

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

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Plant fossils from different horizons of Barakar Formation exposed in Jagaldagga-Tubed areas and Sikni Open Cast Mine of Auranga Coalfield are represented by different species of *Neomariopteris*, *Sphenophyllum*, *Gangamopteris*, *Glossopteris*, *Senotheca*, *Noeggerathiopsis*, *Saportaea*, *Rhipidopsis*, *Ginkgoites* and *Vertebraria*.

The distribution of taxa indicates relative change of floral components at successive horizons (Nos. I-IV) of Barakar Formation. The lower horizons (I & II) show the presence of floral elements of Karharbari Formation, whereas, assemblages of higher horizons (III & IV) are comparable with the flora of Upper Barakar Formation. Presence of *Senotheca* sp. in Jagaldagga, ginkgopsid leaves in Tubed and *Sphenophyllum* and *Plumsteadia* in Sikni Open Cast Mine reflects regional variation of the flora of Barakar Formation in Auranga Coalfield.

Key-words—Plant fossils, Permian, Barakar Formation, India.

INTRODUCTION

THE Auranga Coalfield known after the river Auranga covers an area of about 250 sq km. between latitudes 23° 42' and 23° 52' and longitudes 84° 18' and 84° 42'. Geological details of the area were first published by Ball (1880). Later, Dunn (1928) and Rizvi (1972) resurveyed the area and recognised Talchir, Barakar, Raniganj, Panchet and Mahadeva as Gondwana sequence. However, palaeobotanical investigations carried out by Srivastava (1977a) and Lele and Srivastava (1977a,b) indicated the presence of Karharbari and Barren Measures formations in Gowa Nala and Sukri River sections. Recent geological studies have also suggested the occurrence of Karharbari and Barren Measures sediments in other parts of the coalfield. Accordingly, Raja Rao (1987) has proposed the following Gondwana sequence in the Auranga Coalfield:

Age	Formation	Lithology (thickness)
Upper Triassic	Mahadeva	Highly cross bedded, medium to coarse-grained ferruginous sandstones, pebble bed and red shales (180 m to 210 m)
-----Unconformity-----		
Lower Triassic	Panchet	Medium to coarse-grained, feldspathic, greenish to yellowish green purple sandstones, with brown and chocolate shales (130m to 150m)
Upper Permian	Raniganj	Fine to medium-grained sandstone, siltstone, sandy shale and carbonaceous shale (180m to 200m)
Middle Permian	Barren Measures	Medium to coarse-grained sandstones, carbonaceous shales and Ironstone bands (80m to 160m)
Lower Permian	Barakar	Fine to coarse-grained sandstones, pebble beds, conglomerates, carbonaceous shales, fireclays, coal seams (400 m to 450 m)
	Karharbari	Grey, mottled, conglomeratic coarse-grained sandstone and shale with dull, clean coal (40 m to 85 m)
Upper Carboniferous (?) to Lower Permian	Talchir	Tillites, yellowish sandstones, needle shales, rhythmites (30 m to 35 m)
-----Unconformity-----		
Precambrian	Metamorphics	Granite gneiss, quartzite, amphibolite and mica schists.

Barakar Formation of the Auranga Coalfield covering an area of about 220 sq km is characterised by coarse

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to very coarse-grained, white to greyish white sandstone with conglomeratic beds and conglomerates at base. Fine to medium grained cross bedded sandstones, siltstones, grey shale, carbonaceous shale, fire clay and coal seams are commonly associated with the sequence.

The Formation is well exposed in Bagdadga Nala section of Jagaldagga Area and Sukri River section near Tubed Village. Rizvi (1972) has recognised 4 Barakar horizons in both the areas (Figs 1-2), whereas, Raja Rao

