CHAPTER III

PLANT MEGAFOSILS FROM THE MAITUR MEMBER OF PANCHET FORMATION

IN RANIGANJ COALFIELD, WEST BENGAL
INTRODUCTION

The Nonia Nala Section in the vicinity of Asansol represents one of the best exposures of the Maitur Member of Panchet Formation. It comprises khaki-green shales, greenish-brown mudstones and khaki-green micaceous sandstones. Excepting the occasionally included coaly fragments the beds are characteristically devoid of coal seams. The Maitur rocks in this area conformably overlies the rocks of the Raniganj Formation.

From Maitur (south of north-west branch of Nonia Nala) Feisbmantel (1880-81) described Schizoneura gondwanensis Feismantel, Peocopteris concinna Presl., Cyclopteris pachyrhachis Göppert, Glossopteris indica Schimper, G. communis Feisbmantel, Oleandridium comp. stenoneuron Schenk and Sarraropsis? sp. Out of these Oleandridium comp. stenoneuron Schenk has been described as Taeniopteris (Oleandridium) cf. stenoneuron (Schenk) by Pascoe (1959). According to Bose (1974) and Banerji and Bose (1977) the specimens of Peocopteris concinna, Cyclopteris pachyrhachis and Oleandridium comp. stenoneuron described by Feismantel (1880-81) are of doubtful nature. From the same locality Satsangi and Shah (1970) described a specimen of fertile organ which they assigned to Schizoneura gondwanensis Feismantel. Later, this material has been described as ?cf. Kendostrobus sp. by Banerji and Bose (1977). Satsangi (1973) described ?Dicroidium and Podozamites sp. from the Panchet beds exposed in the north-western branch of Nonia Nala, east of the Kumarpur Village. Satsangi's (1973) ?Dicroidium and Podozamites sp. were subsequently
described as *?Dicroidium/Lepidopteris* and *Podozamites* sp. cf. *P. lanceolatus* Lindley & Hutton respectively by Banerjee and Bose (1977). They also described dispersed fragment of phytoleimma as '?*Lepidopteris* type of cuticle' from the same locality. From the northern branch of Nonia Nala near "Indigo" factory bridge (Dakashindhadka) Banerji and Bose (1977) described *Schizoneura gondwanensis* Feistmantel, *Glossopteris browniana* Brongniart, *G. angustifolia* Brongniart, *G. communis* Feistmantel, *G. conspicua* Feistmantel, *G. retifera* Feistmantel, *Glossopteris* sp. cf. *G. intermedia* Feistmantel, *Macrotaeniopteris* sp. and *Cordaicarpus* sp. According to Chandra and Surange (1979, p. 77) the species *Glossopteris browniana* Brongniart is an Australian one and it is not represented in India. They mentioned that they have referred the Indian specimens, described by various authors as *G. browniana*, to different species to which they belong. However, the specimens from Dakshindhadka described by Banerji and Bose (1977) as *G. browniana* have neither been referred to any other species nor have been considered as *G. browniana* by Chandra and Surange (1979). Thus *G. browniana* described by Banerji and Bose (1977) is a doubtful form. However, Banerji and Bose (1977) compared their specimens with that of Feistmantel (1880-81, pl. 27, fig. 4) and Chandra and Surange (1979) referred this particular specimen of Feistmantel to their new species *Glossopteris pantii*. Thus the specimens of Banerji and Bose (1977) described as *Glossopteris browniana* may belong to *Glossopteris pantii* Chandra & Surange (1979). Satsangi, Chandra and Singh (1968,1972) reported a striate-bisaccate pollen rich
Map 2. Showing the megafossil localities near Asansol, West Bengal.
miofloral assemblage from the Panchet beds of Kumarpur. A detailed account of qualitative and quantitative analysis of the miofloras of these beds has been published by Maheshwari and Banerji (1975). The miofloral assemblage is dominated by striate-bisaccate pollen grains in association with quantitatively significant and well diversified trilete spores. The monosaccate form, Playfordiaspora, is a characteristic element in this assemblage. Other significant taxa are Punctatisporites, Verrucosisporites, Indotriradites (Decisporis), Lundbladispora, Densoisporites, Falcisporites, Platysaccus and Lunatisporites. Maheshwari and Banerji (1975) also described megaspores from these beds. The megaspore assemblage is represented by species of Banksisporites, Biharisporites, Virrutrilletes (Jhariatriletes), Pantiella, Srivastavaesporites, Talchirella, Maiturisporites and ?Nathorstisporites.

The whereabouts of the Maitur locality in this region (wherefrom Feistmantel, 1980-81, described plant remains) is now not known as mentioned earlier by Banerji and Bose (1977). Plant megafossilis have been recovered from Kumarpur by Satsangi (1971, 1973) and from Dakshindhadka by Banerji and Bose (1977). Regarding the Maitur locality Feistmantel (1880-81) mentioned south of North North-West branch of Nonia Nala. A detailed traverse in the area reveals that Feistmantel's 'Maitur' and Satsangi's 'Kumarpur' are one and the same locality, no other plant fossil locality has been found along the south of north-west branch of Nonia Nala. Present work is based on the collection of plant megafossils from the two localities (Map - 2) of Panchet Formation in the
TEXT-Figure 1
Text-figs. 1A-B. *Trizygia speciosa* Royle, from Kumarpur. A. Specimen no. K/7(c). X 2.


