

MICROPLANKTON FROM THE BHIMAS¹

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ABSTRACT—Sixty-eight samples belonging to the Bhimas in Mysore State are studied here. Samples are sandstones, limestones and shales. The microfossil recovery consists of a variety of microplankton and algal bodies. On the basis of microfloral contents, the Bhimas seem to be the equivalents of the Lower Vindhyan of Son Valley, thus ranging in their age from Late Pre-Cambrian to Cambrian. Abundance of microplankton indicates shallow marine conditions of deposition.

INTRODUCTION

The rocks representing the Bhima Series are exposed in Gulbarga district of Mysore State. They are named after the Bhima river, a tributary of Krishna and are located nearly 75 miles away from Kurnool in a north-westerly direction. They occupy an area of roughly 2000 square miles (Krishnan, 1960). The basin is irregular in outline, its maximum width being nearly 25 miles at the crossing of river Bhima. The Bhima rocks are supposed to be overlying the Kaladgis and are considered equivalent to the Kurnools of Andhra Pradesh. Along their entire north-western border the Bhimas are covered by the Deccan Traps.

The Bhimas were earlier divided into the Lower and Upper Series but lately in 1946

a threefold division i. e. Upper, Middle and Lower has been suggested by Mahadevan, (1946). The eastern and southern parts contain the Lower and Middle divisions while the Upper division is found in north and west.

In view of open sea conditions indicated by the limestone of Upper Bhimas, there is a suggestion that they were once continuous with the like rocks of the Kurnool area and that they have been separated therefrom by denudation (Pascoe, 1959).

MATERIAL AND METHODS

Samples for the present study are collected from the following localities :

(a) Shahabad quarries

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- (b) Sedam quarry and nala
 (c) Chitapur nala
 (d) Ram Tirth
 (e) Near Jewargi bridge
 (f) Bavur near Talikot
 and (g) Talikot.

A total of sixty eight samples are collected. Out of these 27 belong to the Lower, 24 to the Middle and 17 to the Upper Bhimas. The Bhima Series consists of limestone and shales with quartzose sandstone at the bottom. Limestone are bluish grey to cream coloured, hard, dense and well bedded. The shales are usually red and highly fissile.

Majority of the samples are macerated by using Hydrofluoric acid, Nitric acid, Potassium hydroxide etc. Remaining samples are treated with Sodium pyrophosphate, the details of which are given by Samoilovich, Salujha and Sauer (1969). Microfossils are separated by using heavy liquid of specific gravity 2.3. Mounting medium used is either glycerine jelly or Polyvinyl alcohol and Canada balsam. Slides for storage are sealed with Vinyl acetate or lac.

SYSTEMATIC DESCRIPTIONS

Bulk of the microfossil recovery here consists of a variety of sphaeromorphs and algal remains. All these types are classified and described according to the system of classification proposed by Downie, Evitt and Sarjeant (1963).

Group Acritarcha EVITT, 1963

Sub Group Sphaeromorphae DOWNIE,
 EVITT AND SARJ. 1963

Genus *Archaeofavosina* Naumova 1960

Genotype *Archaeofavosina simplex*
 Naumova 1960

Archaeofavosina compta sp. nov.
 Pl. 1, Figs. 1, 2, 3

Holotype. Pl. 1, Fig. 1

Diagnosis. Spherical to subspherical, 30.8—83.2 x 32.2—90.8 μ ; exine thin, pitted, reticuloid in the centre.

Description. Light brown, spherical to subspherical in shape, size 30.8—83.2 x 32.2—90.8 μ ; exine very thin, fragile, less than 1.0 μ , pitted, pits sparsely spaced; central area reticuloid.

Comparison. A comparable specimen is illustrated as *Archaeofavosina simplex* by Naumova (1960; Pl. 3, Text fig. 11) but it is smaller in size. *A. venusta* (Salujha, Rehman and Arora, 1971a; Pl. 3, figs. 2, 3) is smaller in size with a granulate exine.

Genus *Trematosphaeridium* Timofeev 1956

Genotype *Trematosphaeridium decoratum*
 Timofeev 1956

Trematosphaeridium bhimii sp. nov.
 Pl. 1, Figs. 4, 5, 6, 7, 8

Holotype. Pl. 1, Fig. 4

Diagnosis. Spherical to subspherical; 10.6—16.4 x 18.4—24 μ ; exine finely granulose with 1.5—3.2 μ broad perforation.

