SOME FOSSIL PLANT REMAINS FROM RAMKOLA-TATAPANI COALFIELD, MADHYA PRADESH

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ABSTRACT

The paper describes some fragmentary plant remains from three different localities in the Ramkola-Tatapani Coalfield region. Out of these, viz., Ledho Nala near Karamdiha Village (Tatapani), Narola Village (Ramkola region) and Ledho Nala 2 miles north-west of Karamdiha Village (Tatapani), only the last locality has yielded *Lepidopteris* sp. The rest of the localities are characterized by the dominance of *Glossopteris*. Because of the presence of *Lepidopteris* in the Ledho Nala 2 miles north-west of Karamdiha the beds there have been assigned a Lower Triassic age. The other two localities are of doubtful age. They may be either of Uppermost Permian or Early Triassic age.

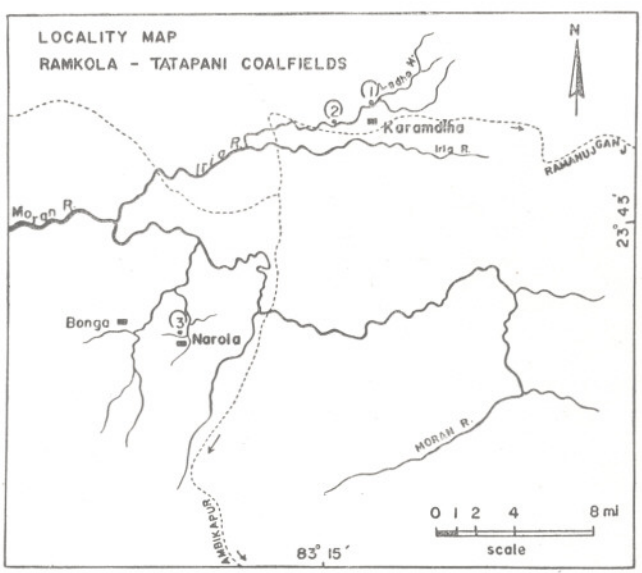
INTRODUCTION

THE Ramkola-Tatapani Coalfield lies about 24 km west of Hutar Coalfield. The complete tract lies between the Kanhar and Rer rivers — w.23°30′ and 23°55′ North latitude in North-East of Sarguja Dist., Madhya Pradesh. This tract has been treated in two parts: an eastern Tatapani area, bordering the Kanhar River, and a western Ramkola area bordering the Rer River. The Gondwana Succession here comprises in ascending order — Talchir, Barakar, Raniganj, Panchet (Lower Triassic) and Mahadevas (Griesbach, 1880).

The Panchet strata of the Ramkola-Tatapani Coalfield are about 360-450 m thick. Lithologically the Panchets are recognizable by red clay shales and clayey sandstones. These rocks alternate with white and yellowish hard shales which in many sections change into an olive-green clay.

Fossil plants from the Panchet or ?Panchet beds, based on material collected by Griesbach (1880) were reported by Feistmantel (1880, 1881). The records are as follows:

a. Nala West of Narola — (Ramkola Coalfield): *Glossopteris* sp.



TEXT-FIG. 1. — Map showing the fossiliferous localities in the Ramkola-Tatapani Coalfield.

b. Ledho Nala — (Tatapani Coalfield): *Glossopteris angustifolia* Brongniart, *Glossopteris communis* Feistmantel, *Glossopteris indica* Schimper, *Thinnfeldia* comp. *odontopteroides* Morris.

c. Near Karamdiha — (Tatapani Coalfield): *Glossopteris communis* Feistmantel.

The present study is based on fresh collections made from these regions. The fossil assemblages from different localities have been described here separately. We are grateful to Dr H. K. Maheshwari for helpful suggestions given on various occasions in connection with the present work.

DESCRIPTION

I. *Plant fossils from shale beds exposed in Ledho Nala near Karamdiha Village (Tatapani)*

Genus — *Schizoneura* Schimper & Mougeot, 1844

Schizoneura gondwanensis Feistmantel

Pl. 1, fig. 1

Single leaf-sheath showing only basal portion, approximately 2·8 cm long. About 7 veins entering base, running almost parallel, converging towards upper half.

Collection — No. 35205 (Pl. 1, fig. 1) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet; Lower Triassic.

