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

USHA BAJPAI AND SHIV MOHAN SINGH

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.

(Received 1 February 1999; revised version accepted 14 September 1999)

ABSTRACT


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 serials 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 cordaitean group of plants.

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

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 southern 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.

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*, *Kawizychyllum*, * Gonophylloides*, *Scutum*, *Cordaitacarpus* 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.

---

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-somatiferous surface showing elongated cells with straight walls, Slide no. BSIP 38162-1, x 100.
Table 1—Stratigraphical sequence in the South Karanpura Coalfield

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

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 µm x 20-35 µm, 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.

Acknowledgements—We are grateful to Professor D.D. Pant and Dr H.K. Maheshwari for very kindly reviewing the manuscript and for valuable suggestions. One of us (SMS) is grateful to the Director and authorities of the Birbal Sahni Institute of Palaeobotany, Lucknow for the award of Birbal Sahni Research Fellowship.

REFERENCES