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Microfossils from the Palri Shale Formation (Lower Vindhyan) of Chittaurgarh, Rajasthan, India

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ABSTRACT

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Microfossils are described from finely laminated, yellowish-light greyish, siliceous and micaceous shales of the Palri Shale Formation (Semri Group) exposed in and around Chittaurgarh, Rajasthan. These microfossils are dark black, poorly preserved, highly compressed, 1 μm thick and 5-100 μm in diameter and commonly exhibit tears and folds. Pseudomicrofossils are also observed, which are golden brown, 6-8 μm in diameter and 0.2-0.3 μm thick and consist of authigenic apatite crystals. These occur either isolated or in clusters and look alike to true microfossils. However, these can be easily deciphered by phase interference light under high-power microscope.

Key-words: Organic-walled microfossils, pseudomicrofossils, Palri Shale Formation, Lower Vindhyan, Chittaurgarh, Rajasthan, India.

INTRODUCTION

The Palri Shale Formation comprises porcellanite (15 m) in its lower part which is overlain by shale (70-75 m). The shale, from which the samples for the present study were collected, is yellowish-grey in colour with lenticular intercalations of flaggy fine sandstone at some places. It is generally soft, thinly bedded and closely jointed. Dark carbonaceous shales are also reported in this area from few wells dug for drinking water. Prasad (1975) published detailed geological information on Lower Vindhyan of Rajasthan. Raja Rao and Mahajan (1965) recorded signatures of biogenic activities (stromatolites) in Bhagwanpura Limestone (= Kajrahat Limestone of Son Valley). Later, geological work on Upper Vindhyan sequences, covering some northern parts of this basin, has been carried out by Banerjee and Sinha (1981) and Prasad (1984). The Lower Vindhyan stratigraphic succession in Chittaurgarh, Rajasthan is given in Table 1.

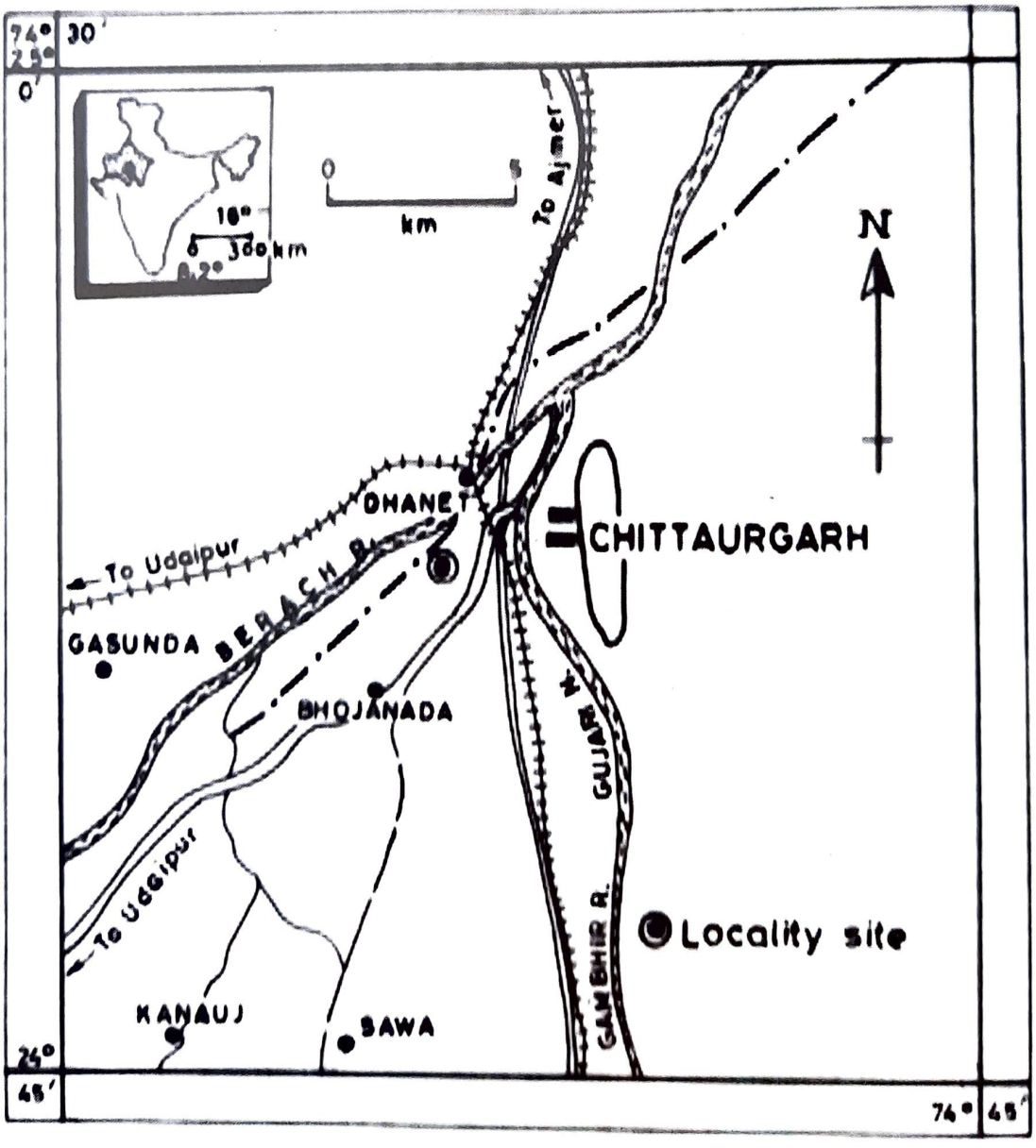
The objective of the present paper is to describe organic-walled microfossils and to record presence of pseudomicrofossils (looking similar to biologic forms) from the shales of Palri Shale Formation (Semri Group), exposed near Chittaurgarh, Rajasthan. Effect of diagenesis and burial metamorphism on highly altered shale facies microbiota is also discussed.

