SOME "ACRITARCHS" AND OTHER MICROFOSSILS FROM BARAKAR STAGE OF LOWER GONDWANAS, INDIA

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ABSTRACT

Some microfossils of uncertain affinities have been described from the Barakar Stage of Lower Gondwanas India. It has been found suitable to include these microfossils under the group " Acritarcha ". A total of 9 genera and 15 species have been described out of which one genus and 7 species are new. A new subgroup *Reticulosphaeromorphitae* has been instituted to accommodate alete microfossils with reticulum on both faces.

INTRODUCTION

THE microfossils described in the present paper were recovered from the Jhingurdah Seam, the uppermost seam of Singrauli Coalfield (M.P.). This seam is the second thickest seam of the world. The palynological assemblage of this seam has been worked out by Bharadwaj and Sinha (in press) and Sinha (in press). Bharadwaj and Sinha (1969) have discussed the age of this coal seam and the palynological succession exhibited in it. The microfossils, lacking any haptotypic mark, are quite prominent in the Jhingurdah mioflora. However, a close perusal of the distribution of these microfossils (BHARADWAJ & SINHA, 1969, HISTOGRAM 1) suggests that their frequency of occurrence is very inconsistent and hence they are not helpful to indicate miofloristic changes. Further, these microfossils do not show any comparable morphological character which could bring them nearer to pteridophytic spores or gymnospermous pollen grains. Yet, their abundance may be of some palaeo-ecological significance. Evitt (1963) proposed that microfossils without haptotypic mark and with uncertain affinities should be placed in an informal category " acritarchs ". Further, Downie, Evitt and Sargeant (1963) suggested a detailed classification for microfossils of uncertain affinities. Microfossils referable to " acritarchs " have been reported to occur both in marine and nonmarine sediments — from Devonian upto recent period. These microfossils occur even in those lithological sediments from which no miospores have been recovered.

From Gondwanaland similar plant microfossils have been reported from time to time. Balme and Hennelly (1956) for the first time described microfossils without any haptotypic mark and assigned them to the genus *Pilasporites*. Since then a number of workers have described such microfossils. Tiwari (1964), Pant and Mehra (1963), Balme and Segroves (1967), Segroves (1967), Bose and Kar (1967), Tiwari and Navale (1967), and Bose and Maheshwari (1968) have described microfossils with uncertain affinities. In the present paper classification by Downie, Evitt and Sargeant (*l.c.*) has been followed.

DESCRIPTION

Subphylum — *Algae*
Division — *Chrysophyta*
Class — *Xanthophyceae*
Order — *Heterococcales*

Genus — *Botryococcus* Kutzing, 1849

Remarks — Genus *Botryococcus* comprises single to multicolonial forms. The microfossils recorded here include bilobed and few irregularly shaped specimens. Moreover, these microfossils do not possess distinct cells of the colony. Hence they have been described as ? *Botryococcus*.

? *Botryococcus* sp. A

Pl. 1, Fig. 1

Description — Microfossils are oval to subcircular, sometimes irregular in shape due to folding. Size range 63 × 60 μ–78 × 78 μ. Spore body is formed of two almost equal colonies, intact in middle forming a thickened zone on only one face; each colony has got small lobes, ± 5 μ wide, thicker than rest of the spore body, ± 15 to many smaller lobes can be counted on each lobe, smaller lobes may be smooth or sculptured. Exine is micropunctate, puncta upto 1 μ.

? *Botryococcus* sp. B

Pl. 1, Fig. 2

Description — Microfossils are oval to subcircular, sometimes irregular in shape due to folding, bilateral; size range 47×45 μ-72×68 μ. Spore body is formed of two almost equal colonies, each colony has got almost smooth outer margin; finer lobes are absent. Exine is finely to coarsely punctate; puncta ± 2 μ wide; *extrema lineamenta* is uneven.

Comparison — ? *Botryococcus* sp. B differs from ? *Botryococcus* sp. A in absence of finer lobes in each colony.

Group — *Acritarcha* Evitt, 1963
Subgroup — *Reticulosphaeromorphitae* Subgr. nov.

Diagnosis — Alete microfossils; reticulations present on both the faces, muri high and meshes low.

Genus — *Maculatasporites* Tiwari, 1965

Genotype — *Maculatasporites indicus* Tiwari, 1964.

