SOME LOWER TRIASSIC PLANT REMAINS FROM ASANSOL REGION, INDIA

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ABSTRACT

Megafossils collected from north-western branch of Nonia Nala, East of Kumarpur and northern branch of Nonia Nala near "Indigo" factory bridge form the subject matter of this paper. In addition further observations have been made on the specimens earlier described by Feistmantel (1881) and Satsangi and Shah (1970) from near Maitur, north-western branch of Nonia Nala. From the first locality only *?Dicroidium/Lepidopteris* and *Podozamites* sp. cf. *P. lanceolatus* Lindley & Hutton have been described. The second locality comprises *Schizoneura*, a few species of *Glossopteris*, *Macrotaeniopteris* sp. and *Cordaicarpus* sp. From the third locality no fresh collection could be made. Only the earlier described fossils, viz., *Pecopteris concinna* Presl., *Cyclopteris pachyrhachis*, Göppert, *Taeniopteris* sp. cf. *T. stenoneuron* (Schenk) Pascoe and ?cf. *Kendostrobus* sp. have been re-examined.

INTRODUCTION

RECENTLY, Maheshwari and Banerji (1975) have described Lower Triassic palynomorphs isolated from shales in the north-western branch of Nonia Nala, East of Kumarpur, near Asansol. From the same locality Satsangi (1973) had described *?Dicroidium* and *Podozamites* sp. The locality was re-visited by us and we could collect only a few fragmentary specimens of *?Dicroidium/Lepidopteris*. But from another locality nearby, viz., northern branch of Nonia Nala near "Indigo" factory bridge we collected a large number of *Glossopteris* and other associated fragmentary plant remains. All these plant remains, together with the earlier collections described by Feistmantel (1881) and Satsangi and Shah (1970), are being described here.

DESCRIPTION

Genus —*Schizoneura* Schimper et Mougeot, 1844

Schizoneura gondwanensis Feistmantel

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

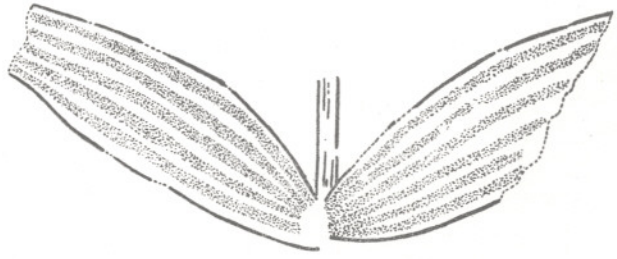
1881 — *Schizoneura gondwanensis* Feistmantel, p. 61, pl. 10A, figs. 1-8.

1861b—*Schizoneura gondwanensis* Feistmantel: Lele, p. 71, pl. 1, fig. 3.

1963 — *Schizoneura gondwanensis*: Bhattacharyya, p. 125.

All the specimens are rather fragmentary (largest available specimen about 6·5 cm long). Most of them show only the leaf sheaths. However, a few have also been found attached to the stems.

Stem articulated; internodes 1·3-4 cm long, 1·5-3 cm in diameter, finely striated; nodal regions slightly swollen. Two almost similar leaf sheaths arising from nodes. Leaf sheaths oval, 0·9-6·8 cm in length, 0·8-1·5 cm in width; veins prominent, 6-9 radiating from base, later running almost parallel to each other, about 0·1 cm in width, finely striated, the outer two veins running along margin, all converging towards apex.



TEXT-FIG. 1 — *Schizoneura gondwanensis* Feistmantel, leaf-sheath showing venation, B.S.I.P. no. 54/1253 × 2.

Collection — Nos. 5/126 (Pl. 1, fig. 1) and 5/125 (Pl. 1, fig. 3) of G.S.I., Calcutta; 25/1013 (Pl. 1, fig. 2) and 54/1253 (Text-fig. 1) of B.S.I.P., Lucknow.

Locality — Maitur, north-west of Asansol; north-western branch of the Nonia Nala, East of Kumarpur and northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks — The above description is based on the original specimens of Feistmantel (1880) and some new specimens collected from opposite 'Indigo' factory. Out of the 8 specimens figured by Feistmantel (1880, pl. 10A, figs. 1-8) only two are available at present. The specimens figured in pl. 10A, figs. 1, 4, 5, 6, 7 and 8 are misplaced.

Genus — *Glossopteris* Brongniart, 1828

Glossopteris browniana Brongniart

Pl. 1, fig. 6; Text-fig. 2A-B

Leaf as a whole lanceolate, 5·5-7·4 cm long and 2·9-5 cm broad; apex more or less acute. Midrib distinct, 2 mm wide, striated. Secondary veins arising at an angle of about 40-45°, forking and forming meshes; meshes narrow, elongated near midrib, veins 10-12 per cm, towards margin 19-20 veins per cm.

Collection — Nos. 6/1253 (Pl. 1, fig. 6; Text-fig. 2A) and 46/1253 (Text-fig. 2B) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks — The specimens described here resemble *G. browniana* described by Feistmantel (1881, p. 102, pl. 27, fig. 4) in venation pattern but in the present specimens the meshes are narrower.