Genus — *Neomariopteris* Maithy, 1974

?*Neomariopteris* sp. cf. *N. lobifolia* (Morris) Maithy

Pl. 1, figs. 7, 8; Text-fig. 2A

Frond atleast bipinnate; rachis smooth, about 1 mm wide. Pinnae linear-lanceolate, alternately arranged, emerging at an angle of about 45° from main rachis. Pinnules subopposite, obliquely attached, obovate in shape, 5 mm long and 3 mm broad, base contracted, basiscopic margin decurrent, margin of pinnules undulated. Only one vein entering base of pinnule, dichotomising once or twice, sometimes more.

Collection — No. 35210 (Pl. 1, figs. 7, 8; Text-fig. 2A) of B.S.I.P., Lucknow.

TEXT-FIG. 2 — A, ?*Neomariopteris* sp. cf. *N. lobifolia* (Morris) Maithy, B.S.I.P. no. 35210 × 2; B, ?*Sphenopteris* sp., B.S.I.P. no. 35211 × 4.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The frond in its gross features resembles *Sphenopteris lobifolia* Morris (Arber, 1905, pl. 5, figs. 2, 3; Srivastava, 1954, pl. 1, figs. 1-3). However, it differs in lacking a persistent median vein. In India this species is so far known only from the Upper Permian. *S. lobifolia* reported by Maheshwari and Prakash (1965, pl. 1, fig. 11) from the Lower Gondwana beds of Bansloi River, Santhal Parganas, Bihar is also comparable to the present specimens in shape and venation pattern.

Genus — *Sphenopteris* (Brongniart) Sternberg, 1825

?*Sphenopteris* sp.

Pl. 1, fig. 9; Text-fig. 2B

A fragment of a pinnate leaf. Pinnules 8 mm long, 3·5 mm broad, elongate-triangular in shape; ?acute apex, attached obliquely by broad base. Each pinnule with a median vein which gives off simple or forked laterals.

Collection — No. 35211 (Pl. 1, fig. 9; Text-fig. 2B) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen somewhat compares with the specimen of *Sphenopteris alata* described by Du Toit (1932) from Natal (Lower Beaufort) in external appearance and venation pattern.

Genus — *Glossopteris* Brongniart, 1828

Glossopteris angustifolia Brongniart

Pl. 1, figs. 3-6

Leaves mostly incomplete, measuring 2·2-4·6 cm in length and 0·7-0·8 cm in width, shape as a whole linear; apex obtuse; base tapering. Midrib usually distinct, 1 mm broad; secondary veins arising approximately at an angle of 10°, curving outwards, dichotomising and anastomosing to form narrow-elongate meshes. Meshes almost of equal size throughout lamina. Concentration of veins 20-22 per cm.

Collection — Nos. 35207 (Pl. 1, fig. 3), 35208 (Pl. 1, fig. 4) and 35209 (Pl. 1, figs. 5, 6) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — In their small size, narrow linear shape and fine venation pattern the leaves are comparable to the smaller leaves of *Glossopteris angustifolia* figured by Feistmantel (1881), Arber (1905), Sahni (1923) etc. *G. angustifolia* described by Maithy (1965) and Maheshwari and Prakash (1965) differ from the present specimens in general shape and size range.

Glossopteris communis Feistmantel

Pl. 1, fig. 13

Leaf showing only lower portion, 6·4 cm long and 4·1 cm wide. Midrib distinct, longitudinally striated, 0·4-0·5 cm wide. Secondary veins arising at an angle of about 35-40° and running straight towards margin, forming narrow elongate meshes throughout lamina.

Collection — No. 35215 (Pl. 1, fig. 13) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

