

MICROBIOTA AND ORGANOSEDIMENTARY STRUCTURES FROM VINDHYAN SUPERGROUP AROUND CHANDREHI, MADHYA PRADESH*

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ABSTRACT

The present paper records the microbiota and stromatolite from Vindhyan Supergroup around Chandrehi Section in Madhya Pradesh. The microbiota is recorded from Semri, Rewa and Bhandar groups. It comprises bacteria — *Biocatenooides*; algae — *Huronispora*, *Sphaerophycus*, *Aphanocapsiopsis*, *Corymbococcus*; acritarcha — *Orygmatosphaeridium*, *Bavlinella*, *Polyedryxium* and other problematical remains.

Key-words — Microbiota, Stromatolite, Vindhyan Supergroup, Pre-Cambrian, India.

सारांश

मध्य प्रदेश में चन्द्रेही के आस-पास स्थित विंध्य महासमूह से कार्बनिक अवसादीय संरचनायें एवं सूक्ष्मजीविता — प्रभात कुमार माइती एवं सुमन्त गुप्ता

प्रस्तुत शोध-पत्र में मध्य प्रदेश में चन्द्रेही खंड के आस-पास स्थित विंध्य महासमूह से उपलब्ध सूक्ष्मजीविताओं एवं स्ट्रोमेटोलाइटों का अभिलेख है। सूक्ष्मजीवितायें सेमरी, रीवा एवं भन्डर समूहों से अभिलिखित की गई हैं। इसमें जीवाणु — बायोकेटिनायडिस; शैवाल — ह्यूरोनिस्पोरा, स्फैरोफाइकस, ऐंफेनोकेप्सिआप्सिस, कोरिम्बोकोक्कस; ऐंक्रोटार्क — ओरिग्मेटोस्फैयरीडियम्, बावलिनैल्ला, पोलिएड्रिक्सियम् तथा अन्य समस्यात्मक अवशेष सम्मिलित हैं।