Description. Brown, subspherical in folded condition, originally may be spherical, size 10.6—16.4 x 18.4—24 μ ; exine over 1 μ thick, finely granulose with few perforations; perforations of varying shapes, measuring 1.5—3.2 μ ; body bearing folds.

Comparison. *Trematosphaeridium* sp. recorded by Timofeev (1963; Pl. 1, figs. 1-4) is larger in size with a thicker and smooth exine. *Trematosphaeridium decoratum* (Timofeev, 1959; Pl. 1, fig. 13) also has a larger diameter with many larger perforations. *T. inspissatum* illustrated by Salujha, Rehman and Arora (1971a; Pl. 3, figs. 14-17) differs in having a thicker exine with coarsely granulate ornamentation.

Trematosphaeridium sp.

Pl. 1, Fig. 9

Description. Dark brown sphaeromorph, subspherical in shape; size 38.8 x 45 μ ; exine 1 μ thick, reticulate, perforations circular, \pm 1.6 μ in diameter, body bearing many folds.

Comparison. *Trematosphaeridium* sp. (Timofeev, 1963; Pl. 1, figs. 1-4) has a thicker and smooth exine.

Genus *Granomarginata* Naumova 1960

Genotype *Granomarginata prima*
Naumova 1960

Granomarginata exquisita sp. nov.

Pl. 1, Figs. 10, 11

Holotype. Pl. 1, Fig. 10

Diagnosis. Circular, 9.6—17.6 μ ; exine dense, faintly granulate, peripheral thickening 1.5—2.9 μ broad.

Description. Brown, circular in shape, size 9.6—17.6 μ ; exine dense with a 1.5—2.9 μ wide thickening at the periphery, faintly granulate, grana up to 1 μ in diameter, closely arranged.

Comparison. *Granomarginata prima* figured by Naumova (1960; Pl. 3, Text-fig. 10) comes close to the present species but differs

in having a coarsely granulate exine. *G. primitiva* illustrated by Salujha, Rehman and Arora (1971a; Pl. 3, figs. 18-20) differs in having coarse and sparsely spaced grana.

Granomarginata primitiva Salujha, Rehman
and Arora 1971

Pl. 1, Fig. 12

Remarks. The size range given for this species is 10.6—18.4 μ . The specimen recorded here measures 27.2 μ , thus the size range for this species may be taken as 10.6—27.2 μ .

Granomarginata sp.

Pl. 1, Fig. 13

Description. Yellowish brown, spherical, appearing subspherical due to folding on one side; size 14.4 μ ; exine thick, granulate, with a 1.6 μ wide peripheral margin.

Comparison. *Granomarginata prima* illustrated by Naumova (1960; Pl. 3, Text-fig. 10) has coarsely granulate exine. *Granomarginata exquisita* described above has a dense exine.