Glossopteris angustifolia Brongniart

Pl. 1, fig. 8; Text-fig. 3

Leaves incomplete, 4·3-9·3 cm long and 0·6-1 cm broad at the broadest region, linear, gradually tapering towards base. Midrib indistinct, about 1 mm broad near base. Secondary veins arising at an acute angle, angle of divergence about 15-20°, bifurcating and anastomosing. Meshes narrow and elongated over entire surface, 8-12 veins per cm.

Collection — No. 41/1253 (Pl. 1, fig. 8; Text-fig. 3) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks— The present specimens resemble the specimens described by Feistmantel (1881, p. 105, pl. 27, figs. 11, 13) from the Raniganj Coalfield.

Glossopteris communis Feistmantel

Pl. 1, fig. 5

Leaves mostly incomplete at base and apex, largest available leaf measures 11·1 × 4·6 cm. Shape as a whole probably lanceolate. Midrib distinct, 0·4 cm broad near base; secondary veins arising at an angle of about 30-35°, forming narrow elongated meshes over entire surface, slightly arched towards margin.

Collection — No. 28/1253 (Pl. 1, fig. 5) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks— The specimens have same venation pattern as *G. communis* of Feistmantel (1881, p. 98, pl. 32, fig. 2).

Glossopteris conspicua Feistmantel

Pl. 1, fig. 7; Pl. 2, fig. 21; Text-fig. 4

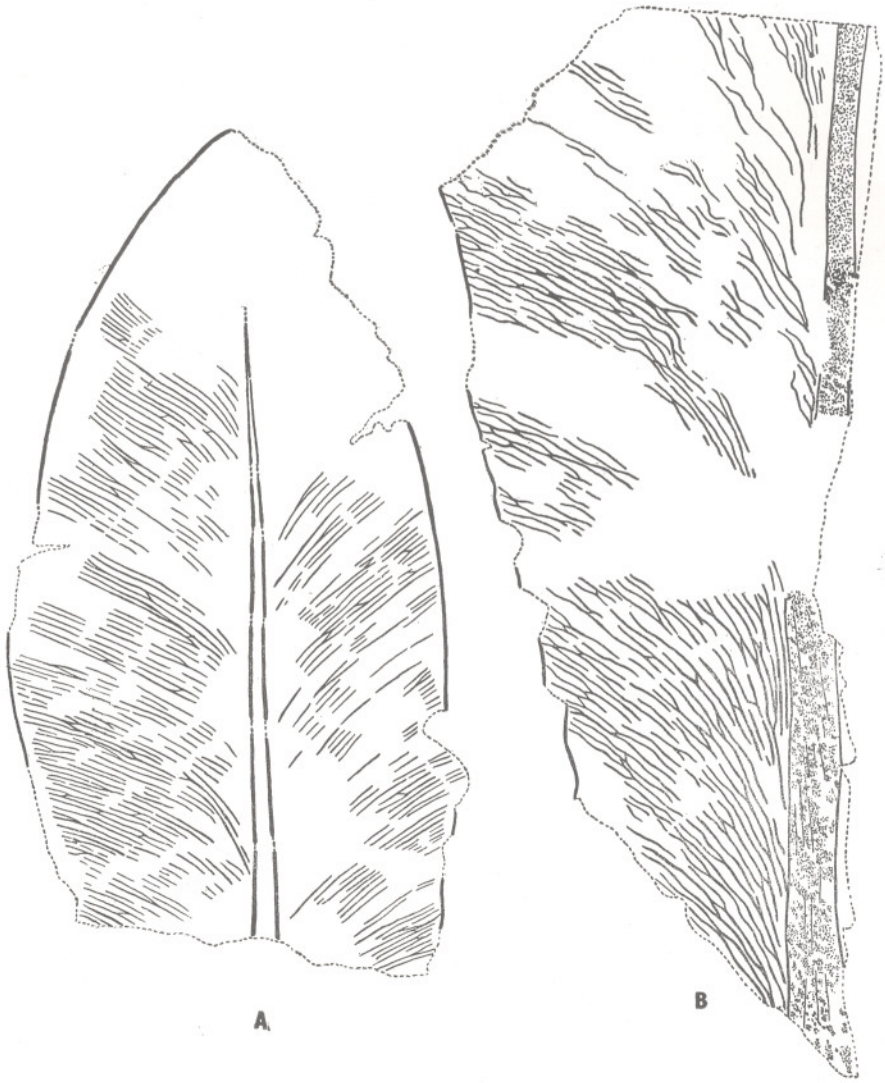
Leaf shape as a whole obovate, largest lefa measures 6·5 × 3·6 cm; apex acute; gradually tapering towards base. Midrib distinct, 1·5 mm thick near base, evanescent towards apex. Secondary veins arising from midrib at an angle of about 35-40°, forming large and broad meshes over major portion of lamina, but near margin slightly narrower; meshes oblong-polygonal in shape. Near midrib secondaries 4-6 per cm and towards margin 6-8 per cm.

