Carbonaceous fossils from the Panna Shale, Rewa Group (Upper Vindhyan), Central India: A possible link between evolution from micro-megascopic life

Primitive life underwent several evolutionary changes from unicellularity to multicellularity, from prokaryotes to eukaryotes, and from microscopic to megascopic size during the Meso-Neoproterozoic period. Evidences of some such events are well preserved in Vindhyan rocks. However, their sequential representation and nature of evolution are yet to be worked out. Plausible initial and intermediate fossil forms are missing in available records. The present correspondence reports such intermediate forms, which can represent the link between the evolution from micro- to megascopic life.

Among carbonaceous fossils, *Chuaria* is considered to be megascopic (greater than 0.2 mm), but for the Panna specimens (size range from 0.02 to 2.0 mm) it is difficult to delimit the lower size range for *Chuaria*. Presence of carbonaceous discs overlapping in size of micro- and megafossils draws attention and morphological similarity of these spheroids with *Chuaria*, places this genus as a potential taxon, which can provide clues for evolution from micro- to megascopic life, especially during deposition of Upper Vindhyan.

The Vindhyan Supergroup is divided into four groups; in stratigraphic order these are: the Semri Group, the Kaimur Group, the Rewa Group and the Bhandar Group. Among these groups, the Semri Group is considered as Lower Vindhyan, whereas the other three groups are considered as Upper Vindhyan.

The Rewa Group comprises basically sandstone and shale, which conformably overlie the Kaimur Sandstone. The Rewa Group is subdivided into four different lithostratigraphic units (Table 1). The Group is well exposed in Son Valley and Chambal Valley areas. For the present study the samples have been collected from the Panna Shale, Drammondganj section of Son Valley area (Figure 1a).

The Panna Shale in Drammondganj section is characterized by the well developed thinly laminated greenish-grey, khaki brown and chocolate coloured shale. Occasionally, very thin limestone bands can also be noticed. Thickness of the shale varies from 100 to 130 m (Figure 1b). The Panna Shale is overlain by 8–10 m thick greenish-grey glauconitic sandstone (Lower Rewa Sandstone) with lenticular bedding, thin shale and siltstone partings. It also shows well-developed ripple marks, mud cracks and load casts.

The fossil-bearing shale samples have been collected from a spot located nearly 400 m ahead of the 108 km Rewa milestone at Drammondganj-Rewa Road. Fossil-bearing shale is olive green to chocolate brown in colour.

Carbonaceous remains of the Panna Shale exhibit moderate morphological variation and wide size range of 0.02–3.5 mm. The assemblage comprises *Chuaria–Tawaia* and specimens comparable to *Tilsoiida*11. *Chuaria* occurs in abundance.

<table>
<thead>
<tr>
<th>Table 1. Lithostratigraphic succession of the Rewa Group</th>
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<tbody>
<tr>
<td>Son Valley area (after Krishnan1)</td>
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<tr>
<td>Chambal Valley area (after Prasad2)</td>
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<tr>
<td>Rewa Group</td>
</tr>
<tr>
<td>Upper Rewa Sandstone</td>
</tr>
<tr>
<td>Jhiri Shale</td>
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<tr>
<td>Lower Rewa Sandstone</td>
</tr>
<tr>
<td>Panna Shale</td>
</tr>
<tr>
<td>Taragarh Fort Sandstone</td>
</tr>
<tr>
<td>Govindgarh Sandstone</td>
</tr>
<tr>
<td>Jhiri Shale</td>
</tr>
<tr>
<td>Indergarh Sandstone</td>
</tr>
<tr>
<td>Panna Shale</td>
</tr>
</tbody>
</table>

Figure 1. a. Geological map of the study area (after Chakraborty and Chaudhury15). b. Lithostratigraphic column of the Panna Shale at Drammondganj.
whereas *Tawaia* and *Tilsoia* occur rarely, *Chuaria* has been considered as a large acritarch, *Leiosphaeridia* and was also suggested having algal and brown algal affinity[15–17]. A close relationship of *Chuaria* with *Tawaia* has already been discussed[13,18].

*Chuaria* occurs as circular to elliptical carbonaceous compressions and impressions on the bedding surface. Wrinkles may or may not be present (Figure 2 a, e, m). *Chuaria* in Panna Shale exhibits smaller dimensions (between 0.02 and 2.0 mm; 116 specimens measured) in comparison to specimens reported from the other Vindhyan stratigraphic units (Table 2). There is a possibility that the smaller carbonaceous discs may represent the juvenile forms of this genus.

A number of views have been offered by several workers regarding the identification of *Chuaria*[3,10,16,17,19–21–25]. *Chuaria* reported from other Vindhyan successions is given in Table 2.

In Panna Shale, *Tawaia dalensis* occurs rarely. The level of preservation is also not good. The length varies between 0.9 and 3.5 mm, width varies between 0.2 and 0.4 mm (four specimens measured). It has been recorded from both Lower as well as Upper Vindhyan successions and other parts of the world like Svalbard, China and Russia[3,16].