Genus *Vavosphaeridium* Timofeev 1956

Genotype *Vavosphaeridium michailovskyi*
Timofeev 1960

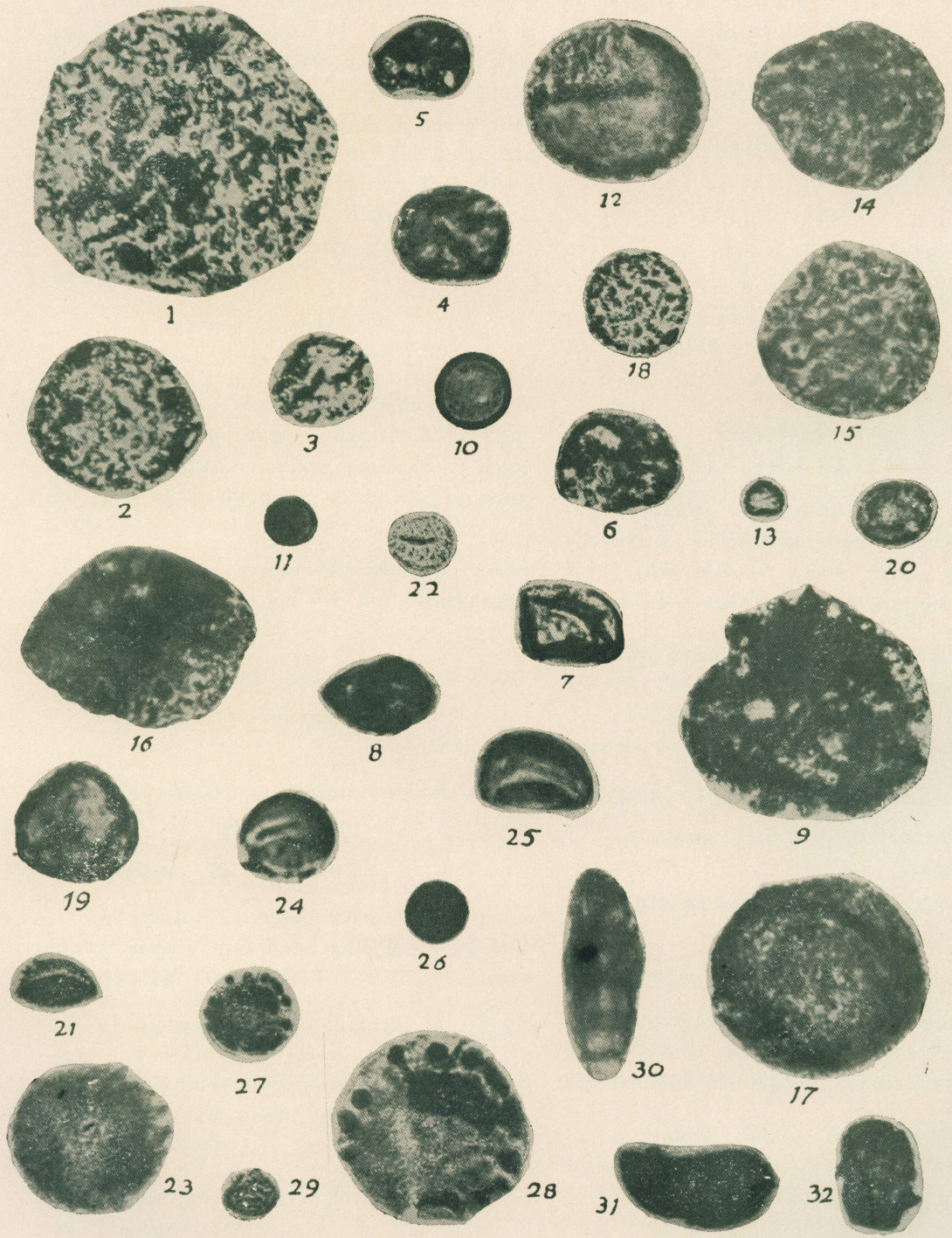
Vavosphaeridium reticulatum sp. nov.

Pl. 1, Figs. 14, 15, 16

Holotype. Pl. 1, Fig. 14.

Diagnosis. Spherical to subspherical, 28.8—34.6 x 30.4—38.8 μ ; exine thick, covered with incomplete reticulations.

Description. Dark brown, spherical to subspherical in shape; size 28.8—34.6 x 30.4—38.8 μ ; exine thick, reticulate, reticulations incomplete, muri \pm 1.5 μ wide with lumina of varying shape.



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Comparison. *Vavosphaeridium michailovskyi* Timofeev (1960; Pl. 1, fig. 8) is comparatively larger in size with finer network on the exine. *V. bharadwajii* illustrated by Salujha, Rehman and Rawat (1971b; Pl. 1, figs. 1-2) differs in having thicker muri with broader reticulations.

Vavosphaeridium sp.

Pl. 1, Fig. 17

Description. Dark brown, spherical grain, measuring 27.2 μ ; exine 1.5 μ thick, reticulate, muri seen in small parts forming incomplete but fine meshwork, sometimes 1.0—1.5 μ wide lumina seen.

Comparison. The present species differs from *Vavosphaeridium reticulatum* described above in having a finer meshwork on the exine.

Genus *Lophosphaeridium* Timofeev 1959

Genotype *Lophosphaeridium rarum*
Timofeev 1959

Lophosphaeridium bellus sp. nov.

Pl. 1, Figs. 18, 19, 20, 21

Holotype. Pl. 1, Fig. 18.

Diagnosis. Spherical, 14.4—26.8 μ ; exine thin, beset with \pm 1.5 μ long and

equally broad projections, tapering towards the tips.

Description. Yellowish to brown in colour, spherical but usually folded, measuring 14.4—26.8 μ in diameter; exine thin to mediumly thick, ornamented with \pm 1.5 μ long and equally broad (at the base) projections with tapering ends.

