

PALAEOBOTANICAL EVIDENCE FOR THE PRESENCE OF KARHARBARI STAGE IN THE AURANGA COALFIELD, BIHAR: MIOFLORA

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ABSTRACT

The paper describes for the first time the Karharbari miospore assemblage from the Auranga Coalfield. The mioflora (19 genera and 39 species) is characterized by the dominance of trilete taxa *Callumispora* and *Brevitriletes* together with monosaccates, *Parasaccites*, *Caheniasaccites* and *Vivkkipollenites*. Other quantitatively significant genera are *Faunipollenites*, *Psilalacinites*, *Microbaculispora*, *Kibambaites*, *Verrucosisporites* and *Latosporites*.

INTRODUCTION

PALAEOBOTANICAL records from the Auranga Coalfield date back to the time of Ball (1880). Feistmantel (1881a, 1881b, 1882, 1886) studied in detail the plant fossils in this area. Bhattacharyya (1959) reported the miospores and plant fossils from the eastern part of Auranga Coalfield. Bhattacharyya (1963) reported the megafossils only from the western part of the Coalfield. Maithy (1971) reported some megafossils and miospores from the Barakar deposits. Srivastava and Anand-Prakash (1973) reported the miospore assemblages from Jagaldagga and Tubed area. Recently, Srivastava (1977) has reported the plant fossils from the Gowa Village. However, no systematic study of the palynological assemblage was so far done on the various Lower Gondwana horizons of the Auranga basin. This work was therefore undertaken and palynological samples were collected systematically from several sites generally marked as Barakar in the geological work of Rizvi (1972). The material which has yielded the present mioflora is also included among the Barakar by Rizvi (*loc. cit.*), but the palynological evidence now suggests a Karharbari age for it.

MATERIAL AND METHODS

Samples have been collected from a section exposed along north bank of Gowa Nala about 0.5 km west of Gowa Village

(see Map; Srivastava, 1977). The rock section is as follows:

Sandstone	1 m
Fireclay intercalated with sandstone	5 m
Carbonaceous shale (mioflora described here)	3 m
rest concealed below	

The carbonaceous shale sample was macerated in the conventional manner using Schulz's method. All the type slides are preserved at the Museum, Birbal Sahni Institute of Palaeobotany.

DESCRIPTION

- Anteturma — *Sporites* H. Potonié, 1893
Turma — *Triletes* (Reinsch) Potonié & Kremp, 1954
Subturma — *Azonotriletes* Lubert, 1935
Infraturma — *Laevigati* (Bennié & Kidston) Potonié, 1956

Genus — *Psilalacinites* Kar, 1969

Psilalacinites triangularis Kar, 1969

Pl. 1, fig. 1

Description — Size range 51-60 × 51-60 μ, apices rounded, trilete rays extend up to three fourth of radius, associated with lacinate fold, exine laevigate, rarely fine intramicro-punctate.

Genus — *Callumispora* Bharadwaj & Srivastava, 1969

Callumispora tenuis var. *minor* Bharadwaj & Srivastava, 1969

Pl. 1, fig. 2

Description — Size range 60-80 × 56-74 μ, circular to subcircular, trilete mark distinct, rays more than 3/4 of the body radius, exine 2-4 μ thick, margin smooth.

Remarks — Only *C. tenuis* var. *minor* is present in this assemblage and *C. tenuis* is not found. This suggests that *C. tenuis* var. *minor* can be raised to specific level.

Infraturma — *Apiculati* (Bennié & Kidston) Potonié, 1956

Subinfraturma — *Verrucati* Dybova & Jachowicz, 1957

Genus — *Verrucosisporites* (Ibrahim) Smith & Butterworth, 1967

Verrucosisporites donarii Potonié & Kremp, 1956

Pl. 1, fig. 3

Description — Size range 45-47 × 52-54 μ, trilete rays extend up to 3/4 of radius, exine covered by verrucae of irregular shape, 2-3 μ in size, 52-60 along margin.

Verrucosisporites ambiplicatus Kar, 1968

Pl. 1, fig. 4

Description — Size range 35-38 × 38-44 μ, trilete rays extending up to 3/4 of radius, exine folded along equatorial margin, verrucae 2-2.5 μ long and 75-90 along margin.

Subinfraturma — *Baculati* Dybova & Jachowicz, 1957

Genus — *Microbaculispora* Bharadwaj, 1962

Microbaculispora tentula Tiwari, 1965

Pl. 1, fig. 5

Description — Size range 50-52 × 50-56 μ, trilete rays distinct, reaching corner, covered with closely set 1 × 1 μ bacula.