Nonia Nala Section - i) North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kamurpur village (23°42'15" N: 86°57'22" E) and (ii) Northern branch of Nonia Nala, near "Indigo" factory, Dakshindhadka (23°43'24" N: 86°59'25" E). In both the localities plant megafossilis are preserved in the khaki-green shales in the form of brown or brownish-grey impressions and totally devoid of carbonaceous matter. The fossiliferous shales are fine-grained and the impressions are quite satisfactory. In addition to some of the previously described forms (Feistmantel, 1880-81; Satsangi, 1973; Banerji and Bose, 1977) the present collection includes some elements which were hitherto unknown from these localities and those are described here.

**DESCRIPTION**

**PLANT MEGAFOSSILS FROM THE PANCHET BEDS OF KUMARPUR LOCALITY**

**PTERIDOPHYTA**

**SPHENOPSIDA**

Genus - *Trizygia* Royle 1839

*Trizygia* speciosa Royle 1839

Pl. 1, figs. 1-3; Text-figs. 1A-B

DESCRIPTION - In the present collection this taxon is represented by altogether twelve specimens, some of which are with both parts and counterparts. Maximum available length is 3.4 cm, broken at both ends. Stem is differentiated into nodes and internodes. Internodes are 0.5-1.0 mm wide with a distinct median ridge. Nodal region is slightly
swollen, bearing a whorl of 6 leaves. Leaves in a whorl are in 3 distinct pairs - two pairs of larger leaves and a third pair of smaller leaves. Leaves are of ovate-spathulate in shape, sessile and constricted at base. Larger leaves are 1.1 - 1.3 cm long and 0.5 - 0.8 cm wide at the broadest region and smaller ones are 0.5 - 0.9 cm x 0.3 - 0.6 cm. All the leaves have entire margins and rounded apices. A single vein enters the leaf base, then forks two to four times and approaches freely towards lateral sides as well as distal margin without any anastomoses.

LOCALITY - North-western branch (northern bank) of Nonia Nala about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON and AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - Trizygia speciosa occurs abundantly in the underlying Raniganj Formation (Upper Permian). Bose and Banerji (1976) have described it from the Panchet Formation of Koel Valley Basin. Its occurrence in the Panchet rocks of Damodar Valley Basin is hereby recorded for the first time.

FILICOPSIDA

Genus - Neomariopteris Maithy 1974

Neomariopteris hughesii (Zeiller) Maithy 1974

Pl. 1, figs. 5-6 ; Text-figs. 2A-B

DESCRIPTION -(Fronds of Neomariopteris hughesii are known to be at least tripinnate. However, the present collection includes four fragmentary specimens out of which one shows the bipinnate nature and the rest are ultimate pinna-fragments broken at bases) Secondary rachis is 1.0-1.5 mm wide, narrowly winged. Pinnae are subopposite, arising at more or less
TEXT-Figure 3
right angles, lanceolate in shape. Pinna-rachis is 0.3 mm wide, winged. Pinnules are alternate to subopposite, arising at angles of 45-60° (angle of emergence gradually diminishing towards the pinnae apex), typically lanceolate in shape (basiscopic basal pinnule somewhat ovate), 4-7 mm long and 2-4 mm broad. Towards pinna apex pinnules are gradually becoming smaller and relatively slender, apical pinnules are imperfectly differentiated. Acroscopic basal margin of pinnule is slightly constricted, basiscopic basal margin is decurrent and contiguous with the acroscopic basal margin of the pinnule lying below. Lateral margins of pinnule are entire, sometimes undulated. Pinnule apex is acute or subacute. Each pinnule is supplied by a single midvein, little zig-zag in course and becoming evanescent near apex. Lateral veins are alternate, once or twice forked.

**LOCALITY** - North-western branch (north/bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

**HORIZON AND AGE** - Maitur Member, Panchet Formation; Lower Triassic.

**REMARKS** - The specimens in all available features resemble those of *Neomariopteris hughesii* (Zeiller) Maithy (1974a) described from the Barakar and Raniganj formations. Hereby the taxon has been first time recorded from the Panchet Formation of Peninsular India.