Comparison. *Lophosphaeridium rarum* (Timofeev, 1959; Pl. 2, fig. 5) has larger diameter and the processes are blunt tipped. *Lophosphaeridium parvum* recorded by Stockmans & Williere (1963; Pl. 2, fig. 2; Pl. 3, fig. 27) also differs in having blunt tipped processes. *L. jainii* (Salujha, Rehman and Rawat, 1971b; Pl. 1, figs. 14-16) has longer processes.

Lophosphaeridium sp.

Pl. 1, Fig. 22

Description. Light brown, circular, appearing subcircular due to a fold, measuring 10.6 μ in diameter, exine very thin bearing projections with rounded tips.

Comparison. The present species distinguishes in its smallest size and grana-like protuberances.

Sub Group Comorphitae DOWNIE,
EVITT AND SARJ. 1963

EXPLANATION OF PLATE 1

1—3. *Archaeofavosina compta* sp. nov. (Photo Nos. 27/3, 22/10, 22/15). 4—8. *Trematosphaeridium bhimii* sp. nov. (Photo Nos. 22/16, 22/21, 24/10, 22/11, 24/19). 9. *Trematosphaeridium* sp. (Photo No. 22/14). 10—11. *Granomarginata exquisita* sp. nov. (Photo Nos. 28/13, 20/17). 12. *Granomarginata primitiva* Salujha, Rehman and Arora, 1971 (Photo No. 20/2). 13. *Granomarginata* sp. (Photo No. 20/11). 14—16. *Vavosphaeridium reticulatum* sp. nov. (Photo Nos. 24/15, 28/21, 28/20). 17. *Vavosphaeridium* sp. (Photo No. 24/2). 18—21. *Lophosphaeridium bellus* sp. nov. (Photo Nos. 22/12, 24/12, 24/16, 23/14). 22. *Lophosphaeridium* sp. (Photo No. 21/17). 23. *Ooidium* sp. (Photo No. 20/5). 24—25. cf. *Tasmanites* sp. (Photo Nos. 22/2, 21/13). 26. *Discoidal body* (Photo No. 20/13). 27—28. *Dasycladaceous alga* (Photo Nos. 20/7, 20/8). 29. *Incertae sedis Type 1*, (Photo No. 11/1). 30. *Incertae sedis Type 2*, (Photo No. 22/15). 31—32. *Incertae sedis Type 3*, (Photo Nos. 26/14, 27/4). (Figs. 10—11, 13, 25—27, 29, \times 500; rest \times 750).

Genus *Ooidium* Timofeev 1957

Genotype *Ooidium rossicum* Timofeev 1957

Ooidium sp.

Pl. 1, Fig. 23

Description. Brown, subspherical grain, size $34.4 \times 31.2 \mu$; exine about 1.2μ thick, granulose; a cluster of small spine like projections seen on one side; no germinal mark observed.

Comparison. *Ooidium rossicum* (Timofeev, 1959; Pl. 13, fig. 1) and *O. sablincaense* (Timofeev, 1960; Pl. 2, fig. 20) are smaller in size with a smooth exine. Salujha, Rehman and Rawat (1971 b; Pl. 1, fig. 26) have illustrated a specimen of *Ooidium*, which is bigger in size and the exine is faintly reticulate.

Family Tasmanacea SOMMER, 1956

Genus *Tasmanites* Newton 1875

Genotype *Tasmanites punctatus* Newton 1875

cf. *Tasmanites* sp.

Pl. 1, Figs. 24, 25

Description. Brown, spherical, size $12.8-23.6 \mu$, exine $\pm 1.8 \mu$ thick, psilate to faintly punctate, wall pores indistinct.

Comparison. The specimens figured here come very close to *Tasmanites* cf. *salustianoii* illustrated by Combaz (1966; Pl. 1, fig. 5) but marked difference in their size keeps them apart.

Discoidal body

Pl. 1, Fig. 26

Description. Dark brown, spherical in shape, measuring 19.2μ in diameter, exine about 1.5μ thick, psilate.

Remarks. The exact nature of such specimens is not known. However, considering their frequent occurrence one specimen is illustrated here.

Dasycladaceous alga

Pl. 1, Figs. 27, 28

Description. Brown, almost circular, size $63.4 \times 64 \mu$; wall about 1.3μ thick, granulose, a few black, oval, sessile, sporangia-like bodies present along the periphery, each body measuring $4.8 \times 6.4 \mu$.

