

MICROBIOTA FROM SUBSURFACE OF GANGA BASIN¹

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ABSTRACT

Cryptarchs and algal remains from the Ujhani Deep Well-1 and Ujhani Wells 1, 2, 3 are described. The microbiota comprises twelve genera and sixteen species. The microbiota favours a late Precambrian age for subsurface samples of Ganga Basin.

INTRODUCTION

The Ganga Basin is located in the northern part of India covering an area of 250,000 sq km, falling within long. 77°-88°E and lat. 24°N-30°N. In the north, the basin is restricted by Himalayan foot-hills and the Siwaliks, and to the southwest and south by the Vindhyan Basin as well as the Bundelkhand Granites, gneisses and unclassified crystallines of Satpura and Aravalli. The basin is limited on the northwest and west by the shallow basement corresponding to the Delhi-Aravalli Systems, and in the east and the southwest by the Satpura Massif and its subsurface ridge-like extensions.

The Oil and Natural Gas Commission drilled 4 deep wells—Ujhani-1, Tilhar-1, Raxaul-1 and Mohand-1, and 4 other wells—Ujhani 1, 2, 3 and Kasganj-1 in this basin. The subsurface sequence (for location and geological details see SASTRI & VENKATACHALA, 1968) is represented by crystalline metamorphic rocks of basement, overlain by Vindhyan, Tertiary and Quaternary sediments. Overlying the basement, two separate stage of sedimentation divided by an angular unconformity are discernible. The older sediments are siltstone-quartzitic sandstone and limestone-orthoquartzite-shale associations correlatable with Vindhyan rocks, while the younger sediments contain continental sands, silts and clays of Tertiary and Quaternary age.

The microbiota from the Ganga Basin below the unconformity in Ujhani Structural Well no. 2 was first reported by SALUJHA, RAWAT AND REHMAN (1967). The forms recorded are—*Leiosphaeridia*, *Protoleiosphaeridium*, *Nucellosphaeridium*, *Leioligotriletum* and dissacates. SASTRI AND VENKATACHALA (1968) recorded trace fossil—*Diplocraterion*, and microbiota comprising cuticular remains, filamentous algal remains, *Protoleiosphaeridium*, *Symplassosphaeridium* and spores with trilete mark in pre-Siwaliks sediments from Tilhar Deep Wells.

The present study records the microbiota from the subsurface sediments below the unconformity in Ganga Basin, and highlightens their significance in dating the sediments. The study is based on the slides of macerates of material from Ujhani deep well, Ujhani structural wells and Kasganj well earlier prepared by I. O. P. Dehra Dun. The microbiota in the drill core samples of Ujhani Deep Well-1 and Ujhani Structural

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Wells 1, 2, 3 is well preserved; however, in Kasganj Well the microbiota is poor and, thus, it is not suited for detailed taxonomic studies.

SYSTEMATICS

The microbiota recored is listed below, with illustrations mention in parenthesis.