Genus — *Horriditriletes* Bharadwaj & Salujha, 1964

Horriditriletes concavus Maheshwari, 1969

Pl. 1, fig. 7

Description — Size range 45-50 × 40-43 μ, trilete rays weak, exine thin, ornamented with 5-10 μ long and 1-2.5 μ wide bacula, apex conate, spinose or blunt, proximal ornamentation few, 30-35 bacula present along the equator.

Remarks — The bacula are long in size as compared to holotype (3-5 μ) and they are few on proximal side.

Subinfraturma — *Varitrileti* Venkatachala & Kar, 1965

Genus — *Brevitriletes* Bharadwaj & Srivastava, 1969

Brevitriletes unicus (Tiwari) Bharadwaj & Srivastava, 1969

Pl. 1, fig. 6

Description — Size range 36-47 × 37-42 μ, exine thin, trilete rays equal, associated with minute folds, distally bears sparsely set spines, 2-4 μ long and 2-3 μ broad, rounded tips, 12-18 spines present along margin.

Brevitriletes levis (Balme & Hennelly) Bharadwaj & Srivastava, 1969

Pl. 1, fig. 8

Description — Size range 26-31 × 20-27 μ, trilete rays distinct, exine thin, distally bears small compound sparse spine, 1-2 μ long and 0.5-1 μ wide, 13-19 spines present along margin.

Turma — *Monoletes* Ibrahim, 1933

Subturma — *Azonomonoletes* Luber, 1935

Infraturma — *Laevigatomonoleti* Dybova & Jachowicz, 1957

Genus — *Latosporites* Potonié & Kremp, 1954

Latosporites colliensis (Balme & Hennelly) Bharadwaj, 1962

Pl. 1, fig. 9

Description — Size range 75-82 × 80-84 μ, monolete extends up to three fourths, exine 1-1.5 μ thick, folded.

Turma — *Aletes* Ibrahim, 1933

Subturma — *Azonaletes* (Luber) Potonié & Kremp, 1954

Infraturma — *Tuberini* Pant, 1954

Genus — *Mammialetes* Kar, 1969*Mammialetes mammus* Kar, 1969

Pl. 3, fig. 30

Description — Size range 40-50 × 50-55 μ , exine sculptured with 6-8 μ high, mammilate process with swollen tips.

Anteturma — *Pollenites* Potonié, 1931Turma — *Saccites* Erdtman, 1947Subturma — *Monosaccites* (Chitaley) Potonié & Kremp, 1954Infraturma — *Dipolsacciti* Hart, 1965
emend. Dibner, 1971Subinfraturma — *Parasaccini* Diber, 1971**Genus — *Parasaccites* Bharadwaj & Tiwari, 1964***Parasaccites diffusus* Tiwari, 1965

Pl. 1, fig. 10

Description — Size range 105-115 × 90-115 μ , body ill-defined, mark indistinct, saccus attachment diffused.

Parasaccites korbaensis Bharadwaj & Tiwari, 1964

Pl. 1, fig. 11

Description — Size range 123-132 × 95-100 μ , body 95-100 × 68-71 μ , exine mark obscure, saccus intrareticulation fine with radially elongated muri.

Parasaccites singrauliensis Sinha, 1972

Pl. 2, fig. 18

Description — Size range 80-60 μ , body distinct 40-46 × 35-37 μ , exine without wrinkles, mark obscure, saccus attachment indistinct, intrareticulation fine to medium.

Remarks—The size of holotype is more (116-136 μ) than the present specimen.

Parasaccites bilateralis Tiwari, 1965

Pl. 3, fig. 26

Description — Size range 121-128 × 90-105 μ , body 57-65 × 62-65 μ , mark absent, saccus attachment zones ill-defined, intrareticulation fine to medium.

Genus — *Caheniasaccites* Bose & Kar, 1966*Caheniasaccites flavatus* Bose & Kar, 1966

Description — Size range 120-125 × 62-65 μ , body 1.5 μ thick, saccus attachment subequatorial, sulcus horizontally oval, intrareticulation coarse.

Caheniasaccites granulatus Lele & Chandra, 1972

Pl. 1, fig. 13

Description — Size range 62-70 × 40-46 μ , body 38-40 × 40-44 μ , mark ill-defined, saccus attachment subequatorial, intrareticulation medium.

Caheniasaccites ovatus Bose & Kar, 1966

Pl. 1, fig. 12

Description — Size range 70-117 × 45-50 μ , body 33-51 × 33-44 μ , saccus attachment subequatorial, sulcus subcircular to circular, intrareticulation coarse.