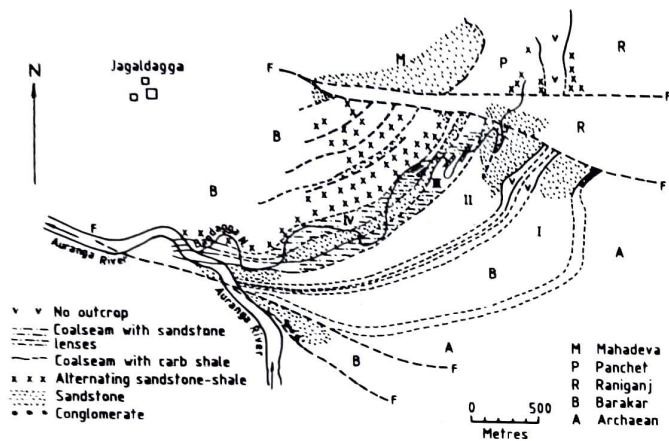


Fig 1

(1987) has identified Lower, Middle and Upper members of the Barakar and also demarcated Karharbari Formation in Jagaldagga Area. Coarse-grained massive felspathic sandstone with thin band of conglomerate represents the youngest horizon in Jagaldagga. However, in Tubed Area fire clay forms the base of Barakar and rests directly over the Archaean. Other horizons (Nos. II-III) in both the areas are represented by carbonaceous shale, coal seam and sandstone (Rizvi 1972).

Plant fossils from Barakar Formation of Auranga Coalfield have earlier been studied by Feistmantel (1881, 1886), Bhattacharyya B. (1959), Bhattacharyya A. K. (1963), Maithy (1971) and Srivastava (1977 a,b, 1978). Present investigation has been undertaken to examine the morphotaxonomy and distribution of plant fossils

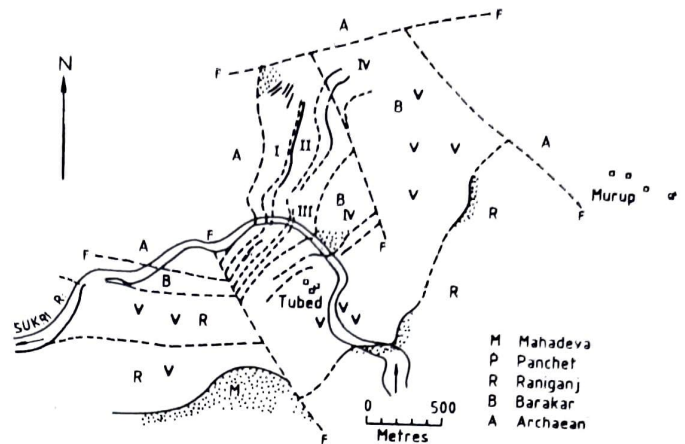


Fig 2

from youngest to oldest horizons of Barakar Formation exposed in Jagaldagga and Tubed areas.

MATERIAL

Systematic collections of plant fossils were made from different horizons of the Barakar Formation exposed in Bagdadga Nala section of Jagaldagga Area and Sukri River section near Tubed Village (Figs 1-2). Except from the oldest horizon (I) in Jagaldagga Area, fossils were recovered from all the horizons (II-IV). Carbonaceous shale samples collected from newly opened Sikni Open Cast Mine situated about 12 km away from the main town Latehar on Daltonganj-Chandwa Road have yielded well preserved plant fossils. All the plant fossils are preserved in the form of impressions and their taxonomic identification is based on their external morphological features. Figured specimens are preserved in the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

Floristic Composition

Plant fossils recovered from different sections have been assigned to the already known taxa. Therefore,

Plate 1

- Sphenophyllum* sp., two leaf fragments of a whorl showing arched dichotomizing veins, BSIP No. 37641. Locality: Sikni Open Cast Mine. Nat. size.
- Gangamopteris major* Feistmantel, complete leaf showing obtuse apex (slightly broken) and tapering base. BSIP No. 37642. Locality: Horizon II Tubed Area. x 1.5.
- G. angustifolia* McCoy, incomplete, linear lanceolate leaf. BSIP No. 37643. Locality: Horizon II, Tubed Area. x 1.5.
- 4-5. *Senothecca* sp., part and counterpart of *Glossopteris* leaf showing linear fructification attached to the midrib. BSIP NO. 37644-37645, Locality: Horizon II, Jagaldagga Area. x 1.5.
- Plumsteddia* sp., detached glossopterid fructification showing elongate rounded scars. BSIP No. 37646. Locality: Horizon II, Tubed Area. x 2.
- Neomariopteris hughesii* (Zeiller) Maithy, showing pinnules. BSIP No. 37647. Locality: Sikni Open Cast Mine. Nat. size.
- Glossopteris communis* Feistmantel, incomplete leaf with thick midrib and narrow-elongate mesh. BSIP No. 37646. Locality: Horizon II, Tubed Area. x 1.5.
- Noeggerathiopsis hislopii* Feistmantel, leaf fragment showing parallel running dichotomizing veins. BSIP No. 37646. Locality: Horizon II, Jagaldagga Area. x 1.5.