CRYPTARCHS

Genus—*Protosphaeridium* Timofeev, 1966

P. volkova Maithy & Shukla, 1977 (Pl. 1, Fig. 1)

P. densum Maithy, 1975 (Pl. 1, Fig. 2)

Genus—*Granomarginata* Naum., 1961

G. minuta Maithy, 1975 (Pl. 1, Fig. 3)

G. rotata Maithy & Shukla, 1977 (Pl. 1, Fig. 4)

Genus—*Orygmato-sphaeridium* Timofeev, 1959

O. plicatum Maithy & Shukla, 1977 (Pl. 1, Figs. 5-7).

Genus—*Vavosphaeridium* Timofeev, 1956

V. vindhyanensis Maithy & Shukla, 1977 (Pl. 1, Fig. 8)

Genus—*Archaeofavosinia* Naum, 1960

A. sinuta Maithy, 1975 (Pl. 1, Fig. 17, Pl. 2, Fig. 19)

Genus—*Kildinella* Timofeev, 1963

K. suketensis Maithy & Shukla, 1977 (Pl. 2, Fig. 26)

Genus—*Nucellosphaeridium* Timofeev, 1963

N. minutum Timofeev, 1966 (Pl. 1, Fig. 9)

N. zonatum Maithy, 1975 (Pl. 1, Fig. 12)

N. medianum Timofeev, 1966 (Pl. 1, Figs. 10, 11)

Genus—*Zonosphaeridium* Timofeev, 1956

Z. punctatum Maithy & Shukla, 1977 (Pl. 1, Figs. 13, 14)

Genus—*Leioligotritetum* Timofeev, 1958

L. crassus Salujha, Rehman & Rawat, 1971 (Pl. 1, Figs. 15, 16)

ALGAE

Genus—*Myxococcoides* Schopf, 1968

M. globosa Maithy & Shukla, 1977 (Pl. 2, Fig. 20)

Genus—*Palaeoanacystis* Schopf, 1968

P. verrucosus Maithy & Shukla, 1977 (Pl. 1, Figs. 21, 22)

Genus—*Gunflintia* Barghoorn, 1965

G. minuta Barghoorn, 1965 (Pl. 2, Figs. 23)

INCERTAE SEDIS

Cells showing binary fission (Pl. 2, Figs. 24)

Fungal body (Pl. 1, Fig. 18; pl. 2, Fig. 25)

DISCUSSION

Diversified opinions have been put forward in past on the age of the Ujhani and Tilhar sediments below the unconformity in Ganga Basin. MATHUR AND EVANS (1964) are of the opinion that a major thickness of the sediments below the unconformity in

Ganga Basin belongs to Mesozoic and only a few meters above the basement belong to Upper Palaeozoic. METRE (1968) feels that these sediments are of Palaeozoic age. SALUJHA, RAWAT AND REHMAN (1967) opined that the Ujhani sediments below the unconformity are of early Palaeozoic age. However, later SALUJHA (1973) considered them to be closely related with the Upper Vindhyan, specially the upper part. SASTRI AND VENKATACHALA (1968) suggested a Palaeozoic, probably Carboniferous or Pre-Cambrian age for these sediments. Subsequently, VENKATACHALA AND RAWAT (1972) on the basis of biota, considered them to be of Pre-Ordovician age.

The microbiota from the Vindhyan of Rajasthan described by SALUJHA, REHMAN AND RAWAT (1971) resembles in the common presence of *Protosphaeridium*, *Vavosphaeridium*, *Zonosphaeridium* and *Leioligotriletum*. However, the Cryptarchs occurring in the Ujhani sediments, viz. *Granomarginata*, *Orygmato-sphaeridium*, *Archaeofavosina*, *Kildinella* and *Nucellosphaeridium* are not recorded from the Rajasthan assemblage. Similarly, *Leiosphaeridia*, *Symplastosphaeridium*, *Lophosphaeridium*, *Gymatiosphaera*, *Dictyotidium*, *Priscogalea* and *Leiovalia* of Rajasthan assemblage are not recorded in the Ujhani wells. Moreover, Ujhani microbiota differs totally in the presence of algal remains.

MAITHY AND MANDAL (1983) reported microbiota from the Upper Vindhyan of Karuli-Sapotra area. This assemblage is comparable due to common occurrence of *Protosphaeridium*, *Orygmato-sphaeridium*, *Granomarginata*, *Kildinella*, *Myxococcoides* and *Palaeoanacystis*. However, Karuli-Sapotra assemblage differs due to the presence of other algal forms, viz. *Corymbococcus*, *Nanococcus*, *Gloeocapsomorpha* and *Palaeoglauco-cystis*.

Microbiota of the Vindhyan Supergroup from Son Valley recorded by SALUJHA REHMAN AND ARORA (1971) compares with the microbiota of Ujhani sediments in the common presence of *Vavosphaeridium*, *Archaeofavosina*, *Granomarginata* and *Zonosphaeridium*. However, the Son Valley assemblage differs considerably in the presence of *Microhystridium*, *Baltisphaeridium*, *Pteriospermopsis*, *Trematosphaeridium*, *Lophosphaeridium* and *Leiosphaeridia*. Furthermore, the algal-remains recorded in Ujhani sediments are totally absent in Son Valley assemblage.

Microbiota of Ujhani sediments has a close similarity with the microbiota reported from the Vindhyan of Suket Shale (Ramapura) described by MAITHY AND SHUKLA (1977). Algal-remains referable to *Myxococcoides*, *Palaeoanacystis* and Cryptarchs, viz. *Protosphaeridium*, *Granomarginata*, *Orygmato-sphaeridium*, *Zonosphaeridium*, are present in both the assemblages. However, the Suket Shale microbiota is more diversified than the Ujhani assemblage in number of algal and Cryptarch species. An important element of Ujhani sediment—*Leioligotriletum*—is totally absent in the Suket Shale assemblage. This cryptarch bears a triradiate fold but as earlier commented by SASTRI AND VENKATACHALA (1968) it may not be a land plant spore. The trilete mark could as well be the tetragonal compression mark as is seen in several red and brown algae (see comparable spores in *Protosalvinia*).