MATERIAL AND METHODS

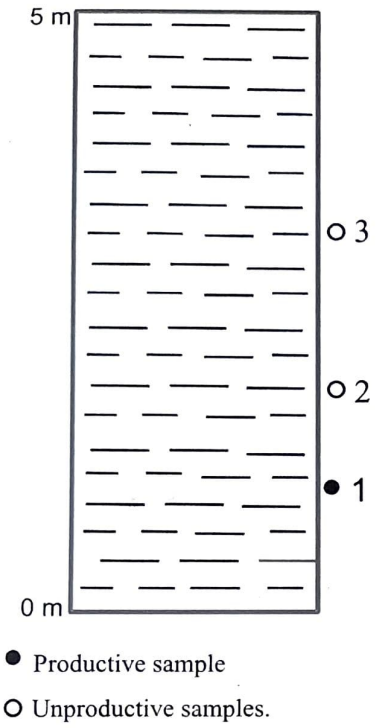
For the present investigation, three samples were collected from yellowish-grey shale of the Palri Shale Formation exposed near Berach River Bridge, 1.5 km south-west of Chittaurgarh Railway Station, Rajasthan (Text-figures 1-2). Of these, one sample yielded microfossils. Petrographic thin sections (~200 μm thick) were prepared both along and perpendicular to the bedding plane for studying microfossils. The observations were made under Lietz Dialux high power microscope under 40x and 100x (oil immersion) objectives through transmitted optical light. The photomicrographs were taken with attached auto camera. Samples,

Table 1. Generalised geological sequence of the Lower Vindhyans (after Prasad 1984)

Group	Thickness	Formation
Khorip	475 m	Suket Shale
		Nimbahera Limestone
		Bari Shale
		Jiran Sandstone
Lasrawan	272 m	Binota Shale
		Kalmia Sandstone
Sand	210 m	Palri Shale
		Sawa Sandstone
Satola	835 m	Bhagwanpura Limestone
		Khardeola Sandstone
		Khairmalia Andesite
----------Unconformity----------		
Pre-Aravalli?		



Text-figure 1. Map showing locality of sample collection.



Text-figure 2. Stratigraphic section near Berach River Bridge, 1.5 km south-west of Chittaurgarh Railway Station in Rajasthan, from where samples for the present study were collected.

slides and negatives of microfossils have been deposited at the museum of the Birbal Sahni Institute of Palaeobotany, Lucknow, India.

DESCRIPTION

Microfossils in petrographic thin sections are poorly preserved. They are dark brown to nearly black. In thin sections cut parallel to lamination, they have circular to elliptical outline and measure 10-55 µm. In their gross morphology, they compare with acritarchs. Most envelopes exhibit small tears (Plate 1, figure 13). Some forms are folded (Plate 1, figures 5, 7, 12) and some are fragmented into 3-5 segments (Plate 1, figures 4, 8, 10).