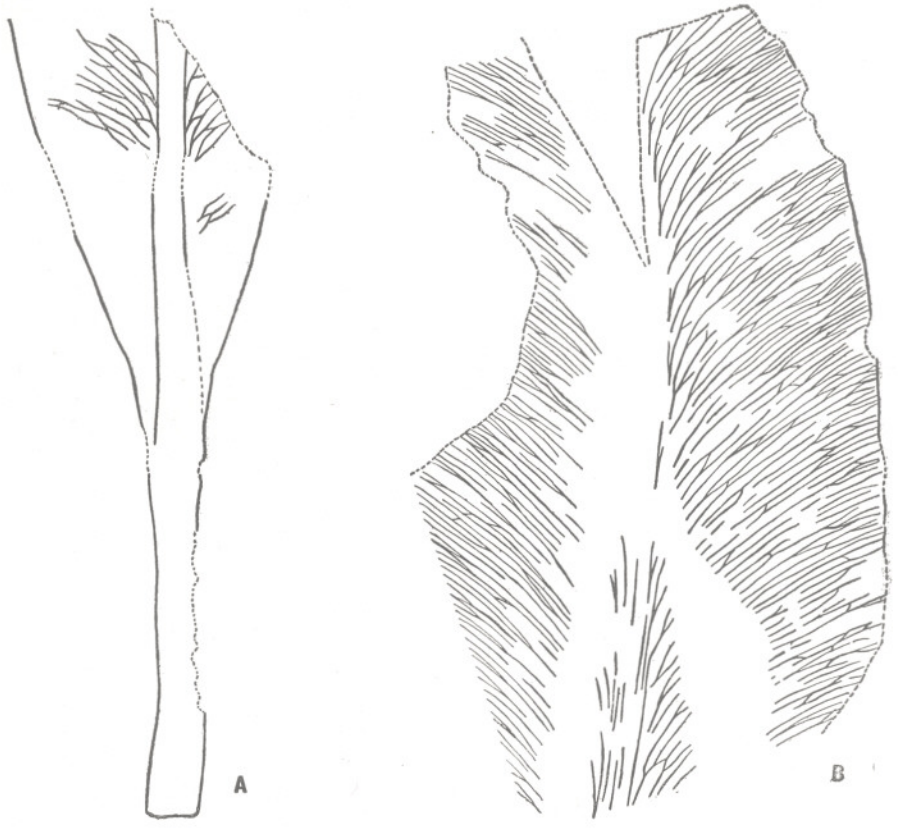
Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen somewhat resembles the specimens of *Glossopteris communis* Feistmantel (1879, pl. 17, figs. 1, 2; pl. 31, figs. 4, 5).

Glossopteris longicaulis Feistmantel

Pl. 1, fig. 11; Text-fig. 3A

Specimen representing only basal part, 5·5×1·5 cm, lamina base inequilateral, petiolate. Petiole 2·5 cm long, slightly swollen at base. Midrib distinct, 0·3 cm broad. Secondary veins arising at an angle of 50-60°, slightly arched, dichotomising and anastomosing to form oblong meshes, slightly bigger near midrib. Concentration



TEXT-FIG. 3 — A, *Glossopteris longicaulis* Feistmantel, showing only the basal portion, B.S.I.P. no. 35213 × 2; B, *G. indica* Schimper, B.S.I.P. no. 35224 × 2.

of veins 10-13 per cm near midrib.

Collection — No. 35213 (Pl. 1, fig. 11; Text-fig. 3A) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen compares with the figured specimens of *Glossopteris longicaulis* Feistmantel (1879, pl. 31, figs. 1, 3), Bhattacharyya (1963, pl. 1, fig. 5) and Maheshwari (1965, pl. 2, fig. 13).

Glossopteris retifera Feistmantel

Pl. 2, fig. 21; Text-fig. 4

Leaf incomplete, 5·5 cm long and 2·6 cm broad. Midrib distinct, stout and persistent. Secondary veins arising at an angle of about 30-40°, dichotomising just after emergence, anastomosing and forming oblong-polygonal meshes of almost equal size. Concentration of veins near midrib 6 per cm and 8 per cm towards margin.

Collection — No. 35220 (Pl. 2, fig. 21; Text-fig. 4) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

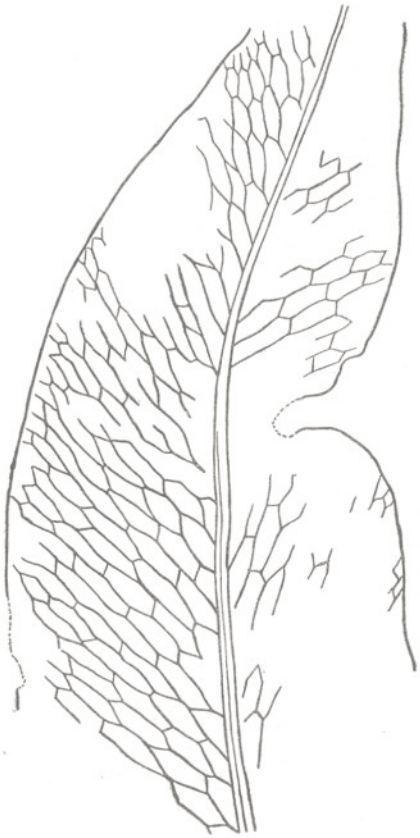
Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen resembles the specimens of *Glossopteris retifera* described by Feistmantel (1881, pl. 28, fig. 2) and Maheshwari and Prakash (1965, pl. 3, fig. 19).

