

# On an enigmatic fossil plant from the Early Permian of South Karanpura Coalfield, India

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## ABSTRACT

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An apparent whorl of heterophyllous leaves is reported from the Barakar Formation of South Karanpura Coalfield, Bihar. The leaves are heterophyllous and their non-stomatiferous cuticle shows cells in longitudinal series with thick anticlinal walls. The specimen presents superficial resemblance with leaf whorls of the sphenophylls; the latter, however, differ in having sinuous-walled cells in the epidermis of both the surfaces. There is a distinct possibility that this specimen represents a bunch of immature leaves of a taxon related either to *Euryphyllum* or *Pantophyllum*, regarded as members of the cordaitalean group of plants.

**Key-words**—Gondwana, Permian, South Karanpura, Cordaitales, India.

## सारांश

भारत के दक्षिणी करनपुरा कोयला क्षेत्र से प्राप्त एक प्रारंभिक परमियनयुगीन रहस्यमय पादपाश्म के बारे में

ऊषा बाजपेई एवं शिवमोहन सिंह

बिहार के दक्षिणी करनपुरा कोयला क्षेत्र के बराकर शैलसमूह से विषमपर्णी पत्तियों का एक आभासी चक्र प्राप्त हुआ है। इसकी पत्तियाँ विषमपर्णी हैं तथा उनका अरंधधर उपचर्म स्थूलअपनतिक भित्तियों के साथ अनुदैर्घ्य श्रेणी में कोशिकाएँ प्रदर्शित करता है। प्रादर्श स्फीनीनोफिल के पत्तियों युक्त चक्के के साथ पृष्ठीय सादृश्य प्रस्तुत करता है, परन्तु यह दोनों पृष्ठों की बाह्यत्वचा की कोटर-भित्ति युक्त कोशिकाओं के मामले में भिन्नता रखता है। एक दूरस्थ सम्भावना हो सकती है कि यह प्रादर्श *यूरीफिल्लम* अथवा *पन्तोफिल्लम* से सम्बन्धित एक वर्गक की अपरिपक्व पत्तियों का गुच्छ प्रदर्शित करता हो, जिसे कार्बेट समूह के पादपों का सदस्य कहा जाता था।