Maculatasporites gondwanensis Tiwari, 1965

Pl. 1, Fig. 3

Remarks — Size ranges from 35 to 40 μ. Exine is thin, covered with big, complete reticulum on both the faces, meshes are 4-6 μ across, muri are ± 1 μ high and ± 1 μ wide.

Genus — *Greinervillites* Bose & Kar, 1967

Genotype — *Greinervillites undulatus* Bose & Kar, 1967.

Greinervillites undulatus Bose & Kar, 1967

Pl. 1, Fig. 4

Remarks — Present specimens are similar to the specimens from Congo (Bose & Kar, 1967) in all the morphographical characters except the fine negative sculpture over the exine. Exine is very thin, finely negative sculptured and variously folded forming complete big reticulations, meshes are 10-25 μ wide, circular or polygonal in shape; muri are high in the middle and low at the junctions, maximum height 10-15 μ, vertex smooth.

Greinervillites irregularis sp. nov.

Pl. 1, Fig. 5

Holotype — Pl. 1, Fig. 5; Slide No. 3225.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 10; Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Circular to oval alete microfossils; size 75×78 μ-95×105 μ; exine ridges irregular, forming incomplete reticulations.

Description — Microfossils are alete and circular to oval. Holotype measures 100× 82 μ, irregularly folded forming incomplete reticulations, meshes are mostly ill defined, rarely defined, 15-25 μ wide, muri upto 10 μ wide, but never prominent; *extrema lineamenta* is uneven.

Comparison — This species differs from *Greinervillites undulatus* Bose & Kar, 1967 in having reticulum with incomplete muri and irregular meshes.

Greinervillites sp.

Pl. 1, Fig. 6

Description — The solitary microfossil is circular, alete, 108 μ in size. Exine is thin, variously folded forming perfect reticulation, meshes 12 in number and 20-25 μ wide; muri are zig-zag and frilled, ± 5 μ across. *Extrema lineamenta* is uneven.

Comparison — *Greinervillites undulatus* Bose & Kar, 1967 although possesses perfect reticulation, differs from *Greinervillites* sp. in having simple unfrilled muri. *G. irregularis* sp. nov. possesses irregular and incomplete reticulation.

Subgroup — *Schizomorphitae* Segr., 1967

Genus — *Hemisphaerium* Hemm. & Nygr., 1967

Genotype — *Hemisphaerium inominatum* Hemmer & Nygreen, 1967.

Hemisphaerium singrauliensis sp. nov.

Pl. 1, Figs. 7, 8

Holotype — Pl. 1, Fig. 7; Slide No. 3127.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 3, Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Circular to subcircular, alete microfossils; size ± 50 μ-95×65 μ; exine thick, negative sculptured; a weak zone running across middle of the specimen.

Description — Microfossils are circular to subcircular without any mark, pore or striation; holotype measures 65×60 μ. Exine is mediumly thick, ± laevigate with sparse puncta. In some specimens a hyaline, thin, membraneous covering envelops the spores. A linear zone present in the middle of the miospore along which it usually gets split into two equal halves. *Extrema lineamenta* is mostly smooth but for the sparse puncta.

Comparison — *Hemisphaerium singrauliensis* sp. nov. differs from all the species of the genus described by Hemmer and Nygreen (1967) in having a thinner exine.

Remarks — It is probable that the members of the genus *Hemisphaerium* had a membraneous covering which was often lost during fossilization.

Hemisphaerium signum Hymm. & Nygr., 1967

Pl. 1, Fig. 9

Remarks — Solitary microfossil, alete, size 60×60 μ dividing along a weak zone. Exine is thick, 2 μ in optical section, laevigate, minutely pitted. *Extrema lineamenta* is ± smooth.

Genus — *Circulisporites* De Jersey emend. Norris, 1962

Genotype — *Circulisporites parvus* De Jersey emend. Norris, 1962.

Circulisporites parvus De Jersey emend. Norris, 1962

Pl. 1, Fig. 10

Remarks — Present microfossils compare very closely with the specimens described by De Jersey (1962), but differ in having high verrucae, concentrically arranged, and not in spiral striae.