Glossopteris sp.

Pl. 1, fig. 10; Text-fig. 5

Leaf 2·1 cm long and 1 cm broad, obovate; apex obtuse; base not preserved,



TEXT-FIG. 4 — *Glossopteris retifera* Feistmantel, B.S.I.P. no. 35220 × 2.

TEXT-FIG. 5 — *Glossopteris* sp., B.S.I.P. no. 35121 × 5.

midrib distinct nearer base, gradually evanescent towards apex. Secondary veins arched anastomosing and forming elongate meshes. Concentration of veins 14 per cm near midrib and 20 per cm near margin.

Collection — No. 35212 (Pl. 1, fig. 10; Text-fig. 5) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet, Lower Triassic.

Remarks — In size and shape the above specimen agrees with the specimen of *G. browniana* Brongniart described by Kulkarni (1971, pl. 1, fig. 7) but the latter differs by its polygonal meshes and higher concentration of secondary veins.

Genus — *Cistella* Plumstead, 1958

?Cistella sp.

Pl. 2, figs. 16, 17

A solitary detached receptacle, oblong-ovate, 1·8 cm long and 1 cm broad, 1 mm narrow rim around margin. Surface covered with closely arranged small tubercle-like structures.

Collection — No. 35217 (Pl. 2, figs. 16, 17) of B.S.I.P., Lucknow.

Locality — Ledho Nala near Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — Unlike Plumstead's (1958b) species of *Cistella* the present specimen is detached and it differs from them (*C. stricta* and *C. waltonii*) in having short and stout pedicel. *C. indica* described by Maheshwari (1965) from the Upper Permian of

Raniganj Coalfield is comparable with the present specimen in shape, size and presence of narrow rim. *C. ovata* Surange & Chandra (1974) differs from ?*Cistella* sp. in being oval in shape.

II. *Plant fossils from the Shale beds exposed in Ledho nala 2 miles N.W. of Karamdiha Village (Tatapani)*

Genus — *Schizoneura* Schimper & Mougeot, 1844

Schizoneura gondwanensis Feistmantel

Pl. 1, fig. 2

Single leaf-sheath, 2·5 cm long and 0·8 cm broad; 5-6 veins entering base, subparallel, converging towards apex.

Collection — No. 35206 (Pl. 1, fig. 2) of B.S.I.P., Lucknow.

Locality — Ledho Nala 2 miles N.W. of Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet; Lower Triassic.

Genus — *Lepidopteris* Schimper, 1869

Lepidopteris sp.

Pl. 3, figs. 23, 24, 27, 28

Detached pinnae (for description assumed to be bipinnate), 1·5-2·2 cm long, 0·4-0·7 cm broad. Pinna rachis 0·5-2 mm broad, having minute lumps. Pinnules, alternate to subopposite, 2-3 mm long and 1·5-2 mm broad, oblong in shape, attached by entire base; apex obtuse; basiscopic margin decurrent, margin entire, venation obscure.

Surface cells (studied from cellulose acetate paper pulls from one surface only) showing polygonal epidermal cells; lateral and end-walls straight, surface wall papillate. Papillae circular, solid, more or less centrally placed. Stomata irregularly arranged, subsidiary cells 4-6 in number, having overhanging papillae, guard cells not preserved.

Collection — No. 35222 (Pl. 3, figs. 23, 24, 27 & 28) of B.S.I.P., Lucknow.

Locality — Ledho Nala 2 miles N. W. of Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet; Lower Triassic.

Remarks — Out of the three specimens, preserved in the form of cast, peels were prepared with the help of cellulose acetate paper pull method. Because of the presence of lumps on the rachis and overhanging papillae (lappets) the present specimens have been placed under *Lepidopteris*.