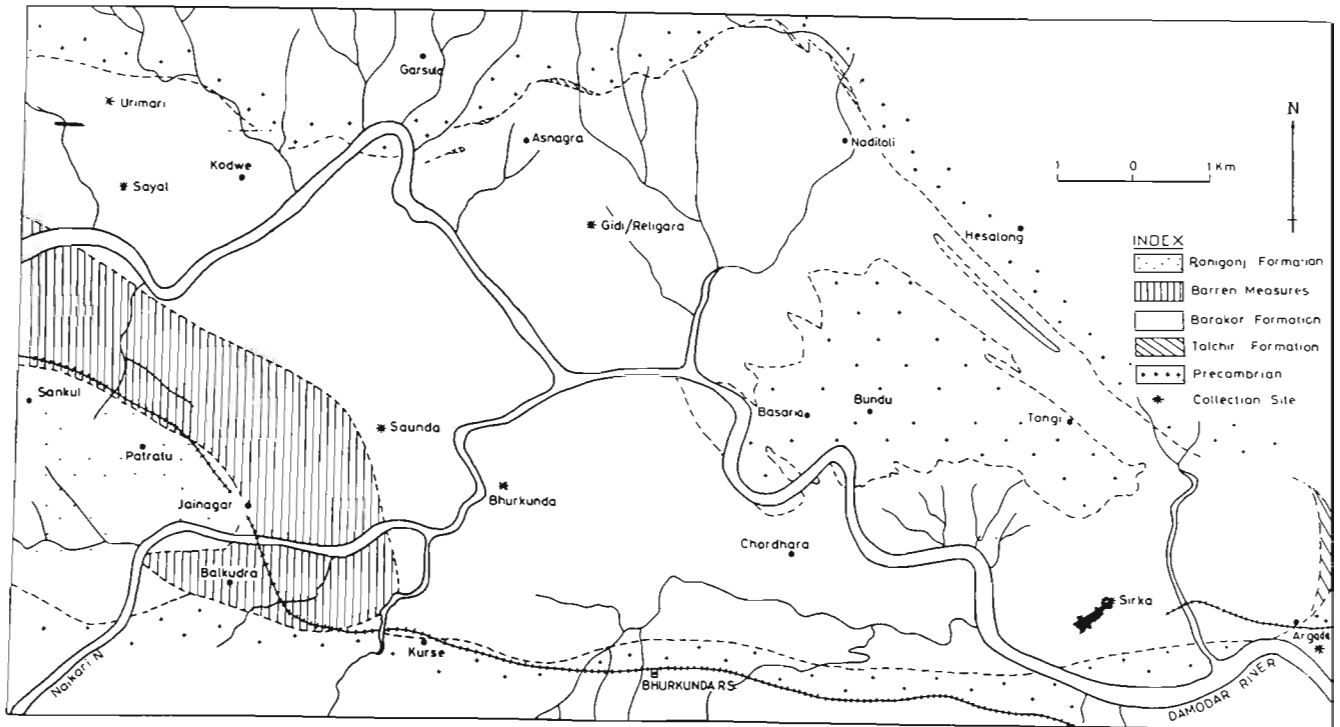
## INTRODUCTION

THE Karanpura Coalfield, situated between Hazaribagh and Ranchi Plateau, lies between 85°28' – 84°46' east longitudes and 23°38' – 23°50' north latitudes. The southern part of the coalfield is separated by a narrow bridge of Archaean rocks from the northern part. The northern and south-

ern parts, however, are connected by a narrow corridor comprising Talchir rocks.

## SOUTH KARANPURA COALFIELD

The South Karanpura Coalfield, situated in the western part of the Damodar Valley, exposes all the main Permian for-



**Text-figure 1**—Geological map of a part of South Karanpura Coalfield showing the fossil plant localities. The collection locality of the present specimen is marked by an arrow.

mations of the Gondwana Supergroup. The Karanpura Coalfields were mapped in detail by Hughes (1871). Albert Jowett (1925) remapped the area. C.S. Raja Rao of the Geological Survey of India remapped a large part of the South Karanpura Coalfield. A generalised stratigraphical sequence in the coalfield is shown in Table 1 (after Raja Rao, 1987, p. 144).

Surange and Kulkarni (1968) reported *Phyllothea ampla* and *P. angusta* from the Barakar ("Karharbari") Formation of this coalfield. Kulkarni (1971a, b) described *Sphenopteris*, *Gangamopteris buriadica*, *G. cyclopteroides*, *G. intermedia*, *G. spatulata*, *Glossopteris angustifolia*, *G. barakarensis*, *G. browniana*, *G. communis*, *G. damudica*, *G. decipiens*, *G. fusa*, *G. indica*, *G. karanpuraensis*, *G. linearis*, *G. spathulocordata* and *G. stricta* from the shales of Argada, and Lower and Upper Nakkari Seams. She suggested that dominance of *Gangamopteris* is indicative of a Karharbari age. Maithy (1978) reported two new forms, namely, *Paratrizygia rhodesii* and *Parasphenophyllum crenulatum* from the Lower Nakkari Seam.

In recent years, one of us (SMS) made a large collection of plant fossils from the Gondwana sediments of the South Karanpura Coalfield (Text-figure 1). The fossils include species of the genera *Neomariopteris*, *Gangamopteris*, *Glossopteris*, *Pantophyllum*, *Euryphyllum*, *Kawizophyllum*, *Gonophylloides*, *Scutum*, *Cordaicarpus* and *Vertebraria* besides a unique 'whorl' of lanceolate leaves; the last named fossil forms the subject of this report.

## SYSTEMATICS INCERTAE SEDIS

(Pl. 1, figs. 1-4)

*Specimen no.*—BSIP 38162/4738 (cp. BSIP 38163/4738).

