

ORGANOSEDIMENTARY STRUCTURES AND BIOTA FROM UPPER PROTEROZOIC OF EQUATORIAL AFRICA

P. K. MAITHY

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India

ABSTRACT

Organosedimentary structures and biota from the Upper Proterozoic of Lower Zaire, Kasai, Shaba, North-east Zaire and South-east Burundi are recorded. These structures belong to oncolites, viz., *Ambigolamellatus*, *Asterosphaeroides*, *Polysphaerula*, *Babetosphaera* and *Burundiocyathus* f. nov. and catagraphs — *Conferia* and *Vesicularites*. The stratigraphical significance of the organosedimentary structures in the Upper Proterozoic of Equatorial Africa has also been given.

Key-words — Organosedimentary structures, Oncolites, Catagraphs, Upper Proterozoic, Equatorial Africa.

सारांश

भूमध्यरेखीय अफ्रीका के उपरि प्राजीवी कल्प से कार्बनिक-अवसादीय संरचनायें एवं जीवितायें — प्रभात कुमार माइती

प्रस्तुत शोध-पत्र में अघरि जायर, कसाई, शाबा, उत्तर-पूर्व जायर एवं दक्षिण-पूर्व बुरुंडी के उपरि प्राजीवी कल्प से जीवितायें एवं कार्बनिक-अवसादीय संरचनायें अभिलिखित की गई हैं। ये संरचनायें आंकोलाइटों अर्थात् ऐम्बोगोलामैलेटस, ऐस्टॅरोस्फेयरोइड्स, पोलिसफेयरूला, बाबेटोस्फेयरा एवं बुरुंडीस्यैथस नव जाति तथा कैटाग्राफों — कनफर्टा एवं वैसिकुलाराइटिस — से सम्बन्धित हैं। ह्यूरोनिस्पोरा, ऐफेनोकैप्सिआप्सिस एवं कोरिम्बोकोक्कस अभिनिर्धारित की गई जीवितायें हैं। भूमध्यरेखीय अफ्रीका के उपरि प्राजीवी कल्प में कार्बनिक-अवसादीय संरचनाओं का स्तरिकीय महत्व भी दिया गया है।

INTRODUCTION

CAYEUX (1930, 1931) reported the presence of algal structure from the System "Schisto-Calcaire" of Zaire. Choubert (1931, 1932) reported the presence of algae, viz., *Sycidium panderi* f. *minor* Karpinoy, *Sycidium dubosi* sp. nov. and *Robertia katangae* sp. nov. from the "Calcaire rose Oolithique" and the Kundelungu Superior of Zaire. Hacquaert (1931a, 1931b) also reported the algal remains from the 'Calcaire Rose' and limestone of the Kundelungu System of Katanga with a discussion on their distribution in the Kundelungu System. Later in 1933, he reported the existence of algae in "Oolithe de Kisantu". Hacquaert (1943) reported *Girvanella* from the "Mwaysha Oolite" of Katanga.

Bertrand-Sarfati (1972) reported several forms of stromatolites from the Precambrian

of Zaire. Along with these remains of Catagraphs, viz., *Vesicularites* were also reported. Maithy (1979) recorded Oncolite — *Volvatella*, *Ambigolamellatus*, *Asterosphaeroides* and *Osagia* and Catagraphs — *Vesicularites* from the Upper Proterozoic of Lower Zaire, Shaba and eastern Kasai.

In 1972, Binda described a preliminary account of biota from Katanga. Maithy (1975) recorded microbiota from the Bushimay System of Kanshi, Zaire. The biota has rich assemblage of algae and acritarchs. Edhorn (1978) reported the microbiota from the Mwashya Group from N'Guba, Mulungwishi and Shituru localities of Shaba. The important records are *Cumulosphaera*, *Girvanella* tubes, *Chlamydomonopsis*, spherical coccoid algae and spiralled inner structure of filament.

The present paper deals with the organosedimentary structures and biota previously not known from the Upper Proterozoic of

Bas Zaire, Kasai, Shaba, North and north-east Zaire and South-east Burundi.

MATERIAL

A. BAS ZAIRE — WEST CONGOLIAN SUPERGROUP

All the specimens from Bas Zaire belong to West Congolian Supergroup (see Cahen, 1978). Those specimens, that proved to be positive, some from four of the five groups of this supergroup have been marked with asterisk in the following enumeration from youngest to oldest.