Lepidopteris sp. may be compared with *L. madagascariensis* (Carpentier) Townrow (1966) in having minute obtuse pinnules, straight walled papillate cells, monocyclic stomata and stomatal pit surrounded by overhanging lappets. *L. stormbergensis* (Seward) Townrow (1956) can readily be distinguished from *Lepidopteris* sp. by its pinnules which have pointed apex, epidermal cells with sinuous walls and dicyclic stomata.

INCERTAE SEDIS

?Equisetalean Stem

Text-fig. 7

Stem articulated, about 10·8 cm long, devoid of leaf-sheath. Three distinct nodes present, about 2·6 cm wide. Internodal region 4 cm long, ridges and grooves are opposite at each node, grooves 1 mm broad.

Collection — No. 35225 (Text-fig. 7) of B.S.I.P., Lucknow.

Locality — Ledho Nala 2 miles N.W. of Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet;; Lower Triassic.

Remarks — Rigby (1966) has preferred to use the name *Paracalamites* Zalessky for the leafless articulated stems from the Gondwana. The stem figured here is comparable to *P. australis* Rigby, however, it differs in possessing raised ribs.

Axis with Rhomboidal Scars

Pl. 2, fig. 18

Axis covered with rhomboidal markings, 1·8 cm long, 0·5 cm broad. Surface showing polygonal cells with straight walls, surface walls papillate; papillae solid, cutinized. Stomata irregularly arranged, monocyclic, subsidiary cells 6-8, papillate, papillae overhanging stomatal aperture.

TEXT-FIG. 6 — A, *Glossopteris leptoneura* Bunbury, B.S.I.P. no. 35214 × 1·5; B, Shoot with lateral branches, B.S.I.P. no. 35223 × 1.

Collection — No. 35218 (Pl. 2, fig. 18) of B.S.I.P., Lucknow.

Locality — Ledho Nala 2 miles N.W. of Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet; Lower Triassic.

Remarks — The cuticular structure of this axis, as obtained by cellulose acetate paper pulls, is remarkably similar to that of the *Lepidopteris* leaves, present in the same collection.

TEXT-FIG. 7 — ?Equisetalean stem showing ridges and grooves, B.S.I.P. no. 35225 × 1.

SHOOT WITH LATERAL BRANCHES

Pl. 3, figs. 25, 26; Text-fig. 6B

Branched axis, 6·2 cm long. Main axis 0·4 cm wide, bearing radially arranged lateral branches. Lateral branches emerging at an angle of ±45° from central axis. Some of the branches showing a distinct flattening at distal end. One such branch shows 3 oval bodies, one of the oval bodies being at a slightly lower level than the other two. True nature of these bodies not known. These could be seeds or sporangia.

Collection — No. 35223 (Pl. 3, figs. 25, 26; Text-fig. 6B) of B.S.I.P., Lucknow.

Locality — Ledho Nala 2 miles N.W. of Karamdiha Village (Tatapani region), Sarguja District, Madhya Pradesh.

Horizon & Age — Panchet; Lower Triassic.

Remarks — The specimen is too incomplete to be compared with any of the fructification found in the Gondwana rocks of India or else where. In the absence of any definite fertile organ it is difficult to say whether it is a male or female fructification.

III. *Plant fossils from the nala near Narola Village (Ramkola region)*

Genus — *Glossopteris* Brongniart, 1828

Glossopteris indica Schimper

Pl. 1, fig. 14; Pl. 2, fig. 15; Text-fig. 3B

Incomplete specimens, measuring 7-11 cm in length and 2·8-3·6 cm in width, lanceolate; apex acute. Midrib distinct, flat, 2·0-2·5 mm broad in lower half. Secondary veins emerging from midrib at an acute angle, arching towards margin, dichotomising and anastomosing to form meshes which are comparatively shorter and broader near midrib. At places anastomosis seen right near leaf margin. Concentration of veins is about 9-11 per cm near midrib and 17-26 per cm at the margin.

Collection — Nos. 35216 (Pl. 1, fig. 14; Pl. 2, fig. 15) and 35224 (Text-fig. 3B) of B.S.I.P., Lucknow.

Locality — Nala near Narola Village (Ramkola region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimens compare with the figured specimens of *Glossopteris indica* Feistmantel (1881, pl. 23, fig. 10), Maheshwari and Prakash (1965, pl. 2, fig. 15) and Kulkarni (1971, pl. 1, fig. 4) in venation pattern but differs in size.

