The flora of the Damuda-Panchet divisions

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(Ser. XII.)

THE FOSSIL FLORA OF THE GONDWANA SYSTEM.

Vol. III.

(LOWER GONDWANAS.)

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Palæontologist, Geological Survey of India.

2-3 Damuda-Panchet Divisions

1 (1879): THE FLORA OF THE TALCHIR-KARHARBARI BEDS, pp. 1-48; Pls. I—XXVII.

1 (Suppl. 1881): THE FLORA OF THE TALCHIR-KARHARBARI BEDS, pp. 49-64; Pls. XXVIII—XXXI.

2 (1880): THE FLORA OF THE DAMUDA-PANCHET DIVISIONS (first half); pp. 1-77; Pls. I*A*—XVI*A bis*.

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THE FOSSIL FLORA OF THE GONDWANA SYSTEM IN INDIA.

VOL. III.

PREFACE.

THE present volume, the third of the Fossil Flora of the Gondwána System in India, is made up of four fasciculi, composing two parts. It contains the descriptions and illustrations of the fossil plants of the Lower Division of the Gondwána system, so far as represented in the survey collections, up to the beginning of the year 1880.

Others subsequently received will be described in a succeeding volume. The names of all the animal remains found in the various groups together with the flora have been recorded.

The first part of the present volume (composed of two fasciculi, No. 1 and 1, Suppl., published in 1879 and 1881) contains the descriptions and illustrations of the lowest groups of the Gondwána system, *viz.*, the Talchir shales and Karharbári beds. The former are present in almost every coal-field, at the base; while the Karharbári beds are typically developed in the Karharbári coal-field, and are also known from the Mohpáni coal-field, and have recently been identified in the South Rewah basin by Mr. Hughes. The Talchir shales have not, however, been found fossiliferous in all the coalfields; at present we know of distinct fossils from the following districts only, *viz.* :—

a.—The Deoghur (Kuraun) coal-field, in the Santál Parganas, close to Khurmatár and Muddapúr Stations, E. I. Railway (Chord line); from here Talchir fossils were first discovered by the Survey.

b.—The Káranpúra coal-field, in Hazáribágh district, where Mr. T. Hughes first ascertained their occurrence, and where I have myself recently collected them. Mr. Hughes' fossils are included in this volume, while those collected by me will be illustrated in a following volume.

c.—In the beginning of this year I also collected Talchir fossils in the Aurunga coal-field, on the northern face of the Latiahar hill. These will also be included in the next volume.

d.—Quite recently Mr. Hughes has sent Talchir fossils from the South Rewah basin, Sohágpur. This discovery is of importance in connexion with the presence of the Karharbári beds (mentioned above), and of a typical Raniganj group, showing that similar relations existed here as during the formation of the Bengal coal-fields.

The Karharbári beds are highly fossiliferous where known to exist. The first impulse to our knowledge of this interesting flora was given by Mr. I. J. Whitty, C.E., late Superintendent of the Karharbári Collieries, E. I. R., who in 1876 sent to our Museum a magnificent slab of shale, containing, as it were, the nucleus of the entire flora, as afterwards made known. I have subsequently visited the coal-field several times, and with the kind assistance of the officers in charge I have made the collection of Karharbári plants which now fills five table-cases in our Museum comprising the specimens described and figured in this part.

In the Mohpáni coal-field one bed is also highly fossiliferous from which I collected in 1878. There were also some specimens from earlier times in our collections, probably collected by Mr. J. G. Medlicott.

This first part contains 31 Plates (six of which are double Plates), illustrative of the flora of the Talchir shales and Karharbári beds; on the whole tolerably well executed.

The second part (composed of two fasciculi, Nos. 2 and 3, published in 1880 and 1881) treats of the fossils of the Damuda and Panchet Divisions. They are more numerous than those of the Talchir-Karharbári beds, especially in the Damuda Division, which is *the* coal-bearing portion of the Gondwána system.

In bringing together the specimens of these rocks, many officers of the Survey, past and present, have contributed.

The descriptions and illustrations refer to all the fossils hitherto known from these rocks excepting those recently collected by Mr. Hughes in South Rewah and by myself in the Káranpúra and Aurunga coal-fields, which have, however, been mentioned in their respective places. They will be described and illustrated in the next (fourth) volume of the Gondwána Flora.

This second part is paged separately from the first one, and has, like it, a separate index.

It is illustrated by 47 Plates, also numbered separately, their numbers being distinguished by the addition of an *A* after the Plate number.

Although this volume concludes a description of the whole Gondwána flora as at present known, this can only be regarded as a basis for further researches; for large areas remain unsurveyed and additions to our collections are made continually. These will in due time be made known by descriptions and illustrations, always with reference to the volumes already published.

OTTOKAR FEISTMANTEL, M.D.

Calcutta, June 1881.

TABLE OF CONTENTS

(To Vol. III of the Gondwána Flora).

DIRECTIONS FOR THE BINDER.

Four fasciculi make up the present volume—See title-page to the volume.

Remove title pages and prefaces of all four fasciculi, as well as the tables of contents of the first three fasciculi (No. 1, No. 1 Supplement, and No. 2).

Bind text (pages 1—64) and plates (I—XXXI) of the first two fasciculi (No. 1 and No. 1 Supplement) together; as also the text (pages 1—149) and plates (I*A*—XLVII*A*) of the two other fasciculi (Nos. 2 and 3), and these two parts then form the volume and have to be bound together in the order indicated.

Bind title-page, contents and preface to the volume at the beginning of part 1 (first fasciculus).

Replace plate VII*A*, issued originally with fasciculus 1 of this volume, by the same plate (VII*A*) issued now.

THE FOSSIL FLORA OF THE LOWER GONDWANAS.

II.—THE FLORA OF THE DAMUDA AND PANCHET DIVISIONS.[1]

WITH PLATES I*A*—XVI *A bis*.

BY

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The fossil flora of the Damuda division, the chief coal-bearing group of the Lower Gondwánas, is much more numerous than that of the Talchir-Karharbári beds, both as regards the number of specimens and species, while, on the other hand, the flora of the Panchet group, the uppermost member of the Lower Gondwánas and locally overlying the Damuda division, is a very small one. The determination and comparison of the plants of the Panchet group has shown, that to a very great extent they are forms which are already represented in the Damuda sub-division, for which reason I have decided upon describing both floras together. Before proceeding to the description, I shall enumerate the fossils of the various coal-fields according to the groups and localities, as far as known at present, from which it will be best seen what fossils are known from the various groups and in what relation they are to each other.

In the Raniganj coal-field, where the Damuda division appears best developed, it was sub-divided into three groups: the Barákar group (being best developed in the west of the field on the Barákar river), Iron shales, and Raniganj group (so named from the town of Raniganj); and it is yet overlaid by rocks comprised under the heading "Panchet division." The other Bengal coal-fields show the same groups more or less developed: while in the fields to the west and south certain groups

[1] For general understanding, I may mention that the lower portion of the Gondwána system is sub-divided into three divisions, which are in ascending order: (*a*) the Talchir division, which includes the Talchir group proper and the Karharbári beds; (*b*) the Damuda division, which contains most of the Indian coal, and is again sub-divided into three groups; (*c*) the Panchet division, the top of the lower Gondwánas.

For further information see the Memoirs of the Geological Survey, and especially the Manual of the Geology of India, 1879, Vol. I, pp. 107—134.

occur, some of which differ in mineral character from those of Bengal, yet palæontologically can be correlated with the latter. This will be indicated in discussing the fossils of the various coal-fields, taking them in order from east to west and south, as observed in the Manual of Indian Geology (Vol. I, p. 162).

A.—The Rájmahál region.

Rájmahál Hills.—In his memoir on the geology of the Rájmahál hills,[1] Mr. V. Ball treats fully of the Damuda series of this area, showing that it mostly belongs to the Barákar group. Only very few fossils are known.

Mr. Ball mentions some leaves of *Glossopteris* (*l. c.*, p. 27) from shales near Ramgarh (south of the Bráhmani river), and there are a few specimens in our collections from some other localities:—

1. Musinia, on the Bráhmani river (Bráhmani coal-field).
   Vertebraria indica, Royle—one specimen distinctly branching.
   Glossopteris sp.
2. Burgo, in the Pachwara coal-field, on the Bansloi nadi, west of Amrapara.
   Vertebraria indica, Royle.
   Macrotæniopteris danæoides, Royle (this specimen will be found figured in the next part, Plate XXI *A*, fig. 2).

Glossopteris communis, Fstm.—two or three specimens of the usual form.

At these two localities the plants are preserved in dark-grey coal-shale usually met with in the Barákar group.

3. There are a few fossils from two other localities, differing lithologically from the mode of preservation usual in Barákar fossils. One of the localities, as indicated on the labels, is "Lohundia, upper bed below trap." The rock in which the fossils (which, according to our present knowledge, must be considered as "Damuda fossils") are preserved, is a light purplish-grey, fine, soft shale, which resembles more some shales from the Upper Gondwánas, and I think these are the shales to which Mr. Ball refers (*l. c.*, pp. 47 and 48), saying that the white beds of the Dubrajpur group on the Kair Pahar "were considered by Mr. Blanford (MSS.) to have so strong a resemblance to some in the vicinity of Lohundia and Ramzanpúr in the north of the area, that he suggested a possibility that the latter should be referred to the same group; but he added that the resemblance may only be accidental." In this latter conjecture Mr. Blanford was probably correct; for the fossils from Lohundia, as far as known, must be classed with the Lower Gondwánas, although they may represent a higher group than the Barákars, for I have determined—

Glossopteris communis, Fstm., with a very narrow net-venation.
Glossopteris indica, Schimp., a narrow-leaved form.

[1] Mem. Geol. Surv., India, Vol. XIII, pt. 2, 1877.

Glossopteris angustifolia—Bgt. This form is especially represented in the Raniganj group.

Small, scale-like leaflets: similar to some in the Raniganj group.

Winged seeds—of which I can form no opinion to what plant they might belong, as no other plants but *Glossopteris* occur with them. Winged seeds of the same nature are known from the Raniganj (Kámthi) group in the Raniganj field, South Rewah and Sátpura basin (Bijori horizon).

These fossils show a decided relation to those of the Raniganj group, and it is perhaps not improbable that these beds at Lohundia (in the Hura coal-field) represent that group—a view already suggested by Mr. Ball in his Geology of the Rájmahál hills (*l. c.*, p. 26).

4. The other locality lies further to the south of the area. Two specimens are preserved in our collection, both being of identically the same rock. There is no other record about them except that one bears the inscription "Dubrajpur." They consist of a purplish-grey shale, the fossils on it being much paler. They most probably come from the Gopikándar beds, close to the east of Dubrajpur (*l. c.*, p. 186).

It is very much to be regretted that their exact position is not known, for although there is a *Glossopteris* preserved in them, yet there is also another fossil, a broad-leaved *Phyllotheca*, very much similar to one from the Siberian Jura, recently described by Prof. Schmalhausen[1] of Kiew. This association is of a certain importance: for either are these fossils from the Damuda rocks of Gopikándar, and then there is another fossil of genuine jurassic type in association with *Glossopteris*, or they are from the Dubrajpur group (judging from the *Phyllotheca*), when there would be another instance of *Glossopteris* in Upper Gondwánas. In either case the discovery of the new *Phyllotheca* here in India is of interest; it will be figured on Plate XIV *A bis* [2]).

The fossils represent two species only:—

Phyllotheca robusta, n. sp.—the new species mentioned above. (Pl. XIV*A bis.*)

Glossopteris communis, Fstm.—Both from "Dubrajpur."

B.—Birbhum, Deogarh, and Karharbári region.

From this region very few fossils can be recorded as coming from the Damuda series, and only from two coal-fields:—

1. *Sahajori coal-field, in the Deogarh area.*—In his report on this coal-field,[3] Mr. Hughes mentions in the Barákar group (p. 254) "many fine specimens of *Glossopteris* in the shales accompanying the coal," but he does not mention any species, and I could not identify the specimens in our collections.

[1] Mem. de l'Acad. Imp. d. Sc. de St. Petersbourg, VII Ser., Tome XXVII, No. 4.

[2] As I identified it only after the plates were numbered, I had to intercalate a new plate after Plate XIV *A* as XIV *A bis*.

[3] Mem. Geol. Surv., India, Vol. VII, 1870.

2. *The Jainti or Karaun field* deserves notice, because that here the first, and up to date the most numerous, Talchir fossils were found, which were described in my previous paper, and which will also be taken into the comparative list of the Lower Gondwána fossils.

3. *Karharbári coal-field.*—In my Flora of the Talchir-Karharbári beds[1] I had an opportunity to point out, that in the Karharbári coal-field, which is mostly composed of Talchir and Karharbári beds, at one locality only, on the Lumki hill (in the southern portion of the field), there were found a few fossils which indicate a higher horizon than that of the Karharbári beds, and I thought it best to consider the beds on the Lumki (Komaljore) hill as representatives of the Damuda division. I also indicated that the seam on the Bhudua hill may be of the same horizon.

The Lumki hill fossils are—

Schizoneura gondwanensis, Fstm. Fragmentary, but distinct. This fossil is, it is true, especially frequent in the Raniganj group, but it also is known in the Barákar group, and the genus in the Talchir division also.

Vertebraria indica, Royle. Known from the whole Damudas.

Sphenopteris polymorpha, Fstm. Known from the Raniganj group also.

Glossopteris communis, Fstm. A common Damuda fossil.

Gangamopteris, sp. A form resembling somewhat certain long-leaved forms of *Gangamopteris cyclopteroides*, Fstm., of the Karharbári beds.

From the stratigraphical position of these beds on the Lumki hill, I suggested that they should be considered as belonging to the Barákar group.

The fossils of the Karharbári beds, including those which I recently (April 1880) collected from the second seam at shafts No. 24 and No. 40 (Passerabhia), from which seam hitherto no fossils were known, will be taken in consideration at end of this chapter, when the general table of the Lower Gondwána fossils will be given.

C.—Damuda Valley region.

I. Damuda valley coal-fields.—From this region the greatest number of fossils have been hitherto made known.

1. Raniganj field.—It was in this coal-field that the Damudas were earliest studied in detail, and where a regular three-fold grouping was first established. In this coal-field also the Panchet rocks were first separated. All these groups are fossiliferous. A detailed description of this field was given by Mr. W. T. Blanford.[2] From this coal-field also plants were first described by European authors, as I shall mention when speaking of the Raniganj group.

[1] Pal. Ind., Ser. XII, 1, pp. 43, 44.

[2] Mem. Geol. Surv., India, Vol. III.

a. Barákar group.—In 1877 I visited the western portion of the Raniganj coal-field where the Barákar group is best developed, and collected a number of fossils from these beds at two localities. A short account of my observations was given at that time,[1] to which some slight corrections are now required.

The fossils are (I find it necessary to introduce also the new names already here)—

Vertebraria indica, Royle—Various forms, amongst them also several branching specimens. (Figured on Pl. XIII*A*, figs. 1, 2, 4, 8, Pl. XIV*A*, figs. 1, 4). From Kumerdhubi and Nirscha.

Equisetaceous stems.—These may be either of *Schizoneura* or *Phyllotheca* (Pl. XIII*A*, fig. 7). Kumerdhubi.

Glossopteris communis, Fstm. (Figured Pl. XXXII*A*, fig. 2). Kumerdhubi and Nirscha.

Gl. communis, var. *stenoneura.*—A variety with a much narrower net-venation than in the original species (Pls. XXXII*A*, fig. 3, XXXIII*A*, fig. 1). Kumerdhubi.

Gl. indica, Schimp. Kumerdhubi.

Gl. browniana, Bgt. Kumerdhubi.

Gl. damudica, n. sp. (Pls. XXXI*A*, figs. 1-3; XXXII*A*, fig. 1). Kumerdhubi.

Gl. ingens. n. sp. Fragmentary. (Pl. XXXI*A*, figs. 4, 5). Kumerdhubi.

Gl. intermittens, n. sp. (Pl. XXXIII*A*, figs. 2-4). Nirscha.

Angiopteridium infarctum n. sp. (Pls. XXX IV*A*, figs. 4, 5.) Kumerdhubi.

Squamæ gymnospermarum (?) Scales of cycadeous plants (Pl. XLVII *A*, figs. 19-21). Kumerdhubi.

These are all the plants at present known from the Barákar group in the Raniganj field.

The next horizon in this field and from which plants are known is that of—

b. The ironshales.—These shales being generally very fine and compact, the fossils are mostly well preserved. They are, however, only very few—

Glossopteris communis, Fstm.

Glossopteris damudica, n. sp. A splendid specimen will be figured on Pl. XXX*A*, fig. 1.

An insect-wing-like leaf, figured on Pl. XVI*A bis*, figs. 7, 7*a*.

Coniferous stems. There are several fragments of stems, with little scars, which remind very much of coniferous stems, and which again agree with a Siberian plant. I shall refer to it more closely when describing these fossils in the proper place, Pl. XLVII *A*, figs. 5-7.

The best of these fossils are from Kulti, on the Barákar extension of the East Indian Railway.

c. Raniganj group.—This group contains in this coal-field the richest coal-seams; from it also most of the Lower Gondwána plants are known. From this group also the first fossils were known to European authors. Already in his "Prodrome d'une histoire des végétaux fossiles, 1828," Adolphe Brongniart mentions

[1] Rec. Geol. Surv., Vol. X, p. 73.

Glossopteris browniana from Raniganj[1] and a *Zeugophyllites calamoides* from the same locality.

In his "Histoire des végétaux," etc., we find another species of *Glossopteris*, *i. e.*, *Gl. angustifolia*, also from Raniganj. Prof. Göppert (1836) and later Schimper (1869) gave copies of Brongniart's drawings. At present the flora is much more numerous, for besides that there was in our Museum a large collection of plants from the Raniganj field, made during the survey of that field, I had an opportunity to collect several fossils myself in the neighbourhood of Assensole,[2] and I had also a collection of plants from Raniganj placed at my disposal by Mr. J. Wood-Mason.[3]

Most of these fossils are ferns, which will be illustrated in the next number, but a list of them all is given now.

EQUISETACEÆ.

Schizoneura gondwanensis, Fstm. Raniganj; Assensole, north branch of the Nunia river. Pls. I*A*, II*A*, III*A*, figs. 1, 2; Pl. IV*A*, figs. 1, 2; Pl. V*A*, figs. 1—5; Pl. VI*A*, figs. 1—3; Pl. VII*A*, fig. 2; Pls. VIII*A*, XIV*A*, fig. 5.

Stalks of Schizoneura. Pl. IX*A*, figs. 1—6. Raniganj.

Phyllotheca indica, Bunb., the real form. Pl. XII*A*, fig. 6. Raniganj.

Vertebraria indica, Royle. Pl. XII*A*, figs. 10, 11; Pl. XIII*A*, fig. 3; Pl. XIV*A*, figs. 2, 3. Raniganj, Assensole, (northern and southern branch of Nunia river), &c.

Trizygia speciosa, Royle. Pl. XI*A*, figs. 1, 3, 4, 5, 7, 8; Pl. XII*A*, fig. 1. Raniganj, Mangalpur.

FILICES.

Sphenopteris polymorpha, Fstm. Raniganj. Pls. XV*A*, XVI*A*, figs. 5, 6; Pl. XVI*A bis*, figs. 1—6. Sitarampur. Pl. XVI*A*, fig. 3.

Alethopteris (*Asplenium*), comp. *whitbyensis*, Göpp. Raniganj. Pl. XIX*A*, figs. 2, 2*a*.

Alethopt. lindleyana, Royle, Raniganj. Pl. XVIII*A*, fig. 2; Pl. XIX*A*, figs. 3, 4; Pl. XXIII*A*, fig. 10; Pl. XXXIX*A*, fig. 11.

Alethopt. phegopteroides, Fstm. Raniganj. Pl. XVIII*A*, fig. 1.

Pecopteris affinis, McClell. Raniganj. Pl. XXXIX*A*, fig. 10.

Merianopteris major, n. sp. Raniganj field. Pl. XIX*A*, figs. 9—11.

Macrotæniopteris danæoides, Royle. Raniganj. Pl. XX*A*.

Palæovittaria kurzi, Fstm. Raniganj. Pl. XLIV*A*.

Glossopteris communis, Fstm. (type). Raniganj field; Assensole, north branch, Nunia river. Pl. XXIX*A*, fig. 4; Pl. XXXV*A*, figs. 1, 2; Pl. XXXVI*A*, figs. 1—3.

Gl. communis, var. *stenoneura*. Raniganj. Pl. XXXVIII*A*, fig. 5.

Gl. indica, Schimp. Raniganj. Pl. XXV*A*, fig. 3; Pl. XXXV*A*, fig. 3.

Gl. browniana, Bgt. Raniganj. Pl. XXVII*A*, fig. 4.

Gl. intermedia, n. sp. Raniganj. Pl. XXIX*A*, figs. 3, 6.

[1] Written Rana-Gunje in Brongniart's work (pp. 54 and 169).

[2] I gave a short account of them in Rec. Geol. Surv., India, Vol. X, p. 75.

[3] These were already described by me in the Jour. As. Soc. Bengal, 1876, (Vol. XLV.)

Gl. retifera, Fstm. Raniganj; Sitarampur. Pl. XXVIII*A*, figs. 2, 7, 10; Pl. XLI*A*, fig. 9.
Gl. conspicua, n. sp. Raniganj; Assensole, north branch of the Nunia river; Dadka; Sitarámpur. Pl. XXVIII*A*, figs. 1, 5, 6, 8, 9.
Gl. divergens, n. sp. Raniganj. Pl. XXVIII*A*, figs. 3, 4.
Gl. augustifolia, Bgt. Raniganj; Assensole, south branch of the Nunia. Pl. XXVII*A*, figs. 6, 8, 9, 11—13; Pl. XXXIV*A*, fig. 3; Pl. XXXIX*A*, figs. 1, 2.
Gl. formosa, n. sp. Raniganj. Pl. XXXIX, figs. 3—7.
Gl. orbicutaris, n. sp. Raniganj; Assensole, north branch of the Nunia river. Pl. XLI*A*, figs. 1, 2.
Glossopteris, sp. Raniganj. Pl. XXXIV*A*, figs. 1, 2.
Gangamopteris whittiana, Fstm. Raniganj. Pl. XLIII, figs. 1, 2.
Gangamopteris, sp. Raniganj. Pl. XXVII*A*, figs. 7, 10.
Gangamopteris anthrophyoides, n. sp. Assensole, south branch of Nunia river. Pl. XXXIX*A*, figs. 8, 8*a*.
Belemnopteris wood-masoniana, Fstm. Raniganj. Pl. XLIII, figs. 3, 4.
Sagenopteris(?) longifolia, n. sp. Raniganj. Pl. LX*A*, fig. 1.
Sag. (?) polyphylla, Fstm. Raniganj. Pl. XLI*A*, figs. 3, 4; Pl. XLIII*A*, fig. 5.
Sagenopteris, sp.? Raniganj. Pl. XLI, fig. 7; Pl. XLII, figs. 2, 4.
Actinopteris? bengalensis, Fstm. Pl. XIX*A*, fig. 1. Raniganj.
Dictyopteridium sporiferum, n. sp. Pl. XXIII*A*, fig. 12.

CYCADEACEÆ.

Pterophyllum burdwanense, Fstm. Raniganj. Pl. XLVII*A*, fig. 1.
Nöggerathiopsis (= *? Rhiptozamites*) *hislopi*, Bunb., sp. Pl. XLV, figs. 10, 11.
Squamæ. Raniganj. Pl. XLVII*A*, figs. 8, 16.

CONIFERÆ.

Voltzia ? scale. Raniganj. Pl. XLVII*A*, fig. 19.
Samaropsis comp. *parvula*, Heer. Raniganj. Pl. XLVII*A*, figs. 14, 15.

If we compare the fossils enumerated above, we shall find that all the plants of the Barákar group, except *Gl. ingens*, n. sp., *Glossopteris intermittens*, n. sp., and *Angiopteridium infarctum*, n. sp., are found also in the Raniganj group, and that two species of the three from the iron shales are both in the Barákar and Raniganj groups. The Raniganj group is the richest in forms, and in this group in this coalfield altogether the most species have hitherto been distinguished.

d. Panchet group.—This group was established in Mr. Blanford's report, and at first a lower and upper division was distinguished; but later, the name Panchet was retained for the lower division only, as belonging to the Lower Gondwánas, while the upper Panchet group, although no fossils have been found in it, is considered as probably representing the Dubrajpur group. We have to deal here with the lower portion only, or with the Panchet group proper. It is fossiliferous, and is the only group of the Lower Gondwánas in which hitherto animal fossils have been found numerously.

ANIMALS.

Dicynodon orientalis, Huxley. Deoli, Damuda river, south-west of Assensole.
Ankistrodon indicus, Huxley. *Ibid.*
Gonioglyptus longirostris, Huxley. *Ibid.*
Pachygonia incurvata, Huxley. *Ibid.*
Estheria (comp. *mangaliensis*, Jon.) South of Maitur, north-west branch, Nunia river.

PLANTS.

Schizoneura gondwanensis, Fstm. The same species as in the Raniganj group. Maitur, north-west branch of the Nunia river, north-west of Assensole. Pl. X*A*.

Pecopteris concinna, Presl. Pretty frequent. *Ibid.* Pl. XVII*A*, figs. 1—6.

Cyclopteris pachyrhachis, Göppt. *Ibid.* Pl. XVII*A*, fig. 7.

Oleandridium comp. *stenoneuron*, Schimp. *Ibid.* Pl. XIX*A*, figs. 5—8.

Glossopteris. Two species can be distinguished, although the specimens are only fragmentary, but the net-venation can be well seen, and it can be referred to that of two species in the Damuda division, *i.e.*—

Glossopt. indica, Schimp., and *Gl. communis*, Fstm. *Ibid.* (Figures see in Rec. Geol. Surv., India, Vol. X, pp. 139, 140, figs. 3—8, on plate facing page 140).

Samaropsis comp. *parvula*, Heer. Several winged seeds, which are of the same type as those already mentioned in the Raniganj group, only a little smaller. North-west branch of the Nunia river. Pl. XLVII*A*, figs. 11—13.

A comparison of the fossils in the Panchet division with those in the Raniganj group shows that there is great resemblance of the two floras, four species out of seven being identical.

The *Estheria* appears to be identical with some forms occurring at other localities, which are also considered as representatives of the Raniganj group.

Further general remarks can be given only at the end, when the floras of the other districts have been named.

2. Jharia coal-field.—The next coal-field from which we have to record fossils of the Damuda series is the Jharia coal-field, to the west of the Raniganj field.

Several fossils were collected by Mr. Hughes, by whom the coal-field has been described;[1] and I published a short note on a *Dicksonia* from this coal-field.[2] All the groups of the Damuda series and also the Panchet rocks are found in this field, but fossils were only found in the Barákar and Raniganj groups; from the latter the fossils are in our collections.

a. From the Barákar group Mr. Hughes mentions (*l. c.*, p. 311)—

Vertebraria (*indica*, Royle).
Glossopteris, sp.

[1] Mem. Geol. Surv., India, Vol. V, pp. 227—336.
[2] Rec. Geol. Surv., India, Vol. X, p. 198, figs. 10, 11.

b. From the Raniganj group are known (*l. c.*, p. 313).

Schizoneura gondwanensis, Fstm. Pl. IV*A*, fig. 3.
Vertebraria indica, Royle.
Dicksonia hughesi, n. sp. Pl. XXIII*A*, figs. 1, 2.
Alethopteris (*Asplenium*) comp. *whitbyensis*, Göpp. Pl. LX*A*, figs. 2, 3.
Macrotæniopteris danæoides, Royle. Pl. XX*A*, fig. 1.
Glossopteris communis, Fstm. Pl. XL*A*, fig. 4.

Also from the Talchirs a *Glossopteris* is mentioned (*l. c.*, p. 243).

3. Bokáro coal-field.—The next field to the west of the Jharia coal-field is the Bokáro field, which was described by Mr. T. H. Hughes in 1869.[1] All groups of the Damuda field occur; fossils, however, were very rare, and occurred in the Barákars and the Raniganj group only. I could identify only one specimen in our collections.

a. Barákar group.—Mr. Hughes mentions the genus *Asterophyllites* on p. 40 of his report from a section near Layeo. This specimen I have identified in our collections; it bears a label on which is written: "*Asterophyllites*, Bokáro coal-field." The specimen is, however, not an *Asterophyllites*, but *Trizygia speciosa*, Royle.

b. Raniganj group.—From this group one fossil only is mentioned by Mr. Hughes (*l. c.*, pp. 63,161) from near Hurdeeamo, south-west of Sarun. Mr. Hughes mentions *Schizoneura* as being very numerous here; I think we can with all probability presume that it was the common Raniganj species *Schizoneura gondwanensis*, Fstm.

4. The *Káranpúra* field deserves a notice here, only in so far as the Talchirs yielded several fossils, which I have already described (*l. c.*), and they will be named again in the general comparative table of the Lower Gondwána fossils. The Damudas did not yield any fossils.

II. Coal-fields of *Palmaun* (*Palamow*).—Of this area, the *Auranga coal-field* only, described by Mr. Ball, 1878,[2] comes into consideration, as having yielded some fossils.—Mr. Ball describes the Barákar and Raniganj groups and also the Panchet group. He did not, however, collect any fossils from the Damudas, only a few from a doubtful horizon, to be mentioned presently.

Barákar group.—A few fossils were brought in 1879 by Mr. Griesbach, collected (on his way to the Sirguja coal-fields) in the Auranga coal-field, at a locality west of Murup, in the coal-beds, most likely Barákars: these fossils were:

Trizygia speciosa, Royle.
Glossopteris communis, Fstm.

I have mentioned them already in a short note in the Records for 1880, p. 65.

Doubtful horizon.—South-east of Panripara, near Latiahar, Mr. Ball[3] found

[1] Mem. Geol. Surv., India, Vol. VI, pp. 39-108.
[2] Mem. Geol. Surv., India, Vol. XV, Pt. 1.
[3] Mem. Geol. Surv., India, Vol. XV, Pt. 1, p. 89.

several fossils in a red shale, like some shales of the Mahádevas, but as they were in immediate proximity of a fault, it was not possible to determine with certainty the true horizon; this is much to be regretted, for the fossils, compared with others, are of decidedly Damuda forms; yet they might as well come from the Panchet rocks, and it would even not be surprising, although very interesting, if they were from the Mahádevas. On the label, which Mr. Ball gave me with the fossils, he wrote "horizon uncertain, but apparently Mahádevas." In this case they would be from the Upper Gondwánas. But at present I name the fossils here, treating them as of the Panchet group; they are:—

Vertebraria indica, Royle.
Pecopteris? or *Cyclopteris?*
Glossopteris communis, Fstm.
Gl. indica, Schimp.
Gl. damudica, n. sp.
Squamæ gymnospermarum. These are also known from the Raniganj group.
Samaropsis?—small winged seeds.

D.—Son, Mahanadi, and Bráhmani region.

1. Ramkola and Tatapáni coal-fields.—These fields, in the eastern extension of the Son basin, were lately surveyed by Mr. Griesbach[1], who also brought a good collection of fossils upon which I gave a short note in the Records.[2] Of the Damuda series Mr. Griesbach distinguished the Barákar and Raniganj groups, and also the Panchet division. All were found fossiliferous. I shall at present give only a general list of the fossils from all groups collectively:—

Names.	Barákar group.	Raniganj group.	Panchets.
Vertebraria indica, Royle ...	Sendur river, west of Mitgain; on the Ledho nala near Karamdiha; between Mahan river and Tamor hill, near Majurdaki; Suknai nala, north of Sarsera.	Between Mahan river and Tamor hill; nala between Gouri and Ghui; Morne river, north of Parasdiha.	.....
Schizoneura gondwanensis, Fstm.	.....	Nala at Budatand; near Lanjit.	.....
Glossopteris communis, Fstm.	Sendur river, west of Mitgain; west of Chumra; Ledho nala near Karamdiha; west of Dhonda; Suknai nala, north of Sarsera.	Banki nala, between Chumra and Gidhi; east of Ghui; south of Nowadih; Ledho nala.	Ledho nala near Karamdiha.
Glossopt. var. *stenoneura* ...	.....	North of Meguli ...	.....

[1] Mem. Geol. Surv., India, Vol. XV, Pt. 2.
[2] Vol. XIII, pt. 1, p. 65.

Names.	Barákar group.	Raniganj group.	Panchets.
Glossopt. browniana, Bgt. ...	Sendur river, west of Mitgain.	.....	.....
Glossopt. damudica, n. sp. ...	Sendur river, west of Mitgain; between Mahan river and the Tamor hill.	Morne river, north of Parasdiha.	.....
Glossopt. indica, Schimp. ...	Between Mahan river and the Tamor hill (Majurdaki); north-west of Reonti; west of Dhonda.	Between Chumra and Gidhi.	Ledho nala.
Glossopt. angustfolia, Bgt. ...	.....	Banki nala, between Chumra and Gidhi; between Mahan river and Tamor hill; Morne river, north of Parasdiha; Budatand nala near Budatand; south of Nowadih; in the Ledho nala.	Ledho nala.
Glossopt. retifera, Fstm. ...	.....	Banki nala, between Chumra and Gidhi.	.....
Glossopt. formosa, n. sp. ...	.....	South of Nowadih ...	.....
Glossopteris, sp. ...	.....	.....	Nala west of Narolah.
Thinnfeldia comp. *odontopteroides*, Morr., sp. Pl. XXIIIA, figs. 6-8.	.....	.....	Ledho nala near Karamdiha.
Nöggerathiopsis hislopi, Fstm.	Between Mahan river and Tamor hill (Majurdaki); Suidud nala, 1½ mile north of Bheria.	.....	.....

The observations of interest which can be based on these fossils are —

a.—The establishment of the true Raniganj group.

b.—The close relation of the various groups, especially of the Raniganj-Panchet groups. The fossils which I have marked as coming from the Panchet group might as well be considered as coming from the Raniganj group, but it appears that stratigraphically these localities belong to the Panchet group.

2. South Rewah and Sohágpur.—Under this title a very large portion of the great Gondwána basin of the Son has hitherto been described (*see* Manual, Geology of India, pp. 199-204). The names indicated the two areas where the lower (coal-bearing) groups are exposed, on the north-eastern and the southern margins of the basin. Since the early explorations the Sohágpur district has been transferred to the Rewah State, so that it is now more truly South Rewah than is the area so designated; for this latter we may therefore substitute the name *Gopat coal-fields*,

from the large tributary of the Son which drains that part of the ground. A survey of the whole basin has recently been undertaken by Mr. Hughes; there are several fossils amongst our older collections brought by Mr. J. G. Medlicott and Mr. Hacket; lately a good number of fossils were sent by Mr. Hughes. No horizons were indicated with the former fossils, but I think they come from a horizon representing the Raniganj group, as Mr. Hughes' fossils do.

a. Gopat coal-fields.—There is a collection of plants labelled "South Rewah, J. G. Medlicott, 1861," without any further indication of locality. The fossils are in a soft, light greenish-grey or reddish-grey shale, very much like that I shall mention hereafter from the Bijori horizon of the Sátpura basin, and are—

Vertebraria indica, Royle—the branched form.
Stems (? *Schizoneura*).
Glossopteris communis, Fstm.
Nöggerathiopsis hislopi, Fstm.—very numerous (Pl. XLV *A*, figs. 1-5). (Comp. *Rhiptozamites*, Schmalh.).
Voltzia heterophylla, Bgt. (Pl. XLVII*A*, figs. 19, 20).
Small seeds, probably of *Voltzia*.

Another collection of fossils is labelled, "Sent by Mr. Medlicott, 1861." There is little doubt that these also are from South Rewah, but there is no further indication as to any particular locality. The fossils are preserved in a dark grey sandy shale. They are only few—

Glossopteris communis, Fstm.—a variety with very narrow and straight veins. Pl. XXIX *A*, figs. 5-9.
Nöggerathiopsis hislopi, Fstm.

If we consider these fossils as a whole, and compare them with other floras within the Damuda series, we shall perhaps do best to range them with the representatives of the Raniganj group in the neighbourhood of Bijori, Nágpur, and elsewhere.

b. Recent collection from South Rewah.—While this paper was going through the press, Mr. Hughes, who is now engaged upon a regular survey of the South Rewah coal-field, has sent in a good number of fossils. To complete the above list, I name those belonging to the Lower Gondwánas; they are from several localities, and to avoid repetition, a collective list may be sufficient here :—

Schizoneura gondwanensis, Fstm.: Bajbai, 2 miles east of Gopat river; Mahan river, near Minarra; between Minarra and Gajar; Chanduidol.
Phyllotheca, sp.: Mahan river, between Minarra and Gajar.
Vertebraria indica, Royle: Bajbai, 2 miles east of Gopat river; Mahan river, near Tansar. Many nice specimens are in this collection.
Alethopteris comp. *Whitbyensis*, Göpp.: Mahan river near Minarra; between Minarra and Gajar.
Angiopteridium comp. *McClellandi*, O. M.: Mahan river, between Minarra and Gajar.

Glossopteris communis, Fstm.: Bajbai, 2 miles east of Gopat river; Mahan river near Minarra; between Minarra and Gajar.

Glossopteris indica, Schimp.: Bajbai, 2 miles east of Gopat river; Mahan river near Minarra.

Gl. retifera, Fstm.: Mahan river near Minarra.

Gl. angustifolia, Bgt.: Bajbai, 2 miles east of Gopat river; Mahan river near Minarra; between Minarra and Gajar.

Glossopt. formosa, n. sp. Chanduidol.

Glossopteris, sp. From river running between Parasi and Kunjwar (nearly opposite (west of) Parasi.)

There is no doubt that these fossils belong to the Raniganj group proper, and they support the suggestion made above about the horizon of the fossils of the older collections. Even the shale agrees completely with that of the Raniganj group, in the Raniganj field. (See also Rec. G. S. I., Vol. XIII, pt. 3.)

c. Sohágpur coal-fields.—There is a collection of fossils in our Museum, labelled "Sohágpur, J. G. Medlicott, 1861," without other reference; they are preserved in a light yellowish-reddish sandy shale, and are—

Vertebraria indica, Royle—the more branched form, as known from Kámthi (*see* further), and also a section (Pl. XIV *A bis*, fig. 3).

Gl. communis, Fstm.

Gl. browniana, Bgt. (Pl. XL*A*, fig. 5).

Gl. damudica, n. sp. (Pl. XL*A*, fig. 6). Rare.

We have another collection from this field, made by Mr. Hacket (1872), with which the following locality is given: "Son river, west of Garara." The fossils are preserved in a dark greenish-grey micaceous sandy shale, and are—

Vertebraria indica, Royle.

Macrotæniopteris feddeni, Fstm.—a form known also from Nágpur.

Glossopteris communis, Fstm.

Dictyopteridium, sp? (Pl. XLII*A*, fig. 5).

3. Bisrampur coal-field.—In Mr. Ball's survey of this coal-field [1], he distinguishes of the Damuda series the Barákar group only. Fossils were rather rare, and they are only mentioned from one locality. On pp. 35-36 (*l. c.*) Mr. Ball describes a seam in the Galphúla river, near Bilaro, in the shales of which there were found *Glossopteris* sp. and other plant-remains which I could not, however, identify in our collections.

4. Raigarh-Hingir coal-field.—In this coal-field, Mr. Ball [2] distinguished of the Damuda series the Barákar group, in which no fossils were observed, and then another group, above the Barákars, which he at first called "upper sandstones" or "Hingir group." In this some fossils were found in highly ferruginous shales; I gave a preliminary list of the same (Mr. Ball's paper *l. c.*, p. 115). Later Mr. Ball brought some more fossils from the same horizon, and the re-

[1] Rec. Geol. Surv., India, Vol. VI, pp. 25-41.

[2] Rec. Geol. Surv., India, Vol. VIII, pp. 102-121 (a short note was given *l. c.*, Vol. IV, pp. 101-107).

examination of the whole collection led to the conclusion, that the "Hingir group" can well be correlated with some other groups of the Damudas, already known, especially with the "Kámthis."[1] The fossils are—

Schizoneura gondwanensis, Fstm. Garjan hill, Hingir.
Vertebraria indica, Royle, both the branched (Kámthi) and common (Raniganj) form. Garjan hill, Hingir; Girundla; Kodaloi, and on the Bilpahari.
Sphenopteris comp. *polymorpha*, Fstm. Garjan hill.
Glossopteris communis, Fstm. Garjan hill.
„ *indica*, Schimp. *Ibid.*
„ *browniana*, Bgt. *Ibid.*
„ *damudica*, n. sp. *Ibid.*

These fossils, considered by themselves, without reference to the rocks in which they are preserved, must be taken in the first place as fossils of the Raniganj group. As regards the rock in which they are preserved, I think it has rather more resemblance to the "iron shales" than to Mahádeva shales or any rocks of the "Kámthis," so that a correlation of the "Hingir group" directly with the Raniganj group would appear more appropriate.

5. *Talchir coal-field.*—This is the coal-field which was first regularly surveyed and described by the Geological Survey. We find the report on the same in the first volume of the Memoirs of the Geological Survey[2]. In this report the names of the groups, Mahádeva, Damuda, and Talchir, were at first introduced. The Damudas were at that time not further sub-divided. In the Manual of the Geology of India (p. 212) the Damuda series is described as consisting of the Barákars and Kámthis, and it is in the former that numerous fossils were found. They were found at two localities (see the mentioned report, *l. c.*, pp. 56 and 59): (*a*) in the nala west of Gopálprasád, in ferruginous clay, imbedded in carbonaceous shales, and (*b*) at Talchir, in sandy shale of light colour, overlying the carbonaceous beds.

The fossils are—

Vertebraria indica, Royle. Talchir and Gopálprasád.
Trizygia speciosa, Royle. Pls. XI*A*, figs. 2, 9, XII*A*, fig. 2. Gopálprasád.
Cyathea comp. *tchihatcheffi*, Schmalh. Pl. XVI*A*, figs. 1, 2, 4. Talchir.
Glossopteris indica, Schimp. Pl. XXIX*A*, fig. 7. Gopálprasád.
Gl. communis, Fstm. Gopálprasád and Talchir. Pl. XXXVIII*A*, fig. 2.
Gl. intermedia, n. sp. Pl. XXIX*A*, figs. 1, 2. Gopálprasád.
Gl. damudica, n. sp. Gopálprasád. Pls. XXV*A*, fig. 4, XXX*A*, fig. 2.
Gl. angustifolia, Bgt. Gopálprasád.
Dictyopteridium ? sporiferum, n. sp. Pl. XXIII*A*, figs. 3, 4, 5. Talchir and Gopálprasád.

Of interest amongst these fossils is the rather numerous occurrence of *Trizygia*; and the occurrence of a fern which I at first referred to my *Sphenopt. polymorpha* of the Raniganj group, but which now has to be referred to what at first was

[1] Ball: Rec. Geol. Surv., India, Vol. X, p. 171.

[2] On the geological structure and relations of the Talchir coal-field by Messrs. W. T. and H. F. Blanford and W. Theobald, 1859: Mem. Geol. Surv., India, Vol. 1, pp. 33—88.

described by Göppert as *Sphenopteris anthriscifolia*[1], but what recently Prof. Schmalhausen described as *Cyathea tchihatcheffi*[2] from the Kusnezk basin in the Altai, the flora of which is a jurassic flora, and has many relations to our Damuda flora, as I shall point out hereafter.

E.—Satpura Region.

I. Sátpura basin.—Besides several previous papers on this ground, the most recent report on the Sátpura basin is that by Mr. H. B. Medlicott,[3] in which, besides several groups of the Upper Gondwánas, also several groups in the Lower Gondwánas are distinguished. It is true that also in the original report[4] on this area by Mr. J. G. Medlicott two groups of "Damudas" were distinguished as "Lower" and "Upper Damudas." But this latter was subsequently replaced by the name of Jabalpur group, as its flora differed widely from that of the "Upper Damuda group" (Raniganj group) distinguished in the Raniganj field.

We shall therefore keep to Mr. H. B. Medlicott's report, and as the Jabalpur group and Mahádevas (Denwa, Bagra, and Pachmari groups) belong to the Upper Gondwánas, we shall have to deal with the lower groups only. I shall proceed in ascending order.

1. Talchir division.—The Talchir group of this basin was not found fossiliferous, but in the Mohpáni coal-field (in the north-east) and in the Sháhpur coal-field (in the south-west) fossils were observed which seem to correlate the beds in which they occur, with the Karharbári beds of the Talchir division. I pointed to these relations in my Talchir-Karharbári flora.[5] About the Mohpáni fossils being of the Karharbári type, I think there is no doubt, and I shall enumerate them only in the general table at end of this chapter; but the Sháhpur fossils are not so numerous, and it will be well to mention them here again with the Barákar fossils.

I have, however, to mention here one Mohpáni species, which I omitted to figure in my previous publication, *i. e.*—

Nöggerathiopsis hislopi, Fstm.,

and the figures of it given hereafter in the supplemental plates will help to complete the observation on the genus *Nöggerathiopsis*, Fstm., in its relations to *Rhiptozamites*, Schmalh.

3. Damuda division.—In this division three groups are distinguished, and a fourth indicated: the Barákar group, Motúr horizon, Bijori horizon, and Almod beds. Two only of these were found fossiliferous, and by fixing their horizon from the fossils, the position of the others may approximately be determined.

[1] Göppert, in Tchihatcheff, Voy. dans l' Altai orient., 1845, p. 387, Tab. 28, 29.

[2] Beitr. z. Jurafl. Russlands, 1879: Mem. de l' Acad. Imper. de St. Petersbourg, VII Ser., Vol. XXVII, No. 4, p. 24, especially Pl. II, figs. 1, 2—5.

[3] Mem. Geol. Surv., India, Vol. X.

[4] Mem. Geol. Surv., India, Vol. II.

[5] 1879, Pal. Ind., Ser. XII, 1.

a. Barákar group.—Formerly the Mohpáni coal-beds also were included in this group, but as I mentioned above they may better now be classed with the Karharbári beds. We have therefore at present to include here only the plants from the Sháhpur coal-field and from the Pench valley. I have given a short note of the former in 1879[1], where I also mentioned that at one or two localities they seem to indicate the presence of Karharbári beds. I observed fossils at four localities. I enumerate the fossils collectively—

Vertebraria indica, Royle. Mardanpur outcrops.
Equisetaceous stalks (Schizoneura?). Kotmi section; Dolári outcrops.
Glossopteris communis, Fstm. Kotmi section.
Glossopteris sp. Dolári outcrops.
Gangamopteris cyclopteroides, Fstm. Kotmi and Dolári outcrops.
From this fossil, which is so very frequent in the Karharbári beds, both in the Karharbári and Mohpáni fields, I supposed that the beds at these localities also may represent the Karharbári beds.
Nöggerathiopsis hislopi, Fstm. Kotmi section; Suki outcrops; Dolári outcrops.

For the present these fossils may be correlated with those of the Barákars elsewhere.

In an eastern continuation, the coal-beds are again met with in the Pench valley, in the vicinity of Umrét, near the village Barkoi. There are several specimens from this place and from Bhuwan in our collections; but we must first mention some that were previously noticed. In his note on the geology of some parts of Central India, Lieutenant Sankey[2] mentions the following genera from near Barkoi—

Phyllotheca.
Vertebraria.
Sphenopteris.
Pecopteris.
Glossopteris.

In a subsequent note on the same subject by the Rev. Mr. Hislop[3] the following genera are mentioned—

Phyllotheca.
Vertebraria.
Glossopteris.
Cyclopteris.[4]

No species were named.

[1] Rec. Geol. Surv., India, Vol. XII, pp. 79, 80.
[2] Quar. Jour. Geol. Soc., Vol. X (1854), p. 55.
[3] *Ibid.*, Vol. XI, p. 557.
[4] This is what we now know as *Nöggerathiopsis.*

The specimens in our Museum represent—

Vertebraria indica, Royle. Barkoi.
Equisetaceous stem. (Probably Mr. Hislop's *Phyllotheca*). Barkoi.
Glossopteris communis, Fstm. Barkoi.
Gl. indica, Schimp. Barkoi and Bhuwan.
Nöggerathiopsis hislopi, Fstm. Pl. XLVI*A*, figs. 3, 4. Barkoi.

The fossils are preserved in a black ferruginous shale, resembling that from the Barákars in the Talchir coal-field, and there is no objection to consider these beds as Barákars.

b. Motúr horizon.—In this horizon, succeeding the Barákars, no fossils have been found as yet, and the correlation with other horizons is therefore somewhat precarious. But from the intermediate position between the Barákars and the next group, the Bijori horizon, which most likely represents the Kámthi-Raniganj group, we may consider it as probably representing the ironstone-shales in the eastern coal-fields.

c. Bijori horizon.—These beds, which overlie the Motúr horizon, are fossiliferous, and take their name from Bijori near the foot of the Pachmari hills on the south, at which locality a portion of a Labyrinthodont reptile was found. Plants are known from two localities, from near Barikondam, and further to the west from near Harapala (between Rorighat and this place); at both these localities I have collected a good number of specimens, and there were a few from the former locality already in our collections. I gave a short note of these fossils in 1879.[1]

The fossils known at present from this horizon are—

ANIMALS.

Archegosaurus? sp. Bijori. Skull and a portion of the vertebral column.

PLANTS.

Schizoneura gondwanensis, Fstm. From Barikondam, Pl. III*A*, fig. 4, and between Rorighat and Harapala.
Vertebraria indica, Royle. The branched form. Between Rorighat and Harapala.
Trizygia speciosa, Royle. Denwa nadi, Pachmari.[2]
Dicksonia, sp. Barikondam. (Pl. XXIII*A*, figs. 11, 12).
Glossopteris communis, Fstm. Barikondam.
Gl. damudica, Fstm. Barikondam.
Gl. retifera, Fstm. Barikondam.
Gl. angustifolia, Bgt. Barikondam, and between Rorighat and Harapala.
Gangamopteris, sp. Small, rounded leaf. Barikondam. (Pl. XXXIX *A*, figs. 9, 9*a*.)
Samaropsis comp. *parvula*, Heer. Barikondam. (Pl. XLVII*A*, figs. 9, 10.)

[1] Rec. Geol. Surv., India, Vol. XII, pp. 76—79.
[2] This is the locality written on the label on the specimen.

If we compare these fossils with those of other groups mentioned in the foregoing pages, we shall find the greatest relation with the fossils from the Raniganj group, and we may therefore consider this *Bijori horizon* as local representative in the Sátpura basin of the Raniganj group, with which also another group, the Kámthi group, will have to be correlated.

Almod beds.—In his description of the Bijori horizon (*l.c.*, p. 27), Mr. Medlicott indicated the existence also of some higher beds (between the Bijori horizon and the Pachmari sandstone) near Almod and Rorighat as *Almod beds;* I saw these beds at Almod and again further east immediately below the Pachmari sandstone. No distinct fossils have been found as yet, but lithologically these beds differ somewhat from the plant-bearing shales of the Bijori horizon, and it is quite probable that these beds represent the Panchet rocks of other fields.

F.—Godavari Region.

I. Neighbourhood of Nágpur.—On this district we have several important papers by the Rev. Mr. Hislop, published in the Quar. Jour. Geol. Soc., London (Vols. XI, pp. 58, 555, XVI, p. 154, XVII, p. 346, etc.,) and in other Journals; the most recent paper, however, is by Mr. W. T. Blanford.[1] There is also a paper by Sir Ch. Bunbury on plants from Nágpur.[2]

Of the Gondwána rocks we find in this district the Talchir group, and a higher group of the Damuda series, which Mr. Blanford (*l.c.*, pp. 11, 31, etc.) called Kámthi group.

As the Talchir group is here unfossiliferous, and the Barákar group is not exposed, I shall at once enumerate the fossils of the—

a. Kámthi group.—The position and correlation of this group is discussed by Mr. Blanford in his paper (*l.c.*, pp. 31—36), and the conclusion at which he arrived is (p. 36) that "it is far from improbable that they (the Kámthi beds) represent, in part at least, the Raniganj group of the Damudas, or they may be intermediate in age between the Damudas and Panchets."

In the general table in the Manual, Geology of India (p. 108), the Kámthis in the Godávarí district are represented as equivalent of the Iron shales (Motur), Raniganj (Bijori horizon), and Panchets (Almod beds) of the other fields. In fact, the Kámthi beds contain plant fossils of real Damuda type, and may safely be taken as representing the Raniganj group (with the equivalents in the Sátpura basin, South Rewah, and Raigarh-Hingir field).

We have, as mentioned above, a paper on some plants of Nágpur by Sir Ch. Bunbury, others are in our collections. I shall enumerate them together, omitting some of Sir Ch. Bunbury's doubtful forms.

[1] Mem. Geol. Surv., India, Vol. IX, p. 295 et seq.

[2] Quar. Jour. Geol. Soc., London, Vol. XVII, with plates.

The localities from which we know fossils are—

Kámthi (Bunb. and our coll.), about 8 miles north-east of Nágpur.
Silewáda (Bunb. and our coll.), about 10 miles north of Nágpur.
Bharatwáda (Bunb. and our coll.), about 8 miles north-west of Nágpur.
Tondakheri (Bunb.), about 14 miles north-west of Nágpur.
Chicholi (our coll.), about 12 miles north-north-west of Nágpur.
Chorkheri (our coll.), about 36 miles north-west of Nágpur.

