Plant fossils from the Barakar Formation, Jharia Coalfield, Bihar*

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Morphological and systematic analyses of the plant fossils collected from different open cast projects of Basuria, East Basuria, Dhansar, Godhar, Gondudih, Industry, Kusunda and Khas Kusunda collieries of Kusunda Area, Jharia Coalfied are carried out. The flora is essentially dominated by the species of *Glossopteris*. However, the collection from East Basuria Colliery shows presence of *Neomariopteris hughesii*, glossopterid fructification *Partha raniganjensis* and seeds of *Cordaicarpus* sp.

The dominance of *Glossopteris* species in the flora suggests comparison with the fossil assemblages of Upper Barakar Formation.

Key-words- Plant fossils, Barakar Formation, Permian, Jharia Coalfied.

INTRODUCTION

JHARIA Coalfied, one of the biggest repository of coking coals in India, covers an area of about 456 sq km, extends for about 38 km in an eastward direction and 18 km in northwest direction. The Lower Gondwana beds lie unconformably on the Archaean and consist of Talchir, Karharbari, Barakar, Barren Measures (Kulti) and Raniganj formations. The geology of the area has been dealt by Hughes (1866), Fox (1930, 1934), Mehta and Murthy (1957), Sengupta (1980), Verma, Jaipuriar and Paul (1989) and Chandra (1992). The following stratigraphic succession is recognised by Chandra (1992):

Age	Formation	Lithotype	Max. thickness (in meters)
Jurassic or Tertiary		Dolerite dykes	
Lower Jurassic		Mica lamprophyre, dykes and sills,	
Upper Permian	Raniganj	Fine grained feldspathic sandstones, shales and carbonaceous shale	800
Middle Permian	Barren Measures	Buff coloured sandstones, shales and carbonaceous shales	730
Lower Permain	Barakar	Buff coloured coarse and medium grained feldspathic sandstone, grits, shales and carbonaceous shales and coalseams	1250
Upper Carboniferous	Talchir	Greenish shales and fine grained sandstones	245
		——————Unconformity——————	
Archaean		Metamorphics	

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Coal exploration in the area is being carried out by Bharat Coking Coal Limited (BCCL). The coalfield is divided into 18 areas and each area includes a number of collieries which are being mined as open cast or underground systems, representing different seams of Barakar and Raniganj formations.

Plant fossils from Jharia Coalfield have not yet been investigated systematically. The earlier records are mainly confined to the flora of Barren Measures and Raniganj formations (Kar 1969, Tewari, in press). However, fossil wood genera are well known from the Barakar Formation.

Present investigation was carried out to examine the fossil flora of the Barakar Formation. The formation consists of a number of good quality coking coal seams with an area of about 210 sq km. The coal seams vary from 800 to 1250 meters in thickness. Originally, 18 coal seams were identified in the Barakar Formation (Fox 1930). Sengupta (1980) recognized 49 seams of which 26 are local and impersistent in nature. The rest 23 are regional in distribution. Sengupta (1980) however, maintained the original number of coal seams of Fox in identifying seams I- XVIII and for other seams suffixed alphabet to the number. Finally Sengupta (1980) regrouped the seams of Barakar Formation into 9 groups.

The samples collected from the Barakar seams (nos. V-X) of eight open cast projects of Basuria, East Basuria, Dhansar, Godhar, Gonducdih, Industry, Kusunda and Khas Kusunda of Kusunda Area (No. 6) have yielded well preserved impressions of plant fossils. Since the flora is mainly represented by the known species of *Glossopteris* and other floral elements only their number of specimens of each species is given here in brackets, alongwith the distribution in different collieries (Table-1). However, glossopterid fructification and seed are briefly described. All the figured specimens are preserved in the museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

Plant fossils assemblage (Fossils marked with an asterisk are described):

Neomariopteris hughesii (Zeiller) Maithy (8)

Glossopteris angusta Pant & Gupta (3)

