

## REAPPRAISAL OF *FERMORIA* AND ALLIED REMAINS FROM THE SUKET SHALE FORMATION, RAMAPURA

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### ABSTRACT

*Fermoria* and other allied remains described earlier have been restudied critically. The observations suggest that all the Indian forms, viz., *Fermoria*, *Krishnaniania acuminata*, *Tawuia* and *Vindhyaniania* are morphologically alike and similar to the genus *Chuarina* Walcott, but they are distinct at specific level.

*Key-words* — *Fermoria*, *Chuarina*, Suket Shale Formation, Precambrian (India).

### सारांश

सुकेत शैल से उपलब्ध फर्मोरिया एवं समवंशी अवशेषों का पुनः आकलन — प्रभात कुमार माइती एवं मनोज शुक्ला

फर्मोरिया एवं अन्य समवंशीयों के पूर्व वर्णित अवशेषों का पुनः अध्ययन किया गया है जिससे यह दंगित होता है कि फर्मोरिया, कृष्णानिआ ऐंक्यूमिनेटा, तवुइया एवं विन्ध्यानिया नामक सभी भारतीय प्रारूप बाह्य-आकारिकीय दृष्टि से एक-सदृश हैं तथा चुआरिआ वाल्कोट से मिलते-जुलते हैं। परन्तु जातीय स्तर पर ये एक दूसरे से भिन्न हैं।

### INTRODUCTION

JONES in 1909 (in Holland, 1910) first recorded small carbonised horny concentrically wrinkled discs in the Suket Shale near Ramapura. Examination of the collections made by several workers, viz., Chapman (1935), Sahni (1935), Ghare and Badve (1978) have led considerable divergence of opinion whether they are organic or inorganic, and if organic then whether they are animal or plant remains comparable to *Chuarina* Walcott. The present study has been carried out especially to assess the different shapes of discs and their possible biological affinities.

The present observation is based on the material collected by Bharadwaj and Verma in 1956 from the Suket Shale Formation, Ramapura, Madhya Pradesh. The collection comprises carbonised compressions and impressions of discs showing different shapes and wide size range. Carbonised specimens were first studied on the rock surface in incident light and then they were encircled by wax for isolation from rock. To isolate

the discs from rocks hydrofluoric acid was poured in the enclosed area. The discs after becoming loosened from the rock matrix were picked up, subsequently cleared and mounted in glycerine jelly. About 100 discs have been measured at random for size variation. Measurements of discs were also taken to understand the size frequency distribution both from the yellow and black shales separately. All the figured specimens are preserved in the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

### DESCRIPTION

*Genus* — *Chuarina* Walcott, 1899

*Genotype* — *Chuarina circularis* Walcott, 1899.

*Chuarina minima* Chapman, 1935 emend.

Pl. 1, figs 1-10

*Synonymy*:

1909 Discinoid discs Jones.

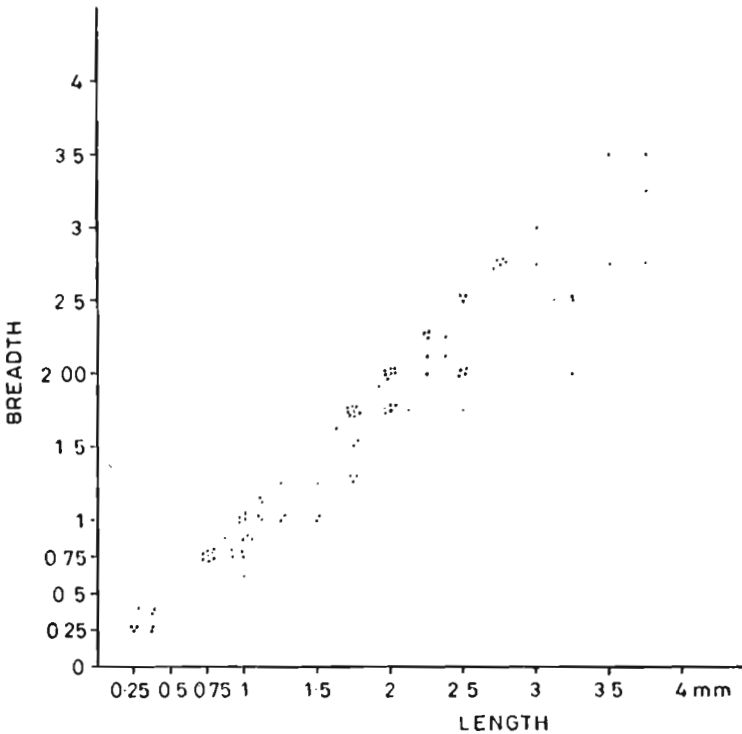
1935 *Fermoria minima* Chapman, p. 115, pl. 1, figs 1, 3.