Collection — Nos. A26/1253 (Pl. 1, fig. 7) and 26/1253 (Pl. 2, fig. 21; Text-fig. 4) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks — The specimens figured here resemble somewhat the specimen of *G. conspicua* described and figured by Feist-



TEXT-FIG. 2 — A, *Glossopteris browniana* Brongniart, apical portion of a leaf, B.S.I.P. no. 6/1253 × 2; B, basal portion of a leaf, B.S.I.P. no. 46/ 1253 × 2.

mantel (1881, p. 104, pl. 28A, fig. 5) from the Raniganj Coalfield.

Glossopteris retifera Feistmantel

Pl. 1, fig. 4

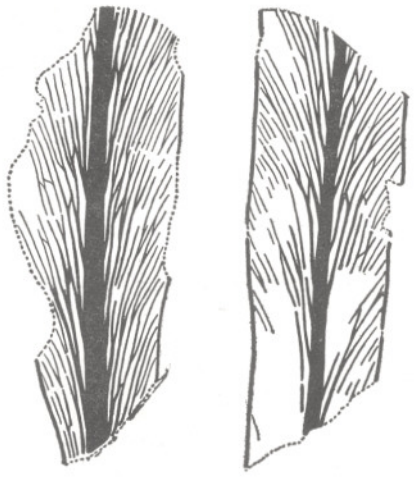
Shape of leaf as a whole probably obovate, 3·1 cm long and 2·5 cm broad. Margin entire; apex acute. Midrib distinct; secondary veins arising at 30-40°, anastomosing and forming small meshes of equal length and breadth over entire surface. Vein concentration near margin 11-12 per cm and 10-11 veins per cm near midrib.

Collection — No. 74/1253 (Pl. 1, fig. 4) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near ' Indigo ' factory bridge.

Age — Lower Triassic.

Remarks — The above specimens are closely comparable with the specimens of *G.*



TEXT-FIG. 3 — *Glossopteris angustifolia* Brongniart, B.S.I.P. no. 41/1253 × 2.

retifera described by Feistmantel (1881, p. 103, pl. 28, figs. 2, 10).

Glossopteris sp. cf. *G. intermedia* Feistmantel

Pl. 1, fig. 9; Text-fig. 5A

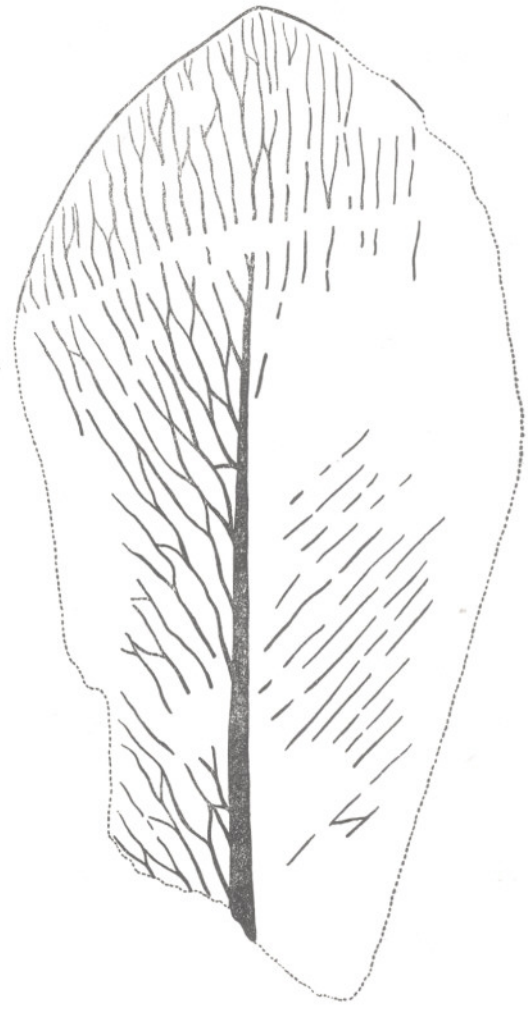
The largest specimen 8·8 cm long and 2·8 cm broad, shape as a whole probably lanceolate. Midrib distinct, 2 mm thick, showing prominent longitudinal ridges. Secondary veins arising at an angle of about 30-50°; meshes elongated polygonal, near midrib meshes slightly longer. Veins near midrib 3-4 per cm and towards margin 7 per cm.

Collection — No. 41/1253 (Pl. 1, fig. 9) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks — The specimen figured here resembles most *G. intermedia*, described by Maheshwari (1965, pl. 1, fig. 5), in over all shape and venation pattern. *G.* sp. cf. *G. intermedia* differs from *G. conspicua* in having narrower meshes. *G. retifera* can be distinguished from the present specimen by its meshes alone which are as long as broad.



