REPORT OF POSSIBLE LYCOPOD AXES IN THE LOWER GONDWANA BEDS OF INDIA

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Abstract

Some possible lycopodaceous remains have been recovered from the Karharbari Formation of Chirimiri and Ganjra Nala Section of South Rewa Gondwana Basin, Madhya Pradesh. Known records of lycopod remains in the Lower Gondwana flora of India and their nomenclatural problems have been discussed and examined in view of the present day knowledge.

Introduction

Lycopodaceous remains are extremely rare in the Lower Gondwana flora of India. A review of the previously described specimens of lycopod remains reveals that only a few of them could be regarded as lycopodaceous (Bunbury, 1861; Seward & Sahni, 1920; Maithy, 1965; Kar, 1961; Chandra & Rigby, 1981).

During the investigation of plant fossil assemblages of South Rewa Gondwana Basin, we observed many axes apparently showing leaf scar-like structures on the surface, but microscopic examination proved them as the structure produced due to weathering or due to mineral filled minute concretions. Four specimens collected from the Karharbari Formation of Chirimiri and Ganjra Nala Section show impressions of structures regarded as possible leaf scars with remains of subtended organs. Figured specimens are preserved in the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

Satisfactorily preserved lycopodaceous specimens have not been encountered in the Lower Gondwana flora of India but the presence of *Cyclodendron* (the only known genus) has been mentioned by many workers from the Karharbari (Maithy, 1965), Barren Measures (Kar, 1968) and Kamthi (Bunbury, 1861; Chandra & Rigby, 1981) formations.

In 1861 Bunbury, while describing the Hislop and Hunter's (1854) collection of Lower Gondwana plant fossils from Nagpur District, doubted the presence of lycopodaceous characters in three specimens (pl. 12, figs. 1-3). However, he was not sure about their exact affinities, therefore, he described them under "*Knorria?* (conifer)" rhizome of a fern? and stem respectively Such doubtful specimens, can not be considered as the true representative of lycopods. Later, Feistmantel (1881) described some stem remains from Nagpur and Iron Stone shale beds of Kulti Formation, Raniganj Coalfield, he compared them with the Indian and Russian specimens of *Knorria* (Bunbury, 1861; pl. 12, fig 1) and *Rhipidopsis ginkgoides* (Schmalhausen, 1879; Pl. 6; fig. 12). Seward Sahni (1920) restudied all such specimens and considered them as "thin membrane with spirally disposed oval or rhomboidal pits or scars very similar in form and arrangement to the leaf scars of a *Bothrodendron* stem". Accordingly, they described them (Seward & Sahni 1920; Pl. II, figs. 28a-c) as the impressions of the surface of a *Bothrodendron* stem, similar to *B. leslii*, recorded by Seward (1903; Pl. 11, fig. 1) from the Permo-Carboniferous beds of Vereeniging, South Africa. Kräusel (1928) transferred this species under *Cyclodendron leslii*.

Maithy (1965) recorded two specimens under cf. *Cyclodendron* sp. (pl. 1, fig. 5; pl. 2, fig. 8) from the Karharbari Formation of Giridih Coalfield. Examination of the specimens indicates that the stem remains which have been considered as having leaf scars are, in fact, the weathered marks on the stem

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axis, produced due to mineral concretions. Moreover, there is no consistency and uniformity in the pattern, which can be taken as the criteria for identifying leaf scars. Hence, the two specimens should not be considered as the representative of *Cyclodendron*. Kar (1968) described *Cyclodendron leslii* from Barren Measures Formation of the Jharia Coalfield. The specimens are quite small, 2.5 cm long and 1 cm broad. The leaf scars are quite distinct, regular, spindle shaped, and are arranged in quincucial fashion. Kar (1968) has observed a pin hole cavity in the centre of leaf scars. Such characters are usually not present in the leaf scars of *Cyclodendron*. It is quite likely that the specimens of Barren Measures Formation probably represent another type of lycopod stem. The pattern and distribution of leaf scars are comparable with *Knorria* or *Lepidodendron* type of lycopodaceous axis. However, it is difficult to ascertain their exact affinities due to their small size and poor preservation. The record of *Cyclodendron leslii* from the upper most bed of the Lower Gondwana, i. e. Kamthi Formation by Chandra and Rigby (1981) is quite significant. They have described two specimens, the bigger stem (Pl. 1, fig. 3) does not show the exact nature of leaf scars and could very well be due to weathering, as has been observed in the specimens of Karharbari Formation (see Maithy, 1965; Pl. 2, figs. 5,8). Small specimen (Pl. 1, fig. 10) certainly possesses typical *Cyclodendron* scar.