In the memoir referred to, Mr. W. T. Blanford also noticed several of these localities as plant-bearing, but besides these also Bokhára, about 6 miles north of Nágpur, where *Phyllotheca* was observed.

In enumerating now the plants collectively, I shall quote only the figures of my paper, while Sir Bunbury's figures will be duly noticed in the text—

Phyllotheca indica, Bunb. (Pl. XII*A*, figs. 3—5, 7—9). Bharatwáda, Bokhára, Chicholi.
Vertebraria indica, Royle. Both the common and the more branched form. Kámthi, Tondakheri.
Pecopteris and *Cladophlebis*, Bunb. Kámthi.
Glossopteris communis, Fstm. With fructification. Pl. XXVI*A*, figs. 1, 4; XXVII*A*, fig. 1; XXXVII*A*, fig. 3. Silewáda.
Gl. indica, Schimp. Fructif. Pls. XXVI*A*, fig. 3; XXVII*A*, figs. 3, 5. Silewáda, Chicholi hill, Chorkheri.
Gl. browniana, Bgt. Fructif. Pls. XXVI*A*, fig. 2; XXVII*A*, fig. 2. Silewáda (Bharatwáda.)
Gl. damudica, Fstm. From Kámthi.
Glossopt. stricta, Bunb. Pl. XXXVII*A*, figs. 1, 2. Kámthi, Silewáda.
Glossopt. musæfolia, Bunb. Kámthi, Silewáda. (This species appears to be doubtful).
Glossopt. leptoneura, Bunb. Kámthi.
Gangamopteris hughesi, Fstm. Pl. XLIII*A*, figs. 6—8. Kámthi.
Angiopteridium comp. *McClellandi*, Oldh. Pl. XXI*A*, figs. 4—7. Kámthi. (To this has, I think, also Sir Bunbury's *Tæniopteris danæoides*, McClell., to be referred).
Macrotæniopteris danæoides, Royle., sp. Kámthi; the typical form.
Macrotæniopt. feddeni, Fstm. Pls. XXI*A*, fig. 3; XXII*A*. Kámthi.
Nöggerathiopsis hislopi, Fstm. Bunb. sp.; Bharatwáda (Pl. XLV*A*, figs. 6, 8). Silewáda (Pl. XLV*A*, fig. 7); Kámthi (Pls. XLV*A*, fig. 9, XLVII*A*, figs. 1—3); Chorkheri.
Nöggerathiopsis, sp. Fragments of leaves, with strong veins. Kámthi.
Seeds (of ? *Nöggerathiopsis*). Bharatwáda.

This is the list of fossils from the original Kámthi group in the Nágpur district, and we shall fix now the horizon, so as to be able to refer to it when naming the fossils of this group in the other districts. A comparison of this list with the previous ones will show that there is the greatest coincidence with the fossils from the Raniganj group. We have the real *Phyllotheca* (*indica*), *Gl. communis*, and *Gl. indica* numerous, *Gl. damudica* rarer, the true *Macrot. danæoides*, *Gl. leptoneura*, which represents the *Gl. angustifolia*.

We miss, it is true, *Schizoneura* and *Trizygia*. But *Trizygia* was not found also in several other fields, in the true Raniganj group (for instance, Jharia coal-field

and Bokáro coal-field). As to *Schizoneura*, the case stands differently. We know that it generally occurs in the Raniganj group, but we know as well that it was also found in the higher Damuda rocks of the Raigarh and Hingir coal-field, which were at first distinguished as Hingir group, but later[1] (1877) and recently[2] (1879) correlated with the Kámthi group, specially from the lithological point of view; but from a palæontological point of view these Hingir beds represent, as already mentioned, the Raniganj group, and through these Hingir (Raniganj) beds, the Kámthi group, although differing in lithological character, has to be considered as representative at least of the Raniganj group (if not also of the Ironstone shales).

II. Wardha—Pranhita—Godávari basin.—From this great basin Lower Gondwána fossils are so far known from the northern portion (Chanda coal-field) and the south-eastern portion, while from the central portion we know fossils from the Upper Gondwánas (Kota-Maleri beds) only.

1. Chanda coal-field.—On this ground there is a detailed report by Mr. Hughes, 1877.[3] Of the Lower Gondwána rocks the Talchir, Barákar, and Kámthi beds are distinguished. From the first two, no fossils were procured.

Kámthi group.—The fossils are not many. Mr. Hughes has enumerated most of them in his Memoir, p. 69, et seq. The localities are—

Mángli, about 36 miles north-west of Chanda, and about 11 miles north of Warora.
Kawársa, about 16 miles west of Chanda, and about 12 miles south-east of Wun.
Isápúr, about 4 miles south-south-east of Chanda.
Charwat, about 3 miles south of Chanda.
Anúr, about 32 miles south-south-east of Chanda, near Antargaon on the Wardha river.
Porsa, Wardha valley, about 36 miles south-east of Chanda.

I shall discuss the fossils from the localities separately—

Mángli and Kawársa.—These are again localities where in the Lower Gondwánas animal remains were found; they are land and fresh-water animals; but at both localities also some plants were met with.

ANIMALS.

Brachyops laticeps, Ow. From Mángli.

Ganoid fish-scales. Mángli.

Estheria, two forms; one, the larger, described as *Estheria mangaliensis*, Jones.[4] From Mángli.

The other one is smaller, but it is quite possible that it is of the same species. Mángli.

Estheria, sp., Kawársa. I think this is identical with the smaller variety from Mángli, and probably the same as the form in the Panchets of Bengal.

[1] Rec. Geol. Surv., India, Vol. X, p. 175.
[2] Manual, Geol. India, p. 128.
[3] Mem. Geol. Surv., India, Vol. XIII.
[4] See Rupert Jones: Quar. Journ. Geol. Soc., Vol. XIX, p. 149.

PLANTS.

Vertebraria indica, Royle. Kawársa.

Equisetaceous stems. Fragmentary (*Phyllotheca* or *Schizoneura*). Kawársa.

Glossopteris. Very fragmentary, but three forms can be distinguished as—

Gl. angustifolia, Bgt. *Gl. communis*, Fstm., and *Gl. damudica*. Kawársa.

Fernstem or *Rhizome*. Mángli.

Coniferous stem. Mángli. Pl. XLVII*A*. That this cannot be a *Knorria* may easily be recognised from Sir Ch. Bunbury's drawing. I shall mention it again further on in the text.

From the occurrence of *Estheria*, from the condition in which the plants are preserved, and from the lithological character, I thought that it might be possible to correlate the beds at these two localities with the Panchets in Bengal. But as Messrs. Th. Hughes and W. T. Blanford include them both in the Kámthis, I adopt for the present this classification, as altogether these two groups (Panchet and Kámthi-Raniganj group) are in close relation.

The fossils from Mángli are in a thin laminated red shale, with brownish-yellow markings where the fossils are preserved; the Kawársa fossils are in a soft, light yellowish and greenish-grey, argillaceous shale, and are very fragmentary.

Isápúr and Anúr.—The fossils from these two localities are preserved in a reddish and white, hard shaly sandstone. They are only plants—

Equisetaceous stem. Anúr.

Glossopteris communis, Fstm. Isápúr (Pl. XXXVII*A*, fig. 4, Pl. XXXVIII*A*, figs. 1—3), and Anúr.

Glossopt. angustfolia, Bgt. Anúr.

Gl. browniana, Bgt. Isápúr and Anúr.

Gl. indica, Schimp. Isápúr (Pl. XXV*A*, figs. 1, 2).

Pterophyllum, sp., Anúr. There are some fragments of leaflets, which appear to belong to this genus.

Charwat.—Some plant fragments were found at this locality in a soft, brownish (ferruginous) sandstone. I at first thought that this rock resembled very much the Gollapili sandstone (Rájmahál beds, near Ellore), and was inclined to consider these sandstones at Charwat as representatives of the Rájmahál group. But after a re-examination of the fossils, it appears to me, that some of the fragments represent *Glossopteris*, which would be more in favor of this locality, belonging also to the Kámthi group. The fossils are, however, altogether very scanty—

Glossopteris, sp.

Some radiately striated forms, which I thought may belong to *Actinopteris*.

Seeds, similar to some, observed at Bharatwáda, in the Nágpur district. They are rather numerous, and it is impossible to determine them, as there is no plant to which they might be referred.

Porsa.—From here some fragmentary fossils were sent in (1879) by Mr. King, preserved in a reddish-white tough shale. These are—

Equisetaceous stems (*Phyllotheca* or *Schizoneura*).

Glossopteris communis, Fstm.

Gl. indica, Schimp.

2. South-eastern extension.—From this region there are fossils from two localities in our collections, which were collected partly by Mr. King and partly by Mr. W. T. Blanford, by both of whom we also have papers on this ground. Only the Kámthi group was found fossiliferous.

The two localities are—

Sádgudiam, 16 miles north of Ellore.
Kunlacheru, north of Ellore.

The fossils are—

Vertebraria indica, Royle. Kunlacheru (Pl. XIII*A*, figs. 5, 6); Sádgudiam.
Alethopteris, sp. Kunlacheru.
Glossopteris communis, Fstm. Kunlacheru.
Glossopt. indica, Schimp. Kunlacheru.
Sagenopteris, sp. (Pl. XLI*A*, fig. 6, Pl. XLII*A*, figs. 1, 3). Kunlacheru.
Anthrophyopsis, sp. (Pl. XLI*A*, fig. 5.) Kunlacheru.
Rhipidopsis, sp. (Pl. XLVI*A*, figs. 1, 2, p.). Kunlacheru. This last is a genus occurring in the Jura of Russia, to which our species appears closely related.

A third locality, where fossils were met with, is mentioned by Mr. W. T. Blanford in Rec. Geol. Surv., India, vol. V, p. 26; it is—

Somávaram, about 20 miles north-west of Ellore—and the fossils found were *Glossopteris* sp.

G.—Sikkim Damudas.

All the basins and localities of Lower Gondwánas, mentioned in the foregoing pages, lie within the peninsular area of India: the only spot where Lower Gondwánas are found in the extra peninsular area is in Sikkim. But the fossils are only very few. We have a report on these beds by Mr. Mallet[2], where also the fossils are mentioned; the first notice of these fossils was by Dr. Hooker in his Himalayan Journals[3]; he mentions—

Fern-leaves. *Trizygia*. *Vertebraria*.

The *Trizygia* has, however, not been met with again; but accepting the observation as correct, and including the fossils in our museum, we have the following fossils:—

Equisetaceous stems, Phyllotheca? Schizoneura? Museum.
Vertebraria indica, Royle. Museum and Dr. Hooker's observation.
Trizygia (*speciosa*, Royle). Dr. Hooker's observation.
Glossopteris? indica, Schimp. Museum.

[1] Rec. Geol. Surv., India, Vols. IV, pp. 49, 59, 82, 107; V, pp. 23, 112; VI, p. 57; VII, p. 159; X, p. 55, and also Manual, Geology of India.

[2] Mem. Geol. Surv., India, Vol. XI.

[3] Vol. I, p. 402.

It is rather difficult to decide from these fossils to which group of the Damudas they belong, for the *Trizygia speciosa* is not a fossil of the Raniganj group only; on the contrary, it has been also found equally numerous in the Barákars; it cannot therefore be adduced as the evidence of these beds belonging to the Raniganj group. The fossils indicate the Barákar group as well as the Raniganj group. Mr. Mallet places them with the Raniganj group, in which I do not see any objection to follow him.

This is the state of our knowledge of fossils in the Lower Gondwánas at present; it is, however, hoped that further researches will increase this our knowledge, as always some of the officers of the Geological Survey are employed in exploring the Gondwána deposits. At present Mr. Hughes is employed in South Rewah, and his researches will certainly prove most valuable, not only for the geology, but also for the palæontology of that district, as already shown by his collection of fossils mentioned above. (See also Rec. G. S. I., Vol. XIII, Pt. 3.)

With regard to the several groups mentioned in the foregoing pages and also in my previous paper on the Talchir-Karharbári flora, we can adopt the following list of equivalent groups (as identified by their fossils) with reference to the Bengal standard list: (order ascending)—

I. Talchir Division ...	Talchir group=Deoghar field, Kárunpúra field. Karharbári beds=Karharbári field, Mohpáni field (? Shapur field).
II. Damuda Division ...	Barákar group=Bengal fields and Sátpura basin. Iron shales=Probably Motúr horizon, Sátpura. Raniganj group = Hingir-Kámthis; Bijori horizon, Sátpura basin; Kámthis of Nágpur and S. Godávari.
III. Panchet Division ...	Panchet group = Probably the Almod beds of the Sátpura basin.

ALPHABETICAL LIST OF THE COAL-FIELDS AND AREAS FROM WHICH LOWER GONDWANA FOSSILS ARE KNOWN, WITH THE LOCALITIES AT WHICH THEY WERE FOUND.[1]

Auranga coal-field, in the Palamow area.

1878. Ball: Mem. Geol. Surv. India, Vol. XV, pt. I.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pt. 1, p. 65.

Localities.—Murup, west of—Barákar group; fossils collected by Mr. Griesbach.
Panripura, south-east of—near Latiahar, horizon doubtful; fossils collected by Mr. Ball.

[1] The fossils of each locality will be found in the alphabetical list of the localities. (*See* further on). At most of the localities plants only were found, and they are here therefore not specially marked. The occurrence of animals, however, is noticed at the respective locality.

BISRAMPUR COAL-FIELD, Son region.

1873. V. Ball: Rec. Geol. Surv. India, Vol. VI, pp. 25-41.

Locality.—Galphula river, near Belaro; Barákar group.

BOKARO COAL-FIELD, Damuda valley region.

1867. T. Hughes: Mem. Geol. Surv. India, Vol. VI, pp. 39-108.

Localities.—Hurdeeamo, south-west of Sarun; Raniganj group.
Layeo, section near;—Barákar group.

BRÁHMANI COAL-FIELD.—*See* Rájmahál hills.

GOPICANDAR AREA, HURA COAL-FIELD.—*See* Rájmahál hills.

JHARIA COAL-FIELD, Damuda valley region.

1866. Hughes: Mem. Geol. Surv. India, Vol. V.
1877. Feistmantel: Rec. Geol. Surv. India, Vol, X, p. 198.

Raniganj and Barákar group; the localities are not specified: fossils mentioned on pages 313 and 311 respectively.

Talchir group fossils occurred in the Boosjooreea river (*see l. c.*, p. 243).

KARANPURA COAL-FIELD, Damuda valley region.

1871. Hughes: Mem. Geol. Surv. India, Vol. VII, pt. 3, p. 269.
1879. Feistmantel: Talchir-Karharbári flora, Pal. Ind., Series XII—1, p. 2.

Locality.—Below the junction of the Lurunga and Tordág streams. Talchir fossils.

KARAUN FIELD (Jainti coal-field), Deoghur district.

1863. Blanford: Mem. Geol. Surv. India, Vol. III, p. 38.
1870. Hughes: Mem. Geol. Surv. India, Vol. VII, pt. 2.
1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 1, 2.

Locality.—Kumár[1], Parganah Saruth-Deoghur (on the original labels of the specimens).

Talchir fossils; plants and insect wing.

KARHARBÁRI COAL-FIELD, Karharbári region.

1870. Hughes: Mem. Geol. Surv. India, Vol. VII, pt. 2.
1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 196.
1879. Feistmantel: Pal. Ind., Ser. XII—1.

[1] I am not certain about the position of this locality. On Mr. Hughes' map, (*l. c.*), there is a Khumar marked about 7 miles north-east of Karaun, but out of the field altogether; there is, however, Khumarbad, about 9 miles north-west of Karaun, within the Talchirs; this would correspond better, I think.

Localities.—

a.	Buriadi (shaft No. A)	Karharbári beds.
	Chunka (shafts Nos. 16,16G)	,, ,,
	Domahni (ghât)	,, ,,
	Jogitand (shafts No. 2, No. 5)	,, ,,
	Máthadi (shaft No. 1)	,, ,,
	Passerabhia (shaft No. 5D, 5G, 17 B, 17 C, 24, 40)...	,, ,,
b.	Lumki (Komaljore) hill	Barákar group.

MOHPANI COAL-FIELD, Sátpura basin.

1870. Medlicott (H. B.): Rec. Geol. Surv. India, Vol. III, pt. 3 (and subsequent papers).
1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII, p. 74.
1879. *Id.* Pal. Ind., Ser. XII, pt. 1, p. 4, 47.

Locality.—That of the field, Karharbári beds.

NÁGPUR AREA, Godávari region.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., Vol. XI, pp. 53, 555.
1862. Hislop: Quar. Jour. Geol. Soc., Vol. XVII, p. 346 et seq.
1862. Bunbury (Sir Ch.): Quar. Jour. Geol. Soc., Vol. XVI—Plants.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, pt. 2.

Localities.—Bharatwáda, Bokhára, Chicholi, Chorkheri, Kámthi, Silewáda, Tondakheri.—Kámthi (Raniganj) group.

PENCH VALLEY.—*See* Sátpura basin.

RAIGARH AND HINGIR COAL-FIELD.—Bráhmani region.

1871. Ball: Rec. Geol. Surv. India, Vol. VI, pp. 101—107; *id.* 1875: Rec. Geol. Surv. India, Vol. VIII, pp. 102—121; *id.* 1877: Rec. Geol. Surv. India, Vol. X, p. 171.

Localities.—On the Bilpahari; Garjan hills; Girundla; Kodaloi. Kámthi (Raniganj) group.

RÁJMAHÁL HILLS, Rájmahál area.

1877. Ball (V.): Geology of the Rájmahál hills: Mem. Geol. Surv. India, Vol. XIII, pt. 2.

Localities.—

a.	Burgo (Pachwara coal-field),	Barákar group.
	Mussinia (Bráhmani coal-field),	,, ,,
	Ramgarh ,, ,, ,,	,,
b.	Dubrajpur (Gopicándar area),	Raniganj group (?)
	Lohundia (Hura coal-field),	,, ,, (?)

RAMKOLA COAL-FIELDS, Son region.

1880. Griesbach (C. L.): Mem. Geol. Surv. India, Vol. XV.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII.

Localities.—

a. Chumra, west of— ... ... Barákar group.
Dhonda, west of— ... ... ,, ,,
Ledho nala, near Karamdiha ... ,, ,,
Mahan river and Majurdaki ... ,, ,,
Mitgain, west of—Sendur river ... ,, ,,
Reonti, west of— ... ... ,, ,,
Sendur river (Mitgain) ... ... ,, ,,
Suidud nala, 1¼ mile north of Bheria... ,, ,,
Suknai nala, north of Sarsera ... ,, ,,
Tamor hill—*See* Majurdaki ... ,, ,,

b. Banki nala, between Chumra and Gidhi ... Raniganj group.
Budatand, nala at— ... ... ,, ,,
Chumra and Gidhi, between—*See* Banki nala ,, ,,
Ghui, south of— ... ... ,, ,,
Gidhi and Chumra, between—*See* Banki nala ,, ,,
Gouri and Ghui, nala between— ... ,, ,,
Karamdiha, near— ... ... ,, ,,
Lanjit, near— ... ... ,, ,,
Ledho nala, near Karamdiha ... ... ,, ,,
Mahan nala and Tamor hill, between— ... ,, ,,
Meguli, north of— ... ... ,, ,,
Nowadih, south of— ... .. ,, ,,

c. Ledho nala, near Karamdiha ... .. Panchet group.
Narola, nala west of— ... ... ,, ,,

RANIGANJ COAL-FIELD.

1863. W. T. Blanford : Report on the Raniganj coal-field : Mem. Geol. Surv. India, Vol. III.
1877. Feistmantel : Rec. Geol. Surv. India, Vol. X, pp. 73-75.

Localities.—

a. Kumerdhubi, near Barákar ... ... Barákar group.
Nirsa, west of Barákar ... ... ,, ,,

b. Kulti, between Sitarampur and Barákar. Iron shales.

c. Assensole, in the north-west and south-east branch of Nunia river ... Raniganj group.
Beldanga, south-east branch of Nunia ... ... ,, ,,
Dadka, north-west branch of Nunia ... ... ,, ,,
Khumárpur, south-west branch of Nunia ... ... ,, ,,
Mangalpur ... ... ,, ,,
Raniganj ... ... ,, ,,
Sitarámpur ... ... ,, ,,

d. Deoli, near—bank of Damuda river, south-west of Assensole. Panchet group. Animals.
Maitúr, south of—north-west branch of Nunia. Panchet group. Animals and plants.

SAHAJORI COAL-FIELD.—Deogarh area, south-east of Karaun.

1870. Th. Hughes : Mem. Geol. Surv. India, Vol. VII, p. 2.

Locality.—Not specified. Barákar group.

SÁTPURA BASIN, Sátpura region.

1854. Sankey (Lieut.): Quar. Jour. Geol. Soc., London, Vol. X, p. 55.
1855. Rev. Hislop: *Ibid.*, Vol. XI, p. 357.
1860. J. G. Medlicott: Mem. Geol. Surv. India, Vol. II, pt. 2.
1870. H. B. Medlicott: Rec. Geol. Surv. India, Vol. IV, pt. 3. (Mohpáni.)
1873. H. B. Medlicott: Mem. Geol. Surv. India, Vol. X, pt. 1. (Sátpura basin.)
1875. H. B. Medlicott: Rec. Geol. Surv. India, Vol. VIII. (Sháhpur coal-field.)
1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII. Fossils.

Localities.—

a. Mohpáni (Mohpáni coal-field). Talchir division (Karharbári beds).

b. Dolári outcrops ... } Sháhpur coal-field, Barákar group.
Kotmi section ... }
Mardanpur outcrops ... }
Suki outcrops ... }
Barkoi ... } Pench valley, „ „
Bhuwan ... }

c. Baricondam ... ... } Bijori horizon. Plants and reptiles.
Bijori ... . }
Rorighat and Harapala, between— ... }

SHAHPUR COAL-FIELD. *See* Sátpura basin.

SIKKIM Damudas.—Sikkim.

1854. Hooker: Himalayan Journals, Vol. I, p. 402.
1875. Mallet: Mem. Geol. Surv. India, Vol. XI, pp. 2, 30.

Locality.—Pankabári. (? Raniganj.)

SOUTH GODÁVARI district (Wardha—Pranhita—Godávari basin; south-east extension).

1871. Blanford (W. T.): Rec. Geol. Surv. India, Vol. IV.
1872. *Idem: Ibid.*, Vol. V.
1874. King (W.): Rec. Geol. Surv. India, Vol. VII, p. 158.
1877. *Idem: ibid.*, Vol. X.

Locality.—Sadgúdiam, 16 miles north of Ellore; Kunlacheru, north of Ellore; Somávaram, 20 miles north-west of Ellore. Kámthi (Raniganj) group.

SOUTH REWAH (Gopat and Soházpur coal-fields). Son region.—

1869. J. G. Medlicott: Mem. Geol. Surv. India, Vol. II, pt. 2.
1879. Manual Geology of India, pp. 199-204.
1880. Mr. Hughes' recent collection.

Localities.—

Soházpur (Coll. J. G. Medlicott.) ... ... } Raniganj group (Kámthis).
Sone river, west of Garara (Mr. Hacket's fossils) ... }
South Rewah (generally) (Coll. J. G. Medlicott) ... }

Bajbai, 2 miles east of Gopat river (Th. Hughes' coll.)
Chanduidol ... ...
Mahan river, between Minarra and Gajar ...
" " near Minarra ... ...
" " near Tansar ... ...
Parasi and Kunjwar, river running between— ...
} South Rewah coal-field, Raniganj group. (See also Rec. G. S. I., Vol. XIII, pt. 3—note on a second collection of Mr. Th. Hughes.)

TALCHIR COAL-FIELD.—Mahánadi region.

1859. Mem. Geol. Surv. India, Vol. I, pt. 1.

Localities.—

Talchir, sandy, light-coloured shales ... ...
Gopálprasád, west of Talchir, ferruginous clay ...
} Barákar group.

WARDHA VALLEY COAL-FIELD.—Chanda coal-field (Wardha—Pranhita—Godávari basin.)

1877. Th. Hughes: Mem. Geol. Surv. India, Vol. XIII.

Localities.—

Anúr, about 32 miles south-south-west of Chanda, near Antargaon ... ...
Charwat, about 8 miles south of Chanda ... ...
Isápúr, about 4 miles south-south-west of Chanda ...
Porsa, about 36 miles south-east of Chanda, Wardha valley
} Kámthi (Raniganj) group.

Kawársa, about 16 miles west of Chanda and 12 miles south-east of Wun ... ...
Mángli, about 36 miles north-west of Chanda and about 11 miles north of Warora ... ...
} Kámthis (?Panchets). Plants and animals.

ALPHABETICAL LIST OF LOCALITIES AT WHICH LOWER GONDWANA FOSSILS HAVE BEEN HITHERTO FOUND,[1] TOGETHER WITH THE FOSSILS IDENTIFIED AT EACH LOCALITY.

ANUR, about 32 miles south-south-east of Chanda, near Antargaon, Wardha river, Central Provinces.

1877. Hughes: Mem. Geol. Surv. India, Vol. XIII, pp. 70, 80.

Kámthi (Raniganj) *group*—

Equisetaceous stems (?)
Glossopteris communis, Fstm.
Gl. browniana, Bgt.
Gl. angustifolia, Bgt.
Pterophyllum, sp.

[1] I include also the localities and plants of the Talchir-Karharbári beds. Those specimens which were figured are marked by the numbers of plates and figures placed opposite the names. The Roman numbers with an *A* appended indicate the plates of the present Memoir, those without an *A* indicate the plates in the Talchir-Karharbári flora (Pal. Ind., Ser. XII—1, Pls. I—XXVII).

ASSENSOLE, north—(near Khumárpur) and south branch (near Beldanga) of the Nunia river.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 75.

Raniganj group—

Schizoneura gondwanensis, Fstm., north branch.
Vertebraria indica, Royle, north and south branch.
Glossopteris communis, Fstm., north branch.
Glossopteris conspicua, n. sp., north branch.
Gl. angustifolia, Bgt., south branch.
Gl. orbicularis, n. sp., north branch.
Gangamopteris anthrophyoides, n. sp., south branch. Pl. XXXIX*A*, fig. 8.

ASSENSOLE, Panchet group. *See* Deoli and Maitúr.

BAJBAI, 2 miles east of Gopat river, South Rewah coal-field.

1880. Fossils sent by Mr. Hughes.

Raniganj group—

Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Glossopteris communis, Fstm.
Gloss. indica, Schimp.
Gloss. angustifolia, Bgt.

BANKI NALA, between Chumra and Gidhi, Ramkola coal-fields; Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 34.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 67, 68.

Raniganj group—

Glossopteris communis, Fstm.
Gl. indica, Schimp.
Gl. retifera, n. sp.
Gl. angustifolia, Bgt.

BARIKONDAM, upper Denwa valley, south of Pachmari, Sátpura basin.

1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII, p. 77.

Bijori horizon (Raniganj group)—

Schizoneura gondwanensis, Fstm. (Pl. III*A*, fig. 4).
Trizygia speciosa, Royle.
Dicksonia, sp. Pl. XXIII*A*, figs. 11, 12.
Gl. communis, Fstm.
Gl. retifera, Fstm.
Gl. damudica, Fstm.
Gl. angustifolia, Bgt.
Gangamopteris, sp. Pl. XXXIX*A*, fig. 9.
Samaropsis comp. *parvula*, Heer. Pl. XLVII*A*, figs. 9 10.

BARKOI, near Umrét, Damudas in the Pench valley, Sátpura basin, Central Provinces.

1854. Sankey (Lieut.): Quar. Jour. Geol. Soc., London, Vol. X, p. 55.
1855. Rev. Hislop: *Ibid.*, Vol. XI, p. 557.

Barákars—

Vertebraria indica, Royle.
Equisetaceous stalks *(Phyllotheca ?)*
Gl. communis, Fstm.
Gl. indica, Schimp.
Nöggerathiopsis hislopi, Fstm. (Bunb. sp.) Pl. XLVI*A*, figs. 3, 4.

BELDANGA, south-east portion of the Nunia river, south-east of Assensole.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 75.

Raniganj group. *See* Assensole.

BHARATWADA, about 8 miles north-west of Nágpur, Central Provinces.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., London, Vol. XI, p. 370 et seq.
1861. Bunbury (Sir. Ch.): *Ibid.*, Vol. XVII, p. 325 et seq.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 307.

Kámthi (Raniganj) *group*—

Phyllotheca indica, Bunb. Pl. XII*A*, figs. 3—5, 7—9.
Nöggerathiopsis hislopi, Bunb. sp. (Fstm.) Pl. XLV*A*, figs. 6, 8.
Seeds.

BHUWAN, near Umrét, Pench valley, Sátpura basin, Central Provinces.

Specimen in the Survey collections.

Barákars—

Glossopteris indica, Schimp.

BIJORI, Sátpura basin, south of Pachmari.

1864. Major Gowan: Jour. As. Soc., Bengal, XXXIII, pp. 336, 442.
1873. Medlicott (H. B.): Mem. Geol. Surv. India, Vol. X, p. 159.

Bijori horizon—

Archegosaurus (?) sp. (?)

BILPAHARI, in the Raigarh and Hingir coal-field.

1875. Ball (V.): Rec. Geol. Surv. India, Vol. VIII, p. 115.

Kámthi (Raniganj) *group*—

Vertebraria indica, Royle.

BOKHARA, about 6 miles north of Nágpur, Central Provinces.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., London, XI, p. 370.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 308.

Kámthi (Raniganj) *group*—

Phyllotheca indica, (Bunb.)

BOOSJOOREEA RIVER. *See* Jharia coal-field, Talchirs.

BUDATAND, nala at—Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 55.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 68.

Raniganj group—

Schizoneura gondwanensis, Fstm.
Glossopteris angustifolia, Bgt.

BURGO, in the Pachwara coal-field, Rájmahál hills.

1877. Ball (V.): Mem. Geol. Surv. India, Vol. XIII, p. 33.

Barákar group—

Vertebraria indica, Royle.
Macrotæniopteris danæoides, Royle. Pl. XXI*A*, fig. 2.
Glossopteris communis, Fstm.

BURIADI, shaft No. 11*A* (or No. 2, new). Karharbári coal-field.

1879. Feistmantel: Talchir-Karharbári flora. Pal. Ind., Ser. XII—1, pp. 36—45.

Karharbári beds—

Neuropteris valida, Fstm. Pls. II—VI.
Glossopteris decipiens, Fstm. Pl. XVIII, figs. 3—5; Pl. XXIV, fig. 6.
Gangamopteris cyclopteroides, Fstm. Pl. XII, figs. 2, 3; Pl. XXVI, figs. 1—3.
„ var. *subauriculata*. Pl. XIII, fig. 2; Pl. XV, figs. 1—3; Pl. XV, fig. 3.
„ var. *areolata*. Pl. XVI, fig. 4.
„ var. *attenuata*. Pl. XII, fig. 1; Pl. XIV, figs. 1, 2; Pl. XVI, fig. 5.
„ *buriadica*, Fstm. Pl. XVIII, figs. 1, 2.
„ *major*, Fstm. Pl. XIV, fig. 3; Pl. XVI, figs. 1, 2.
Nöggerathiopsis hislopi, Fstm. Pl. XIX, figs. 2, 6; Pl. XX, fig. 1.
Euryphyllum whittianum, Fstm. Pl. XXI, fig. 1.
Voltzia heterophylla, Bgt. Pls. XXII, XXIII, XXV.
Albertia, sp. Pl. XXVI, fig. 2; Pl. XXIV, fig. 3.
Samaropsis, sp. Pl. XXIV, fig. 5.

CHANDA. *See Isápúr.*

1877. Hughes, Wardha valley coal-field: Mem. Geol. Surv. India, Vol. XIII.

CHANDUIDOL, South Rewah coal-field.

1880. Fossils sent by Mr. Hughes.

Raniganj group—

Schizoneura gondwanensis, Fstm.
Glossopteris formosa, n. sp.

CHARWAT, about 8 miles south of Chanda.

1877. Hughes: Mem. Geol. Surv. India, Vol. XIII, pp. 69, 73.

Kámthi group (?)

Glossopteris? sp.? (Fragments).
Seeds.
Peculiar radiated forms (which I at first determined as *Actinopteris*).

CHICHOLI, hill about 12 miles north-north-west of Nágpur.

1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 309.

Kámthi (Raniganj) *group*—

Phyllotheca indica, Bunb.
Glossopteris indica, Schimp. (Our coll.)

CHORKHERI, about 36 miles north-west of Nágpur.

1855. Hislop and Hunter; Quar. Jour. Geol. Soc., London, Vol. XI, p. 340.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 313.

Kámthi (Raniganj) *group*—

Glossopteris indica, Schimp.
Nöggerathiopsis hislopi, Bunb. sp. (Fstm.)

CHUMRA, west of— Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 37.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 66.

Barakárs—

Glossopteris communis, Fstm.

CHUMRA AND GIDHI, between—Raniganj group, Ramkola coal-field. *See* Banki nala.

CHUNKA, No. 16 (4) and No. 16 G. (6) shafts, lowest seam, Karharbári coal-field.

1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 37, 45.

Karharbári beds—

Gangamopteris cyclopteroides, Fstm., No. 16 (4).
Gang. major, Fstm., No. 16 (4) and 16 G (6).

DADKA, near Assensole, Raniganj field.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. V, p. 75.

Raniganj group—

Glossopteris conspicua, n. sp.

DEOGARH coal-field (Jainti coal-field)—See Karaun field.

DEOLI, banks of the Damuda river, south-west of Assensole, Raniganj field.

1862. Blanford, W. T.: Mem. Geol. Surv. India, Vol. III, p. 129.
1864. Huxley: Pal. Ind., Ser. IV—1, with 6 Plates.
1879. Lydekker: Pal. Ind., Ser. IV, pt. 3, with 6 Plates.

Panchet rocks—

Dicynodon orientalis, Huxl.
Ankistrodon indicus, Huxl.
Gonioglyptus longirostris, Huxl.
Pachygonia incurvata, Huxl.

DHONDA, west of—Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 62.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 67.

Barákars (?)—

Glossopteris communis, Fstm.
Gl. indica, Schimp.

DOLARI (outcrops), Sháhpur coal-field, Sátpura basin.

1875. Medlicott (H. B.): Rec. Geol. Surv. India, Vol. VIII, p. 77.
1879. Feistmantel: Jour. Geol. Soc., London, Vol. XII, p. 81.

Barákars (Karharbári beds ?)—

Equisetaceous stalks.
Glossopteris, sp.
Gangamopteris cyclopteroides, Fstm.
Nöggerathiopsis hislopi, Fstm.

DOMAHNI (Ghât), Karharbári coal-field, 1st seam (from below).

1879. Feistmantel: Talchir-Karharbári flora, Pal. Ind., Ser. XII—1, pp. 38, 39, and 45, 46.

Karharbári beds—

Neuropteris valida, Fstm.
Gangamopteris major, Fstm.
Gang. angustifolia, McCoy.
Sagenopteris? stoliczkana, Fstm. Pl. XIII, fig. 4.
Glossozamites stoliczkanus, Fstm. Pl. XX, figs. 4, 5.
Nöggerathiopsis hislopi, Fstm. Pl XIX, figs. 3—5.
Voltzia heterophylla, Bgt. Pl. XXIV, fig. 4.

DUBRAJPUR, Gopikándar area, north of Bráhmani coal-field, Rájmahál hills.

1877. Ball (V.): Mem. Geol. Surv. India, Vol. XIII, p. 186.

Raniganj group (?)—

Phyllotheca robusta, n. sp. Pl. XIV *A bis*.
Glossopteris communis, Fstm.

GALPHULA river, near Bilaro, in the Bisrampur coal-field.

1873. Ball: Rec. Geol. Surv. India, Vol. VI, p. 36.

Barákar group—

Glossopteris, sp. (and other plant remains, not named further *l. c.*, and which I also could not identify).

GARJAN HILL, Raigarh and Hingir coal-field.

1875. Ball: Rec. Geol. Surv. India, Vol. VIII, p. 115.

Kámthi (Raniganj) group—

Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Sphenopteris? polymorpha (*?*) Fstm.
Glossopteris communis, Fstm.
Gl. indica, Schimp.
Gl. browniana, Bgt.
Gl. damudica, n. sp.

GHUI, east of—Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 62 (Noudiha)
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 68.

Raniganj group—

Glossopteris communis, Fstm.

GIRUNDLA, Raigarh and Hingir coal-fields.

1875. Ball (V): Rec. Geol. Surv. India, Vol. VIII, p. 115.

Kámthi (Raniganj) *group*—

Vertebraria indica, Royle.

GOPALPRASAD, Talchir coal-field; about 12 miles west of Talchir. (Fossils in ferruginous, carbonaceous shale).

1859. Mem. Geol. Surv. India, Vol. I, p. 59.

Barákar group—

Vertebraria indica, Royle.
Trizygia speciosa Royle. Pl. XI *A*, figs. 2, 9; Pl. XII *A*, fig. 2.
Glossopteris communis, Fstm. Pl. XXXVIII *A*, fig. 2.
Gl. indica, Schimp. Pl. XXIX *A*, fig. 7.
Gl. intermedia, n. sp. Pl. XXIX *A*, figs. 1, 2.
Gl. damudica, n. sp. Pl. XXV *A*, fig. 4; Pl. XXX *A*, fig. 2.
Gl. angustifolia (*?*) Bgt.
Dictyopteridium sporiferum, n. sp. Pl. XXIII *A*, figs. 3-5.

GOURI AND GHUI, nala between—Ramkola field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 62 (Noudiha).
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 67.

Raniganj group—

Vertebraria indica, Royle.

HARAPALA (between this place and Rorighat), Sátpura basin.

1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII, pp. 78, 79.

Bijori horizon (Raniganj group)—

Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Glossopteris angustifolia, Bgt.

HURDEEAMO, south-west of Sarun, Bokáro coal-field.

1866. Hughes: Mem. Geol. Surv. India, Vol. VI, pp. 63 (101).

Raniganj group—

Schizoneura gondwanensis, Fstm.

ISÁPÚR, about 4 miles south-south-east of Chanda, Wardha valley coal-field.

1877. Hughes: Mem. Geol. Surv. India, Vol. XIII, pp. 69, 74.

Kámthi (Raniganj) *group*—

Glossopteris communis, Fstm. Pls. XXXVII*A*, fig. 4; XXXVIII*A*, figs. 1, 3 (? *musæfolia*, Bunb.)
Gl. indica, Schimp. Pls. XXV*A*, figs. 1, 2.
Gl. browniana, Bgt.

JAINTI coal-field. *See* Karaun field.

JHARIA COAL-FIELD, in the Damuda valley, west of the Raniganj field.

1865. Hughes: Mem. Geol. Surv. India, Vol. V, pp. 227-336.
1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 198.

Talchirs (*l. c.*, 243); *Barákar* group (*l. c.*, p. 311); *Raniganj* group (our collection)—

Schizoneura gondwanensis, Fstm. Pl. IV*A*, fig. 3. Raniganj group.
Vertebraria indica, Royle. Barákar and Raniganj group.
Dicksonia hughesi, Fstm. Pl. XXIII*A*, figs. 1, 2. Raniganj group.
Alethopteris comp. *Whitbyensis*, Göpp. Pl. XL*A*, figs. 2, 3. Raniganj group.
Macrotæniopteris danæoides, Royle. Pl. XXI*A*, fig. 1. Raniganj group.
Glossopteris communis, Fstm. Pl. XL*A*, fig. 4. Raniganj group.
Glossopteris, sp. Barákar group.
Glossopteris, sp. Talchirs (in the Boosjooreea).

JOGITAND, No. 2 and No. 5 shafts, 1st seam, Karharbári coal-field.

1879. Feistmantel: Pal. Ind., Ser. XII, p. 42 (45, 46).
1880. Fossils collected by myself.

Karharbári beds—

Gangamopteris cyclopteroides, Fstm. No. 2 shaft.
Glossopteris decipiens, Fstm. No. 2.
Nöggerathiopsis hislopi, Bunb. sp. (Fstm.) No. 2 and No. 5, var. *subrhomboidalis*. (Pl. XX, fig. 2.) No. 2.

KÁMTHI, about 8 miles north-east of Nágpur, Central Provinces.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., Vol. XI, p. 369.
1862. Bunbury: *Ibid.*, Vol. XVII, p. 385 et seq.
1872. Blanford (W. T.): Mem. Geol. Surv. India., Vol IX, p. 313.

Kámthi (Raniganj) *group*—

Vertebraria indica, Royle.
Pecopteris and *Cladophlebis*, Bunb. (*l. c*).
Angiopteridium comp. *McClellandi*, O. M. Pl. XXI*A*, figs. 4-7.
Macrotæniopteris danæoides, Royle (the true form).
Macrot. feddeni, Fstm. Pls. XXI*A*, fig. 3; XXII*A*.
Glossopteris damudica, Fstm.
Gl. stricta, Bunb. Pl. XXXVII*A*, figs. 1, 2.
Gl. musæfolia, Bunb.
Gl. leptoneura, Bunb.
Gangamopteris hughesi, Fstm. Pl. XLIII*A*, figs. 6-8.
Nöggerathiopsis hislopi, Fstm. Pls. XLV*A*, fig. 9; XLVII*A*, figs. 3-5.
Nöggerathiopsis, sp.

KARAMDIHA, near—Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 45.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII.

Panchets (?)—

Glossopteris communis, Fstm.
Thinnfeldia comp. *odontopteroides*, Morr., sp. Pl. XXIII*A*, figs. 6-8.

KARANPURA coal-field (below the junction of the Tordág and Lurunga streams), Damúda valley, Western Bengal.

1867. Hughes: Mem. Geol. Surv. India, Vol. VII, p. 296.
1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 1, 2.

Talchirs—

Gangamopteris cyclopteroides, Fstm. Pl. XI, figs. 2-4.
„ „ var. *subauriculata*. Pl. X, fig. 1.
„ „ var. *areolata*. Pl. XI, fig. 2.
„ „ var. *attenuata*. Pl. XI, fig. 1.
„ *angustifolia*, McCoy. Pl. IX, fig. 5.
Glossopteris, sp.

KARAUN FIELD (Jainti coal-field, Deogarh coal-field), Deoghur district; (Kumár, Pargana Saruth-Deoghur, Bírbhum).

1863. Blanford, W. T.: Mem. Geol. Surv. India, Vol. III, p. 38.
1870. Hughes: Mem. Geol. Surv. India, Vol. VII, pt. 2.
1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 1, 2.

Talchirs—

Schizoneura, sp. Pl. I, fig. 1.
Gangamopteris cyclopteroides, Fstm. Pls. VII, VIII, IX, figs. 1-6; X, fig. 3.
Nöggerathiopsis hislopi, Fstm. Pl. XIX, fig. 1.

KAWÁRSA, about 16 miles west of Chanda, and 12 miles south-east of Wún.

1877. Hughes: Mem. Geol. Surv. India, Vol. XIII, pp. 70 and 77.

Kámthi (Raniganj) *group?* (Panchets?)

Estheria (?Mangaliensis, Jones) : small form.
Vertebraria indica, Royle.
Equisetaceous stalks.
Glossopteris communis, Fstm.
Gl. damudica, n. sp.
Gl. angustifolia, Bgt.

KHUMAR (Kumár, Khumárbad?). *See* Karaun field.

KHUMARPUR, north-west branch of the Nunia river, near Assensole.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 75.

Raniganj group. *See* Assensole.

KODALOI, Raigarh and Hingir coal-field.

1875. Ball: Rec. Geol. Surv. India, Vol. VIII, p. 115.

Raniganj group—

Vertebraria indica, Royle.

KOMALJORE HILL. *See* Lumki hill.

Barákars in the Karharbári coal-field.

KOTMI (section at)—Sháhpur coal-field (Bétul district), Sátpura basin.

1875. H. B. Medlicott: Rec. Geol. Surv. India, Vol. VIII, p. 80.
1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII, p. 79.

Barákars? (Karharbári beds?)

Equisetaceous stalks, (*Schizoneura*).
Glossopteris communis, Fstm.
Gangamopteris cyclopteroides, Fstm.
Nöggerathiopsis hislopi, Bunb. sp. (Fstm.)

KULTI, Raniganj field.

Iron shales—

Glossopteris communis, Fstm.
Glossopteris damudica, Fstm. Pl. XXX*A*, fig. 1.
Insectwing-like leaf. Pl. XVI*A bis*, figs. 7, 7*a*.
Coniferous (?) stem. Pl. XLVII*A*, figs. 5-7.

KUMERDHUBI (near Barákar, on the Barákar river), Raniganj coal-field.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, pp. 73, 74.

Barákars (type)—

Vertebraria indica, Royle. Pls. XIII*A*, figs. 1, 2, 4, 8; XIV*A*, figs. 1, 4.
Phyllotheca or *Schizoneura?* (stalks). Pl. XIII*A*, fig. 7.

Glossopteris communis, Fstm. Pl. XXXII *A*, fig. 2.
Gloss. communis var. *stenoneura*. Pls. XXXII*A*, fig. 3; XXXIII *A*, fig. 1.
Gl. indica, Schimp.
Gl. browniana, Bgt.
Gl. damudica, Fstm. Pls. XXXI *A*, figs. 1-3; XXXII*A*, fig. 1.
Gl. ingens, n. sp. Pl. XXXI *A*, figs. 4, 5.
Angiopteridium infarctum, n. sp. Pl. XXXIV *A*, figs. 4, 5.
Squamæ gymnospermarum. Pl. XLVII*A*, figs. 19-21.

KUNLACHERU, South Godávari, near Ellore.

1872. Blanford, W. T.: Rec. Geol. Surv. India, Vol. V, p. 27.
1874. King (W): *Ibid.*, Vol. VII, p. 159.

Kámthi (Raniganj) *group*—

Vertebraria indica, Royle. Pl. XIII*A*, figs. 5, 6.
Alethopteris, sp.
Glossopteris communis, Fstm.
Glossopteris indica, Schimp.
Sagenopteris, sp. Pls. XLI*A*, fig. 6; XLII*A*, figs. 1, 3.
Anthrophyopsis, sp. Pl. XLI*A*, fig. 5.
Rhipidopsis, sp. Pl. XLVI*A*, figs. 1, 2.

LANJIT, near—Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 64.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 67, 68.

Raniganj group—

Schizoneura gondwanensis, Fstm.

LATIAHAR, Auranga coal-field. *See* Panripura, Panchets? (?)

LAYEO, close to—in the Bokáro coal-field.

1866. Hughes: Mem. Geol. Surv. India, Vol. VI, p. 40 (78).

Barákars—

Trizygia speciosa, Royle.

LEDHO NALA, near Karamdiha, Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 44.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 66—69.

Barákar group—

Vertebraria indica, Royle.
Glossopteris communis, Fstm.

Raniganj group—

Glossopteris communis, Fstm.
Glossopteris angustifolia, Bgt.

Panchet division—

Glossopteris communis, Fstm.
Gl. indica, Schimp.
Gl. angustifolia, Bgt.
Thinnfeldia comp. *odontopteroides*, Morr., sp. Pl. XXIII*A*, figs. 6—8.

LOHUNDIA, Hura coal-field, Rájmahál.

1877. Ball: Mem. Geol. Surv. India, Vol. XIII (map facing pages 40 and 48).

? Raniganj group—

Glossopteris communis, Fstm. Very narrow.
„ *indica*, Schimp.
„ *angustifolia*, Bgt.
Scale-like leaves, like those from Raniganj and the Bijori horizon.
Winged seeds.

LUMKI HILL (Komaljore hill), Karharbári coal-field.

1879. Feistmantel: Talchir-Karharbári flora. Pal. Ind., Ser. XII—1, pp. 43, 44.

Barákar group—

Schizoneura gondwanensis, Fstm. Pl. I, figs. 2, 3.
Vertebraria indica, Royle.
Sphenopteris polymorpha, Fstm.
Glossopteris communis, Fstm.
Gangamopteris, sp.

LURUNGA AND TORDAG streams, below the junction of the—*Talchirs*. See Káranpúra coal-field.

MAHAN RIVER and Tamor hill, between—Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 63.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 67, 68.

Raniganj group—

Vertebraria indica, Royle.
Glossopteris angustifolia, Bgt.

Barákars. *See* Majurdaki.

MAHAN RIVER, South Rewah coal-field. *See* Minarra and Tansar.

MAITUR, south of—in the north-west branch of the Nunia nadi, north-west of Assensole.

1862. Blanford (W. T.): Mem. Geol. Surv. India, Vol. III, p. 130.

Panchet rocks—

Estheria (comp. *Mangaliensis*, Jones).
Schizoneura gondwanensis, Fstm. Pl. X*A*.
Pecopteris concinna, Presl. Pl. XVII*A*, figs. 1—6.

Cyclopteris pachyrhachis, Göpp. Pl. XVII*A*, fig. 7.
Oleandridium (*stenoneuron*, Schimp.) Pl. XIX*A*, figs. 5—8.)
Glossopteris indica, Schimp., and *communis*, Fstm. (Rec. Geol. Surv. of India, Vol. X, pp. 139—140, figs. 3—8.)
Samaropsis comp. *parvula*, Heer. Pl. XLVII*A*, figs. 11-13.

MAJURDAKI, near—between Mahan river and Tamor hill, Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 63.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 66, 67.

Barákar group—

Vertebraria indica, Royle.
Glossopteris damudica, Fstm.
Gl. indica, Schimp.
Nöggerathiopsis hislopi, Fstm. (Bunb.)

MANGALPUR, Raniganj field.
Raniganj group—

Trizygia speciosa, Royle. Pl. XI*A*, fig. 8.

MANGLI, about 60 miles south of Nágpur (about 36 miles north-west of Chanda, and about 11 miles north of Warora).

1854. Owen: Quar. Jour. Geol. Soc., Vol. X, p. 473.
1855. Owen: *Ibid.*, Vol. XI, p. 37.
1861. Bunbury: *Ibid.*, Vol. XVII.
1862. Jones: *Estheria*, Palæontographical Society, p. 78.
1877. Hughes: Mem. Geol. Surv. India, Vol. XIII, pp. 69, 71.

Kámthi (Raniganj) *group* (Panchets?)—

Brachyops laticeps, Ow.
Ganoid fish scales.
Estheria mangaliensis, Jones (two forms.)
Rhizom of fern (Bunbury's figure).
Coniferous stem (resembling a form in the Ironstone shales).

MARDANPUR *outcrops*, Sháhpur coal-field, Sátpura basin.

1875. Medlicott (H. B.): Rec. Geol. Surv. India, Vol. VIII, p. 79.
1879. Feistmantel: Rec. Geol. Surv. India, Vol. XII, p. 79.

Barákar group—

Vertebraria indica, Royle.

MATHADI, Karharbári coal-field, No. 1 shaft (39), 1st seam.

1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 42, 45, 46.

Karharbári beds—

Gangamopteris cyclopteroides, Fstm. Pl. XIII, fig. 1.
" " var. *attenuata*. Pl. XIII, fig. 3.
Glossopteris communis, Fstm. Pl. XVII, figs. 1, 2.

MEGULI, north of—Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 38.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 68.

Raniganj group—

Glossopteris communis, var. *stenoneura*.

MINARRA, near—on Mahan river, South Rewah coal-field.

1880. Fossils collected by Mr. T. Hughes.

Raniganj group—

Schizoneura gondwanensis, Fstm.
Alethopteris comp. *Whitbyensis*, Göpp.
Glossopteris communis, Fstm.
Gloss. indica, Schimp.
Gloss. retifera, Fstm.
Gloss. angustifolia, Bgt.

MINARRA and GAJAR, between—Mahan river, South Rewah coal-field.

1880. Fossils collected by Mr. T. Hughes.

Raniganj group—

Schizoneura gondwanensis, Fstm.
Phyllotheca, n. sp.
Alethopteris comp. *Whitbyensis*, Göpp.
Glossopteris communis, Fstm.
Gloss. angustifolia, Bgt.
Angiopteridium comp. *Mc'Clellandi*, O.M.

MITGAIN, west of—Sendur river; Ramkola coal-field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 33.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 66, 67.

Barákar group—

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
Gl. browniana, Bgt.
Gl. damudica, n. sp.

MOHPANI coal-field, on the Sitariva river, north-east corner of Sátpura basin.

1870. Medlicott (H. B.): Rec. Geol. Surv. India, Vol. III, pt. 3.
1879. Feistmantel: Pal. Ind., Ser. XII—1, pp. 4, 47.

Karharbári beds—

Equisetaceous stalks.
Ganganopteris cyclopteroides, Fstm. Pl. XXVII, figs. 2, 3.
,, var. *attenuata*. Pl. XXVII, fig. 1.
Glossopteris communis, Fstm.
Nöggerathiopsis hislopi, Fstm. (Bunb.) Suppl.

MURUP, west of—Auranga coal-field, Palamaun district.

1878. Ball: Mem. Geol. Surv. India, Vol. XV, p. 60.
1879. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 65.

Barákar group—

Trizygia speciosa, Royle.
Glossopteris communis, Fstm.

MORNE RIVER, north of Parasdiha, Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 58.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, pp. 67, 68.

Raniganj group—

Vertebraria indica, Royle.
Glossopteris damudica, n. sp.
Gl. angustifolia, Bgt.

MUSINIA, on the Bráhmani river, Bráhmani coal-field, Rájmahál hills.

Barákar group—

Vertebraria indica, Royle.
Glossopteris, sp.