*Locality*—Sirka Colliery, South Karanpura Coalfield, Bihar.

*Horizon*—Barakar ("Karharbari") Formation, shale associated with the Naditoli Seam.

## PLATE 1

- 1 & 2. Specimen showing a bunch of heterophyllous leaves arranged in a tight spiral on a swollen node; Specimen no. BSIP 38162/4738 and 38163/4738, respectively. x 0.8.
3. The specimen in figure 1 enlarged to show the variation in size and

- shape of the leaves, and the dichotomous, non-anastomosing venation. Specimen no. BSIP 38162/4738. x 2.
4. A portion of the non-stomatiferous surface showing elongated cells with straight walls. Slide no. BSIP 38162-1. x 100.

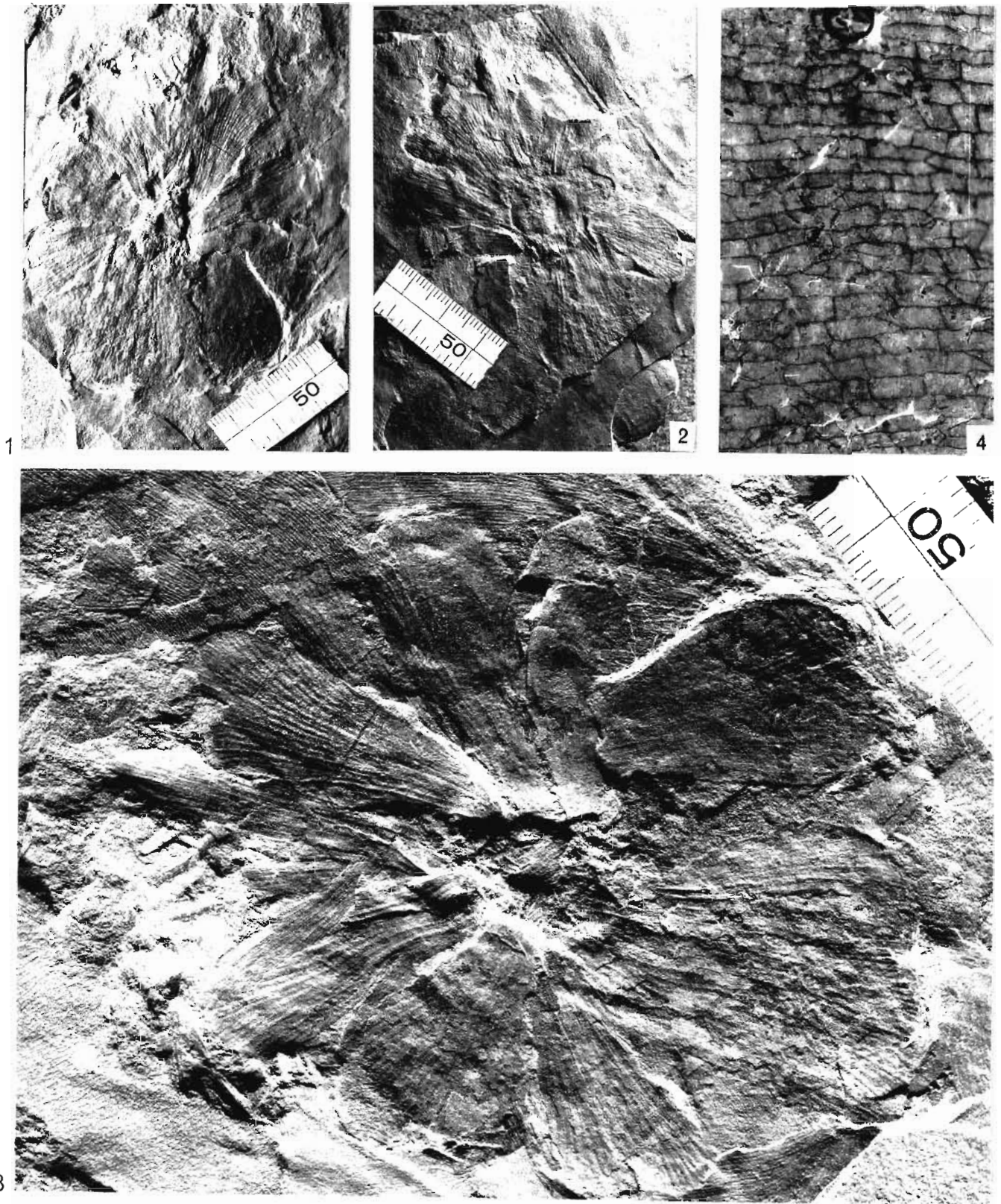


PLATE 1

**Table 1—Stratigraphical sequence in the South Karanpura Coalfield**

AGE	FORMATION	LITHOLOGY AND THICKNESS
Cretaceous		Dolerite and mica-peridotite intrusive
Upper Permian	Raniganj	Fine-grained sandstones, micaceous sandy shale and carbonaceous shales. (610 m)
	Barren Measures	Medium-grained sandstones, ironstone shales, siltstones, micaceous and carbonaceous shales. (304-457 m)
Lower Permian	Barakar	Coarse-grained sandstones, shales and coal. (1053 m)
	Karharbari	Coarse-grained, pebbly sandstones, shales and coal seam. (74 m)
	Talchir	Conglomerates, fine-to medium-grained sandstones and olive-green shales. (3-16 m)
~~~~~Unconformity~~~~~		
Precambrian		Granite, mica schists, quartzite and limestone?

**Description**—In the present collection there is one specimen (with counterpart, and poorly preserved carbonified crust) of uncertain taxonomic status. At first glance it looked apparently like a whorl of heterophyllous leaves. However, after excavation of some part of the rock, particularly from the part presumed to represent the axis, it became clear that the specimen comprises approximately 12 leaves arranged in a tight spiral at a swollen node (Pl. 1, figs 1, 2). Of these, about 8 leaves are comparatively large, obovate to sub-cuneate in shape, and with obtuse rounded