*Neomariopteris lobifolia* (Morris) Maithy 1974

Pl. 1, fig. 4; Text-fig. 3

**DESCRIPTION** - (According to Maithy (1974a), the fronds of *Neomariopteris lobifolia* are "probably tripinnate". However, all of the three specimens
in the present collection are bipinnate in nature and broken at both ends."
Maximum available length is 3 cm. Rachis is ±0.5 mm wide, gradually
narrowing distally, winged. Pinnae are alternate to sub-opposite, arising
at an angle of ± 60°. Individual pinna is linear-lanceolate in shape,
typically 1.5 cm long. Pinna-rachis is 2-3 mm wide, winged. Pinnules are
alternate to subopposite, arising at an angle of 40-50°, more or less
ovate in shape, 4-6 mm long and 2.5-3.5 mm wide. Towards pinna apex
pinnules are gradually becoming smaller and lanceolate. Acroscopic basal
margin of the pinnule is constricted and the basiscopic basal margin is
decurrent. Lateral margins are entire, sometimes irregularly lobed.
Pinnule apex is typically obtuse. Each pinnule is supplied by a single
median vein, zig-zag in course and becoming evanescent near apex. Lateral
veins are alternate to sub-opposite, once forked or unforked.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about
1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimens characteristically resemble those of
Neomariopteris lobifolia (Morris) Maithy (1974a) described from the
Raniganj Formation (Upper Permian). Bose, Banerjee and Maithy (1977)
described a specimen, as Neomariopteris sp. cf. N. lobifolia (Morris)
Maithy, from a horizon of the Ramkola-Tatapani Coalfield (Madhya Pradesh)
which they assigned to the Panchet Formation with a query mark. Present
account is not only the first record of N. lobifolia in the Panchet
Formation of Damodar Valley Basin but also it proves the definite
occurrence of this species in the early Triassic of Indian Peninsula.
Genus - *Dichotomopteris* Maithy 1974

*Dichotomopteris lindleyii* (Royle) Maithy 1974

Pl. 1, fig. 7; Text-fig. 4

DESCRIPTION - The solitary specimen is a sterile frond, bipinnate in nature and broken at base. Available length is 2.7 cm. Rachis is 0.5 - 0.75 mm wide bearing subopposite pinnules. Pinnules are arising at an angle of ± 45° and typically oblong-lanceolate in shape, 1.2 - 1.8 cm long and 3-4 cm broad at the widest region. Acroscopic basal margin of pinnule is straight, basiscopic basal margin is decurrent and contiguous with the adjacent one. Lateral margins of pinnule are shallowly lobed to straight. Pinnule apex is subacute. Midrib is distinct upto 3/4 distance and then becoming evanescent. Lateral veins dichotomise once or twice.

LOCALITY - North-western branch (northern bank) of Nonia Nala about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - *Dichotomopteris lindleyii* is known from the Raniganj Formation (Maithy 1974b, 1975). The specimen described above is fragmentary in nature, however, it resembles the sterile fronds of *D. lindleyii* described by Maithy (1974b, 1975) in all available gross features and venation pattern of pinnules.

*Dichotomopteris ovata* Maithy 1977

Pl. 1, figs. 8-9; Text-fig. 5

DESCRIPTION - The taxon is represented in the present collection by altogether four specimens out of which one depicts the bipinnate nature of
the frond and the rest are pinna-fragments broken at their bases. Primary rachis is 0.4 mm wide, gradually tapering distally, narrowly winged. Pinnae are alternate to subopposite, more or less at right angles, lanceolate in shape. Maximum available length of pinna is ± 2.1 cm. Pinna-rachis is ± 2 mm wide, narrowly winged. Pinnules are alternate, attached at angles of ± 40°, ovate in shape, typically 6 x 4 mm. Acroscopic basal margin of pinnule is straight and basiscopic basal margin is decurrent. Lateral margins are entire, apex rounded. Terminal pinnules are relatively shorter and broader with broadly acute apex. Each pinnule is supplied by a single median vein, flexous, distinct upto 1/2 - 3/4 of the pinnule length and then becoming evanescent in apical region. Lateral veins are more or less alternate, dishotomising once or twice.

LOCALITY  - North western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation ; Lower Triassic.

REMARKS  - In all available features the specimens resemble those of Dichotomopteris ovata described by Maithy (1977) from Raniganj Formation of Pachwara Coalfield, Rajmahal Hills. So far, D. ovata was known from Barakar and Raniganj formations and its occurrence in the Triassic (Panchet Formation) is hereby recorded for the first time.
TEXT-FIGURE 6
GYMNOSPERMS
GLOSSEOPTERIDALE
GLOSSEOPTERIDACEAE

Genus - Glossopteris Brongniart 1828

Glossopteris angustifolia Brongniart 1830
Pl. 1, figs. 10-11 ; Text-figs. 6A-B

DESCRIPTION - This species is represented in the present collection by altogether twelve specimens, none of which depicts a complete leaf. A few specimens represent the basal part of the frond and a single specimen depicts the leaf apex. Largest available length of the leaf-fragments is 7.5 cm and maximum available width is 1.5 cm. From the fragments representing various regions the estimated total length of the leaf appears to be 11 - 12 cm and the shape appears to be linear. Leaf base is acute-cuneate, margins are entire and apex is obtuse. Midrib is rather broad and gradually narrowing towards apex. Secondary veins arise at acute angles (20-30°), after a small distance from the midrib arch outwards, meeting the margins at an angle of 45°. Secondary veins dichotomise and anastomose forming narrowly elongated polygonal meshes. In course of a lateral vein, usually two complete meshes are formed, meshes are more or less same in size throughout the lamina, 3-4 mm long and about 0.5 mm wide. Concentration of veins near midrib is 12-14 /cm and near margin is 18-20 /cm.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan district, West Bengal, India.
TEXT-Figure 7
HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimens in form and venation pattern resemble those of *Glossopteris angustifolia* described by Brongniart (1828), Bose and Banerji (1976), Banerji and Bose (1977), Banerjee (1978) and Chandra and Surange (1979) from the Permo-Triassic deposits of Peninsular India. *G. angustifolia* has earlier been described from the northern branch of Nonia Nala near the "Indigo" Factory bridge by Banerji and Bose, 1977. However, its occurrence in the Kumarpur locality was not known so far.