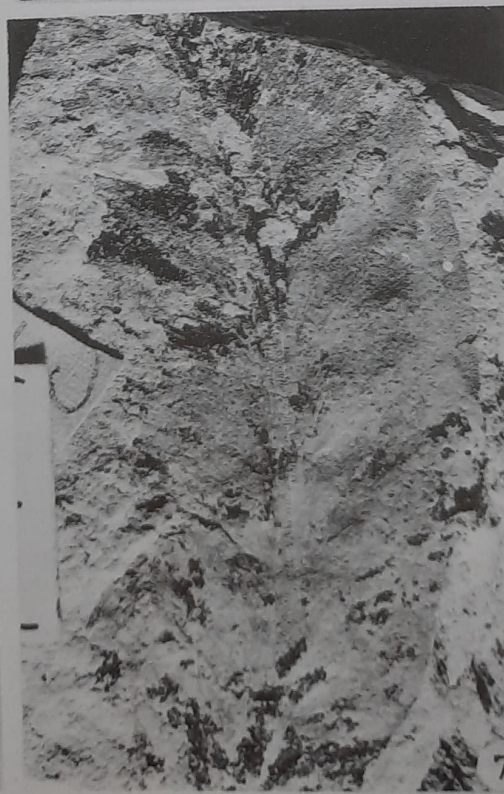
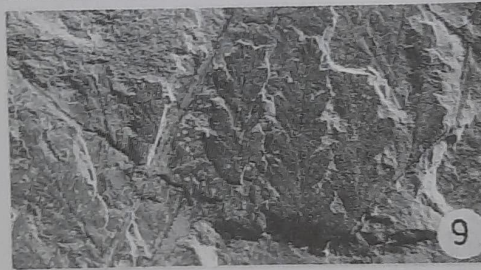
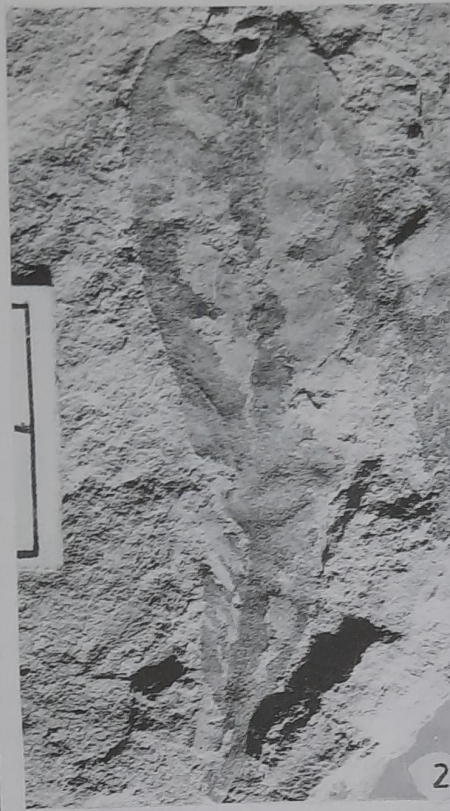


Plate 1

they are only listed here, their occurrence in different Barakar horizons (No. I-IV) are marked in brackets.