Caheniasaccites indicus Srivastava, 1970

Pl. 3, fig. 23

Description — Size 156 × 88 μ , body 80-92 μ , saccus attachment subequatorial, intrareticulation fine to medium.

Genus — *Kibambaites* Bose & Kar, 1967*Kibambaites corius* Bose & Kar, 1967

Pl. 2, fig. 17

Description — Size range 60-65 × 50-55 μ , body distinct, 33-42 × 30-34 μ , \pm laevigate, proximal attachment equatorial, distally covers major part of the body, sulcus well defined; saccus intramicroreticulate.

Remarks—The specimens are smaller in size as compare to holotype (99 × 78 μ).

Kibambaites sp.

Pl. 3, fig. 24

Description — Size 108 × 91 μ , circular to subcircular, central body distinct 55 × 80 μ , circular, \pm intramicroreticulate, slit like

monolete mark present, saccus attachment proximally equatorial, distally encroaching the body, \pm equal at opposite sides of the body circle, saccus thick, leathery, fine intramicroreticulate.

Comparison — In general shape and organization the specimens resemble with *Kibambaites* but it is not known to possess the haptotypic mark, whereas in the present specimen a slit is present which recalls the mark. Specific name has not been given due to lack of sufficient number of specimens.

Genus — *Gondwanapollis* Lele & Maithy, 1969

Gondwanapollis ganjrensis Lele & Maithy,
1969
Pl. 2, fig. 20

Description — Size range 150-152 \times 75-80 μ , body 56-61 \times 55-60 μ , monolete distinct, infolds \pm polygonal, saccus attachment amphilateral, proximally subequatorial, distally bilateral, both attachment zones associated with body infolds, intrareticulations fine to medium.

Gondwanapollis concavus Lele & Maithy,
1969
Pl. 2, fig. 14

Description — Size range 130-135 \times 60-65 μ , body 58-63 \times 42-45 μ , monolete mark obscure, two concave vertical body infold present, saccus attachment amphilateral, proximally circular, distally vertically oval, intrareticulation medium to coarse.

Remarks — The specimens have a sub-circular to oval body in comparison to distinct circular body present in the holotype.

Gondwanapollis sp.
Pl. 2, fig. 19

Description — Size 100 \times 82 μ , circular to subcircular, central body distinct, 54 \times 53 μ , subcircular to polygonal, thin, intramicroreticulate, monolete mark weakly developed, eccentric, 1/2-2/3 of the body diameter, not straight, proximal attachment very marginal, producing a rim-like thickening, 2-3 μ thick, distal encroachment deep, associated with a thin subcircular

body infolds up to 7 μ wide and thinning down to 2 μ , saccus longer axis nearly twice as wide as on the shorter axis, may be notched and developed few stronger frills along the shorter axis, saccus fine intramicroreticulate, lumina circular to elongated, \pm radially directed.

Comparison — The present specimen differs from *Gondwanapollis ganjrensis* (Lele & Maithy, 1969, pl. 3, fig. 28) in its smaller size, subcircular central body and indistinct body infolds and *G. concavus* (Lele & Maithy, 1969, pl. 3, fig. 30) has a biconcave vertical body infolds which is quite distinct. Due to lack of specimens no specific name has been given here.

Subinfraturma — *Amphisaccini* Dibner,
1971

Genus — *Stellapollenites* Lele, 1965

Stellapollenites talchirensis Lele, 1965
Pl. 2, fig. 16

Description — Size 114 \times 103 μ , body indistinct, amphilateral zones of saccus attachment \pm concavely triangular, saccus fine to medium intrareticulate.

Subinfraturma — *Apertacorpini* Dibner,
1971

Genus — *Plicatipollenites* Lele, 1964

Plicatipollenites gondwanensis (Balme & Hennesly) Lele, 1964
Pl. 2, fig. 22

Description — Size range 148-152 \times 125-130 μ , body distinct 80-82 \times 90-95 μ , exine marks weak, rays asymmetrical, body infold polygonal, well-developed, saccus intrareticulation medium to coarse.