*Glossopteris conspicua* Feistmantel 1880

Pl. 1, fig. 13 ; Text-fig. 7

DESCRIPTION - This species in the present collection is represented by a single specimen with both part and counterpart, broken at both ends. Length of the leaf fragment is 13.2 cm and it is 4 cm wide at the broadest region. Midrib is about 2 mm broad, very gradually tapering towards the apex. Secondary veins arising from the midrib are at an angle of about 45° and travel straight to the margin, forming large, broad, polygonal or hexagonal meshes (6.0 x 1.5 mm - 7.0 x 1.75 mm). Concentration of veins near midrib is 5-6/cm and that near margin is 8-9/cm.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimen in all available features is closely comparable with those of *Glossopteris conspicua* described earlier by Feistmantel
TEXT-Figure 8
from the Raniganj Formation and Banerji and Bose (1977) from the Panchet beds of northern branch of Nonia Nala near "Indigo" Factory (Dakshindhadka).

**Glossopteris intermedia** Feistmantel 1880

*Pl. 1, fig. 12; Text-fig. 8*

**DESCRIPTION** - This species is represented by three specimens and all are broken at both ends. Maximum available length is 7.7 cm and maximum available width is 3.7 cm. Margins are entire, midrib is distinct, more or less broad (2.0 - 2.5 mm) and gradually narrowing towards apex. Secondary veins are arising at angles at 35-40°, travel almost straight to the margin or rarely arching slightly. Mesheś are large, broad, elongated-polygonal in shape and more or less uniform in size throughout the lamina (5.0 - 5.25 mm X 1.0 - 1.25 mm). Concentrations of veins are 6-7/cm near midrib and 8-9/cm near margin.

**LOCALITY** - North-western branch (northern bank of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

**HORIZON AND AGE** - Maitur Member, Panchet Formation; Lower Triassic.

**REMARKS** - The specimens in all available features resemble those of *Glossopteris intermedia* described earlier by Feistmantel (1880-81) and Maheshwari (1965) from the Raniganj Formation. Banerji and Bose (1977) described a specimen from the Panchet rocks exposed near the "Indigo" Factory bridge (Dakshindhadka) as *Glossopteris* sp. cf. *G. intermedia*. Later Chandra and Surange (1979) considered it as *G. intermedia*. The present account is the first record of the species from the Kumarpur locality.
Glossopteris retifera Feistmantel 1880
Pl.2, fig. 1-3; Text-figs. 9A-C

DESCRIPTION - The present collection includes altogether thirty specimens, majority of them are broken at both ends. In some specimens apical portions or basal portions are preserved. Maximum available length is 7 cm and maximum available width is 3.8 cm at the broadest region. Apex is acute, base is obtuse cuneate, margins are entire. Midrib is distinct, maximum width of the midrib near base is 2.5 mm, very gradually attenuates upwards. Secondary veins arise at an angle of ±45°, dichotomising just after emergence or little away from the midrib, anastomosing and forming pentagonal or hexagonal meshes which are almost straight or very gently curved from midrib to margin. Meshes are broad near midrib (5.0 x 1.25 mm - 6.5 x 2.0 mm) and markedly becoming narrower and shorter towards the margin. Concentration of veins is 4-6/cm near midrib and 8-10/cm near margin.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimens in form and venation pattern resemble those of Glossopteris retifera described by earlier authors from the Permo-Triassic deposits of India (Feistmentel, 1880-81; Srivastava, 1957; Maheshwari and Prakash, 1965; Banerji, Maheshwari and Bose, 1976; Bose, Banerji and Maithy, 1977; Banerji and Bose, 1977 and Chandra and Surange, 1979).
TEXT-Figure 10
Banerji and Bose (1977) described a fragmentary specimen of *G. retifera* from the Panchet beds exposed on the northern branch of Nonia Nala, near "Indigo" factory bridge (Dakshindhadha). Its occurrence in the Panchet locality of the north-western branch of Nonia Nala, east of Kumarpur is hereby recorded for the first time.