Jagaldagga Area (Bagdagga Nala Section)

- Gangamopteris cyclopteroides* Feistmantel (II)
G. major Feistmantel (II)
Glossopteris communis Feistmantel (II,III,IV)
Gl. indica Schimper (II, III, IV)
Gl. decipiens Feistmantel (II, III)
Gl. karharbariensis Chandra & Surange (II)
Gl. zeilleri Pant & Gupta (III, IV)
Gl. angusta Pant & Gupta (II,IV)
Gl. stenoneura Feistmantel (III)
Noeggerathiopsis hislopii (Bunbury) Feistmantel (II)
Senothea sp. (II)
Vertebraria indica Royle (II-IV)

Tubed Area (Sukri River Section)

- Neomariopteris hughesii* (Zeiller) Maithy (II)
Gangamopteris angustifolia McCoy (II)
G. major Feistmantel (II)
Glossopteris angustifolia Brongniart (I-IV)
Gl. barakarensis Kulkarni (II, III)
Gl. churiensis Srivastava (I, II)
Gl. communis Feistmantel (I-IV)
Gl. indica Schimper (I-IV)
Gl. browniana Brongniart (III, IV)
Gl. stricta Bunbury (IV)
Gl. intermittens Feistmantel (II, III)
Gl. taenioides Feistmantel (III)
Saportaea reniformoides Maheshwari & Bajpai (II)
Rhipidopsis densinervis Feistmantel (II)
Ginkgoites huraensis Maheshwari & Bajpai (II)
Vertebraria indica Royle (I-IV)

Sikni Open Cast mine

- Neomariopteris hughesii* (Zeiller) Maithy
Sphenophyllum churulianum Srivastava & Rigby
Sphenophyllum sp.
Glossopteris damudica Feistmantel
Gl. indica Schimper
Gl. communis Feistmantel
Gl. browniana Brongniart
Gl. stricta Bunbury
Gl. churiensis Srivastava
Gl. intermittens Feistmantel
Gl. barakarensis Kulkarni
Gl. stenoneura Feistmantel
Vertebraria indica Royle

COMPARISON

Plant fossil assemblages from all the three areas show restricted distribution of certain genera (Table 1). *Senothea* sp. is present only in Jagaldagga Area. Ginkgopsid elements i.e. *Saportaea*, *Rhipidopsis* and *Ginkgoites* are characteristic of Tubed flora and *Sphenophyllum* and *Plumsteadia* are recorded only in the assemblage of Sikni Open Cast Mine.

Distribution of plant fossils in different horizons (Nos. I-IV) of Barakar Formation in Jagaldagga and Tubed areas suggests the presence of *Gangamopteris* and *Noeggerathiopsis* alongwith the species of *Glossopteris* in the lower horizons i.e. (I-II). In strict sense such distribution is known to occur in the flora of Karharbari Formation (Maithy 1969) but recent investigations of the plant fossil assemblages from lower and upper Barakar seams of Raniganj Coalfield (Srivastava 1992) indicates that *Gangamopteris*-*Noeggerathiopsis* association which was dominant during Karharbari phase continues to flourish in the flora of lower Barakar seams. However, significant occurrence of *Senothea* sp. in No. II horizon of Jagaldagga and ginkgopsid leaves e.g. *Saportaea*, *Rhipidopsis* and *Ginkgoites* in No. II horizon of Tubed Area indicates regional variation of the flora of Barakar Formation (Maheshwari 1992). The sole representation of *Glossopteris* species in younger horizons (Nos. III & IV) is comparable with the flora known from Upper

Plate 2

- Glossopteris damudica* Feistmantel, large size leaf fragment showing venation pattern. BSIP No.37650. Locality: Sikni Open Cast Mine. Nat. size.
- Gl. indica* Schimper, BSIP No. 37651. Locality: Horizon II, Tubed Area. Nat. size.
- Gl. communis* Feistmantel, leaf fragment showing venation pattern. BSIP No. 37646. Locality: Horizon II, Tubed Area. Nat. size.
- Gl. intermittens* Feistmantel, apical portion of leaf showing dense venation pattern. BSIP No. 37652. Locality: Horizon II, Tubed Area. Nat. size.
- Sphenophyllum churulianum* Srivastava & Rigby, showing six uniform leaves arranged in a symmetrical whorl. BSIP No. 37653. Locality: Sikni Open Cast Mine. Nat. size.