Glossopteris communis Feistmantel

Pl. 2, fig. 22

Leaves oblanceolate in shape, 12·6 cm long, 2·4 cm broad at the broadest region. Margin entire, tapering both towards apex and base. Midrib 1·5 mm broad in basal region. Secondary veins arising from midrib at acute angle, dichotomising repeatedly and anastomosing to form narrow-elongate meshes of almost equal size throughout lamina.

Collection — No. 35221 (Pl. 2, fig. 22) of B.S.I.P., Lucknow.

Locality — Nala near Narola Village (Ramkola region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The venation of this leaf is like *G. communis* Feistmantel (1879, pl. 17, figs. 1, 2; pl. 31, figs. 4, 5). The present specimen is also comparable with *G. communis* described by Maheshwari and Prakash (1965, pl. 2, fig. 14).

Glossopteris leptoneura Bunbury

Pl. 1, fig. 12, Text-fig. 6A

Leaf 10·5 cm long and 1·5 cm broad, linear, gradually tapering towards apex and base, basal portion incomplete; margin entire; midrib distinct from base to apex; 2 mm broad at base, striated and having minute lumps. Secondary veins arising at 30-35°, running obliquely towards margin, concentration of veins near midrib 8-10 per cm and towards margin 24-26 per cm. Secondary veins bifurcating and anastomosing to form broad oblong-polygonal meshes near midrib which become comparatively narrower towards margin.

Collection — No. 35214 (Pl. 1, fig. 12; Text-fig. 6A) of B.S.I.P., Lucknow.

Locality — Nala near Narola Village (Ramkola region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen resembles the specimens of *Glossopteris leptoneura* figured by Bunbury (1861, pl. 9, figs. 1-4) from the Kamthi beds near Nagpur. Bunbury's text-fig. 4 shows formations of some very small meshes near leaf margin. This character is, however, not seen in the present specimen.

Glossopteris sp.

Pl. 2, figs. 19, 20

Apical part of a leaf, 7·3 cm long and 3·4 cm broad; apex acute. Midrib prominent, persistent, secondary veins emerging from midrib at 50-60° and passing straight towards margin, bifurcating and anastomosing to form elongate-narrow meshes, somewhat narrower towards margin. Concentration of veins near midrib 15-17 veins per cm and 20-24 veins per cm near margin.

Collection — No. 35219 (Pl. 2, figs. 19, 20) of B.S.I.P., Lucknow.

Locality — Nala near Narola Village (Ramkola region), Sarguja District, Madhya Pradesh.

Horizon & Age — ?Panchet; Lower Triassic.

Remarks — The specimen in its venation characters compares with *Glossopteris damudica* Feistmantel (1880, pl. 30, figs. 1, 2). However, it differs in having an acute apex. The apex in *G. damudica* is broadly rounded.

DISCUSSION AND COMPARISON

The megafossils described in the previous pages were collected from three localities of the Ramkola-Tatapani Coalfield. They are as follows:

1. Ledho Nala near Karamdiha Village (Tatapani region)
2. Ledho Nala 2 miles N.W. of Karamdiha (Tatapani region).
3. Narola (Ramkola region).

The flora of locality (1), viz., Ledho Nala near Karamdiha Village includes *Schizoneura gondwanensis*, ?*Neomariopteris* sp. cf. *N. lobifolia*, ?*Sphenopteris* sp, *Glossopteris angustifolia*, *G. communis*, *G. longicaulis*, *G. retifera*, *G.* sp. and ?*Cistella*. This flora somewhat resembles the assemblage, (Banerji, Maheshwari & Bose, 1975), recovered from Nidpur locality (2), i.e. about 3 km east-south east of Nidpur and 1 km east-north east of Gothara on the east bank of Gopad River, having *Sphenopteris* sp., *Glossopteris browniana*, *G. communis*, *G. damudica*, *Scutum* sp., *Dicroidium* sp. and scale leaves. Nidpur locality (2) definitely belongs to Lower Triassic because of the presence of *Dicroidium*, whereas the present assemblage has been doubtfully referred to Lower Triassic due to the absence of *Dicroidium*.

Locality (2), viz., Karamdiha (Tatapani region) comprises *Schizoneura gondwanensis*, ?Equisetalean stem, *Lepidopteris* sp. and a shoot with lateral branches. Due to the presence of the genus *Lepidopteris* these beds can be assigned a Lower Triassic age.