G. angustifolia Brongniart (18)

G. barakarensis Kulkarni (2) Pl.1, Fig. 5

G. communis Feistmantel (52)

G. damudica Feistmantel (2)

G. churiensis Srivastava (3), Pl.1, Fig. 9

G. indica Schimper (7), Pl.1, Fig.1

G. intermittens Feistmantel (6), Pl. 1., Fig. 7

G. karanpuraensis Kulkarni (2)

G. stenoneura Feistmantel (42), Pl. 1, Fig.8

S.No.	Seam Group	Members
1.	XVIII	XVIII G, XVIII F, XVIII E, XVIII D, XVIII C, XVIII B, XVIII A, XVIII TOP, XVIII Bottom/Combined
2.	XVII	XVII A, XVII Top, XVII Bottom/Combined
3.	XVI	XVI E, XVI D, XVI C, XVI B, XVI A, XVI Top, XVI Bottom/Combined
4.	XV	XV B, XV A, XV Top, XV Bottom/Combined
5.	XI, XII, XIII, XIV	XIV A, XIV, XIV A, XIV Combined XIII B, XIII A, XIII, XII A, XII, XI, XI/XII Combined, XI/XII/XIII Combined, XI/XII/XIII/XIV Combined
6.	IX, X	X B, X A, X, IX, IX/X Combined
7.	VIII	VIII F, VIII E, VIII D, VIII C, VIII B, VIII A, VIII
8.	V, VI, VII	VII, VI, V, V/VI/VII Combined
9.	I, II, III, IV	IV, III, II, IV/III/II Combined III/II Combined I, II/I Combined

Plate 1

1. *Glossopteris indica*, BSIP Specimen No. 37443 x 1.
2. *G. zeilleri* Pant & Gupta, BSIP Specimen No. 37444 x 1.
3. *G. tenuifolia* Pant & Gupta, BSIP Specimen No. 37445. x 1.
4. *G. vulgaris* Pant & Gupta, BSIP Specimen No. 37446. x 1.
5. *G. barakarensis* Kulkarni, BSIP Specimen No. 37447. x 1.
6. *G. tenuifolia* Pant & Gupta, BSIP Specimen No. 37448. x 1.
7. *G. intermittens* Feistmantel, BSIP Specimen No. 37449. x 1.
8. *G. stenoneura* Feistmantel, BSIP Specimen No. 37450. x 1.
9. *G. churiensis* Srivastava, BSIP Specimen No. 37457 x 2.
10. *Partha raniganjensis* Srivastava showing seed bearing organ and scale leaves, BSIP Specimen No. 37452. x 2. Part
11. Counterpart of the specimen shown in figure 10. x 2.
12. *Cordaicarpus* sp., BSIP Specimen No. 37453. x 2.