Remarks — The present specimen closely compares with the diagnosis and description of *Plicatipollenites gondwanensis* (Lele, 1964, pl. 2, fig. 11). However, the grains assigned to this species have symmetrical trilete mark whereas in the present specimen the trilete mark is asymmetrical. Two rays are longer, measuring 8 μ , with blunt ends and meeting at wide angle. At their junction a third ray emerges which is 3 μ long with a pointed end. The two long rays are nearly aligned parallel to the longer

axis of the grain which is comparable with *Potonicisporites neglectus* (Potonié & Lele, 1961) and with some species of *Plicatipollenites*. In such marginal forms it is difficult to choose between *Potonicisporites* and *Plicatipollenites* only on the basis of the mark. However, the overall shape and width of saccus is very similar to *Plicatipollenites gondwanensis* (Lele, 1964, pl. 2, fig. 11). Probably the grain demonstrates that in *P. gondwanensis* the mark becomes heterotrophic as in *P. indicus* (Lele, 1964, pl. 2, fig. 7).

cf. *Plicatipollenites magnus* Tiwari, 1965

Pl. 1, fig. 8

Description — Size range 153-195 × 135-162 μ , body 65-67 × 62-65 μ , indistinct, mark weak, exine laevigate, sometimes intramicropunctate or intramicroreticulate, 3 folds present along the attachment zone of saccus.

Remarks — The specimens in overall shape and size resemble with the diagnosis and description of *Plicatipollenites magnus* (Tiwari, 1965, pl. 5, fig. 91). However, it differs in having a \pm circular body and smooth exine with weakly developed mark. Due to lack of specimens it has been described under cf. *P. magnus*.

Plicatipollenites densus Srivastava, 1970

Pl. 3, fig. 27

Description — Size range 60-63 × 41-43 μ , body 35 × 37 μ , mark obscure, exine intramicroreticulate, saccus outline frilled and undulated.

Remarks — The specimens are smaller in size than the holotype (84 μ).

Genus — *Virkkipollenites* Lele, 1964

Virkkipollenites mehtae Lele, 1964

Pl. 3, fig. 28

Description — Size range 77-83 × 74-80 μ , body 42-50 × 40-48 μ , fine intramicroreticulate, mark obscure, saccus attachment zone discernible.

Virkkipollenites obscurus Lele, 1964

Pl. 2, fig. 21

Description — Size range 105-125 × 100-110 μ , body 65-72 × 55-62 μ , mark faintly discernible, saccus attachment zone indistinct.

Virkkipollenites densus Lele, 1964

Pl. 2, fig. 15

Description — Size range 98-102 × 80-84 μ , body 62-55 × 64-66 μ , mark not visible, saccus attachment zone obscure.

Virkkipollenites triangularis (Mehta) Lele, 1964

Description — Size 133 × 112 μ , body 52 × 41 μ , mark faintly visible, saccus attachment clear, surface \pm frilled.

Subturma — *Disaccites* Cookson, 1947

Infraturma — *Striatiti* Pant, 1954

Genus — *Faunipollenites* Bharadwaj, 1962

Faunipollenites varius Bharadwaj, 1962

Pl. 3, fig. 29

Description — Size 123 × 85 μ , horizontal striations 8-10, sulcus 30 μ wide.

Faunipollenites goraiensis (Potonié & Lele) Maithy, 1965

Pl. 3, fig. 32

Description — Size range 96-102 × 65-90 μ , horizontal striations, 7-10, sulcus 2-5 μ wide.

Faunipollenites parvus Tiwari, 1965

Pl. 3, fig. 34

Description — Size range 66-70 × 45-47 μ , horizontal, striations 7-9, sulcus 5-7 μ wide.

Faunipollenites perexiguus Bharadwaj & Salujha, 1965a

Pl. 3, fig. 33

Description — Size range 70-80 × 60-75 μ , horizontal striations 4-6, branched, sulcus 6-7 μ wide.

**Genus — *Crescentipollenites* (Leschik)
Bharadwaj, Tiwari & Kar, 1974**

Crescentipollenites limpidus (Balme & Hennelly) comb. nov.

Pl. 3, fig. 35

1955 *Lunatisporites limpidus* Balme & Hennelly, pl. 3, figs. 29-32.

1958 *Lunatisporites limpidus* (Balme & Hennelly) Potonié, p. 53.

Lectoholotype — Balme and Hennelly, 1955, pl. 3, fig. 29.

Emended Diagnosis — Size range 42-76 × 37-67 μ, body 32-41 × 35-50 μ, striations 8-11, some striations may become thicker by folding, sulcus biconvex, 11-17 μ wide, saccus hemispherical, saccus root convex, associated with two semilunar body infold, fine intramicroreticulate.