Observations

Nomenclature—The genus, *Cyclodendron* was instituted by Krausel in 1928 for the lycopodaceous stem discovered from the Karoo Formation of South West Africa (now Namibia) and he included the specimens of *Bothrodendron leslii* described by Seward (1903) from South Africa. In 1961, he made a detailed study of the lycopodaceous remains from almost all the Gondwana countries and instituted a new genus, *Lycopodiophlois* and redefined the generic status of *Lycopodiopsis* Ranault 1890, *Cyclodendron* Krausel 1928 and *Lycopodiophlois* Krausel 1961.

Recently, Lemoigne and Brown (1980) discussed the lycopodaceous plants of South Africa, India and South America and observed the characters and organization pattern of the leaf scars in all the three genera of Gondwana countries, i.e., *Lycopodiopsis*, *Cyclodendron* and *Lycopodiophlois*. He examined foliar characters and concluded that the leaf scars pattern in all the three genera are closely inter related (see Lemoigne & Brown, 1980; p.558; figs. 1A-E, 2A-A', B.C. D.). On this basis they transferred *Cyclodendron* and *Lycopodiophlois* into the earlier known genus *Lycopodiopsis* Renault, B. 1890. As such Gondwana lycopods are left with only one genu . Since Indian Lower Gondwana lycopsids posses *Cyclodendron leslii* type of leaf scar pattern a new combination for such specimens is proposed for the genus *Lycopodiopsis* Renault, 1890.

Lycopodiopsis leslii (Seward) comb. nov.

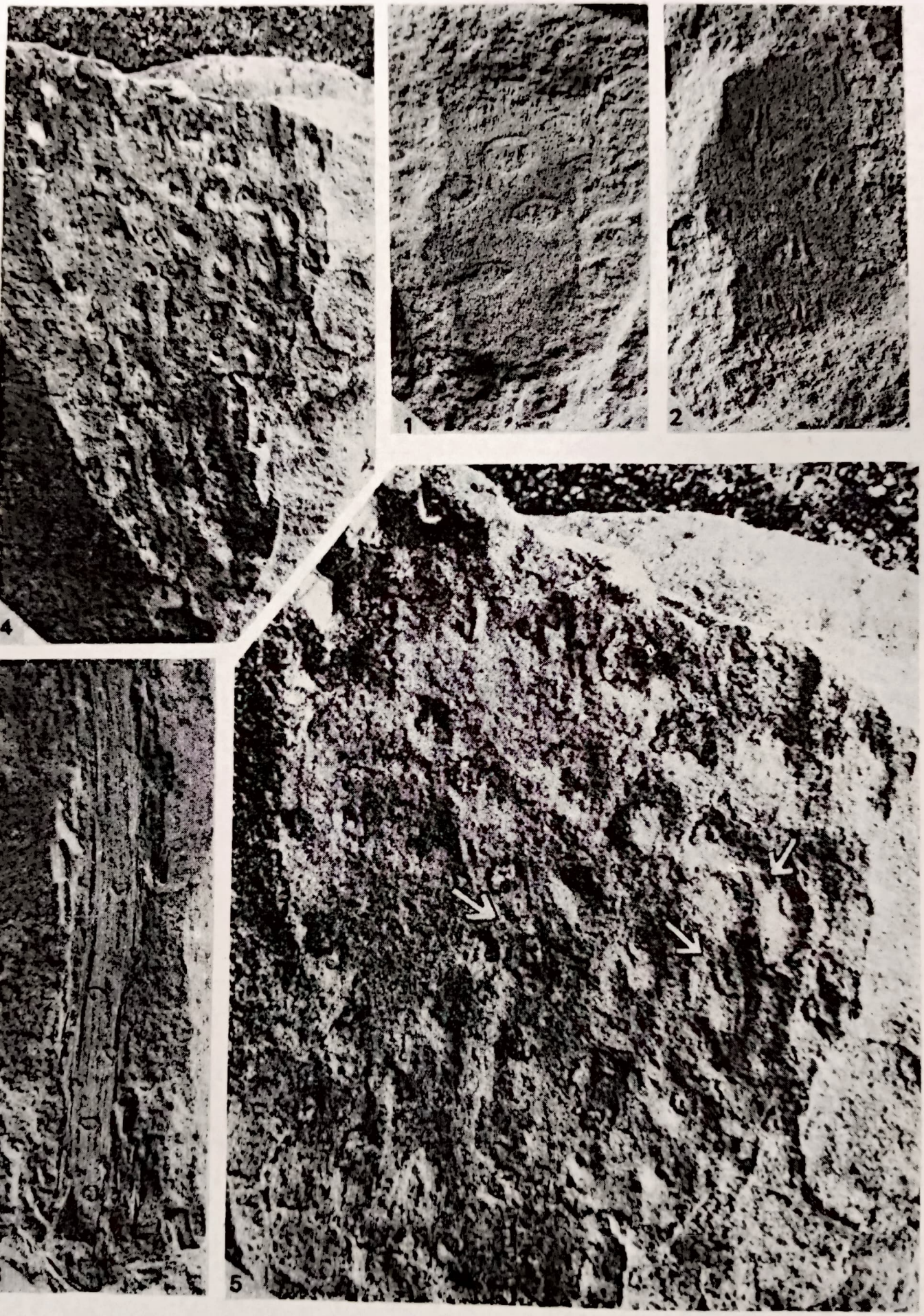
Basionym : *Bothrodendron leslii* Seward, 1903; *Ann. S. Afr. Mus.* 4; p. 87; figs. 1,4,6.