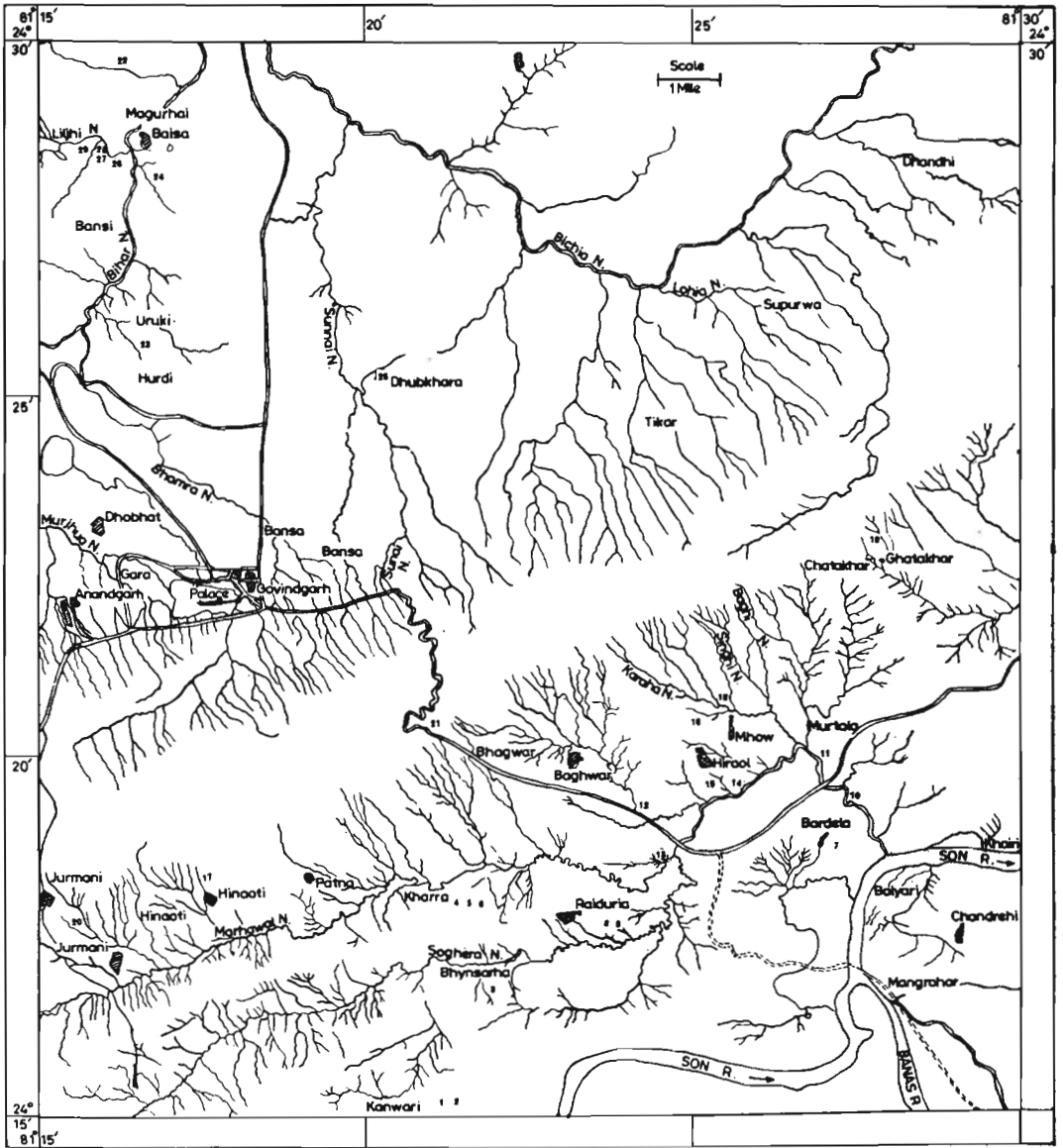
INTRODUCTION

BIOTA and organosedimentary structures from the Vindhyan Supergroup are known long back. The important contributions on microbiota are of Sitholey, Srivastava and Varma (1953), Salujha, Rehman and Rawat (1971), Salujha, Rehman and Arora (1971) and Maithy and

Shukla (1977). Records of stromatolites have recently been summarized by Kumar (1980).

The present paper deals with the stromatolites, bacteria, algae, acritarch and other problematical forms along the Chandrehi Section in Madhya Pradesh. In 1981, Maithy and Gupta recorded archaeocyatha along Chandrehi Section.

*Collaborative study of microbiota from Vindhyan Supergroup with Geological Survey of India, Madhya Pradesh Circle I.



MAP 1 — Locality map showing sampling areas.

The geological succession of Vindhyan Supergroup along Chandrehi is as follows:

	Bhander Group	Nagod Limestone Formation Simrawal Shale Formation
UPPER VINDHYAN	Rewa Group	Govindgarh Sandstone Formation Kokah Shale Formation
	Kaimur Group	Kaimur Sandstone Formation
LOWER VINDHYAN	Semri Group	Baghwar Shale Formation Hinoti Limestone Formation Rampur Shale Formation Chorhat Sandstone Koldha Shale Formation Deonar Porcellanite Formation Kanwari Shale Formation Deoland Sandstone Formation

----- Unconformity -----

Archean

MATERIAL AND METHODS

In all 65 samples were collected from Semri, Rewa and Bhander groups (Map 1). These were studied in thin sections and

also by maceration method. For maceration of samples all the precautions were taken as detailed by Pflug and Maithy (1978). Only those samples which have yielded identifiable biota are detailed here:

NO.	SAMPLE NO.	LOCALITY	GROUP; FORMATION; MEMBER	DESCRIPTION OF SPECIMEN
1.	219/SG/76-77	Close to Kanwari (24°15'81°20')	Semri Group; Kanwari Shale Formation	Greenish grey and dirty white cal- careous shale
2.	289/TKR/76-77	1.6 km N 44 W of Kanwari	Semri Group; Deonar Porcellanite Formation	Ash grey, and dirty white por- cellanite
3.	208/SG/76-77	0.8 km South of Bhynsarha	Semri Group; Deonar Porcellanite Formation	Greenish, olive green porcella- nite
4.	335/TKR/76-77	2.0 km S 88 W of Kharra	Semri Group; Koldha Shale Formation, Bal- yari Limestone Member	Light grey, cherty stromatolitic limestone
5.	337/TKR/76-77	1.8 km W of Kharra	Semri Group; Koldha Shale Formation; Kharra Shale Member	Light ash grey and khaki green splinty shale
6.	338/TKR/76-77	1.7 km N 86 W of Kharra	Semri Group; Koldha Shale Formation; Kharra Shale Member	Dark green and khaki green silt- stone with fine grained sand- stone interbeds

— *Contd.*

No.	SAMPLE NO.	LOCALITY	GROUP; FORMATION; MEMBER	DESCRIPTION OF SPECIMEN
7.	349/TKR/76-77	0.9 km S 21 W of Bardela	Semri Group; Koldha Shale Formation; Kharra Shale Member	Khaki greenish grey splintary shale
8.	138/SG/76-77	2.0 km N 76 E of Raiduria	Semri Group; Chorhat Sandstone Formation; Raiduria Sandstone Member	Khaki flaggy shale
9.	135/SG/76-77	1.2 km N 74 E of Raiduria	Semri Group; Chorhat Sandstone Formation; Raiduria Sandstone Member	Khaki siltstone
10.	275/SG/76-77	2.2 km S 33 E of Murtala	Semri Group; Rampur Shale Formation; Palaia Limestone Member	Light grey fine grained lime- stone
11.	269/SG/76-77	0.9 km South of Murtala	Semri Group; Rampur Shale Formation; Seraj- pur Shale Member	Black porcellanic shale
12.	133/SG/76-77	3.45 km S 43 E of Baghwar	Semri Group; Rampur Shale Formation; Seraj- pur Shale Member	Black porcellanic shale
13.	416/TKR/76-77	0.4 N 8 E of Sel- kasa	Semri Group; Rampur Shale Formation; Palaia Limestone Member	Dark grey lime- stone with inter- bedded dirty yellow agrilla- ceous limestone
14.	386/TKR/76-77	0.8 km S 8 W Hiraol	Semri Group; Hinoti Limestone Formation	Dark grey, fine grained limestone
15.	385/TKR/76-77	0.6 km S 8 W of Hiraol	Semri Group; Hinoti Limestone	Rose-pink, argil- laceous limestone
16.	391/TKR/76-77	1.4 km N 46 W of Mhow	Semri Group; Hinoti Limestone Formation	Dirty white, light grey fine grained limestone
17.	170/SG/76-77	1.15 km N 35 E of Hinaoti	Semri Group; Hinoti Limestone Formation	Light grey and ash coloured lime- stone
18.	277/SG/76-77	1.4 km N 51 W of Mhow	Semri Group; Hinoti Limestone Formation	Dirty white lime- stone

— Contd.

NO.	SAMPLE NO.	LOCALITY	GROUP; FORMATION; MEMBER	DESCRIPTION OF SPECIMEN
19.	282/SG/76-77	1.8 km N 32 W of Ghotakahar	Semri Group; Baghwar Shale Formation, Daorahra Porcellanite Member	Thinly laminated dirty white and grey porcellanite
20.	185/SG/76-77	2.0 km N 62 E of Jurmani	Semri Group; Baghwar Shale Formation; Daorahra Porcellanite Member	Black thinly laminated and flabby porcellanite shale
21.	450/TKR/76-77	2.2 km S 25 W of Gaddi	Rewa Group; Kokah Shale Formation	Purple, thinly laminated shale
22.	306/SG/76-77	0.9 km S 37 W of Khujhua	Bhander Group; Simrawal Shale Formation	Purple and green calcareous shale
23.	18/TKR/76-77	0.8 km N 75 W of Hurdi	Bhander Group; Simrawal Shale Formation	Greenish calcareous siltstone
24.	22/TKR/76-77	0.8 km S 64 W of Baisa	Bhander Group; Nagod Limestone Formation	Argillaceous limestone
25.	10/SG/76-77	0.4 km N 60 W of Dhubkhara	Bhander Group; Nagod Limestone Formation	Chert band
26.	11/SG/76-77	1.0 km West of Baisa in Liljhi Nala	Bhander Group; Nagod Limestone Formation	Chert band
27.	9/TKR/76-77	1.1 km S 55 E of Kulwaru	Bhander Group; Nagod Limestone Formation	Dark grey limestone
28.	9/SG/76-77	1.8 km S 50 W of Jitouhi	Bhander Group; Nagod Limestone Formation	Black chert in light grey limestone
29.	23/TKR/76-77	1.6 km West of Baisa	Bhander Group; Nagod Limestone Formation	Ash grey argillaceous limestone