Remarks — The present specimens compare with *Lunatisporites brevis* (Bose & Kar, 1966, pl. 29, fig. 11) but distinguish by smaller size, haploxylooid, organization oval to subcircular shape (not diploxylooid as mentioned by the author), thicker body and lesser number of striations (2-5). Balme and Hennelly (1955) originally described *Lueckisporites limpidus* (pl. 3, figs. 29-32; pl. 4, figs. 33-35) from Australian Lower Gondwana. Of the several specimens illustrated, the one (pl. 3, fig. 29) resembles the present specimens, in size, body shape, and of striations. Balme and Hennelly, however, gave no information about the nature of the sulcus and the infolds which border the sulcus. The diagnosis of this species is, therefore elaborated and emended here on the basis of the present material and the illustrations of Balme and Hennelly (1955).

Infraturma — *Circumstriati* Lele & Makada, 1972

**Genus — *Circumstriatites* Lele & Makada,
1972**

cf. *Circumstriatites obscurus* Lele & Makada, 1972

Pl. 3, fig. 25

Description — Size range 75-80 × 40-44 μ, body distinct, 45-60 × 37-41 μ, grooves 9, perfect to imperfect, branched, proximally

not reaching the periphery, tapering on either ends, in between the grooves exine verrucate, verrucae up to 1 μ, saccus attachment not clear, sulcus 10 μ wide.

Remarks — In its general shape and organization the specimens compare with *Circumstriatites obscurus* (Lele & Makada, 1972, pl. 4, fig. 46) but differs in having small size with distinct central body and a narrow sulcus (10 μ).

***Circumstriatites* sp.**

Pl. 3, fig. 36

Description — Size 70 × 44 μ, bisaccate, bilateral, central body indistinct, 48 × 34 μ, horizontally oval, 8 horizontal grooves present over the body, sometimes associated with fold, exine thin ± laevigate, saccus hemispherical, variously folded, saccus root straight, proximally equatorial, sulcus 10-12 μ wide, straight, saccus fine intramicroreticulate.

Comparison — The specimen compares in the nature of grooves with *Circumstriatites* but differs from all the known species in its small size and having a characteristically folded saccus.

Turma — *Plicates* (Naumova) Potonié, 1960

Subturma — *Monocolpates* Iversen & Troels Smith, 1950

Infraturma — *Intortes* (Naumova) Potonié, 1958

**Genus — *Ginkgocycadophytus* Samoilovich,
1953**

Ginkgocycadophytes cymbatus (Balme & Hennelly) Potonié & Lele, 1961

Pl. 3, fig. 31

Description — Size range 40-60 × 70-80 μ, exine 1.5-2 μ thick, grana 0.5 μ high, colpus funnel shape, extending from one margin to other.

COMPARISON AND DISCUSSION

The spore assemblage is dominated by triletes and monosaccates. The quantitatively important genera individually or forming characteristic association with other genera are *Parasaccites*, *Callumispora*, *Fauni-*

pollenites, *Caheniasaccites*, *Brevitriletes* and *Psilalacinites*.

The other quantitatively significant genera are *Microbaculispora*, *Virkkipollenites*, *Kibambaites*, *Verrucosisporites* and *Latosporites*.

The following genera are also rarely present: *Plicatipollenites*, *Gondwanapollis*, *Crescentipollenites*, *Circumstriatites*, *Mammialetes*, *Stellapollenites* and *Ginkgocycadophytus*.

Miofloristically the assemblage approaches closest to the known Karharbari miofloras in the dominance of trilete and monosaccate taxa. Srivastava (1973) has recognized two zones in the type area of Giridih Coalfield, Bihar. The Upper Karharbari is dominated by disaccates like *Scheuringipollenites*

(=*Sulcatisporites*), *Platysaccus*, *Striatites*, *Faunipollenites* and *Striatopodocarpites*. The Lower Karharbari is dominated by triletes and radial monosaccates in general and particularly by the association of the genera *Callumispora* and *Parasaccites* (Srivastava, 1973). Similarly studies in the North Karanpura Basin (Kar, 1973), Korba bore core (Bharadwaj & Srivastava, 1973) and Jayanti Coalfield (Lele & Makada, 1974) also confirm this palynological characteristic of the Lower Karharbari Assemblage. Now in the Auranga Coalfield also the striking association of *Callumispora* and *Parasaccites* has been discovered. There is, therefore, no doubt that the Karharbari Stage is represented in the Auranga Coalfield as well.