- Inkisi
- *Mpioka
- *Schisto-Calcaire
- *Haut-Shiloango
- *Sansikwa

Mpioka Group

- 16608 — Fine grained grey blue rock with pyrite, Bangu Plateau; river Nkela; coll. M. C. Brades (B. 372).
- 16551 — Blue grey slate, Bangu Plateau, river Bidi; coll. M. C. Brandes (B. 281).

Schisto-Calcaire Group

Lukunga Subgroup (C-II)

- 11615 — Oolitic limestone, Kinganga, point 1133; coll. J. Lepersonne (n°E 2100).

Kwilu Subgroup (C-I)

- 11619 — Limestone ("calcaire a structure en betonnets") lovo, point 1139. coll. J. Lepersonne (n°E 2108).

Haut Shiloanga Group

Sekelolo Subgroup

- 18061 — Black finely laminated argillaceous Sekelolo limestone, Safricans Quarry, near Kimpese, coll. L. Cahen (n° 33/10).

B. EASTERN KASAI — MBUJI MAYI SUPERGROUP

The remains from eastern Kasai are all from the uppermost B-II group of the Mbuji Mayi Supergroup (Raucq, 1957, 1970). Only one specimen from the topmost formation of this group is described here, i.e. from the B-IIe formation,

- 31784 — B-IIe formation, dark grey limestone with discontinuous, lighter laminations; small quarry near Miya, 3 km NE of Lomuele, coll. P. Raucq (n° 194c/15).

C. SHABA — KATANGAN

From Shaba (formerly Katanga) all specimens studied belong to the Katangan. From top to bottom it is subdivided in three supergroups, viz. upper Kundelungu, Lower Kundelungu and Roan (Francois, 1974). Several specimens belong to the "Calcaire oolithique des cimenteries de Lubudi" (oolithic limestone of the Lubudi cement works) which is a distinctive formation of the lower part of the Upper Kundelungu, and one specimen comes from the "Kakontwe Limestone", the lowest formation of the Lower Kundelungu.

Upper Kundelungu

- 7314 — Oolitic limestone of the above horizon, Lukafu region, coll. C.S.K.
- 7339 — d° from NE of Degree Sheet Mokabe Kasari, coll. L. Cahen (n° 1642).
- 74016 — Sedimentary breccia from NE of Degree Sheet Mokabe Kasari, coll. L. Cahen (n° 1639).
- 74017 — d° from Lubudi cement Quarry, as in previous paper (1979).

Lower Kundelungu

- 12884 — Kakontwe limestone, Kakontwe Quarry, coll. M. Sluys (SK 23).

D. NORTH-EAST ZAIRE

The Liddian Supergroup is situated in the north-east of Zaire. From top to bottom it is subdivided into three groups — Aruwimi, Lokomo and Ituri (Verbeek, 1970). Following four specimens are described from the Mamungi Formation of the Bombua Subgroup which belongs to the 'Lokoma Group'.

- 12958 — Grey oolitic limestone, Wanie Rukula, coll. M. Sluys (1496).
- 12959 — Red oolitic limestone, Wanie Rukula, coll. M. Sluys (1497).
- 12960 — Red oolitic limestone, Wanie Rukula, coll. M. Sluys (1498).

41000 — d° bore hole, depth between 9-13.50 m, near Wanie Rukula, coll. CICO n° 6/42.

E. SOUTH BURUNDI — MALAGASIAN SUPERGROUP

The Malagarasian Supergroup of South Burundi corresponds to the Bukoba of Tanzania. It is more or less connected with the Katangan of Shaba. The present state of knowledge is given by Cahen and Snelling (1974). In this Supergroup several superposed groups are known in which the four youngest in Burundi are Kibago, Mosso, Nkoma, and Musindozi. The Kibago and the Mosso groups correspond to Uha Group of Tanzania. Nkoma is only known in Burundi. The Musindozi Group is correlated with the Kingonero Flags of Tanzania. Two specimens from the Bugono silicified Limestone of the Mosso Group and three from the Kusasa Dolomitic Limestone at the top of the Musindozi Group proved productive.

Mosso Group

69119 — Silicified oolith, right bank of Ndekwe River, coll. A. Waleffe (n° 108).

69131 — d° (rolled pebble), Makamba-Songa road, coll. A. Waleffe (127/1).

Musindozi Group

69365 — Finely laminated dark grey argillaceous limestone, Bukamba Hill, coll. A. Waleffe (n° 103/2).