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**Figure 2.** Carbonaceous remains from the Panna Shale, Rewa Group, Vindhyan Supergroup, Dhanmondgaj Section, Central India. Scale for a-c, g and m = 0.33 mm; for e, o, q = 0.5 mm, for f = 1.0 mm; for h-m and n = 0.2 mm. a. *Chuaria* with well-marked wrinkles and folds, specimen no. DG-5. b. *Chuaria* with well-marked inner circle, specimen no. DG-M. c. *Chuaria* with egg-shaped morphology, specimen no. DG-5. d. Ellipsoidal carbonaceous film assignable to *Tawaia dalensis* specimen no. DG-1. e. *Chuaria* with marginal folds, specimen no. DG-K. f. Structure comparable to *Tilsoia khoripensis*, specimen no. DG-S. g. Process bearing acanthomorphic acritarchs-like morphology, specimen no. DG-U. h-n. Small sized spheroidal carbonaceous remains that are considered to be the link between evolution from micro to megascopic life, specimen no. DG-C, o, q. *Chuaria* with folds, specimens nos DG-E and DG-D, respectively. p. egg-shaped *Chuaria* with well-marked wrinkles, specimen no. DG-S.
### Table 2. Chuaria reported from different Formations of the Vindhyan Super group

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Geological unit</th>
<th>Dimension (mm)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuaria circularis</td>
<td>Rohtas garh Limestone</td>
<td>Up to 5</td>
<td>6</td>
</tr>
<tr>
<td>C. melanoecentricum</td>
<td>Rohtas Group</td>
<td>9.0–10.0</td>
<td>6</td>
</tr>
<tr>
<td>C. circularis</td>
<td>Suket Shale</td>
<td>1.45–9.5</td>
<td>11</td>
</tr>
<tr>
<td>C. vindhyavanus</td>
<td>Suket Shale</td>
<td>0.2–4.7</td>
<td>11</td>
</tr>
<tr>
<td>C. circularis</td>
<td>Suket Shale</td>
<td>0.2–9.5</td>
<td>11</td>
</tr>
<tr>
<td>C. circularis</td>
<td>Sirbu Shale</td>
<td>0.2–5.1</td>
<td>12</td>
</tr>
<tr>
<td>C. circularis</td>
<td>Dholpura Shale</td>
<td>0.5–4.7</td>
<td>8</td>
</tr>
</tbody>
</table>

Besides *Chuaria* and *Tawulia*, the other morphologies comparable to *Tilsoxia kho-ripensis* (Figure 2f) and a vesicle exhibiting process like structures as marked in acanthomorphs (Figure 2f). Egg-shaped *Chuaria*-like structures with folds and wrinkles can also be seen (Figure 2c).

In Panna Shale, carbonateous discs assignable to *Chuaria* exhibit a complete size gradation from micro to megafossils (0.02 to 2.0 mm). Since *Chuaria*, in general, is considered to be megascopie and should be identified with an unaided eye, the Panna specimens draw attention. These carbonateous discs assignable to *Chuaria*, exhibit marginal folds, wrinkles and sheath-like structures. Considering the size, uniformity and consistency in morphology of these forms, it is inferred that they can be considered as the intermediate-transitional forms and *Chuaria* is the fossil form, which can represent a link between micro and megascopic evolution of life.


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**Conservation status of Rudraksh in tropical wet evergreen forests of Arunachal Pradesh**

Rudraksh [*Elaeocarpus angustifolius* Blume (synonyms include *E. goniatus* Roxb. and *E. sphaericus* (Gaertn.) K. Schum.)], family Elaeocarpaceae is a conjugate word related to Lord Shiva. The ancient Indian scriptures describe the importance of Rudraksh. ‘Rudra’ means Shiva and ‘Aksh’ means eyes; the two words combine to form Rudraksh and literally, it means ‘the eyes of Rudra’. According to a mythological story in the *Puranas*, Rudra (Lord Shiva) had fought for a long time keeping his eyes wide open in order to kill the dangerous ‘Asur’ named Tripur in the Himalayas. During the prolonged struggle, the eyes of Lord Shiva grew tired and tears rolled down on the earth and took the shape of a plant. Lord Brahma, the creator of the Universe, directed that this plant be called Rudraksh as it was formed from the flowing tears of Lord Shiva.

Many rare plants and their parts are used in the Tantric (Hindu occult science) system. According to Hindu belief, Nature has created many things which destroy negative planetary forces, help get rid of evil auras in our homes, protect us from enemies or opposition around and create powerful friendly auras for health, wealth, success and happiness. The holy Rudraksh is one such thing which is believed to do these by establishing a unique link between the material world and the occult world. Its powerful presence keeps away all evil and negative forces. Rudraksh is the fruit (stone) of the Rudraksh tree. The Rudraksh bead (stony endocarp) is found after removing the fruit pulp. The bead is rough in texture, with the surface divided into segments by ridges running from top to bottom. The sculpturing of