The third locality, viz., Narola (Ramkola region) has only *Glossopteris* (*G. indica*, *G. communis*, *G. leptoneura* and *G.* sp.). Similar type of assemblage is found at Nidpur locality (2) (Banerji, Maheshwari & Bose, 1975), which, too, is dominated by *Glossopteris*. In the absence of *Lepidopteris* or any other undoubted Triassic forms, at present, we prefer not to assign these beds a definite age. They could be Uppermost Permian or Lowermost Triassic.

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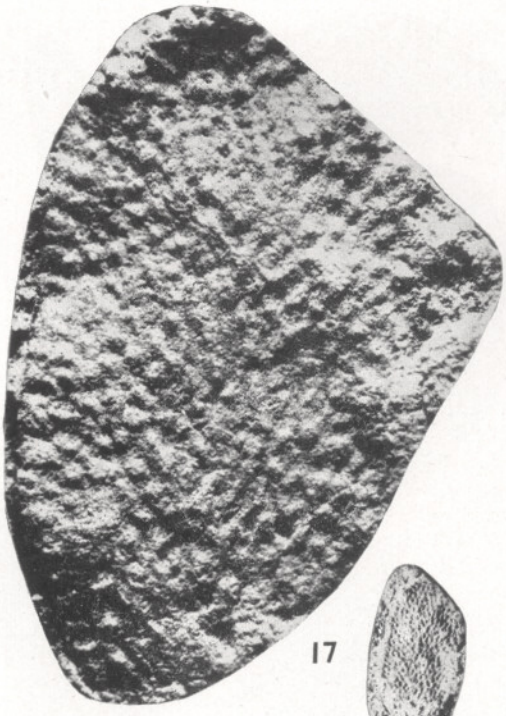

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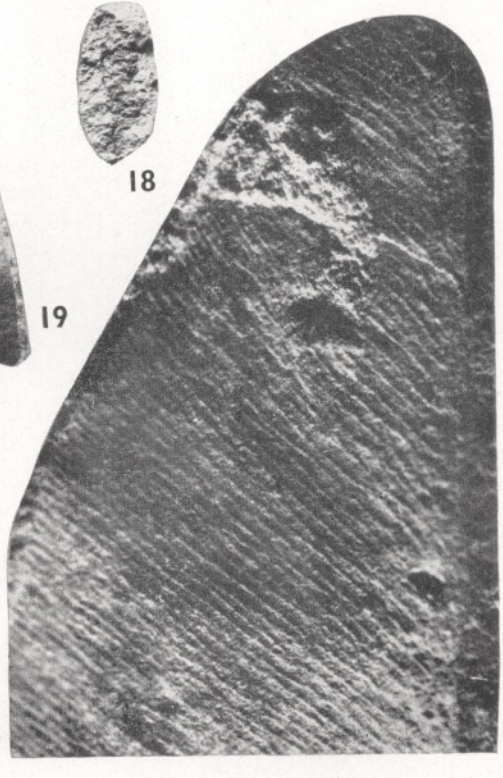

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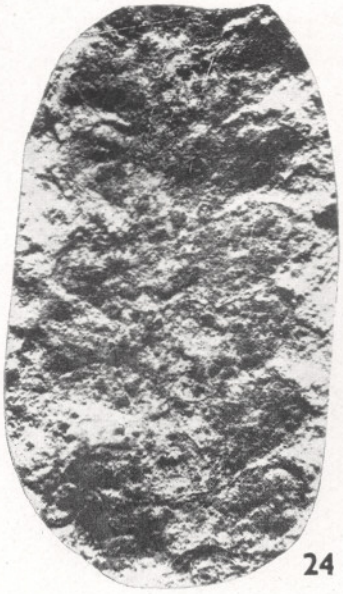

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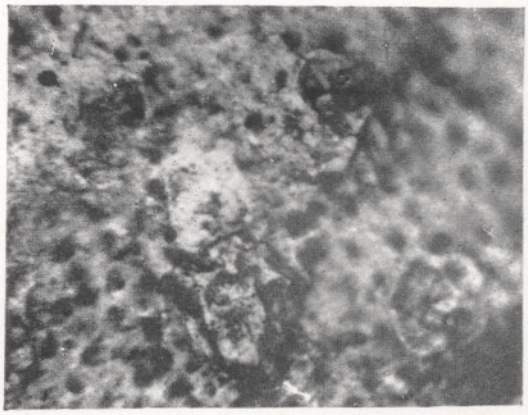