**Glossopteris gopadensis** Banerji, Maheshwari & Bose, 1976

Pl. 2, fig. 4; Text-fig. 10

DESCRIPTION - The solitary specimen is 3.5 cm long and 1.5 cm wide, broken at both ends. Midrib is 1.25 mm wide near the basal region and gradually tapering near the apical region. Lateral margins are entire. Secondary veins arise at an angle of 50° with gentle arching and meet the margins at an angle of 65°. Meshes are dense, narrowly elongated (1.7 x 0.4 mm near midrib). Concentration of veins near midrib is 16-18/cm and that near the margin is 20-25/cm.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimen described above in form and venation pattern resembles the holotype of *Glossopteris gopadensis* described by Banerji, Maheshwari and Bose (1976) from the Triassic beds of Gopad River Section in the South Rewa Gondwana Basin. The species has been recorded hereby from the early Triassic of Damodar Valley.
TEXT-Figure 11
**Glossopteris taeniensis** Chandra & Surange 1979

Pl. 2, figs. 5-6; Text-figs. 11A-B

**DESCRIPTION** - Out of the five specimens assignable to this species one depicts the apex, another represents the basal region and the rest are broken at both ends of the leaf. Maximum available length is 2.5 cm and the width is 1 cm at the broadest portion. Overall shape of the leaf appears to be obovate, the base is acute-cuneate and the apex is obtuse. Midrib is slender, less than 1 mm in width near the base, gradually attenuates towards apex. Margins are entire. Secondary veins arise at an angle of about 45°, forming oblong-polygonal meshes (2.5 x 0.75 mm near midrib), becoming slightly shorter and narrower near leaf margin. Concentration of veins near the midrib is 10-12/cm and that near margin is 14-16/cm.

**LOCALITY** - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

**HORIZON AND AGE** - Maitur Member, Panchet Formation; Lower Triassic.

**REMARKS** - The species *Glossopteris taeniensis* has been instituted by Chandra and Surange (1979) and the specimen from the Karharbari stage of South Karampura Coalfield described by Kulkarni (1971, Pl. 1, fig. 7) was designated by the authors as the holotype of the taxon. The authors also included *Glossopteris browniana* described by Banerji, Maheshwari and Bose (1976) from the Triassic beds of Gopad River Section in the synonomy of *Glossopteris taeniensis*. The present specimens are closely comparable
TEXT-Figure 12
with those of G. taeniensis (Chandra and Surange 1979). This species has not been reported earlier from the Panchet rocks of Damodar Valley Basin.

Glossopteris sp. cf. G. dhenkanalensis Singh and Chandra 1987
Pl. 2, fig. 7; Text-fig. 12;...

DESCRIPTION - The solitary specimen is broken at the basal region. Available length of the specimen is 4.6 cm and width is 2.4 cm at the broadest region. Midrib is distinct, about 0.5 mm wide. Leaf apex is broad and pronouncedly emarginate. Secondary veins arising at an angle of more than 45° and travel to the margin with very gentle arches, at the apical emarginate part secondary veins bend inwards. Meshes are more or less broad, oblong polygonal (3-3.5 mm x 1.75 mm). Concentration of veins is 8-10/cm near midrib and 10-12/cm near margins.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District; West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - Glossopteris dhenkanalensis has been described only from the Kamthi Formation of Handapa, Orissa (Singh and Chandra, 1987). The specimen from the Panchet beds of Kumarpur, in its venation pattern and character of leaf apex resembles that of G. dhenkanalensis Singh & Chandra (1987). However, the leaf from Kumarpur appears to be much larger than that from Handapa. In view of this as well as for its fragmentary
TEXT-Figure 13
Text-fig. 13A. Scale leaf Type-A, from Kumarpur. Specimen no. K/73. X 2.

Text-fig. 13B. Scale leaf Type-B, from Kumarpur. Specimen no. K/26. X 3. 5.
nature; the specimen from Kumarpur has been described as *Glossopteris* sp. cf. *G. dhenkanalensis* Singh & Chandra 1987.

**Scale leaf : Type - A**

Pl. 2, fig. 8; Text-fig. 13A

**DESCRIPTION** - Scale leaves are somewhat rhomboidal in shape with subacute apex and measuring 0.75-1.6 cm in length and 0.9-1.6 cm in width. Veins are numerous, dichotomising and forming elongate meshes.

**LOCALITY** - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

**HORIZON AND AGE** - Maitur Member, Panchet Formation; Lower Triassic.

**REMARKS** - The above described scale leaves are comparable with the laminar part of *Eretmonia* du Toit 1932 which is a common element in the Lower Gondwana formations. Similar type of scale leaves have been described earlier by Banerji, Maheshwari and Bose (1976, scale-like leaf-type 1) from the Lower Triassic of Gopad River Section, Madhya Pradesh.

**Scale leaf : Type - B**

Pl. 2, fig. 9; Text-fig. 13B

**DESCRIPTION** - Solitary specimen with its counterpart is 1.3 cm long and 0.3 cm wide, broken at base. Shape appears to be linear-lanceolate. Margins are entire and the apex is acute-cuneate. Veins are dichotomising and anastomosing, forming elongated very fine meshes.

**LOCALITY** - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.
Text-fig. 14A. Scale like organ, from Kumarpur. Specimen no. K/185. X 2.

Text-fig. 14B. Cupulate seed like organ, from Kumarpur. Specimen no. K/23. X 3.
HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - This isolated scale like or bract like organ is comparable with *Gondwanolepis* Banerjee (1984) known from the Permian strata of India.

Scale like organ

Pl.2, fig. 10; Text-fig. 14 A

DESCRIPTION - Forked scale like organ is somewhat semi-circular in shape with a deep apical notch, measuring 0.75 - 0.8 cm. Veins are obscure.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The above described forked scale like organ is comparable with *Mahudaeaa* Banerjee (1984) from the Lower Gondwana rocks of India.