The microbiota recorded from Kaladgi by VENKATACHALA AND RAWAT (1973) and VISWANATHIA, VENKATACHALAPATHY AND MAHALAKSHANAMMA (1975), and from Bhima by VENKATACHALA AND RAWAT (1972) are significantly different from the biota of Ujhani sediments, both in the algal and cryptarch composition.

SALUJHA, REHMAN AND ARORA (1972) recorded microbiota from Kurnools, which is being considered to be Cambrian in age. The Kurnool biota compares in the common presence of *Protosphaeridium*, *Granomarginata*, *Archaeofavosina* and *Vavosphaeridium*. However, the Ganga Basin biota differs in the presence of *Orygmato-sphaeridium*, *Kildinella*, *Nucellosphaeridium* and *Leioligotriletum*.

The Ganga Valley assemblage compares with the biota recorded from C-16 Group of Bushimay System of Kanshi, Zaire by MAITHY (1975). Bushimay has been radiometrically dated to be ca 1050-1100 m. y. All the elements recorded in Ujhani sediments are known in Bushimay, except for *Leioliogotriletum*, but the Bushimay biota is highly diversified, both in algae and cryptarchs.

The above comparison suggests that the biota of Ganga Basin below the unconformity has a closer similarity with the Upper Vindhyan biota.

Recent studies on the biostratigraphic distribution of acritarch and cryptarchs in the Precambrian and Cambrian by NAUMOVA (1974), DOWNIE (1974), LOPUCHIN (1974), TIMOFEEV (1974), PYZHOVA (1974) and VANGUESTAINE (1974) have shown that the acritarch with exine processes, i. e. with spines, etc. occur only in the rocks from Cambrian onwards. Their occurrence even in the close of late Precambrian is negligible. Late Precambrian is characterised by the presence of simple cryptarchs belonging to Sphaeromorphitae. The Ganga Basin subsurface microbiota from Ujhani, as discussed above, shows the dominance of simple cryptarchs, viz. *Kildinella*, *Orygmato-sphaeridium*, *Nucellosphaeridium*, etc. belonging to Sphaeromorphitae. This evidence favours for a late Precambrian age for it. This result corroborates with that of the Potassium-Argon dating of the sericite quartzite from a core in Ujhani Deep Well-1 from a depth of 2115-2119 meter as 1045 million years by R. E. FOLINSBEE (SASTRI & VENKATACHALA, 1968, p. 77).