- 1935 *Fermoria granulosa* Chapman, p. 116, pl. 1, figs 2, 4; pl. 2, fig. 5.
- 1935 *Fermoria capsella* Chapman, p. 117, pl. 2, figs 3, 4.
- 1935 *Protobolella jonesi* Chapman, p. 117, pl. 1, figs 5, 6; pl. 2, fig. 1.
- 1936 *Fermoria minima* Chapman: Sahni, p. 466, pl. 43, figs 1-4.
- 1936 *Vindhyanella jonesi* Sahni, p. 467.
- 1952 Broadly ovoid form: Misra & Dube, p. 48, fig. 2.
- 1952 Egg-shaped form: Misra & Dube, p. 48, fig. 3.
- 1952 Semi-ovoid, tapering towards one end: Misra & Dube, p. 48, fig. 4.
- 1952 Kidney-shaped form: Misra & Dube, p. 48, fig. 5.
- 1952 Cluster of discs: Misra & Dube, p. 48, fig. 6.
- 1952 Almond-shaped form: Misra & Dube, p. 48, fig. 7.
- 1952 Circular form: Misra & Dube, fig. 1.
- 1954 *Krishnania acuminata* Sahni & Srivastava, p. 40, fig. 4.
- 1957 Circular form (*Fermoria* spp. Chapman): Misra, p. 56, pl. 7, fig. 1.
- 1957 Broadly ovoid form: Misra, pl. 7, fig. 2.
- 1957 Almond-shaped form: Misra, pl. 7, fig. 3.
- 1957 Semi-ovoid form tapering towards one end (*Krishnania acuminata* Sahni & Srivastava): Misra, pl. 7, fig. 4.
- 1957 Kidney-shaped form: Misra, pl. 7, fig. 5.
- 1962 *Fermoria* Chapman: Hantzschel, p.W. 240, figs 148, 4.
- 1962 *Krishnania* Sahni & Srivastava: Hantzschel, p.W. 241.
- 1973 *Chuarua circularis* Walcott: Ford & Breed (Indian specimen), pp. 539-540.
- 1975 *Krishnania* Sahni & Srivastava (*K. acuminata*): Hantzschel, p.W. 185.
- 1975 *Protobolella* Chapman: Hantzschel, p.W. 187, figs 108, 4; 107, 5.
- 1977 *Chuarua circularis* Walcott (Indian forms): Hofmann, p. 7.
- 1977 Disc-like remains — Type-1, Maithy & Shukla, p. 183, pl. 5, fig. 37.
- 1977 Disc-like remains — Type-2, Maithy & Shukla, p. 183, pl. 5, fig. 35.
- 1977 Disc-like remains — Type-3, Maithy & Shukla, p. 183, pl. 5, fig. 36.
- 1977 Disc-like remains — Type-4, Maithy & Shukla, p. 183, pl. 5, fig. 38.
- 1977 Disc-like remains — Type-5, Maithy & Shukla, p. 183, pl. 5, fig. 39.
- 1977 Disc-like remains — Type-6, Maithy & Shukla, p. 183, pl. 5, fig. 40.
- 1977 *Fermoria minima* Chapman: Sahni, pl. 1, figs 1-6; pl. 2, figs 1-4; pl. 3, figs 1, 2.
- 1977 *Krishnania acuminata* Sahni & Srivastava: Sahni, pl. 3, fig. 3.
- 1978 *Chuarua circularis* Walcott: Ghare & Badve, p. 34, pl. 1, figs 1-4, text-figs 1-6.
- 1979 *Chuarua circularis* Walcott: Ghare & Badve, p. 91, pl. 7, figs 1, 2; pl. 8, figs 3, 4.
- 1982 *Chuarua circularis*: Mathur, p. 128, fig. 3A.
- 1982 *Chuarua fermorei* Mathur, p. 128.
- 1982 *Morania antiqua*: Mathur, p. 128.
- 1982 *Tawuia suketensis* Mathur, p. 128, fig. 3B.
- 1982 *Tawuia rampurensis* Mathur, p. 128.
- 1982 *Vindhyania jonesii* Mathur, p. 129, fig. 3C.