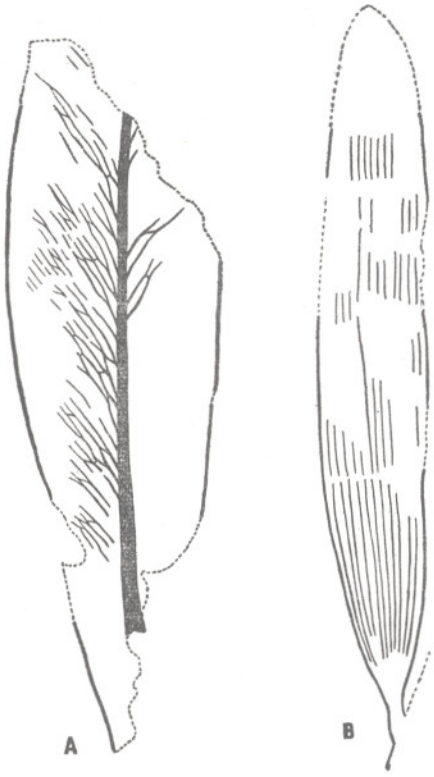
TEXT-FIG. 4 — *Glossopteris conspicua* Feistmantel, B.S.I.P. no. 26/1253 × 2.

Genus — *Macrotaeniopteris* Schimper, 1869

Macrotaeniopteris sp.

Pl. 1, fig. 11

The description is based on two fragmentary specimens. In both, only one side of the lamina is preserved, while it is difficult to estimate the length of the leaves, the width seems to be about 7 cm. In both the leaves the midrib is distinct and the secondary veins arise at an acute angle which after emergence run almost parallel to each other. Secondary veins often bifurcating but never anastomosing.



TEXT-FIG. 5 — A, *Glossopteris* sp. cf. *G. intermedia* Feistmantel, B.S.I.P. no. 41/1253 × 1; B, *Podozamites* sp. cf. *P. lanceolatus* Lindley & Hutton, a leaf showing venation, G.S.I. no. 18454 × 2.

Collection — No. 35/1253 (Pl. 1, fig. 11) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks —*Macrotaeniopteris* sp. resembles the specimen described by Feistmantel (1886, p. 24, pl. 1A, fig. 1) as *M. feddeni* from the Barakar of Sukri River, Auranga Coalfield.

Genus — *Dicroidium* Gothan, 1912
***Lepidopteris* Schimper, 1869**

?Dicroidium/Lepidopteris

Pl. 2, figs. 12-18

1971 — *?Dicroidium* Satsangi, p.319.

Detached fragmentary pinnae (for description assumed to be bipinnate) measuring 1-2·2 cm in length and 0·8-1 cm in width. Rachis about ·05-1 cm wide, uneven. Pinnules arising at an angle of about 60-70°; oval or broadly oval in shape, 4-5 mm long, 2-2·5 mm broad; apex obtuse or sub-acute; base distinctly decurrent. Veins mostly obscure, seems to have a midrib; secondaries arising at a narrow angle, two of them seem to emerge near the base, mostly forked.

Collection — Nos. 24/1358 (Pl. 2, figs. 12, 15), and 23/1359 (Pl. 2, fig. 16) of B.S.I.P., Lucknow; 18455 (Pl. 2, figs. 13, 14) and 18456 (Pl. 2, figs. 17, 18) of G.S.I., Calcutta.

Locality — North-western branch of the Nonia Nala, East of Kumarpur.

Age — Lower Triassic.

Remarks — The above description is based on a few fragmentary specimens. Most of the pinnules do not show any vein. Only in two of the detached pinnules a few veins could be observed (Pl. 2, figs. 17, 18). But here, too, they are not so clear.

The rachis at places seems to have impressions of lumps or scale-like bodies but they are not so very clear.

The pinnules of the present specimens are much smaller than all the known species of *Dicroidium*. The venation too is unlike *Dicroidium*. The pinnules here have too few veins which emerge at narrow angles. In this character venation is more like some of the species of *Pachypteris* (Bose & Kasat, 1971). None of the *Lepidopteris*, so far known, has venation like the present specimens.

In size and shape the pinnules somewhat resemble the smaller pinnules of *Lepidopteris stormbergensis* (Seward) Townrow (1956). But the venation pattern in the latter species is quite distinct.

From whatever little is known, these specimens of *?Dicroidium/Lepidopteris* do not show complete identity with either *Dicroidium* or *Lepidopteris*. So at present it is preferred to keep their systematic position open.

Genus — *Podozamites* Braun, 1843

Podozamites sp. cf. *P. lanceolatus* Lindley & Hutton

Pl. 2, figs. 22, 23; Text-fig. 5B

1971 — *Podozamites* sp. : Satsangi, p. 319.

Specimen fragmentary. Axis about 1 mm wide with alternately arranged leaves.

Leaves attached by their constricted base, linear lanceolate, 2·5-3 cm long, 0·5 cm broad; margin entire; apex obtuse or subacute. Veins numerous, closely set, after emergence running almost parallel, sometimes dichotomising.

Collection — No. 18454 (Pl. 2, figs. 22-23; Text-fig. 5B) of G.S.I., Calcutta.

Locality — North-western branch of the Nonia Nala, East of Kumarpur.

Age — Lower Triassic.

Remarks — The specimen described above is the only known record of *Podozamites* from the Triassic of India. It compares most the specimens described by Walkom (1921, pl. 4, figs. 4, 5) from the Talbragor beds of New South Wales, Australia. The Indian specimen differs from the Australian specimens in having smaller leaves and also in having finer veins.