Remarks—While transferring the genus *Cyclodendron* under *Lycopodiopsis* Lemoigne and Brown (1980) did not consider fragmentary specimens showing only *C. leslii* type of characters, new combination includes isolated form having the characters of *C. leslii*. Specific diagnosis and synonymy lists have already been given by Krausel (1928, 1961) and Surange (1966).

Description—Present specimens were collected from a section exposed along the Railway line, 1 km northwest of Chirimiri Railway Station, Chirimiri Coalfield and from a section exposed in the Ganjra Nala, 0.5 km east of the Ganjra Nala-Johilla River confluence.

The study includes four impressions of axes (Pl. 1, figs. 1-5). The biggest one is 4.7 cm long and 2.3 cm broad. The axes show regular scars, arranged alternately. The scars have well preserved oval, circular, rhomboidal or slightly polygonal outlines which vary in size from 1-2.5 × 1.25 mm in diameter. Some of the scars show a raised part with the possible base of the attached organ which is slightly swollen but whose margin and outline is not discernible.

Comparison—The structure and organizational pattern of the scars present in the specimens are comparable with *Cyclodendron leslii* (Krausel, 1928; pl. 1, figs. 4-6,10; pl. 2, fig. 1; Krausel, 1961, pl. 35, fig. 25; pl. 36, fig. 30) but there is nothing to enable us to decide that the axes described here are stems with leaf scars or rhizomatous axes with attached rootlets. We have attributed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our axes to ? *Lycopodiopsis leslii* (Seward) comb. nov. only due to their external morphological similarities.

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Explanation of plate

Plate 1

1. ? *Lycopodiopsis leslii*, (Seward) comb. nov. stem axis showing spindle shaped scars, X 2; BSIP Specimen no. 36579, Chirimiri area.
2. Another specimen showing partially weathered marks of scar, X 2; BSIP Specimen no. 36580, Chirimiri area.
3. Narrow-elongate axis with sparcely distributed scars, X 1; BSIP Specimen no. 36581, Chirimiri area.
4. Stem axis showing the regular distribution of scars, X 2; BSIP Specimen no. 36582, Ganjra Nala Section.
5. A portion of stem axis enlarged to show the fragments of attached organ and base (arrows), X 4.