*Emended Diagnosis* — Platyspermic discs, when solitary circular or oval in shape; when in groups almond or elongate oval shape, disc diameter 0.25-3.5 mm; surface smooth or with thickenings; thickenings either in the form of concentric rings on margin or irregular folds of varying patterns. Isolated discs confirm the compression outline; exine structure smooth to finely intrapunctate (comparable to cryptarch genus *Orygmatosphaeridium* Timofeev).

*Holotype* — K. 21/360 Geological Survey of India.

*Description* — Discs are either preserved in the form of impressions on yellow colour shales or carbonised compressions on greyish-black colour shales. At times discs with different shapes, i.e. circular, oval and elongate-oval are found closely packed together at one place on the rock (Pl. 1, fig. 1). The size of discs vary from 0.25 to 3.5 mm. At random measurements of 100 discs show that there is a distinct relationship between the shape of discs and increase in size. The smaller forms are circular in outline whereas the oval forms are bigger in size (see Text-fig. 1). The different type of surface thickenings preserved on the specimens can be observed in impressions (Pl. 1, figs 3, 4) and also on isolation of specimens from rock. Isolated specimens show several fine microfolds or concentric thickenings on the margin. Specimens are also with irregular folds or with two to three thick vertical



TEXT-FIG. 1 — Showing size variations of discs to show their circular to oval tendencies.

folds (Pl. 1, fig. 5). These different shapes and fold patterns of discs may have formed either due to drying of specimens by the loss of aqueous media before fossilization or may be due to pressure of sediments during fossilization.

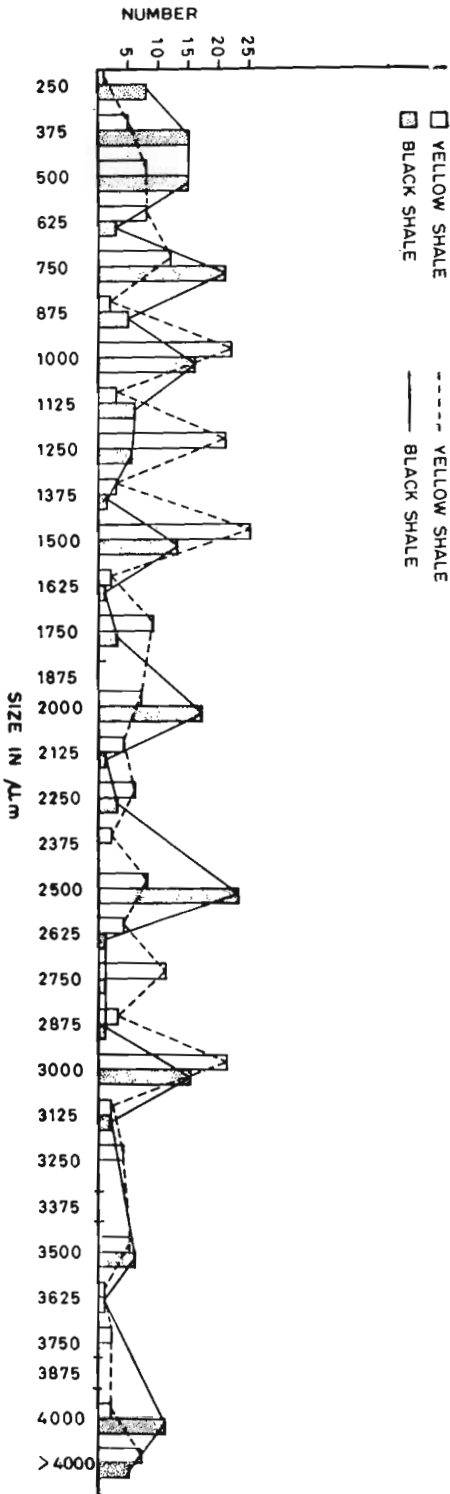
Often 4 or more discs are preserved together in a linear row to form a single oval mass, measuring 4-6 mm in length (Pl. 1, fig. 6). Similar specimens have also been described by Hoffmann (1977, p. 10, fig. 2a) from Red Pine Shale. In view of their linear alignment and nearly equal size, Hofmann (1977) considered it to be a case of consanguinity, i.e. the original uncompressed spheroids were the part of single colonial strand of bead-like cells which remained intact even after burial.

All the discs of different shapes and size on isolation from rock show identical exine structure. Exine in well-preserved specimens is thin, laevigate with intrapunctate structure (Pl. 1, figs 7, 19, 10) comparable to cryptarch genus *Orygmatosphaeridium* Timofeev.

The distorted specimens show secondary thickenings on the surface, as a result the original exine pattern of specimens gets distorted. This distortion may even give rough appearance to surface or irregular reticulate ornamentation (Pl. 1, fig. 8).