NAROLA, nala west of—Ramkola fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 62.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 68.

Panchets (?)—

Glossopteris, sp.

NIRSCHA (near Barákar) Raniganj coal-field.

1877. Feistmantel: Rec. Geol. Surv. India, Vol. X, p. 74.

Barákar group—

Vertebraria indica, Royle.
Glossopteris intermittens, n. sp. Pl. XXXIII*A*, figs. 2—4.

NOWADIH, south of—Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 42.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 68.

Raniganj group—

Glossopteris communis, Fstm.
,, *formosa*, n. sp.

PANCHET (fossils). *See* Deoli and Maitur.

PANKABARI, Damuda Series. *See* Sikkim.

PANRIPURA, hill south of—near Latiahar, in the Auranga coal-field, Palamaun area.

1878. Ball: Mem. Geol. Surv. India, Vol. XV, p. 89.

Horizon uncertain, but according to Mr. Ball, "apparently Mahádevas; as it may, however, be as well Panchet group, I mention the fossils here—

Vertebraria indica, Royle.
Pecopteris?
Glossopteris communis, Fstm.
" *indica*, Schimp.
" *damudica*, n. sp.
Squamæ gymnospermarum.
Samaropsis parvula (?) Heer.

PARASI and KUNJWAR, from river running between—South Rewah coal-field.

1880. Fossils collected by Mr. Th. Hughes.

Raniganj group—

Glossopteris, sp.

PASSERABHIA, Karharbári coal-field, shafts 5D (9); 5G (12); 24 (29); 40 (33); 17B (23); 17C (24).

1879. Pal. Ind., Ser. XII—1, pp. 39—42, 45, 46.
1880. Fossils collected by myself from the 2nd seam.

Karharbári beds, 1st, 2nd, and 3rd seams.[1]

	First Seam.		Second Seam.		Third Seam.	
	No. 5 D (9)	No. 5 G (12)	No. 24 (29)	No. 40 (33)	No. 17 B (23)	No. 17 C (24)
Schizoneura comp. *Meriani*, Schimp. Pl. I, figs. 6, 7	+	...	...	...	...	...
Schizoneura comp. *gondwanensis*, Fstm.	...	...	...	+	...	...
Equisetaceous stalks (numerous)	...	...	...	+	..	...
Vertebraria indica, Royle. Pl. I, figs. 8, 9	+	...	...	+	...	...
Neuropteris valida, Fstm.	+	+	...	...	...	...
Gangamopteris cyclopteroides, Fstm. Pl. XIII, fig. 5	+	+	+	+	+	+
" " var. *attenuata*	...	...	...	...	+	+
Gangamopteris, sp.	...	...	...	...	...	+
Glossopteris communis, Fstm.	+	+	+	+	+	+
Glossopteris, other species	...	...	...	+	...	...
" *damudica*, Fstm.	...	...	...	...	...	+
Nöggerathiopsis hislopi, Fstm.	+	+	+	+	+	+
Seeds	...	+	...	+	...	+

[1] There were hitherto no fossils known from the second seam (counting from below) in the Karharbári coal-field; quite recently (April 1880) I collected a good number of fossils from this seam, at shafts No. 24 and No. 40 (Passerabhia); I include their names already here, in order to complete the list; but a more complete note, together with the sections of the shafts, will be found in Rec. Geol. Surv. of India, Vol. XIII, pt. 3 (1880). Some of the fossils, together with others from the first and second seams (also recently acquired), will be illustrated in a supplemental fasciculus to my Talchir-Karharbári Flora.

PORSA, on the Wardha river, about 36 miles south-east of Chanda.

1879. Fossils sent by Mr. W. King.

Kâmthi group (reddish-white, tough shales).

Equecetaceous stems.

Glossopteris communis, Fstm. } Fragmentary
„ *indica*, Schimp. }

RAIGARH *and* HINGIR coal-field.

1875. Ball: Rec. Geol. Surv. India, Vol. VIII, p. 115.
1877. Ball: *Ibid.*, Vol. X, p. 171.

Raniganj group—

Schizoneura gondwanensis, Fstm. Garjan hills.
Vertebraria indica, Royle. Garjan hills, Girundla, Kodaloi.
Sphenopteris polymorpha, Fstm. Garjan hills.
Glossopteris communis, Fstm.
„ *indica*, Schimp.
„ *browniana*, Bgt.
„ *damudica*, n. sp.

RAMGARH, Bráhmani coal-field, south bank of Bráhmani river, Rájmahál hills.

1877. Ball: Mem. Geol. Surv. India, Vol. XIII, pt. 2, p. 27.

Barákar group—

Glossopteris, sp.

RANIGANJ, Raniganj field.

1862. Blanford (W. T.): Mem. Geol. Surv. India, Vol. III.
1876. Feistmantel: Jour. As. Soc., Bengal, Vol. XLV, p. 329.

Raniganj group.

The list of fossils from the locality Raniganj is, excepting *Gangamopteris anthrophyoides*, the same as that given before for the Raniganj group of the Raniganj coal-field, so I need not repeat it here again and refer to the first list.

REONTI, north-west of— Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, pp. 61-62.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 67.

Barákar group—

Glossopteris indica, Schimp.

RORIGHAT and HARAPALA, between—Bijori horizon. *See* Harapala.

SADGUDIAM, 16 miles north of Ellore, South Godávari (our collection).

Kámthis—

Vertebraria indica, Royle (branched and common form).

SAHAJORI (coal-field).

1867. Hughes: Mem. Geol. Surv. India, Vol. VII ,pp. 253, 254.

Barákar group—

Glossopteris, sp.

SÁTPURA BASIN. *See* Mohpáni, Shapur, Umrét, Baricondam, Bijori, Harapala.

SENDUR RIVER. See *Mitgain*. (*Barákar group*, Ramkola coal-fields).

SHAPUR COAL-FIELD, Sátpura basin. *See* Dolari, Kotmi, Murdanpur, Suki.

SIKKIM (Darjeeling, Pankabári).

1854. Hooker's Himalayan Journals, Vol. I, p. 402.
1875. Mallet: Mem. Geol. Surv. India, Vol. XI, pp. 2-30.

Damudas (? Raniganj group).

Phyllotheca, sp. (?). Equisetaceous stalks.
Vertebraria indica, Royle.
Trizygia speciosa, Royle. (Dr. Hooker's quotation).
Glossopteris indica, Schimp.

SILEWADA, about 10 miles north of Nágpur.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., Vol. XI, p. 370.
1861. Bunbury: Quar. Jour. Geol. Soc., Vol. XVII, p. 325.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 304.

Kámthis (Raniganj group)—

Glossopteris communis, Fstm. (Fructificating). Pl. XXVI*A*, figs. 1, 4; Pl. XXVII*A*, fig. 1; Pl. XXXVII*A*, fig. 3.
„ *indica*, Schimp. (Fructificating). Pl. XXVI*A*, fig. 3; Pl. XXVII*A*, figs. 3, 5.
„ *browniana*, Bgt. (Fructificating). Pl. XXVI*A*, fig. 2; Pl. XXVII*A*, fig. 2.
„ *stricta*, Bunb.
„ *muscæfolia*, Bunb.
Nöggerathiopsis hislopi, Bunb. (Fstm.) Pl. XLV*A*, fig. 7.

SITARAMPUR, Raniganj field (our collections).

Raniganj group—

Sphenopteris polymorpha. Pl. XVI*A*, fig. 3.
Glossopteris retifera, Fstm. Pl. XXVIII*A*, fig. 2.
„ *conspicua*, n. sp. Pl. XXVIII*A*, figs. 5, 6, 8.

SITARIVA RIVER, Sátpura basin. *See* Mohpáni coal-field, Karharbári beds.

SOHAGPUR, in South Rewah (Mr. J. G. Medlicott's collection).

1860. J. G. Medlicott: Mem. Geol. Surv. India, Vol. II.
1879. Manual Geology of India, pp. 199—204.

Raniganj (Kámthi) *group*—

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
Gl. browniana, Bgt., Pl. XL *A*, fig. 5.
Gl. damudica, n. sp., Pl. XL *A*, fig. 6.

SON RIVER, west of Garara (Mr. Hacket's collection).

Raniganj group—

Vertebraria indica, Royle.
Macrotæniopteris feddeni, Fstm.
Glossopteris communis, Fstm.
Dictyopteridium, sp. Pl. XLII *A*, fig. 5.

SOUTH REWAH (Gopat coal-fields), coll. by Mr. J. G. Medlicott.

Raniganj group—

Vertebraria indica, Royle (light shale).
Equisetaceous stems (light shale).
Glossopteris communis, Fstm. (light and dark shale).
Nöggerathiopsis hislopi, Bunb. (Fstm.) (light and dark shale). Pl. XLV *A*, figs. 1-5.
Voltzia heterophylla, Bgt. (light shale). Pl. XLVII *A*, figs. 19-20.
Small seeds (light shale).

SOUTH REWAH (Gopat coal-fields), coll. by Mr. Th. Hughes, 1880.

See Bajbai, Chanduidol, Minarra, Parasi and Kunjwar, Tansar.[1]

SUIDUD nala, $1\frac{1}{4}$ mile north of Bheria, Ramkola coal-fields, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, pp. 59–63.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 67.

Barákars—

Nöggerathiopsis hislopi, Fstm.

SUKI (outcrop), Shapur coal-field, Sátpura basin.

1875. H. B. Medlicott: Rec. Geol. Surv. India, Vol. VIII, p. 81.
1879. Feistmantel: *Ibid.*, Vol. XII, p. 80.

Barákars—

Nöggerathiopsis hislopi, Fstm.

SUKNAI NALA, north of Sarsera, Ramkola field, Sirgujah.

1880. Griesbach: Mem. Geol. Surv. India, Vol. XV, pt. 2, p. 52.
1880. Feistmantel: Rec. Geol. Surv. India, Vol. XIII, p. 67.

Barákars—

Vertebraria indica, Royle.
Glossopteris communis, Fstm.

TALCHIR, Talchir coal-field: fossils in sandy shales.

1859. Mem. Geol. Surv. India, Vol. I, p. 59.

Barákars—

Vertebraria indica, Royle.
Cyathea comp. *tchihatcheffi*, Schm. Pl. XVI *A*, figs. 1, 2, 4.

[1] Besides the fossils named above, there is another collection lately sent by Mr. Hughes, but they cannot be included here: they will be described and figured (as far as necessary) together with others subsequently. (*See* also R. G. S. I., Vol. XIII, pt. 3).

Gl. communis, Fstm.

Dictyopteridium sporiferum, n. sp. Pl. XXIII *A*, figs. 3—5.

TAMOR hill; *Barákars*. *See* Majurdaki.

TANSAR, near—on Mahan river, S. Rewah coal-field.

1880. Fossils collected by Mr. Th. Hughes.

Raniganj group—

Vertebraria indica, Royle.

TONDAKHERI, about 14 miles north-west of Nágpur.

1855. Hislop and Hunter: Quar. Jour. Geol. Soc., Vol. XI, p. 370.
1861. Bunbury: *Ibid.*, XVII, p. 338.
1872. Blanford (W. T.): Mem. Geol. Surv. India, Vol. IX, p. 307.

Kámthi group—

Vertebraria indica, Royle.
Glossopteris—fragments.

TORDAG and LURUNGA streams (below the junction of the)—
Talchir fossils. *See* Káranpúra field.

UMRÉT coal-field, in the Pench valley, Sátpura Basin, Central Provinces.
Barákars.

1854. Sankey (Lieut.): Quar. Jour. Geol. Soc., Vol. X, p. 55.
1855. Rev. Hislop: *Ibid.*, Pl. XI, p. 557.

See Barkoi.

THE VARIOUS LOCALITIES FROM WHICH LOWER GONDWANA FOSSILS ARE KNOWN, ARRANGED ALPHABETICALLY WITHIN THE GROUPS.

TALCHIR-KARHARBÁRI BEDS.—(The localities in the Shapur coal-field are included within the Barákar group.) Talchirs marked = T., Karharbári beds=K.B.

Buriadi, Karharbári coal-field, shaft No. 11A (2)=K.B.
Chunka, Karharbári coal-field, shaft Nos. 16 (4) and 16G (6); 1st seam=K.B.
Domahni (ghât), Karharbári coal-field; 1st seam=K.B.
Jharia coal-field=T.
Jogitand, Karharbári coal-field, No. 2 and No. 5 shafts, 1st seam=K.B.
Káranpúra field=T.
Karaun field (Kumar, Purgannah Saruth-Deoghur, Bírbhum)=T.
Lurunga and Tordág streams, Káranpúra field=T.
Mathadi, Karharbári field, No. 1 shaft (39); 1st seam=K.B.
Mohpáni coal-field=K.B.
Passerabhia, Karharbári coal-field, 1st, 2nd, and 3rd seams; shaft No. 5D (9); 5G (12); 24 (29); 40 (33); 17B (23); 17C (24)=K.B.
Sitariva river.—*See* Mohpáni=K.B.
Tordág and Lurunga streams, Káranpúra field=T.

BARAKAR GROUP (one or two localities in the Shapur coal-field, which are here also included, may perhaps represent the Karharbári beds).

Barkoi, near Umrét, Pench valley, Sátpura basin, C.P.
Bhuwan, Pench valley, Sátpura basin, C. P.
Burgo, Pachwara coal-field (on the Bansloi river), Rájmahál hills.
Chumra, west of—Ramkola coal-field, Sirgujah.
Dhonda, west of—Ramkola coal-field, Sirgujah.
Dolari (outcrops), Shapur coal-field, Sátpura basin.
Galphula river, near Bilaro, Bisrampur coal-field.
Gopálprasád, Talchir coal-field (fossils in dark ferruginous shale).
Jharia coal-field.
Komaljore hill, Karharbári coal-field.
Kotmi (section), Shapur coal-field, Sátpura basin.
Kumerdhubi, near Barákar, Raniganj coal-field.
Layeo, close to—in the Bokáro coal-field.
Ledho nala, near Karamdiha, Ramkola coal-field, Sirgujah.
Lumki hill, Karharbári coal-field (the same as Komaljore hill).
Mahan river. *See* Majurdaki.
Majurdaki, near—between Mahan river and Tamor hill, Ramkola coal-field, Sirgujah.
Mardanpur outcrops, Shapur coal-field, Sátpura basin.
Mitgain, west of—Sendur river, Ramkola coal-field, Sirgujah.
Múrup, west of—Auranga coal-field, Palamow district.
Mussinia, on the Bráhmani river (Bráhmani coal-field), Rájmahál hills.
Nirsha, near Barákar, Raniganj coal-field.
Ramgurh, Rájmahál hills, south of Bráhmani coal-field.
Reonti, north-west of—Ramkola coal-field, Sirgujah.
Sahajori coal-field.
Sendur river. *See* Mitgain. (Ramkola coal-field, Sirgujah).
Suidud nala, 1¼ mile north of Bheria, Ramkola coal-field, Sirgujah.
Suki (outcrop), Shapur coal-field, Sátpura basin.
Suknai nala, north of Sarsera, Ramkola coal-field, Sirgujah.
Talchir, Talchir coal-field. (Fossils in sandy shale.)
Tamor hill. *See* Majurdaki. Ramkola coal-field, Sirgujah.
Umrét coal-field, Pench valley, Sátpura basin, C. P.

IRONSTONE SHALES—

Kulti, Raniganj field, between Sitarámpur and Barákar.

RANIGANJ GROUP.—(In this is included the Bijori horizon, marked =B, and the Kámthi group, marked =K; the Raniganj group is marked =R.)—

Anúr, about 32 miles east-south-east of Chanda, Wardha valley coal-field=K.
Assensole, north-west and south-east of—in the Nunia river=R.
Bajbai, 2 miles east of Gopat river, South Rewah coal-field=R.
Banki nala, between Chumra and Gidhi; Ramkola coal-field, Sirgujah=R.
Barikondam, Upper Denwa valley, Sátpura basin, south of Pachmari=B.
Beldanga, south-east branch of the Nunia river=R. *See* Assensole.
Bháratwáda, about 8 miles north-west of Nágpur, C. Prov.=K.

Bijori, Sátpura basin, south of Pachmari=B. Reptiles.
Bilpahari, Raigarh and Hingir coal-field=K.
Bokhara, about 6 miles north of Nágpur=K.
Budatand, nala at—Ramkola coal-field, Sirgujah=R.
Chanda, Wardha valley coal-field. *See* Isápúr=K.
Chanduidol, South Rewah coal-field=R.
Charwat, about 8 miles south of Chanda=K.
Chicholi Hill, about 12 miles north-north-west of Nágpur=K.
Chorkheri, about 36 miles north-west of Nágpur=K.
Chumra and Gidhi, between=R. *See* Banki nala.
Dadka, north of Assensole, Raniganj coal-field=R.
Dubrajpur, north of Bráhmani field, Rájmahál Hills=R. (?).
Garjan Hills, Raigarh and Hingir coal-field=K.
Ghui, east of—Ramkola coal-field, Sirgujah=R.
Gidhi and Chumra, between=R. *See* Banki nala.
Girundla, Raigarh and Hingir coal-field=R.
Gouri and Ghui, nala between—Ramkola coal-field, Sirgujah=R.
Harapala (between this and Rorighat), Sátpura basin=B.
Hurdeeamo, south-west of Sarun, Bokáro coal-field=R.
Isápúr, about 4 miles south-south-east of Chanda, Wardha valley coal-field=K.
Jharia coal-field=R.
Kámthi, about 8 miles north-east of Nágpur=K.
Karamdiha, near—Ramkola coal-field, Sirgujah=R.
Kawársa, about 16 miles west of Chanda, and 12 miles south-east of Wún=K.; animals and plants.
Khumárpur, in the north-west branch of the Nunia river, Raniganj coal-field=R.
Kodaloi, Raigarh and Hingir coal-field=K.
Kunlácheru, south Godávari, Ellore district=K.
Lanjit, near—Ramkola coal-field, Sirgujah=R.
Ledho nala, near Karamdiha, Ramkola coal-field, Sirgujah=R.
Lohundia, in the Hura coal-field, Rájmahál Hills=R. (?)
Mahan river and Tamor Hill, between—Ramkola coal-field, Sirgujah=R.
Mahan river, South Rewah, between Minarra and Gajar; near Minarra; near Tansar=R.
Mangalpur, Raniganj field=R.
Mangli, about 60 miles south of Nágpur, and 36 miles north-west of Chanda=K.; animals and plants.
Meguli, north of—Ramkola field, Sirgujah=R.
Minarra, near—on Mahan river, South Rewah=R.
Minarra and Gajar, between—on Mahan river, South Rewah=R.
Morne river, north of Parasdiha, Ramkola coal-field, Sirgujah=R.
Nowadih, south of, Ramkola coal-field, Sirgujah=R.
Panripura, Hills south-east of—near Latiahar, Auranga coal-field, Palmaun area=R.
Parasi and Kunjwar, from river running between—South Rewah=R.
Porsa, on the Wardha river, about 36 miles south-east of Chanda=K.
Raigarh and Hingir coal-field=K.
Raniganj, Raniganj coal-field R.
Sadgúdiam, 16 miles north of Ellore, south Godávari=K.

Sikkim (Darjeeling, Pankabári)=R. (?).
Silewáda, about 10 miles north of Nágpur=K.
Sitarámpur, Raniganj field=R.
Sohágpur, in South Rewah=R.
Son river, west of Garara=R. (Mr. Ch. Hacket, 1872, Th. Hughes, 1880.)
South Rewah (Coll. of Messrs. J. G. Medlicott, Ch. Hacket, and Mr. Th. Hughes)=R.
Tansar, near—on Mahan river, South Rewah=R.
Tondakheri, about 14 miles north-west of Nágpur=K.

PANCHET GROUP. (Includes the Almod beds also).

Deoli, near banks of the Damuda river, Raniganj field, south-west of Assensole; animals.
Ledho nala, near Karamdiha, Ramkola coal-field, Sirgujah.
Maitúr, south of—in the north-west branch of the Nunia river, north-west of Assensole; animals and plants.
Narola nala, west of—Ramkola coal-field, Sirgujah.

GENERAL LIST OF FOSSILS OF THE LOWER GONDWANAS.

I give now the systematical list of all fossils hitherto known from the Lower Gondwánas; the chief divisions are indicated in six columns, *i. e.*:—

Talchir division = Talchir group, Karharbári beds, first and second column.
Damuda division:
Barákar group =third column.
Iron shales (Motur horizon)=fourth column.
Raniganj group (=Hingir group, Bijori horizon, Kámthi group)=fifth column.
Panchet division, Panchet group (Almod beds) = sixth column.

I have, for general understanding and comparison, taken in also the fossils of the Talchir-Karharbári beds, which were already described in a previous fasciculus of the Palæontologia Indica.

To avoid repetition of the localities, I indicate within the columns the coal-field only where the fossils were found; and to save room, I use abbreviations, of which an alphabetical list follows[1]:—

Aur. = Auranga coal-field (Mr. V. Ball, Mr. Griesbach).
Bisr. = Bisrampur coal-field (Mr. V. Ball).
Bok. = Bokáro coal-field (Mr. Hughes).
Jhar. = Jharia coal-field (Mr. Hughes).
Karanp. = Káranpúra coal-field (Mr. Hughes).
Karaun. = Karaun (Jainti) coal-field (Mr. Hughes).
Karh. = Karharbári coal-field (Messrs. Hughes, Whitty, Miller, and Feistmantel).
Mohp. = Mohpáni coal-field (Messrs. H. B. Medlicott and Feistmantel).
Nágp. = Nágpur area (Rev. Hislop, Mr. W. T. Blanford, and F. Fedden).
Rájm. = Rájmahál Hills (Messrs. Oldham, V. Ball, Feistmantel).
Ramk. = Ramkola coal-field (Messrs. C. L. Griesbach and Feistmantel).

[1] The names in brackets indicate those gentlemen, either officers of the Survey or others, who have either surveyed the respective coal-fields, or have collected fossils and published notes.

Ranig. = Raniganj coal-field (Messrs. W. T. Blanford, Th. Oldham, Feistmantel).
R. H. = Raigarh and Hingir coal-field (Mr. V. Ball).
Sahaj. = Sahajori coal-field (Mr. Th. Hughes).
Sátp. = Bijori horizon (Raniganj group) in Sátpura basin (Capt. Gowan, Messrs. J. G. and H. B. Medlicott, V. Ball and Feistmantel).
Shap. = Shapur coal-field (Messrs. H. B. Medlicott and Feistmantel).
Sikk. = Sikkim (Dr. Hooker, Mr. Mallet).
S. G. = South Godávari (Messrs. W. T. Blanford and W. King).
S. R. = S. Rewah (Messrs. J. G. Medlicott, C. Hacket, and Th. Hughes), including Sohágpur (Mr. J. G. Medlicott).
Talch. = Talchir coal-field (Messrs. W. T. and H. B. Blanford, and W. Theobald).
Umr. = Umrét coal-field in the Pench valley, with Barkoi and Bhuwan (Lieutenant Sankey, Rev. Hislop).
Ward. = Wardha valley coal-field (Mr. T. Hughes).

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division.			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
PLANTÆ.							
A. CRYPTOGAMÆ.							
I. PTERIDOPHYTA.							
1. Equisetaceæ.							
Schizoneura comp. *Meriani*, Schimp.	...	Karh.	.....	...	.....	...	.....
Schizoneura gondwanensis, Fstm.	...	(?) Karh.	Karh., Mhop....	...	Ranig., Jhar., Bok., Ramk., R. H., S. R., Sátp.	Ranig.	*Schizoneura paradoxa*, Schimp. and Moug., Europe.
Schizoneura, sp.? . .	Karaun.	...	.....	...	.....	...	.....
Phyllotheca indica, Bunb.	...	...	.....	...	Ranig., Nágp.	...	*Phyllotheca sibirica*, Heer.; *Phyll. deliquescens* in East Siberia and the Altai; *Phyllotheca australis*, Bgt., in Australia.
Phyllotheca robusta, n. sp.	...	...	.....	...	? Rajm. ...	...	*Phyllotheca stschurowskii*, Schmalh., in the Altai.
Phyllotheca, sp. . .	...	...	.....	...	S. R.	...	.....
Trizygia speciosa, Royle .	...	...	Bok., Aur., Talch.	...	Ranig., Sátp., Sikk.	...	*Sphenophyllum ?*
Vertebraria indica, Royle .	...	Karh.	Rajm., Karh., Ranig., Jhar., Ramk., Talch., Shap., Umr.	...	Ranig., Jhar., Ramk., S. R., R. H., Satp., Nágp., Ward., S. G., Sikk.	Aur. (?)	*Vertebraria australis*, McCoy, in New South Wales.

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division,			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
Equisetaceous stems . .	...	Karh., Mhop.	Ranig., Shap., Umr.	...	Ranig., Jhar., S. R., Sátp., Nágp., etc.	...	.....
2. Filices.							
a. Cyatheaceæ.							
Cyathea comp. *Tchihatcheffi*, Schmalh.	...	...	Talch. ...	...	.....	...	Jura of the Altai.
Sphenopteris polymorpha, Fstm.	...	...	Karh. ...	...	Ranig., R. H. (?)	...	Very likely also a *Cyathea*.
Dicksonia hughesi, Fstm....	...	...	.....	...	Jhar. (?) Sátp.	,,	*Conf. Dicksonia sapportana*, Heer, Jura of East Siberia.
b. Polypodiaceæ.							
a. Group of Asplenium whitbyense.							
Alethopteris (*Asplenium*) *whitbyensis*, Göpp.	...	...	.....	...	Ranig., Jhar. S. R.	...	The same elsewhere.
Alethopt. lindleyana, Royle	...	...	.....	...	Ranig. ...	...	.....
Alethopteris, sp. . .	...	...	.....	...	S. G. ...	...	.....
Alethopteris phegopteroides, Fstm.	...	...	.....	...	Ranig. ...	...	*Phegopteris decussata*, Mett.
β. Incertæ.							
Pecopteris affinis, McCl. .	...	...	.....	...	Ranig. ...	...	.....
Pecopt. concinna, Presl. .	...	...	.....	...	.....	Ranig.	Rhæt. in Europe.
Merianopteris major, n. sp.	...	...	.....	...	Ranig. ...	...	*Merianopteris angusta*, Heer, Keuper, Europe.
c. Neuropteridæ.							
Neuropteris (*Neuropteridium*) *valida*, Fstm.	...	Karh.	.....	...	.....	...	*Neuropteridium grandifolium*, Sch.
Cyclopteris (?) *pachyrhachis*, Göpp.	...	...	.....	...	.....	Ranig.	The same in Europe.
Insect wing-like leaf	...	...	.....	Ranig.	.....	...	.....
d. Pachypteridæ.							
Thinnfeldia comp. *odontopteroides*, Morr., sp.	...	...	.....	...	.....	Ramk.	*Thinnfeldia rotundata*, Nath. Rhætic, Sweden.
e. Tæniopteridæ.							
Macrotæniopteris danæoides, Royle.	...	...	Rajm. ...	...	Ranig., Jhar., Nágp.	...	*Macrot. lata*, Oldh. Rájmahál group.
Macrotæniopt. feddeni, Fstm.	...	...	.....	...	S. R., Nágp.	...	*Macrot. abnormis*, Gutb., Perm, Europe.

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division.			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
Palæovittaria kurzi, Fstm.	...	...	.....	...	Ranig. ...	...	
Oleandridium comp. *stenoneuron*, Schenk.	...	...	.....	...	.....	Ranig.	Rhæt., Europe.
Angiopteridium comp. *mc'Clellandi*, Oldh.	...	...	.....	...	Nagp., S. R. ..	...	Rájmahál Group.
Angiopt. infarctum, n. sp.	...	...	Ranig. ...	...	.....	...	.....
f.—Dictyotæniopterideæ.							
α. Forms with narrow nets.							
Glossopteris communis, Fstm.	...	Karh., Mohp.	Rájm., Karh., Ranig., Aur., Ramk., Talch., Shap., Umr.	Ranig.	Rájm., Ranig., Jhar., Ramk., S. R., R. H., Sátp., Nágp., Wardh., S. G.	Ranig., Ramk., Aur. (?)	Most common form.
Glossopteris communis, var. *stenoneura*.	...	...	Ranig. ...	...	Ranig., Ramk.	...	.....
Gl. intermittens, n. sp.	...	...	Ranig. ...	...	.....	...	.....
Gl. stricta, Bunb.	...	...	.....	...	Nágp. ...	...	.....
Gl. (?) musæfolia, Bunb.	...	...	.....	...	Nágp. ...	...	Doubtful.
Gl. indica, Schimp.	...	...	Ranig., Ramk., Talch., Umr.	...	Rájm., Ranig., Ramk., R. H., S. R., Nágp., Wardh., S. G., Sikk.	Ranig., Ramk., Aur. (?)	.....
β. Intermediate forms.							
Glossopteris browniana, Bgt.	...	...	Ranig., Ramk.	...	Ranig., S. R., R. H., Nágp., Wardh.	...	In New South Wales in lower and upper coal-measures.
Gl. intermedia, n. sp.	...	...	Talch. ...	...	Ranig. ...	...	.....
γ. Broad-netted forms.							
Glossopteris retifera, Fstm.	...	...	.....	...	Ranig., Ramk., S. R., Sátp.	...	.....
Gl. conspicua, n. sp.	...	...	.....	...	Ranig. ...	...	.....
Gl. (?) ingens, n. sp.	...	...	.....	...	Ranig. ...	...	.....
Gl. divergens, n. sp.	...	...	.....	...	Ranig. ...	...	.....
Gl. damudica, n. sp.	...	Karh. ...	Ranig., Ramk., Talch.	Ranig.	Ramk., S. R., R. H., Sátp., Nágp., Wardh.	Aur. (?)	*Gl. parallela*, Fstm., N. S. Wales.
δ. Narrow-leaved forms.							
Glossopteris angustifolia, Bgt.	...	...	Talch. ...	...	Rájm., Ranig., Ramk., S. R., Sátp., Wardh.	Ramk...	*Gl. linearis*, Mc'Coy., N. S. Wales.

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division.			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
Gl. leptoneura, Bunb. .	...	...	.....	...	Nágp. ...	...	*Gl. angustifolia ?*
Gl. formosa, n. sp. . .	...	...	.....	...	Ranig., Ramk., S. R.	...	.....
e. Round-leaved forms.							
Glossopteris orbicularis, n. sp.	...	...	.....	...	Ranig. ...	...	.....
f. Incertæ.							
Glossopteris decipiens, Fstm.	...	Karh. ...	.....	...	.....	...	Passage form.
Glossopteris, sp. . .	Káranp.	...	.....	...	.....	...	.....
Glossopteris, sp. . .	...	...	Rajm., Sahaj.; Jhar., Bisr., Shap.	Ranig., Wardh.	.....	...	Various fragmentary and undeterminable forms.
g. Dictyopteridæ.							
Gangamopteris anthrophyoides, n. sp.	...	...	.....	...	Ranig. ...	...	*Anthrophyopsis*, Nath.
Gangam. buriadica, Fstm.	...	Karh. ...	.....	...	.....	...	.....
Gangam. major, Fstm. .	...	Karh. ...	.....	...	.....	...	.....
Gangam. comp. *angustifolia*, Mc'Coy.	Káranp.	Karh. ...	.....	...	.....	...	Victoria and New South Wales.
Gangam. whittiana, Fstm.	...	...	.....	...	Ranig. ...	...	*Anthrophyum.*
Gangam. hughesi, Fstm. .	...	...	.....	...	Nágp. ...	...	.....
Gangam. cyclopteroides, Fstm.	Karaun., Káranp.	Karh., Mohp.	Shap. ...	...	.....	...	.....
Gangam. cyclopteroides var. *subauriculata.*	Káranp.	Karh. ...	.....	...	.....	...	.....
Gangam. cyclopteroides „ *areolata.*	Káranp.	Karh. ...	.....	...	.....	...	.....
Gangam. cyclopteroides „ *attenuata.*	Káranp.	Karh., Mohp.	.....	...	.....	...	.....
Gangamopteris, sp. . .	...	...	Karh. . .	...	.....	...	.....
Gangamopteris, sp. . .	...	...	.....	...	Ranig. ...	...	.....
Gangamopteris, sp. . .	...	...	.....	...	Sátp. ...	...	.....
Belemnopteris wood-masoniana, Fstm.	...	...	.....	...	Ranig. .	...	*Pteris. sagittæfolia*, Radd., living.
Anthrophyopsis (?) sp. .	...	...	.....	...	S. G. ...	...	.....
Dictyopteridium, sp. .	...	...	Talch. . .	...	Ranig., S. R....	...	.....
Incertæ sedis.							
Sagenopteris (?) *longifolia*, n. sp.	...	...	.....	...	Ranig. ...	...	.....

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division.			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
Sag. polyphylla, n. sp.	...	...	.....	...	Ranig. ...	...	.....
Sagenopteris (?), sp.?	...	...	.....	...	Ranig. ...	...	.....
Sagenopteris, another species.	...	...	.....	...	S. G. ...	...	.....
Sagenopteris (?) *stoliczkana*, Fstm.	...	Karh.	.....	...	.....	...	.....
Actinopteris bengalensis, Fstm.	...	...	.....	...	Ranig. ...	...	.....
Radiary striated forms	...	...	.....	...	Wardh. ...	...	Doubtful.
Fern stem ? or *Rhizome*	...	...	.....	...	Wardh. ...	...	.....
B. PHANEROGAMÆ.							
II. GYMNOSPERMÆ.							
1. Cycadeaceæ.							
Pterophyllum burdwanense, M'Cl., sp. (Fstm.)	...	..	.....	...	Ranig. ...	...	.....
Pterophyllum, sp.	...	...	.....	...	Jhar., Wardh.	...	.....
Glossozamites stoliczkanus, Fstm.	...	Karh.	.....	...	.....	...	.....
Nöggerathiopsis hislopi, Fstm.	Karaun.	Karh. Mohp.	Ramk., Shap., Umr.	...	Ranig., S. R., Nágp.	...	*Nöggerathiopsis*, in Australia, *Rhiptozamites*, Schmalh., in Jura of Siberia.
Nöggerathiopsis hislopi var. *subrhomboidalis*.	...	Karh.	.....	...	.....	...	.....
Nöggerathiopsis, sp.	...	...	.....	...	Nágp. ...	...	.....
Scales—(*Squamæ gymnospermarum*).	...	...	Ranig.	...	Rájm., Ranig.	Aur. (?)	Similar in the Jura of the Altai and Rhæt. of Sweden.
2. CONIFERÆ.							
a. Salisbureæ.							
Euryphyllum whittianum, Fstm.	...	Karh.	.....	...	.....	...	.....
Rhipidopsis densinervis, n. sp.	...	...	.....	...	S. G. ...	...	*Rhipidopsis*, Jura of Russia.
b. Abietaceæ.							
Voltzia heterophylla, Bgt.	...	Karh.	.....	...	S. R. ...	...	.....
Voltzia (?), scale ?	...	...	.....	...	Ranig. ...	...	.....
Albertia, sp.	...	Karh.	.....	...	.....	...	.....

Names of Classes, Orders, Families, &c.	LOWER GONDWANAS.						Remarks.
	Talchir Division.		Damuda Division.			Panchet Division.	
	Talchir group.	Karharbári beds.	Barákar group.	Iron shales.	Raniganj (Kámthi) group.	Panchet group.	
c. TAXODIACEÆ.							
Samaropsis comp. *parvula*, Heer.	...	Karh.	.....	...	Ranig., Sátp.	Ranig. Aur. (?)	Jura of Siberia.
INCERTÆ.							
Carpolithes milleri, Fstm.	...	Karh.	.....	...	.....	..	.....
Seeds (winged) . . .	...	...	.....	...	Rájm. ...	...	... ..
Seeds, sp.? . . .	...	...	.....	...	S. R., Nágp., Wardh.	...	.....
Coniferons (?) stem . .	...	...	.....	...	Wardh. ...	...	?*Rhipodopsis*, Schmalh. Jura of Russia.
ANIMALIA.							
CRUSTACEA.							
Estheria mangaliensis, Jones.	...	...	.....	...	Wardh. ...	...	.....
Estheria (comp. *mangaliensis*).	...	...	.....	...	.....	Ranig.	Smaller form.
PISCES.							
Scales of Ganoid fish .	...	...	.....	...	Mangli ...	...	*Lepidotus?* In our collections.
DICYNODONTIA.							
Dicynodon orientalis, Huxl.	...	...	.....	...	.....	Ranig.	.....
DINOSAURIA.							
Ankistrodon indicus, Huxl.	...	...	.....	...	.....	Ranig.	.....
LABYRINTHODONTIA.							
Gonioglyptus longirostris, Huxl.	...	...	.....	...	.....	Ranig.	.....
Pachygonia incurvata, Huxl.	...	...	.....	...	.....	Ranig.	.....
Brachyops laticeps, Ow. .	...	...	.....	...	Wardh. ...	...	.....
Archegosaurus, sp.? . .	...	...	.....	...	Sátp. ...	...	.....
Insect wing . . .	Karaun.	...	.....	...	.....	...	.....

At present I shall draw from this list conclusions referring only to the Lower Gondwánas. Comparisons between the fossils of the Lower Gondwánas and those of other formations in other countries, as well as between the Lower and Upper Gondwána fossils, will be given (with lists) after the description of the fossils.

If we examine the preceding list, we find as the oldest floras of the Lower Gondwánas those of the Talchir group and the Karharbári beds the relation of which to each other, etc., were already discussed in a previous fasciculus. The fossils of these two groups were found to correspond more closely with each other than with any of the higher floras of the Lower Gondwánas, and both were comprised under the common heading "*Talchir division.*" The richer flora of these two groups is that of the Karharbári beds, and that of the Talchir group is subordinate to it.

In the flora of the Talchir group there are hardly any elements of the flora of the subsequent (Damuda) division. We find only fragments of (*?*) *Schizoneura* and one undeterminable *Glossopteris :* the predominant fossils being *Gangamopteris.*

In the Karharbári beds, the characteristic fossils of which also are forms of *Gangamopteris*, we find for the first time, but rather scarce, the genus *Vertebraria ; Glossopteris* somewhat more numerous; and also *Schizoneura* and *Nöggerathiopsis* appear—the latter numerous. Besides these there are other fossils which are in relation with European forms, while the *Gangamopteris* correlates these beds with certain rocks in Victoria.

The floras of the next three groups, Barákar, Ironshales, and Raniganj, with their respective equivalents (*see* above), are to each other in the same relation as those of the Talchir group and Karharbári beds, and they are therefore comprised under the same heading as the *Damuda division.*

The most characteristic (and partly most numerous) fossils of these groups are *Schizoneura, Vertebraria, Trizygia, Sphenopteris, Macrotæniopteris, Glossopteris,* and *Nöggerathiopsis*; identical species occur in all three of them, or at least in the Barákar and Raniganj groups.

These are completely sufficient to bring all these three groups into closest relation.

But there are two other elements in these floras of the Damuda division, *i. e.*, several forms are very closely related with Triassic and Jurassic forms in Europe and Siberia, while others have their representatives in Australia and South Africa. These relations give the Damuda flora a peculiar interest; they have already been duly noticed in the Manual of Indian Geology, and will be discussed in the concluding portion of this paper; the horizon of the Damudas must be affected by that of the Talchirs and their representatives.

The last (highest) flora with which we have to deal here is that of the *Panchet group.* We find two peculiar forms of plants; but the others are those of the Damuda division, so that the flora of the Panchet group does not differ by far

so much from that of the Damuda division as does the flora of the Talchir division, and it always occurs to me that the Panchet group might rather be included as a fourth group in the Damuda division. Besides the plants, animals also were found in the Panchet group: *Estheria*, *Dicynodontia*, and *Labyrinthodontia*. The *Estheria* appear to be identical, or at least very closely allied to certain forms in certain beds at Mángli and Kawársa, classed with the Kámthis (=Raniganj group). *Labyrinthodont* reptiles are also known from the Raniganj (Bijori) group of the Damuda division, while *Dicynodon* is found in South Africa in beds representing the Ranigarj and Panchet groups. It would appear therefore that also, with regard to the animal remains, the Panchet group shows a close connection with the Raniganj group.

This may be sufficient at this place; these are merely observations, based on the palæontological relations of the groups themselves. All other relations regarding these groups were fully described and discussed by Mr. W. T. Blanford in the Manual of the Geology of India, pp. 109—134.

DESCRIPTION OF THE FOSSILS.

In the systematical description of the fossils, I shall follow Schimper's system, partly from the new Handbook of Palæontology by Schimper and Zittel, as far as it is here available;[1] the rest will be taken from the same author's previous work on botanical palæontology.[2] I shall also add the etymological derivation of the names of the fossils.

CRYPTOGAMÆ OR ACOTYLEDONES.

PTERIDOPHYTA.

EQUISETACEÆ.

The Equisetaceæ of the Lower Gondwánas cannot be said to be very numerous, at all events not very various. There occur altogether four genera only; and if we except one, which will be described as *Vertebraria*, and which has an almost general distribution through all the groups of the Lower Gondwánas (except the Talchir group proper) and occurs at most of the localities, the others are found either only in certain horizons or in a few districts. But they are interesting genera on account of their relations.

These four genera are: *Schizoneura*, *Phyllotheca*, *Trizygia*, and *Vertebraria*. The relations of these various genera will be shown under the description of each.

[1] Handbuch der Palæontologie. Schimper und Zittel (Phytopalæontology by Schimper). Of the botanical portion we have at present one part (pp. 1—152), 1879, Vol. II. pt. 1.

[2] Traité de Paléontologie végétale, 1869—75 (3 Vols. and Atlas).

In a short paper published in the 3rd part of last year's (1879) Records, I noticed some of the relations of the first three of the above genera in general, and especially of *Trizygia*. At present this can be done more in detail.

Genus: SCHIZONEURA,[1] Schimper, 1849.

1828. *Convallarites*, Brongniart: Prodr. d'une Histoire des végétaux fossiles, Paris, p. 128.
1828. *Equisetum*, Brongniart: Histoire des vég. fossiles, partly (p. 115).
1828. *Convallarites*, Brongniart: Flore du grès bigarré. In Ann. des sc. nat. 1me series, XV, Pl. XIX.
1844. *Schizoneura*, Schimper et Mougeot: Monogr. des pl. foss. d. grès bigarré des Vosges, pp. 48—51. Tab. XXIV—XXVI.
1850. *Schizoneura*, Unger: Genera et species plant. fossilium, p. 316.
1864. *Calamites*, Heer: Urwelt der Schweiz.
1865. *Calamites*, Schenk, in Schoenlein, Abbildungen der fossilen Pflanzen im Keuper Frankens.
1869. *Schizoneura*, Schimper: Traité de Pal. végét, p. 280, pls. XIII—XVI.
1876. *Schizoneura*, Heer: Primæval world of Switzerland, p. 51.
1876. *Schizoneura*, Feistmantel: Jour. As. Soc., Bengal, Vol. XLV, pt. II, p. 344.
1878. *Schizoneura*, Nathorst: Om Floran Skånes Kolförande Bildningar. I. Floran vid Bjuf, p. 24, II. Floran vid Höganäs och Helsingborg, Stockholm, 1878, p. 9.
1879. *Schizoneura*, Feistmantel: Pal. Indica, Ser. XII, 1. Talchir-Karharbári flora, p. 7.
1877. Feistmantel: Records Geol. Surv. India, Vol. X, p. 199, &c.
1879. Feistmantel: *Ibid.*, Vol. XII, p. 163.

Plantis herbaceis vel subarborescentibus. Caulibus ramosis (? verticillatim), ipsis ramisque articulatis, anguste longitudinaliter sulcatis, costis sulcisque (præcipue in caulibus majoribus) juxta postis. Articulationibus vaginis circumdatis, imprime foliis coalitis, integris, tandem in folia secundum lineas commisurales vel, frequentissime, duas in partes, folia opposita simulantes, dissolutis.

The chief character of this equisetaceous plant, the stems and stalks of which are articulated and longitudinally ribbed, lies in the sheaths which are found in the joints of the stalks. These consist in the first stage of development of a certain number of longitudinal leaflets with a central vein, attached along their margins. In the process of development, however, this sheath splits along the sutural lines either into the leaflets again, in various degrees of completeness or, as it appears, much more frequently into two portions, generally equal in size and spread out so that they appear opposite.

A similar case is also seen in the living Equiseta, where in the young stage the sheaths are also more or less closed, and open only by growing up of the internodes.

The number of leaflets in the sheath vary, and they always begin to split from the top.

These relations are sufficiently illustrated in Schimper's plates.

Known species and range of the genus out of India.—The genus has no wide geographical (and geological) distribution.

[1] Σχίζω to split, and νεῦρον the vein. When first establishing this genus, Prof. Schimper thought that the leafsheath splits along the thick veins, and called it therefore *Schizoneura*; this surmize, however, proved wrong and was corrected by Prof. Schimper himself, but the name was retained

The species known are:—

Schizoneura paradoxa,[1] Schimp. and Moug. (*l. c.*) *Convallarites erecta* and *nutans*, Brongniart (*l. c.*), known from the lower Trias (Grès bigarré) of the Vosges.

Schizoneura meriani,[2] Schimp., 1869, *Equisetum meriani*, Brongt. Schenk in Schœnlein, &c., known from the upper Trias (Keuper) in the neighbourhood of Stuttgart, Sulz on the Neckar, Sinsheim in the Grand-dukedom Baden, and in Bavaria.

Schizoneura hœrensis,[3] Schimp., 1869 (*Calamites hœrensis*, Hisinger[4]), known from Rhætic in Sweden, in Hanover, and in Baden.

Schizoneura? lateralis,[5] Schimper. This species, which was at first described as *Equisetum*, is placed by Schimper also with *Schizoneura*,[6] while Professor Heer places it with *Phyllotheca*.[7] The original specimen is rather badly preserved, and both these views may be considered equally correct; known from the Oolite of Haiburne Wyke and Scarborough, Yorkshire.

The range of *Schizoneura* in Europe is therefore Trias—Oolite (taking *Equisetum laterale* also as belonging to this genus).

Relations and differences.—The relations of this peculiar genus are not many. Regarding the sheath in the articulations, a certain analogy can be seen between this genus and *Equisetum* of the present flora in its young state.

The palæontological relations are only in so far of importance as according to Mr. Grand Eury,[8] this genus (*Schizoneura*) of the Grès bigarré may be considered as representing the genus *Asterophyllites* of the Palæozoic. I have already had occasion to mention this relation,[9] pointing out the morphological similarity of these two genera.

As regards the differences, I have only to indicate two incorrect correlations made by various authors, especially with regard to the Indian forms; *Schizoneura* was correlated with *Zeugophyllites* (the Australian form) and also with *Nöggerathia*.

In a short note in the Records,[10] I have shown that the correlations were only based upon superficial resemblance, and that there is really a generical difference between *Schizoneura*, Schimp., *Zeugophyllites*, Bgt., *Nöggerathia*, Stbg.

As regards *Nöggerathia*, I shall have occasion to point to it again.

Regarding *Zeugophyllites*, I may here say what is needful.

It appears to me that a slight confusion gave rise to the correlation of *Schizoneura* and the Australian *Zeugophyllites*. Brongniart established the genus *Zeugophyllites*[11] on a specimen from India; he called it *Zeugoph. calamoides*, and the locality is given "Mines de Rana-gunje,[12] près Rajemahl, dans l' Inde septentrionale."

[1] Paradoxus, strange.
[2] Merian, proper name.
[3] From Hör in Sweden.
[4] Hisinger, Lethæa Suecica, 1836—1840.
[5] From latus, lateris, side.
[6] Trait. d. Pal. végétale, Vol. I, p. 284.
[7] Juraflora Ostsibiriens und des Amurlandes, 1876, pp. 43, 44.
[8] Flora carbonifère du Dptmt. de la Loire, etc., 1877, p. 404.
[9] Rec. Geol. Surv. India, 1879, Vol. XII, p. 165.
[10] Vol. X, p. 200.
[11] Prodrome, 1828, pp. 118, 121, 175.
[12] This of course means Raniganj.

As regards this species, I would not be disinclined to think that it may have been a specimen of *Schizoneura*, which is numerous at Raniganj. Brongniart gave no figures, but the diagnosis may well fit to that of *Schizoneura*. He mentions six to eight equal and well-marked veins in each of the opposite leaves, he also alludes to a splitting of the leaves at top (although he does not mention anything of a coalescence of several leaflets); but he compared the leaves with Palm leaves and placed *Zeugophyllites* with the Palms. Schimper thought that it might have been a *Pterophyllum*. The Australian *Zeugophyllites* was subsequently (1845) described by Morris,[1] and the slight confusion I have alluded to was, that, although Morris in his paper only provisionally placed the Australian leaf with Brongniart's *Zeugophyllites* and pointed out the difference from *Schizoneura*, yet both these forms were considered identical amongst themselves and with *Schizoneura*.[2] But as mentioned before, Brongniart's *Zeugophyllites* can hardly be taken into consideration (although the circumstances might permit of its being considered a *Schizoneura* of Raniganj), and the Australian *Zeugophyllites* appears really to differ from *Schizoneura*, although even in this case the material seems to be insufficient, only one specimen (one leaflet) having ever been figured. We may therefore safely dismiss the correlation of *Schizoneura* with *Zeugophyllites*, at least with the Australian form.

It appears to me that we have two species of *Schizoneura* in India.

SCHIZONEURA GONDWANENSIS,[3] Fstm. Plates I*A*—X*A*.

1876. Feistmantel: Rec. Geol. Surv. of India, Vol. IX, p. 69.
1876. *Id.*: Jour. As. Soc., Bengal, Vol. XLV, p. 345.
1879. *Id.*: Talchir-Karharbári flora, Pal. Ind., Ser. XII, pt. 1.

Trunco articulato, ramoso; caulibus (ramisque) articulatis, striatis magnitudine variantibus, vaginis in articulis ex 12—22 pluribusque foliolis consistentibus, plerumque duas in partes, folia opposita simulantes, partitis, nonnunquam in foliola dissolutis; partibus vaginæ frequentissime oblonge-ovalibus, magnitudine variantibus, 5—14 nervis crassiusculis, equalibus (singulorum foliolorum) percursis, sæpe lineas commissurales exhibentibus. Fructificatione adhuc ignota.

Description.—This Indian form which in general appearance bears the characters of the genus as established by Prof. Schimper is rather numerous in the Lower Gondwánas, and exhibits a great variety as regards size of stems and stalks, form and size of the portion of the sheath, and number of the leaflets.

Most of the specimens were found with sheath portions in the articulations, but there occur also a great number of leafless stems in the rocks of the Lower Gondwánas, many of which are, I believe, of *Schizoneura gondwanensis*, at least at those

[1] Strzelecki, New South Wales and Vandiemen's Land, p. 250, Pl. VI, fig. 5.
[2] Mem. Geol. Surv. India, Vol. II, p. 327.
[3] From the ancient tribal region, Gondwána.

places where this species is very numerous. I refer for instance to Plates V*A*, fig. 3, VII*A*, fig. 1 *a*, VIII*A*, fig. 2, and IX *A*. Judging from these stems, the plant must have been of a good size. The stem was articulated and ribbed—the ribs and sulci were in juxtaposition, a character which we also find in the European (Triassic) *Schizoneura* (although it is also found in some palæozoic species of *Calamites*). The stems appear to have been branched (Plate V*A*, fig. 3). The leaved specimens may represent branches (in older specimens), as well as unbranched (younger) plants. They are also articulated; the internodes ribbed.

The articulations bear the sheaths. These are generally separated into two almost equal portions. In most of the specimens these are well seen to be embracing (amplexicaules). These portions of the sheath have various forms—some are oblong lanceolate (Pls. 1*A*, figs. 1, 3, 4, III*A*, fig. 2), mostly, however, oblong-oval. They are traversed by a varying number of equally strong well marked longitudinal veins, approaching at the base and the apex. The number of these veins is very varying; and, correspondingly, the breadth of the sheath portion. The least number is 5, 6, 7 in each portion (*see* Pl. I*A*, figs. 1—4), and consequently the portions (pseudo-leaves) are narrow.

In the majority of the specimens, the number of the veins in the sheath portions is much larger, generally 9, 10, 11; the greatest number of veins I observed in a specimen (Pl. V*A*, fig. 5), which is a sheath portion, was 14 veins (the thicker lines; the thinner ones have another meaning, of which I shall speak presently). These veins represent as many single leaflets as the sheath portion consists of (which it is composed). That this is indeed so we can see in those specimens where, besides the thicker veins (or ribs), there are also in the interspaces thinner lines (Pls. II*A*, fig. 2; IV*A*, figs. 2, 3; V*A*, figs. 2, 5; VI*A*, figs. 1, 2, 3; VII*A*, figs. 1*b*, 2; VIII*A*, figs. 1, 2), the nature of which will be understood from the following:—

In most of the cases the sheath portions are entire at their apex; in several cases, however, a splitting was observed, which takes place between the veins and along the thinner lines where these are seen. (Pls. I*A*, figs. 3, 4; III*A*, fig. 2; VIII*A*, fig. 1). Where the splitting of the sheath portion is farther advanced, there we can see better that the sheath portions consist of single leaflets, and that the splitting takes place along the commissural lines of the leaflets; fig. 3, Pl. III*A*, exhibits a specimen where the sheaths are almost entirely reduced into the single leaflets; on Pl. V*A*, fig. 2, the sheaths are partly divided into single leaflets, and partly have two or three leaflets still joined together, the splitting along the lines of junction being well seen; so also in fig. 2, Pl. VI*A*. In fig. 1*b*, Pl. VII*A*, the sheaths are resolved entirely into the leaflets which are long and broad, the veins well marked; but there is still a portion of the sheath preserved (to the right of the figure between the two internodes); fig. 2, Pl. VII*A*, exhibits various states of splitting; a very far-advanced splitting is also seen in fig. 5, Pl. VIII*A*. That

these sheath portions and leaflets were originally joined to one common sheath, is partly exhibited by four specimens figured in this paper; they are, fig. 2, Pl. II*A*, a specimen with two articulations, in both of which the sheath is not entirely split, but is still entire in the lower portion. The same is partly seen also in fig. 2, Pl. VI*A*, also in fig. 2, Pl. VII*A*, and in fig. 2, Pl. VIII*A*.