Cupulate seed like organ

Pl. 2, fig. 11; Text-fig. 14 B

DESCRIPTION - The specimen is an impression of single seeded cupulate structure, 1.4 cm long and 0.9 cm wide and is with a more or less slender stalk.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimen described here is comparable with *Rusangea* Lacey, Dijk & Gordon-Gray (1975).
PELTASPERMALES

PELTASPERMACEAE

Genus - Lepidopteris Schimper 1869

Lepidopteris sp.

Pl. 2, fig. 12; Text-fig. 15

DESCRIPTION - Frond is bipinnate and broken at both ends. Principal rachis is ± 1.5 mm broad bearing subopposite pinnae. Pinnae are lanceolate in shape, 1.0-1.2 cm long and 3-4 mm wide. Pinna rachis is 0.5-1.0 mm broad, bearing subopposite pinnules at angles of ±60°. Pinnules are 1.5-2.0 mm long and 0.5-1.0 mm broad, oblong to ovate in shape and are attached by their broad bases. Margins of the pinnules are entire and apices. Each pinnule is supplied by a midvein distinct up to apex, lateral veins are indistinct.

LOCALITY - North-western branch (northern bank) of Nonia Nala, about 1.6 km east of Kumarpur Village, Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The above description is based on a single specimen. In gross features the specimen resembles Lepidopteris sp. described by Bose, Banerji and Maithy (1977) from the Lower Triassic of Ramkola-Tatapani Coalfield, Madhya Pradesh. The present specimen is also comparable with Lepidopteris martinsii (Kurtze) Townrow, described from the Permian of Europe and America (Townrow, 1960) and with some smaller forms of Lepidopteris madagascariensis Carpentier, described from the Triassic of Australia (Townrow, 1960) and Tiki Formation of India (Pal, 1984b).
Text-fig. 16. *Glossopteris indica* Schimper, from Dakshindhadka. Specimen no. D/51. X 1.5
Presence of 'lumps' over the rachis is one of the distinguishing features of the genus Lepidopteris and no such 'lump' is visible in the present specimen. However, it may be noted that some fronds of Lepidopteris have been found which are either with a few low 'lumps' only near the leaf base (the portion which is missing in the Kumarpur specimen) or the rachis is totally devoid of any 'lump' (Townrow, 1960; Pal, 1984b). Moreover, the present specimen is not comparable with any known Permo-Triassic form other than Lepidopteris. Therefore, the specimen has been described here as Lepidopteris sp. Dispersed cuticular fragment similar to those of Lepidopteris, with overhanging cutinized papillae around stomatal pits has been described earlier from this locality by Banerji and Bose (1977).

PLANT MEGAFOSILS FROM THE PANCHET BEDS OF DAKSHINDHADKA LOCALITY

GYMNOSPERMS

GLOSSOPTERIDALES

GLOSSOPTERIDACEAE

Glossopteris indica Schimper 1869

Pl. 2, fig. 13; Text-fig. 16

DESCRIPTION - The present collection includes altogether eleven specimens, mostly incomplete leaves. However, in some specimens apices or bases are preserved. Maximum available length of the leaf is 11 cm and maximum available width is 4 cm (measured at the broadest region). Apex is acute, base is acute-normal and margins are entire. Midrib is wide and stout, maximum width of the midrib near base is 3-4 mm, tapering towards
the apical region. Secondary veins arise from the midrib at an angle of ±40° and travel towards the margin with a gentle curve. Secondary veins near base as well as apex are steeper, running almost parallel to midrib upto certain distance then arching towards the margin. Meshes near midrib are shorter and broader (3.0 x 0.5 mm - 5.0 x 0.75 mm), whereas, near margin those are relatively narrower. Meshes are pentagonal or hexagonal. Concentration of veins is 10-12/cm near midrib and 18-26/cm near margin.

LOCALITY - Northern branch of Nonia Nala, near "Indigo" factory (Dakshindhadka), Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - The specimens described above resemble the specimens of Glossopteris indica Schimper figured by Feistmantel (1880-81) Maheshwari and Prakash (1965); Kulkarni (1971); Bose and Banerji (1976); Bose, Banerji and Maithy (1977) and Chandra and Surange (1979) from various Permo-Triassic formations of India. It may be noted that the leaves assigned to G. indica from various strata though possess a constancy in form and venation pattern but differ considerably in size. The leaves described from the Triassic horizon, including the present specimens, have been found to be considerably smaller in size than those recovered from the underlying Permian strata. Specimens of G. indica have been described earlier by Feistmantel (1880-81) from the Kumarpur (Maitur) locality. Occurrence of this species in the Dakshindhadka locality also is recorded hereby.
Text-fig. 17. *Glossopteris emarginata*
Maheshwari & Prakash, from Dakshindhadha.
Specimen no. D/50. X 2.
**Glossopteris emarginata** Maheshwari & Prakash 1965

Pl. 2, fig. 14; Text-fig. 17

**DESCRIPTION** - In the present collection this species is represented by a solitary specimen broken near the base. The specimen is 6 cm long and 2.5 cm wide at the broadest region. Apex is distinctly retuse. Midrib is moderately broad and stout, persistent, gradually tapering towards the apex, having a breadth of 1 mm at the broadest region. Leaf margin is entire. Secondary veins arising from the midrib are at an angle of 45° and travel straight to the margin, forming more or less narrow, elongated meshes (typically 3.0 x 0.4 mm). Concentration of veins is 16-20/cm near midrib and that near margin is 20-40/cm.