Genus — *Peltacystia* Balme & Segr., 1967

Peltacystia venosa Balme & Segr., 1967

Pl. 1, Fig. 11

Remarks — Microfossils are circular, 25×26 μ-51×42 μ, split in two equal halves. Exine is thin, sculptural elements present in 2-3 concentric rings. Exine in between the ornamentation is prominently reticulate, muri ± 1 μ high, meshes ± 1 μ broad and low.

Subgroup — *Sphaeromorphitae* Evitt, 1963

Genus — *Pilasporites* Balme & Henn., 1956

Genotype — *Pilasporites calculus* Balme & Hennelly, 1956.

Pilasporites brevis sp. nov.

Pl. 1, Figs. 12, 13

Holotype — Pl. 1, Fig. 12, Slide No. 3131.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 2, Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Circular to subcircular microfossils; size 14-35 μ; exine thin, intragranulose; *extrema lineamenta* uneven.

Description — Miospores are alete, circular to subcircular. Holotype measures ± 28 μ. Exine is thin, sometimes folded, uneven, minutely intragranulose.

Comparison — This species can be compared to *Pilasporites plurigenus* Balme & Hennelly (1956) in its size range but differs in having thin exine which is 2-4 μ thick in the latter.

Genus — *Leiosphaeridia* Eisen., 1958

Genotype — *Leiosphaeridia baltica* Eisenack, 1958 emend. Downie & Sargeant, 1963.

Remarks — A number of species belonging to the genus *Leiosphaeridia* have been listed by Downie and Sargeant (1965). It is, however, very difficult to distinguish many species in a genus with only a few variable characters. So here it is proposed to compare the new species with the already existing species of Gondwanaland.

Leiosphaeridia crescentica sp. nov.

Pl. 1, Figs. 14, 15

Holotype — Pl. 1, Fig. 15, Slide No. 3133.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 5, Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Subcircular to oval, alete microfossils, size 40×37 μ-67×46 μ; exine thin, semicircular fold present; indistinctly sculptured to smooth; *extrema lineamenta* smooth.

Description — Microfossils are circular, subcircular to oval in over all shape. Holotype measures 50×40 μ. Exine is thin, sometimes mediumly thick, usually folded with a big semicircular fold. *Extrema lineamenta* is always ± smooth.

Comparison — This species is distinguished from *Leiosphaeridia* sp. of Segroves (1967) in having a distinct semicircular fold.

Leiosphaeridia simplex sp. nov.

Pl. 1, Figs. 16, 17

Holotype — Pl. 1, Fig. 16, Slide No. 3135.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 93; Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — ± subcircular microfossils, 70×50 μ-112×100 μ in size; exine thick, indistinctly sculptured, *extrema lineamenta* ± smooth.

Description — Microfossils are ± subcircular to irregular in overall shape. Holotype measures 90×65 μ. Exine is thick, laevigate, usually folded in irregular directions. *Extrema lineamenta* is always smooth.

Comparison — *Leiosphaeridia simplex* sp. nov. differs from *L. crescentica* in having bigger size range. *L.* sp. of Segroves (1967) is although of same size range but differs in having distinctly structured exine.

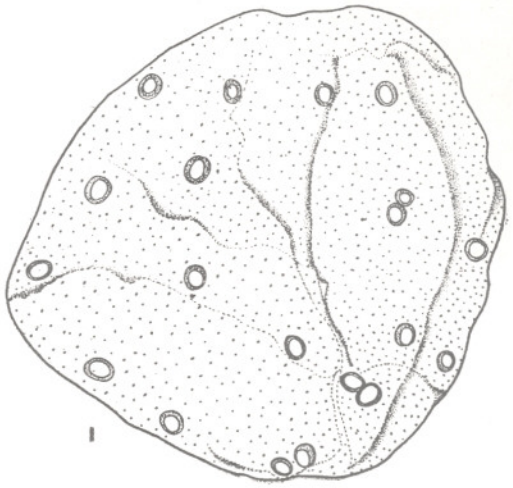
Genus — *Singraulipollenites* gen. nov.

Genotype — *Singraulipollenites indicus* gen. et sp. nov.

Diagnosis — Circular to subcircular microfossils; exine thin, sparsely or closely pitted, pits bordered.

Description — Microfossils are circular to subcircular, sometimes oval or irregular in shape. No mark or pore is present. Exine is thin, generally folded and covered with bordered pits. The pits are big or small, circular to oval, completely or partially surrounded with thick elevated borders. In between the bordered pits, either small simple pits are present or the exine is indistinctly sculptured.