Damuda and Panchet forms identical.—The specimens hitherto referred to in the text were all from the Damuda division. But there is also a form of *Schizoneura* in the top formation of the Lower Gondwánas, *i.e.*, in the Panchet group of Bengal. The specimens are figured on Pl. X*A*. They are not so large as those from the Damudas, but all the characters of these are also found in these Panchet forms. The sheath portions are oblong-oval, embracing, and show up to nine veins. I could not observe the commissural lines, the specimens being rather badly preserved; but there is no doubt that the veins are those of the single leaflets. There is no character of distinction between the Damuda and Panchet forms.

Relations.—Of the known species of *Schizoneura*, our species resemble most closely the Lower Triassic *Schizoneura paradoxa*, Schimp.[1] Our plants appear somewhat stronger, and the number of the leaflets composing the sheaths, larger, the sheath portions therefore broader; they also are shorter, their shape more generally oblong-oval; in *Schizoneura paradoxa*, Schimp., the number of leaflets does not seem to exceed eight, while the smallest number of leaflets in *Schizoneura gondwanensis*, Fstm., is ten.

Stems.—As mentioned before, there occur with the leaved stems many without leaves, or partly so (*see* Pls. V*A*, VII*A*, VIII*A*, and IX*A*). Most of these stems were generally designated as *Phyllotheca*. My opinion, however, is, that they mostly belong to *Schizoneura* and to *Schiz. gondwanensis;* it is at least certainly so with the specimens figured on Pl. V*A*, fig. 5; Pl. VII*A*, fig. 1*a*, which completely resemble the other stem of the same figure to which the leaflets belong; Pl. VIII*A*, figs. 2, 3, are partly leaved stems, and Pl. IX*A*, figs. 1, 2, are really also of *Schizoneura gondwanensis*. There are, however, several other stems figured (Pl. VIII*A*, fig. 4; Pl. IX*A*, figs. 3, 4, 5, 6) which may also be of *Schizoneura gondwanensis*, but which also might be considered as belonging to another species, *Schizoneura meriani*, which will be next described.

Range and localities of Sch. gondwanensis, Fstm.—

1. *Talchir division:*

Karharbári beds, Karharbári coal-field. I have collected this year at Passerabhia, shaft No. 40, several fossils, which are from the roof of the second seam, and amongst which are two fragmentary specimens, which I can refer only to *Schizoneura gondwanensis*, Fstm. The sheaths are split. Mohpáni coal-field (Pls. III*A*, fig. 3, VII*A*, figs. 1 *a*, *b*).

[1] Schimper and Mougeot: *l.c.* Pls. XXIV—XXVI, 1844.
Schimper: Tr. Pal. végét., Pls. XIII - XVI, 1869.

2. *Damuda division:*

(*a*) Barákar group:—

Lumki hill, Karharbári coal-field (Pal. Ind. XII, pt. 1, Pl. I, figs. 2, 3).

(*b*) Raniganj group:—

Raniganj (Pls. I*A*, II*A*, III*A*, figs. 1, 2; IV*A*, figs. 1, 2; V*A*, VI*A*, VII*A*, fig. 2; VIII*A*, IX*A*); Assensole (north-west branch of Nunia river).

Jharia coal-field (Pl. IV*A*, fig. 3).

Hurdeamo, south-west of Sarun, Bokáro coal-field.

Nala at Budatand and Lanjit, Ramkola coal-field.

Garjan hills, Raigarh coal-field.

Bajbai, 2 miles east of Gopat river; Chanduidol; Mahan river near Minarra, and between Minarra and Gajar (and other localities), South Rewah coal-field.

Baricondam (Pl. III*A*, fig. 4) and near Harapala, Sátpura basin.

3. *Panchet division:*

Maitúr, north-west of Assensole, north-west branch of Nunia river, Raniganj coal-field, Pl. X*A*.

Schizoneura comp. Meriani, Schimp.

1828. *Equisetum*, Bgt.: Hist. d. végét. foss., p. 115, Tab. XII, fig. 13.
1865. *Calamites*, Schenk, in Schœnlein, *l. c.*, Tab. V, fig. 4; Tab. VI, figs. 1, 2, 4.
1869. *Schizoneura*, Schimp.: Tr. Pal. végét., Vol. I, pp. 782-783; Pls. XV and XVI.
1879. Feistmantel: Pal. Ind., Ser. XII, Pl. I, figs. 6-7.

In my Talchir-Karharbári flora (*l.c.*), I have mentioned some specimens from Passerabhia, Karharbári coal-field, which I thought might be referred to the above species.

There are also among the Raniganj plants several stems which agree quite well with this European species (Pl. VIII*A*, fig. 4; Pl. IX*A*, figs. 3-6). I have mentioned them already with *Schizoneura gondwanensis*, but their appearance is also that of *Schizoneura meriani*, Schimp.

I am afraid, however, that I shall have to leave this question unsettled, for although these Raniganj stems resemble closely *Sch. meriani*, yet their association with *Schiz. gondwanensis* makes me hesitate to separate them from the species.

Schizoneura, sp.

1879. Feistmantel: Talchir-Karharbári flora, p. 8, Pl. I, fig. 1.

Another specimen was figured from the Talchir group, which appeared to be a *Schizoneura*, but which I did not identify specifically, on account of its incomplete preservation.

In India *Schizoneura* ranges from the (?) *Talchir group* to the *Panchet group*.

Genus : PHYLLOTHECA,[1] Bgt., 1828.

1828. Brongniart : Prodrome, pp. 151 and 175.
1845. Morris : in Strzelecki, New South Wales and Vandiemen's Land, p. 250 etc.
1847. McCoy : Ann. and Mag. Nat. Hist., vol. 20, Ser. I, pp. 152-157.
1849. Dana : U. S. Expl. Exped., p. 710.
1850. Unger : Gen. and spec. plant foss., pp. 62-73.
1863. Bunbury : Quar. Jour., Geol. Soc., London, Vol. XVII, p. 355.
1846-56. Zigno : Flora formation. Oolithicæ, Padova.
1876. Heer : Juraflora Ostsibiriens und des Amurlandes, p. 43.
1876. Feistmantel : Raniganj flora, Jour. As. Soc., Bengal, Vol. XLV, p. 346.
1878. Heer : Nachträge zur Juraflora von Irkutsk, p. 4 ; Flora foss. arctica, vol. V.
1879. Schmalhausen (T.) : Beiträge zur Juraflora Russlands, M. de l'Ac. Imp. d. sc. d. St. Petersbourg, 7th Ser., Pl. XXVII, pp. 12, 46, 62.

Plantis herbaceis ; habitu equisetorum Floræ vivæ. Cauli simplici vel ramoso, ipso ramisque articulatis striatisque ; foliis verticillatis, basi in vaginam connatis superne liberis, linearibus et lineari lanceolatis, æqualibus, erecto incurvis, costatis.

This is another peculiar equisetaceous plant, recalling most closely forms of the living *Equisetum*.

The stems and branches (in branched stems) are articulated and the internodes striated or ribbed. The leaflets, which are linear and have a central vein, are joined into a sheath in the lower part, the upper part being free. The leaflets (the free portion of the sheath) are either erected or in other forms reflexed.

As this genus occurs only rarely in India, I cannot add much to our knowledge of it, and I can only refer to the literature, especially to the recent publications by Heer and Schmalhausen.

Known species and distribution of Phyllotheca.—The species of *Phyllotheca* hitherto described are—

Phyllotheca australis, Bgt., *Phyllotheca ramosa* and *hookeri*, McCoy, *Phyllotheca indica*, Bunb., *Phyllotheca brongniartiana* and *equisetiformis*, Zigno, *Phyllotheca ? lateralis*, Phill., sp., *Phyllotheca sibirica*, Heer ; *Phyllotheca deliquescens*, *socolowski*, *stschurowski*, *striata*, *paucifolia*, *stellifera*, *equisetitoides*, Schmalh.

One new species will be described in the present memoir.

These known species are distributed as follows :—

a. AUSTRALIA.—From here the genus was at first described by Brongniart[2] ; his locality, however, is indistinctly indicated : "Hawkesbury river near Port Jackson, New South Wales"—and there is no horizon mentioned from which the fossil came. McCoy, Morris, Dana, and myself figured and described other specimens, and we now know that *Phyllotheca* is known in Australia from four horizons :

Phyllotheca.—Mentioned as genus from the lower coal-measures (below the marine fauna). Palæozoic.

[1] Φύλλον=leaf, θήκη=a sheath (of leaves).

[2] Prodrome, 1828, p. 151.

Phyllotheca australis,[1] Bgt., from the Newcastle beds (upper coal-measures), New South Wales, and from the jurassic beds (upper mesozoic) at Cape Paterson, Victoria.

Phyllotheca ramosa,[2] McCoy (this, I think, not differing from *Ph. australis*), from the Newcastle beds in N. S. Wales.

Phyllotheca hookeri,[3] McCoy, from the Wianamatta beds, from the Newcastle beds, and from the locality Avowa (which belongs to a lower horizon, Palæozoic).

The range of *Phyllotheca* in Australia is therefore from Palæozoic (carboniferous, lower coal-measures), N. S. Wales, to upper mesozoic in Victoria.

b. India.—In India one species was hitherto known from the Raniganj-Kámthi group, *Ph. indica*, Bunb., which will also be described here. A new species will also be described, the affinities of which are with a jurassic form in Siberia.

c. Siberia.—The knowledge of *Phyllotheca* in Siberia is quite recent.

Phyllotheca sibirica[4] was described and figured in 1876 and 1878 by Professor Heer (*l. c.* ante from jurassic beds in the Gouvernement Irkutsk (Siberia).

Phyllotheca deliquescens,[5] Göpp., sp., described and illustrated by Professor Schmalhausen, 1879, (see *l. c.* ante) from jurassic beds of the Kusnezk basin in the Altai (Siberia) and from the same formation on the lower Tunguska river, North Siberia.

Phyllotheca socolowskii,[6] Eichw., sp., and *Phyllotheca stschurowskii*,[7] Schmalh., described by the same author from the Kusnezk basin.

Phyllotheca striata,[8] Schmalh., described by Professor Schmalhausen, from the jurassic beds of the Petschora country.

Phyllotheca paucifolia,[9] Schmalh.

Phyllotheca stellifera,[10] Schamlh.

Phyllotheca equisetitoides,[11] Schmalh., described by the same author, 1879 (*l. c.*) from jurassic beds on the lower Tunguska river, North Siberia.

We have, therefore, eight species of *Phyllotheca* in jurassic beds in Siberia, amongst which both our Indian forms find their representatives.

d. Italy.—From the jurassic beds in Northern Italy two species of *Phyllotheca* were described by M. Zigno (*l. c.* ante).

Phyllotheca brongniartiana,[12] Zign. (*l. c.* p. 59).

Phyllotheca equisetiformis,[13] Zign. (*l. c.* p. 60).

[1] Australia.
[2] Ramus = the branch.
[3] From a proper name.
[4] Siberia.
[5] Deliquesco, to be dissolved.
[6] Proper name.
[7] Proper name.
[8] Striatus = striated.
[9] Paucus = scarce; folium = leaf.
[10] *Stella* = star; *fero* = to bear, to have.
[11] Like *equisetites*.
[12] Proper name.
[13] Resembling *equisetum*.

e. ENGLAND.—No true *Phyllotheca* has hitherto been described from England, and mention of this country is made here only because of the doubtful *Equisetum laterale*, Phill., as mentioned before, which, although referred to *Schizoneura* by Schimper, was lately (1876) correlated by Heer with *Phyllotheca*. The original specimen is, however, so badly preserved that either of these correlations might be possible.

The range of *Phyllotheca* as known at present is therefore from *palæozoic* (carboniferous ? in Australia) through the subsequent formations into *jurassic* beds, where it is most numerous and most widely distributed.

PHYLLOTHECA INDICA,[1] Bunb. Pl. XII*A*, figs. 3—9.

1862. Bunbury: Nágpur plants, Quar. Jour. Geol. Soc. London, Vol. XVII, p. 355, Pls. X, XI.
1876. Feistmantel: Raniganj plants, Vol. XLV, pp. 346, 347.

This plant was originally described by Sir Charles Bunbury from the Nágpur district (*l. c.*) and several specimens were figured. I am afraid I cannot add much to the knowledge of this plant, as there are not many specimens in our collections, and they seem to be just as incomplete as Sir Bunbury's specimens were. But I shall at least add something regarding the distribution of the plant.

Most of the specimens which I figure (Pl. XII*A*, figs. 3—5, 7—9) are also from the Nágpur district. They are fragments of foliated stems or branches. The partial sheaths are not quite well seen, but all the specimens show the reflex leaflets.

Fig. 6 of the same plate shows another specimen a little more complete, but from the Raniganj field. That it is a *Phyllotheca* nobody can doubt, and that it is identical with the Nágpur plant must occur to everybody who compares the plants.

In the Raniganj specimen we see better the somewhat funnel-shaped sheaths as described by Sir Ch. Bunbury (*l. c.*, p. 336); they are furrowed, the furrows corresponding with the numbers of leaflets which compose the sheath. According to this the leaves would be numerous, but in none of the whorls are they completely preserved so as to allow of their number being fixed. The leaves (at least the free portion of them) are setaceous, longer than the sheaths, at first erect, then spreading out and at last reflexed.

I did not observe any branched specimens, so that I can form no idea of the mode of ramification, but in the Australian *Phyllotheca*, as well as in the Italian form, and as it appears from Mr. Schmalhausen's figures *l. c.* 1879, Pl. X of *Phyll. deliquescens*, also in the Siberian forms, the branches originated above the articulation of the stem, and we can therefore assume the same for the Indian form.

Relations and differences.—There are especially two species with which the Indian *Phyllotheca* can be compared, i.e., *Phyll. australis*, Bgt., in the first place, and then *Phyllotheca sibirica*, Heer; the former from the upper coal-measures (Newcastle beds) in New South Wales, and the upper mesozoic (jurassic) beds of

[1] Indicus = Indian.

Victoria in Australia; the latter from jurassic beds in Siberia. The Australian *Phyllotheca*, however, has the stem more smooth or only slightly striated, and the sheaths more adpressed.

The *Phyll. sibirica* seems to have the sheaths shorter and the leaves not so reflexed as the Indian form, and it is besides this distinguished by the presence of certain small radiately ribbed discs, the nature of which is not quite explained.

Stems.—In the neighbourhood of Nágpur, wherefrom this species was first described, there were also numerous stems having no leaves or sheaths, so that their position must remain somewhat doubtful; but taking their association with *Phyllotheca* and the absence of other equisetaceous leaved plants into consideration, we are, I think, quite justified in placing these stems with *Phyllotheca*, just as we did with other stems associated with *Schizoneura*, assigning them to this genus. Already Sir Ch. Bunbury noticed these stems, and from the absence of any sheaths whatever in their articulations, he conjectured that the sheaths must have been deciduous.

These *Phyllotheca* (?) stems have, however, a great resemblance to those of *Schizoneura*, at least in one important character, *i.e.*, they are ribbed, and the ribs and sulci are not alternating, but in juxtaposition. Some of the Siberian and one of the Australian forms (*Phyll. hookeri*) show the same relations.

Range and distribution of Phyllotheca indica, Bunb.

Raniganj—Kámthi group.

Raniganj, Raniganj coal-field, Pl. XII *A*, fig. 6.

Bharatwáda (Pl. XII *A*, figs. 3-5, 7-9). Bokhara and Chicholi, near Nágpur.

PHYLLOTHECA ROBUSTA,[1] n. sp. Pl. XIV *A bis*, figs. 1, 2.

Caulibus ramificatis (?) ramis tenuibus, articulatis, tenuiter striatis, foliis in articulis 10-14, verticillatis, oblonge latiusculis, basi attenuatis, apice obtuse-acuminatis, basi decurrentibus inque spatham connatis (?) striatis, nervo medio mediocri.

This new species is based upon two specimens from the Rájmahál hills, figured on Plate XIV *A bis*. It is one of the broad-leaved forms, which, however, are only rare. It appears that our specimens are of a branched plant, the stalks (here perhaps branches) are articulated and the internodes are finely striated. The leaves in the articulations number from 10-14, are broadly lanceolate, their midrib is not quite distinct, and they are longitudinally striated. They are arranged in whorls in the articulations, their bases are decurrent on the internode, and from several of the whorls it appears that the bases of the leaves are joined to a sheath, but the nature of this cannot be more closely stated, as the specimens are too much pressed

[1] *Robustus*, strong.

and the structure is badly preserved. These are the only specimens known from India.

Analogies and differences.—The only form which resembles very closely this new Indian *Phyllotheca* is a jurassic form from the Kusnezk basin, on the Altai, South-West Siberia, described only recently (1879) by Prof. Schmalhausen as *Phyll. schtschurowskii* (see ante *l. c.* p. 16, Plates III, fig. 2*b*; IV, 4*b*, VI, 2, 3). It might be quite possible that this Indian and the Siberian forms are identical, but Prof. Schmalhausen's specimens are rather too imperfect to justify an identification. As it stands, the two forms seem to differ in the number of the leaflets (10—14 in the Indian and 20 in the Siberian) and somewhat in the form of the same, those of our plant being a little more produced at the apex; but still *Phyll. robusta* has to be considered in closest relation to *Phyll. schtschurowskii*.

Locality and horizon.—Raniganj group (?)

Dubrajpur, Gopicándar area, Rájmahál hills (our collections).

Genus: TRIZYGIA,[1] Royle, 1834.

1834-39. Royle: Botany and Nat. Hist., Himalayan Mts., p. 431.

Trizygia speciosa[2], Royle. Pls. XI*A*, XII*A*, figs. 1, 2.

1834-35. *Royle: l. c.* p. 431, Pl. II, fig. 8.
1845. *Trizygia*, Unger: Synopsis plant. fossil., p. 114.
1850. *Sphenophyllum speciosum:* McClelland's Geological Report, etc. (1848), p. 54, Pl. XIV, fig. 5.
1850. *Sphenophyllum trizygia*, Unger: Genera et species plant. fossil., p. 71.
1860. *Sphenophyllum*, T. Oldham: Mem. Geol. Surv. India, Vol. II, p. 316.
1865. *Trizygia*, W. T. Blanford: Mem. Geol. Surv. India, Vol. III, p. 31.
1876. *Sphenophyllum trizygia*, Feistmantel: Rec. Geol. Surv. India, Vol. IX, pt. 3, p. 70.
1876. *Sphenoph. trizygia*, Id.: Jour. As. Soc. Bengal, Vol. XLV, p. 342, Pl. XV, figs. 1, 2.
1877. *Trizygia*, Grand' Eury: Flore Carbonif. d. Dept. d. l. Loire, p. 404.
1879. *Trizygia*, Feistmantel: Rec. Geol. Surv. India, Vol. XII, pp. 163—166.

I do not give a diagnosis of the genus also, because only one species being at present known, the diagnoses of genus and species must be identical.

Caule articulato, tenerrimo, fluctuante (?); foliis obovato-oblonge cuneiformibus, integris; senis in articulis, verticillum totum haud formantibus sed unilateraliter in tria paria dispositis; pare summo longissimo, imo brevissimo minimoque; nervo medio nullo; nervulis crebris æqualibus ex duobus primariis regulariter dichotomis.

The chief character of this plant, which seems to have been an aquatic plant as can be judged from the proportion of leaf to stalk, consists in the arrangement of the leaves round the articulations; they are not arranged in an entire whorl, but, *always*

[1] Τρεῖς = three
Ζεῦγος = a pair.

[2] Speciosus = handsome.

numbering six only, they are placed semi-circularly, in *three pairs*, on one side of the articulation; the pairs are of an unequal size; the uppermost pair, which is horizontally (or suberectly) spread out, is the longest, the lower pair hanging down vertically, is the smallest, the middle pair, taking its place between these two, is generally shorter than the first pair, sometimes equal to it in size. The leaflets of the whorls differ also in shape, those of the first two (upper) pairs are more oblong-oval, while those of the third (undermost) pair are more egg-shaped. They are entire and replete with veins, which originate from two in the cuneiform base, and pass radiating, constantly bifurcating to the apical margin.

From this number of the leaflets Royle named it *Trizygia*, a name certainly quite appropriate, as the characters are quite constant and not found again in any other of the known fossil equisetaceous plants.

McClelland (1850) and also Unger (1850) have classed it with *Sphenophyllum*, and I did the same in my first notes on the Damuda plants. But after close examination, it appeared to me that it must be considered a peculiar genus, which view I communicated in my recent note "on *Sphenophyllum* etc.";[1] but still taking the Indian *Trizygia* as belonging to the *Sphenophylloideæ* and, so to speak, as representative of the carboniferous *Sphenophyllum*, which view we also find in Mr. Grand 'Eury's quoted work. The classification would be then as follows:—

Group: *Sphenophylloideæ*.[2]

a.—Leaf-whorls complete round the joint; number of leaves variable; leaves of the same size and shape (or nearly so) in the same whorl: the true *Sphenophyllum*[3] of the palæozoic epoch.

b.—Whorls incomplete on one side of the joints; number of leaves six, arranged in *three* pairs, each of which differs from the other in size and partly also in the shape of the leaves. The *Trizygia* of the Indian coal-beds.

Raniganj and Barákar form.—This species is one of those which have a pretty wide, vertical and horizontal range. By officers of the Survey it was at first discovered in the Talchir coal-field, in beds which, according to the subsequent classification of the Damudas, have to be classed as Barákars; later it was found numerous in the Raniganj field, but in the Raniganj group.[4] It was subsequently found also elsewhere. The specimens from the Raniganj and Talchir coal-fields appeared at first to indicate a certain difference in size of these two forms, but later discoveries showed that this cannot be taken as a distinguishing character, and we have to consider them as indeed identical.

[1] Rec. Geol. Surv. of India, Vol. XII, p. 3.

[2] Belonging to the *Equisetaceæ*.

[3] Σφήν = a wedge; φύλλον = a leaf.

[4] Royle's original specimens are described as coming from the shales of Raniganj, without indicating any horizon, while Mc'Clelland described it amongst his Burdwan fossils, without indicating also any horizon or locality, from which reason I spoke of it in my note in the last number of Records (XIII, p. 65) as having been made known at first from the Barákars of the Talchir coal-field.

Range and distribution of Trizygia speciosa.

a. Barákar group :

Bokáro coal-field, near Layeo ; Auranga coal-field, west of Múrup.
Talchir coal-field, near Gopalprásad (Pl. XI *A*, figs. 2, 9 ; Pl. XII*A*, fig. 2).

b. Raniganj group :

Raniganj coal-field, Raniganj and Mangálpur (Pl. XI *A*, figs. 1, 3, 4, 5-8; Pl. XII *A*, fig. 1).
Sátpura basin, south of Pachmari, upper Denwa valley.
Sikkim (according to Dr. Hooker's quotation).

Genus : VERTEBRARIA,[1] Royle, 1834-39.

1839. *Vertebraria*, Royle : Botany and Nat. Hist. Himal. Mountains, p. xxix,* Pl. II, figs. 1-7.
1847. *Vertebraria*, M'Coy, in Ann. and Mag. Nat. Hist., Vol. 20, 1st ser., pp. 145-147, Pl. IX, fig. 1.
1849. *Clasteria*, Dana : Un. St. Expl. Exped., Pl. XIV.
1850. *Sphenophyllum*, Unger : Gen. et sp. plant. foss., p. 71.
1861. *Vertebraria*, Sir Ch. Bunbury : Quar. Jour. Geol. Soc., Vol. XVII, p. 338, Pl. XI, fig. 3.
1876. *Vertebraria*, Feistmantel : Raniganj plants, Jour. As. Soc., Bengal, Vol. XLV, p. 347.
1879. *Vertebraria*, Feistmantel : Lower Gondwána foss., Pal. I. Ser. XII, 1, p. 8, Pl. I, figs. 8, 9.

This very peculiar genus, which is at present known only from India and the upper coal-measures (Newcastle beds) of Australia (N. S. Wales), has been already sufficiently described as regards its appearance and form, etc., and has been also figured. The true nature of it was, however, not yet made out, and I must confess that even now I cannot advance much our knowledge in this direction, although numerous specimens are at my disposal for examination. There is no instance of *Vertebraria* being found in connexion with any other plant. So much seems, however, certain, that *Vertebraria* is the root or rhizome of some other plant. This already was stated by Sir Ch. Bunbury, at least for one of the forms of his *Vertebraria*, and in my paper on some Raniganj plants (1876, *l. c.*) I tried to show the equisetaceous nature from the figured specimens. I cannot add more to-day, and shall therefore give the following synopsis referring to the figured specimens.

Vertebraria is in India a wide-spread fossil, both as regards vertical and horizontal distribution. I think there is only one species of *Vertebraria* in India, *i. e.*, *Vertebraria indica*, Royle, while *Vertebraria radiata* is a cross-section of *Vertebraria indica*. There are two varieties, so to speak. One which appears a more tender plant and is more branched, and another variety which represents rather the stems ; this latter is more generally distributed, while the former appears to be more common in the Kámthi representative of the Raniganj group, although the other form also is not absent.

Analogies.—The Australian form shows the closest analogy to our Indian *Vertebraria ;* about the identity of the genera there is no doubt, the species are perhaps

[1] Vertebra= a joint of the backbone.

different. Dana's *Clasteria* (*l. c.*) is nothing else but *Vertebraria;* it represents the longitudinal section of the same plant of which *Vertebraria australis* (as figured by Mc'Coy) formed the transverse section, an analogous case to that in India, where *Vertebraria indica* was the longitudinal section, and *Vertebr. radiata* the transverse section of the same plant. In Australia it is described from the upper coal-measures only.

Unger placed both the Indian and Australian *Vertebraria* with *Sphenophyllum;* that this is an error everybody will perceive from the figures.

Lately only a *Vertebraria ? petschorensis* was described by Mr. Schmalhausen (*l. c.*, p. 53, tab. VII, figs. 14-18) from jurassic beds of the Petschora country (Oranetz, on the right bank of the Petschora river). But so far as I can judge from the drawings, Mr. Schmalhausen's specimens do not show much relation with either the Indian or the Australian *Vertebraria.*

In India, as said before, we have only one species—

VERTEBRARIA INDICA,[1] Royle. Pls. XII*A*, figs. 10, 11; XIII*A*; XIV*A*, figs. 11-4; XIV*A bis*, fig. 3.

Littérature the same as that of the genus.

I have figured several specimens of the peculiar forms; fig. 11, Pl. XII*A*, fig. 3, Pl. XIII*A*, and figs. 1, 3, 4, Pl. XIV*A*, are the most typical forms. Figs. 5, 6, Pl. XIII*A*, represent Sir Charles Bunbury's branched form, to which perhaps also figs. 1, 2 on the same plate may be placed (although they are from a different horizon).

Fig. 8, Pl. XIII*A*, is a specimen exhibiting partly also the transverse section, showing the cuneiform segments, which are still better seen in fig. 3, Pl. XIV*A bis*.

Fig. 11, Pl. XII *A*, and fig. 2, Pl. XIV *A*, are specimens from which thick branches, with the same *Vertebraria* structure, branch off.

Range and distribution of Vertebraria indica.—As far as known at present, *Vertebraria* is known from all divisions of the Lower Gondwánas and almost from all horizons.

Talchir division:

(*a*) *Karharbári beds*—

Passerabhia, Karharbári coal-field, Pl. I, fig. 89. I have recently collected several specimens from the second seam.

Damuda division:

(*a*) *Barákar group*—

Rájmahál coal-field (Mussinia, Burgo); Karharbári coal-field (Lumki hill).
Raniganj coal-field (Kumerdhubi. Pls. XIII *A*, figs. 1, 2, 4, 8; XIV *A*, figs. 1, 4).

[1] Indian.

Jharia coal-field.

Ramkola coal-field (Sendur river, west of Mitgain; Ledho nala, near Karamdiha; between Mahan river and Tamor hill; near Majurdaki; Suknai nala, north of Sarsera).

Talchir coal-field (Gopálprasád and Talchir).

Shahpur coal-field (Mardanpur outcrops).

Umrét coal-field (Barkoi).

(*b*) *Raniganj group* (Kámthi group)—

Raniganj field (Raniganj, Pls. XII *A*, figs. 10, 11; XIII *A*, fig. 3; XIV *A*, figs. 2, 3 Assensole, etc.).

Jharia coal-field.

Ramkola coal-field (between Mahan river and Tamor hill; nala between Gouri and Ghui; Morne river, north of Parasdiha).

South Rewah (Sohágpur; Sone river, west of Garara; Bajbai, 2 miles east of Gopat river; Mahan river near Tansar).

Raigarh and Hingir coal-field (Garjan hill, Girundla, Kodaloi and on the Bilpahari).

Sátpura basin (Bijori horizon, between Rorighat and Harapala).

Nágpur area (Kámthi, Tondakheri, the more branchead form prevailing).

Wardha valley coal-field (Kawársa).

South-east Godávari basin (Kunlácheru, Pl. XIII *A*, figs. 5, 6; Sadgudiam).

Sikkim-Damudas.

Panchet division.—From the true Panchet group of Bengal no *Vertebraria* is known, but from the Auranga coal-field a collection of fossils was brought by Mr. V. Ball from a locality south-east of Panripura, near Latiahar; they were in a red shale, like some shales of the Mahádevas. Mr. Ball designated them as from an uncertain horizon, but apparently Mahádevas. I for the present would, as stated before, rather feel inclined to include them in the Panchet division; amongst the fossils are several distinct specimens of *Vertebraria indica*, and this would be at present the highest known horizon in which *Vertebraria* has been found.

Résumé of the Equisetaceæ in India.

The Equisetaceous plants in the Lower Gondwánas of India are therefore represented by four genera, the affinities of which are rather peculiar—

(*a*) *Schizoneura*, Schimp., may represent a later (more recent) stage of the palæozoic *Asterophyllites*.

The genus is rather numerous in the Damuda and Panchet divisions.

In Europe it is Triassic and Rhætic.

The Indian *Schizoneura gondwanensis*, Fstm., is most closely related with *Schizoneura paradoxa* of the lower trias in Europe; another species is probably identical with an European form. Including the Indian species, we know at present four species of *Schizoneura* (not including in this genus the *Equisetum laterale*, Phill., which perhaps better be included with *Phyllotheca*).

(*b*) *Phyllotheca*, Bgt., may be taken as representative of the recent *Equisetum*.

The genus is not very numerous in India; two species are known from approximately the same horizon (Raniganj-Kámthi group).

In extra-Indian countries this genus is known from palæozoic rocks (in Australia), but especially from mesozoic rocks (Australia, Siberia, Italy and ? England).

Of the two Indian species, *Phyll. indica*, Bunb., most closely resembles to *Phyll. australis* in N. S. Wales and Victoria, and to *Phyll. sibirica*, Heer, and *Phyll. deliquescens*, Göpp., sp., in Siberia. The other species *Phyll. robusta* comes very close to *Phyllotheca schtschurowski*, Schmalh., from the Kusnezk basin of the Altai. Together with the Indian species we know sixteen species of *Phyllotheca*, eleven of which are from jurassic rocks, while one species (in Australia) passes from palæozoic into jurassic rocks.

(*c*) *Trizygia*, Royle, represents the genus *Sphenophyllum*. It is not rare both in the Barákar and Raniganj group of the Damudas.

One species is known.

(*d*) *Vertebraria*, Royle, of unknown affinities.

A genus known from India and Australia only, in both countries represented by one species respectively.

In India it is known (as the same species) from the whole Lower Gondwána portion.

In Australia from the upper coal-measures (Newcastle beds) of New South Wales.

DIAGRAM.

Asterophyllites, Bgt.	*Schizoneura*, Schimp.	*Schizoneura*, Schimp.	
Palæozoic	Two species in India (Lower Gondwánas).	Lower and Upper Trias, Rhætic.	Europe.
Phyllotheca, Bgt.	*Phyllotheca*, Bgt.	*Phyllotheca*, Bgt.	*Equisetum*:
Lower coal-measures, N. S. Wales. Upper coal-measures (Newcastle beds), N. S. Wales	Two species in India Raniganj group.	Upper mesozoic, Victoria Jurassic, E. Sibiria. Altai. Tunguska R. Petschora C. Italy. England.	recent.
? Sphenophyllum, sp.	*Trizygia*, Royle.		
Palæozoic	One species, India— Damuda Series.		
Vertebraria, Royle.	*Vertebraria*, Royle.		
Upper coal-measures (Newcastle beds), N. S. Wales.	One species, India. Lower Gondwánas.		

FILICES.

The by far most numerous fossils of the Lower Gondwánas are remains of ferns, and we shall find many interesting forms amongst them.

The most numerous, as regards species and specimens and distribution, are forms with single leaves and with net-venation.

In the systematical arrangement, I follow Professor Schimper's system in the new Handbook of Palæontology.[1]

In the present fasciculus I shall describe only two species of ferns, while all the other fossils will be described in a subsequent number of the Palæontologia.

The two species which I have to describe now were formerly joined by me to one species, but further investigations and comparisons have shown that they really belong to two forms, one of which represents a jurassic species from the Altai.

The filices will be subdivided as follows:—

- *a.* *Cyatheaceæ.*
- *b.* *Polypodiaceæ*—
  - *α.* Group of *Alethopteris whitbyensis.*
  - *β.* *Incertæ.*
- *c.* *Neuropterideæ.*
- *d.* *Pachypterideæ.*
- *e.* *Tæniopterideæ.*
- *f.* *Dictyotæniopterideæ.*
  Several sections—
- *g.* *Dictyopterideæ.*
  Incertæ sedis.

a.—CYATHEACEÆ.

Amongst this family I include of our Lower Gondwána fossils: a *Cyathea*, a *Sphenopteris*, and a *Dicksonia;* the two first will be described here:—

Genus: CYATHEA.

Cyathea comp. Tchihatcheffi, Schmal. Pl. XVI *A*, figs. 1, 2, 4.

1845. *Sphenopteris anthriscifolia* and *Sph. imbricata*, Göpp.: Tchihatcheff's voyage dans l'Altai Orientale, p. 387, Pls. XXVIII and XXIX.
1871. Geinitz in Cotta, Altai, Tab. II, fig. 4.
1876. *Sph. polymorpha*, Fstm. (ex parte): Jour. As. Soc., Bengal, Vol. XLV, p. 356.
1879. *Cyathea tchihatcheffi*, Schmalhausen: Beiträge zur Juraflora Russlands. Mem. d. l'Ac. Imp. d. Sc. d. St. Petersbourg, XXVII, No. 4.

When first describing (1876 *l.c.*) my *Sphenopteris polymorpha* from Raniganj,

[1] Handbuch der Palæontologie, Schimper und Zittel, Vol. II, No. 1.

I also placed with it some specimens from the Barákar group in the Talchir coal-field.

When examining them later more carefully, I found that the specimens from the Talchir coal-field differ from my *Sph. polymorpha*, and they appeared to me to be very closely related with Prof. Göppert's *Sphenopteris anthriscifolia* (*see* Göppert, 1845, and Geinitz, 1871, *l.c.*), and I intended to describe them under that name. But as Prof. Schmalhausen in his recent work (*l. c.*) described this species together with *Sph. imbricata*, Göpp., under one name, as *Cyathea tchihatcheffi*, I must refer our form from the Talchir coal-field to Prof. Schmalhausen's species, not identifying them, however completely for the present, although I cannot find any conspicuous and important distinguishing characters. If we compare our drawings (Pl. XVI *A*, figs. 1, 2, 4), and the quoted drawings of *Sphenopteris anthriscifolia*, Göpp., but especially *Sph. imbricata*, Göpp. (in Göpp. *l.c.*, Plate XXIX, figs. 10,11), we shall find a great resemblance between them; we can in fact say that our forms have the characters of both of Göppert's species, the venation (where preserved) is more that of *Sph. anthriscifolia*, Göpp., while the form of the pinnulæ, especially the mode of their connection at the base on the rhachis (forming a winged rhachis) agrees more with *Sph. imbricata*, Göpp.

Geinitz's drawing of *Sph. anthriscifolia*, Göpp. (in Cotta's Altai, *l. c.*,) resembles also very much our specimens, but the rhachis does not seem to be much winged. The same seems to be also the case with Prof. Schmalhausen's specimens, although fig. 1, Plate III, is exceedingly like our form from the Talchir coal-field. Prof. Schmalhausen's diagnosis also applies well to our specimens; I therefore refer them to *Cyathea tchihatcheffi*, as closely related.

For all other particulars I have to refer to Prof. Göppert's and especially Schmalhausen's papers. I would only mention that Prof. Schmalhausen compared some of his specimens with *Sph. lobifolia* (Morris in Strzelecki, *l. c.*, p. 246, Tab. XII, fig. 3), the difference being in *Cyathea tchihatcheffi* not having the pinnulæ at their base so constricted. I can observe the same as regards our specimens, especially fig. 4, Pl. XVI*A*, and *Sph. lobifolia*, Morr.; the distribution of the veins is very similar in both; but in our fern the pinnulæ are connected at the base, forming a winged rhachis.

Locality of the Indian form.—Barákar group:

Talchir, Talchir coal-field.

Genus: SPHENOPTERIS, Bgt., 1828.

Sphenopteris polymorpha, Fstm. Pls. XV*A*, XVI*A*, fig. 3, XVI*A bis*, figs. 1—6.

1876. Feistmantel: Jour. As. Soc., Bengal, Vol. XLV, pp. 356-358, Pl. XVI, figs. 5-7; Pl. XVII.

This species was first described by me from some specimens brought by Mr. Wood-Mason from Raniganj, and several of the figures then given are copied here

again. But at present I give also the drawing of one of the large specimens which shows the polymorphous nature of the pinnulæ.

As for the diagnosis, I must refer to my original paper. I have nothing to add here to complete it, but some corrections are necessary.

I stated in my original paper that I thought Mc'Clelland's *Pecopteris affinis* also belonged to *Sph. polymorpha;* but now having had Mc'Clelland's original specimen drawn again, I find that it differs in the chief character from *Sph. polymorpha*, i. e., in not having the rhachis of the pinna winged.

I shall therefore quote Mc'Clelland's specimen again as *Pecopteris affinis* (*see* further on).

I also compared *Sph. polymorpha* with *Pecopteris alata*, Bgt., from N. S. Wales (Hawkesbury river), and I must refer to it again; I have to point out some confusion which arose about this species. In his paper on "Sedimentary formations in New South Wales" published in "Mines and Mineral Statistics," 1874, p. 186, the Revd. Mr. Clarke correlated this *Sph. alata* with the carboniferous form, known at first by the same name, and later as *Sph.* (*Hym.*) *grandini*. The matter stands, however, as follows:—

The Australian species was at first described as *Pecopt. alata*, Bgt., and was subsequently placed with *Sphenopteris* (as *Sph. alata*) by Sternberg, and is at present quoted as such.

The European carboniferous form to which Mr. Clarke referred was at first described as *Sphenopteris alata*, Bgt., and was later quoted by Göppert as *Hymenophyllites grandini*, and now by Schimper as *Sphenopteris grandini*, Göpp.

Now, both Morris and Mc'Coy, who mention *Sphenopteris alata*, mention it in Brongniart's sense of *Pecopteris alata*, the Australian form, and not in the sense of the original *Sph. alata*, or the present *Sph. grandini* of the carboniferous.

This latter (Brongt., hist. végét. foss., Pl. XLVIII, fig. 4) is totally different from the Australian *Sph. alata*, Bgt. sp. (Brongniart, hist. végét. foss., Pl. CXXVII, p. 361), and it was with this latter that I have compared the upper portion of our *Sph. polymorpha;* the lower pinnæ appeared to me to resemble *Sph. athyrioides*, Bgt. sp., from the oolite, with the exception, that in this form the rhachids are not winged.

Range and distribution of Sph. polymorpha—

a. Barákar group—

Although the specimen from Talchir had to be separated from *Sph. polymorpha*, I yet think, it also occurs in the Barákar group, *i. e.*, on the Lumki hill in the Karharbári field.

b. Raniganj group—

Raniganj (Raniganj field), Pls. XV*A*, XVI*A*, fig. 3; Pl. XVI*A bis*, figs. 1—6.

See next section

Note.—So much for the present number. There is on Plate XVI*A bis* still one figure (7) which is not comprised amongst the preceding descriptions. I thought it from the first aspect to be an insect wing, but I was assured by a competent authority that it is not an insect wing, but a leaf, and in this case it most probably belongs to some *Cyclopteris*-like form, and I shall mention it in my second part at end of the *Neuropterideæ*. The figure had to be given on this plate, which, however, affords the opportunity of its being examined by other palæobotanists, who perhaps will be able to form an opinion about it of which I may have the benefit when preparing the text for the next number of the Palæontologia.

This separate note does not belong, of course, to this paper, and when the other portion is published, will have to be taken out.

PLATE I*A*.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. A leaved specimen, sheath-portions of the longer and narrower kind, resembling those of *Schiz. paradoxa*, Schimp.

Fig. 2. The same variety, with shorter, broader oval sheath-portions.

Figs. 3 & 4. The same species: sheath-portions again of the narrower variety; fig. 3, and the lowest-sheath portion to the left in fig. 4, showing the beginning of a splitting at the apex.

Fig. 5. A specimen of the same species with small sheath-portions.

All specimens from the Raniganj group, in the Raniganj field.

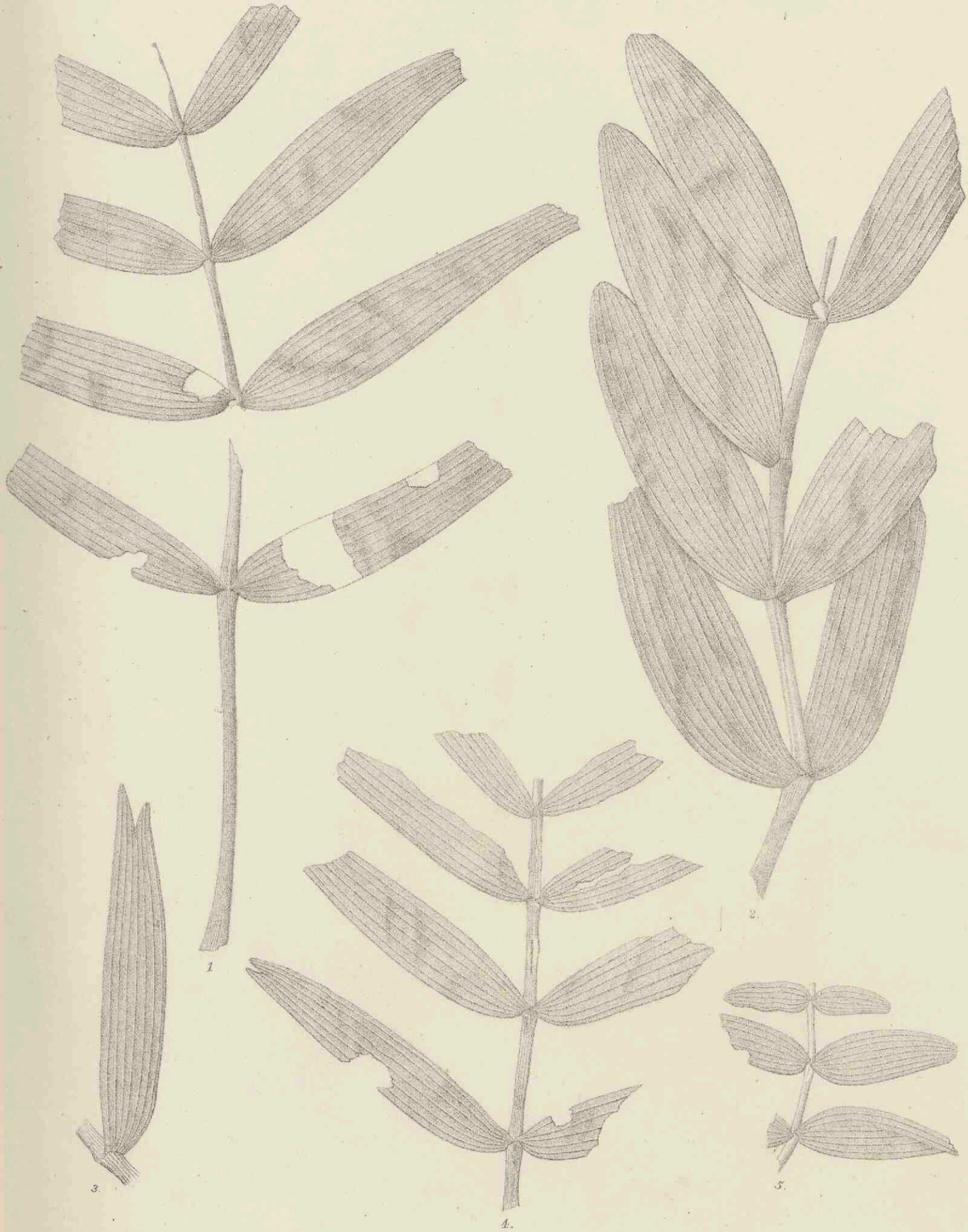

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PLATE II*a*.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. A robust specimen, with a thick stalk and two internodes; apparently the stem. In the internodes the sheath-portions are seen, but here the splitting of the sheath was not quite complete, and we can distinctly see that the sheath-portions originally formed only one sheath. In the sheath-portion two kinds of lines can be distinctly seen—some are considerably thicker, and these are the veins of the leaflets composing the sheath—the others, thinner, between the former, are the commissural lines, along which the leaflets are connected; the stem is ribbed.

Fig. 2. The same species—a leaved specimen with the shorter and broader variety of sheath-portions. Apparently a branch.

Both specimens are from the Raniganj group, in the Raniganj field.

2.

1.

Lith^d by Nilkanto Das

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PLATE IIIA.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. Two specimens preserved in the same position, as they are figured on the same slab of shale. One of them is probably the end portion of the stem, while the other one may represent a branch. The leaf portions contain numerous veins, but do not exhibit the commissural lines; they show well their embracing character in the joints.

Fig. 2. A smaller specimen of the same species with narrower sheath-portions, one of them showing the beginning of the splitting at the apex.

These two specimens are from the Raniganj group, in the Raniganj field.

Fig. 3. SCHIZONEURA GONDWANENSIS, Fstm. A small specimen with the sheath-portions almost entirely dissolved into the single leaflets. Stalk pretty broad and ribbed.

This specimen is from the Mohpáni coal-field.

Fig. 4. SCHIZONEURA GONDWANENSIS, Fstm., from the Bijori horizon (= Raniganj group) near Baricondam, upper Denwa valley, Sátpura basin.

Lith: by Jadu Nath Dos. Printed at Geol: Survey Office.

PLATE IV*A*.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. A considerable specimen with rather shortish sheath-portions.

Fig. 2. The same species, the sheath-portions showing distinctly the veins of the leaflets and the commissural lines of the same.

These two specimens are from the Raniganj group, Raniganj field.

Fig. 3. SCHIZONEURA GONDWANENSIS, Fstm. Fragmentary specimen with considerably broad sheath-portions, showing distinctly veins and commissural lines.

From the Raniganj group of the Jharia coal-field.

Lith.d by Jodu Nath Dos.

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PLATE V*a*.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. A leaved specimen, the lower portion of the stalk rather long, which makes me believe that this specimen represents the plant in the unbranched state.

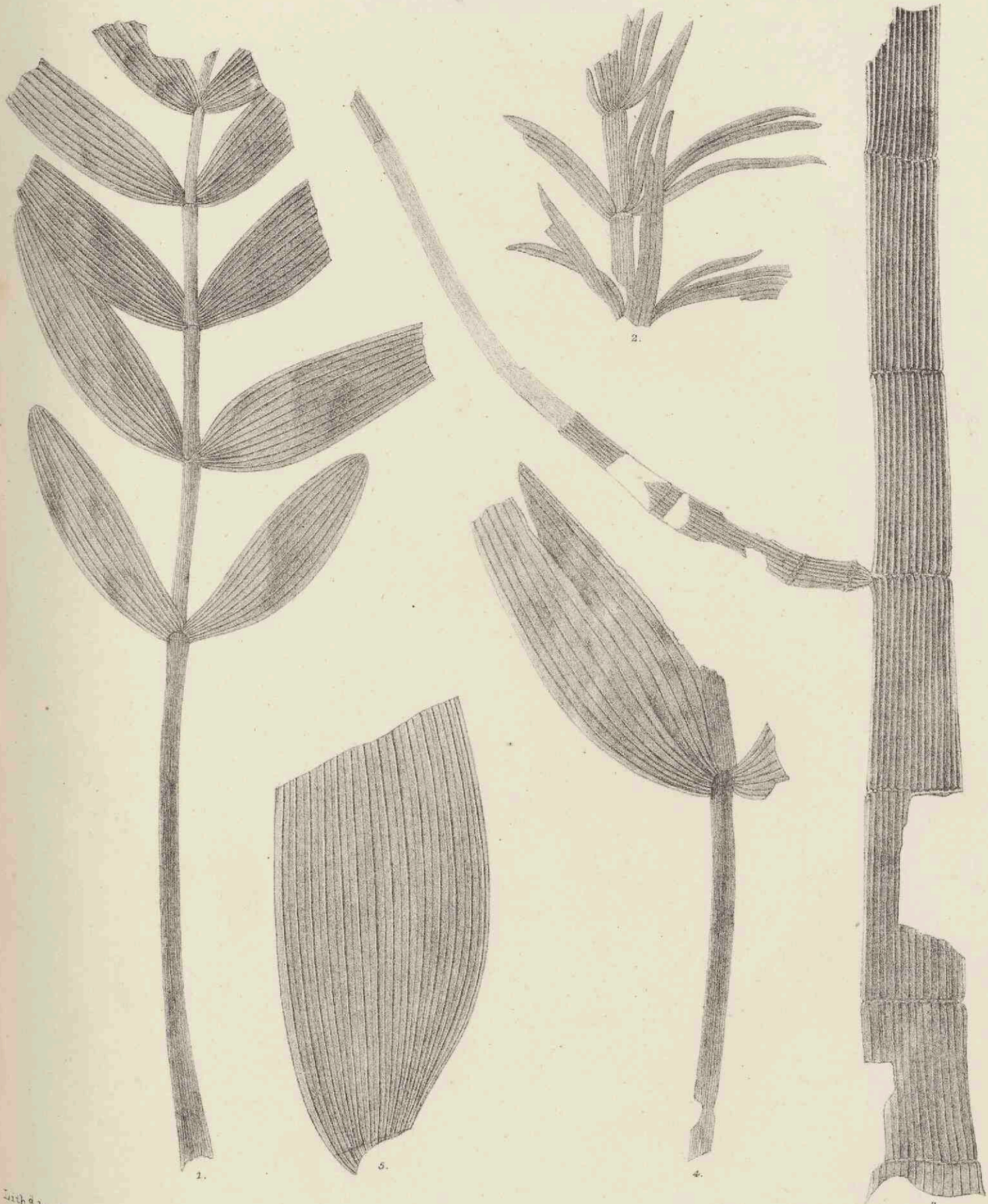
Fig. 2. The same species, with partly dissolved sheath-portions.

Fig. 3. A stem with a branch originating from one of the internodes. The ribs of the stem in juxtaposition. The same character is exhibited also in the branch. This specimen occurred on the same slab with *Schizoneura*, and I have no doubt that it is of this genus (page 63).

Fig. 4. The same species with a broad sheath-portion and rather broad leaflets.

Fig. 5. A sheath-portion, the broadest known to me at present, containing fourteen thick veins of as many leaflets, and showing also distinctly the commissural lines.

All specimens from the Raniganj group, in the Raniganj field.