**LOCALITY** - Northern branch of Nonia Nala, near "Indigo" factory (Dakshindhadka), Asansol, Burdwan District, West Bengal, India.

**HORIZON AND AGE** - Maidur Member, Panchet Formation; Lower Triassic.

**REMARKS** - The specimen, in all available features resembles *Glossopteris emarginata* Maheshwari & Prakash (1965) described from the Raniganj Formation of Bansloi Valley, Rajmahal Hills, Bihar and the present work proves the occurrence of this species in the Panchet Formation as well.

**Glossopteris tenuifolia** Pant & Gupta 1968

Pl. 2, fig. 15; Text-fig. 18

**DESCRIPTION** - Solitary specimen representing this species is broken at both ends. The specimen is 8.5 cm long, 3 cm wide at the broadest region. Midrib is ±1.5 mm wide, persistent but gradually tapering
Text-fig. 18. Glossopteris tenuifolia Pant & Gupta, from Dakshindhadka. Specimen no. D/31. X 1.5.
upwards. Secondary veins arising at an angle of ±30° are gently arched, meeting the margins at angles of about 40°. Meshes are very long and narrow, more or less fusiform in shape (typically 8.0 x 0.5 mm near midrib). Concentration of veins near midrib is 12-16/cm and near margin is 18-24/cm.

LOCALITY - Northern branch of Nonia Nala, near "Indigo" factory (Dakshindhadka), Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - Glossopteris tenuifolia, as instituted by Pant and Gupta (1968) was based on both morphographic as well as cuticular features. Later on, Chandra and Surange (1979) opined that the species is morphographically quite distinct. The present specimen, though preserved as impression, in all available morphographical details resembles those of G. tenuifolia described earlier by Pant and Gupta (1968) and Chandra and Surange (1979) from the Raniganj Formation. G. tenuifolia is hereby recorded first time from the Lower Triassic horizon of India.

Glossopteris hinjridaensis Singh & Chandra 1987
Pl. 2, fig. 16; Text-fig. 19

DESCRIPTION - The present collection includes a specimen with both part and counterpart showing a complete leaf assignable to Glossopteris hinjridaensis Singh & Chandra. The leaf is 5.2 cm long. It is widest at the distance of 4.7 cm from the very base where it is about 7 mm broad, then tapering gradually to a width of 1.3 mm at laminar base and tapering a little towards apex. The overall shape of the leaf is thus
Text-fig. 19. *Glossopteris hinjridaensis*
oblanceolate. Leaf base is somewhat pulvinus and laminar base is acute cuneate. Leaf margins are entire and the apex is emarginate. Midrib is distinct right up to the apex, about 0.8 mm wide near base and very gradually attenuating upwards. Lateral veins are rather thin, arising at acute angles (10-15° near base; 35-40° near the middle region of lamina) and arching a little towards leaf margins. Lateral veins bifurcate and form narrow elongated polygonal meshes (typically 3.5 x 0.5 mm). Number of meshes vary from 2-3 during the course of lateral veins from midrib to margin. Concentration of veins close to the midrib is 12-15/cm and that near margin is 18-26/cm.

DISCUSSION -

*Glossopteris hinjridaensis* was instituted by Singh and Chandra (1987) based on a few specimens from the Kamthi rocks of Dhenkanal district, Orissa. The present specimen from the Panchet Formation agrees with those of Singh and Chandra (1987) in all available features. However, the Panchet specimen is an impression of a complete frond. Singh and Chandra's (1987) accounts are based on altogether five specimens, none of which depicts the basal portion of the leaf; their largest figured specimen is about 3.8 cm in length and they estimated the total length of the leaf as 5-7 cm and the overall shape as oblanceolate to narrow oblanceolate. Nevertheless, the complete leaf from the present collection corroborates the estimation of Singh and Chandra (1987) about the total length and overall shape of the frond. However, due to fragmentary nature of their specimens the authors failed to describe the feature of the leaf base and detail of venation patterns at various levels of the frond. An emended diagnosis of the taxon is therefore given here.
Emended diagnosis - Leaf small, narrowly oblanceolate, broadest at about 8/9 distance from the base, leaf base somewhat pulvinus, lamina base acute-cuneate, margin entire, apex emarginate; midrib distinct up to apex, moderately thick, very gradually tapering upwards; lateral veins rather thin, arising at acute angles (10-15° near base and 35-40° near the widest region of the lamina), arching very little towards margin; lateral veins bifurcating and forming narrow and elongated polygonal meshes; number of meshes varying from 2-3 during the course of lateral veins from midrib to the margin; concentration of veins 12-15/cm near midrib and 13-20/cm near margin.