Comparison. A grain of this type is recorded for the first time from the Early Paleozoic rocks of India. A comparison with the available records shows that it comes very close to one of the types of Dasycladaceous algae (*Physoporella*, Gumb) belonging to the Order Siphonales in Class Chlorophyceae. *Physoporella* also has sessile sporangia embedded in the wall of the thallus. *Piania* Gowda (1959; Pl. 6, fig. 2) has sporangia borne on well developed stalks. However, since only one specimen is recovered, it is described here as a Dasycladaceous alga.

Incertae sedis

Type 1

Pl. 1, Fig. 29

Description. Light brown, subcircular grain, size $10.2 \times 12.4 \mu$; exine thick, reticulate, grain ruptured on one of its sides.

Type 2

Pl. 1, Fig. 30

Description. Brown, almost oval, multicellular with distinct septations, cells in 2 or 3 rows, overall size $35.6 \times 14.8 \mu$; septa $1-1.5 \mu$ wide.

Remarks. Almost similar grains are referred to as *Polycellaria* by Pflug (1965).

Type 3

Pl. 1, Figs. 31, 32

Description. Dark brown, elongated bodies, measuring 16.6–20.8 x 8.8–10.2 μ , wall thick, sometimes bearing small projections, neck not clearly demarcated.

DISCUSSION

The microfossil recovery from the Bhima sediments consists of a variety of microplankton referable to Sub Groups Sphaeromorphitae and Oomorphitae of Downie, Evitt and Sarjeant (1963). Few other specimens assigned to Families Tasmanaceae and Dasycladaceae of Chlorophyceae are also recorded. The microplankton are said to belong to algae. The present microfloral assemblage is very primitive in nature and does not record any definite spore—pollen type characteristic of Devonian and younger periods. Thus the present assemblage may belong to one of the periods older than Devonian. A survey of the available literature on the pre-Devonian palynology shows that microfloral assemblages from the Silurian, Ordovician, Cambrian and Precambrian periods are apparently not very distinct, bulk of these consisting of smooth to ornamented sphaeromorphs. However recent studies by Timofeev (1959, 1960) and Andreeva (1962) have shown the stratigraphic importance of various phytoplankton genera of the Proterozoic and Early Paleozoic. This has been further elucidated by Downie (1967) in his paper on the geological history of microplankton.

The microfloral assemblage recovered here consists of the following genera: *Arch-*

aeofavosina, *Trematosphaeridium*, *Granomarginata*, *Vavosphaeridium*, *Lophosphaeridium* and one specimen each of *Ooidium*, cf. *Tasmanites* and Dasycladaceous alga. Out of these *Archaeofavosina* and *Trematosphaeridium* are restricted to Late Precambrian to Cambrian. The genus *Granomarginata* is restricted to Cambrian. *Ooidium* appears in Cambrian and extends into Ordovician. Remaining genera met with here have a wide distribution range and are not of stratigraphic value. Thus the Bhima Series may be assigned a Late Precambrian to Cambrian age.

An exactly similar conclusion has been drawn by Salujha (in press) for the Lower Vindhyan of Son Valley exposed in Uttar Pradesh and Madhya Pradesh. A comparison of the palynological fossils has shown that most of the phytoplankton genera represented in the Bhimas exposed in South are also present in the Lower Vindhyan of Son Valley. However, minor differences in the representation of a couple of genera like *Dictyotidium*, *Leiovalia* and Dasycladaceous alga are noticed in the two assemblages but these have a very poor occurrence, usually represented by solitary specimens. Such genera are considered to be of minor importance. Taken as a whole the microfloral contents of the Bhimas are similar to those recovered from the Lower Vindhyan of Son Valley, and thus seem to be their equivalents.

As already indicated most of the microfloral types recovered here are microplankton having an affinity with algae. Spores and pollen grains are completely absent thereby indicating the deposition of these sediments under shallow marine conditions.

ACKNOWLEDGEMENTS

We are thankful to Shri V. V. Sastri, Additional Director, Dr. V. R. Rao (former Deputy Director (Geology), Shri L. L. Bhandari, Senior Deputy Director, (Geology) and Dr. B. S. Venkatachala, Senior Scientific Officer (Paly.) of the Institute of Petroleum Exploration, Oil and Natural Gas Commission, Dehra Dun for their constant encouragement, advice and help. Sincere help by Dr. C. G. Rao in collecting samples is thankfully acknowledged.

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