Lith.d by Jadu Nath Dos

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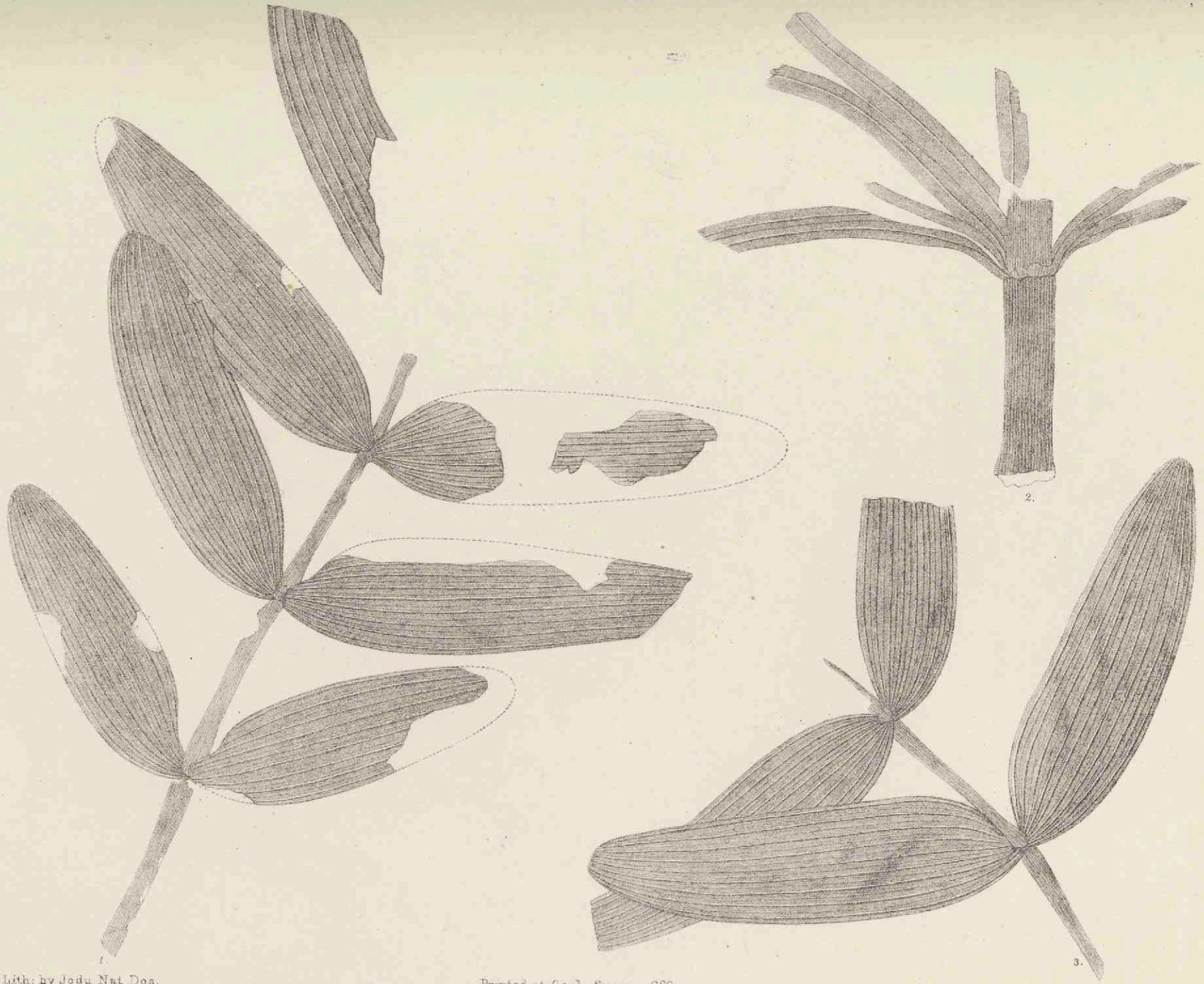
PLATE VI*A*.

Figs. 1 & 3. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. Specimens with oval sheath-portions and exhibiting distinctly veins and commissural lines.

Fig. 2. The same species—specimen with a dissolved sheath-portion, the leaflets very broad; they are, however, not separated entirely till at the joint, but show that they were joined to a common sheath. The stem of the specimen is rather broad and ribbed.

All specimens from the Raniganj group of the Raniganj field.



Lith: by Jodu Nat Dos. Printed at Geol: Survey Office.

PLATE VII *A*.

Figs. 1 *a* & *b*. SCHIZONEURA GONDWANENSIS, Fstm., page 59. Two specimens, both preserved on the same slab of shale. Fig. *b* is a rather broad stem, showing two joints and the internodes distinctly ribbed. In the two joints we see a number of free leaflets with a marked midrib; these are certainly the dissolved sheath-portions. To the right there is still a fragment of the sheath-portion not dissolved, showing veins and partly the commissural lines also. At the top of the figure there are seen still other leaflets crossing those of the second joint; these belong to a next higher joint.

Fig. *a* is a stem broader than that of fig. *b*, but of the same nature, and we can safely refer it to the same species.

From the Mohpáni coal-field.

Fig. 2. The same species—a specimen with sheath-portions partly quite dissolved, partly beginning to dissolve. The leaflets broad, the sheath-portion showing well the commissural lines.

From the Raniganj group in the Raniganj coal-field.

Lith: by Jadu Nath Dos. Printed at Geol: Survey Office.

PLATE VIII*A*.

Fig. 1. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. Specimens with sheath-portions showing well the veins and commissural lines, and the beginning of a splitting at the tops of the leaflets.

Fig. 2. The same species. A broad stem, with one joint, in which there is the sheath dissolved in the upper portion, but still joined below; veins and commissural lines distinct.

Fig. 3. Same species—broad stem, with fragmentary sheath-portions.

Fig. 4. Stem of the (?) same species, resembling also *Schizoneura meriani*, Schimp.

Fig. 5. Branches of *Schiz. gondwanensis*, Fstm., with dissolved sheath-portions.

All specimens from the Raniganj group of the Raniganj coal-field.

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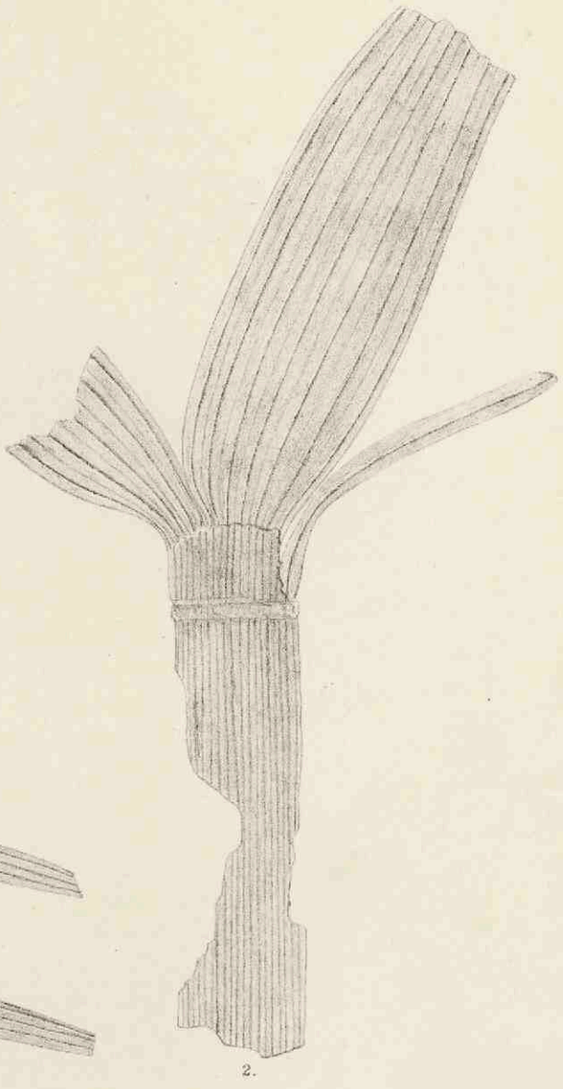

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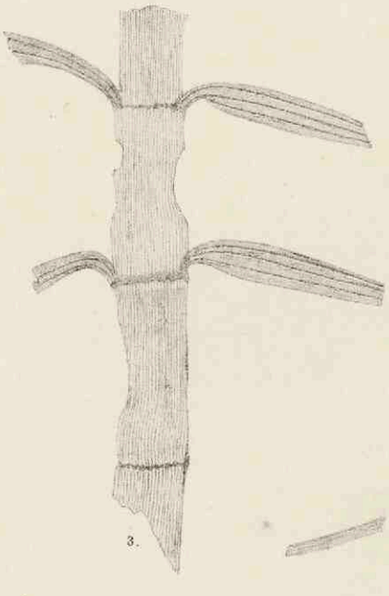

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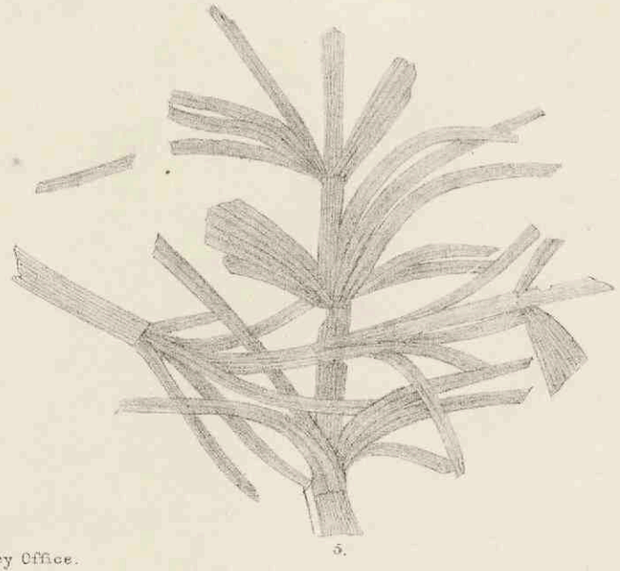

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PLATE IX*A*.

Figs. 1—6. SCHIZONEURA GONDWANENSIS, Fstm. Stems (pages 63 & 64) of various sizes and various lengths of the internodes. From their association with *Schizoneura gondwanensis*, we have to consider them as belonging to that species. Figs. 5 and 6, however (of which fig. 5 is the reverse impression to fig 4 on Pl. VIII *A*), remind one forcibly of *Schiz. meriani*, Schimp., but as already mentioned in the text, their association with *Schiz. gondwanensis* made me hesitate to separate them.

From the Raniganj group, Raniganj field.

Fig. 7. A stem, with ribs and furrows in juxtaposition, as those of *Schizoneura gondwanensis*, Fstm., so that I consider it of this species.

From the Mohpáni coal-field.

Geol: Surv: of India.

Pl: IX A.

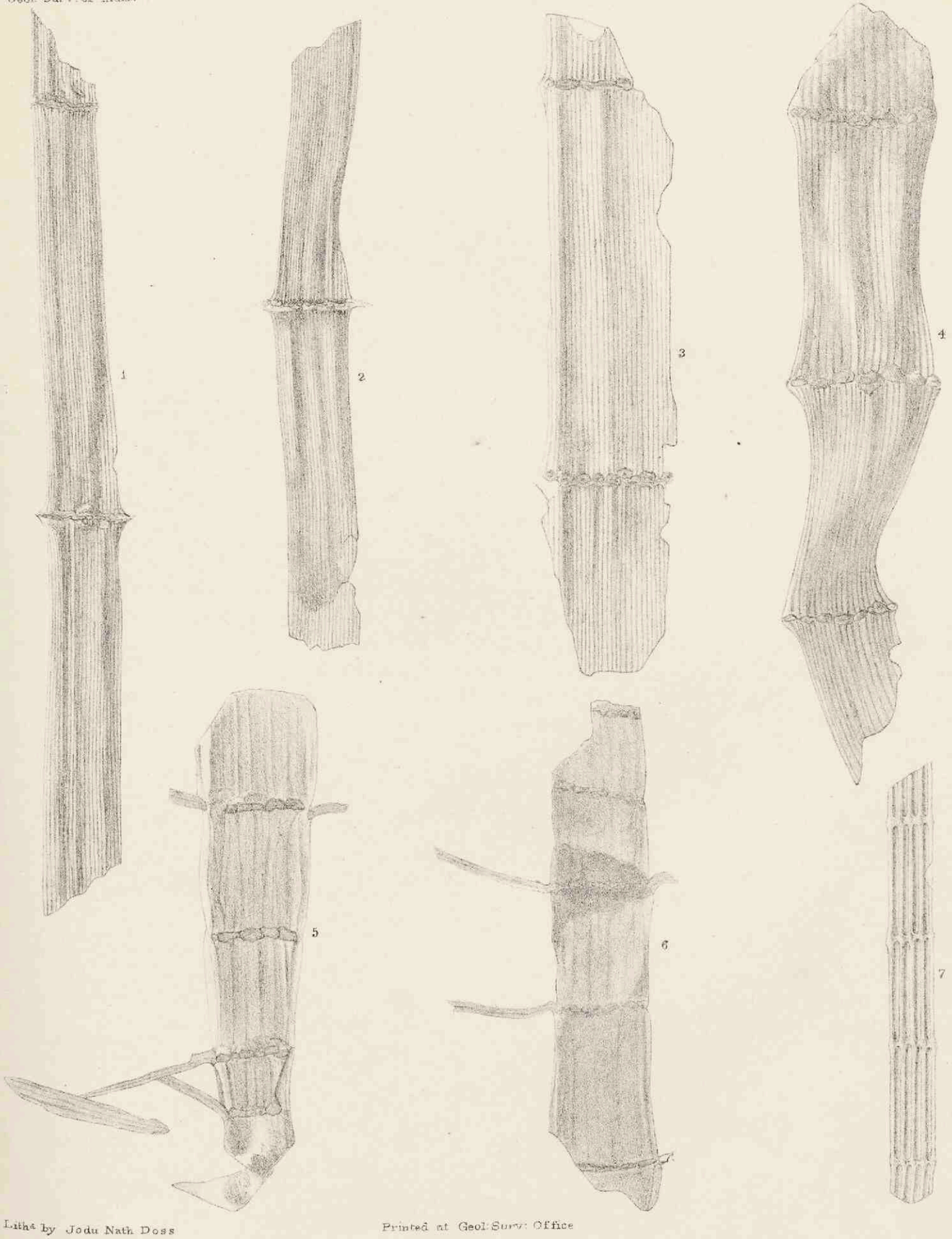

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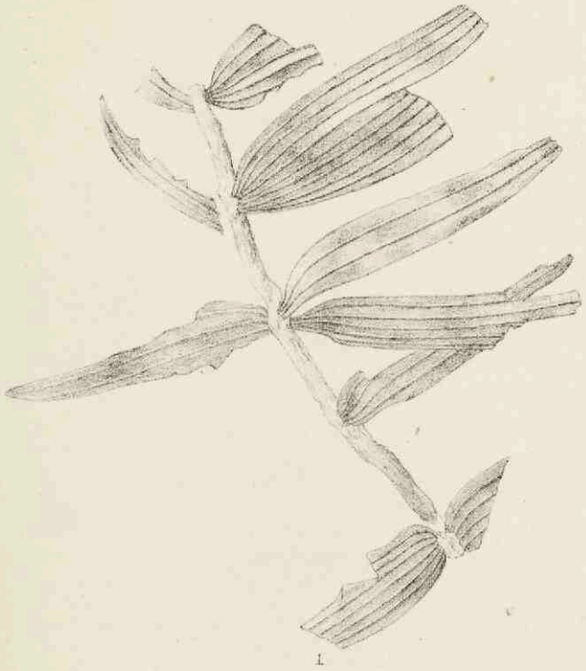
PLATE X*a*.

Figs. 1—8. SCHIZONEURA GONDWANENSIS, Fstm., page 63. Several leaved specimens, apparently branches exhibiting well the veins of the leaflets composing the sheaths.

These specimens are from the Panchet group of the Raniganj coal-field, and do not differ in anything from the typical form of the Raniganj group.



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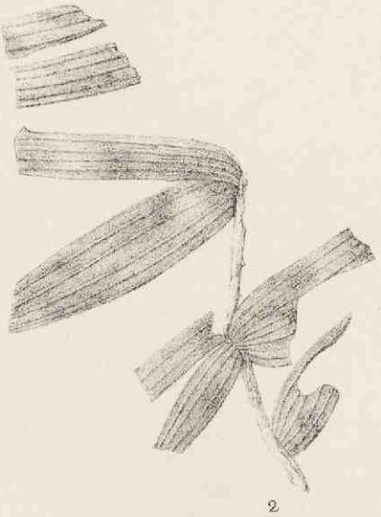

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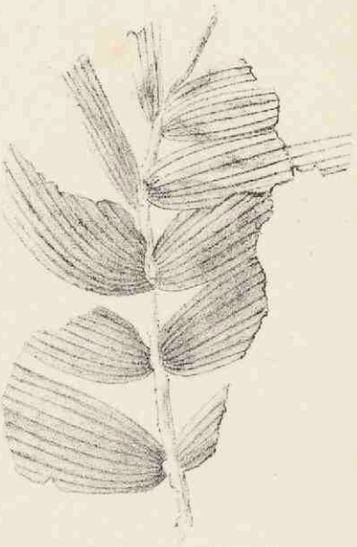

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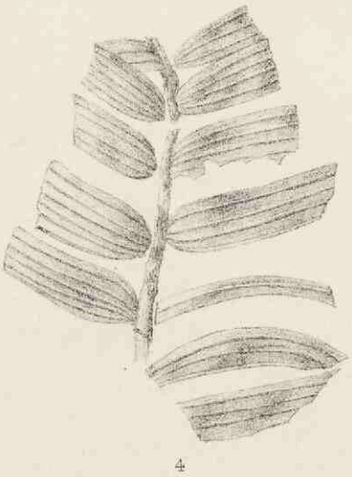

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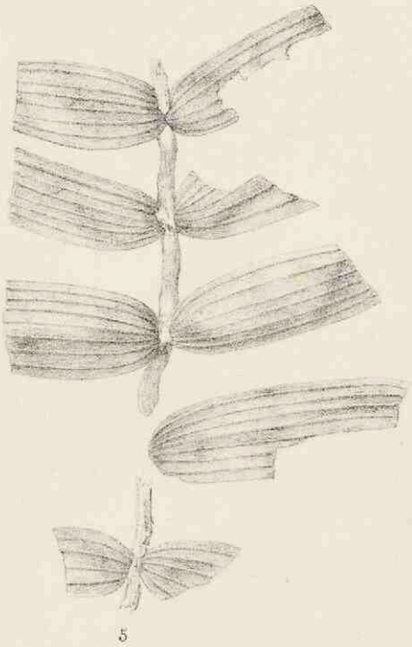

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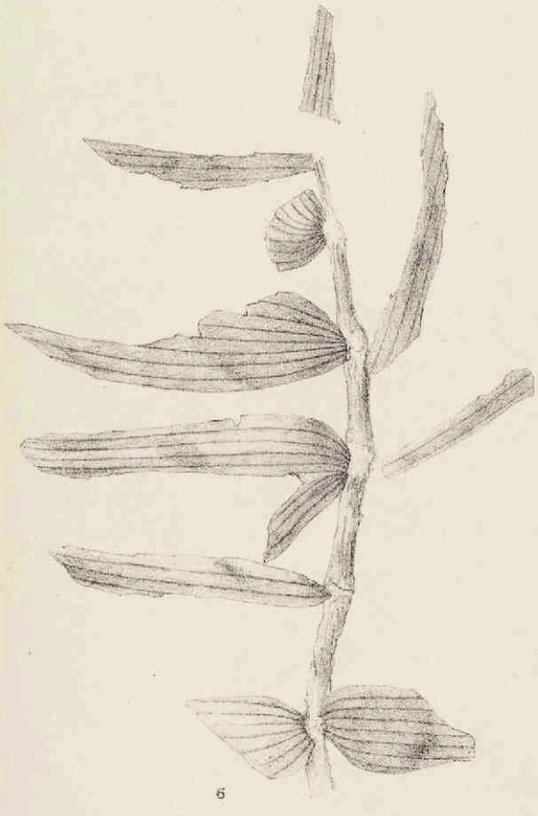

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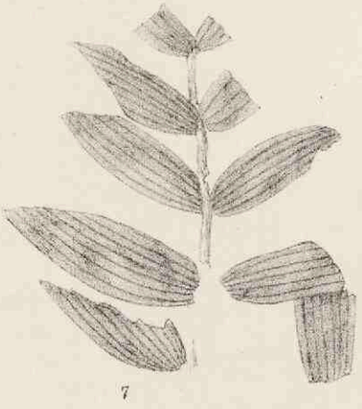

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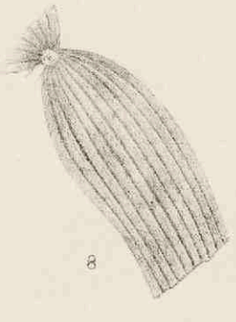

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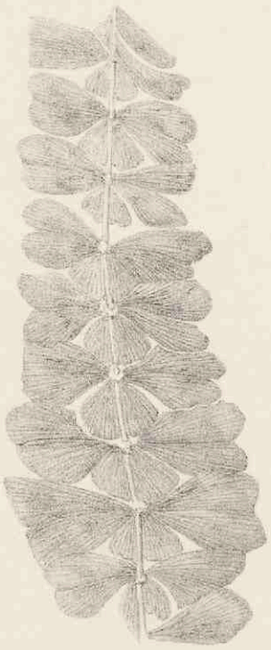
PLATE XI*A*.

Figs. 1—9. Trizygia speciosa, Royle, pages 69—71. Specimens representing the forms both of the Raniganj and Barákar groups. At the first glance a slight difference in size would appear to exist between, for instance, fig. 1 (Raniganj group) and fig. 2 (Barákar group); but in fig. 9, which also is of the Barákar group, the lower leaf whorls equal well those in the specimens of the Raniganj group; and in the specimen from the Barákar group of the Bokaro coal-field (which is not figured here), and also in the specimens from the Barákar group of Auranga coal-field, the leaf whorls are as large as in any specimen of the Raniganj group.

Figs. 1, 3, 4, 5, 7, 8, specimens from the Raniganj group of the Raniganj coal-field; figs. **2, 9,** from the Barákar group of the Talchir coal-field (Gopálprasád). **Fig. 6,** half of a leaf-whorl enlarged (of fig. 5), to show the veins.



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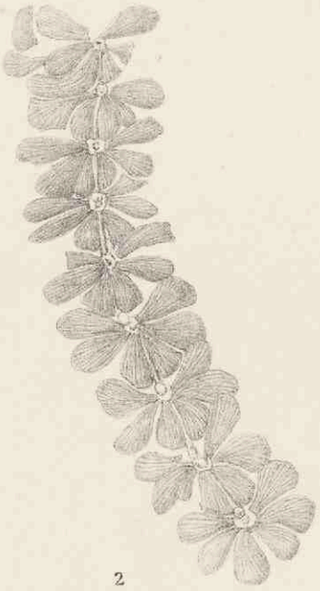

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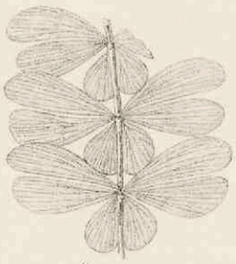

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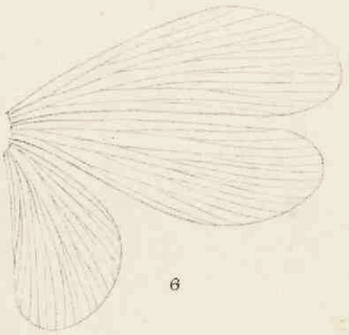

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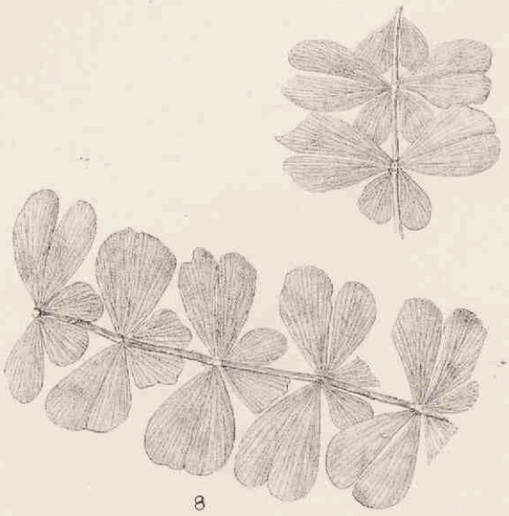

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PLATE XII*A*.

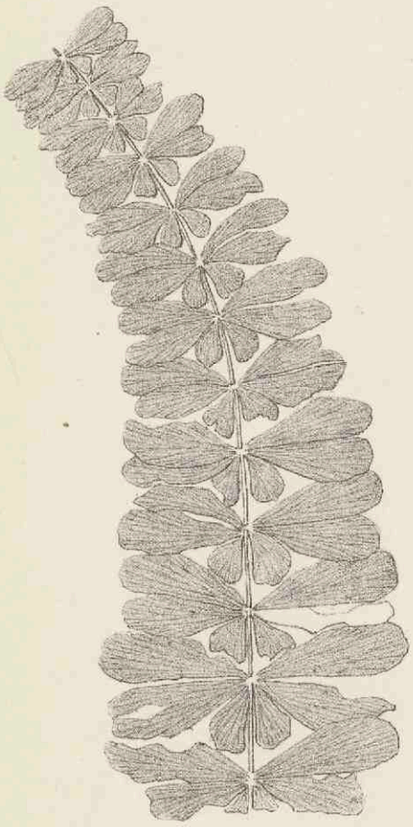
Figs. 1 & 2. TRIZYGIA SPECIOSA, Royle, from the Raniganj (fig. 1) and Barákar groups (fig. 2). Figs. 1*a* and 2*a*, enlarged views of leaflets (pages 69—71).

Figs. 3—9. PHYLLOTHECA INDICA, Bunb., pages 65—68. Fragments of branchlets not very favorably preserved, but showing at least partly the sheaths and the reflexed leaflets.

From the Raniganj group, Raniganj field (fig. 6), and from the Kámthi group, Nágpur area (figs. 3—5, 7—9).

Figs. 10 & 11. VERTEBRARIA INDICA, Royle, pages 71—73. Fig. 10 appears to exhibit the surface with ribs and articulations (?). Fig. 11 is a more typical form, showing the longitudinal section and a ramification.

Both specimens from the Raniganj group, Raniganj field.



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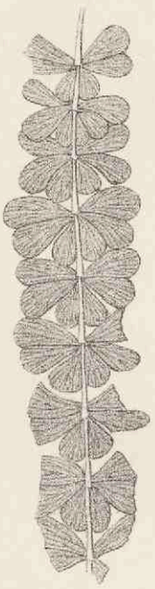

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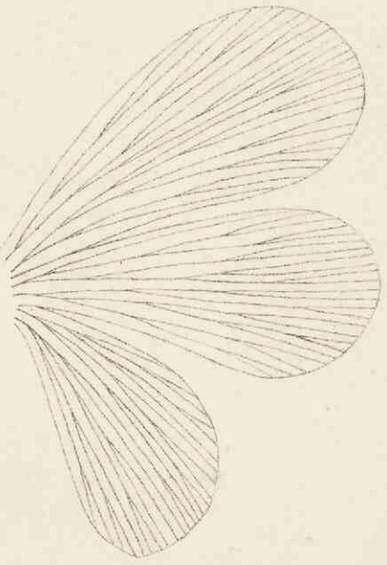

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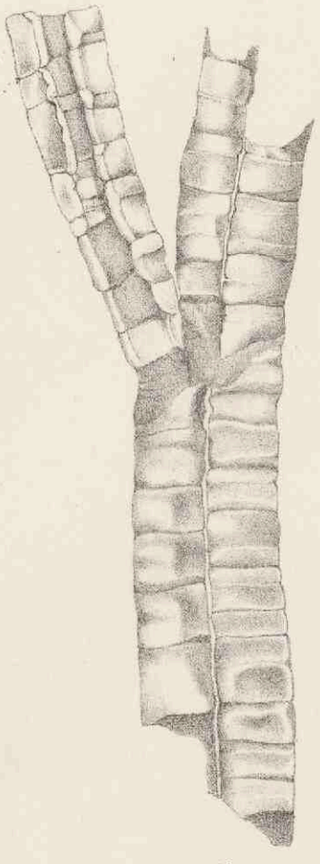

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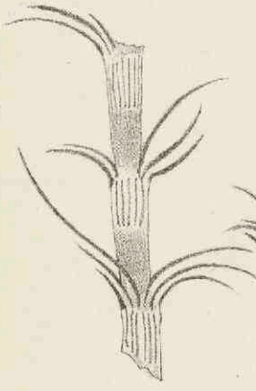

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PLATE XIII*A*.

Figs. 1, 2, 4, 8. VERTEBRARIA INDICA, Royle, pages 71—73. Specimens from the Barákar group (Kumerdhubi) in the Raniganj coal-field. Fig. 8 showing partly also the cross section.

Fig. 3. VERTEBRARIA INDICA, Royle, somewhat resembling what Dana described as *Clasteria australis*, which also is a *Vertebraria*.

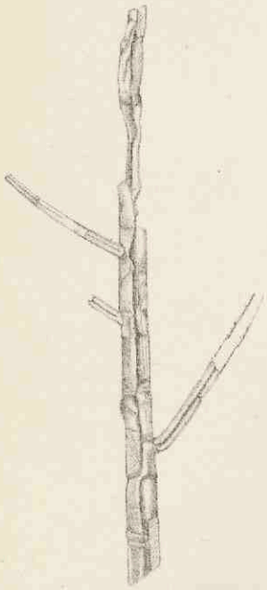
From the Raniganj group, Raniganj field.

Figs. 5 & 6. VERTEBRARIA INDICA, Royle. That form which was described by Sir Ch. Bunbury from Nágpur.

From the Kámthi group, South Godávarí area (Kunlacheru).

Fig. 7. Equisetaceous stem (pages 63, 68). One of those specimens the nature of which cannot be described with certainty, no leaved forms occurring with it to which it might be assigned; it may be of *Schizoneura* or of *Phyllotheca*.

From the Barákar group, Raniganj coal-field (Kumerdhubi).



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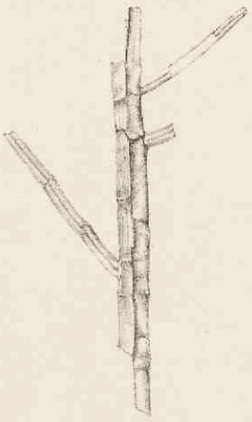

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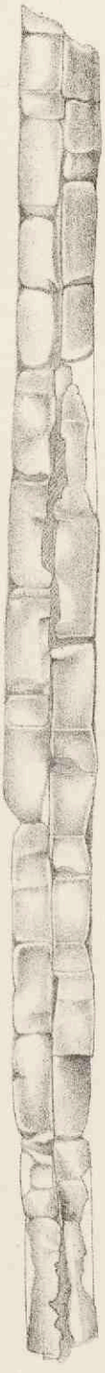

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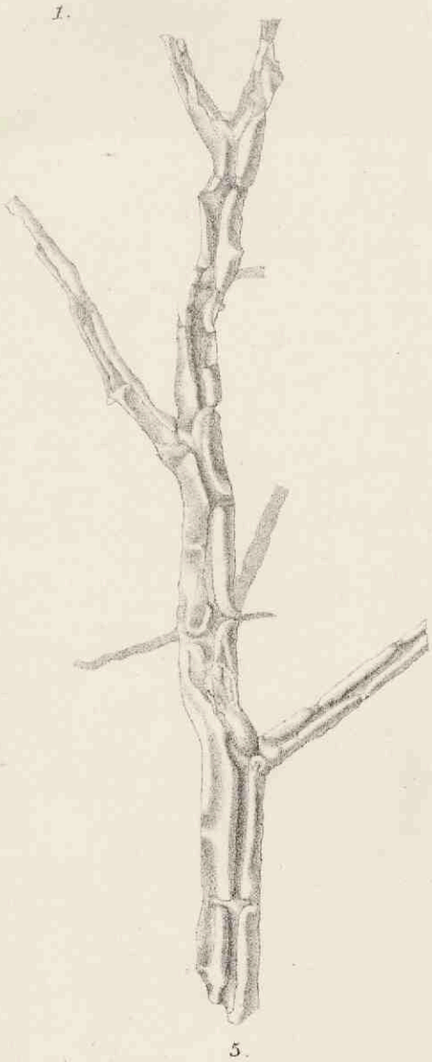

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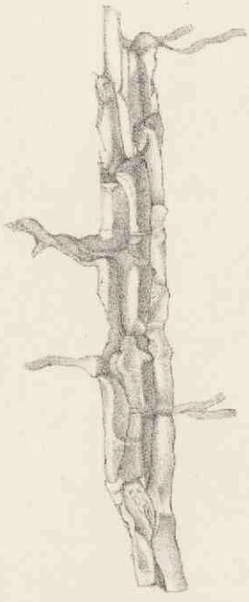

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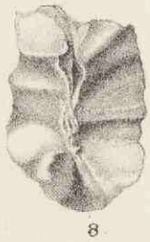

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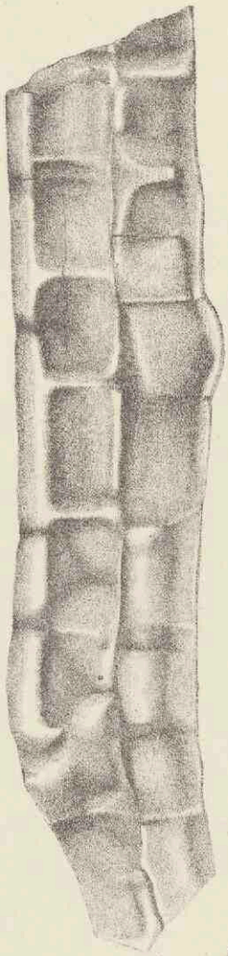
PLATE XIV*A*.

Figs. 1—4. VERTEBRARIA INDICA, Royle, pages 71—73 : Various conditions. Fig. 2, a branched specimen showing, as it appears, the surface, with ribs and articulations.

From the Barákar group (figs. 1 and 4, Kumerdhubi), and Raniganj group (figs. 2, 3), Raniganj field.

Fig. 5. SCHIZONEURA GONDWANENSIS, Fstm., pages 59—64. Appears to represent a joint of a large specimen, with dissolved leaflets of the sheath, partly, however, still joined in the lower part.

From the Raniganj group in the Raniganj field.



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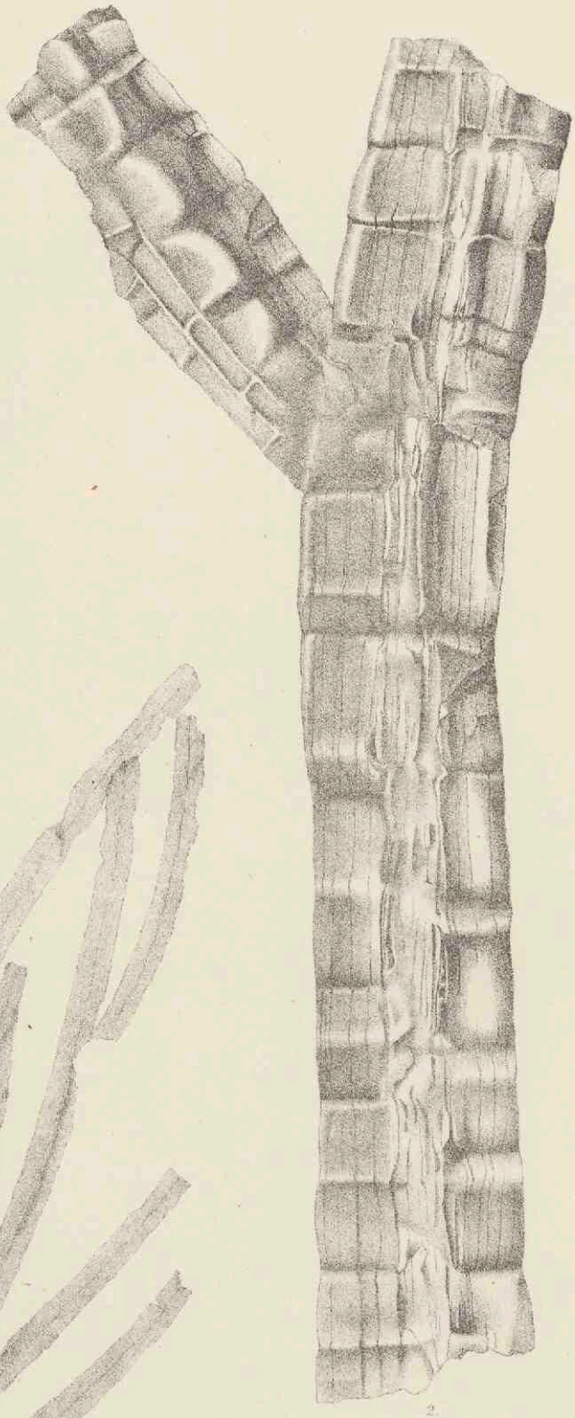

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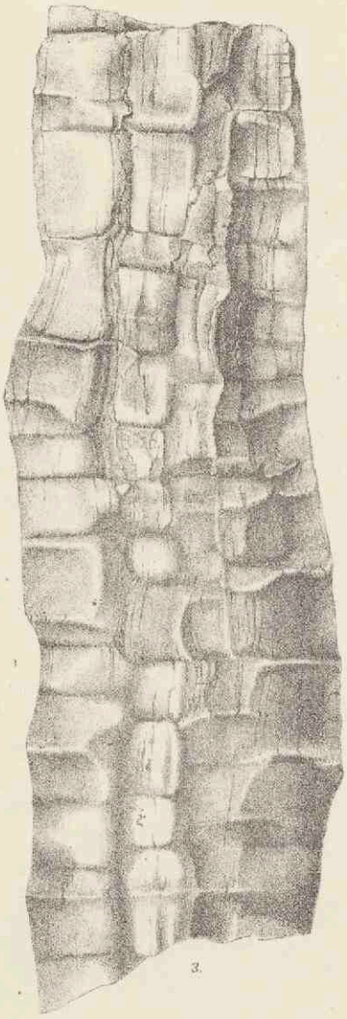

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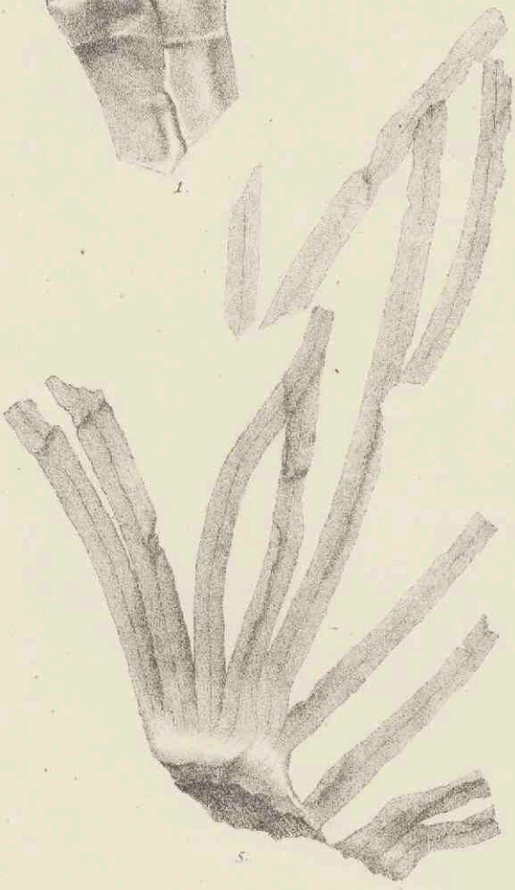

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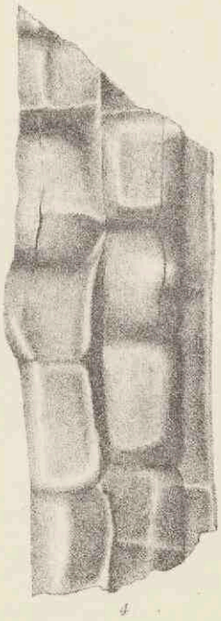


4.

Lith. by Nilkont Das. Printed at Geol. Survey Office

PLATE XIV*A bis*.

Figs. 1 & 2. PHYLLOTHECA ROBUSTA, n. sp., pages 68 and 69. The only two specimens known ; not very favourably preserved, but yet showing the *Phyllotheca* nature. One of the broad-leaved forms, a very closely related form of which is *Phyll. schtschurowski*, Schmalh., from the Siberian Jura.

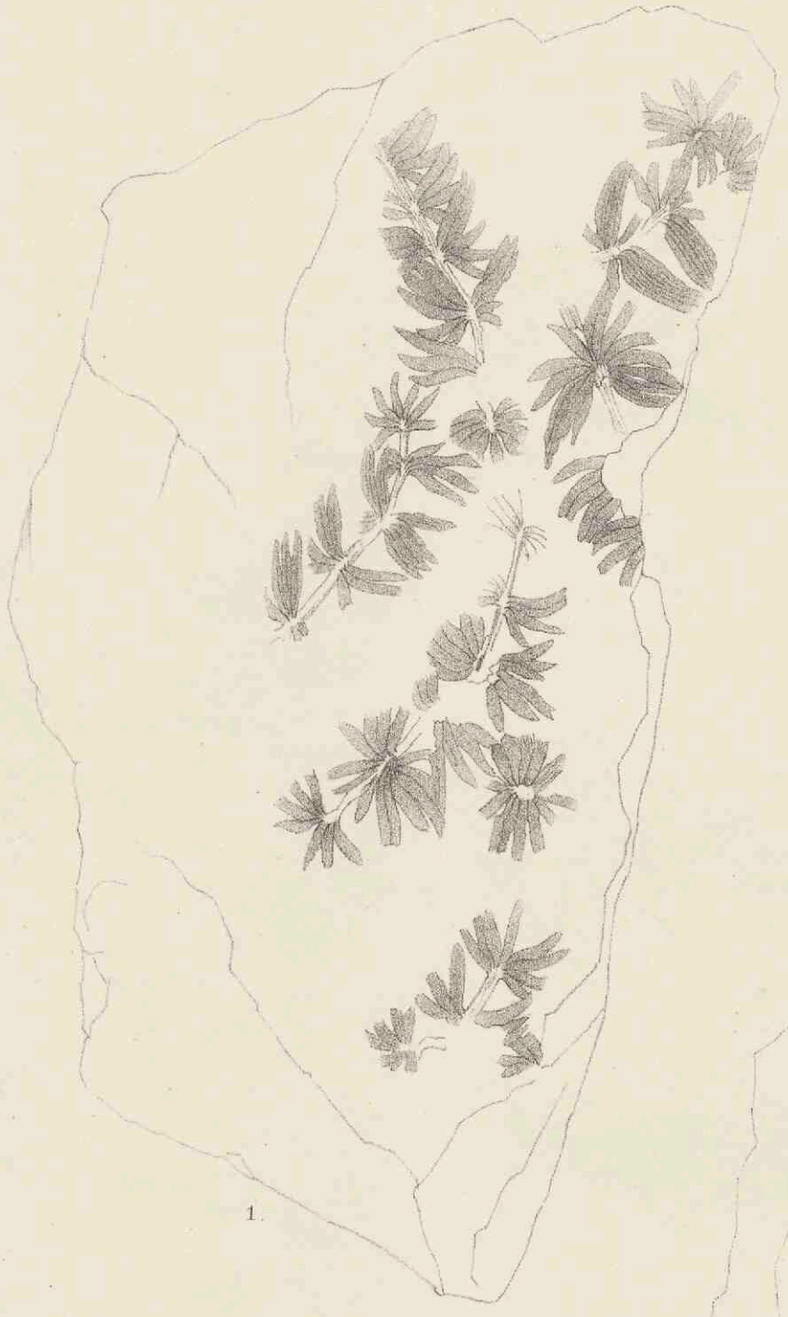
With the specimen in fig. 2 there is also a leaf of *Glossopteris communis*, Fstm.

Fig. 1 *a*. Represents two enlarged whorls.

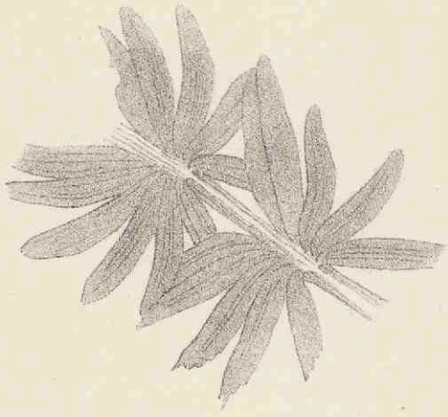
From the Raniganj group (?), Dubrajpur, Gopicándar area, in the Rájmahál hills.

Fig. 3. VERTEBRARIA INDICA, Royle—transverse section (page 72).

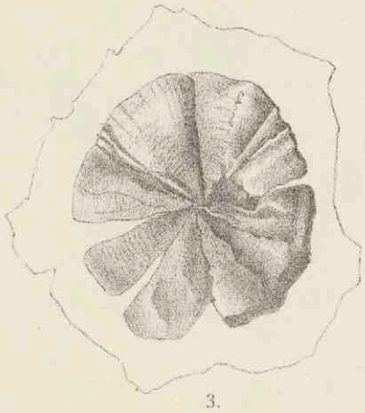
From the Sohagpúr area, Kámthi (Raniganj) group.



1.



1. a.



3.

2.

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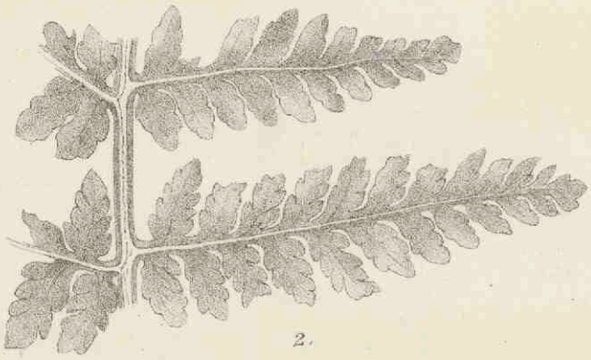
PLATE XV*A*.

Figs. 1—9. SPHENOPTERIS POLYMORPHA, Fstm., pages 76 and 77. Several specimens, showing pinnæ from various parts of the frond. All exhibit distinctly the winged rhachis.

It was the pinnæ of the upper part (figs. 2 and 4) which I compared with the similar parts of *Sphenopteris alata*, Bgt., from Australia (New South Wales).

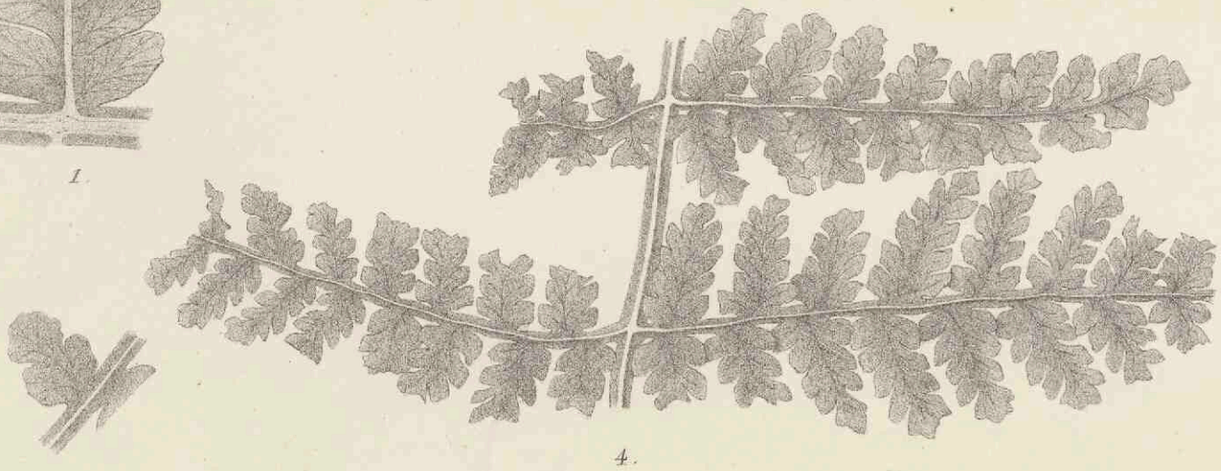
From the Raniganj group of the Raniganj coal-field.

1.



2.

3



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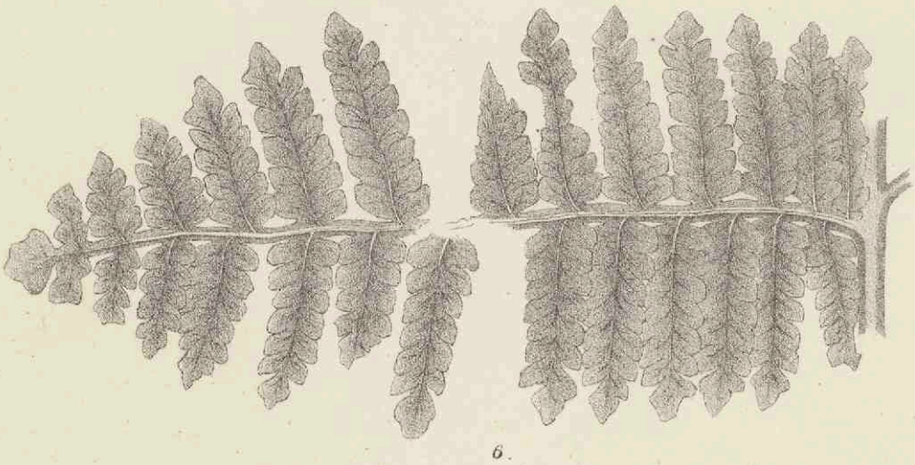
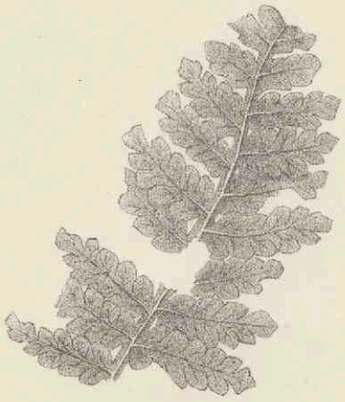


6.



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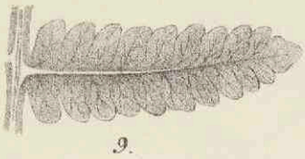

9.

8.

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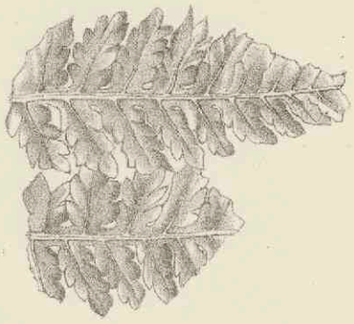
PLATE XVI*A*.

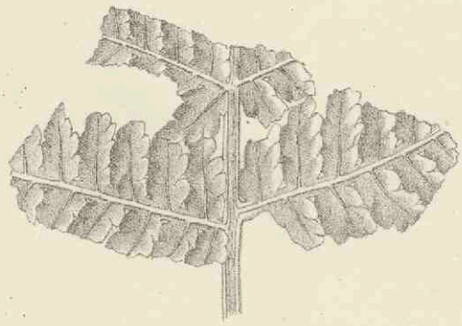
Figs. 1, 2, 4. CYATHEA comp. TSCHIHATCHEFFI, Schmalh., pages 75 and 76. These specimens were by me at first considered also as belonging to *Sph. polymorpha*, but after more careful comparison they appeared more closely related to what Prof. Göppert described as *Sph. anthriscifolia* and *Sph. imbricata*, both of which Prof. Schmalhausen joined under the above name, under which I therefore also quote our Indian fern.

From the Barákar group of the Talchir coal-field.

Fig. 3. SPHENOPTERIS POLYMORPHA, Fstm., pages 76 and 77. Another specimen from the Raniganj group, Raniganj field.

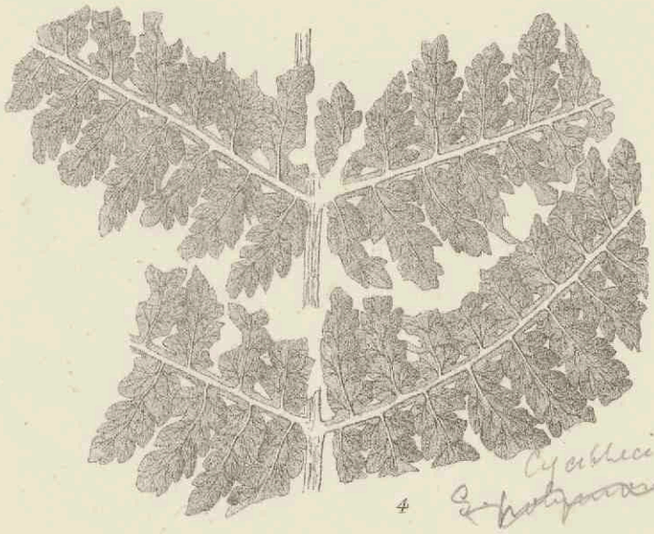


1.



2.

3.



4

Glossopteris Tschichatschoffi

Schizopteris

5.

6.

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PLATE XVI*A bis.*

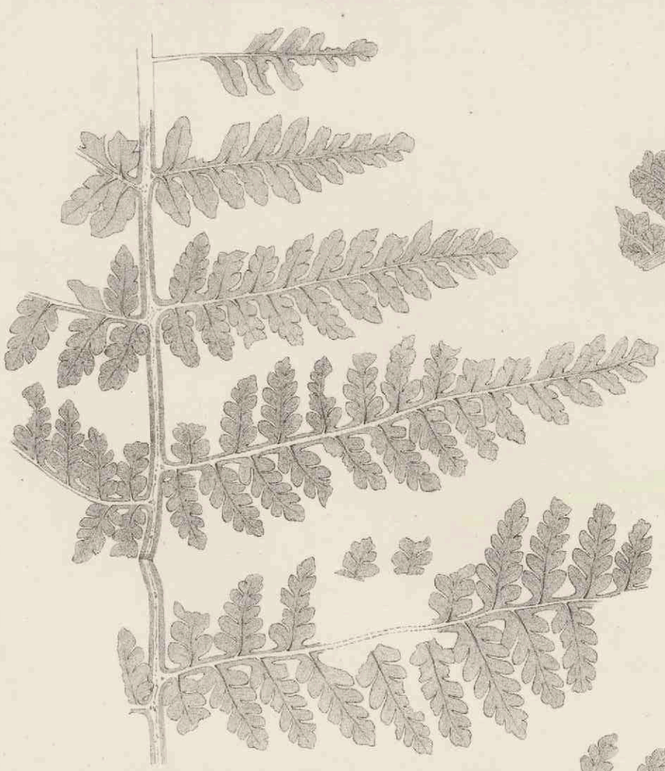
Figs. 1—6. SPHENOPTERIS POLYMORPHA, Fstm., pages 76 and 77. Fig. 1 represents a frond with pinnulæ at the top almost entire or only slightly lobed, while the lower pinnulæ become always more lobed and incised, and at last pinnate. Figs. 2 and 3 belong to still lower parts of the frond.