DESCRIPTION

BACTERIA

Biocatenoides Schopf, 1968

Biocatenoides sphaerula Schopf, 1968

Pl. 1, fig. 1

Description — Uniseriate, unbranched chains of rod-shaped coccoid cells, less than

1 μm broad (commonly less than 0.5 μm broad), chains up to 200 μm long, straight or recurved.

Occurrence — Nagod Limestone, Bhander Group.

Previous Records — *B. sphaerula* Schopf (1968) has earlier been recorded from the Bitter Spring Formation of Australia (900 m.y.) and by Hofmann (1976) from Belcher Island (1800 m.y.).

ALGAE

Huronispora Barghoorn, 1965

Huronispora microreticulata Barghoorn, 1965

Pl. 1, figs 2, 3

Description — Cells circular to spherical in outline, measuring 7-12 μm ; exine with microreticulate structure, muri raised and thick.

Occurrence — Kanwari Shale Formation, Semri Group and Chorhat Sandstone Formation, Semri Group.

Previous Records — *H. microreticulata* Barghoorn (1965) has earlier been recorded from the Gunflint Iron Formation, Ontario (1400 m.y.) and Amelia Dolomite, Australia (1500 m.y.).

Huronispora psilata Barghoorn, 1965

Pl. 1, fig. 4

Description — Cells circular, solitary, 2-10 μm in size, exine smooth, enveloping sheath absent.

Occurrence — Kanwari Shale Formation, Semri Group; Koldha Formation, Semri Group; Rampur Shale Formation, Semri Group; Hinoti Limestone Formation, Semri Group; and Kokah Shale Formation, Rewa Group.

Previous Records — *Huronispora psilata* Barghoorn (1965) has earlier been recorded from the Gunflint Iron Formation (1400 m.y.) and Amelia Dolomite (Muir, 1967, 1500 m.y.).

Sphaerophycus Schopf, 1968

Sphaerophycus parvum Schopf, 1968

Pl. 1, figs 5, 6

Description — Cells spherical to somewhat ellipsoidal, commonly solitary or in pairs, less frequently arranged in loosely associated irregular groups of few to many cells or in uniseriate aggregates, few cells long, cell size 4-6 μm ; individual cell encompassed by a sheath.

Occurrence — Baghwar Shale Formation, Semri Group and Nagod Limestone Formation.

Aphanocapsiopsis Maithy & Shukla, 1977

Aphanocapsiopsis sitholeyi Maithy & Shukla, 1977

Pl. 1, fig. 7

Description — Cells spherical, 5-15 μm , arranged in the form of a loose flat colony, composed of 20 to 40 cells, surface texture smooth.

Occurrence — Baghwar Shale Formation, Semri Group.

Previous Records — *Aphanocapsiopsis sitholeyi* Maithy & Shukla (1977) has earlier been reported from the Suket Shale Formation, Semri Group, Ramapura.

Corymbococcus Awramik & Barghoorn, 1977

Corymbococcus sp.

Pl. 1, fig. 8

Description — Spheroidal cells aggregated in colonies, entire colony encompassed in thick, \pm circular unlamellated sheath, cells 2-10 μm in size with smooth exine.

Remarks — Due to paucity of specimens a detailed comparison is not possible with the known species. Hence, they are referred to *Corymbococcus* sp.