Genus — *Cordaicarpus* Geinitz, 1862

Cordaicarpus sp.

Pl. 2, fig. 24

Winged seed, more or less circular, rarely broadly oval, 1-1·5 × 1-1·4 cm. Wing faintly marked, uniformly surrounding the nucule, about 1·5 mm broad. Nucule 8·5-1·35 × 8·5-1·25 cm, surface smooth.

Collection — No. 14/1253 (Pl. 2, fig. 24) of B.S.I.P., Lucknow.

Locality — Northern branch of Nonia Nala near 'Indigo' factory bridge.

Age — Lower Triassic.

Remarks — *Cordaicarpus* sp. may be compared with *C. chichariensis* Lele (1962, p. 13, pl. 1, fig. 1) described from Chicharia, South Rewa Gondwana Basin. In the present specimens the conical beak is not visible.

INCERTAE SEDIS

Genus —*Pecopteris* (Brongniart) Sternberg, 1825

Pecopteris concinna Presl

1881 — *Pecopteris concinna* Presl: Feistmantel, p. 82, pl. 17A, figs. 1-6.

1927 — *Cladophlebis concinna* Presl: Du Toit, p. 318.

1959 — *Pecopteris concinna* Presl: Pascoe, p. 962, fig. 3.

Remarks — Feistmantel's (1881) description was based on six specimens. Out of these, at present, only the specimens figured in pl. 17A, figs. 1 and 2 are available. The specimens do not show the details of the venation pattern. Only at places the outlines of the pinnules are faintly marked. So with the available data it is difficult to comment more on these specimens. Du Toit (1927) had placed these specimens under the genus *Cladophlebis*. But from Feistmantel's (1881) drawings the venation pattern seems to be different from *Cladophlebis*. It is also different from *Pecopteris phegopteroides* described from the Permian of Raniganj. The secondary veins in the Raniganj specimens are mostly undivided.

Collection — No. 5177 of G.S.I., Calcutta.

Locality — Maitur, north-west of Asansol.

Age — Lower Triassic.

Genus — *Cyclopteris* Brongniart, 1830

Cyclopteris pachyrhachis Göppert

1881 — *Cyclopteris pachyrhachis* Göppert: Feistmantel, p. 84, pl. 17A, fig. 7.

1959 — *Cyclopteris* (?) *pachyrhachis* Göppert: Pascoe, p. 962, fig. 4.

Remarks — Out of the two specimens of *Cyclopteris* mentioned by Feistmantel (1881, p. 84), at present, only one is available (pl. 2, fig. 1). This specimen, too, due to considerable rubbing over, does not show any detail of the veins. Even the outlines of the pinnules are not clearly marked. From whatever is visible it is extremely difficult to make out its exact nature. Unfortunately, besides this solitary specimen no other specimen of *Cyclopteris pachyrhachis* is available from any of the Lower Triassic localities in India. So under the present circumstances it is better to leave the affinities of this specimen open.

Collection — No. 5182 of G.S.I., Calcutta.

Locality — Maitur, north-west of Asansol.

Age — Lower Triassic.

Genus — *Taeniopteris* Brongniart, 1828

Taeniopteris sp. cf. *T. stenoneuron* (Schenk) Pascoe

Pl. 1, fig. 10

1881 — *Oleandridium stenoneuron*, Schimper (Schenk sp.): Feistmantel, p. 92, pl. 19A, figs. 5-8.

1959 — *Taeniopteris* (*Oleandridium*) cf. *Stenoneuron* Schenk: Pascoe, p. 963, fig. 7.

Remarks — From Maitur, Feistmantel (1881, pl. 19A, figs. 5-8) had figured four specimens of *Taeniopteris*-like leaves as *Oleandridium stenoneuron*. Out of these, the specimen figured in pl. 19A, fig. 8 is now misplaced. In the available specimens only the outlines are visible. One of the specimen (Pl. 3, fig. 6) shows a deep median groove indicating the position of the midrib. In the other two specimens the position of the midrib is also clearly marked. Besides the midrib no other veins are visible in any of the leaves. So from the present state of preservation it is extremely difficult to ascertain their exact affinity and no further comparison with other species is possible.

Collection — No. 5189 (Pl. 1, fig. 10) of G.S.I., Calcutta.

Locality — Maitur, north-west of Asansol.

Age — Lower Triassic.

Genus — *Kendostrobus* Surange & Chandra, 1974

? cf. *Kendostrobus* sp.

1970 — *Schizoneura gondwanensis* Feistmantel: Satsangi & Shah, p. 187, pl. 1, figs. 1-3.

Remarks — Satsangi and Shah (1970) described a specimen with impressions of three cone-like organs borne on long slender stalks. The fertile regions show only minute circular projections.

The best preserved specimen has a long slender stalk measuring about 7 cm in length. The stalk seems to bear a cylindrical cone-like structure measuring about 2 cm in length and 2·5 mm in width. The cone shows minute circular projections perhaps spirally (?) arranged.

Satsangi and Shah (1970) have mentioned that out of the three cones, the stalks of two cones are attached to each other. On re-examination we have found that none of them are attached to each other. Only their placement suggests that they may have originated from a common place.