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EXPLANATION OF PLATES

(All magnifications. $\times 500$)

PLATE 1

1. *Psilalacinites triangularis* Kar. Slide no. 4990.
2. *Callumispora tenuis* var. *minor* Bharad. & Sriv. Slide no. 4990.
3. *Verrucosiporites donarii* Pot. & Kar. Slide no. 4992.
4. *V. ambiplicatus* Kar. Slide no. 4990.
5. *Microbaculispora tentula* Tiw. Slide no. 4991.
6. *Brevitriletes unicus* (Tiw.) Bharad. & Sriv. Slide no. 4990.
7. *Horriditriletes concavus* Maheshw. Slide no. 4992.
8. cf. *Plicatipollenites magnus* Tiw. Slide no. 4992.
9. *Iatosporites colliensis* (Balme & Henn.) Bharad. Slide no. 4990.
10. *Parasaccites diffusus* Tiw. Slide no. 4990.
11. *P. korbaensis* Bharad. & Tiw. Slide no. 4992.
12. *Caheniasaccites ovatus* Bose & Kar. Slide no. 4991.
13. *C. granulatus* Lele & Chandra. Slide no. 4991.

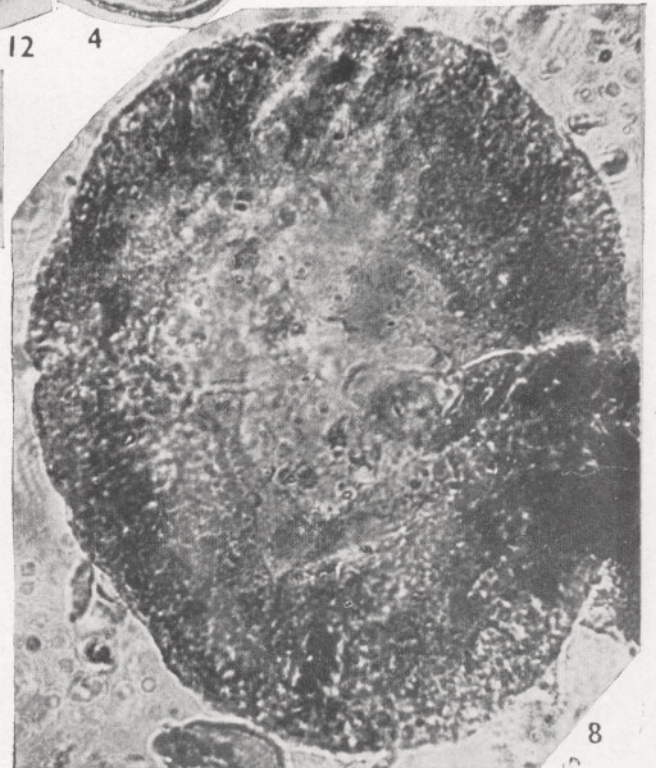
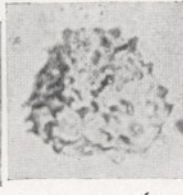
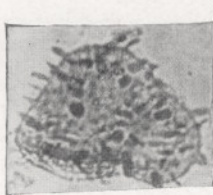
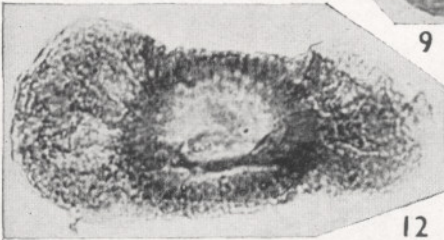
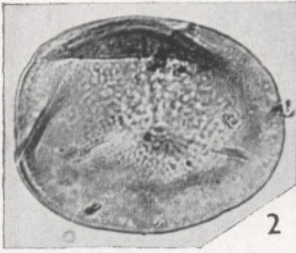
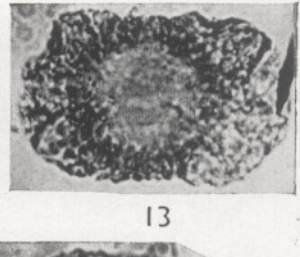
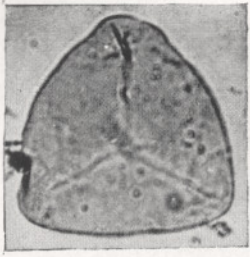
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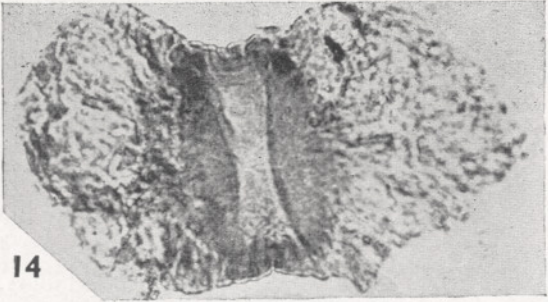
14. *Gondwanopollis concavus* Lele & Maithy. Slide no. 4990.
15. *Virkkipollenites densus* Lele. Slide no. 4990.
16. *Stellapollenites talchirensis* Lele. Slide no. 4990.