69371 — Fine grained dark grey limestone, coll. A. Waleffe (n° 103/8).

The material was studied in thin sections of 30 μm thickness. All the figured slides are preserved at the Museum of Musée Royal de la Afrique, Tervuren, Belgium.

DESCRIPTION

ONCOLITES

Ambigolamellatus Zhuravleva, 1968

Ambigolamellatus horridus Zhuravleva, 1968

Pl. 1, fig. 1; Text-fig. 1B

Description — Tumour circular or circular-oval in outline measuring 1-3.5 mm common

3-2.5 mm, distinct lamellate zones present around central nucleus, commonly 5-10 lamellate zones present.

Comparison — *Ambigolamellatus horridus* Zhuravleva (1968) is morphologically similar with the present specimens. This species has also been reported earlier by Maithy (1979) from Shaba.

Asterosphaeroides Zhuravleva, 1968

Asterosphaeroides serratus Zhuravleva, 1968

Pl. 1, fig. 1; Text-fig. 1E

Description — Tumour circular in outline, measuring 0.5-1 mm (common 0.5 mm), several radial thickenings radiating from the central point to margin, thickenings narrow near centre and broader towards margin.

Comparison — *Asterosphaeroides serratus* Zhuravleva (1968) agrees morphologically with this form.

Babetosphaera Boureau & Monod, 1958

Babetosphaera africana Boureau & Monod, 1958

Pl. 1, fig. 2; Text-fig. 1C

Description — Tumour circular in outline, measuring 300-500 μm ; entire area with polygonal, reticulate thickenings; central region occasionally distorted by iron pyrites.

Comparison — The form compares with *Babetosphaera africana* reported by Boureau (1975) from Mauritinae, Africa.

Polysphaerula Boureau, 1975

Polysphaerula globosa Boureau, 1975

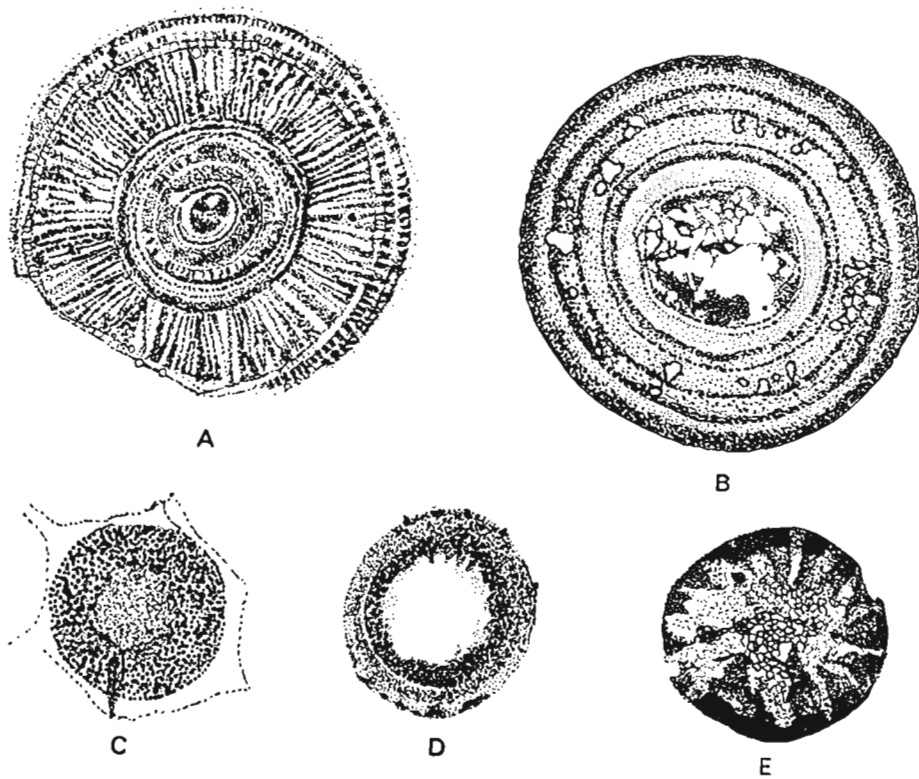
Pl. 1, fig. 3; Text-fig. 1D

Description — Tumour circular, 1-2 mm, central zone circular surrounded by a wide outer zone; outer margin with irregular thickenings.