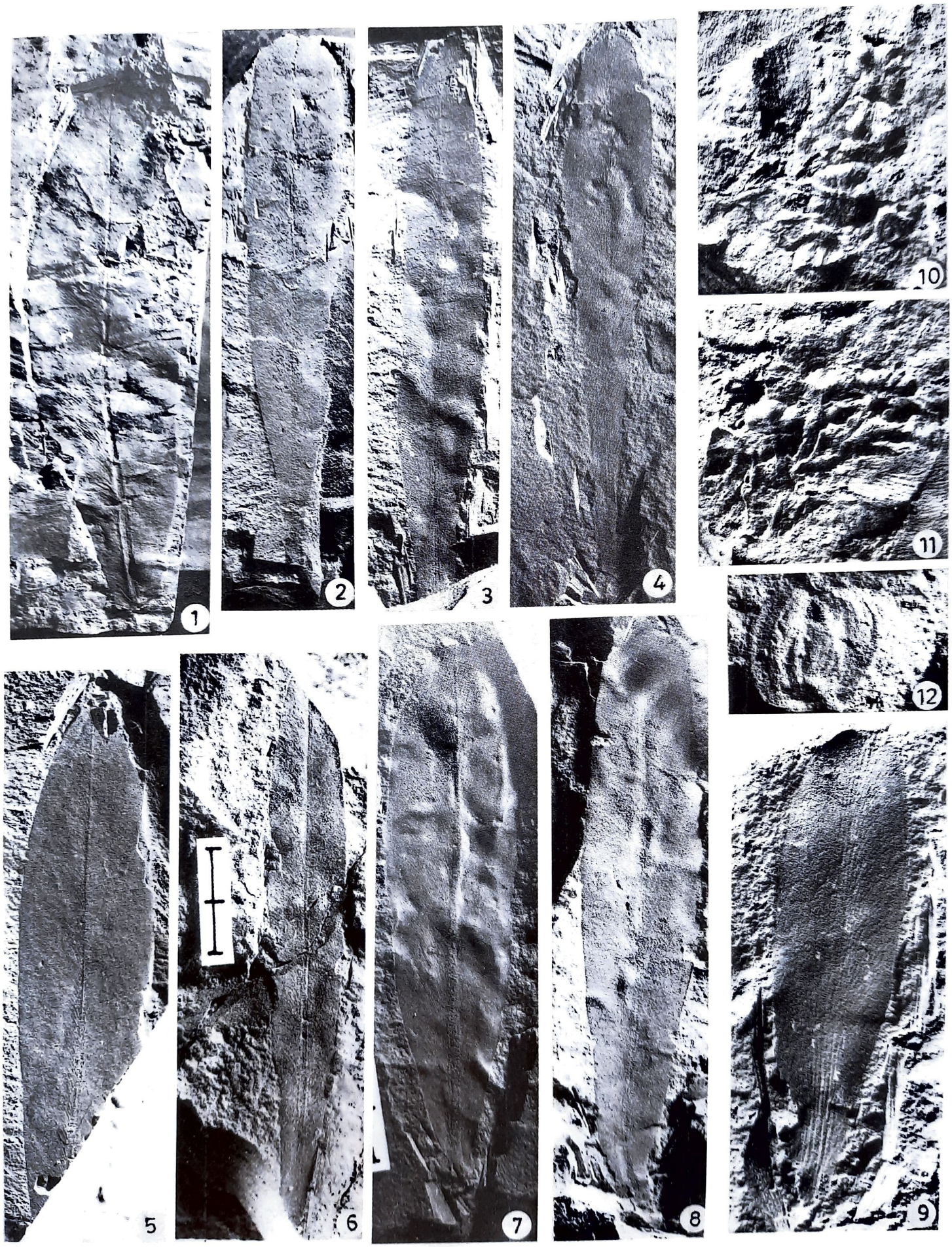

Plate 1

G. taenioides Chandra & Surange (2)

G. tenuifolia Pant & Gupta (25), Pl. 1, Figs. 3,6

G. vulgaris Pant & Gupta (2), Pl.1, Fig. 4

G. zeilleri Pant & Gupta (2), Pl.1, Fig.2

* *Partha raniganjensis* Srivastava (6), Pl.1, Figs. 10,11

* Glossopterid scale leaves (7)

* *Cordaicarpus* sp. (6) Pl. 1, Fig. 12

Partha raniganjensis Srivastava, 1992

Pl. 1, Figs 10, 11

There are six specimens in the collection showing incomplete impressions of scale leaves and seed organs of fructification. One specimen with part and counterpart possess scale leaf and attached fertile structure. Fertile structure is found only on one side of scale leaf and shows three stalks arising from the base of leaf with a saucer shaped four lobed seed bearing organ. The nature of scale leaf and position of seed bearing organ are comparable with *Partha raniganjensis* Srivastava (1992, Pl.7, figs 1-4).

Scale leaves

The assemblage includes seven complete to incomplete linear-lanceolate, 2-3 cm long and 0.8 -1 cm broad scale leaves showing narrow elongate meshes.

Cordaicarpus sp.

Pl.1, Fig. 12

The collection includes dispersed pear shaped seeds with narrow border, comparable with the seeds of *Cordaicarpus* reported from the Barakar Formation of Raniganj Coalfield (Srivastava, 1992).