Genus: *Protosphaeridium* Timofeev 1966

Protosphaeridium volkovae Maithy & Shukla 1977

Plate 1, figures 4-5, 7-8, 11

Description: Vesicles spheroidal, dark black to grey, measuring 20-40 µm, surface smooth, with irregular folds. Folds either near margin (Plate 1, figure 4) or on the entire vesicle crossing one another (Plate 1, figure 5). In some cases, prominent folds observed in centre with feeble marginal folds (Plate 1, figure 7). Few dark grains show distinct polygonal cracks (Plate 1, figure 8). Occasionally, some grains are preserved with irregular outline (Plate 1, figure 11).

Genus: *Orygmatosphaeridium* Timofeev 1959

Orygmatosphaeridium plicatum Maithy & Shukla 1977

Plate 1, figures 6, 10, 12-13

Description: Vesicles spheroidal, dark black to grey in colour, measuring 60-140 µm, surface pitted, pits small and closely arranged; surface with prominent folds, showing various patterns of arrangement, fold alignments effect vesicle's shape. Exine in the darker grains ruptured into polygonal areas measuring 5-10 µm (Plate 1, figure 10). Gaps between ruptured areas variable. Occasionally, some areas of vesicle not preserved, owing to bacterial damage before their burial. Some grains (Plate 1, figure 6) appear to be buried in sediments after total collapse due to desiccation of water.

Scolecodont

Plate 1, figure 9

Description: Triangular dark black specimen, measuring 40-50 µm; surface smooth, corners rounded, margin serrated.

Remarks: The fossil might be mouth part of any micro-invertebrate (insect/annelids). Body part, containing cellulose and protein, get usually decayed by biotic (specialized bacteria) and fragmented by abiotic (high thermal) activities.

Pseudomicrofossils

Plate 1, figures 1-3

Pseudomicrofossils have two main arrangements, i.e. solitary spheroids and spheroids in groups. Solitary one (Plate 1, figure 1) is spheroidal with a central body measuring 16 µm. It can be compared with *Sphaerophycus* Schopf (1968). The grouped one comprises number of individuals