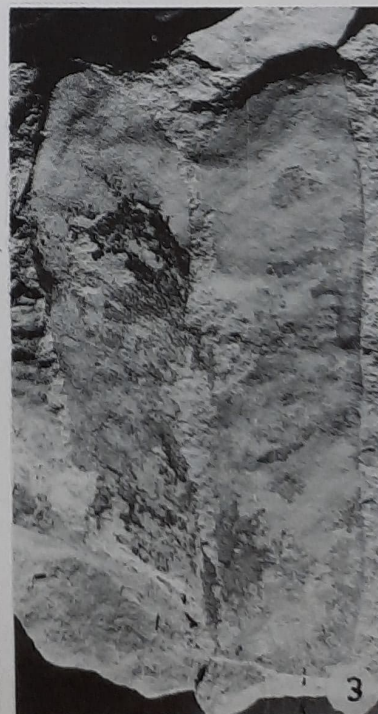
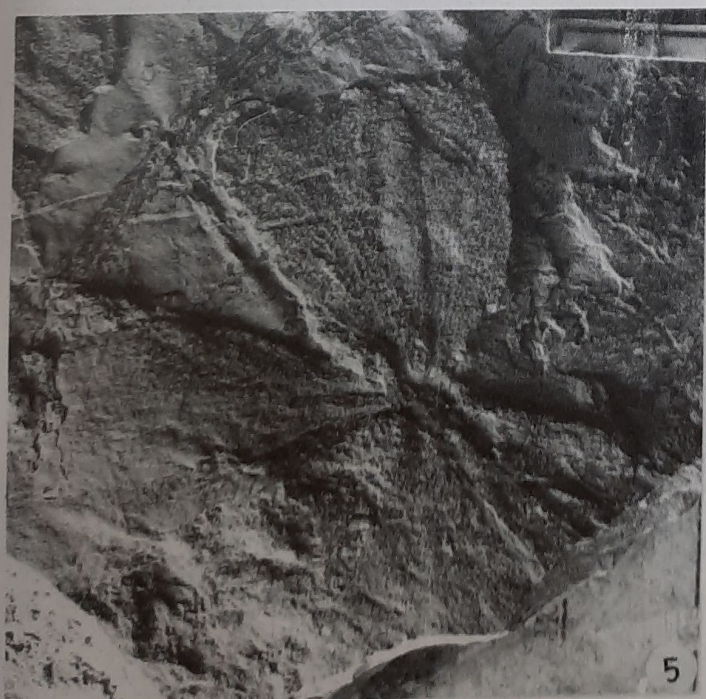
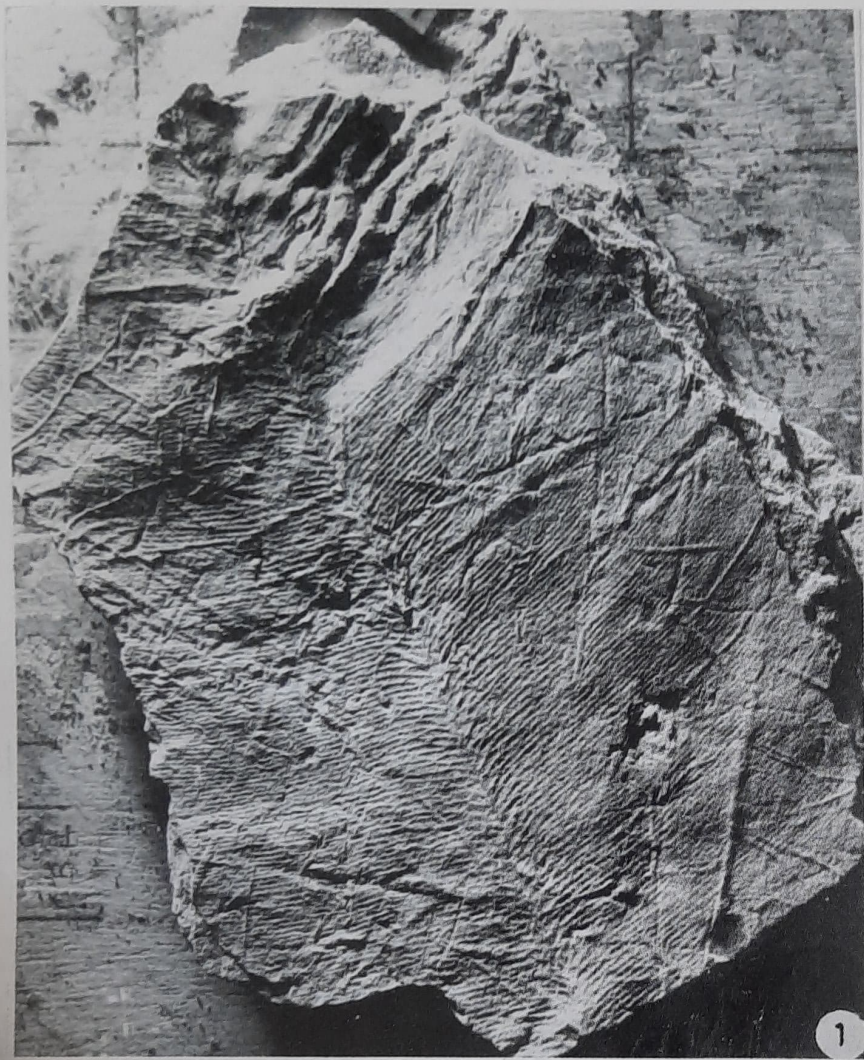