17. *Kibambaites corius* Bose & Kar. Slide no. 4991.
18. *Parasaccites singrauliensis* Sinha. Slide no. 4990.
19. *Gondwanopollis* sp. Slide no. 4992.
20. *G. ganjyensis* Lele & Maithy. Slide no. 4991.
21. *Virkkipollenites obscurus* Lele. Slide no. 4991.
22. *Plicatipollenites gondwanensis* (Balme & Henn.) Lele. Slide no. 4991.

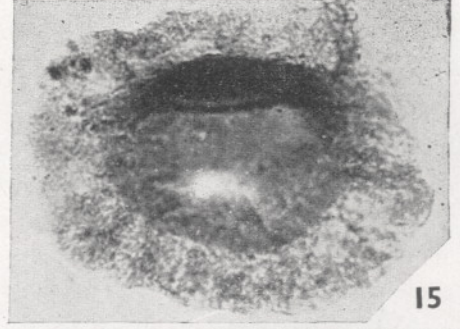
PLATE 3

23. *Caheniasaccites indicus* Sriv. Slide no. 4990.
24. *Kibambaites* sp. Slide no. 4991.
25. cf. *Circumstriatites obscurus* Lele & Makada. Slide no. 4991.
26. *Parasaccites bilateralis* Tiw. Slide no. 4990.
27. *Plicatipollenites densus* Sriv. Slide no. 4990.
28. *Virkkipollenites mehtae* Lele. Slide no. 4990.
29. *Faunipollenites varius* Bharad. Slide no. 4991.
30. *Mammialetes mammus* Kar. Slide no. 4990.
31. *Ginkgocycadophytus cymbatus* (Balme & Henn.) Pot. & Lele. Slide no. 4990.
32. *Faunipollenites goraiensis* (Pot. & Lele) Maithy. Slide no. 4990.
33. *F. perexiguus* Bharad. & Sal. Slide no. 4990.
34. *F. parvus* Tiw. Slide no. 4992.
35. *Crescentipollenites limpidus* (Bamel. & Henn.) Comb. nov. Slide no. 4990.
36. *Circumstriatites* sp. Slide no. 4991.