Figs. 1*a*, 2*a*, and 6*a* enlarged leaflets to show the venation.

From the Raniganj group in the Raniganj field.

Figs. 7, 7*a*. An insect-wing-like leaf. See note at end of this paper. Will be described in the next fasciculus.

From the ironstone-shales at Kulti, Raniganj field.



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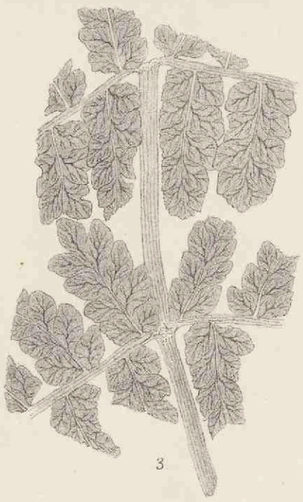


3

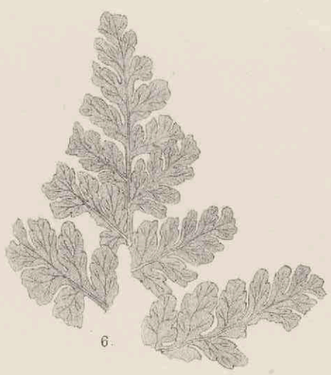
2. a.

5.

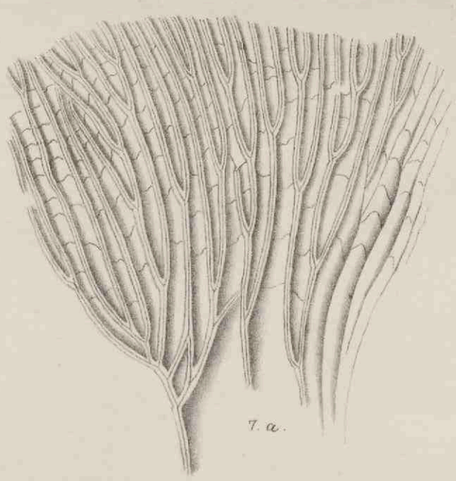
1

1. a.

6. a.



6.



7. a.

7.

4.

Nilcanto Das. Lith.

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again. But at present I give also the drawing of one of the large specimens which shows the polymorphous nature of the pinnulæ.

As for the diagnosis, I must refer to my original paper. I have nothing to add here to complete it, but some corrections are necessary.

I stated in my original paper that I thought Mc'Clelland's *Pecopteris affinis* also belonged to *Sph. polymorpha;* but now having examined Mc'Clelland's original specimens, I find that one differs[1] in the chief character from *Sph. polymorpha*, i.e., in not having the rhachis winged; it is an *Alethopteris* (see Pl. XXIII*A*, fig. 11), while the other one (McClell., l. c., fig. 11*b*) resembles somewhat my *Sphenopteris polymorpha*, though its rather indistinct state of preservation makes it difficult to say whether it belongs to this species or whether it is distinct (*Pecopt. affinis*, Mc'Clell.)

I also compared *Sph. polymorpha* with *Pecopteris alata*, Bgt., from N. S. Wales (Hawkesbury river), and I must refer to it again; I have to point out some confusion which arose about this species. In his paper on "Sedimentary formations in New South Wales" published in "Mines and Mineral Statistics," 1874, p. 186, the Revd. Mr. Clarke correlated this *Sph. alata* with the carboniferous form, known at first by the same name, and later as *Sph.* (*Hym.*) *grandini*. The matter stands, however, as follows:—

The Australian species was at first described as *Pecopt. alata*, Bgt., and was subsequently placed with *Sphenopteris* (as *Sph. alata*) by Sternberg, and is at present quoted as such.

The European carboniferous form to which Mr. Clarke referred was at first described as *Sphenopteris alata*, Bgt., and was later quoted by Göppert as *Hymenophyllites grandini*, and now by Schimper as *Sphenopteris grandini*, Göpp.

Now, both Morris and Mc'Coy, who mention *Sphenopteris alata*, mention it in Brongniart's sense of *Pecopteris alata*, the Australian form, and not in the sense of the original *Sph. alata*, or the present *Sph. grandini* of the carboniferous.

The latter (Brongt., hist. végét. foss., Pl. XLVIII, fig. 4) is totally different from the Australian *Sph. alata*, Bgt. sp. (Brongniart, hist. végét. foss., Pl. CXXVII, p. 361), and it was with this latter that I have compared the upper portion of our *Sph. polymorpha;* the lower pinnæ appeared to me to resemble *Sph. athyrioides*, Bgt. sp., from the oolite, with the exception, that in this form the rhachids are not winged.

Range and distribution of Sph. palymorpha—

a. Barákar group—

Although the specimen from the Talchir coal-field had to be separated from *Sph. polymorpha*, I yet think it also occurs in the Barákar group, *i.e.*, on the Lumki hill in the Karharbári field.

b. Raniganj group—

Raniganj (Raniganj field), Pls. XV*A*, XVI*A*, fig. 3; Pl. XVI*A bis*, figs. 1—6.

[1] Mc'Clelland, l. c., Pl. XIII, fig. 11.

Genus: DICKSONIA,[1] L'Herit.

Several species of this genus were described by Professor Heer,[2] from the jurassics of Eastern Siberia and the Amur countries. One species (the first one) was described by myself from the Rájmahál group in the Rájmahál hills,[3] and recently[4] other forms were classed by me with this genus. One species is also known from the lower portion of the Gondwána system.

DICKSONIA HUGHESI,[5] sp. n. Pl. XXIII*A*, figs. 1—3; 12, 13.

1877. Feistmantel, Rec. Geol. Survey of India, Vol. X, pt. 4, page 198; figs. 10-11.

Fronde bipinnata, pinnis subalternantibus, prælongis, subflexuosis, angulo subrecto ex rhachide exeuntibus; rhachide linea percursa, pinnulis, subopppositis, membranaceis, oblongis, inferiore in parte inciso-lobatis, superioribus lobatis an sublobatis-nervis teneribus, flexuosis, furcatis ramos in lobos emmittentibus.

The two specimens figured here appear to represent the upper portion of the frond, from the fact that the pinnulæ are more deeply lobed in the lower portion (see fig. 1), while towards the upper portion the lobes become much shallower, and in another specimen, of which only one pinnula is figured (see fig. 3), the pinnulæ are still less lobed. The rhachis of the frond is traversed by a middle line; the pinnæ are elongate and subalternately inserted, somewhat flexuose.

The pinnulæ are nearly opposite and membranaceous. The lobation of the pinnulæ was already mentioned above. The veins are thin and somewhat flexuose, branched, each of the lobes receiving separate branchlets.

Figs. 1*a* and 2*a* illustrate the character of the venation.

Fig. 3 is an enlarged leaflet of another specimen with little lobed or almost entire pinnulæ, but the venation and the habitus of the plant is identical with that of the others.

The forms to which our plant is related are *Dicksonia concinna*, Heer, and *Dicksonia saportana*, Heer, the former of which was described from the jurassics in Eastern Siberia and the Amur countries, the other from the latter locality.

There are two other small figures (12, 13) on Plate XXIII*A*, which are fragments only, but which from the form of the leaflets and the character of the veins apparently belong to the above species also.

[1] From a proper name.
[2] Flora fossilis arctica, Vol. IV.
Gondwána Flora, Vol. I, pp. 76, 77.
[4] Gondwána Flora, Vol. II, preface, p. XIII; Rec. Geol. Survey of India, Vol. XIV, pt. 1, p. 149.
[5] Mr. Th. Hughes of the Geol. Survey of India.

Locality and horizon.—

Raniganj group :—Jharia coal-field, Pl. XXIII*A*, figs. 1—3.

Bijori horizon :—Baricondam, south of Pachmari in the Sátpura basin, Pl. XXIII*A*, figs. 12, 13.

Order: *POLYPODIACEÆ.*

a. Group of ASPLENIUM WHITBYENSE, Heer (Alethopteris whitbyensis, Göpp.).

Professor Heer[1] and Professor Schimper[2] have in their recent publications sufficiently explained why a certain group of ferns of the mesozoic period formerly classed with *Alethopteris* have rather to be placed with *Asplenium*, Lin. The type of this group is *Asplenium* (*Alethopteris*) *whitbyense* which, at first described from Yorkshire, was subsequently also found in Southern Russia, Persia, Siberia, the Amur countries, and Japan.

I have described it from the Kach-Jabalpúr group, also from the Sripermatur (Vemáveram) group, and there is hardly any doubt that *Alethopteris indica*, Oldh. and Morr., from the Jabalpúr, Sripermatur, and Rájmahál beds belongs to this species. Both Professor Heer and Schimper include *Alethopteris indica* in *Asplenium whitbyense*.

The same species is also known from the Damuda series. There is a fossil fern in Australia, which also has to be included here, *Alethopteris australis*, Morr. Of this it is necessary to state that it has *never* been found in the New Castle beds (upper coal-measures), but only in the upper beds (jurassic) in the Jerusalem basin of Tasmania, and in the Bellarine beds (upper mesozoic) of Victoria, and also in mesozoic beds on the Clarence river in New South Wales. The best figure of this species is in Mc'Coy's Prodrome of the Palæontology of Victoria, Decade II, Pl. 14, and that form resembles most strikingly *Alethopteris indica*.

In my short paper on the Flora of Eastern Australia, in the Geological Magazine (1879), I have explained on page 492 why the beds of the Jerusalem basin in Tasmania have to be considered on about the same horizon as the Bellarine beds, Victoria, the mesozoic beds on the Clarence river, New South Wales, and the upper beds in Queensland, and I refer the reader to that passage.

ASPLENIUM WHITBYENSE, Heer. Pls. XIX*A*, figs. 2, 2*a*; XL*A*, figs. 2, 3.

1876. Heer: Juraflora Ost-Sibiriens und des Amurlandes, pp. 36—40. (Flora fossilis arctica, Vol. IV.)

1876. *Alethopteris*—Feistmantel, Raniganj flora, Jour. As. Soc. Bengal, Vol. XLV, p. 862, Pl. XXI, fig. 6.

(*Alethopteris indica*, Oldh. and Morr., and *Alethopteris australis*, Morr., have also to be included here.)

[1] Flora fossilis, arctica, Vol. IV.

[2] Handbuch der Palæontologie, Zittel and Schimper, II Bd. 1 Lief. p. 97 et sequ, 1879.

In my Raniganj flora (*l. c.*) I have figured a fragment of a pinna of a fern, which I could not identify otherwise but with the above species. I give the same figure here again. There are, however, in the present paper two additional figures on Pl. XL*A*, which, although the venation is obliterated, yet to judge from the character of the leaflets, have also to be included in this species; fig. 2 is uncommonly like some specimens of *Alethopt. indica*, O. and M., from the Rájmahál group of Golapily near Ellore, South Godávari district.

We have as yet no fructificating specimens of this species.

Locality.—Raniganj group, near Raniganj, in the Raniganj coal-field (Pl. XIX*A*, figs. 2, 2*a*), and of the Jharia coal-field (Pl. XL*A*, figs. 2, 3).

b. Type: POLYPODIUM, Linn.

Cladophlebis Royle.

~~ALETHOPTERIS LINDLEYANA~~, Royle. Pls. XVIII*A*, figs. 2, 2*a*; XIX*A*, figs. 3, 4; XXIII*A*, fig. 11; XXIX*A*, figs. 10, 11.

1839. *Pecopteris*, Royle, Ill. Bot., etc., Him. Mts. tab. 2, fig. 4.
1849-50. McClelland, Rep. Geol. Survey of India, Pl. XIII, fig. 10, *a. b. c.*
1849-50. McClelland, *ibid*, Pl. XIII. fig. 11.
1869. Schimper, Trait, Pal. végét., Vol. I, p. 568.
1876. Feistmantel; with group of *Alethopteris whitbyensis*, Jour. As. Soc. Beng., Vol. XLV, p. 360, Pl. XIX, fig. 7.

A diagnosis of this species was given by me in my paper in the Journal Asiatic Society Bengal (see above). When I wrote that paper Professor Heer's work on the Juraflora of Eastern Siberia and the Amur countries was not published, so that I had no information yet about the *Asplenium*-nature of *Alethopteris whitbyensis*, and I therefore included *Alethopt. lindleyana* also with the "group of *Al. whitbyensis*." There are two fertile fronds, one of which I have already figured in the paper referred to, assigning it to *Alethopt. lindleyana*. The fructification is, however, as already mentioned there (*l. c.* p. 361), like that of *Polypodium*, while in *Alethopt. whitbyensis* it is like that of an *Asplenium*.

Alethopteris lindleyana, Royle, cannot therefore be included with the group of *Aleth. whitbyensis*, Göpp., and with regard to the fructificating specimens, which I believe belong to it, I include it under *Polypodium*, Lin.

Unfortunately most of the specimens supposed to be *Alethopt. lindleyana*, Royle, are not very well preserved. Mc'Clelland's figures (*l. c.*) are of no use whatever, the venation being entirely wrong; and I only refer to his report, as he gave some kind of a diagnosis of this species. Royle's (*l. c.*) original figure is much truer to nature, although the venation is also somewhat misdrawn; but there is an apparent identity between Royle's figure and that given by me on Pl. XIX*A*, fig. 4, regarding the form of the leaflets.

I give figures of sterile fronds of this species; they remind very much of *Asplenium whitbyense* and *Alethopteris* (*Asplenium*) *indica*; but the two fertile

specimens, figured on Pl. XIX*A* (figs. 3, 4), which must be taken to represent the fructification of our species, show that both Schimper and myself were wrong in classing *Aleth. lindleyana* with the group of *Aleth. whitbyensis*, which is now an *Asplenium*. The broad relation of both however still remains, as *Asplenium* also belongs to the order *Polypodiaceæ*.

The venation is shown on Pl. XXIII*A*, fig. 11*a*. (This is one of McClelland's specimens of *Pecopt. affinis*, l. c., Pl. XIII, fig. 11.) Together with the fructificating frond (fig. 4, Pl. XIX *A*), there is on the same specimen a sterile pinna, showing also pretty well the venation; I gave a figure of it on Pl. XVIII*A*, fig. 2. If it would not be more natural to suppose that both belong to the same species, I would certainly have to refer this latter to *Asplenium whitbyense*, Heer. I repeat the diagnosis from my paper on some Raniganj plants (*l. c.*):—

"*Fronde bipinnata; pinnis patentibus, rhachide crassiuscula; pinnulis tota basi sessilibus, attingentibus, oblonge-ovalibus, margine integris an sinuatis nervo medio tenero, usque ad apicem excurrente, exquo nervis secundariis sub angulo subacuto eggredientibus, dichotomiis; soris nervulis insidentibus—fructificatione Polypodii.*

To show that I was then well aware of the *Polypodium*-like fructification, I quote the following passage (*l. c.*, p. 361):—

"From the manner of fructification and from the shape of the leaflets we could perhaps trace an analogy between our species and some forms of the genus *Polypodium*, ...etc.," enumerating several forms, with the fructification of which our specimens show some relation.

Locality: Raniganj group.—Raniganj coal-field, Raniganj. (Pl. XVIII*A* 2, XIX*A*, figs. 3, 4; XXIII*A* 11, 11*a*; XXXIX*A*, figs. 10, 11.

ALETHOPTERIS, sp.

Amongst the specimens from the Kámthis of Kunlácheru, in the South Godávari district, there is a pinna of apparently an *Alethopteroid* plant, but the veins are not sufficiently well preserved, so that I cannot decide whether it is more related to *Asplenium whitbyense*, Heer, or *Alethopteris lindleyana*, Royle.

c. Type: PHEGOPTERIS, Mett. (Lastræa, Presl.)

ALETHOPTERIS PHEGOPTEROIDES, Feistm. Pl. XVIII*A*, fig. 1, 1*a*, 1*b*.

1876. Raniganj plants, Jour. As. Soc. Bengal, Vol. XLV, pp. 362-364, Pl. XVIII.

This fine fern has been already described by me in the above paper; I could then figure only a portion of one frond; at present I figure the entire specimen.

It represents two fronds, and from the thickness of the rhachis in the larger one (left hand), and from the length of the pinnæ at the end where the frond is broken

away, we can judge that this frond represents hardly the half of the whole size, and we may safely consider this to have been at least $2\frac{1}{2}$ feet.

From the manner of venation and from the arrangement of the leaflets I have compared our frond with certain species of the living *Phegopteris*, which also belongs to the order *Polypodiaceæ*, family *Aspidieæ*, and I allow this classification to remain, although there is no fructification known of this fern.

The closest living relation is *Phegopteris decussata*, Mett.; amongst fossil plants *Pecopteris* (*Lepidopteris*) *stuttgardensis*, Bgt., is closest.

The diagnosis given by me was as follows:—

Fronde valida, bipinnata; rhachide crassa, punctulata[1], *pinnis sub angulo subrecto e rhachide eggredientibus, earumque rhachide crassiuscula; pinnis mediis longissimis basin apicemque versus attenuantibus; pinnulis oblongis incurvatis contiguis, oblique insertis, primis solum verticaliter adfixis, pauloque latioribus, ommibus ad bases connatis, nervo primario pinnularum distincto ad apicem promoto; nervis secundariis singulis sub angulo acuto eggredientibus. Habitu Phegopteridis-fructificatione adhuc non obvia.*

This is the largest species of lower Gondwána plants known.

Locality: Raniganj group.—Raniganj, Raniganj coal-field. (Pl. XVIII*A*, fig. 1, 1*a*, 1*b*.)

PECOPTERIDEÆ INCERTÆ SEDIS.

There are some other species which, although belonging to the division *Pecopterideæ*, do not show any distinct affinity to living forms.

Pecopteris concinna, Presl. Pl. XVII*A*, figs. 1—6.

1838. Presl. in Sternberg, Fl. d. Vorw. II, p. 149, Tab. XLI, fig. 3.
1869. Schimper, Trait. d. Pal. vég., Vol. I, pp. 534-535.
1863. Oldham, in Mem. Geol. Surv. India, Vol. III, p. 205.
1876. Feistmantel, Rec. Geol. Surv. India, Vol. IX, p. 66.

Fronde bipinnata, pinnis breviusculis, sub angulo subrecto eggredentibus, rhachide crassiuscula; pinnulis alternis, ovatis, obtusis, contiguis, integris, tenerrimis; nervis secundariis numerosis, ex nervo primario dichotomis.

The existence of this fern amongst the Indian fossil plants was already correctly recognised by the late Dr. Oldham (*l. c.*) The figures given at present distinctly show their identity with the original figure in Sternberg's work.

It appears to me, however, that the frond was only *bipinnate*, and not also *tripinnate*, as is said in Schimper's diagnosis (*l. c.*); my diagnosis is according to this character.

[1] This character was, I regret to say, omitted by the lithographer; it is shown in my first figure (*l. c.*).

In Europe this species was at first quoted from the Keuper (Hœfen near Bamberg), but it was subsequently shown that the formation at this locality is Rhætic.

Locality and horizon.—In India this species is known only at one locality, *i.e.*, in the *Panchet rocks*, south of Maitúr, in the north-west branch of the Nunia river, north-west of Assensole, Raniganj coal-field. It appears to be the most numerous species amongst the Panchet-plants of that coal-field.

Genus: MERIANOPTERIS, Heer.

1877. Heer, Flora Fossilis Helvetiæ, p. 88.

Fronde sterili tripinnata, speciosa, pinnis secundariis elongatis, segmentis (vel pinnulis) nervo medio arcuato, nervis secundariis dichotomis, infimis in arcum anastomosatis (Heer, *l. c.*).

This diagnosis of Professor Heer's genus is completely applicable to some specimens of ferns figured by me on Pl. XIX*A*, figs. 9-11, especially as regards the venation. Professor Heer described one species as *Merian. angusta*, but most probably *Pecopt. rütimeyeri*, Hr., also belongs to this genus. Our specimens, however, indicate a by far larger species, and there are also some other characters which show that the Indian form has to be considered as a distinct one.

Both *Merian. angusta* and *Pecopt. rütimeyeri* are from the Keuper of Switzerland (near Basel). I propose to describe the Indian species as—

Merianopteris major, n. sp. Pl. XIX*A*, figs. 9-11.

Fronde magna, tripinnata, pinnis secundariis elongato-latiusculis, apicem versus parum angustatis, pinnati-sectis vel pinnati-fidis, pinnulis vel lobis apice rotundatis, tenerrimis, nervo medio distincto, incurvato; nervis secundariis duobus imis ex parte inferiore nervi mediani eggredientibus, dichotomis, in arcum acutissimum connatis; ceteris superiorem partem pinnulæ versus ex nervo mediano angulo acutissimo eggredientibus dichotomis flexuosis.—(Feistmantel.)

From our specimens representing portions of pinnæ we can judge of a very large-sized form, but at the same time of a very thin-leaved one, as can be seen from the state of preservation. The pinnæ are rather broad, decreasing only slightly in breadth towards the apex. They are either pinnate or lobed. The pinnulæ (respectively lobes) are obtusely rounded. The middle vein is distinct, somewhat curved towards the apex; of the secondary veins, the two lowest pass out from the lower portion of the middle vein, are dichotomous and join with the same of the adjoining leaflets in a pointed arch, while the others are placed more towards the upper portion of the leaflet, pass out at a very acute angle from the middle vein and are also dichotomous, somewhat flexuose.

Locality.—Raniganj group, in the Raniganj field.

The relations have been pointed to above.

Order: *NEUROPTERIDEÆ.*

Genus: NEUROPTERIDIUM, Schimp.

1879. Zittel and Schimper: Handbuch der Palæontologie; II Bd., pp. 116-117.

Neuropteris fronde simpliciter pinnata.—Single pinnate Neuropteris.

The only species of this genus was already described in my Talchir-Karharbári Flora as *Neuropt. validum*, being from the Karharbári beds of the Karharbári coal-field.

Genus: CYCLOPTERIS, Bgt.

With this type two fossil plants are placed, which are of a more or less doubtful character, but which at the same time cannot be better placed otherwise.

CYCLOPTERIS PACHYRHACHIS, Göpp., Pl. XVII*A*, fig. 7.

1836. Göppert, Gattunge foss. Pflanzen, Nos. 5, 6, p. 94, pls. 4, 5, figs. 13, 14.
1850. Unger, gen. et species plant fossilium, p. 100.
1869. Neuropteris pachyrhachis, Schimp., Tr. Pal. vég., Vol. I, p. 450.
1874. Pecopteris, Schimper, ibid., Vol. III, p. 476.
1876. Feistmantel, R. G. S. I., Vol. IX, p. 66.

Fronde bipinnata, pinnis approximatis aeque distantibus, rhachide crassa, pinnulis cuneatis trapezoideis an obovato-cuneatis, brevissime petiolatis nervis numerosis, flabellato dichotomis.

From the fact that the veins of the pinnulæ do not show a distinct midrib, but radiate into the leaf, the placing of this form with *Cyclopteris* seems more appropriate than with *Neuropteris* or *Pecopteris*, as was done by Prof. Schimper.

This species was found in Europe in the same beds from which *Pecopteris concinna* also was procured. And here we must notice the fact that in India it also lies together with *Pecopteris concinna* in the same rocks.

Locality and horizon.—Panchet group, south of Maitúr, north-west branch of Nunia river, Raniganj coal-field.

INSECT-WING-LIKE Leaf. Pl. XVI*A*, figs. 7, 7*a*.

I am sorry that I have to introduce a specimen figured on Pl. XVI*A*. (fig. 7) with the above name only. When I first saw the specimen I was struck with its peculiar appearance, and I thought it might be a fragment of a wing of some large

insect; in this the transverse thin veins (?) between the thicker ones appeared corroborative. Not venturing to trespass into the Department of Entomology independently, I consulted Mr. Wood-Mason,[1] who expressed a firm opinion that the said specimen had nothing whatever to do with an insect of any kind; so I had to assign it a place amongst the fossil plants, and as it is from the Ironshales of the Damuda division, in which fossils are altogether not very numerous, I thought it worthy of being figured, in spite its very indefinite relations.

Fig. 7 on Pl. XVI*A* shows the fossil is natural size; fig. 7*a* is double the size.

It is rather difficult to ascertain whether the thin transverse lines are veins also, or only accidentally produced by bursting.

There is no plant known to me with which this fossil might be identified or compared.

Locality.—Ironstone shales, near Kulti, Raniganj coal-field.

Order: *PACHYPTERIDEÆ.*

Genus: THINNFELDIA, Ettingh.

1852. Ettingshausen, Abh. d. k. k. Geolog. Reichsanstalt, Vol. I.

Panchet

THINNFELDIA, comp. ODONTOPTEROIDES, Morr. sp. (Fstm.), Pl. XXIII*A*., figs. 7-9.

1845. Peropteris odontopteroides, Morris, in Strzelecki Physical Descript. of N. S. Wales and V. Diemens Land, p. 429, Pl. VI, figs. 2-4.
1847. Gleichenites odontopteroides, Mc'Coy, A. and M., Nat. Hist., Vol. XX, 2d. Ser., p. 147.
1850. Idem, Unger, Genera and species plant. fossilum, p. 208.
1869. Cycadopteris (?) odontopteroides, Schimper, Trait. de Paléont. végétale, Vol. I, p. 488.
1869. Alethopteris (?) odontopteroides, Schimper, ibid, p. 569.
1872. Pecopteris odontopteroides, Carruthers, Qu. J. G. S., London, Vol. XXVIII, p. 355, Tab. 27, figs. 2, 3.
1875. Odontopteris, Crépin, Bull. de l'Acad. Royle de Belgique, 1875, Vol. XXXIX, 2 Serie, pp. 258-263, figs. 1-5.
1877. Thinnfeldia morrisi, Feistmantel, N. J. Mineral. etc., 1877, p. 179.
1878. Pecopteris odontopteroides, Etheridge (R.), Catalogue of Australian fossils, p. 98.
1878-79. Thinnfeldia odontopteroides, Feistmantel, Flora des oestl. Australiens, Palæontographica, Supplement III. Lief III, pp. 105, 165.
1878. Cycadopteris, M. Zeiller in Guide du Géologue à l'Exposition Universelle (Paris) de 1878, etc.
1880. Thinnfeldia crassinervis, Gein., and Pecopteris odontopteroides, Morr., probably identical A. G. Nathorst in Ofvers. of Kongl. Vet. Akad. Stolkholm, Förhandl. 1880. No. 5 (Review in botan. Centralblatt, No. II, page 328, 1881).

I think I have identified this peculiar fossil also amongst the Lower Gondwána plants; the figures are on Plate XXIII*A*.; some others will be given in a subsequent memoir. Since its establishment this species has undergone numerous transmigrations from one genus into another, its proper place not being finally settled yet.

[1] Deputy Superintendent, Indian Museum.

It was first found by Count Strzelecki in Tasmania, on Springshill, in the Jerusalem basin, and was described, 1875, by Prof. Morris by the name of *Pecopteris odontopteroides*.

The diagnosis was the following:—

"The frond pinnatifidely bipinnate or flabellate; pinnæ linear, elongate acuminate; pinnulæ opposite, approximate, adnate, ovate, obtuse, entire; veins nearly obliterate."

Of the systematical position Prof. Morris was not certain.

Subsequently Prof. Mc'Coy assigned it to another genus; the dichotomy of the leaf reminded him of *Gleichenia;* thus we find it placed with *Gleichenites*.

Schimper in his Paléontologie végétale quotes this species in the same volume (I) with two different genera, once with *Cycadopteris* (p. 488), and a second time with *Alethopteris* (p. 569); and what is more remarkable, a different diagnosis is given for each, although with the same reference (to Strzelecki's work).

Next we find this species described and figured in Mr. Carruthers' paper on Queensland plants in Mr. Daintree's "Geology of Queensland." He again quotes it as *Pecopteris;* his specimens were smaller than those figured by Prof. Morris, yet Mr. Carruthers thought them to be identical. His diagnosis was the following:—

"Frond with a very short and thick stipes, dichotomously divided; the simple portion at the base of the frond as well as each branch pinnatifid; the segments more or less opposite, quadrate ovate, with the apex obliquely truncate, connate at the base; one vein passing into the centre of the segment and repeatedly dichotomous, several lateral veins, simple or dichotomous, passing direct from the rhachis into the upper and under portions of the segment."

Mr. Carruthers did not think it probable that this fern is a *Gleichenites*.

A quite different place was assigned to it by Mr. F. Crépin, who received a collection of plants from Tasmania, and amongst them *Pecopteris odontopteroides*, which he places with *Odontopteris* and compares it with *Odontopteris alpina*, Gein., no doubt on the assumption that the specimens came from carboniferous rocks. But this is easily disproved. On the same specimens of shale, with this *Pecopteris odontopteroides*, there was another fern, the *Sphenopteris elongata*, Carr.; an association, of forms, just like that described by Mr. Carruthers from the carbonaceous (jurassic) rocks of Queensland, which only shows that both these rock-groups are of the same age.

When Prof. Geinitz sent me (1876) his paper on the rhætic plants of the Argentine Republic (Cassel, 1876), I was at once struck with the similarity of his *Thinnfeldia crassinervis* with *Pecopteris odontopteroides*, and quite recently I find the same view expressed by Mr. Nathorst (*l.c.*), who even thinks that both these plants are identical, after having seen the specimens from Queensland, which were described by Mr. Carruthers.

I have myself had an opportunity of examining several specimens from various localities in Australia, and although sometimes differing in appearance, yet from all the other characters they have, I think, to be considered identical. Considering the differences they present from *Odontopteris*, *Ctenopteris*, and *Pachypteris*, it appeared to me best to place this fossil with *Thinnfeldia*, and I described it as *Thinnfeldia odontopteroides* (*l.c.*).

The distribution of this fern is in Australia the following (in descending order):—

Upper Mesozoic: *a*. Carbonaceous beds in Queensland at Ipswich (Tivoli Mines).
b. Jerusalem basin, Tasmania.

Lower Mesozoic: *a*. Wianamatta beds, N. S. Wales, at Clark's hill near Cobbitee.
b. Hawkesbury beds, Mount Victoria, N. S. Wales.

The diagnosis which I have given in my Austrialian Flora (p. 167) is a very full one, as based upon numerous, partly well preserved, specimens from Australia.

Although the specimens from our Lower Gondwánas, figured in the present paper (see above), represent pinnæ only, yet there is, I think, little doubt that they belong to this species; their character agrees well with that given in Mr. Carruthers' diagnosis quoted above, to which I now refer. The leaflets are opposite, obtusely obovate, contiguous, the veins show the distribution peculiar to the species.

As already mentioned, I shall in a subsequent paper figure other specimens, apparently of the same species, with distinct dichotomy of the frond.

Locality.—The specimens figured at present are from the Ramkola coal-field, from a horizon which stratigraphically appears to represent the Panchet group. It occurred at two localities in the Ledho nala and at Karamdiha.[1] Associated with it were species of *Glossopteris*; one specimen of these is figured on Pl. XXIII*A*, fig. 10. I take it to represent *Gl. indica*, Bgt. The other specimens mentioned above are from Parsora, near Beli, in South Rewah, from rocks which Mr. Th. Hughes has classed as Mahádevas, and I follow his view.

The only European form I can compare with this species is *Thinnfeldia rotundata*, Nath., from Bjuf in Sweden.[2]

Order: *TÆNIOPTERIDEÆ*.

The order *Tæniopterideæ*, which is so largely represented in the upper portion of the Gondwána system, especially in the Rájmahál group, has also its good representatives in the Damuda series, and is not absent in the Panchet rocks; in the for-

[1] See Feistmantel, R. G. S. I., Vol. XIII, pp. 68-69; Griesbach, M. G. S. I., Vol. XV, pt. 2, p. 44. Also pp. 36 and 38 of this paper.

[2] Om Floran Skånes kolförande Bildningar I. Flora of Bjuf, 1878, pp. 49-50, Tab. I, figs. 9-12.

mer it is the very same genus (*Macrotæniopteris*) so numerous in the Rájmahál group, which is well represented.

There are, however, three other genera.

Genus: MACROTÆNIOPTERIS, *Schimper.*

1869. Trait. d. Pal. végét., Vol. I., p. 610.
1879. Zittel and Schimper, Handbuch der Palæontologie, Vol. II., No. 1, p. 132.

Frondibus simplicibus, speciosissimis, ut videtur, membranaceis; nervis numerosis, sub angulo acuto ex rhachide eggredientibus, subito subhorizontaliter marginem versus continuantibus, simplicibus an furcatis.

There are two species of this genus in the Damuda series.

MACROTÆNIOPTERIS DANÆOIDES, Royle sp. (Feistm.), Pl. XX*A*., XXI*A*., figs. 1-2.

1839. Glossopteris danæoides, Royle, Illustr. Bot., etc., Himal. Mts., Tab. 2.
1849-50. Tæniopteris, Mc'Clelland, R. G. S. I., Pl. XV, fig. 1.
1876. Tæniopteris, Feistmantel, R. G. S. I., Vol. IX, pt. 3, p. 74.
1876. Macrotæniopteris, *ibid.*, IX., pt. 4, p. 137.
1876. Macrotæniopteris, Feistmantel, J. A. S. B., Vol. XLV, p. 365, Pls. XIX, figs. 1, 2, & XXI, fig. 1.

Fronde speciosa, oblonge-ovata, apice obtuse-acuminata, distincte pedicellata, membranacea an subcoriacea; rhachide mediocri an crassiuscula; nervis secundariis imprimum sub angulo acuto ex rhachide eggredientibus subito subhorizontalibus, numerosissimis dichotomis, usque ad 1·5 *mm. distantibus, marginem versus paululo sursum incurvatis, crassiusculis.*

This species is distinguished from the other, to be mentioned hereafter, by its very distant veins, and this distance of the veins is here indeed greater than in any other species I am acquainted with.

Royle (*l. c.*) at first figured it with the name of *Glossopteris;* but considering the very distinct characters of *Tæniopteris* and *Glossopteris*, which were then already established, I am almost led to think that the above denomination happened by mistake. Royle's figure resembles very much my fig. 3, on Plate XX*A*., which represents the basal portion.

Of forms related with our species I have to name first the rhætic *Macrotæniopteris gigantea*, Schenk sp.,[1] in which the character of the veins mostly approaches that in our species, although in this latter they are still further distant, and the leaves appear somewhat smaller. Next comes *Macrotæniopteris lata*, Oldh. & Morr., from the Rájmahál group, especially that form which was distinguished as *T. musæfolia*.[2]

[1] Schenk Flora der Grenzschichten, 1867, Pl. XXVIII, fig. 12.
[2] Rájmahál flora, in Gondwána flora, Vol. I, Pl. IV, fig. 1.

As a somewhat related form, specially as regards the size, we can also consider the Australian *Macrotæniopteris wianamattæ*, Feistm., which I figured in my Australian Flora, but of which another figure is given by Mr. C. S. Wilkinson in the Annual Report of the Department of Mines, N. S. Wales, for 1879 (1880), Pl. V (page 215); but in this the veins are already rather close.

Yet another species might be taken into consideration, *i.e.*, *Macrotæniopteris major*, Schimp. (Lindl. & Hutt. sp.). In this the veins are pretty distant, but the leaf is much narrower. I do not, however, see any reason why this latter species should be considered to be the undivided leaves of *Anomozamites lindleyanus* as recently stated by Mr. Nathorst.[1]

The distribution of our species is the following:—

a. Raniganj (Kámthi) group:—

Near Raniganj, Raniganj coalfield (Pl. XX*A*, figs. 1-3).
In the Jharia coalfield (Pl. XXI*A*, fig. 1).
In the Kámthi horizon near Nágpur.

b. Barákar group:—

Near Burgo, in the Rájmahál hills (Pl. XXI*A*, fig. 2).

MACROTÆNIOPTERIS FEDDENI, Fstm., Pl. XXI*A*, fig. 3, & Pl. XXII*A*, figs. 1-4.

1876. Feistmantel, R. G. S. I., Vol. IX, p. 137.

Fronde simplici, speciosissima usque ad 20 cm. lata, elongato-elliptica, apice obtusa, quandoque emarginata, plerumque lacerata subcoriacea; costa crassiuscula, depressa, striata; nervis secundariis numerosissimis, maxime approximatis; in parte inferiore frondis subhorizontalibus, apicem versus subobloquis, marginem versus sursum incurvatis, simplicibus furcatisque alternantibus, furcatione, ut videtur simplici.

This species is dedicated to Mr. Fedden of the Geological Survey, who collected the best specimens (Pl. XXI*A*, fig. 3; Pl. XXII*A*, figs. 1, 3, 4) near Kámthi.

It is an equally large or even larger form than the previous species. The midrib is proportionally thinner, striated; the secondary veins are the chief character of the species; they are very closely set, dichotomous; almost horizontal in the lower portion of the leaves, becoming more oblique towards the apex; but in both cases the veins are somewhat turned upwards near the margin.

The figures on Pl. XXII*A*, although portions of different leaves, are so placed as to show the position they probably occupied in the respective entire leaves; fig. 2 represents an apical portion, fig. 3 a middle portion, and fig. 4 a basal portion of the leaf. Fig. 3 on Pl. XXI*A* also represents an apical portion.

[1] See Botan. Centralblatt, 1881, p. 330.

During a late visit to the Auranga coalfield (Lohárdagga) I collected amongst other interesting fossils a more complete leaf of this species; the portion, as far preserved, measures 10-inch. in length and $5\frac{1}{2}$-inch. in breadth; the top can easily be restored to a length of 2 inch. more, while the lower portion would have to be still about 3 or 4 inches longer, if complete. I shall figure it in a subsequent paper.

The only form related to our species is *Macrotæniopteris abnormis*, Gutb.; but in this species the veins appear to me still closer set and the rhachis much thicker.

Localities and distribution:

a. Barákar group.—Auranga coalfield, Lahárdagga, Sukri river, west of Gurtur (east of Rájbar); to be drawn hereafter.

b. Kámthi (Raniganj) *group.*—Kámthi near Nágpur, C. P. (the figured specimens); on the Son, west of Guráru, south Rewah basin (collected by Mr. Hacket).

With regard to these two species and the forms related to them, we can establish the following sequence of species:—

Macrotæniopteris danæoides, Royle. With the most distant veins, nearly straight.
Macrot. gigantea, Schenk. Leaves larger.
Macrot. lata and *musæfolia*, O. M. From the Rájmahál group, Rájmahál hills.
Macrot. wianamattæ, Fstm. From the Wianamatta rocks, Australia.
Macrot. feddeni, Feistm. Veins very close, slightly curved up towards the margins.
Macrot. abnormis, Gutb., permian. With the closest veins, straight.

Type: VITTARIA, Swartz.

Genus: PALÆOVITTARIA,[1] Fstm.

1876. Feistmantel, J. A. S. Bengal, Vol. XLV, p. 368.
1879. Schimper, in Handbuch der Palæontologie, by Zittel and Schimper, Vol. II, pt. 1, p. 133.

With this name I introduced an interesting fern in my paper on some Raniganj plants (*l. c.*), and I have to quote it again with the same name, as no other genus has come to my notice with which it might be better placed. Prof. Schimper has also introduced it into his Palæobotany, and although remarking that in the fossil plant the secondary veins do not form anastomoses with an intramarginal vein, which in fructificating specimens bears the sori, he did not suggest any other form with which it might be more correctly placed.

Only one species has hitherto been found, which I have dedicated to the late Dr. Kurz (then Curator, Botanical Gardens, Calcutta).

[1] *Palaios* (Gr.) = old; *vittaria* = a living fern.

PALÆOVITTARIA KURZI, Ftsm., Pl. XLIV*A*.

1876. Feistmantel *l. c.*, pp. 368-369, Pl. XIX, figs. 3-4.

Frondibus aggregatis, simplicibus, oblongato-ovato-spathulatis, margine integris, nonnunquam apice excisis; nervo medio (costa) inferiore in parte crassiore, dimidiam partem versus evanescente; nervis secundariis sub angulo acutissimo ex rhachide exeuntibus, in parte apicali radiantibus, simplicibus et furcatis, marginem versus incurvatis, inferiore precedetem ea in parte attingente. Fructificatione non obvia.

The chief character of this species lies in the midrib and the secondary veins. The midrib is distinct in the lower portion of the leaf only, and vanishes towards the apical portion, becoming resolved into the secondary veins. The secondary veins pass out at very acute angles, being simple or forked. Towards the margin they are somewhat incurved, so that a preceding vein approaches closely the subsequent one. If this were more distinct, it might easily lead to an anastomosis of the veins at their marginal ends; and this might then very well represent an anastomosis with an intramarginal vein.

The species with which I compared our fossil is *Vittaria intermedia*.

There is nothing similar amongst the fossils. The genus *Sagenopteris* resembles it somewhat in general arrangement of the veins, but here the secondary veins form anastomoses (a net venation). In the genus *Nöggerathiopsis*, which at the first aspect also resembles somewhat our species, there is no trace of a midrib, all veins radiating at once from the base. *Plæovittaria* is also not to be confounded with *Rubidgea*, Tate,[1] this latter showing no indication of a midrib in the lower part, and the secondary veins being in their direction much more oblique than in my genus, and not straight but curved.

This African species is rather to be compared with the *Zamiopteris glossopteroides*, Schmalh., from the jurassics of the Altai.

Locality and formation.—The above interesting species is hitherto only known from the Raniganj group, Raniganj coalfield, where it was collected in 1876 by Mr. Wood-Mason.

Type: OLEANDRA, Cav. and ANGIOPTERIS, Mitch.

There are some other, rather fragmentary, specimens of narrow *tæniopteroid* fossils, the generical position of which can only be determined with some doubt. They are, however, sufficiently distinct from any of the above described species. These specimens seem to represent three species, and from their analogies appear to represent two genera.

[1] From the Karoo beds, South Africa.

Genus: OLEANDRIDIUM,[1] Schimp.

1869. Trait. d. Pal. végétale, Vol. I, p. 607.

Frondibus simplicibus, lanceolato elongatis vel linguatis, coriaceis.

OLEANDRIDIUM STENONEURON,[2] Schimp. (Schenk sp.) Pl. XIX*A*, figs. 5-8.

1867. Schenk, Flora der Grenzschichten, p. 103, Tab. XXV, figs. 5, 6 (Tæniopteris).
1869. Schimper, *l. c.*, p. 609 (Oleandridium).
1876. Feistmantel, Rec. G. S. of India, Vol. IX, p. 67.

I have figured four specimens of a narrow *Tæniopteris*, which from their more coriaceous appearance I place with *Oleandridium*. Two specimens represent the basal portion of the leaf, while the two other represent the apical portion. From these specimens it would appear that the leaf was only small, the midrib rather thick in proportion; the secondary veins at first coming out at an acute angle, and then running more straight towards the margin, which is entire. The apex is obtusely rounded, and the secondary veins, as far as can be observed, to a greater extent single, although some appear to be forked.

After comparing these specimens with other *tæniopteroid* fossils, I come to the conclusion that it most probably represents *Oleandridium stenoneuron*, Schenk sp. It also bears some resemblance to *Ol. tenuinerve*, Schimp. (Brauns sp.), but in this latter the veins appear to be stronger and somewhat more distant. Even in this somewhat uncertain position, these specimens are of great interest, as they come from the Panchet rocks.

Locality.—Panchet rocks, south of Maitúr, north-west branch of the Nunia river, north-west of Assensole, Raniganj coalfield.

Genus: ANGIOPTERIDIUM,[3] Schimp.

Some other fragments are, I think, to be better placed with this genus, especially from their thinner veins and the more membranaceous appearance of the leaf.

Two species are, I think, represented.

ANGIOPTERIDIUM, COMP. MC'CLELLANDI,[4] (Morr. sp.) Schimp, Pl. XXI*A*, figs. 4-7.

1862. Oldham and Morris: Stangerites, in Rájmahál Flora, Pal. ind., Ser. II, 1 (or Gondwána Flora, Vol. I), p. 33, Pl. XXIII.
1869. Tæniopteris danæoides (P), Bunbury: Qu. J. G. S., London, Fossil plants from Núgpur, p. 332, Pl. X, fig. 2.
1869. Angiopteridium, Schimper: Traité de Pal. végét., Vol. I, p. 605.

[1] Diminutive of *Oleandra* = a living fern.
[2] *Stenos* (Gr.) = narrow, close; neuron (Gr.) = the vein.
[3] Diminutive of *Angiopteris*, a living fern.
[4] Proper name.

In his paper on fossil plants from Nágpur, Sir Ch. Bunbury figured also a leaf of a *tæniopteroid* plant, which he referred, though with some doubt, to *Tæniopteris danæoides*, Mc'Clell. (*Macrotæniopteris danæoides*). He also compared it with *Tæniopteris major*, L. and H. There are fragments of the same plant from Nágpur in our collections, and I have given four figures (see above). If we now compare these figures with those of *Macrotæniopteris danæoides*, Schimp., on my Plates XX*A* and XXI*A*, the very marked differences are very obvious: on one side there is a narrow leaf with closely set veins, and on the other a large broad leaf with very distant veins,—differences which do not want any further comment.

This Indian species under discussion is, however, equally sufficiently distinct from *Tæn. major*, L. and H., which is also a *Macrotæniopteris*, larger of size and having more distant veins.

Our species presents a narrow, oblong leaf, with a thin midrib; the secondary veins pass out from the midrib at a subacute angle, and then turn straight towards the margin; most of them are forked.

Schimper in his Traité, etc. (*l. c.*), classed Sir Ch. Bunbury's figure with *Angiopteridium mc'clellandi*, Schimp. (Oldh. and Morr. sp.); and I quote the specimens figured by myself with the same name. We cannot of course prove whether our leaves are of a pinnate frond, but the form of the single leaves, the midrib, and the secondary veins are in both very much alike.

As there is no other form with which these leaves could be more correctly compared, and as they do not appear to me sufficient to establish a new species upon, it appears best to correlate them for the present with *Angiopt. mc'clellandi.*

Locality and formation.—Kámthi (Raniganj) group at Kámthi Nágpur area. Similar fragments were collected by Mr. Hughes in the South Rewah basin.

ANGIOPTERIDIUM INFARCTUM,[1] sp. n. Pl. XXXIV*A*, figs. 4, 5.

Foliis latiusculis, elongato-lineato obovatis, apice obtusis; nervo mediano (rhachide) tenui, striato; nervis secundariis numerosissimis, maxime approximatis, ex nervo mediano obliquis, dichotomis simplicibusque.

I at first thought that these two specimens figured on Plate XXXIV*A* might be identical with those described above from Kámthi, and consequently would also have to be classed with *Angiopt. mc'clellandi;* but after closer examination I find that they are distinct. They are broader, thus indicating a larger leaf, and the veins show a different character; they are much more closely set and pass out from the midrib obliquely at about an angle of 30°. I, however, think that the present form belongs to the same genus, representing another species, and I take for the specific name the great closeness of the veins.

[1] Infarctus (Lat.) = closely filled.

Locality and formation.—Barákar group, near Kumerdhubi, west of Barákar, Raniganj coalfield.

Sub-order: DICTYOTÆNIOPTERIDEÆ.[1]

This group, although containing one genus of ferns only, is the most numerously represented in the Lower Gondwána system. It is the genus *Glossopteris*, Bgt., which formerly used to be classed with *Dictyopterideæ;* recently, however, Prof. Schimper in the new hand-book of Palæontology established from this genus a sub-order of *Tæniopterideæ* under the above name. As it hitherto contains only that one genus, the characters of the sub-order and genus must be coincident.

Genus: GLOSSOPTERIS,[2] Bgt.

1828. Brongniart, Histoire des vég. fossiles, p. 222.

Fronde simplici (? an digitata), *stipitata vel in petiolum decurrente, integerrima, lanceolata, spathulata vel oblongato-obovata. Rhachide* (costa) *semper distincta, crassa an subcrassa usque ad apicem producta, rarissime apicali in portione subevanescente; nervis secundariis sub angulo variante ex rhachide eggredientibus, dichotomis, anastomosantibus, retia diversa, totam folii superficiem explentia formantibus. Fructificatione ut videtur tribus in modis nota.*—(Feistmantel.)

The chief character of this genus lies in the presence of a distinct midrib, from which the veins pass out forming nets; for there is a net venation also in some other genera to be described next, but the character of the midrib will appear a different one.

This genus is the oldest known fossil of the Gondwána system, as already, in 1828, it was established by Al. Brongniart, when three forms were described, two from India and one from Australia.

Since then it has been found very numerously both in Australia and India, and it was also met with in Africa.

It has a very wide geological range; for taking its occurrence in the three above-mentioned countries into consideration, its range is through formations from carboniferous to jurassic; and if we may add a doubtful case, this genus would go as far up as the tertiaries.

The distribution is the following:—

a.—Australia.

Here it begins in beds below the first marine fauna, or in the lower coal-measures in New South Wales, which have to be considered as of carboniferous

[1] *Tæniopteroid* plants with a net venation.

[2] *Glossa* (Gr.) = the tongue; *pteris* (Gr.) = a fern.

age. Five species are known, three of them described by myself for the first time. It is in similar beds in Queensland also.

The chief development is, however, in the upper coal-measure in New South Wales, or in the New Castle beds, *above* the first marine fauna and *below* the boulder bed of the Hawkesbury group. These upper coal-measures were always considered by Mr. W. B. Clarke as palæozoic, and are recently placed by Mr. C. S. Wilkinson as permian,[1] the Wianamatta-Hawkesbury series being placed as triassic.[2]

The Hawkesbury boulder bed may then be of either age.

Higher up no *Glossopteris* was found in Australia.

b.—In Africa.

Here we find *Glossopteris* in the two uppermost divisions of the Karoo formation, *i.e.*, in the Beaufort and Stormberg beds, both of which also contain numerous remains of Dicynodont reptiles (order Anomodontia). These beds are supposed to be of triassic age.

c.—In India.

Here we have, it appears, a much higher range than in the two countries mentioned above. *Glossopteris* begins, as is ascertained now beyond any doubt, in the Talchir shales,[3] *above* the Talchir boulder bed. It is of more frequent occurrence in the next bed, the Karharbári beds;[4] but the highest development lies in the Damuda series, and again in the uppermost group (Raniganj-Kámthi group). We find this genus further in the Panchet rocks,[5] and it also passes into the upper portion of the Gondwána system. One case is undoubtedly certain, *i.e.*, the occurrence of the genus in the Jabalpur group, which I have noticed previously.[6]

But *Glossopteris* was also collected by Mr. V. Ball and by myself from another horizon in the Auranga coalfield, which both to Mr. Ball and to me appears to belong to the base of the Upper Gondwána system in that coalfield.

This latter occurrence is the more interesting, as here *Glossopteris* is associated with some other plants of the Lower Gondwána, especially with *Vertebraria*.

There are also some plant fragments, which were collected by Mr. H. B. Medlicott in the Denwa group (Sátpura basin), and which appear to me to be also *Glossopteris*, but this is not a very clear case.

[1] Annual Report, Department of Mines, New South Wales, for 1879, p. 216.

[2] The late Mr. W. B. Clarke also treated of them under the heading "Mesozoic or secondary formation."

[3] On my recent visit to the Káranpúra coalfield I obtained several specimens of leaves of true *Glossopteris*. See my note in Rec. G. S. of India, Vol. XIV, Pt. 3.

[4] Gondwána Flora, Vol. III, Pt. 1.

[5] Rec. G. S. of India, Vol. X, p. 139.

[6] See my note in Rec. G. S. of India, Vol. X, p. 140, and Jabalpur Flora (Gondwána Flora, Vol. II), p. 10.

d.—Russia.

Prof. Trautschold,[1] in his paper entitled "Der Klinische Sandstein," which is of cretaceous age, describes a fern with the name "*Glossopteris solitaria.*" The form of the leaf is exactly like some of our numerous representatives of this genus, also the direction of the veins is the same; but I cannot distinguish whether the veins are anastomosing or not. Prof. Trautschold, however, distinctly mentions an anastomosis of the veins in the lower portion of the leaf, although only faintly indicated.

e.—Asia Minor.

From the coalbeds between Eregli and Amasry the genus *Glossopteris* has been quoted twice;[2] but as no figures or descriptions were given, it is not possible to form an opinion as to the correctness of the observation; moreover, in Tchihatcheff's great work "Asie Mineure, 1867," wherein the plants are described by A. Brongniart, who was the founder of the genus *Glossopteris*, no mention is made of this genus. This case must therefore be regarded as doubtful.

f.—Italy.