*Size frequency distribution* — In all, 200 samples each from the yellow and black shales were measured at random for size frequency distribution. Their variations in size with number of specimens have been plotted (Text-fig. 2). The present study supports the observations made by Ghare and Badve (1978) that the large size specimens dominate in black shale while the smaller size ones are common in yellow shales. Furthermore, no morphologic distinction could be marked in the specimens belonging to different lithologies.

*Comparison and Discussion* — Much controversy remained ever since the discovery of these discs from the Suket shales, Ramapura. In 1909, Jones (in Holland, 1910) first reported the discinoid discs and suggested that they may agree with the genus *Obolella*



or *Chuarja circularis* described by Walcott from the Pre-Cambrian rocks of Arizona or possibly the operculum of *Hyolothellus*. Walcott and Resser (1927) opined that the markings represent true fossils closely comparable with brachiopod genus *Acrothele* from the Cambrian. Howell (1926) (in Heron, 1936) suggested them to be the plant remains, considering the fact that the shiny film of fossil which is evidently the only part of organism now remains glowing and burns to grey ash on heating. Chapman (1935) postulated them to be equivalent to protogulum stage of atrematous and neotrematous brachiopods somewhat allied to primitive genera like *Mickwitca*, *Micromitra*, *Obolus* and *Acrothele*. Considering this he created two new genera *Fermoria* and *Protoboella*. Sahni (1936) completely re-examined Chapman's collection and observed "Although the circular outline vaguely reminds one of the primitive obolilids or related forms, this evidence is unsupported by any other, which places beyond dispute the brachiopod affinities of these fossils" (p. 464). He considered all of them to be only one species of *Fermoria*, i.e. *F. minima* and suggested that the genus *Fermoria* be placed in a family by itself for which the name 'Fermoriidae' was proposed. The affinities of this new family were left undetermined till further evidences could be available.

Misra and Dube (1952) heated thin slices of shale bearing the discs as well as isolated discs on a platinum foil in an electric muffle furnace at a temperature of 900°C. The discs remained as such except the change in colour, i.e. they became red as if only oxidized. The chemical examination of discs showed the absence of phosphate and presence of iron and manganese in small amounts. On the basis of these observations they concluded that the discs are inorganic in nature, i.e. an example of colloidal precipitation of mineral matter. This has been further supported by Misra (1957).

In 1954, Sahni and Shrivastava recorded circular discs intimately associated with broad filaments and considered them to be

TEXT-FIG. 2 — Showing the size variations in discs both from black and yellow shales.

algal in nature, possibly the spore sacs. In the same paper they instituted a new genus *Krishnania*. The figured specimen (fig. 4) is incomplete and broken on one side. It is oval in outline, roundly acute apex with two distinct vertical folds comparable to the figured specimen in Pl. 1, fig. 5; while describing this form the authors remarked on p. 39 "a new genus which we propose to name *Krishnania* probably related to *Fermoria*". The present study demonstrates that the oval shape of the specimen is only a preservational feature. Therefore *Krishnania* as such is considered to be the junior synonym to *Chuarua minima*.

Pascoe (1959, p. 498) commented that *Fermoria* left a white ash when incinerated and was therefore a plant, but at the same time he felt that *Fermoria* could be an archaic form of brachiopod though with 'no reliable feature definitely attributable to this class. Glaessner (1966, p. 41) was non-committal and placed both *Fermoria* and *Chuarua* under some other algae. Two years later Cloud (1968) also listed *Fermoria* as possible alga. Thereafter, Ford and Breed (1973, p. 540) considered *Fermoria* to be synonymous to *Chuarua* Walcott. Furthermore, on the basis of isolated specimens, they considered them to be acritarch belonging to subgroup 'Sphaeromorphitae'. On the other hand, Hoffmann (1977) opined that the form genus *Chuarua* most likely comprises a variety of biological groups including planktonic algae and possibly medusoids. On the basis of their studies on the Suket Shale Formation Maithy and Shukla (1977) opined that the

disc-like bodies are either impressions of acritarcha or the algal colonies. Sahni (1977) also considered that the placement of *Fermoria* under *Chuarua* is an erroneous assignation. Ghare and Badve (1978) on the basis of their observations on discs from the Suket Formation, Ramapura, considered them to be identical to *Chuarua circularis* Walcott.