LOCALITY - Northern branch of Nonia Nala, near "Indigo" factory (Dakshindhadka), Asansol, Burdwan District, West Bengal, India.

HORIZON AND AGE - Maitur Member, Panchet Formation; Lower Triassic.

REMARKS - Glossopteris hinjridaensis was so far known only from the Kamthi formation of Handapa, Orissa and hereby the species has been recorded from the Panchet rocks (Lower Triassic) of Asansol region.

DISCUSSION

& Hutton, and Samaropsis sp. Out of these Pecopteris concinna, Cyclopteris pachyrhachis and Taeniopteris (Oleandridium) cf. stenoneuron are doubtful forms (Banerji and Bose, 1977). In the present thesis additional forms described from this locality are Trizygia speciosa Royle, Neomariopteris hughesii (Zeiller) Maithy, N. lobifolia (Morris) Maithy, Dichotomopteris lindleyii (Royle) Maithy, D. ovata Maithy, Glossopteris angustifolia Brongniart, G. conspicua Feistmantel, G. intermedia Feistmantel, G. retifera Feistmantel, G. gopadensis Banerji, Maheshwari & Bose, G. taeniensis Chandra & Surange, Glossopteris sp. cf. G. dhenkanalensis Singh & Chandra and Lepidopteris sp. in addition to a few types of glossopterid scale-leaves, a scale like organ and a cupulate seed like organ. Thus the overall assemblage so far recorded from the Panchet beds of Kumarpur comprises Trizygia speciosa Royle, Schizoneura gondwanensis Feistmantel, Neomariopteris hughesii (Zeiller) Maithy, N. lobifolia (Morris) Maithy, Dichotomopteris lindleyii (Royle) Maithy, D. ovata Maithy, Glossopteris angustifolia Brongniart, G. indica Schimper, G. communis Feistmantel, G. conspicua Feistmantel, G. intermedia Feistmantel, G. retifera Feistmantel, G. gopadensis Banerji, Maheshwari & Bose, G. taeniensis Chandra & Surange, Glossopteris sp. cf. G. dhenkanalensis Singh & Chandra, Lepidopteris sp., ?Dicroidium/Lepidopteris and Pondozamites sp. cf. P. lanceolatus Lindley & Hutton. Among these, as observed in the field, Glossopteris and Schizoneura are the most abundantly occurring forms followed by Trizygia and neomariopteroid ferns. Out of the species of Glossopteris, G.
retifera, G. communis, G. angustifolia and G. indica are more frequently met with than other species. Lepidopteris, Dicroidium and Podozamites are extremely rare in occurrence.

From Dakshindhadka locality forms described earlier (Banerji & Bose, 1977) are Schizoneura gondwanensis Feistmantel, Glossopteris angustifolia Brongniart, G. browniana Brongniart, G. communis Feistmantel, G. conspicua Feistmantel, Glossopteris sp.cf. G. intermedia Feistmantel, G. retifera Feistmantel, Macrotaeniopteris sp. and Cordaicarpus sp. in addition to a fragment of Lepidopteris-type phytoleimma. Out of these identity of Glossopteris browniana is doubtful as has already been discussed (please see page 25). In the present work a few additional species of Glossopteris viz., G. indica Schimper, G. tenuifolia Pant & Gupta, G. emarginata Maheshwari & Prakash and G. hinjridaensis Singh & Chandra have been described. Thus the overall assemblage so far known from the Panchet beds of Dakshindhadka locality is represented by Glossopteris angustifolia Brongniart, G. indica Schimper, G. communis Feistmantel, G. conspicua Feistmantel, G. intermedia Feistmantel, G. retifera Feistmantel, G. tenuifolia Pant & Gupta, G. emarginata Maheshwari & Prakash, G. hinjridaensis Singh & Chandra, Macrotaeniopteris sp., Cordaicarpus sp. and Lepidopteris sp. Like the Kumarpur assemblage the Dakshindhadka one is also dominated by Glossopteris and Schizoneura. However, at Dakshindhadka Trizygia, ferns and Podozamites have not yet been met with and the presence of Lepidopteris is indicated only by a cuticular fragment.
### Table 14. Megafloral assemblages recorded by different authors from the Maitur Member of Panchet Formation in Ramiganj Coalfield, West Bengal.

#### Kumarpur locality —

<table>
<thead>
<tr>
<th>Peistmantel (1880–81)</th>
<th>Satsangi (1973)</th>
<th>Banerji and Bose (1977)</th>
<th>Additional forms described in the present thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schismoneura condamensis</td>
<td>Podocarpites sp.</td>
<td>Podosamites sp.</td>
<td></td>
</tr>
<tr>
<td>Pecopteris concinna</td>
<td>Pecopteris concinna</td>
<td>Pecopteris concinna</td>
<td></td>
</tr>
<tr>
<td>Cyclopteris pachyrhachis</td>
<td>Cyclopteris pachyrhachis</td>
<td>Cyclopteris pachyrhachis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Lepidopteris type cuticle</td>
<td>Lepidopteris type cuticle</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
<tr>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td>Glossopteris communis</td>
<td></td>
</tr>
</tbody>
</table>
| Glossopteris communis | Glossopteris communis | Glossopteri