A *Glossopteris* is, however, also described from beds of tertiary age, which would be the highest range. In their monograph of the tertiary flora of Novale[3] Messrs. Visiani and Massalongo have described a *Glossopteris apocynophyllum* (p. 206 and fig. 1, Pl. I). If the figure correctly represents the specimen, its character would well coincide with those given in the diagnosis of the genus *Glossopteris;* but without seeing the original a decided opinion cannot be formed as to whether it is correctly classed or not.

These are all the districts and localities from which *Glossopteris* has hitherto been described or mentioned, from some of them only doubtfully.

Thus the range of this famous genus is the following (including also the doubtful cases), in ascending order:—

Carboniferous: in the lower coal-measures (and Stroud Series ?) in New South Wales.
? Coal formation of Eregli Asia Minor.

Permian: in the New Castle beds (upper coal-measures) in New South Wales (*below* the Hawkesbury boulder beds).

Above the (*permian ?*) *Talchir boulder beds:* *a.* In the Talchir shales.
b. In the Karharbári beds.
c. Damuda Series.
d. Panchet group.

[1] Nouv. Mém. d. la Soc. Imp. d. Naturalists, Moscou, Vol. XIII, p. 221, Pl. XIX, fig. 1.

[2] Schlehan: Versuch einer geognost. Beschreibung der Gegend zwischen Amasry and Tyrla-Asy, 1852.
Spratt: Quart. Journ. Geol. Soc., London, 1877.

[3] Mem. d' Acad. di Torino IId. Ser., Vol. XVII.

Jurassic: in India in the lower Mahádevas of the Auranga coalfield.
? Denwa group, Sátpura basin.
Jabalpur group, Sátpura basin.
Cretaceous (?) in the "Klinische Sandstein" near Moskau (Trautschold).
Tertiary (?) near Novale (Vicenza), Italy (Visiani and Massalongo).

I may take up the discussion of the fructification of this genus, and of its possible relations with living forms.

Fructification

As regards the fructification, one kind is with certainty known; and it is most interesting that the same kind of fructification has occurred on leaves which with regard to their net venation have to be considered as three distinct species, *i.e.* *Gl. communis*, Feistm. (with narrow nets throughout), *Gl. indica*, Schimp. (broad nets close to the nidrib, becoming narrow towards the margin), and *Gl. browniana*, Bgt. (polygonal nets throughout the leaf). I refer for the respective specimens to Plates XXVI*A* (figs. 1—4) and XXVII*A* (figs. 1, 2, 5).

The fructification consists of round sori (marked in the fossils by round spots) placed in longitudinal rows between the margin and the midrib, which perhaps indicates a relation with *Polypodium*.

The occurrence of this kind of fructification in *Glossopteris browniana*, Bgt., also, is of great importance; because in some Australian specimens, which are also described as *Glossopteris browniana*, Mr. Carruthers[1] thinks he can observe a fructification "in the form of linear sori running along the vein and occupying a position somewhat nearer to the margin of the frond than to the midrib."

This kind of fructification would necessarily indicate a different plant, an *Anthrophyum*: and thus there is every possibility that the Australian and Indian fossils, quoted as *Glossopteris browniana*, are really not only distinct species, but also belong to distinct genera.

A third kind of fructification seems to be slightly indicated in another instance. In a few specimens, which I think to be *Glossopt. angustifolia* (see further on), and which are figured on Pl. XXXIX*A* (figs. 1, 2), the secondary veins quite close to the leaf margin seem to pass into an intramarginal longitudinal vein, leaving thus a very narrow empty space along the margin, which perhaps shows that in fertile fronds the fructification was a marginal one, like the fructification of a *Pteris*.

These are the only instances in which a fructification is indicated.

As there are, however, many other various forms which have not hitherto shown any fructification whatever, I thought it best to arrange the species (if they can all be called so) of *Glossopteris* in several sections according to size and form of the nets, and in this case it will not be necessary to add a separate diagnosis for all species.

[1] Carruthers, in Daintree: Geology of Queensland; Quart. Journ. Geol. Soc., Vol. XXVIII, 1872, p. 354.

Glossopteris Indica

Section *a*: FORMS WITH NARROW NETS.

Foliis plerumque speciosis, retibus oblongis valde angustatis.

GLOSSOPTERIS COMMUNIS,[1] Fstm. Pl. XXIV*A* (leaf in left corner); Pls. XXV*A*, fig. 1; XXVI*A*, figs. 1, 4; XXVII*A*, fig. 1; XXIX*A*, figs. 4, 5, 9; XXXII*A*, fig. 2; XXXV*A*, figs. 1—3; XXXVI*A*, figs. 1, 2; XXXVII*A*, figs. 3, 4; XXXVIII*A*, fig. 1; XL*A*, fig. 4.

1876. Feistmantel: J. A. S. Bengal, Vol. XLV, p. 375. Pl. XXI, fig. 5.

Foliis magnis variantibus; costa crassa; apice acuto; nervis secundariis sub angulo 30°-50° exeuntibus, retia oblonga angustissima formantibus.

The leaves of this form vary in size, some of them are very large (see Pls. XXV*A*, fig. 1; XXXV*A*, figs. 1—3; XXXVI*A*, figs. 1—2; XXXVII*A*, fig. 3); oblongly-obovate or spatulate, narrowing into the stalk, the beginning of the well-marked midrib; the apical portion slightly prolonged, and the apex itself is as a rule pointed.

The midrib is always well and strongly developed, thick and longitudinally striated in the lower portion, forming the stalk of the leaf, and thinning into the apex. In some leaves this midrib shows a peculiar cellular structure (see Pls. XXXVI*A*, figs. 1, 2; XXXVIII*A*, fig. 2) which I only observed in this species.

The secondary veins form the chief character. They pass out from the midrib at an angle varying between 30° and 50°, are nearly equally thick throughout, pass slightly curved to the margin, and form long and narrow anastomoses, only slightly broader close to the midrib.

With most of the figures quoted above there are given enlarged portions, which show the secondary veins.

Of this species we possess specimens which show a fructification; I refer to the figures 1 and 4 on Pl. XXVI*A* and fig. 1, Pl. XXVII*A*; the fructification consists in round sori, arranged in longitudinal rows, of which there may be counted in the mentioned figures two to six.

Fructification

With reference to living ferns, this kind of fructification would be indicative of a *Polypodium*.

This species of *Glossopteris* is one of the commonest in the Lower Gondwánas, and passes also in the upper portion.

Localities and horizons—

Talchir shales: Cháno basin, N. Káranpúra coalfield.
Karharbári beds: Karharbári coalfield, at several shafts.
Mohpáni coalfield.

[1] *Communis* (Lat.) = common.

Barákar group: Rájmahál area; Lumki hill, Karharbári coalfield; Raniganj coalfield (Pl. XXXII*A*, fig. 2); Auranga coalfield (Murup); Ramkola coalfield; Talchir coalfield (Pl. XXXVIII*A*, fig. 2); Shapur coalfield; Umrét coalfield.

Ironstone-shales: Raniganj coalfield (Kulti).

Raniganj (Kamthi) group: Rájmahál area; Raniganj coalfield (Pls. XXIV*A*; XXIX*A*, 4; XXXV*A*, 1-3; XXXVI*A*, figs. 1-2); Jharia coalfield (Pl. XL*A*, 4); Ramkola coalfields; South Rewah basin (XXIX*A*, 5, 9); Raigarh and Hingir coalfield; Sátpura basin (Bijori horizon); Nágpur area (Pl. XXVI*A*, figs. 1, 4 (fructific.); XXVII*A*, 1; XXXVIII*A*, 3); Wardha coalfield (Isápur, XXV*A*, 1; XXXVII*A*, 4; XXXVIII*A*, 1). South Godávari district.

Panchet group: Raniganj coalfield; Ramkola coalfield.

Upper Gondwánas: In the red shales, north face of Latiahar hill, Auranga coalfield, most probably lowest Mahádevas; in shales of the Jabalpur group, on the Sher river, Sátpura basin.

Of the Australian species of *Glossopteris*, it appears that *Gl. ampla*, Dan., agrees in form of venation with *Gl. communis*, Fstm., but the frond appears to have been much shorter and broader. Some forms, although belonging to *Gl. communis*, I had to distinguish as a variety.

GLOSSOPTERIS COMMUNIS, *var.*, STENONEURA,[1] Pls. XXXII*A*, fig. 3; XXXIII*A*, fig. 1; XXXVIII*A*, 5.

The leaf much smaller, spatulate; the midrib less prominent, but also showing the cellular structure of the species. The secondary veins pass out at a very acute angle from the midrib, and continue with a graceful curve towards the margin. The veins are very thin, and the nets they form are very narrow, narrower than in the species.

Localities and horizons—

Barákar group: Raniganj coalfield (Kumerdhubi, Pls. XXXII*A*, fig. 3; XXXIII*A*, 1).

Raniganj group: Raniganj coalfield (Pl. XXXVIII*A*, fig. 5).

GLOSSOPTERIS INTERMITTENS,[2] n. sp. Pl. XXXIII*A*, figs. 2-4.

This is a rather peculiar form, and one which reminds almost more of *Tæniopteris*, at least by the general direction of the veins. Although the veins are apparently well marked, yet I remained somewhat doubtful about their real character. By a careful examination I arrive at the following result. The secondary veins pass out somewhat thickish and with a slight curve from the midrib at an angle of about 45°, then continue more straightly to the margin. Most of the veins are

[1] Stenos (Gr.) = narrow; neura (Gr.) = a vein.

[2] Intermitting, discontinuing.

dichotomous close to the midrib and form here and there anastomoses, producing elongated narrow nets.

The figured specimens give on the whole a correct idea of the form, although figs. 2 and 4 show the veins rather too strongly in their beginning; fig. 3 is the most correct. The enlarged portions (figs. 3a. and 4a.) do not represent the character so satisfactorily as I should have wished; the above given characteristic is, however, correct, and although there is not an anastomosis of veins throughout the leaf, yet I think it has to be classed with *Glossopteris*; moreover, this species seems to be constant in distant areas, for I identified it from the following—

Localities—

Barákar group: Raniganj coalfield (Kumerdhubi, Pl. XXXII*A*, figs. 2-4.)
Káranpúra coalfield (brought by myself only recently and collected at Aráhura, south of Chepa-Jugra.)

Probably distinct or a variety of Indica

GLOSSOPTERIS STRICTA,[1] Bunb., Pls. XXXVII*A*, figs. 1-2; XXXVIII*A*, fig. 3.

1861. Bunbury: Fossil plants of Nágpur. Qu. J. G. S., Lond., Vol. XVII, p. 331, Pl. IX, 5.
1876. Feistmantel: Rec. G. S. of India, Vol. IX, Pl. 3, p. 74.

This species was founded by Sir Ch. Bunbury upon some specimens from the Nágpur area. Apparently his specimens were not quite distinct, as he speaks of them as "almost ambiguous in characters between *Glossopteris* and *Tæniopteris*; at first sight more resembling the latter," and an anastomosis of veins is mentioned only as occurring near the midrib.

By these remarks I was at first led to the belief that this species is rather a *Tæniopteris* than a *Glossopteris*, considering especially the indistinct figure in Sir Ch. Bunbury's paper. But later I think I have identified specimens referrible to this species, and which prove that *Glassopt. stricta*, Bunb., is a real *Glossopteris* and not a *Tæniopteris*. The respective specimens are figured on Plates XXXVII*A* and XXXVIII*A*.

From these figures the following description can be given:—

The leaf appears long and rather narrow in proportion; the midrib very distinct; the secondary veins are characteristic; they pass out from the midrib at a pretty acute angle forming distinct polygonal nets quite close to the midrib; from here they pass with a short arch, and then quite straight to the margin forming very narrow and long nets, with parallel sides, thus imitating at first sight the appearance of *Tæniopteris*, but the lens distinctly shows us the anastomoses throughout,—see the figures quoted above.

Localities and horizons—

Kámthi (Raniganj) *group*: Kámthi,[2] Nágpur area (our figs. 1, 2, Pl. XXXVII*A*).
Isápur near Chanda, Wardha coalfield (Pl. XXXVIII*A*, fig. 3).

[1] Strictus (Lat.) = straight.
[2] Sir Ch. Bunbury quotes it from Silewáda and Kámpti (Kámthi), both in the Nágpur area.

Another somewhat doubtful species, but which I had not hitherto met with, is—

GLOSSOPTERIS MUSÆFOLIA,[1] Bunb.

1861. Bunbury, *l.c.*, pp. 329-330, Pl. VIII, 6.
1876. Feistmantel, l.c., p. 74.

Sir Charles Bunbury gives the following description:—"Frond broadly oblong, rounded, and very obtuse at the apex; side-veins very slender, very much crowded, dichotomous, nearly perpendicular to the midrib and the margin, near the base only oblique and anastomosing."

The figure is not very distinct, and I have not met with any specimen in our collections which could be identified with this species; so I must refer to the above description only.

Locality and horizon—

Kámthi group: Silewáda and Kámpti (Kámthi), Nágpur area.

GLOSSOPTERIS INDICA, Schimp., Pls. XXIII*A*, fig. 10; XXV*A*, fig. 3; XXVI*A*, fig. 3; XXVII*A*, figs. 3, 5; XXIX*A*, fig. 7; XXXV*A*, fig. 4; XXXVIII*A*, 4.

1828. Glossopteris browniana, var. indica, Brongniart, Hist. d. végét, foss., p. 223, Tab. LXII, fig. 2.
1861. Bunbury, *l.c.*, p. 330, Pl. IX, figs. 1-4.
1869. Glossopteris indica, Schimper, Tr. d. Pal. végét., Vol. I, p. 645.

Foliis mediocribus, costa crassa, apice acuto, nervis secundariis retia rhachim versus latiuscula, marginem versus oblonga angustaque formantibus.

This is one of the first described Indian species, not only of *Glossopteris*, but of fossil plants altogether. Brongiart in his "histoire des végétaux fossiles" described a *Glossopteris browniana*, and distinguished, from specimens in his possession, two distinct varieties, *viz.*, an Indian and an Australian variety. Prof. Schimper in the work quoted distinguished both as species, calling the Indian variety *Glossopteris indica*, and leaving the name *Glossopteris browniana* for the Australian variety. I readily adopt this distinction and define *Glossopteris indica* as follows:—

The leaves, as a rule, somewhat smaller than *Glossopteris communis*, especially somewhat narrower; the midrib is strong; the secondary veins have about the same direction, but begin with short and broad anastomoses close to the midrib, whence towards the margin the meshes become longer and narrower.

The apex is prolongate and pointed.

In several specimens a fructification was observed like that of *Glossopteris communis*, *i.e.*, sori, in longitudinal rows between midrib and margin (see Pls. XXVI*A*, fig. 3; XXVII*A*, fig. 5). Already observed by Brongniart.

[1] Musa = the plantain tree; folium (Lat.) = leaf, referring to the shape of the leaf.

Localities and horizons—

Barákar group: Raniganj coalfield, Ramkola-Tatapani, Talchir coalfield (Gopálprasád, Pls. XXIX*A*, fig. 7; XXXVIII*A*, fig. 4).

Raniganj (Kámthi) *group:* Raniganj coalfield (Pls. XXV*A*, 3; XXXV*A*, 4); Nágpur area (Kámthi, Pls. XXVI*A*, 3; XXVII*A*, figs. 3, 5).

Panchet group: Ramkola-Tatapani coalfield (Pl. XXIII*A*, fig. 10).

Section *b*: INTERMEDIATE FORMS.

GLOSSOPTERIS BROWNIANA,[1] Bgt., Pls. XXVI*A*, fig. 2; XXVII*A*, fig. 2; XXIX*A*, figs. 1, 3, 6, 8; XL*A*, 5.

1825. Brongniart, Hist. d. vég. foss., p. 223, Tab. LXII, p. 1.
1845. Morris in Strzelecki, N. S. Wales and VanDiemens Land, p. 248, Tab. VII, figs. 1, 2.
1869. Schimper, Tr. d. Pal. vég., Vol. I, pp. 645, 646.
1872. Carruthers, Qu. J. G. S., Vol. XXVIII, p. 354.

Foliis mediocribus; retibus polygonalibus mediocribus, totam superficiem folii tegentibus, marginem versus paulo angustioribus.

This is the species originally described by Brongniart from Australia, which hereafter was also quoted from India. I had, however, some difficulties in always identifying this species amongst the Indian specimens of *Glossopteris*, and the above figured specimens are placed here only on account of the general resemblance of the venation, while the fructification would seem to indicate a distinct fossil.

The leaves are somewhat smaller than *Glossopteris communis*, Feistm., and *Glossopteris indica*, Schimp.; the midrib distinct, the veins form oblongly polygonal anastomoses, becoming somewhat narrower towards the margin, but here I must distinctly point out that the nets occur all over the surface of the leaf, while from Brongniart's original figure one would get the impression as if there were no anastomoses towards the margin.

Two specimens, which from the mode of reticulation have, no doubt, also to be classed with *Glossopteris browniana*, Bgt., showed a fructification of the same kind as that already described in *Glossopteris communis*, Feistm., and *Glossopteris indica*, *viz.*, round sori in longitudinal lines, parallel to the margin.

In Ad. Brongniart's original description of the Australian *browniana*, there is no mention of any fructification whatever, nor is there in Prof. Morris' description in Count Strzelecki's work.

Mr. Carruthers, however (*l.c.*), mentions a specimen of *Glossopteris browniana* in which there was a fructification along the veins, closer to the margin than to the midrib, so that although there exists in India a form of *Glossopteris* which, with regard to the venation, strikingly resembles the Australian *browniana*, yet from the

[1] From a proper name.

mode of fructification would have to be considered as different,—a fact which is of great interest.

On the other hand, we have, as mentioned before, a similar fructification to that in our *browniana* in the two most frequent Indian species, *Gl. communis* and *Gl. indica;* so that I would be quite justified in placing these in a separate genus altogether, and thus disposing of the difficulty in determining the age of our Damuda series owing to the correlation of the Indian and Australian species; however, everything has its time, and I may quietly leave the matter as it stands for the present.

In Australia this species is known from the lower and upper coal-measures in New South Wales. The figures given in Mr. Tate's paper on South African fossils (Q. J. G. S., Lond., Vol. XXIII, Pl. VI, figs. 5, 7) cannot possibly represent *Glossopteris browniana*, if compared with the Australian (real) and the Indian (pseudo) *browniana*.

Locality and horizons—

Barákar group: Talchir coalfield (Pl. XXIX*A*, figs. 1-2; Raniganj coalfield; Ramkola coalfield.

Raniganj (Kámthi) group: Raniganj coalfield (Pl. XXIX*A*, figs. 3, 6, 8); South Rewah basin (Sohágpur Pl. XL*A*, fig. 5); Raigar and Hingir coalfield; Nágpur area (Pls. XXV*A*, fig. 2; XXVII*A*, fig. 2); Wardha coalfield.

For some specimens with somewhat larger net venation I thought of establishing a distinct name (*Gl. intermedia*), but I find it would only complicate the matter, and I have here joined them with *browniana*.

Section *c*: BROAD-NETTED FORMS.

Foliis mediocribus, retibus maximis, polygonalibus, tota superficie folii equalibus.

In this section belong some of the finest forms.

GLOSSOPTERIS RETIFERA,[1] n. sp. Pl. XXVIII*A*, figs. 2, 7, 10.; Pl. XLII*A*, fig. 9.

The leaf of this species is small, obovate, with, as it appears, an obtuse apex; the midrib distinct, marked with one or two longitudinal lines; the secondary veins form distinct, broadly polygonal nets, not much longer than broad, and almost equal in size throughout the whole leaf.

It is a characteristic species, though not frequent.

Locality and horizon.—Raniganj group: Raniganj coalfield (the above figures); Ramkola coalfield; Sátpura basin.

[1] Rete (Lat.) = a net; fero (Lat.) = to bear, to have.

GLOSSOPTERIS CONSPICUA,[1] n. sp. Pl. XXVIII*A*, figs. 1, 5, 6, 8, 9.

The leaves larger than in the preceding species, midrib distinctly marked. The secondary veins form nets of considerable size; they are polygonal, but oblong, almost twice as large as in *Gl. retifera*, and almost equal in size throughout the whole leaf.

Locality and horizon.—The species was hitherto known only from the Raniganj group, Raniganj coalfield (the figured specimens).

Recently I have brought the same form from other localities in the Káranpúra and Auranga coalfields.

GLOSSOPTERIS, sp. Pl. XXXI*A*, figs. 4, 5.

There are two fragments of a leaf which, considering the venation, would have to be regarded as *Glossopteris*, but of a different type from the others, although belonging to this section with broad nets.

The character of the nets of the secondary veins in these specimens is quite peculiar; and if we might be allowed to suppose that it is the same throughout the whole leaf, it would certainly represent a distinct species, for which I propose the name *Gl. ingens*.[2]

The veins appear to pass straight from midrib to margin, on the whole parallel, forming long trapezoidal nets.

I shall further on mention another fragmentary form of a somewhat similar character, but which I think rather belongs to another genus than *Glossopteris*.

Locality and horizon.—The form under notice is from the Barákar group, Raniganj coalfield (Kumerdhubi).

GLOSSOPTERIS DIVERGENS,[3] n. sp. Pl. XXVIII*A*, figs. 3, 4.

The positive and negative impressions of a peculiar leaf represent the above species. To judge from the specimens the leaf was obovate; the midrib appears to have been strong; it is at least of a good thickness in the upper portion of the specimens, which I believe to be the apical portion. The secondary veins show a peculiar arrangement; in the lower portion their direction is downwards; in the middle they are horizontal; and in the upper portion they pass upwards, exhibiting thus a diverging arrangement, while in all the other species the veins pass more or less obliquely upwards, especially in the basal portion of the leaf.

The veins form anastomoses, the meshes being short close to the midrib, and becoming oblong towards the margin, but being pretty broad throughout.

[1] Conspicuus (Lat.) = distinct. [2] Ingens (Lat.) = considerable. [3] The diverging Glossopteris.

Locality and horizon.—Raniganj group, Raniganj coalfield (the figured specimens).

GLOSSOPTERIS DAMUDICA,[1] n. sp. Pls. XXX*A*, 1-2; XXXI*A*, 1-3; XXXII*A*, 1; XL*A*, fig. 6.

Fronde latissima, obovata, apice obtusa an emarginata; rhachide crassa, nervis secundariis angulo subrecto ex rhachide eggredientibus, retia rhachidem versus breviora, trigonalia an polygonalia, latiuscula, marginem versus oblonge-polygonalia, angusta formantibus.

This is a very common and characteristic species; the leaf is of great size, as can be seen from fig. 1 on Pl. XXX*A*; the apex is obtuse, or in some cases slightly emarginated; the rhachis is thick; the secondary veins pass out from it at almost a right angle, getting somewhat more oblique in the apical portion.

They form a very distinct net venation, the meshes being broadly and shortly trigonal or polygonal towards the midrib, while they become long and narrower the closer they get to the margin.

From its frequent occurrence in all the horizons of the Damuda series I applied to it the above name; it begins in the Karharbári beds and appears to pass into the Upper Gondwána.

Localities and horizons:—

Karharbári beds.—Karharbári coalfield, shafts 17B and 17C, No. 3 Seam.

Barákar group.—Raniganj coalfield (Pls. XXXI*A*, 1-3; XXXII*A*, fig. 1); Ramkola-Tatapáni coalfield; Talchir coalfield (Gopálprasád, Pl. XXX*A*, fig. 2).

Ironstone shales.—Raniganj coalfield (Kulti, Pl. XXX*A*, fig. 1).

Raniganj (Kámthi) group.—Ramkola coalfield, South Rewah basin (Pl. XL*A*, fig. 6); Sátpura basin; Nágpur area; Wardha coalfield.

Upper Gondwánas (?).—Red shales, of apparently Lower Mahádeva age, on the northern face of the Latiahar hill, Auranga coalfield.

Section *d*: NARROW-LEAVED FORMS.

Foliis angustis, lineato spathulatis, an lineato acuminatis; nervo medio distincto, nervis secundariis vario modo anastomosantibus.

GLOSSOPTERIS ANGUSTIFOLIA,[2] Bgt., Pl. XXVII*A*, figs. 6, 8, 9, 11, 12, 13; Pl. XXXIV*A*, fig. 3; Pl. XXXIX*A*, figs. 1, 2.

1828. Brongniart: Histoire des végét. foss. I, p. 227, Pl. LXIII, f. 1.
1876. Feistmantel: J. A. S. Bengal, Vol. XLV, p. 374, Pl. XXI, figs. 2-4.

[1] Belonging to the Damuda series. [2] Angustus (Lat.) = narrow; folium (Lat.) = leaf.

This is the second of the two species, originally described by Mr. A. Brongniart.

Its leaves are narrow, linear, with a pointed apex; the midrib is strong, the secondary veins pass out at an acute angle from the midrib and form oblong nets, larger close to the rhachis, and becoming very narrow towards the margin.

In some of the specimens (Pl. XXXIX*A*, figs. 1, 2) I have observed that the secondary veins do not go as far as to the margin, but finish intramarginally, leaving a very narrow space of the leaf free along the margin. This I consider to be an indication of a marginal fructification, in which case this form would be related to the living genus *Pteris*.

I have also to mention, with regard to the net venation, that the nets distinctly reach to the margin, while Brongniart represented the veins just like in *Gl. browniana* anastomosing only close to the midrib.

Locality and horizons—

Barákar group.—Talchir coalfield.

Raniganj group.—Rájmahál hills (Lohundia); Raniganj coalfield (the above figures); Ramkola coalfield; South Rewah basin; Sátpura basin; Wardha coalfield.

Glossopteris leptoneura,[1] Bunb.

1861. Sir Ch. Bunbury: Q. J. G. S., Lond., Vol. XVII, pp. 330-331, Pl. IX, figs. 1-4.

This is another narrow species of *Glossopteris*, which appears to be confined to one area. Sir Ch. Bunbury first described it from the Nágpur area, and it is only from there that I have again identified it.

The leaf is linear, very narrow, and tapering very gradually at the base into the stalk; the apex acuminate; midrib narrow, but still continued to the apex; secondary veins very fine, very oblique, arched, forming a complete network, with the meshes somewhat more polygonal than in *Gl. angustifolia*, from which the present species is also distinguished by the form of the leaf.

Locality and horizon—

Kámthi (Raniganj) group.—Nágpur area.

Glossopteris formosa, n. sp. Pl. XXXIX*A*, figs. 3-7.

Foliis lineato-lanceolatis, nervo medio tenui, nervis secundariis sub angulo acutissimo eggredientibus, retia oblonge-polygonalia, conspicua formantibus.

This narrow-leaved form resembles the preceding in the shape of the leaf, but differs from it by the venation; the midrib is thinner in proportion to the leaf; the secondary veins pass at a very acute angle from the midrib, and form oblongly-

[1] Leptos (Gr.) = fine, delicate; neuron (Gr.) = the vein.

polygonal wide meshes, almost equal in size throughout the whole leaf. The apex is obtusely pointed, and the apical portion broader than in the former species.

It is a rare, though characteristic species.

Localities and horizons :—

Raniganj group.—Raniganj coalfield (the figured specimens); Ramkola coalfield; South Rewah basin.

Section *e*: ROUND-LEAVED FORMS.

As there is at present only one species to be classed under this section, the diagnosis of the section is the same as that of the species.

GLOSSOPTERIS ORBICULARIS, n. sp. Pl. XLI*A*, figs. 1, 2.

Foliis orbicularibus subemarginatis; nervo medio crasso inferiore in parte, apicem versus subevanescente; nervis secundariis sub angulo acuto eggredientibus, arcuatim marginem versus progredientibus, retia oblonge polygonalia, conspicua formantibus.

This form may perhaps be only a developmental state of some other species; but as I have identified it from two distinct localities in the same coalfield, I thought it right to specify it by a separate name. The leaf is almost circular, there being only a slight prolongation in the basal portion. In one specimen the upper margin is slightly emarginated; the midrib is thick in the basal portion, while it diminishes and gets very thin towards the apex; the secondary veins pass out at a very acute angle from the midrib, run almost parallel to the outer leaf margin, and finish in the margin of the apical portion; they form oblongly polygonal meshes of a good width.

Locality and horizon.—Raniganj group, Raniganj coalfield near Raniganj (the figured specimens) and north-west of Assensole, above the village Khumarpur in the north-west branch of the Nunia river.

INCERTÆ.

GLOSSOPTERIS DECIPIENS,[1] Feistm.

1878. Feistmantel, Talchir-Karharbári Flora, Pal. ind., Ser. XII, 1, or Gondwána Flora, Vol. III, pt. 1.

This is a somewhat abnormal, though constant form of *Glossopteris*, all the characters being the same as in the genus, excepting that of the midrib, which becomes dissolved in the upper apical portion of the leaf.

It is from the Karharbári beds of the Karharbári coalfield, and it was already described and figured before.

[1] Decipio (Lat.) = to deceive.

Order: *DICTYOPTERIDEÆ.*

According to the latest results of investigation this order is now rather restricted; the *Alethopteris*-like plants with a net venation (*Lonchopteris*, Bgt.) have been classed separately as *Dictyalethopterideæ*; the *Neuropteris*-like plants with a net venation (*Dictyopteris*, Gtb.) have been raised to a sub-family *Dictyoneuropterideæ*, while the *Glossopterides* have been classed in a separate sub-family with the name of *Dictyotæniopterideæ*.

Most of the fossil plants remaining in the order *Dictyopterideæ* are from the mesozoic epoch in Europe, *viz.*, *Camptopteris*, Presl., *Dictyophyllum*, *Clathropteris*, etc.; these are classed under the section *Dictyopterideæ* with a compound net venation; while another division, *viz.*, *Dictyopterideæ* with a simple net venation, comprises only two genera, one of which is only known from India, while the other one has numerous representatives in India and Australia.

These two genera are *Gangamopteris*,[1] Mc'Coy, and *Belemnopteris*,[2] Feistm.

Genus: GANGAMOPTERIS, Mc'Coy.

1875. Mc'Coy: Prodromus of the Palæontology of Victoria, Decadel I, p. 11.
1876. Feistmantel: J. As. Soc. Bengal, Vol. XLV, p. 371.
1879. Feistmantel: Talchir-Karharbári Flora, Pal. ind., Gondwána Flora, Vol. III, p. 12.

The chief development of this genus is in the Bacchus-Marsh sandstones in Victoria, from where it was first described by Prof. Mc'Coy (*l. c.*) and in the Talchir shales and Karharbári beds in India, from where I described various forms in my Talchir-Karharbári Flora.

It, however, passes into the higher groups of the Lower Gondwánas, as will now be described, and at the same time the review of the whole genus in India can be given.

The diagnosis, which I have given in my above work, runs thus:—

"*Fronde simplici* (an impare pinnata ?), *forma variabili, nunc ovali, latiuscula, nunc obovato elongata, basi attenuata, amplexicaule an subauriculata, nunc lanceolato spathulata, truncata; nervo medio* (*distincto*) *nullo; omnibus nervis ex basi radiantibus anastomosantibus, retia varia formantibus. Fructificatione adhuc non obvia.*

GANGAMOPTERIS ANTHROPHYOIDES,[3] n. sp. Pl. XXXIX*A*, fig. 8.

Fronde parvula, spathulata; nervis ex basi attenuata radiatim eggredientibus, teneribus, retia oblonga, angusta formantibus.

[1] Gangamon (Gr.) = a small round net; pteris = a fern.
[2] Belemnon (Gr.) = arrowhead.
[3] Like *Anthrophyum*.

Only one leaf was found, but I think it is sufficient to characterise the species. It is spatulate of a small size, the thin veins radiate straightly from the attenuated base and form long narrow nets. This form differs from *Gang. angustifolia*, Mc'Coy, by a different net venation, and by the much narrower base of the leaf.

From its whole appearance the leaf reminds one much of an *Anthrophyum*, whence the specific name; and I am not quite sure whether it ought not to be classed at once with *Anthrophyopsis*, Nath.; but in this the veins do not appear to be so much radiating as in our form, and the shape of the leaf also seems to differ. I shall hereafter mention another specimen, which perhaps more probably is an *Anthrophyopsis*.

Locality and horizon.—Raniganj group, near Assensole (north-west branch of Nunia river), Raniganj coalfield (the figured specimen).

GANGAMOPTERIS WHITTIANA,[1] Feistm., Plate XLIII*A*, figs. 1-2.

1876. Feistmantel: Journ. As. Soc. Bengal, Vol. XLV, p. 371, Pl. XX, figs. 3, 4.

Fronde simplici late ovato subrhomboidali, inequilatera, integerrima, obtuse acuminata; costa nulla, sulco medio tantum indicata, nervis ceteris omnibus e basi divergenter marginem versus radiantibus, omnibus anastomosantibus, retia conspicua oblonge hexagonalia an polygonalia formantibus.

A description of this fine fern has been already given by me in the Journal of the Asiatic Society of Bengal (*l. c.*). Since then no other specimens of the same species have been procured; so I have only to repeat my former remarks.

The frond appears to have been obovate subrhomboidal, or at least with an acuminate apical portion; there is no midrib, but the specimens show a slight furrow in the middle of the leaf; the secondary veins form the chief character; they radiate into the leaf, and form very large polygonal meshes, larger than in any of the other known species of this genus.

The relation of this species to *Anthrophyum* is very conspicuous, and I compared it already with *Anthrophyum latifolium* from Java and the Khasia hills, Assam.

Locality and horizon.—Raniganj group, Raniganj coalfield (the figured specimens).

GANGAMOPTERIS HUGHESI,[2] Feistm., Plate XLIII*A*, figs. 6-8.

1876. Feistmantel: Rec. Geol. Surv. of India, Vol. IX, pt. 4, p. 138.

Fronde simplici, rotunde ovali, subcoriacea, basi ut videtur subcordata, margine integra mediocriter longa, maximo specimine ad 10 cm. longo, 5 cm. lato, rhachide vel nervo medio nullo, nervis omnibus radiatim e basi usque ad

[1] Proper name.

[2] From a proper name.

marginem radiantibus, arcuatis, nonnullis mediis parte inferiore crassioribus, dehinc omnibus repetito furcatis, anastomosantibus, retia oblonge-latiuscula, tota superficie folii prope æqualia, formantibus.

Although this species has been already described by myself, no figure was given of it. At present I figure three specimens, all of which show the characters well. They somewhat remind of *Gangamopteris cyclopteroides* of the Talchir and Karharbári beds, and I think the present species is a direct descendant from this Talchir form, but the frond appears smaller, the meshes of the net venation somewhat larger than is the rule in *Gang. cyclopteroides*, and they are almost equal in size throughout the leaf, while in *Gang. cyclopteroides* the larger meshes prevail towards the middle of the leaf, becoming close and narrow towards the margin. The character of the radiating disposition of the secondary veins is very well exhibited.

Locality and horizon.—Kámthi (Raniganj) group, near Kámthi in the Nágpur area (the figured specimens).

GANGAMOPTERIS, sp., Plate XXXIX*A*, fig. 9.

There is another leaflet of a fern of an oblong shape, the veins distinctly radiating without any midrib whatever, and the veins forming oblong polygonal meshes. All these characters are those of *Gangamopteris*, to which genus I refer the specimen; but I do not think this one specimen sufficient to establish a species upon. I only bring it to notice in connection with the others, and as it is also from a higher horizon in the Lower Gondwánas.

Horizon and locality.—Bijori horizon (Raniganj group), near Baricondam, Sátpura basin.

GANGAMOPTERIS CYCLOPTEROIDES,[1] Feistm.

1879. Talchir-Karharbári Flora, Pal. ind. Gondwána Flora, Vol. III, p. 12, Pls. VII, IX, etc.

The diagnosis and description of this species, which with its varieties is the most numerous of the Indian forms of this genus (in the Talchir and Karharbári beds), is given *in extenso* in the preceding part of this volume (*l. c.*). It is sufficient here to repeat the names only. *Gangam. cyclopteroides* is known from the following—

Localities and horizons.—Talchir beds: Deoghur field, North Káranpúra coalfield.

Karharbári beds: Karharbári coalfield and Mohpáni coalfield.

Barákar group: Near Kotmi, Sháhpur coalfield. As the Karharbári character of the coal beds of this coalfield is not quite distinct, I quote them with the Barákar

[1] Like *Cyclopteris*.

group, so that in this case the range of *Gang. cyclopteroides* would be somewhat wider than otherwise.

The varieties of *Gang. cyclopteroides*, already described by me, are—

GANG. CYCLOPT., var. SUBAURICULATA.[1]

1879. L. c., p. 13, Pl. X, figs. 1, 1*a*, 1*b*, etc.

Locality and horizon.—Talchir shales of the Káranpúra coalfield; Karharbári beds of the Karharbári coalfield.

GANGAM. CYCLOPT., var. AREOLATA.[2]

1879. L. c., p. 14, Pl. X, fig. 2; Pl. XVI, f. 4.

Locality and horizon.—Talchir shales of the Káranpúra coalfield; Karharbári beds, Karharbári coalfield.

GANGAMOPT. CYCLOPT., var. ATTENUATA.[3]

1879. L. c., p. 14, Pl. XI, fig. 1, etc.

Locality and horizon.—Talchir shales, North Káranpúra coalfield; Karharbári beds, Karharbári and Mohpáni coalfield.

I have brought lately a large collection of fossils from the Talchir beds of the Káranpúra coalfield, amongst which there are some other varieties of this species, as well as some species hitherto not known in India.

Besides the abovenamed species and varieties I have described three other species of *Gangamopteris*, two from the Karharbári beds (Karharbári coalfield) and one from the Talchir shales (Deoghur field) and Karharbári beds (Karharbári coalfield), for which I refer to my Talchir-Karharbári flora in the first part of this volume.

In India we have thus for the genus *Gangamopteris* a range from the Talchir shales up to the Raniganj-Kámthi group; the greatest development being in the Talchir shales and Karharbári bed.

In Australia this genus appears more limited, being of any importance only in the Bacchus-Marsh beds of Victoria (on about the horizon of our Talchir shales).

[1] Slightly auricled. [2] Areolated. [3] Narrowed.

Genus: BELEMNOPTERIS,[1] Feistm.

1876. Feistmantel: J. A. S. Beng., Vol. XLV, p. 370.

BELEMNOPTERIS WOOD-MASONIANA,[2] Feistm., Pl. XLIII*A*, figs. 3-4.

1876. Feistmantel: *l. c.*, p. 371, Pl. XX, figs. 1-2.

Fronde simplici, late sagittæfolia, apice obtusa, margine integerrima, tota ad 10·5 cm. longa, inferioribus lobis obtuse acuminatis longiusculis (5·3 cm. longis); nervis primariis tribus; uno crassiore in folii superficiem excurrente duobus ceteris tenuioribus in lobos incurrentibus, omnibus tribus apicem versus attenuantibus; nervis secundariis sub angulo subacuto eggredientibus, anastomosantibus, retia plerumque hexagonalia, sed etiam polygonalia formantibus.

No other specimens of this interesting species have been met with since I described and figured those in the paper quoted. It is of a great interest, being so uncommonly like some living ferns.

In the original description I compared this fossil with *Hemionitis cordata*, Roxburgh, and *Pteris sagittæfolia*, Raddi, correlating it more closely with this latter species. I find, however, in Beddome's ferns of Southern India (Pl. LIII) several figures of *Hemionitis cordata* which bear a very close resemblance to our fossil; it is only by the fructification that it would be possible to decide with which of the two living genera our fossil should be more correctly classed.

The fossil has the shape of a broad arrowhead; the lobes directed downwards, large; margin entire; three chief veins, one of which passes into the leaf towards the apex, while of the two others one passes down into each lobe. The secondary veins between form a nice net venation of conspicuous polygonal meshes.

Locality and horizon.—Raniganj group, near Raniganj, in the Raniganj coal-field (the figured specimens).

INCERTÆ SEDIS.

The leaves hitherto described were, as far as could be decided, single leaves. There are, however, some others which, though exhibiting a net venation, are either actually compound leaves, or have to be considered as such from their shape and other characters.

I was at a loss how best to class these leaves; averse to establishing new genera uselessly, and not thinking myself justified in uniting them with *Glossopteris*, I placed them provisionally with *Sagenopteris*, although I know quite well that this genus has somewhat different characters; the name will, however, do for the

[1] Belemnon (Gr.) = the arrow; pteris = fern. [2] Proper name.

present, and should subsequently a new name be required, I should propose the name DACTYLOPTERIS[1] gen. now. From the material before me it would appear that about five species are represented, one or two of which, however, appear to be true *Sagenopteris*.

SAGENOPTERIS LONGIFOLIA,[2] sp. n. Pl. XL*A*, fig. 1.

Fronde digitata, foliolis, ut videtur six numerantibus, sessilibus, lanceolatis, longis; nervo medio inferiore in parte indicato, evanescente; nervis secundariis sub angulo acuto ascendentibus, retia angusta oblongaque formantibus.

There is apparently a common stalk to the leaflets in this species; the leaflets, about six in number (all that can be counted), passing out of the same, are long and lanceolate, sessile, with a midrib in the lower portion, while towards the top it appears to dissolve into the secondary veins; these are very thin, and form narrow and oblong meshes.

The relations of this fern to both living and fossil forms are entirely obscure; a single leaflet might occasionally pass for a *Glossopteris angustifolia*, Bgt., as regards general form and the secondary veins, but the midrib in this latter is quite distinct throughout.

Locality and horizon.—Raniganj group in the Raniganj coalfield.

SAGENOPTERIS (?) POLYPHYLLA,[3] n. sp. Pl. XLI*A*, figs. 3, 4.

Foliis ex caule commune eggredientibus, six ad septem numerantibus, caule distincto, modico, insertis; costa inferiore in parte solum distincta, apicem versus dissoluta; nervis secundariis sub angulo 40°—45° ad marginem progredientibus retia latiuscula, polygonalia conspicua formantibus.

Like in the former species, we find in this one the leaves attached to a common stalk, as is distinctly shown in fig. 3; the number of the leaves in both specimens is seven; the leaves themselves also possess distinct stalks, from which the midrib originates; the rhachis is distinct in the lower portion of the leaf, while towards the apex it becomes indistinct and dissolved.

The secondary veins are very characteristic; they pass out at an angle of about 40°—45°, and form very conspicuous polygonal meshes of almost the same size throughout the leaf.

It is at least certain that this species and that last described belong to one and the same genus, the principal characters being the same.

Locality and horizon.—Raniganj group of the Raniganj coalfield.

[1] Daktylos (Gr.) = the finger; pteris = fern. [2] Long-leaved. [3] The many-leaved.

SAGENOPTERIS, comp RHOIFOLIA,[1] Presl. Pl. XLII *A*, 2.

1867. Schenk: Flora der Grenzschichten, Pl. XII.

There is one leaflet of a fern with netvenation which, though only single, has, I think, to be considered as being of the genus *Sagenopteris;* the shape is inequilateral, the midrib is indicated in the lower portion only, and the secondary veins pass up at an acute angle to the margin forming a net venation.

The most closely related form is *Sagenopteris rhoifolia*, Presl. But whether or not they are identical cannot, I think, be decided with certainty from this single specimen.

Locality and horizon.—Raniganj group in the Raniganj coalfield.

There are three other specimens of leaves (Pl. XLII *A*, fig. 7; Pl. XLII *A*, figs. 3, 5) which also exhibit to some extent the characters of *Sagenopteris, viz.*, a midrib in the lower portion only, a net venation, and a somewhat oblique shape of the leaf, which would appear to indicate that they belong to a fingered leaf.

I had already in my Talchir-Karharbári flora described a *Glossopteris* as *Gl. decipiens*, wherein the midrib vanishes towards the apex, but these leaves have, I think, to be considered from their shape as single leaves, and, if anything, more in relation to *Gangamopteris*, as intermediate forms between it and *Glossopteris*, while the above leaves are on all accounts more related to *Sagenopteris*.

Locality and horizon.—These three specimens are also from the Raniganj group, Raniganj coalfield.

SAGENOPTERIS (?) STOLICZKANA, Feistm.

1879. Feistmantel: Talchir-Karharbári Flora, Pal. ind., Ser. XII, 1 (or this Vol., p. 18, Pl. XIII, fig. 4).

This species has been figured and described before.

Locality and horizon.—Karharbári beds of the Karharbári coalfield.

Genus: ACTINOPTERIS,[2] Schenk.

1867. Flora der Grenzschichten, p. 23.

Certain circular shield-like leaves, furnished with a stalk and with radiating, dichotomous veins, were classed by Prof. Göppert[3] with *Cyclopteris*, while Prof. Schenk subsequently placed them with *Actinopteris* (*l.c.*). The species was *Cyclopteris peltata* (Göpp., *l. c.*, Pls. IV, V, figs. 6-9) or *Actinopteris peltata* (Schenk, *l.c.* Pl. VI, figs. 3-5).

From the many specimens examined by Prof. Schenk it appears that the leaves

[1] With leaves like those of Rhus=Sumach.

[2] The radiated fern.

[3] Gattungen fossiler Pflanzen Lief. 5, 6, p. 92.

are single pinnate, with circular, sessile, and entirely embracing leaflets. The veins pass radiately from the point of insertion to the periphery, are dichotomous, and connected by transverse branchlets.

There are certain forms among the Damuda fossils which I think have to be referred to this genus, and I proposed for them the name—

ACTINOPTERIS BENGALENSIS,[1] Feistm., Pl. XIX*A*, fig. 1.

1876. Rec. Geol. Surv. of India, Vol. IX, 3, p. 76.

Foliis orbicularibus an late-ovalibus, ut videtur peltatis, ex segmentis profundissime laciniatis compositis, loco insertionis centrali; nervis radiantibus.

The general form of the leaf is exactly as that in *Actinopteris peltata*, Schenk, circular or broadly oval; the leaf appears to consist of about six segments, very deeply incised. In my first description I considered the laciniæ as leaflets, but they are clearly connected at their base, radiating from a central spot, at which there is a shallow cavity with what appears to be a slit, and which I believe to be the point of insertion.

The two leaves (one a fragmentary one) are figured in position as they lie on the specimen; and this is about the same as in Schenk's *Actinop. peltata*. The difference, however, between the two species is obvious.

Some doubt was expressed as to the organic nature of Prof. Schenk's specimens. This could not apply to our fossil, for there can be no doubt whatever as to its true organic nature; and we have only to imagine that the laciniæ in Prof. Schenk's specimens were narrower, the veins therefore more numerous and somewhat projecting above the surface of the leaf substance, and we have the complete picture of Prof. Schenk's *Actinopt. peltata*.

Locality and horizon.—The species occurred only once in the Raniganj group, Raniganj coalfield.

Genus: ANTHROPHYOPSIS, Nath.

1878. Nathorst (A. G.), Floran vid Bjuf, p. 43.

Mr. Nathorst has established this genus upon single oblong leaves, of the same character as the living genus *Anthrophyum*, to which I have already compared some of our forms of *Gangamopteris;* and my belief is that, in the absence of fructification in *Anthrophyopsis*, Mr. Nathorst's specimens should rather have been classed with *Gangamopteris;* they would have to be classed as a separate section of *Gangamopteris* with broad nets.

One fragment amongst the Damuda fossils has, I think, to be classed with that section of *Gangamopteris*, or, as it stands at present, with *Anthrophyopsis*, Nath. It is

[1] Appertaining to Bengal.

figured on Pl. LXI*A*, fig. 5, but not in the correct position, as it ought to have been placed longitudinally, but this does not interfere with the features of the fossil. The veins show a slightly radiating arrangement, are all equal in thickness, and form rhomboidal or elongately polygonal meshes, of an almost equal size throughout. These characters fit well into Mr. Nathorst's diagnosis of his genus, to which I refer our fossil, without attempting, however, a specific determination.

Locality and horizon.—It is from the Kámthi (Raniganj) group, near Kunlácheru, South Godávari district.

PHANEROGAMÆ.

GYMNOSPERMÆ.

Class: CYCADEACEÆ.

Order: *ZAMIEÆ.*

It is now no longer doubtful that true representatives of *Cycadeaceæ* do occur in the Lower Gondwánas; and by establishing the fact that *Nöggerathiopsis* is a *Cycadeaceous* plant, this class of plants has its beginning already in the Talchir division. But there are also other *Cycadeaceæ* besides this.

Genus: PTEROPHYLLUM,[1] Bgt.

This genus (with the subdivision Anomozamites) is very largely developed in the Upper Gondwánas, and especially in the Rájmahál and Sripermatúr group, while in the higher groups (Jabalpur and Kach plant-group) it can hardly be said to exist.

From the Lower Gondwánas a real *Pterophyllum* has already been described and figured by me; and only recently I have been so fortunate as to collect in the Auranga coalfield good representatives of *Anomozamites;* so that we have in the Lower Gondwánas just the same types of *Zamieæ* as in the lower groups of the Upper Gondwánas.

PTEROPHYLLUM BURDWANENSE,[2] Feistm. (Mc'Clell. sp.). Pl. XLVII*A*, fig. 1.

1850. Zamia burdwanensis, Mc'Clelland: Rep. Geol. Surv. of India, p. 53, Pl. XIX, 4.
1877. Pterophyllum, Feistmantel: Rec. Geol. Surv. of India, Vol. X, pt. 2, p. 71, Pl. I, fig. 1.

Fronde mediocri, rhachide tenui (in figura nostra) *pinnulis* (foliolis) *oblonge linearibus, equalibus, subcoriaceis tota basi insertis, basi paulo dilatatis, contiguis, apice obtuse acuminatis; nervis simplicibus, filiformibus, distantibus, 7-8 numerantibus.*

[1] Pteron (Gr.) = a feather; phyllum (Gr.) = leaf.

[2] The Burdwan Pterophyllum.

The leaf was only of moderate size, with a thin rhachis, as can be judged from our fossil; the leaflets are equal, oblong linear, and attached with the entire base; as regards their texture, they appear to be subcoriaceous; at the base they are somewhat widened and connected together; the veins are single, parallel, pretty far apart, and about 7 to 8 in number.

There is but the one specimen of this species. It was at first figured by Mc'Clelland (*l. c.*) as *Zamia burdwanensis*. But as subsequently the specimen was not forthcoming, and considering the general badness and incorrectness of all Mc'Clelland's figures, the cycadeaceous nature of this fossil was generally doubted. Only after the palæontological collections of the Asiatic Society had passed into the possession of the Indian Museum (in 1876) could I (by discovering the original specimen) re-establish its true cycadeaceous nature, and I classed it then with *Pterophyllum*, to which there is little doubt it belongs.

Our fossil shows a relation to *Pteroph. carterianum*, Oldh., of the Rájmahál hills.

Locality and horizon.—Raniganj group, in the Raniganj coalfield.

Up to the beginning of this year this was the only specimen of the *Pterophyllum* family known from the Lower Gondwánas. Recently I have collected from the Barákar group in the Auranga coalfield several well-preserved specimens of *Pterophyllum*-like fossils, of a type which has been classed by Schimper as the sub-genus *Anomozamites*, on account of the unequal breadth of the leaflets. Many of the Rájmahál *Pterophylla* belong to this sub-genus, and this Barákar *Anomozamites*, of which a figure and a provisional notice was given by me in a late number of the Records,[1] and which will be further illustrated and described in a future number of the Palæontologia indica, further establishes the presence of real *Zamieæ* in the Lower Gondwánas.

PTEROPHYLLUM sp.

Only for the sake of record do I mention here some fragmentary specimens which were collected by Mr. Th. Hughes in the Kámthi (Raniganj) group at Anúr, in the Wardha Valley coalfield. As far as can be judged from the fragments, they represent linear leaflets, with an obtuse apex, and longitudinal veins, parallel to each other. I could not form any idea about their mode of insertion, the base being wanting, but they appear to me to be of a *Pterophyllum*. I do not give any figure of them, as they are so uncertain.

Genus: GLOSSOZAMITES,[2] Schimp.

GLOSSOZAMITES STOLICZKANUS,[3] Feistm.

1879. Feistmantel: Talchir-Karharbári flora, p. 19, Pl. XX, figs. 4, 5.

Locality and horizon.—Karharbári beds at Domáhni, Karharbári coalfield.

[1] Volume XIV, pt. 3. [2] Glossa (Gr.) = the tongue; zamia. [3] Proper name (the late Dr. Stoliczka).

Family: *NÖGGERATHIOPOSIDEÆ*,[1] Feistm.

1881. Talchir-Karharbári flora, suppl., this Vol., 55-59.

In describing some supplementary plants from the Karharbári coalfield at the beginning of this year, I have sufficiently discussed the reasons for establishing this family, including at present two genera, which are, however, very closely allied, and which in time may probably be amalgamated. These two genera are *Nöggerathiopsis*, Feistm. (in India and Australia), and *Rhiptozamites*, Schmalh. (Siberia).

The classing of these two genera in a special family has its advantage; for it is at present classed with the *Zamieæ*, as the specimens, hitherto known, justify this classification. Should it, however, happen that the discovery of better and more complete specimens would make another arrangement necessary, it will be easy to transfer the whole family into another class, to which it may appear to belong more properly.

Genus: NÖGGERATHIOPSIS, Feistm.

1879. Talchir-Karharbári flora, this Vol., p. 23.
1881. Suppl., *ibid.*, p. 55 et sequ.

The distribution of this genus in India and Australia in its relation to the Siberian fossil has been given in my supplement to the Talchir-Karharbári flora. The specimens hitherto figured were from the Talchir and Karharbári beds; at present others are figured from the higher groups of the Lower Gondwánas, although they represent the same species.