Recently, Mathur (1982) reported *Chuarua circularis*, *C. fermorei* sp. nov., *Morania antiqua*, *Tawuia suketensis* sp. nov., *T. rampurensis* sp. nov. and *Vindhyania jonesii* gen. et sp. nov. from the Suket Shale, Ramapura. This paper gives poor photographs showing *Chuarua circularis* (3A), *Tawuia suketensis* sp. nov. (3B) and *Vindhyania jonesii* sp. nov. (3C) without any details and diagnosis. *V. jonesii* is an ill-preserved form and in the absence of diagnosis and other details it is nomen nudum. *Tawuia suketensis* is an oval form with 3-4 circular discs arranged closely in a linear fashion as figured in Pl. 1, fig. 6. Hence, it is a synonym to *Chuarua minima* emend.

Thus on the basis of present study it can be summarized that (i) *Fermoria* and other allied Indian forms agree morphologically to the genus *Chuarua* Walcott, but the Indian forms are distinct at specific level; (ii) they are biogenic in origin and resemble morphologically to cryptarch genus *Orygmatosphaeridium* Timofeev on isolation from rock; and (iii) the different shapes of discs from Ramapura belong to a single genus and a single species as evident from their exine pattern and size frequency distribution. The fold patterns and different shapes are the preservational features.

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EXPLANATION OF PLATE

*Chuarva minima* (Chapman) emend.

1. Several specimens of circular to oval discs on rocks. B.S.I.P. specimen no. 27252/273. × 6.
- 2-4. Circular discs showing variation in the width of marginal thickenings. B.S.I.P. specimen nos. 25265/274. × 12; 25198A/273. × 16; 26175/273. × 12.
5. Oval impression with two vertical thickenings. B.S.I.P. specimen no. 25230/273. × 12.
6. Elongate-oval form composed of 4-6 discs preserved adjacent to each other. B.S.I.P. slide no. 6971/27052. × 15.
7. An isolated specimen showing folds on margin and intrapunctate exine. B.S.I.P. slide no. 6972/27502. × 70.
8. Poorly preserved specimen; exine showing coarse reticulate pattern. B.S.I.P. slide no. 6973/26280. × 30.
- 9 & 10. Portion of isolated discs enlarged to show intrapunctate structure and varying fold pattern. B.S.I.P. slide nos. 6974/26527, 6975/27806. × 150.

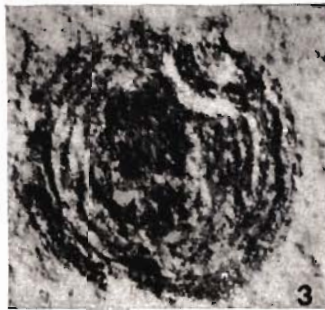
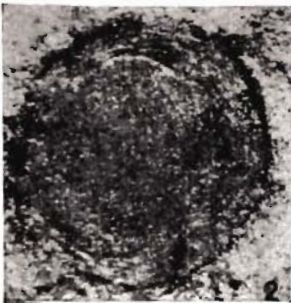
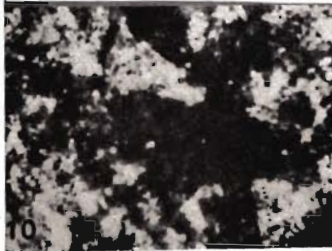
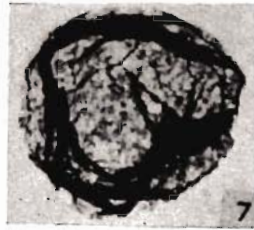
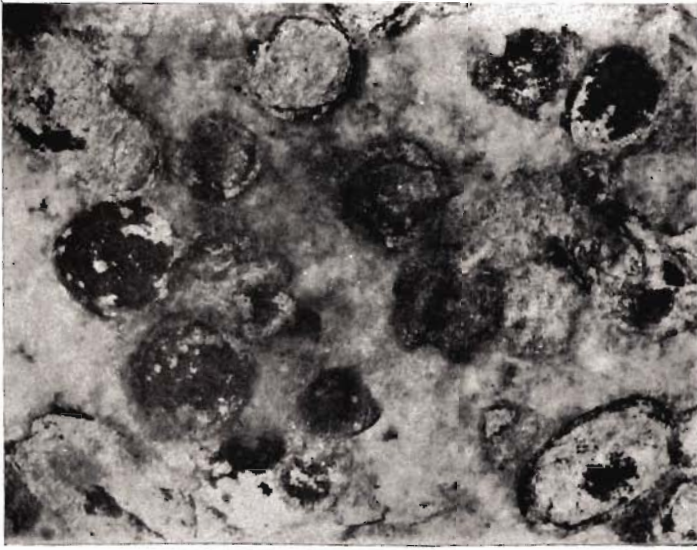


PLATE I