In none of the cones there is any sign of either sporangia or seeds. So their exact nature is extremely doubtful. The cones have been provisionally compared with *Kendostrobus* because of the overall shape of the cones which are also attached to long slender stalks like *Kendostrobus*. It is quite possible the circular projections may had once sporangia attached to them. But in the absence of sporangia, we prefer not to assign these cones definitely to *Kendostrobus*.

Satsangi and Shah (1970) had compared these cones with the fructification of *Schizoneura australis* described by Etheridge (1903, pl. 48, fig. I) and a cone probably belonging to *Schizoneura gondwanensis* described by Srivastava (1954, pl. 3, figs. 22-25). The present cones are quite different in shape and are much narrower. It is quite likely the fructifications described by Etheridge (1903) and Srivastava (1954) belong to *Cistella* Plumstead (1958).

Collection — No. 18292 of G.S.I., Calcutta.

Locality — Maitur, north-west of Asansol.

Age — Lower Triassic.

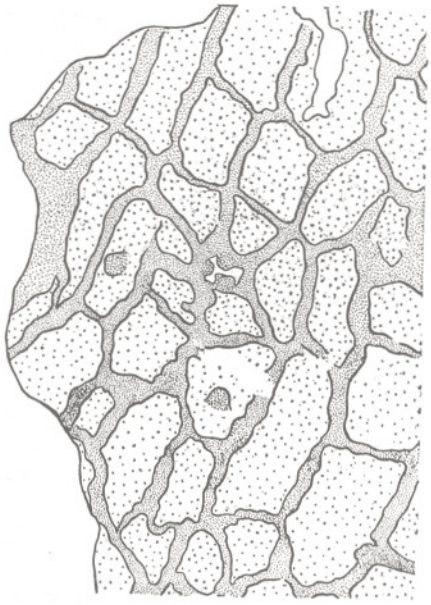
DISPERSED CUTICLE

?*Lepidopteris* type of cuticle

Pl. 2, figs. 19, 20; Text-fig. 6

A few fragmentary pieces of cuticle were isolated by bulk maceration of shale samples having fronds of ?*Dicroidium*/*Lepidopteris* collected from Nonia Nala section at Asansol. These cuticle pieces, though fragmentary, showed a remarkable resemblance with *Lepidopteris*.

Cuticle 2·3-3 μ thick, epidermal cells polygonal in shape, lateral- and end-walls straight, some times slightly wavy. Surface wall papillate, papillae circular, solid, well cutinized. Stomata monocyclic or dicyclic, subsidiary cells 5-7, generally 6, lateral and end-walls straight or wavy, surface papillate; papillae overhanging or projected over stomatal pit. Guard cells mostly not preserved, thinly cutinized.



TEXT-FIG. 6 — ?*Lepidopteris* type of cuticle in dispersed condition, subsidiary cells showing papillae overhanging the stomatal pit, B.S.I.P. slide no. WNP_2/5046 × 500.

Collection — Slide no. WNP_2 /5045 (Pl. 2, fig. 19) and WNP_2 /5046 (Pl. 2, fig. 20; Text-fig. 6) of B.S.I.P., Lucknow.

Locality — Southern bank of Nonia Nala about 1·5 km East of Kumarpur.

Age — Lower Triassic.

CONCLUDING REMARKS

The age of the Panchet beds near Asansol has already been discussed by Maheshwari and Banerji (1975). The megafloral assemblages described here come from three localities and the assemblages recovered from them are quite distinct from each other. From the first locality, viz., north-western branch of Nonia Nala, East of Kumarpur ?*Dicroidium*/*Lepidopteris* and *Podozamites* sp. cf. *P. lanceolatus* have been described. These genera are, so far, not known from the underlying Raniganj beds. Both *Dicroidium* and *Podozamites* are common in Triassic and thus support the view of Maheshwari and Banerji (1975) that the Panchet beds near Asansol are of Lower Triassic age. The genus *Lepidopteris*, too, is typically Triassic though in rare cases their occurrence is also known from the Upper Permian (Townrow, 1960). The pinnules of ?*Dicroidium*/*Lepidopteris* resemble most ?pinnules with cuticle-like *Lepidopteris* described by Bose and Banerji (1976) from Tubed. The Nonia Nala specimens, too, seem to belong to the same genus. Although their cuticle is not known, cuticle pieces similar to the ones described from the ?pinnules of *Lepidopteris* from Tubed, have been found in dispersed condition from the shale pieces bearing ?*Dicroidium*/*Lepidopteris*.

From Maitur, north-west of Asansol no fresh collections could be made. In fact the where abouts of the locality and the village Maitur is now not known. Because of non-availability of new material, only further observations have been made on the specimens earlier described as *Pecopteris concinna* Presl, *Cyclopteris pachyrhachis* Göppert and *Taeniopteris* sp. cf. *T. stenoneuron* (Schenk) Pascoe. None of these species are, so far, known from the underlying Raniganj beds.

