaperturopollenites*; Slide no. 5636.

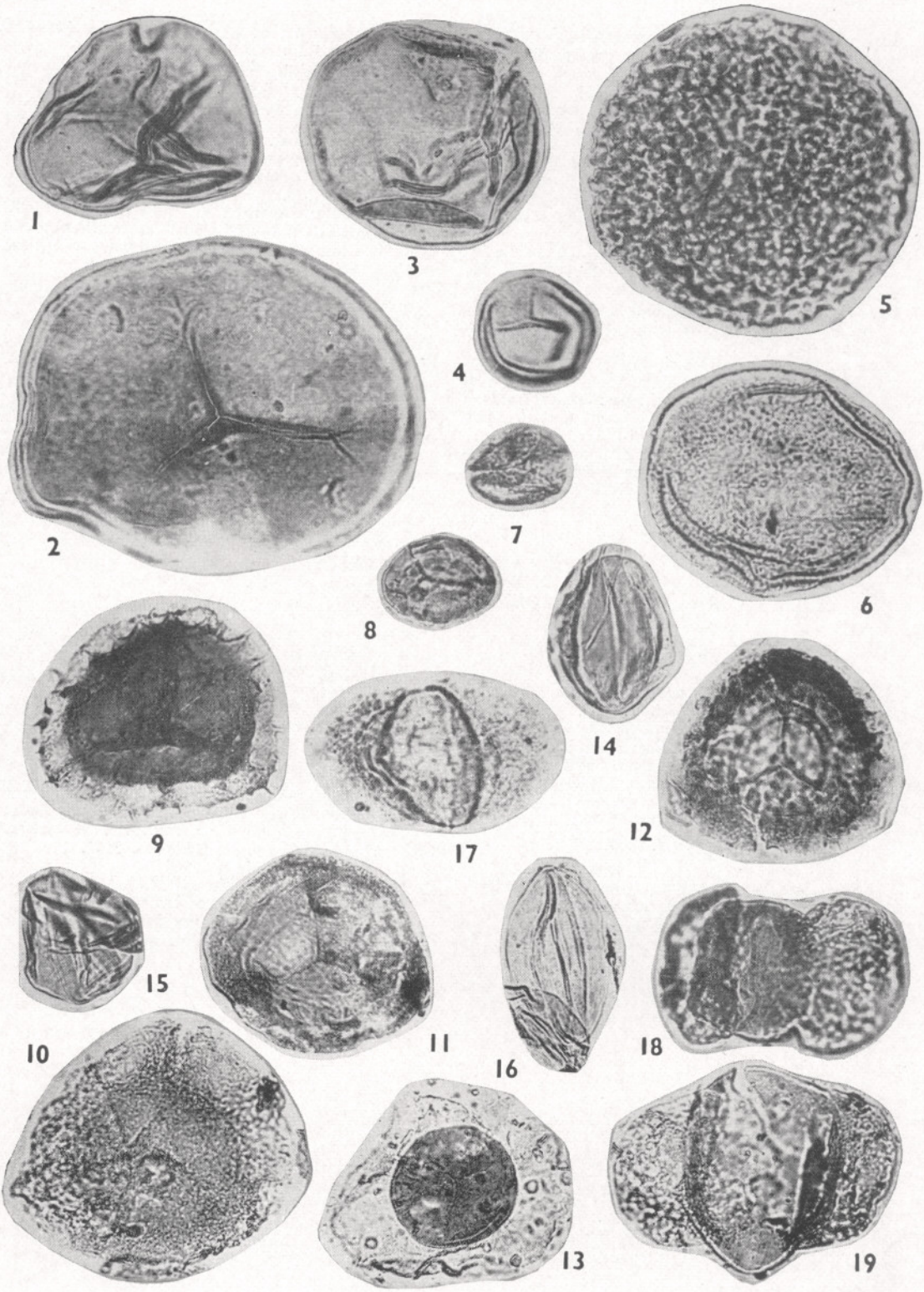