Occurrence — Koldha Formation, Semri Group; Chorhat Sandstone Formation, Semri Group; Hinoti Formation, Semri Group; and Simrawal Shale Formation, Bhandar Group.

ACRITARCHA

Genus — *Orygmato-sphaeridium* Timofeev, 1959

Orygmato-sphaeridium plicatum Maithy & Shukla, 1977

Pl. 1, fig. 9

Description — Vesicle spherical with irregular folds on margin, measuring 60-120 μm , exine thin, surface pitted, pits small and closely arranged.

Occurrence — Koldha Shale Formation, Semri Group and Simrawal Shale Formation, Bhandar Group.

Previous Records — *Orygmatosphaeridium plicatum* Maithy & Shukla (1977) has earlier been recorded from the Suket Shale Formation, Semri Group, Ramapura (Maithy & Shukla, 1977) and Penganga Formation, Ghughus (Maithy, 1981).

Bavlinella Schepelewa, 1962

Bavlinella nagodensis sp. nov.

Pl. 1, figs 10, 11

Diagnosis — Vesicles circular, measuring 15-40 μm , surface covered with closely spaced grana, a small area on one side free and psilate.

Holotype — Slide no. 6592; Pl. 1, fig. 11.

Locality — 1.0 km West of Baisa in Lilhi Nala.

Horizon — Nagod Limestone Formation, Bhandar Group.

Comparison — *Bavlinella faveolata* Schepelewa (1962) differs due to more pronounced grana on the surface. *B. irishi* Sah, Maithy & Bhargava (1977) has sparsely arranged grana.

Polyedryxium Rudavskaja, 1973

Polyedryxium neftelenicum Rudavskaja, 1973

Pl. 1, figs 12, 13

Description — Cells spherical or globular in outline, surface smooth to granulate; cells enclosed in their hyaline structure, circular to octahedral in outline; occasionally a circular pore present; arranged solitary or in irregular groups.

Occurrence — Deonar Porcellanite Formation, Semri Group; Koldha Formation, Semri Group; and Rampur Shale Formation, Semri Group.

Previous Records — *P. neftelenicum* Rudavskaja (1973) was earlier reported from Riphean-Cambrian boundary deposits in South of East Siberia.

INCERTAE SEDIS

Exochobrachium Awramik & Barghoorn, 1977

Exochobrachium sp.

Pl. 1, fig. 14

Microbiota triangular in outline, 20 μm , with three arms radiating from central body in a triradiate fashion swollen at ends, each with a small sphere 5 μm in diameter, subcentral within each swollen ends, surface smooth. As there are only a few specimens in the collection, therefore, a detailed comparison is not possible with the known species. The only known species *E. triangulatum* Awramik & Barghoorn (1977) was recorded from the Gunflint microbiota.

Occurrence — Nagod Limestone Formation, Bhandar Group.

STROMATOLITES

Stromatolite occurs only in Koldaha Shale Formation, Semri Group. The stromatolite belongs to *Conophyton* (Pl. 1, fig. 15). It is light grey in colour, cherty and was buried in the same colour of limestones. From top they show distinctly closely spaced concentric rings. In longitudinal section, it shows cone-like structure with fine straight laminations. Microbiota record is poor. Two types of microbiota have been recorded. The smooth spherical structure is comparable to *Orygmatosphaeridium plicatum* Maithy & Shukla (1977) and the other spherical cells with several small surface thickenings (Pl. 1, fig. 10) is comparable to *Granomarginata* Shepelewa.

DISCUSSION

The Vindhyan succession around Chandreh comprises the following biota:

1. Bacteria — *Biocatenoides*
2. Algae — *Huronispora*, *Sphaerophycus*, *Aphanocapsiopsis*, *Corymbococcus*.
3. Acritarcha — *Orygmatosphaeridium*, *Bavlinella*, *Polyedryxium* and organo-sedimentary structures.
4. Stromatolite — *Conophyton* with biota comparable to *Orygmatosphaeridium* and *Granomarginata*.