The Northern branch of Nonia Nala near 'Indigo' factory bridge has yielded *Schizoneura*, a few species of *Glossopteris*, *Macrotaeniopteris* sp. and *Cordaicarpus* sp. All these plants are also known from the Permian of India. Only thing is near "Indigo" factory they have been found associated with such Estherias which are supposed to be Triassic marker in India.

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EXPLANATION OF PLATES

PLATE 1

1-3. *Schizoneura gondwanensis* Feistmantel; 1, G.S.I. no. 5/126. × 1; 2, B.S.I.P. no. 25/1013. × 1; 3, G.S.I. no. 5/125. × 1.

4. *Glossopteris retifera* Feistmantel; B.S.I.P. no. 74/1253. × 1.

5. *Glossopteris communis* Feistmantel; B.S.I.P. no. 28/1253. × 1.

6. *Glossopteris browniana* Brongniart; B.S.I.P. no. 6/1253. × 1.

7. *Glossopteris conspicua* Feistmantel; B.S.I.P. no. A26/1253. × 1.

8. *Glossopteris angustifolia* Brongniart; B.S.I.P. no. 41/1253. × 1.

9. *Glossopteris* sp. cf. *G. intermedia* Feistmantel; B.S.I.P. no. 41/1253. × 1.

10. ?*Taeniopteris* sp. cf. *T. stenoneuron* (Schenk) Pascoe; G.S.I. no. 5189. × 1.

11. *Macrotaeniopteris* sp.; B.S.I.P. no. 35/1253. × 1.

PLATE 2

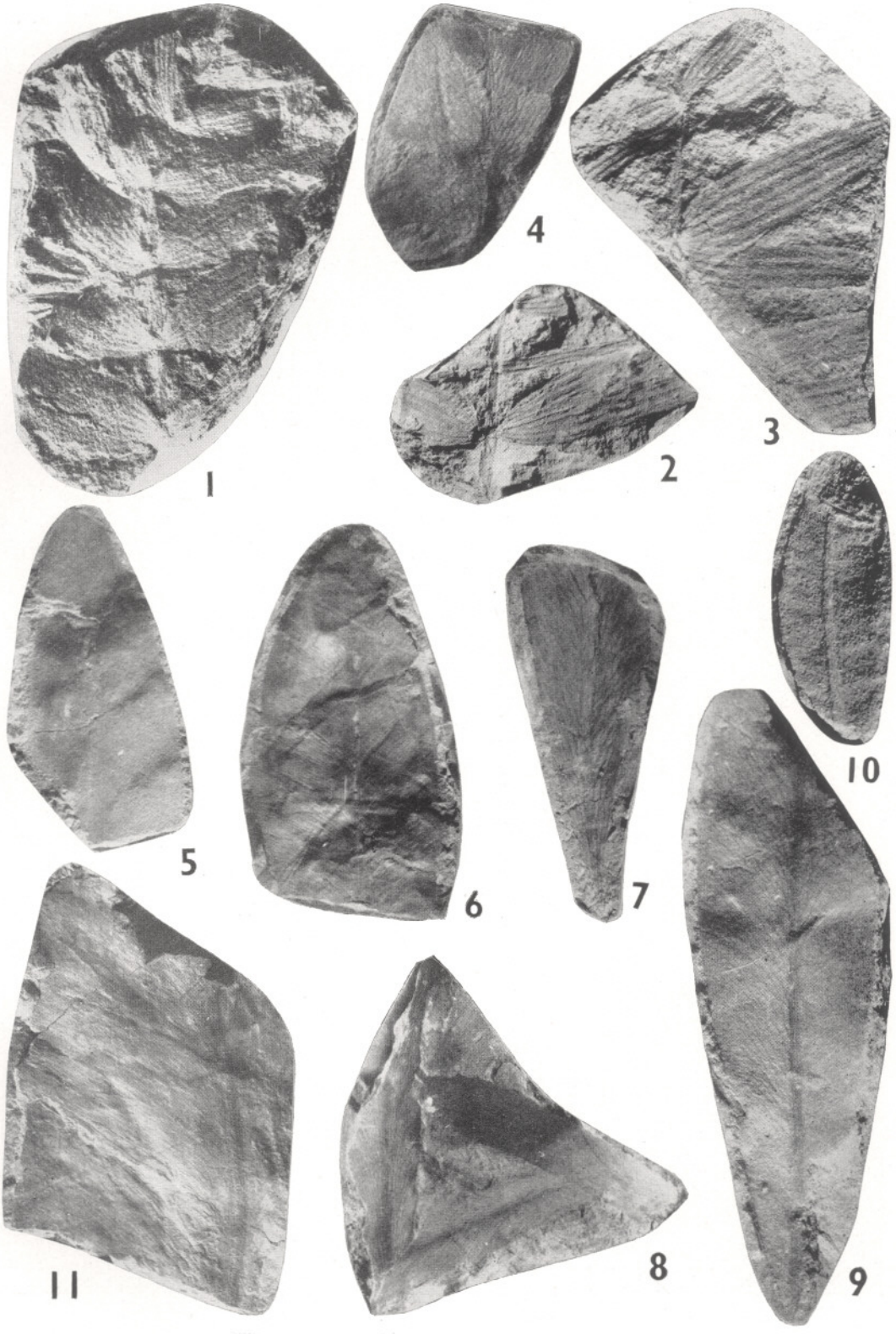
12-18. ?*Dicroidium* sp./*Lepidopteris* sp.; 12, B.S.I.P. no. 24/1358. × 1; 13, G.S.I. no. 18455. × 1; 14, G.S.I. no. 18455. × 2; 15, B.S.I.P. no. 24/1358. × 4; 16, B.S.I.P. no. 23/1359. × 4; 17, 18. G.S.I. no. 18456. × 5.