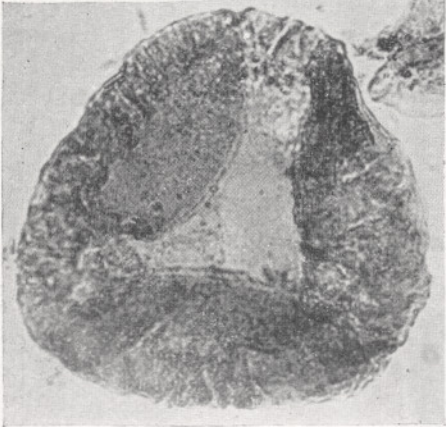




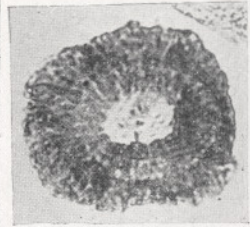
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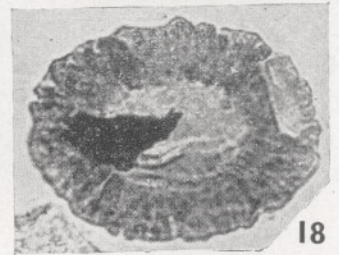
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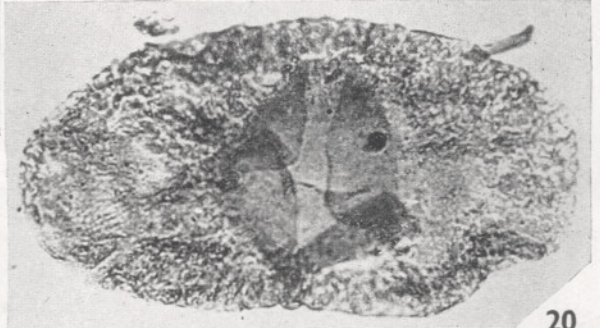
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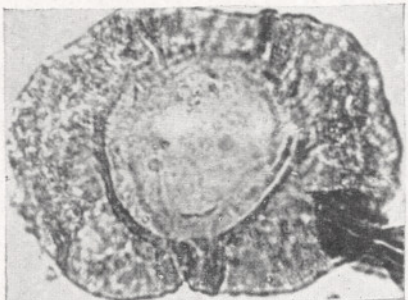
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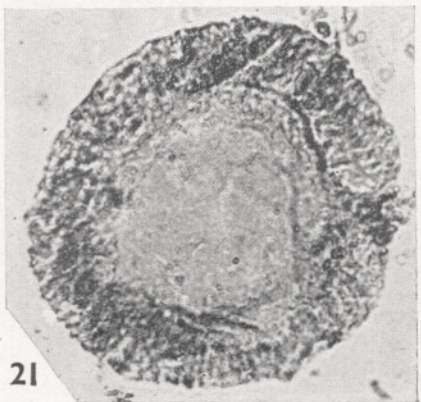
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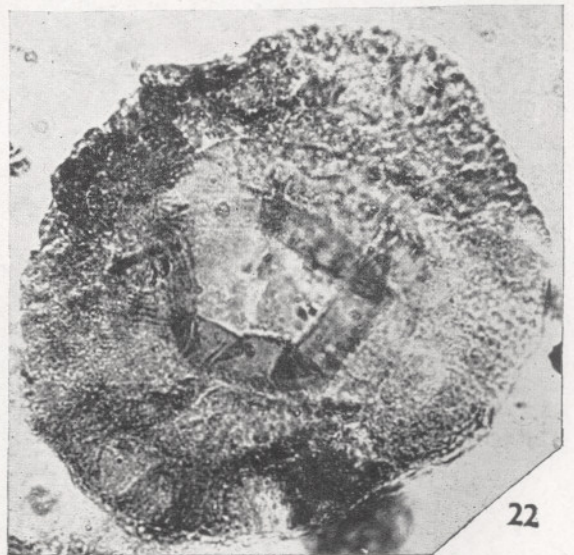
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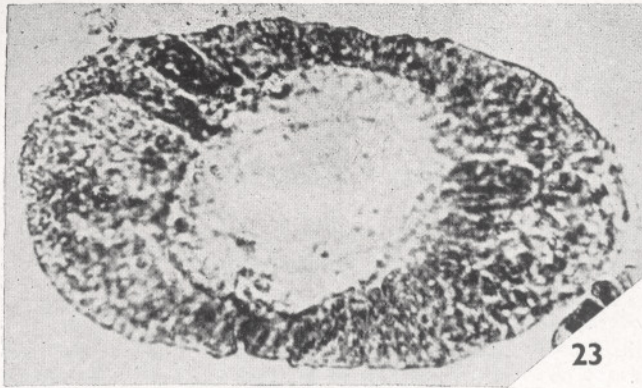
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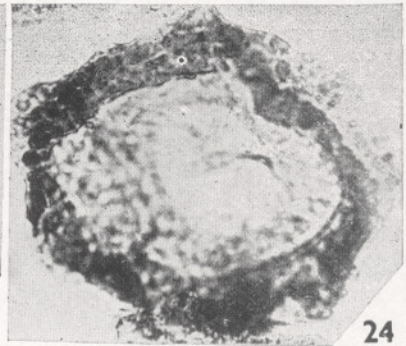
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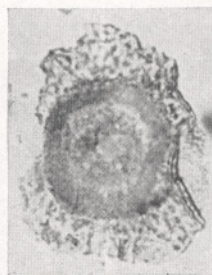
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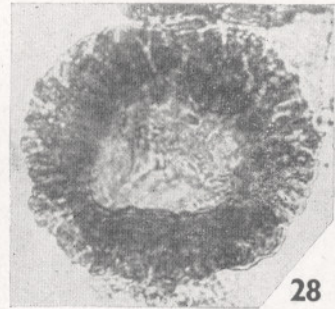
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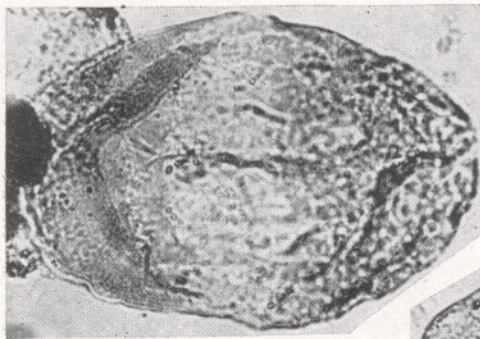
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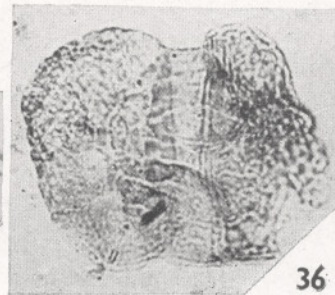
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