Plate 2

Barakar Formation of Raniganj Coalfield (Srivastava 1992). Similarly, the dominance of *Glossopteris* species alongwith *Sphenophyllum* and *Plumsteadia* in the assemblage of Sikni Open Cast Mine suggests comparison with the flora of Barakar Formation of Raniganj Coalfield and Churia Area of the Auranga Coalfield (Srivastava 1977b, 1978, Srivastava & Rigby 1983).

Table 1: Distribution of floral components in different areas of Auranga Coalfield.

Floral Elements	Jagaldagga Area				Tubed Area				Sikni Open Cast Mine
	Horizon				Horizon				
	I	II	III	IV	I	II	III	IV	
<i>Neomariopteris hughesii</i>						+			+
<i>Sphenophyllum churulianum</i>									+
<i>Sphenophyllum</i> sp.									+
<i>Gangamopteris angustifolia</i>						+			
<i>G. cyclopteroides</i>		+							
<i>G. major</i>		+				+			
<i>Glossopteris angusta</i>		+		+					
<i>G. angustifolia</i>					+	+	+	+	
<i>G. barakarensis</i>						+	+		+
<i>G. browniana</i>							+	+	+
<i>G. churiensis</i>					+	+			+
<i>G. communis</i>		+	+	+	+	+	+	+	+
<i>G. damudica</i>									+
<i>G. decipiens</i>		+	+						
<i>G. indica</i>		+	+	+	+	+	+	+	+
<i>G. intermittens</i>						+	+		+
<i>G. karharbariensis</i>		+							+
<i>G. stenoneura</i>			+						+
<i>G. stricta</i>								+	+
<i>G. taeniodes</i>							+		
<i>G. zeilleri</i>			+	+					
<i>Plumsteadia</i> sp.									+
<i>Senotheca</i> sp.		+							
<i>Noeggerathiopsis hislopii</i>		+							
<i>Ginkgoites huraensis</i>						+			
<i>Rhipidopsis densinervis</i>						+			
<i>Saportaea reniformoides</i>						+			
<i>Vertebraria indica</i>		+	+	+	+	+	+	+	+

CONCLUSION

Floristic analyses of the plant fossils from different Barakar horizons of Jagaldagga and Tubed areas of Auranga Coalfield demonstrate variation and change of flora from older to younger horizons. The recovery of *Gangamopteris*-*Noeggerathiopsis* associated flora in

horizons I & II and sole representation of *Glossopteris* species in horizons III & IV demonstrate successive development of *Glossopteris* dominant flora from lower to upper part of Barakar Formation. Presence of certain genera in each of the three localities quite likely represents the variation of the flora of Barakar Formation in time and space.

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