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EXPLANATION OF PLATES

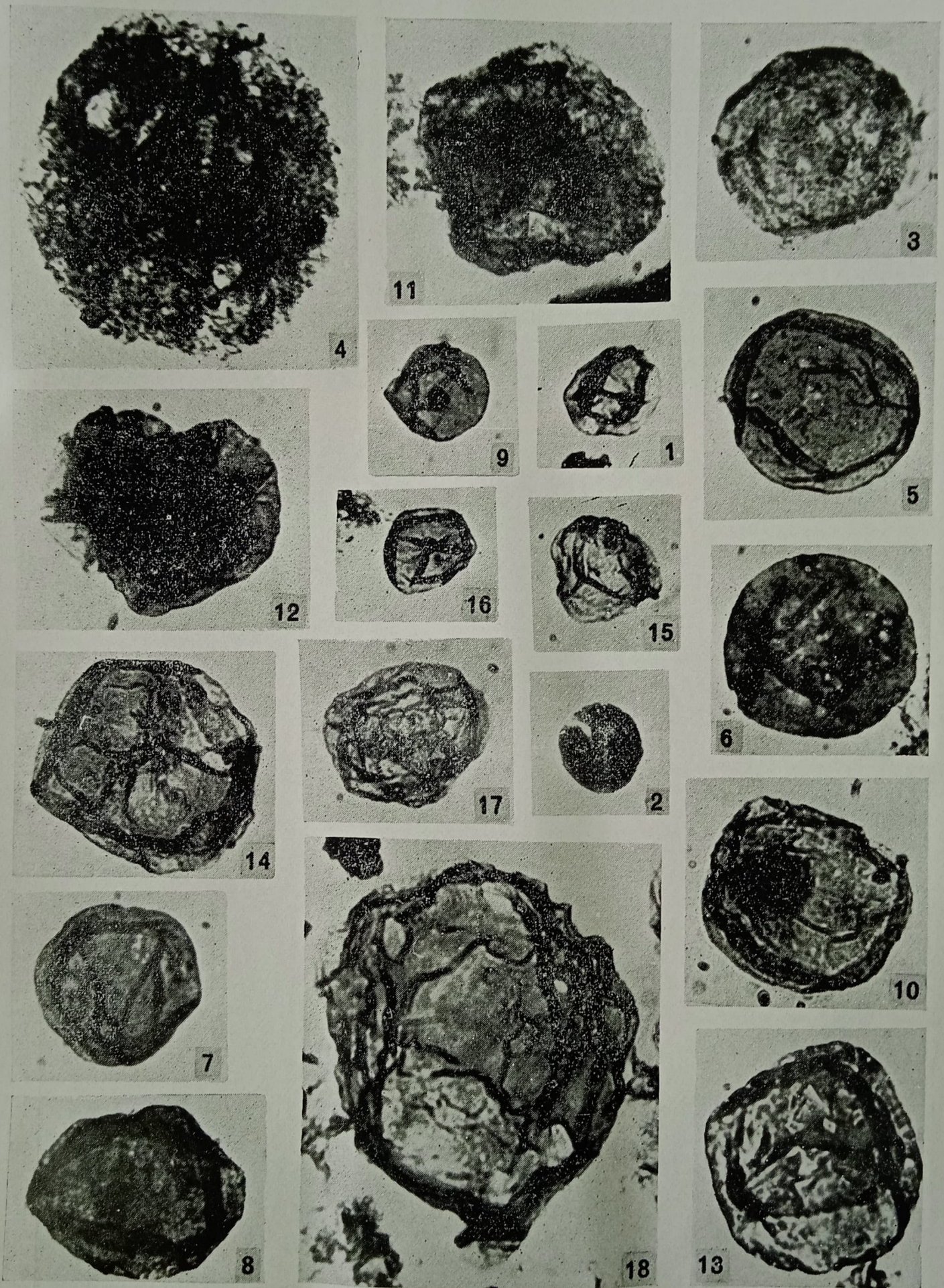
(All figured slides are preserved at K. D. Malviya Institute of Petroleum Exploration, Dehra Dun; All photomicrographs are $\times 500$, Negatives preserved at Birbal Sahni Institute of Palaeobotany, Lucknow).

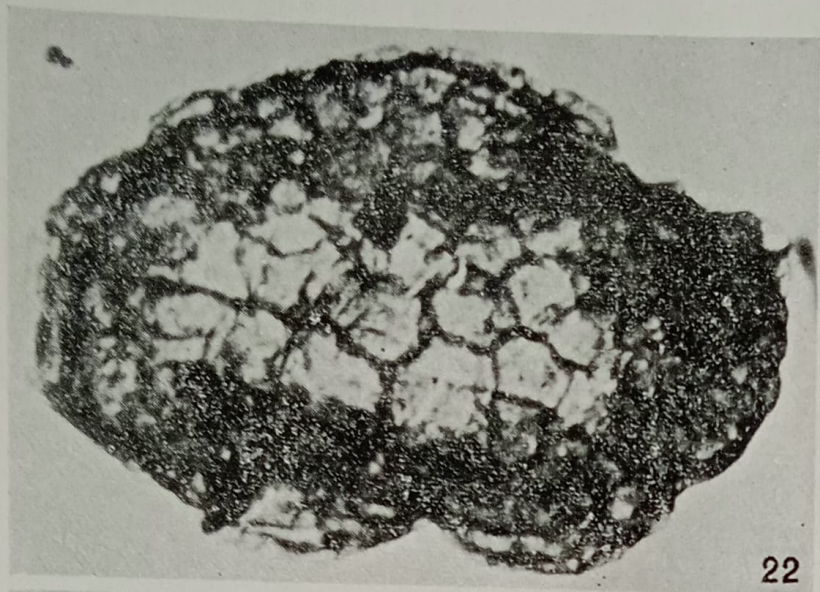
PLATE 1

1. *Protosphaeridium volkovae* Maithy & Shukla
2. *P. densum* Maithy
3. *Granomarginata minuta* Maithy
4. *G. rotata* Maithy & Shukla
- 5-7. *Orymatosphaeridium plicatum* Maithy & Shukla
8. *Vavosphaeridium vindhyanensis* Maithy & Shukla
9. *Nucellosphaeridium minutum* Timofeev
- 10-11. *N. medianum* Timofeev
12. *N. zonatum* Maithy
- 13-14. *Zonosphaeridium punctatum* Maithy & Shukla
- 15-16. *Leioligotritetum crassus* Salujha, Rehman & Rawat
17. *Archaeofavosina sinuta* Maithy
18. ? Fungal body