Distribution of various species of plant fossils (Table-1) indicates uniform floral pattern as evidenced by *Glossopteris* species in different collieries of Area 6 of the Jharia Coalfied. However, restricted records of *G. damudica* in East Basuria, *G. barakarensis* in Gondudih, *G. karanpuraensis* in Khas Kusunda, *G. churiensis* in Kusunda and *G. zeilleri* in Godhar Collieries show variation of the flora at specific level. Occurrence of *Neomariopteris hughesii, Partha raniganjensis* and *Cordaicarpus* sp., in the assemblage of East Basuria colliery (7-10 seams) indicates diversity of the fossils at higher level in the lower Barakar seams of Jharia Coalfied.

COMPARISON AND DISCUSSION

The flora investigated from the lower and upper seams of the Barakar Formation of Raniganj Coalfield (Srivastava, 1992) suggests the presence of Karharbari floral elements i.e. *Gangamopteris - Noeggerathiopsis* complex in the lower seams whereas, flora of the upper Barakar seams is exclusively represented by the species

Table 1. Distribution of plant fossils in different collieries of Kusunda Area (No. 6) of Jnaria Coalfield.

Floral Elements	Basuria	East Basuria	Dhansar	Godhur	Gondudih Industry		Kusunda	Khas Kusunda
Neomariopteris hughesii	-	+	-	-	-	-	-	-
Glossopteris angusta	-	-	+	+	+	-	-	+
G. angustifolia	+	+	+	+	+	+	-	-
G. churiensis	-	-	-	-	-	-	+	-
G. communis	+	+	+	+	+	+	+	+
G. damudica	-	+	-	+	-	-	-	-
G. barakarensis	-	-	-	-	-	-	-	+
G. indica	+	+	+	+	-	+	-	-
G. intermittens	+	+	+	-	+	-	+	-
G. karanpuraensis	-	-	-	-	-	-	-	+
G. stenoneura	-	+	+	+	+	-	+	-
G. taenioides	+	+	-	-	-	-	+	-
G. tenuifolia	+	+	+	+	+	+	+	+
G. vulgaris	-	+	-	-	+	-	-	-
G. zeilleri	-	+	-	-	-	-	-	-
Partha raniganjensis	-	+	-	-	-	-	-	-
Cordaicarpus sp.	+	+	-	-	-	-	+	+
Scale-leaves	+	+	-	+		-	-	-

of *Glossopteris*. The absence of *Gangamopteris* - *Noeggerathiopsis* association, and dominance of *Glossopteris* species in the flora of Barakar Formation in Jharia Coalfield indicates similarity with the flora of Upper Barakar seams of Raniganj Coalfield.

Chandra and Surange (1979) have discussed the stratigraphic significance of *Glossopteris* species in the Lower Gondwana sequence of India. Out of 14 species of *Glossopteris* recorded in the present flora, 7 species viz. *G. damudica*, *G. indica*, *G. churiensis*, *G. barakarensis*, *G. intermittens*, *G. stenoneura* and *G. karanpuraensis* are comparable with the species of Barakar Formation. The presence of three species, *G. angusta* *G. zeilleri* and *G. taenioides* identified as the species of Karharbari Formation (*loc. cit.*) suggests their wider range of distribution in Jharia Coalfield. *G. communis* has been considered here as the common species of all the known Lower Gondwana sequences of India. *G. angustifolia*, *G. tenuifolia* and *G. vulgaris* recognised as the species of Raniganj Formation by Chandra and Surange (1979) are well known in the flora of Barakar Formation of Auranga and Raniganj coalfields (Srivastava 1977, 1992; Maheshwari & Tewari 1992). The occurrence of these species in older strata exterminate them as representatives of Raniganj Formation exclusively.

The recorded flora essentially demonstrates affiliation with the known assemblages of Barakar Formation but the absence of Karharbari floral elements differentiates it from the flora of lower Barakar seams of Raniganj and Deogarh coalfields (Bajpai 1990; Srivastava 1992). It appears that the relics of older flora of Karharbari Formation must be in existence during the earliest stage of Barakar. Comprehensive knowledge of the flora will be determined only with the recovery of plant fossils from the lowest seams (nos. I-IV) and upper seams (XI-XVIII) of Barakar Formation of Jharia Coalfield.

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