Reconstruction — Text-fig. 1.



TEXT-FIG. 1—*Singraulipollenites* gen. nov., showing the nature of pits surrounded by borders.

Comparison — *Pilasporites* Balme & Henn., 1956, differs in being a circular, alete form with a very thick and unsculptured exine. *Greinervillites* Bose & Kar, 1967 and *Maculatasporites* Tiw., 1964 are reticulate, alete forms. *Leiosphaeridia* Eisen., 1958 is a circular alete form with sculptured exine. *Araucariacites* Cooks., 1947 is circular alete miospore but with granulose exine. *Lacunalites* Hemm. & Nygr. (1967) although possesses big pits it differs in having splitting zone and simple pits.

The present genus is characterized by the presence of bordered pits on both the faces.

Singraulipollenites indicus sp. nov.

Pl. 1, Figs. 20, 21

Holotype — Pl. 1, Fig. 20, Slide No. 3137.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 52, Singrauli Coalfield, Madhya Pradesh.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Microfossils ± subcircular in overall shape, mostly with folded exine; size range 50×40 μ-80×50 μ; ± 4 μ wide bordered pits sparsely distributed over both the faces.

Description — Microfossils are alete, without any haptotypic mark, originally probably spherical, irregular mostly in shape due to folding of the exine. Holotype

measures 55×45 μ. Exine is thin, variously folded, covered with 10-25 bordered pits over both the faces, pits are surrounded by thick elevated borders; pits are ± 3-6 μ in diameter, borders usually complete, sometimes incomplete surrounding only ½ the pit. Sometimes simple pits are also found in between the bordered pits. *Extrema lineamenta* is uneven due to pits.

Singraulipollenites finitimus sp. nov.

Pl. 1, Figs. 18, 19

Holotype — Pl. 1, Fig. 18; Slide No. 3139.

Locus Typicus — Bore hole No. NCSJ-4, Sample No. 65.

Stratum Typicum — Barakar Stage, Lower Gondwana.

Diagnosis — Microfossils ± subcircular and folded; size range 46×43 μ-80×60 μ; many closely spaced, ± 2 μ wide bordered pits present over both the faces.

Description — Microfossils are alete, irregularly shaped to ± subcircular due to folded exine. Holotype size 52×40 μ, small (± 2 μ wide) pits are surrounded by elevated borders. 35-70 pits can be counted over both the faces along with few simple pits in between. *Extrema lineamenta* is uneven due to pits.

Comparison — *Singraulipollenites* sp. nov. differs from *S. indicus* sp. nov. in having closely spaced, small sized bordered pits.