The distribution of biota (see Table 1) shows that the Semri Supergroup is dominated by algae and acritarcha, *Polyedryxium*. The Rewa Supergroup is too poor in microbiota having only *Huronispora*. In Bhandar Supergroup the acritarcha and bacteria are quite frequent. The algal records in Upper Vindhyan are poor in comparison to Semris. Microbiota from the Vindhyan Supergroup has earlier been described by Salujha, Rehman and Arora (1971) from the Son Valley and Salujha, Rehman and Rawat (1971) from Kota-Karauli area. A detailed comparison is not possible as only acritarch assemblages are known from these areas. Maithy and Shukla (1977) reported a rich assemblage from the Suket Shale Formation of Ramapura. The Chandrehi succession assemblages and Suket Shale assemblage have very few common forms both in algae and acritarch. Moreover, the Chandrehi assemblage cannot be compared in detail as it deals with the entire succession of Vindhyan Supergroup, whereas the assemblage of Maithy and Shukla (1977) is only from the Suket Formation.

Recently Maithy and Mandal (1983) recorded an interesting microbiota from the Sapotra-Karauli area. The microbiota record in Semri group is poor. The only comparable forms are *Sphaerophycus* and

Orygmatosphaeridium. Moreover, the acritarch are totally absent in the Semris of Sapotra-Karauli area. The Bhanders of this area shows predominance of different algal forms, viz., *Vindhyacapsiopsis*, *Sphaerophycus*, *Gloeocapsomorpha* and *Poleoglaucocystis*. In contrary to this the Bhandar succession around Chandrehi is poor in algal composition. Moreover, the youngest bed shows predominance of acritarch genus *Bavlinella* and the bacteria — *Biocatenoides*.

The age of Vindhyan Supergroup has remained a subject of controversy for a long time. Crawford and Compston (1971) and Vingradov *et al.* (1964) have given the lower limit of Vindhyan to be ± 1400 m.y. on basis of radiometric data. However, no precise data has been given for the upper limits. The evidence available on the basis of microbiota has been applied by Salujha (1973). According to him the Vindhyan ranges up to Silurian. Venkatachala and Rawat (1972) considered it to be Late Precambrian. The present biota recorded around Chandrehi, though poor in microbiota, is suggestive that the upper limit of Vindhyan cannot be younger than the Late Precambrian due to absence of typical acanthomorphitae acritarcha which are well found in Cambrian and younger succession of other countries.

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EXPLANATION OF PLATE

(All photomicrographs are. $\times 2000$ unless mentioned before them. All slides are preserved at B.S.I.P. Museum).

1. *Biocatenoides sphaerula* Schopf, slide no. B.S.I.P. 6590; Nagod Limestone; Bhandar.
- 2, 3. *Huronispora microreticulata* Barghoorn, slide no. B.S.I.P. 6583; Kanwari Shale Formation; Semri.
4. *Huronispora psilata* Barghoorn, slide no. B.S.I.P. 6586; Hinoti Limestone Formation; Semri.
- 5, 6. *Sphaerophycus parvum* Schopf, slide no. B.S.I.P. 6587; Baghar Shale Formation; Semri.
7. *Aphanocapsiopsis sitholeyii* Maithy & Shukla, slide no. B.S.I.P. 6587; Baghar Shale Formation; Semri. $\times 500$.
8. *Corymbococcus* sp., slide no. B.S.I.P. 6585; Rampur Formation; Semri.
- 9, 17. *Orygmatosphaeridium plicatum* Maithy & Shukla, slide nos. B.S.I.P. 6588, Koldha Shale Formation, Semri; and B.S.I.P. 6589, Simrawal Shale Formation, Bhandar. $\times 500$.
- 10, 11. *Bavlinella nagodensis* sp. nov., slide no. B.S.I.P. 6592; Nagod Limestone Formation.
- 12, 13. *Polyedryxium nestelenicum* Rudavskaja, slide no. B.S.I.P. 6584; Deonar Porcellanite; Semri.
14. *Exochobrachium* sp., slide no. B.S.I.P. 6591; Nagod Limestone, Bhandar.
15. *Conophyton* sp.: specimen no. B.S.I.P. 35448; Koldha Shale Formation; Semri. $\times 1/2$.
16. *Granomarginata*, slide no. B.S.I.P. 6588; Koldha Shale Formation; Semri.