Comparison — The present form compares with *Polysphaerula globosa* Boureau (1975) from Mauritinae, Africa.

Burundia f. nov.

Generic Diagnosis — Tumour circular, distinctly demarcated into two zones; central zone with consecutive circular concentric



TEXT-FIG. 1 — A, *Ambigolamellatus horridus*, $\times 10$; B, *Asterosphaeroides serratus*, $\times 10$; C, *Babetosphaera africana*, $\times 100$; D, *Polysphaerula globosa*, $\times 20$; and E, *Burundia malagarsianse*, $\times 20$.

thickenings, outer zone with several transverse thickenings.

Genotype — *B. malagarsianse* sp. nov.

Comparison — The present form differs from the known oncolites in having two distinct zones with different type of thickenings. In *Osagia*, only circular concentric thickening are present all over the tumour; the transverse thickenings are absent.

Etymology — The generic name has been derived after the country 'Burundi'.

Burundia malagarsianse sp. nov.

Pl. 1, fig. 4; Text-fig. 1A

Diagnosis — Tumour \pm circular in configuration in cut sections; central zone with concentric ring-like structure, divisible into two distinct areas, in the inner area the concentric rings are more compactly arranged than in the outer area; outer zone with simple, branched, closely arranged radial thickening.

Holotype — Specimen no. 69119, Musée Royal de la Afrique Centrale, Tervuren, Belgium.

Horizon — Mosso Group, Bugongo Silicified Limestone.

CATAGRAPHS

Vesicularites Retlinger, 1959

Vesicularites renatus sp. nov.

Pl. 1, fig. 5

Diagnosis — Several small \pm circular or circular-oval structures, grouped in kidney-shaped areas; each structure surrounded by narrow margin composed of small rectangular areas.

Holotype — 12884, Musée Royal de la Afrique Centrale, Tervuren, Belgium.

Horizon — Kakontwe Limestone.

Comparison — *Vesicularites renatus* sp. nov. differs from *V. flexuosus* Retlinger

(1959), *V. parvus* Zabrodin (1968), *V. ovatus* Zhuravleva (1968) and *V. textus* Klinger (1968), in its characteristic kidney-shape.

***Conferta* Klinger, 1968**

Conferta rara Klinger, 1968

Pl. 1, fig. 6

Description — Vertical canal-like structures formed due to biological activities. The canals are variously shaped. Occasionally they are branched irregularly.

Comparison — Similar sedimentary gaps formed by the activities of biological organisms were earlier recorded by Klinger (1968) from the Precambrian of Karakhatan, Siberia.

MICROBIOTA

***Aphanocapsiopsis* Maithy & Shukla, 1977**

Aphanocapsiopsis musindoziense sp. nov.

Pl. 1, fig. 7

Diagnosis — Cells circular, loosely arranged in an irregular elongate colony of 8-20 cells, measuring 8-12 μm ; cells with thickenings on the margin, encompassing sheath absent.

Holotype — Specimen no. 69365, Musée Royal de la Afrique Centrale, Tervuren, Belgium.

Locality & Horizon — Bukamba Hill; Musindozi Group, Malagarasian Super-group.

Comparison — *Aphanocapsiopsis sitholeyi* Maithy & Shukla (1977) differs from *A. musindoziense* sp. nov. in the absence of wall thickenings. A similar form has also been figured by Binda (1972, fig. 3) from the Lower Roan of Zambia.

***Corymbococcus* Awarmik & Barghoorn, 1977**

Corymbococcus minutus sp. nov.

Pl. 1, fig. 8

Diagnosis — Small spheroidal cells, 0.5-2 μm , arranged in irregular chains, smooth surface, all cells enclosed in a large thick amorphous sheath.

Holotype — Specimen no. 69371, Musée Royal de la Afrique Centrale, Tervuren, Belgium.

Locality & Horizon — Bukamba Hill; Musindozi Group.

Comparison — *Corymbococcus hodgkissi* Awarmik & Barghoorn (1977) differs due to large size cells and ornamented surface.

***Huronispora* Barghoorn, 1965**

Huronispora psilata Barghoorn, 1965

Pl. 1, fig. 9

Description — Spherical cells, psilate or sculptured. They are solitary or rarely arranged in groups. The size range varies from 10 to 20 μm .

Comparison — *Huronispora psilata* recorded from the Gunflint Iron Formation by Barghoorn (1965) and from Amelia Dolomite by Muir (1967) compares well with the African form.