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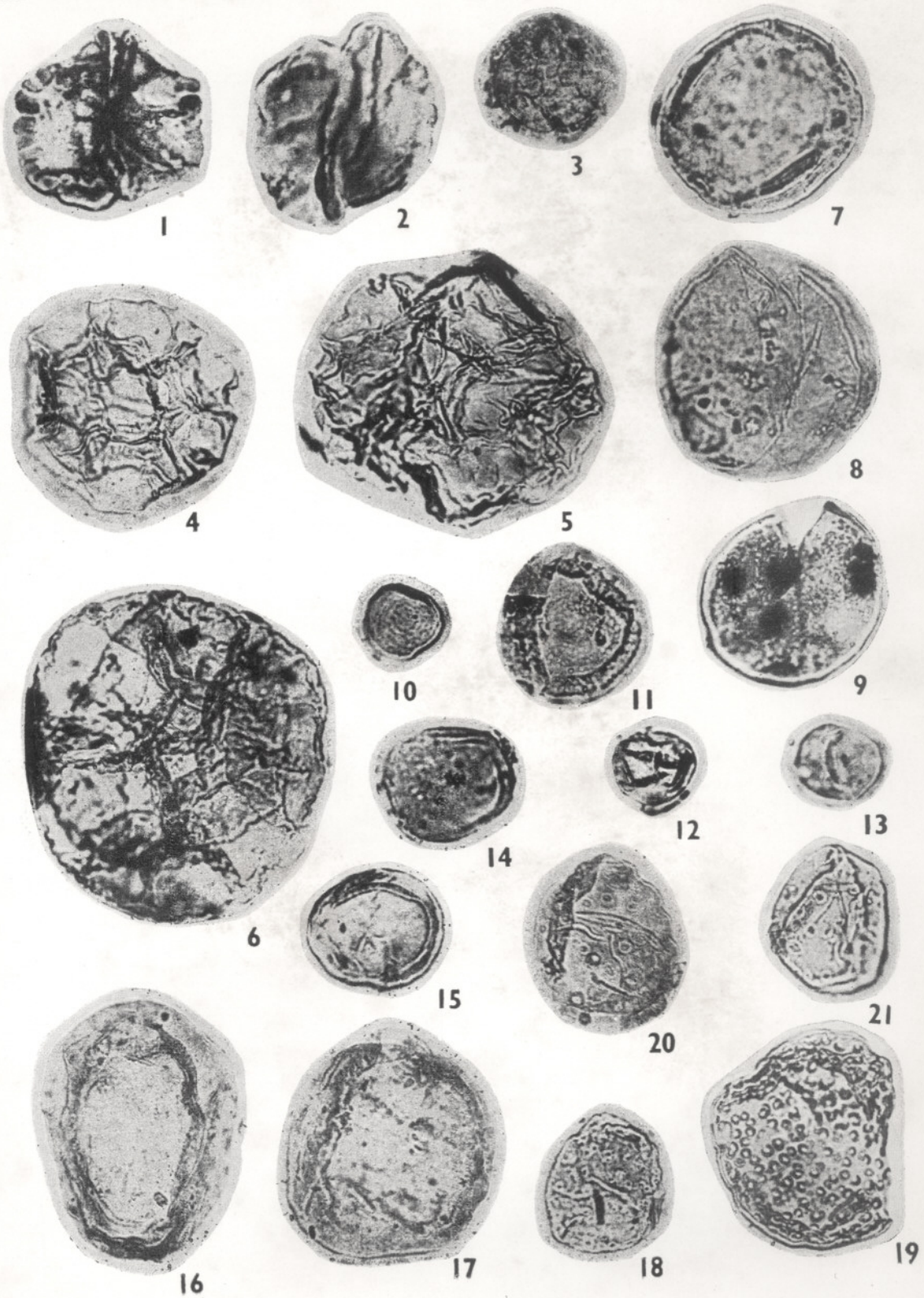
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EXPLANATION OF PLATE

PLATE 1

(Figured slides have been deposited at the repository of Birbal Sahni Institute of Palaeobotany, Lucknow. All photomicrographs magnified × 500)

1. ? *Botryococcus* sp. A, photo no. 289/18, slide no. 3183.
2. ? *Botryococcus* sp. B, photo no. 347/2, slide no. 3182.
3. *Maculatasporites gondwanansis*, photo no. 344/32, slide no. 3181.
4. *Greinervillites undulatus*, photo no. 289/19, slide no. 3180.
5. *Greinervillites irregularis* sp. nov., photo no. 428/9 (Holotype), slide no. 3125.
6. *Greinervillites* sp., photo no. 305/17, slide no. 3179.
7. *Hemisphaerium singrauliensis* sp. nov., photo no. 319/20 (Holotype), slide no. 3127.
8. *Hemisphaerium singrauliensis* sp. nov., photo no. 285/34, slide no. 3178 (specimen showing thin membraneous covering around the body).
9. *Hemisphaerium signum*, photo no. 329/32, slide no. 3177.
10. *Circulisporis parvus*, photo no. 334/16, slide no. 3176.
11. *Peltacystia venosa*, photo no. 395/35, slide no. 3175.
12, 13. *Pilasporites brevis* sp. nov., photo nos. 320/31, 325/18, slide nos. 3131 (Holotype), 3175.
14, 15. *Leiosphaeridia crescentica* sp. nov., photo nos. 357/25, 373/30, slide nos. 3133 (Holotype), 3134.
16, 17. *Leiosphaeridia simplex* sp. nov., photo nos. 289/23, 289/20, slide nos. 3135 (Holotype), 3136.
18, 19. *Singraulipollenites indicus* gen. et sp. nov., photo nos. 326/15, 285/5, slide nos. 3137 (Holotype), 3138.
20, 21. *Singraulipollenites finitimus* sp. nov., photo nos. 370/42, 366/7, slide nos. 3139 (Holotype), 3140.