19, 20. ?*Lepidopteris* type of cuticle; 19, Dispersed cuticle showing distribution of stomata, Slide no. WNP $_2$/5045. × 150; 20, Subsidiary cells showing cutinized lappets overhanging a stomatal pit. Slide no. WNP $_2$/5046. × 500.

21. *Glossopteris conspicua* Feistmantel; B.S.I.P. no. 26/1253. × 1.

22, 23. *Podozamites* sp. cf. *P. lanceolatus* Lindley & Hutton; 22, G.S.I. no. 18454. × 1; 23. × 3.

24. *Cordaicarpus* sp.; B.S.I.P. no. 14/1253. × 1.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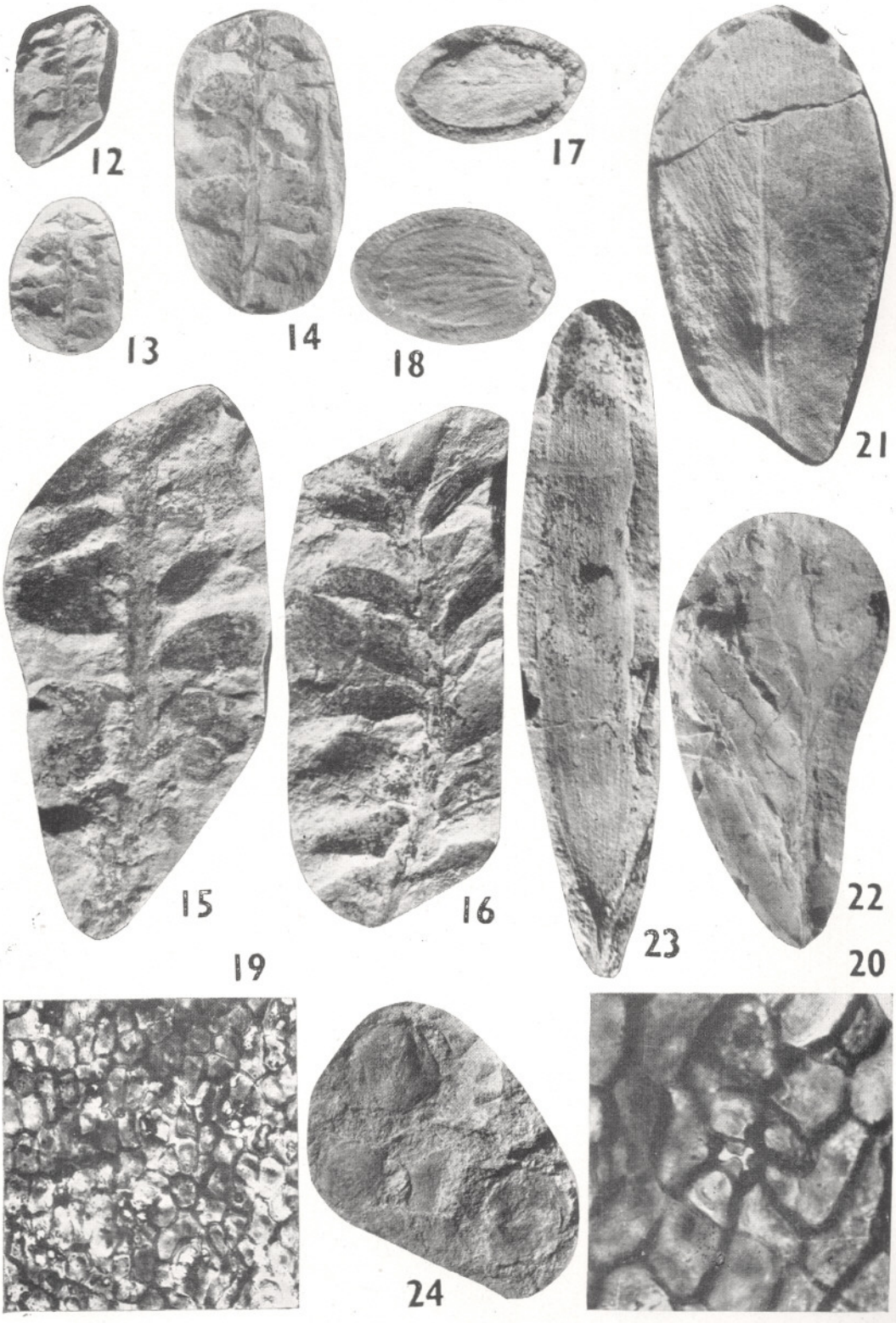
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