CONCLUDING REMARKS

Oncolites are small spheroidal, concentrically laminated calcareous sedimentary structures resembling an oolith and formed by the accretion of successive layered masses of gelatinous sheaths of blue green algae and bacteria. They are smaller than stromatolites and generally do not exceed 10 cm in diameter. It is possible that oncolites, though looking alike in morphology, may have been deposited by different forms of bacteria and cyanophytes. Therefore they should be used with utmost caution for stratigraphic zonation. They may work very well in stratigraphic correlation within one basin for instance in the Siberian platform (Klinger, 1968; Zabrodin, 1968; Zhuravleva, 1968). Earlier an attempt was made by Maithy (1979) to use these sedimentary structures for stratigraphic zonation. In the present paper this is elaborated further (see Table 1). It appears that oncolites with simple organization (*Osagia*) occur in rocks older than 950 m.y. whereas the oncolites with complex organization (*Ambigolamellatus*, *Asterosphaeroides* & *Polysphaerula*) occur in younger sequence of equatorial Africa.

Catagraph is a complex structure made up of traces of canals and cavities formed due to the activity of Cyanophytes and bacteria in the Late Precambrian and the Lower Cambrian. The role of catagraphs in stratigraphy is well established in the Russian platform. Their significance in the African succession is still not known and their

TABLE 1 — DISTRIBUTION OF UPPER PROTEROZOIC BIOTA AND ORGANOSEDIMENTARY STRUCTURES FROM EQUATORIAL AFRICA

(1) Ma	BAS ZAIRE WEST CONGO SUPERGROUP	KASAI & W. SHABA MBUJI MAJI SUPERGROUP	SHABA KATANGAN	N & NE ZAIRE LINDIAN SUPERGROUP	S. BURUNDI MALAGARASIAN SUPERGROUP
600	Inkisi Gp.		Upper III	Aru Banalia arkoses	Kibago Gp.
C. 715	Mpioka Gp.		Kunde II	Wimi Aलो Shales Galamboge quartzites	Mosso Gp. <i>Burundia malagarsianense</i> <i>Babetosphaera africana</i>
	<i>Huronispora psilata</i>				
C. 800	Schisto-calcaire Gp. CIV CIII Bangu Subgp. <i>Volvatella vadosa</i>		lungu I lubudi cement works limestone	Lokoma Gp. Wanie Rukula limestone	Nkoma Gp.
	<i>Volvatella marginatus</i> <i>Ambigolamellatus ovatus</i> <i>Ambigolamellatus zonatus</i> <i>Asterosphaeroides asymmetricus</i> <i>Vesicularites parvus</i> CII Lukunga Subgp. <i>Ambigolamellatus horridus</i> <i>Vesicularites</i> aff. <i>parvus</i> <i>Vesicularites bothridioformis</i> <i>Vermiculites</i> cf. <i>tortuosus</i> CI Kwilu Subgp. <i>Polysphaerula globosa</i>		<i>Ambigolamellatus horridus</i> <i>Asterosphaeroides serratus</i>	<i>Ambigolamellatus horridus</i> <i>Asterosphaeroides serratus</i>	
	Haut Shiloango Gp. Sekelolo Limestone <i>Huronispora psilata</i>		Lower Kunde-lungu Gp. Kakontwe Limestone <i>Vesicularites renatus</i>		
C. 950	Sansikwa Gp.	Mbuji Maji Supergroup BIle <i>Conferta rara</i> BIId <i>Osagia tenuilamellata</i>	Roan	Mwashya Ituri Gp.	Musindozi Gp. <i>Aphanocapsiopsis musindoziense</i> <i>Corymbococcus minutus</i>
	<i>Osagia</i> sp.	BIIf Rich microbiota algae acritarchs & others		Upper Roan Lower Roan	Kavumwe Gp.
		BI			
C. 1100					

(1) The geochronological framework of this table is schematic and adopted from L. Cahen in final Report IGCP PROJECT-99

importance will only be assessed when they are recorded from other localities.