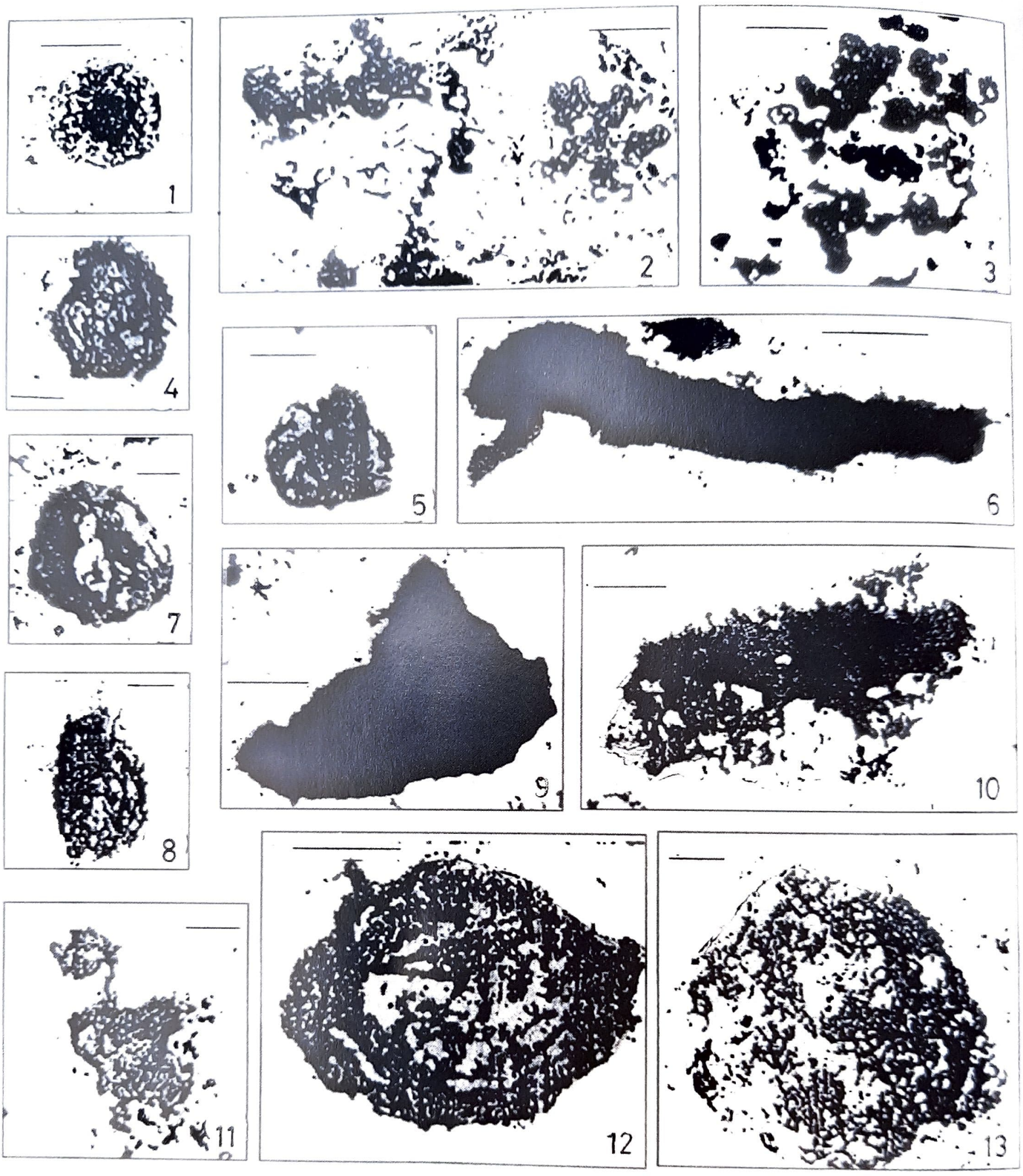


Plate 1

Bar = 10μm

1-3. Pseudomicrofossils. 1. Solitary crystal with dark inclusion, slide no. BSIP 9876, Q44. 2-3. Crystals arranged in clusters, crystal with dark inclusion, slide no. BSIP 9876; Figure 2: Q39/4, Figure 3: Q51/2.

4-8. *Protosphaeridium volkovae* Maithy & Shukla. 4. Vesicle with marginal and body folds, slide no. BSIP 9877, Q35. 5. Vesicle with pronounced median body folds resulting sagging of margin, slide no. BSIP 9876, Q28/3. 6. Vesicle with distorted Wall due to bacterial activity before burial, slide no. BSIP 9876, Q44/2. 7. Vesicle with polygonal areas formed due to desiccation before burial, slide no. BSIP 9877, R 49/4. 8. Vesicle with irregular and folded margin. This is due to plasmolysis of specimen before being entombed to sediments for burial, slide no. BSIP 9876, Q44/3.

9-12. *Orygmatosphaeridium plicatum* Maithy & Shukla. 9. Vesicle oval in out line with polygonal areas formed due to desiccation, slide no. BSIP 9876, Q46. 10. Shrunken vesicle due to plasmolysis before burial, slide no. BSIP 9876, Q26. 11. Vesicle showing granulate surface and spaces due to distortion before fossilization, slide no. BSIP 9876, Q25. 12. Well preserved vesicle with prominent margin folds, slide no. BSIP 9876, Q45/3

13. Scolecodont, slide no. BSIP 9876, Q44/3

in clusters (Plate 1, figures 2-3) measuring 3-5 μm. Individuals are closely adpressed forming colonies. It compares with *Coleogleba* Strother et al. (1983) or *Corymbococcous* Awramik & Barghoorn (1977). The forms are golden brown in colour. These pseudomicrofossils are petrographically identified as anhedral crystals of Apatite.

DISCUSSION

The Palri Shale Formation of Chittaurgarh shows presence of authentic microfossils along with pseudomicrofossils. The microfossils are strongly compressed parallel to lamination and appear to represent flattened and highly altered sphaeromorphs. The folding, tearing and fragmentation has resulted due to evaporation of water from the vesicles before their burial. Their further distortion might have been during the course of metamorphism of sediments. Contrary to this, pseudomicrofossils and crystals with dark inclusion do not show any surface distortion. They can be easily deciphered under phase interference as they show bright luminescence. The Palri Shale Formation in Chittaurgarh is significant because it illustrates the effects of burial metamorphism on authentic microfossils.

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