PLATE 2

19. *Archaeofavosina sinuta* Maithy
20. *Myxococcoides globosa* Maithy & Shukla
- 21-22. *Palaeoanacystis verucosus* Maithy & Shukla
23. *Gunflintia minuta* Barghoorn
24. Dividing cells
25. ? Fungal body
26. *Kildinella suketensis* Maithy & Shukla

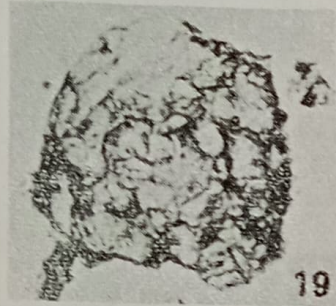




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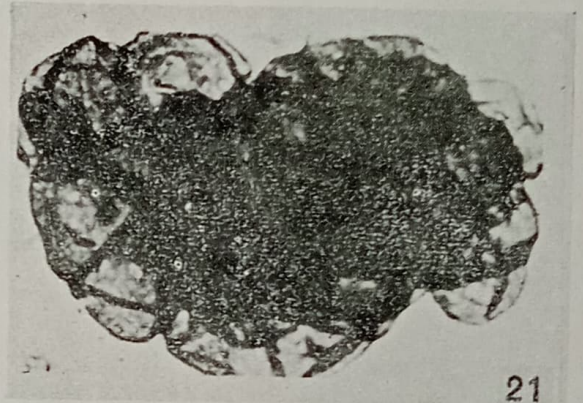
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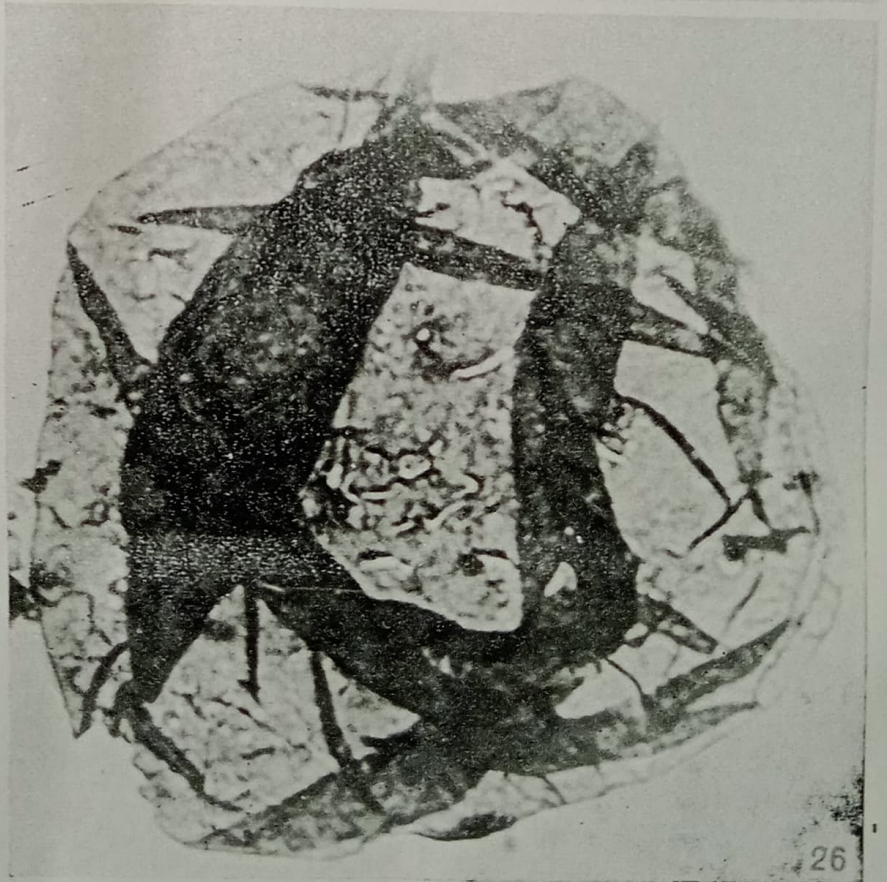
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