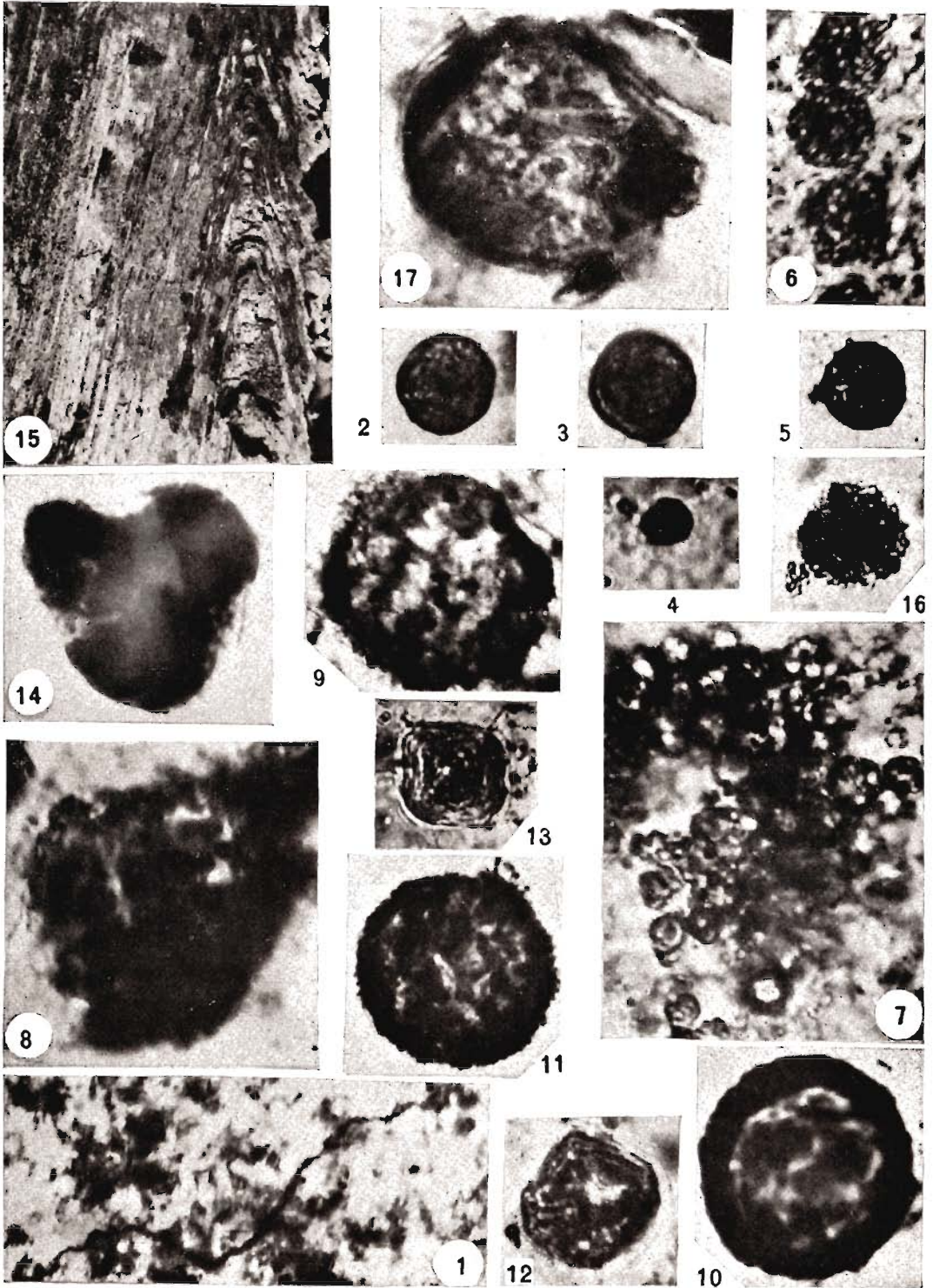


PLATE 1