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EXPLANATION OF PLATE

1. *Ambigolamellatus horridus* and *Asterosphaeroides serratus*; specimen no. 74016. × 4.
2. *Babetosphaera africana*; specimen no. 69131. × 100
3. *Polysphaerula globosa*; specimen no. 11615. × 20.
4. *Burundia malagarsianense* gen. et sp. nov., specimen no. 69119. × 20.
5. *Vesicularites renatus*; specimen no. 74016. × 4.
6. *Conferta rara*; specimen no. 31784. × 20.
7. *Aphanocapsiopsis musindziense* sp. nov., specimen no. 69365. × 2000.
8. *Corymbococcus minutus* sp. nov., specimen no. 69371. × 500.
9. *Huronispora psilata*; specimen no. 18061. × 2000.

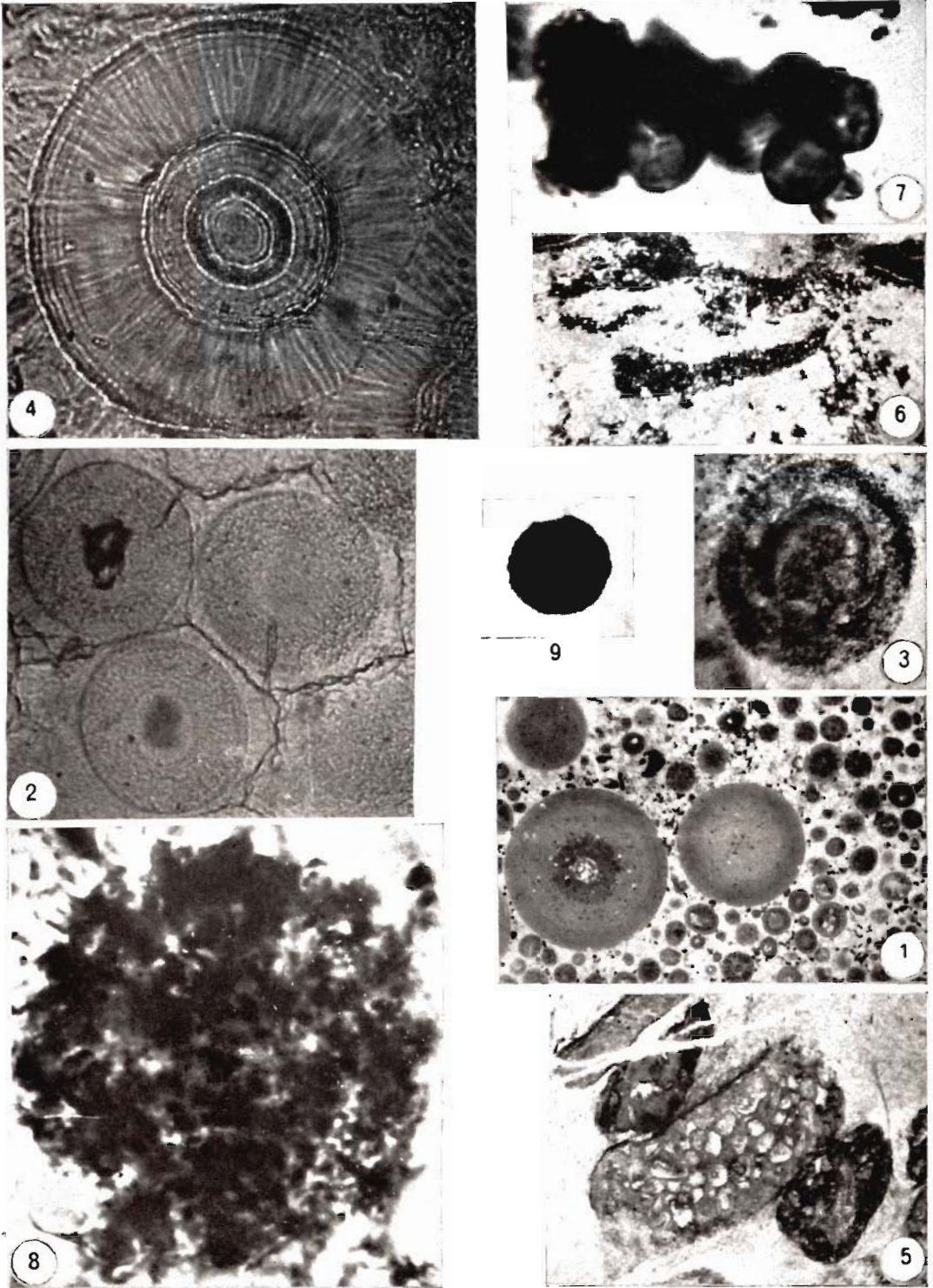


PLATE I