apex, cuneate base and entire margin. The leaves are 2.8–3.5 cm long and 1–1.5 cm broad. The other four leaves are much less in breadth and are lanceolate in shape; they are up to 0.4 cm at the widest and have acuminate apices (Pl. 1, fig. 3). Two (possibly only one) veins enter the base of each leaf, dichotomise a few times, do not anastomose, further up in the lamina become slightly curved and end up at the upper margin as well as the apex. In the narrower leaves, the veins simulate that of *Pantophyllum* and run straight up to the apex. On acid-alkali treatment, the carbonified crust yielded small pieces of cuticle, but only of the non-stomatiferous surface. The cuticular membrane is thick, with straight-walled cellular outlines (Pl. 1, fig. 4). The cells are rectanguloid, longer than broad, 55-110  $\mu\text{m}$  x 20-35

$\mu\text{m}$ , and arranged end-to-end.

**Comparison**—This specimen shows a superficial resemblance with specimens of the genera *Trizygia* and *Sphenophyllum*. *Trizygia* no doubt is heterophyllous but it has only six cuneate leaves and that too arranged in three distinct pairs in a whorl. *Sphenophyllum* also has six symmetrical leaves (sometimes may be 9) which again are arranged in a whorl. The cell walls in both *Trizygia* and *Sphenophyllum* are sinuous on both the surfaces (Pant & Mehra, 1963; Pant & Srivastava, 1985; Boureau, 1964). Therefore, any affinity with the sphenophylls is definitely ruled out.

Presence of an acid resistant cuticle and the arrangement of leaves in a tight spiral indicate a definite gymnospermous affinity. From the general shape of the leaves, there seems to be a distinct possibility that this specimen represents a bunch of immature leaves of either *Euryphyllum* or *Pantophyllum* or of a taxon related to these genera. The exact identification of the taxon may be possible only after recovery of the stomatiferous surface and/or more specimens.

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