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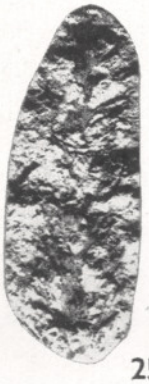

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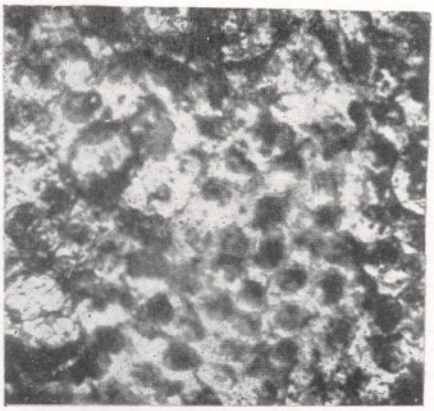

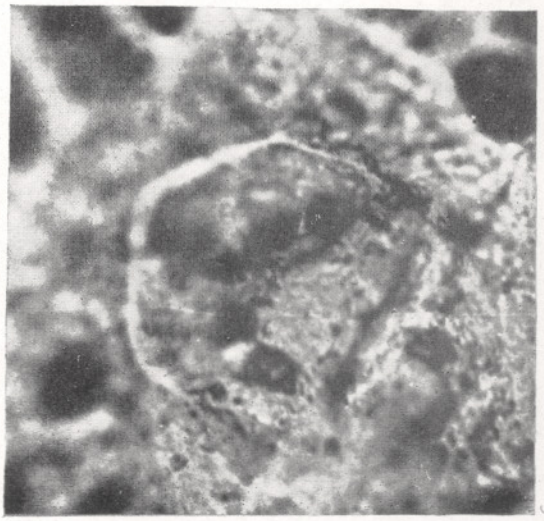

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EXPLANATION OF PLATES

PLATE 1

1-2. *Schizoneura gondwanensis* Feistmantel; B.S.I.P. nos. 35205, 35206. × 1.

3-5. *Glossopteris angustifolia* Brongniart; B.S.I.P. nos. 35207, 35208, 35209. × 1.

6. Specimen in fig. 5 enlarged. × 5.

7. ?*Neomariopteris* sp. cf. *N. lobifolia* (Morris) Maithy; B.S.I.P. no. 35210. × 1.

8. The above enlarged. × 2.

9. ?*Sphenopteris* sp.; B.S.I.P. no. 35211. × 1.

10. *Glossopteris* sp.; B.S.I.P. no. 35212. × 1.

11. *G. longicaulis* Feistmantel; B.S.I.P. no. 35213. × 1.

12. *G. leptoneura* Bunbury; B.S.I.P. no. 35214. × 1.

13. *G. communis* Feistmantel; B.S.I.P. no. 35215. × 1.

14. *G. indica* Schimper; B.S.I.P. no. 35216. × 1.

PLATE 2

15. *Glossopteris indica* Schimper; B.S.I.P. no. 36216. × 2.

16. ?*Cistella* sp.; B.S.I.P. no. 35217. × 1.

17. The above enlarged. × 4.

18. Axis with rhomboidal scars; B.S.I.P. no. 35218. × 1.

19. *Glossopteris* sp.; B.S.I.P. no. 35219. × 1.

20. A portion of the above enlarged. × 2.

21. *G. retifera* Feistmantel; B.S.I.P. no. 35220. × 1.

22. *G. communis* Feistmantel; B.S.I.P. no. 35221. × 1.

PLATE 3

23. *Lepidopteris* sp.; B.S.I.P. no. 35222. × 1.

24. The above enlarged. × 4.

25. Shoot with lateral branches; B.S.I.P. no. 35223. × 1.

26. The above enlarged. × 2.

27-28. *Lepidopteris* sp.; showing distribution and orientation of stomata, slide nos. 4976 and 4975. × 500.

29. Surface cells of the specimen having axis with rhomboidal scars (fig. 18), showing distribution and orientation of stomata; slide no. 4977. × 500.

30. A stoma. enlarged from the above. × 1000.