PLATE 1

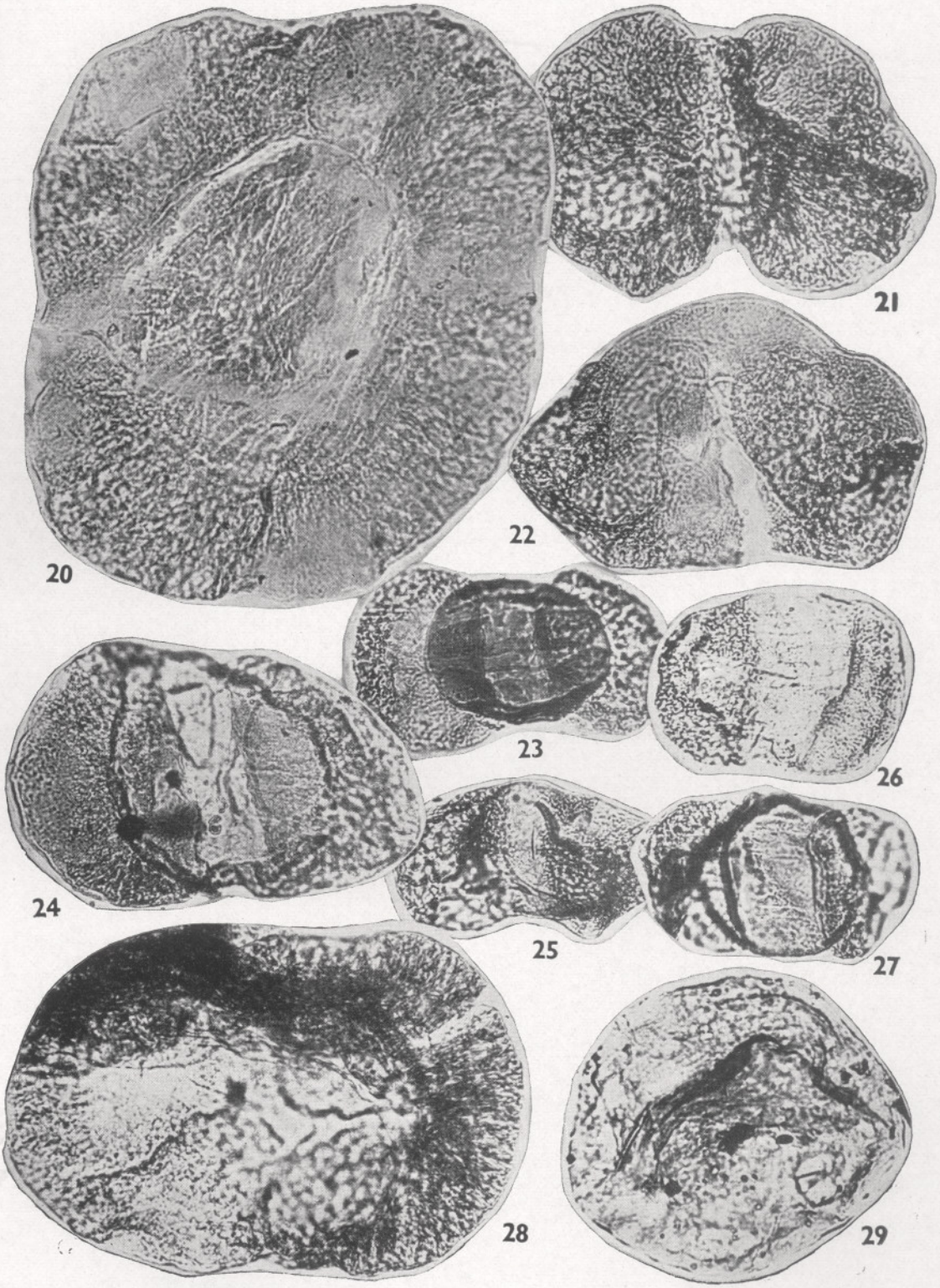

PLATE 2