Nöggerathiopsis hislopi[2] (Feistm.), Bunb., sp. Pls. XLV*A*, figs. 1-11; XLVI*A*, fig. 1.

1879. *l.c.*, p. 23, Pls. XIX, figs. 1-6; XX, 1.
1881. *l.c.*, Pls. XXVIII, figs. 1-7; XXIX, 1-4; XXX, 5-9.

As regards the characters of the leaves, their shapes, size, and the distribution of the veins, as well as regards their correlation, I have nothing further to add; they all exhibit their close relation to the Siberian *Rhiptozamites*. I would only point once more to the circumstance that also in these newer specimens the distance of the veins is somewhat variable.

The reasons for the supposition that these leaves are leaflets of a pinnate leaf were also given in my previous memoirs. Amongst the specimens figured at present, there are again some which bear the character of associated leaflets,—see figs. 3 and 11 on Pl. XLV*A*, and fig. 3 on Pl. XLVI*A*, and all of those figured show more or less the oblique shape of the leaf.

[1] Fossils like Nöggerathia.

[2] Proper name (the late Rev. Hislop of Nágpur).

Locality and horizon.—(*a*) Barákar group, near Barkoi Umrét coalfield, Central Provinces (Pl. XLVI*A*, fig. 3), also in the Ramkola and Shapur coalfields; (*b*) Raniganj group (including Kámthi group), Raniganj coalfield (Pl. XLV*A*, figs. 10-11), South Rewah coalbasin (Pl. XLV*A*, figs. 1-5), Nágpur area (Bháratwáda, Pl. XLV*A*, figs. 6, 8. Silewára, *ib.*, fig. 2; Kámthi, *ib.*, fig. 9).

SQUAMÆ.

Together with the Lower Gondwána fossils described above there occur certain scale-like leaves, the systematic position of which is uncertain, although they show analogies with similar fossils described from elsewhere.

I have given figures of them on Pl. XLVII*A*, figs. 8, 16-18, 21 and 23. They vary in size, but the general outline of the leaves is very similar in all. It is obovate or obovately triangular with a truncate base, showing in some specimens at least a distinct point of insertion. Most of them have a distinct venation; the veins pass out radiating from the base, and either continue so up to the margin, or in another instance (where the leaf is obovate) converge towards the top.

Fig. 8, Pl. XLVII*A*, is very similar to some specimens figured by Mr. Schmalhausen,[1] especially to figs. 7, 6 on Pl. XVI.

Fig. 21 falls in more with some figures given by Nathorst in his flora of Palsjö,[2] Pl. XII, figs. 15, 16; and our fig. 16 may probably be also placed here.

Fig. 23 resembles somewhat Nathorst's fig. 7, Pl. XVII, in his flora of Bjuf;[3] while our figs. 17 and 18 (Pl. XLVII*A*) resemble very much Schmalhausen's (*l.c.*) fig. 22, Pl. XVI.

The above authors have introduced these scale-like leaves as "squamæ gymnospermarum" or "squamæ cycadearum," but their place is uncertain. I also must leave them with this general title only.

If they are of *cycadeaceous* nature, the only plant to which they might belong is *Nöggerathiopsis* described above.

Locality and horizon—

Barákar group: Kumerdhubi, Raniganj coalfield (Pl. XLVII*A*, figs. 17, 18, and 21).

Raniganj group: near Lohundia in the Rájmahál hills; in the Raniganj coalfield (Pl. XLVII*A*, figs. 8, 16); near Guráru on the Sone in the South Rewah basin (*ib.*, fig. 23).

One fossil, which at first I thought had also to be classed with *Cycadeaceæ*, is now, I believe, more correctly classed by me with the coniferæ.

[1] Juraflora Sibiriens, Mem. de l'Acad Imp. d. Sc. d. St. Petersbourg, VII Ser., Vol. XXVII, No. 4, 1879, Pls. XV and XVI.

[2] Kongliga Svenska Vetenkaps Akad. Handlingar, Vol. XIV, I, 1875.

[3] Sveriges Geologiska Undersökning, Ser. C., No. 33, Stockholm, 1879.

Class: CONIFERÆ.

Coniferous plants are not very largely represented in the Lower Gondwánas, although there are some rather interesting forms amongst them, some of which have only recently been collected by myself.

Order: *TAXACEÆ.*

Family: SALISBUREÆ.

The type of this family in present days is the genus *Salisburia* or *Gingko*, now living in Japan and China. In geological times this genus had a much wider distribution, and there were also other types in existence belonging to this family. From Asia Professor Heer described several species of *Gingko*[1] from the jurassics of Eastern Siberia and the Amúr countries; I have described and figured two species of *Gingko* from the Upper Gondwánas.[2] (Jabalpur group and Sripermatúr group.)

From the jurassics of the Altai and of the Petschora country species of *Gingko* and other *Gingko*-like fossils were described by Professor Schmalhausen.[3]

Our Lower Gondwánas also contain some *Gingko*-like fossils, one of which appears to be identical with a species from the Petschora country, while two others belong to genera from Petschora, from the Altai and the Tunguska river.

Genus: EURYPHYLLUM,[4] Feistm.

1879. Feistmantel: Talchir-Karharbári flora, this Vol. (III), p. 26.

Hitherto only one species is known.

EURYPHYLLUM WHITTIANUM,[5] Feistm.

1879. Feistmantel: *l.c.*, pp. 26-27, Pl. XXI, fig. 1.

Locality and horizon.—Karharbári beds in the Karharbári coalfield, No. 11A Mine (at Buriadi).

[1] Flora fossilis arctica, Vol. IV, pp. 57-64, 115-116.
[2] Gondwána Flora, Vols. I and II.
[3] Mem. de la'Acad. Imp. p. Sc. de St. Petersbourg, VIIe Ser., Tome XXVII, No. 4.
[4] Eurys (Gr.) = broad; the broad-leaved fossil.
[5] Proper name.

Genus: RHIPIDOPSIS,[1] Schmalh.

Folia longe stipitata, coriacea, flabelliformia, palmatisecta; segmenta 6-10, integerrima, lateralia minora, e basi cuneiformia, obovata, media majora, usque pedalia, basi substipitata cuneiformia, antice obtusa, nervis numerosis pluries dichotomis.—(Schmalh.)

When Prof. Schmalhausen constructed the diagnosis of this genus only one species was known, so that necessarily the diagnosis of the genus and species were identical.

There are, however, amongst our Lower Gondwána fossils two specimens which have to be placed with this genus, judging from the majority of characters being identical with those in the above diagnosis, but they represent a distinct species, so that the diagnosis of the genus will have to receive some slight additions.

RHIPIDOPSIS DENSINERVIS,[2] n. sp. Pl. XLVI*A*, figs. 1, 2, 2*a*.

Foliis stipitatis, flabelliformibus, coriaceis, segmentis ut videtur six numerantibus, oblonge triangularibus, apice emarginato dissectis mediis longioribus; nervis radiantibus, densissimis, repetito dichotomis.

The leaves bear a stalk, of the length of which we can form no conjecture, as only a small portion of it is preserved.

The leaf is fan-shaped, with about six segments, which are of oblongly triangular shape; the middle segments longer than the lateral ones, but not in the same proportion as in *Rhipidopsis gingkoides*, Schmalh.; the apical margin of the segments in our species is also not entire as in Schmalhausen's species, but emarginate and even incised.

The veins also form a distinguishing character; they are very closely set, and thin throughout, while in the Petschora species they are thicker and wider apart in the lower portion. They are, however, also repeatedly forked in our species.

This fossil was classed by me at first with the *Cycadeaceæ*, as I thought that it belonged to the genus *Macropterygium*, Schimp., and I even asserted this confidently; but closer examination shows now that it is more correct to class it with *Rhipidopsis*, for the leaves have a distinct stalk, and all the segments are separate leaflets constituting the leaf by being inserted on a common stalk, while in *Macropterygium* there is hardly any stalk to the leaves, and the segments are only produced by incisions in the leaf; and further, the veins in our fossil are repeatedly forked, while in *Macropterygium* they appear to be simple.

Locality and horizon.—Kámthi (Raniganj) group, near Kunlácheru, South Godávari district.

[1] Rhipis (Gr.) = a fan; opsis (Gr.) = appearance.

[2] Densus (Lat.) = close; nervus (Lat.) = a vein.

But while these two specimens from the South Godávari represent a new species there are some others, which I have only recently collected, and which I think represent the Russian species, *viz.*, *Rhipidopsis gingkoides*, Schmalh. Only one leaf has been figured[1] as yet, while more figures will be given in a subsequent memoir; but this one specimen sufficiently shows the characters pointed out by Prof. Schmalhausen: the common stalk to the leaflets composing the leaf; the middle leaflets much longer than the lateral ones, and with a truncate apex; the veins stronger and apart in the lower portion and becoming very close by repeated forkings towards the apical portion; there are 8 to 9 leaflets (segments) in the leaves. I shall have occasion to point to this more closely when all the other figures will be given.

I have collected the specimens in the Barákar group (as determined by Mr. Ball), in the Sukri river, near Gurtur in the Auranga coalfield.

Genus: CYCLOPITYS,[2] Schmalh.

1879. Schmalhausen, *l. c.*, p. 39, &c.

Another peculiar coniferous plant of another family was described by Prof. Schmalhausen with the above name from the Altai and the Lower Tunguska river.

With the abovementioned *Rhipidopsis gingkoides* there occurred in the Barákar group of the Auranga coalfield several specimens of a plant which I can only class with *Cyclopitys*, but it represents a new species, the leaves being dichotomous. I have figured one leaflet in a paper in the last number of Records (*l. c.*). The entire specimens will be figured on a subsequent opportunity.

Order: *ABIETACEÆ.*

Genus: VOLTZIA,[3] Bgt.

VOLTZIA HETEROPHYLLA[4] Bgt., Pl. XLVII*A*, figs. 20, 22, 23, and ? 19.

1879. Talchir-Karharbári flora, this Vol. (III), p. 28, Pls. XXII—XXIV, fig. 4; XXV.

From the Karharbári beds (*l. c.*) many specimens of this species were figured. At present I have to record the same from another locality, *i.e.*, from South Rewah. I identified it long since amongst an old collection from that region, made by Mr. J. G. Medlicott in 1861 (see *supra*, page 12) in the Gopat area; no horizon was indicated, but I placed them provisionally in the Raniganj group.

Only last year Mr. Hughes collected some fossils near Hardi in the Sohágpur district (South Rewah basin) amongst which there was also *Voltzia heterophylla*,

[1] Rec. G. S. of I., Vol. XIV, pt. 3, Pl. II, fig. 2.

[2] Kyklos (Gr.) = circle; pitys (Gr.) = the pinetree.

[3] Proper name.

[4] With two kinds of leaves.

thus confirming my former identification. I have given figures of specimens from both districts. They are of the type of *V. heterophylla*, var *brevifolia*.

There is also on Pl. XLVII*A*, fig. 19, a specimen which very much resembles certain scales, said to represent fruit scales of the cones of *Voltzia*. As, however, only one specimen occurs, I do not venture to class the fossil finally with *Voltzia*, but the resemblance is striking.

Locality and horizon.—Raniganj group: South Rewah basin (Gopat area, Pl. XLVII*A*, 20, 24; Hardi, *ib.*, fig. 22); Raniganj coalfield (*ib.*, fig. 19).

Genus: ALBERTIA, Schimp.

1879. Talchir-Karharbári flora, this Vol., p. 29.

Certain specimens of coniferous branchlets were referred by me (*l. c.*) to this genus. Since then no fresh material has been procured, and thus the identification cannot be made with more certainty now than before. I have, however, compared it with *Alb. speciosa*, Schimp.

Locality and horizon.—Karharbári beds, Karharbári coalfield, Buriadi (No. 11A Mine).

SEEDS.

Seeds are of rather rare occurrence in the Lower Gondwánas. Those which occur more generally are small-winged seeds.

I am afraid I cannot offer much about their systematical position. From their general character and their relation to similar fossils from elsewhere, they have most probably to be classed with *Coniferæ*, but unfortunately these fossil seeds were found in most cases without any coniferous plants whatever.

Prof. Heer in his Juraflora of Eastern Siberia and the Amúr countries figured very similar seeds, classing some with *Ephedrites* and others with *Samaropsis*, although I could not satisfy myself that he had traced the connection of the seeds with their mother-plants.

Prof. Schmalhausen (*l. c.*) figured also similar forms from the Altai, from the Lower Tunguska, and from the Petschora country, classing some with *Samaropsis*, and others with *Rhipidopsis*.

Our seeds bear entirely the appearance of those classed by Heer and Schmalhausen with *Samaropsis*, and I have introduced them as such in my list of Lower Gondwána fossils at the beginning of this Memoir (p. 56).

But there is not the slightest indication with what plant they might be brought in connection. They are known from the Karharbári beds (this Vol., Pls. XXIV, fig. 5; XXX, 11-13) in the Karharbári coalfield where there are some coniferous plants as *Euryphyllum*, *Voltzia* and *Albertia*, but there is no reason whatever to class them with any of these.

In the Raniganj group of the Raniganj coalfield (Pl. XLVII*A*, 14, 15) and Sátpura basin (Pl. XLVII*A*, 9, 10) where these seeds also were met with, they are not associated with any coniferous plants, and the same is the case with those from the Panchet group (Pl. XLVII*A*, 11-13) of the Raniganj coalfield; so that their classification with *Samaropsis* has hardly any other value but that of reference; they are, however, so far of importance, as analogous seeds occur under similar uncertain circumstances in the jurassic flora of Eastern Siberia and the Amúr countries, of the Altai, the Tunguska river, and of the Petschora country.

There are some other indeterminable small seeds known from the Karharbári beds (Karharbári coalfield), and from the Raniganj group from the South Rewah basin and the Nágpur area.

There is also a larger seed from the Karharbári beds at Passerabhia, Karharbári coalfield, which I have described as *Carpolithes milleri* (after its first discoverer); it is very characteristic[1] in form, but I could not fix its place with certainty, although from its occurrence in association with numerous specimens of *Nöggerathiopsis* I thought it might eventually be assigned thereto.

This supposition seems to be corroborated by the circumstance that in a collection of plants recently made by Mr. Hughes in the South Rewah basin, which have to be looked on as of Karharbári beds, there are very fine leaves of *Nöggerathiopsis* (predominant), and together with these are about nine specimens of this very same fruit.

Stems of coniferous plants.

Sir Ch. Bunbury in his paper on fossil plants from Nágpur[2] figured also a fragment of a stem "distinctly marked with numerous, small, roundish, dot-like leaf-scars," and he says about its position:—

"This fragment is perhaps technically referable to *Knorria*, and may have belonged to a *lycopodiaceous* plant; but its appearance is so strikingly like that of a small branch of a Spruce-fir stripped of its leaves, that, in the absence of any positive evidence to the contrary, I am strongly inclined to believe it to be *coniferous*."

There is a small fragment of the same kind of stem in our collections, and from the same locality, *viz.*, Mángli, south of Nágpur; from the disposition of the scars it appeared to me to belong to the coniferous, and I even thought myself justified in referring it to *Palissya*.[3]

Three other fragments of stems are figured on Pl. XLVII*A*, figs. 5, 7, of my present paper. They are from the Ironstone shales of the Raniganj coalfield. These also I suppose to be coniferous stems, and my supposition is strengthened by their analogies.

[1] See this Volume, *ante*, p. 59, Pl. XXX, fig. 14.

[2] Qr. Jour. Geol. Soc., Vol. XVII, p. 340, Pl. XII, fig. 1.

[3] Rec. Geol. Surv. of Ind., Vol. X, pt. 1, p. 26.

The fragments are not very large, but they distinctly show on their surface small rhomboidal or obovate scars, which are placed in a distinct regular quincunx; there is no doubt that they are the scars of fallen-off leaves.

A portion of a quite similar stem was figured by Prof. Schmalhausen in his paper so often mentioned (Pl. VIII, fig. 12), and classed by him with the coniferæ as a stem of *Rhipidopsis gingkoides*.

But in our case there is again the unfortunate circumstance that these stem fragments do not occur with any other plants but *Glossopteris*, with which these stems cannot be brought into any relation, and from their analogy we have to refer them, though still with some uncertainty, to the *coniferæ*.

ANIMALIA.

The remains of animals are rather rare in the Lower Gondwánas—one group only, *viz.*, the Panchet group of the Raniganj group, yielded animal remains in somewhat greater numbers. Most of them have already been described in various papers; and as there is nothing new to be added to these descriptions, I shall quote the names only with the necessary references to the literature as to horizon and locality. Their names are introduced here only because they occur together with the Flora.

CRUSTACEA.

Genus: ESTHERIA,[1] Straun.

Specimens of *Estheria* are locally very numerous, although geographically only limited.

ESTHERIA MANGALIENSIS,[2] Jones.

1862. Jones: Monograph of fossil Estheriæ (Palæontographical Society), 1862, p. 78, Pl. II, figs. 16—23.
1876. Prof. Geinitz: Rhätische Pflanzen und Thierreste der Argent. Republik (Palæontographica Cassel, 1876). Pl. I, figs. 1—6, p. 3.

Locality and horizon.—Very numerous in the red shales at Mángli, about 30 miles south of Nágpur.

There occur two kinds of *Estheria* at this place, one of a larger size, which was described with the above name. The smaller kind was not specifically named, but is in so far of interest, as it appears to be the same as the *Estheria* occurring in the Panchet rocks of the Raniganj coalfield (near Maitúr, north-west of Assensole), and in the beds near Kawarsa in the Wardha Valley coalfield.

In a paper on the occurrence of *Estheria* in the Gondwánas[3] I tried to establish the view that, from the common occurrence of the smaller kind of *Estheria*

[1] Proper name.
[2] Mangali = locality.
[3] Rec. Geol. Surv. of India, Vol. X, pt. 1, pp. 26—29.

in the Panchet rocks, the Mángli shales, and at Kawarsa (coupled with the rare occurrence of other fossils at all of them), the respective beds might be considered as on the same horizon. There seem, however, to be some reasons for considering the beds at the two latter places to be somewhat older than Panchets.

PISCES.

The only remains of fishes in the Lower Gondwána system are scales of ganoid fishes; they are, however, very rare.

They were first mentioned by the late Rev. Mr. Hislop[1] in his paper on the Nágpur Sandstone and Coal, when he also mentions "Jaws of ganoid fishes." One or two specimens of scales are amongst the collections of the Geological Survey, and they are also referred to by Mr. Lydekker[2] in his paper on fossil Reptilia and Batrachia. They are from Mángli.

BATRACHIA.

LABYRINTHODONTIA.

GONIOGLYPTUS[3] LONGIROSTRIS,[4] Huxley.

1865. Huxley: Vertebrate fossils of the Panchet rocks, Pal. Ind., Ser. IV (Vol. I), p. 8.
1879. Lydekker: *ib.*, Vol. I, pt. 3, p. 17, Pl. III, figs. 14, 15.

Locality and horizon.—Panchet group, near Deoli, south-west of Assensole, on the Damuda river, Raniganj coalfield.

PACHYGONIA[5] INCURVATA,[6] Huxley.

1865. Huxley, *l. c.*, p. 6.
1879. Lydekker, *l. c.*, pp. 18, 19.

Locality and horizon.—The same as above.

BRACHYOPS[7] LATICEPS,[8] Owen.

1855. Owen: Qu. Journ. Geol. Soc., Vol. XI, p. 37, Pl. II.

Locality and horizon.—Shales at Mángli.

[1] Qu. Journ. Geol. Soc., Vol. XVII (1861), p. 347.
[2] Indian pre-tertiary Vertebrata, Pal. Ind. (Ser. IV), Vol. I, pt. 3, 1879, p. 36.
[3] Gonia (Gr.) = angle; glyptus (Gr.) = sculptured.
[4] With a long snout.
[5] Pachys = thick; gonia = angle.
[6] Incurved.
[7] Brachys = short; ops (Gr.) = face.
[8] With a broad head.

ARCHEGOSAURUS[1] (?) sp. (?)

1864. Journ. As. Soc., Vol. XXXIII, pp. 336, 442.
1873. Dr. Oldham: Rec. Geol. Surv. of India, Vol. IV, p. 79.
1873. H. B. Medlicott: Mem. Geol. Surv. of India, Vol. X, p. 159.
1875. H. F. Blanford: Qu. J. Geol. Soc., London, Vol. XXXI, p. 522.
1879. Lydekker: Pal. Ind., IV, 3, p. 36.
1879. Feistmantel: Rec. Geol. Surv. of Ind., Vol. XII, pp. 76, 78.
1880. Lydekker: J. A. S. B., Vol. XLIX, p. 16.

This interesting fossil, of which there is, however, only a cast in the collection of the Geological Survey, was picked up by Major Gowan, west of Barikondam, below the Pachmari plateau, close to the village Bijori, in beds, which hereafter were introduced by Mr. H. B. Medlicott as the Bijori horizon (*l. c.*). The fossil has not been figured or described, nor I think identified with certainty; but the prevalent view is that it belongs to *Archegosaurus* (see Lydekker, *l. c.*, 1880).

Locality and horizon.—Bijori horizon (=Raniganj group), near Bijori and Barikondam, in the Sátpura basin.

REPTILIA.

DINOSAURIA.

ANKISTRODON[2] INDICUS, Huxley.

1865. Huxley, *l. c.*, p. 11.
1879. Lydekker, *l. c.*, p. 17.

Locality and horizon.—Panchet group, near Deoli, south-west of Assensole, in the Damuda river, Raniganj coalfield.

DICYNODONTIA.

DICYNODON[3] ORIENTALIS,[4] Huxley.

1865. Huxley, *l. c.*, p. 8 et sequ.
1879. Lydekker, *l. c.*, pp. 1-16, Pls. I, II, III, figs 1-11.

Locality and horizon.—Same as above.

This reptile is the most frequent animal fossil of the Lower Gondwánas.

Insect wing.—I mention here only for the sake of completeness a fragment of an apparently hymenopterous insect wing, which I disclosed in a piece of Talchir shale from the Kuraun (Deoghur) basin. Its fragmentary condition must frustrate any attempt of identification.

[1] The ancient saurian. Archegos (Gr.) = the ancestor; sauros (Gr.) = the saurian.
[2] Ankistron = a hook; odus = a tooth.
[3] Dis = twice; kyon = dog; odus = tooth.
[4] Orientalis = Orientale.

General Remarks.

With this memoir the description of the Flora of the Lower Gondwánas, which was begun with the Talchir-Karharbári flora (see first part of this volume), is concluded, so far as based on the collections made up to 1880.

There is other material of Gondwána plants collected in 1880 and 1881 in South Rewah basin (by Mr. Hughes) and in Káranpúra and Aurunga coalfields (by myself), but they could not be comprised within the present volume, and will be published in two subsequent fasciculi.

As most of the general relations of the Gondwána system have been treated of in Volume I of the Manual of the Geology of India, there is no need to repeat them here, and I shall restrict my remarks to the palæontological relations of the Lower Gondwánas and their probable correlations.

1. The fossils of the Lower Gondwánas consist of animals and plants.

2. The animals are by far the smallest portion of the fossils, and represent fresh-water and land animals only.

3. The land animals are represented by remains of *Batrachia* (Labyrinthodontia) and *Reptilia* (Dinosauria and Dicynodontia). The relations of these animals were lately discussed by Mr. Lydekker.[1]

The most frequent were remains of *Dicynodontia* in the Panchet group, by which this group can best be correlated with the Stormberg beds of the Karoo formation of South Africa.

4. The fresh-water animals are represented by very rare and fragmentary fish remains, and locally numerous remains of bivalved crustacea, one of which has been identified in Rhatic beds in South America.

5. Plant remains are very numerous, especially as regards specimens. They represent *Equisetaceæ*, *Filices*, *Cycadeaceæ*, and *Coniferæ*.

The *Equisetaceæ* are represented by four very characteristic genera: *Vertebraria*, *Schizoneura*, *Phyllotheca*, and *Trizygia*, the relations of which were discussed at the respective chapters (see especially *ante*, pp. 73-74). *Vertebraria* and *Phyllotheca* are also numerous in the New Castle beds in Australia.

The *Filices* are very numerous and contain especially representatives of single leaves with net venation. The most interesting of these are *Gangamopteris* and *Glossopteris*, both of which are common to India and Australia, but in a reverse proportion—in India, *Gangamopteris* appears in the bottom beds of the *Gondwána* system, and is here at once very numerous, while *Glossopteris* is subordinate and finds its greatest development in the beds above the Talchir and Karharbári beds; in Australia, on the other hand, *Glossopteris* has its greatest development in the New Castle beds (upper coal-measures), where *Gangamopteris* is rare, while the latter genus has its greatest development in the Bacchus-Marsh beds in Victoria,

[1] Sketch of the history of the fossil vertebrata of India, Jour. As. Soc. Bengal, Vol. XLIX, pp. 12-14.

which are held by the Australian Geologists (W. B. Clarke, C. S. Wilkinson, Mc'Coy, etc.) to be higher than the New Castle beds, and on about the horizon of the Hawkesbury beds in New South Wales (above the New Castle beds). It is, however, necessary to state that these two genera are the most frequent of ferns in the two countries in the respective beds.

Some other ferns (such as *Cyathea*, *Dicksonia*, *Asplenium whitbyense*, *Meri-anopteris*, *Neuropteridium*, *Macrotæniopteris*, *Oleandridium*, *Angiopteridium*, *Pecopt. concinna*, etc.) are related to mesozoic forms in Asia and Europe, and have hardly any representatives in the flora of the Australian coal-measures, except in those belonging to "secondary formations."

Again, some other ferns are local types, such as *Alethopteris phegopteroides*, *Belemnopteris*, and *Palæovittaria*, which are especially interesting on account of their relations to living forms.

The *Cycadeaceæ* are well enough represented in the Lower Gondwánas by characteristic forms; one genus (*Nöggerathiopsis*) is also known from Australia and here already from carboniferous beds, and passes with a very closely related form (*Rhiptozamites*) into the jurassic flora of the Altai and the Tunguska river in Siberia.

The other three genera—*Pterophyllum*, *Anomozamites*, and *Glossozamites*—have mesozoic affinities, and excepting the *Otozamites*, which I have described from the jurassic beds of Queensland, no *Cycadeaceæ* (Zamieæ) of this kind are hitherto known from Australia.

Of the coniferous plants occurring in the Lower Gondwánas none has any representatives in Australia; on the contrary, all of them have relations in mesozic formations of Asia and Europe. Thus *Rhipidopsis* is in the jurassics of the Petschora country; *Cyclopitys* is from the Jura of the Altai and Tunguska river (Siberia); our *Voltzia* is in the Trias in Europe (though the genus is also known from upper permian beds in Hungary).

Some of the seeds, especially those referred to *Samaropsis*, have their relations in the jurassics of Siberia and the Amúr countries.

6. I would now arrive at the point when mention should be made of the age of the Lower Gondwánas. This question also has been discussed in the Manual of Indian Geology, and I shall add only a few short remarks. I shall not endeavour to fix the age of the various groups (as I would do it only for my own satisfaction), but shall indicate the approximate position of the whole fossiliferous portion of the Lower Gondwánas, by fixing with the most possible probability (from the information at present available) the position of the lowest groups, *viz.*, of the Talchir-Karharbári beds.

I would also state that I do not any longer take such a pessimistic view of this point as five years ago when I wrote my papers in the Records on this subject, thinking my view the only correct one; and I frankly confess that if at that time I had been acquainted with the relations of the respective Australian deposits as at present,

the unpleasant disagreement of opinions of those days would not have appeared. As, however, it did occur, I would explain briefly how the matter stands at present.

When I wrote my first paper in the Records[1] on the flora and probable age of the Damuda formation, I was entirely averse to any correlation of our Damuda series which I considered lower mesozic with the lower coal-strata of Australia which are carboniferous (*l. c.*, p. 68), and I explained the occurrence of *Glossopteris* in both by its having originated in the latter and survived into the former. When I wrote that paper the Karharbári beds were still classed as Barákars.

In a paper in the same number of Records Mr. W. T. Blanford urged from good reasons the connection of the upper coal-measures in Australia with the lower coal-measures (acknowledged of palæozoic age), in which he was, as will be seen hereafter, entirely correct, although a strict correlation of the Damuda with the upper coal-measures (New Castle beds in Australia) cannot apparently be maintained.

In a subsequent paper (*l. c.*, part 4) I again tried to disprove the connection of our Damuda with the lower coal-measures, admitting a comparison with the upper portion only; I wrote on page 124 (*l. c.*): "Our Damuda flora (then including the Karharbári beds) could at all events only be compared with the upper portion, and only through the *Glossopteris* and *Vertebraria*, our flora being much more numerous;" and in the tabular list (p. 125) I placed against our division "Damuda group" all those beds in Australia, which I comprised under the heading "Upper coal-measures," according to the communications of the late Mr. W. B. Clarke. This was, as I shall show presently, not quite correct, especially with regard to the Bacchus-Marsh sandstones and the mesozoic beds (Bellarine beds) in Victoria, New South Wales, and Queensland.

Soon afterwards[2] I received a communication from Mr. C. S. Wilkinson regarding the position of the Bacchus-Marsh beds with their numerous representatives of *Gangamopteris*.

At the same time the coal beds of Karharbári[3] were separated from the Damuda series and classed closer with the Talchir shales within the Talchir division; and when writing my Memoir on the Talchir-Karharbári flora (see this volume, No. 1) I duly took notice of the communication received about the position of the Bacchus-Marsh beds and the consequent effect of the same upon the correlation of our Damuda series.

In this connexion I especially refer to pp. 31 and 32 of the Talchir-Karharbári flora (this volume, part 1), where I quote a passage from Mr. C. S. Wilkinson's above-mentioned letter, and where I show that our Talchir-Karharbári beds can best be correlated with the Bacchus-Marsh beds. I already then pointed to the probability (p. 32) that the Damuda flora is on a higher horizon than the New Castle beds

[1] Vol. IX, pt. 3, 1876, p. 67 et sequ.

[2] September 1877.

[3] W. T. Blanford: Rec. G. S. of I., Vol. XI, pt. 1, p. 145.

flora, although I was not at the time aware of the possible correlation of the Bacchus-Marsh beds with the Hawkesbury beds.

I expressed this view more distinctly in my communications to the late Mr. W. B. Clarke, who embodied them in the fourth edition of his "Remarks on the sedimentary formations in New South Wales, 1878; in the tabular list, pp. 159-162, the sequence of the strata is clearly shown, when the Bacchus-Marsh beds are placed above the New Castle beds, and on page 163 there is in two columns my statement about the correlation of the Bacchus-Marsh beds with the Talchirs, in relation to the New Castle beds and the Damuda series; it stands thus:

AUSTRALIA.	INDIA.
	III. Damuda Coal-bearing strata with *Glossopteris, Phyllotheca, etc.*
Bacchus-Marsh beds with *Gangamopteris.*	Talchir group with *Gangamopteris.*
II. New Castle beds with *Glossopteris, Phyllotheca, Vertebraria, etc.*	
I. *Glossopteris, Phyllotheca,* etc., with marine animals, etc., in New South Wales.	

The numbers I, II, III indicate the three different stages of the flora with *Glossopteris.*

I did not directly refer here to the Hawkesbury beds, but by classing the New Castle beds directly below the Bacchus-Marsh beds, I have indirectly correlated the latter with the Hawkesbury beds which overlie the New Castle beds.

In a footnote on p. 165 (*l. c.*) there is a passage from my letter with regard to the age of the New Castle beds, saying that I do not see "any objection to consider these New Castle beds as terminating the Palæozoic epoch in Australia, but after which only *Glossopteris* spread out to India and Africa."

In a short paper on the Australian flora in the Geological Magazine, 1879, I pointed (p. 488) to the same relations of the Bacchus-Marsh beds and New Castle beds.

Up to this time I had no distinct knowledge about the relations of the Hawkesbury beds and their correlations. In subsequent letters, however, Mr. C. S. Wilkinson communicated to me his observations on a certain boulder bed in the Hawkesbury beds, apparently due to ice action, which he compared with a similar deposit in the Bacchus-Marsh beds, thus correlating these two deposits from this point of view; as, however, the Bacchus-Marsh beds already were previously correlated by myself from a palæontological point of view with the Talchir-Karharbári beds, of which the former are underlaid by a boulder bed of similar relations, the occurrence of a similar phenomenon in the Bacchus-Marsh beds would further corroborate this correlation, and would also involve a correlation with the Hawkesbury beds. These new additions to our knowledge of the stratigraphical relations

appear to solve the difficult question of the correlation of the Indian and Australian plant beds; and in a short paper in a late number of the Records (Vol. XIII, pt. 4, 1880) I quoted the several passages from Mr. C. S. Wilkinson's letters to me as well as from his paper on this subject, and drew up a list showing the sequence and correlation of the various beds, based upon all this new information.

The flora of the New Castle beds retains, however, entirely its former character, although through the above-mentioned correlation of the Hawkesbury boulder bed with the Bacchus-Marsh conglomerates it has to be relegated into the Palæozoic epoch, but yet as distinct from the lower coal-measures which are carboniferous. This was also only recently illustrated by Mr. C. S. Wilkinson in the Annual Report, Department of Mines, New South Wales, for 1879, where there is (page 226) a list[1] of the formations in that colony, classing the Wianamatta-Hawkesbury series as triassic, the New Castle beds as permian, and the lower coal-measures as carboniferous.

It is only just to mention here that the late Mr. W. B. Clarke in his papers on New South Wales Geology always advocated the palæozoic age of the New Castle beds (upper coal-measures), and that Mr. W. S. Blanford followed his view, which had the necessary consequence that the Indian coal beds (Damuda series), the flora of which was by the latter and by other authors correlated with that of the Australian coal-strata, would have to be considered as of the same age.

I took the opposite course, considering the Indian coal beds as triassic; and having to correlate them with the Australian upper coal-measures (not then knowing the relations of the Bacchus-Marsh and Hawkesbury beds), I advocated a like age for these upper Australian coal-measures, removing them at the same time from the lower coal-measures.

The abovementioned more recent observations remove now these difficulties to a considerable extent, helping to fix with great probability the position of the Lower Gondwánas; for, taking into consideration the correlation of the Talchir-Karharbári beds with the Bacchus-Marsh beds, and of these latter with the Hawkesbury beds, which overlie the New Castle beds, and considering these latter as permian while the two former are considered as lower mesozoic, then the age of our Lower Gondwánas will have to be approximately the same.

To fix the horizons of the various groups of the Lower Gondwánas within the Lower Mesozoic epoch, is, although I tried it once before, of no actual necessity here.

[1] This list refers to the sequence of formations, according to which the palæontological specimens from New South Wales were arranged at the Sydney Exhibition.

APPENDIX.

1. List of fossils according to the horizons, with reference to the figures.

As the plant fossils were described here collectively from the several groups, I think it will be useful for easier reference to give here lists of the fossils occurring in the various groups separately. This has, however, reference only to the second number of this Volume (III), the Damuda-Panchet Flora,[1] as in the first number, the Talchir-Karharbári Flora, the separation is by itself enough conspicuous.

a. BARÁKAR GROUP.

Schizoneura gondwanensis, Feistm. Lumki Hill, Karharbári coalfield (the specimens figured in No. 1 of this Volume, Pl. I, figs. 2, 3); also Auranga coalfield.

Trizygia speciosa, Royle. Talchir coalfield (see Pls. XI*A*, figs. 2, 9; XII*A*, 2); Bokaro coalfield; Auranga coalfield.

Vertebraria indica, Royle. Most of the coalfields; specimens figured from the Raniganj coalfield (Pls. XIII*A*, figs. 1, 2, 4, 8; XIV*A*, figs. 1, 4).

Cyathea, comp. *Tchihatcheffi*, Schmalh. Talchir coalfield (Pl. XVI*A*, figs. 1, 2, 3).

Sphenopteris polymorpha, Feistm. Lumki Hill, Karharbári coalfield.

Macrotæniopteris feddeni,[2] Feistm. Auranga coalfield (a portion figured in R. G. S. of India, XIV, pt. 3).

Macrotæniopteris danæoides, Royle s. p. Rájmahál area near Burgo (Pl. XXI*A*, fig. 2); also Auranga coalfield.

Angiopteridium (?) *infarctum* n. s.p. Raniganj coalfield (Pl. XXXIV*A*, figs. 4, 5).

Glossopteris communis, Feistm. Widely distributed; specimens figured from Raniganj coalfield (Pl. XXXII*A*, fig. 2); Talchir coalfield (Pl. XXXVIII*A*, fig. 2).

Glossopteris communis, var. *stenoneura*, Feistm. Raniganj coalfield (Pls. XXX*A*, fig. 3; XXXIII*A*, fig. 1); also Káranpúra coalfield.

Glossopteris intermittens, Feistm. Raniganj coalfield (Pl. XXXIII*A*, figs. 2-4).

Glossopteris indica, Schimp. Talchir coalfield (Pls. XXIX*A*, fig. 7; XXXVIII*A*, 4); also in Raniganj, Káranpúra, Auranga and Tatapáni coalfields.

Glossopteris browniana, Bgt. Talchir coalfield (Pl. XXIX*A*, figs. 1-2); also Raniganj and Ramkola-Tatapáni coalfields.

Glossopteris damudica, Feistm. Raniganj coalfield (Pls. XXXI*A*, figs. 1-3; XXXII*A*, 1); Talchir coalfield (Pl. XXX*A*, 2); also Auranga coalfield and Ramkola-Tatapáni coalfields.

Glossopteris angustifolia, Bgt. Talchir coalfield (no specimens figured).

[1] I shall also take in here those fossils which were received since the first part of this number was written from the South Rewah basin, the Káranpúra and Auranga coalfields.

[2] This has not been figured here from this group, but the figures of the Kámthi specimens can safely be used for comparison.

Glossopteris conspicua, Feistm. Auranga coalfield (not figured).

Gangamopteris cyclopteroides, Feistm. Shápur coalfield (horizon not quite certain).

Anomozamites (balli, n. sp.). Auranga coalfield (recently collected by myself and two specimens figured in R. G. S. Ind., Vol. XIV, pt. 3).

Nöggerathiopsis hislopi, Feistm. Umrét coalfield (Pl. XLVI*A*, fig. 3); also Ramkola-Tatapáni coalfield.

Rhipidopsis, comp. *gingkoides*, Schmalh. Auranga coalfield (one leaf figured in R. G. S. Ind., Vol. XIV, pt. 3).

Cyclopitys, Schmalh. (dichotoma, n. sp.). Auranga coalfield (one leaflet figured in R. G. S. Ind., Vol. XIV, pt. 3).

b. IRONSTONE SHALES.[1]

Equisetaceous stems (Jainagur). South Káranpúra coalfield.

Macrotæniopteris dancœoides, Royle, *Ibid.*

Glossopteris communis, Fstm. (Kulti). Raniganj coalfield and South Káranpúra coalfield.

Glossopt. indica, Schimp. South Káranpúra coalfield.

Glossopt. retifera, Fstm. *Ibid.*

Glassopt. damudica, Fstm. Raniganj coalfield (Pl. XXX*A*, fig. 1); South Káranpúra coalfield.

Glossopt. conspicua, Fstm. South Káranpúra coalfield.

Glossopt. angustifolia, Bgt. *Ibid.*

Insect-wing-like fossil. Raniganj coalfield (Pl. XVI*A*, *bis*. fig. 7).

Nöggerathiopsis hislopi, Fstm. South Káranpúra coalfield.

Coniferous stems (Rhipidopsis?). Raniganj coalfield (Pl. XLVII*A*, figs. 5-7).

c. RANIGANJ GROUP.

(Comprising Kámthi group and Bijori horizon also)—

Schizoneura gondwanensis, Fstm. Raniganj coalfield very numerous (Pls. I*A*, II*A*, III*A*, figs. 1-2; IV*A*, 1-2; V*A*, VI*A*, VII*A*, 2; VIII*A*, IX*A*, stems); Jharia coalfield (Pl. IV*A*, fig. 3); Bokharo coalfield; Káranpúra, Auranga, Ramkola, Tatapáni, and Raigarh-Hingir coalfields; South Rewah basin; Sátpura basin, near Baricondam (Pl. III*A*, fig. 4).

Phyllotheca indica, Bunb. Raniganj coalfield (Pl. XII*A*, 6); Nágpur area (Pl. XII*A*, 3-5, 7-9).

Phylloth. robusta, Fstm. Rájmahál hills (Pl. XIV*A*, 1-2).

Trizygia speciosa, Royle. Raniganj coalfield (Pls. XI*A*, 1, 3, 4, 5-8; XII*A*, fig. 1); Sátpura basin; Sikkim (Dr. Hooker's quotation).

Vertebraria indica, Royle. In most of the coalfields. Specimens figured from Raniganj coalfield (Pls. XII*A*, figs. 10-11; XIII*A*, 3; XIV*A*, 2-3); South Godávari basin (Kunlácheru, Pl. XIII*A*, figs. 5-6).

Sphenopteris polymorpha, Fstm. Raniganj coalfield (Pls. XV*A*, XVI*A*, 3; XVI*A*, *bis* figs. 1-6).

Dicksonia hughesi, Fstm. Jharia coalfield (Pl. XXIII*A*, 1-3); Sátpura basin (Pl. XXIII*A*, 12, 13).

Asplenium whitbyense, Heer. Raniganj coalfield (Pl. XIX*A*, fig. 2); Jharia coalfield (Pl. XL*A*, 2-3).

Alethopteris (*Polypodium*) *lindleyana*, Royle. Raniganj coalfield (Pls. XVIII*A*, 2; XIX*A*, 3, 4; XXIII*A*, 11; XXXIX*A*, 10-11).

[1] Only a few of the fossils from this group were figured, most of them agreeing with the same figured from the other groups.

Alethopt. phegopteroides, Fstm. Raniganj coalfield (Pl. XVIII*A*, 1).

Merianopteris major, Fstm. Raniganj coalfield (Pl. XIX*A*, 9—11).

Macrotæniopteris danæoides, Royle. Raniganj coalfield (Pl. XX*A*, 1—3); Jharia coalfield (XXI*A*, fig. 1); Nágpur area; Aurunga coalfield.

Macrotæniopt. feddeni, Fstm. Nágpur area (Pls. XXI*A*, 3; XXII*A*, 1—4); South Rewah basin.

Palæovittaria kurzi, Fstm. Raniganj coalfield (Pl. XLIV*A*).

Angiopteridium, comp. *mcclellandi*, Oldh. and Morr. sp, Nágpur area (Pl. XXI*A*, figs. 4—7); also South Rewah basin.

Glossopteris communis, Fstm. Very widely distributed. The figured specimens are from Raniganj coalfield (Pls. XXIV*A*; XXIX*A*, 4; XXXV*A*, 1—3; XXXVI*A*, 1—2); Jhari coalfield (Pl. XL*A*, 4); South Rewah basin (Pl. XXIX*A*, 5, 9); Nágpur area (Pls. XXVI*A*, 1, 4; XXVII*A*, 1; XXXVII*A*, 3); Wardha Valley coalfield (Pls. XXXVII*A*, 4; XXXVIII*A*, 1).

Glossopt. communis, var. *stenoneura*. Raniganj coalfield (XXXVIII*A*, 5).

Glossopt. stricta, Bunb. Nágpur area (Pl. XXXVII*A*, 1, 2); Wardha Valley coalfield (Pl. XXXVIII*A*, 3).

Glossopt. (?) musæfolia, Bunb. Nágpur area (Bunb.)

Glossopt. indica, Schimp. Raniganj coalfield (Pls. XXV*A*, 3; XXXV*A*, 4); Nágpur area (Pls. XXVI*A*, 3; XXVII*A*, 3, 5); Wardha Valley coalfied (Pl. XXV*A*, 1, 2); Káranpúra coalfield.

Glossopt. browniana, Bgt. Raniganj coalfield (Pl. XXIX*A*, 3, 6, 8); South Rewah (Sohágpur, Pl. XL*A*, 5); Nágpur area (Pls. XXVI*A*, 2; XXVII*A*, 2); also Raigarh and Hingir coalfield; Wardha coalfield.

Glossopt. retifera, Fstm. Raniganj coalfield (Pls. XXVIII*A*, 2, 7, 10; XLI*A*, 9); Káranpúra coalfield; Ramkola coalfield; Sátpura basin.

Glossopt. conspicua, Fstm. Raniganj coalfield (Pl. XXVIII*A*, 1, 5, 6, 8, 9); also Káranpúra and Auranga coalfields.

Glossopt. divergens, Fstm. Raniganj coalfield (Pl. XXVIII*A*, figs. 3, 4).

Glossopt. damudica, Fstm. South Rewah basin (Pl. XL*A*, 6); also Ramkola coalfield; Sátpura basin; Nágpur area; Wardha coalfield; Káranpúra coalfield.

Glossopt. angustifolia, Bgt. Raniganj coalfield; (Pls. XXVII*A*, 6, 8, 9, 11—13; XXXIV*A*, fig. 3; XXXIX*A*, 1, 2); also in the Rájmahál hills; Ramkola coalfield; South Rewah basin; Sátpura basin; Wardha coalfield; Káranpúra coalfield; Auranga coalfield.

Glossopt. leptoneura, Bunb. Nágpur area.

Glossopt. formosa, Fstm. Raniganj coalfield (Pl. XXXIX*A*, 3—7); also in Káranpúra coalfield; Ramkola and Tatapáni coalfields.

Glossopt. orbicularis, Fstm. Raniganj coalfield (Pl. XLI*A*, 1, 2).

Gangamopteris anthrophyoides, Fstm. Raniganj coalfield (Pl. XXXIX*A*, 8).

Gangamopt. whittiana, Fstm. Raniganj coalfield (Pl. XLIII*A*, 1, 2).

Gangamopt. hughesi, Fstm. Nágpur area (Pl. XLIII*A*, 6—8).

Belepmopteris wood-masoniana, Fstm. Raniganj coalfield (Pl. XLIII*A*, 3—4).

Sagenopteris polyphylla, Fstm. Raniganj coalfield (Pl. XLI*A*, 3, 4).

Sagenopt. longifolia, Fstm. Raniganj coalfield (Pl. XL*A*, 1).

Sagenopt. (*?*) *rhoifolia*, Presl. Raniganj coalfield (Pl. XLII*A*, 2).

Actinopteris bengalensis, Fstm. Raniganj coalfield (Pl. XIX*A*, 1).

Anthrophyopsis (*?*) (sp. ?). South Godávari district (Pl. XLI*A*, 5).

Pterophyllum burdwanense, Fstm. Raniganj coalfield (Pl. XLVII*A*, fig. 1).
Nöggerathiopsis hislopi, Fstm. (Bunb. sp.) Raniganj coalfield (Pl. XLV*A*, 10, 11); South Rewah basin (XLV*A*, 1—5); Nágpur area (Pl. XLV*A*, 6—9).
Rhipidopsis densinervis, Fstm. South Godávari (Kunlácheru, Pl. XLVI*A*, 1, 2).
Voltzia heterophylla, Bgt. South Rewah basin (Pl. XLVII*A*, figs. 20, 22, 23); Raniganj field scale? (Pl. XLVII*A*, fig. 19).
Samaropsis winged seeds. Raniganj field (Pl. XLVII*A*, figs. 14-15); Sátpura basin (Pl. XLVII*A*, figs. 9-10).
Coniferous stem. Mángli, Wardha coalfield.
Estheria mangaliensis, Jones. Mángli, Wardha coalfield.
Estheria, smaller form. Mángli, Káwarsa (Wardha coalfield).
Scales of ganoid fishes. Mángli.
Brachyops laticeps, Owen. Mángli.
Archegosaurus (?) sp. *(?)* Sátpura basin, Bijori.

d. PANCHET GROUP.

Schizoneura gondwanensis, Feistm. Raniganj coalfield (Pl. X*A*).
Pecopteris concinna, Presl. Raniganj coalfield (Pl. XVII*A*, figs. 1-6).
Cyclopteris pachyrhachis, Göpp. Raniganj coalfield (Pl. XVII*A*, fig. 7).
Thinnfeldia, comp. *odontopteroides*, Feistm. (Morr. sp.) Ramkola coalfield. (Pl. XXIII*A*, figs. 7-9).
Oleandridium, comp. *stenoneuron*, Schenk. Raniganj coalfield (Pl. XIX*A*, figs. 5-8).
Glossopteris communis, Feistm. Raniganj coalfield; Ramkola coalfield.
Glossopt. indica, Schimp. Raniganj coalfield; Ramkola coalfield (Pl. XXIII*A*, fig. 10).
Glossopt. angustifolia, Bgt. Ramkola coalfield.
Samaropsis, winged seeds. Raniganj coalfield (Pl. XLVII*A*, 11-13).
Estheria (? mangaliensis, small form); Raniganj coalfield.
Gonioglyptus longrostris, Huxley. Raniganj coalfield.
Pachygonia incurvata, Huxley. *Ibid.*
Ankistrodon indicus, Huxley. *Ibid.*
Dicynodon orientalis, Huxley. *Ibid.*

2. Supplementary list of localities at which Lower Gondwána fossils were found.

Since I have written the list of localities in the first part of the present number (Damuda-Panchet Flora, see this Vol. No. 2, pp. 22-47), Lower Gondwána fossils have been collected at several new localities, which are not contained in that list. For the sake of completeness they are given now; I arrange the localities according to the groups. I also add a few localities which I have overlooked when writing my first list.

a. TALCHIR GROUP.

Numerous additions were made by myself to our collections of Talchir plants and also a new locality was added.

LATIAHAR hill, northern face of, opposite Panripura, Auranga coalfield.—(Feistmantel, 1881. New locality.)

Equisetaceous stalks.
Gangamopteris cyclopteroides, Feistm.
„ „ var. *subauriculata*.
„ „ var. *acuminata*.
„ „ var. *attenuata*.
„ „ var. *cordiformis*.
„ comp. *spathulata*, Mc'Coy.
Nöggerathiopsis hislopi, Feistm.
Samaropsis, winged seeds.

RIKBA, 2 miles, north-north-west of, Chano-basin, Káranpúra coalfield.

This locality was already mentioned before as below the junction of the Tordág and Lurunga streams. I only mention it, because I have brought recently very numerous specimens from here which will be figured and described in a subsequent fasciculus.

Quite lately Mr. Th. Hughes added a new locality from South Rewah:

ANUKPÚR, Sohagpur district. (Th. Hughes, 1881.)

Gangamopteris cyclopteroides, Feistm., and varieties.

b. KARHARBARI BEDS.

PASSERABHIA, No. 23D shaft, Karharbári coalfield (3rd seam). (Feistmantel, 1881.)

Equisetaceous stalks.
Gangamopteris cyclopteroides, Fstm.
Glossopteris communis, Fstm.
Nöggerathiopsis hislopi, Fstm. (Bunb. sp.)

DHAMNI, South Rewah, Sohágpur district, south-east of Pali, about 2 miles south-east of Khaira (Th. Hughes, 1881).

The fossils represent mostly—

Nöggerathiopsis hislopi, (Bunb. sp.) Fstm.
Carpolithes milleri, Fstm. This fruit which was already described by me from the Karharbári coalfield, and supposed to belong to *Nöggerathiopsis*, is here very numerous, also in company with this latter fossil.

c. BARAKAR GROUP.

ARAHURA (Joogra), Ghui river near, 1 mile south of Jugra, 11 miles south-west of Hazáribágh. (Feistmantel, 1881.)

Vertebraria indica, Royle.
Glossopteris indica, Schimp.
„ *communis*, Fstm.

BALUNAGUR, outlier of, at the north-east corner of the Auranga coalfield, (Feistmantel, 1881.)

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
Glossopteris sp.

BISHUNPUR river, 3½ miles south-east of Bálumáth, North Káranpúra coalfield. (Feistmantel, 1881.)

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
„ *comm.*, var. *stenoneura*, Fstm.
„ *indica*, Schimp.
Nöggerathiopsis hislopi, Fstm.
Squamæ.

JUGULDUGGA, south and south-east of, in the Auranga coalfield. (Feistmantel, 1881.)

Vertebraria indica, Royle.

MURUP, Sukree river, west of, Auranga coalfield. (Feistmantel, 1881.)

Vertebraria indica, Royle.

SUKREE RIVER, east of Rájbar, Auranga coalfield. (Feistmantel, 1881.)

Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Glossopteris communis, Fstm.
„ *indica*, Schimp.
„ *conspicua*, Fstm.
„ *damudica*, Fstm.
„ *angustifolia*, Bgt.

SUKREE RIVER, west of (and close to) Gurtúr, Auranga coalfield. (Feistmantel, 1881.)

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
„ *indica*, Schimp.
„ *damudica*, Fstm.
Macrotæniopteris feddeni, Fstm.
„ *dancæoides*, Royle.
Anomozamites (balli n. sp.)
Rhipidopsis, gingkoides, Schmalh.
Cyclopitys (n. sp. dichotoma).

d. IRONSTONE SHALES.

JAINAGUR, north of Ránchi and Pittoria, in the South Káranpúra coalfield, on the Naikoree river. (Feistmantel, 1881.)

Equisetaceous stems.
Macrotæniopteris danæoides, Royle.
Glossopt. communis, Fstm.
„ *indica*, Schimp.
„ *retifera*, Fstm.
„ *damudica*, Fstm.
„ *conspicua*, Fstm.
„ *angustifolia*, Bgt.
Nöggerathiopsis hislopi, Fstm.
Squamæ.

e. RANIGANJ GROUP.

BURGAON, 2 miles west of, in Ganéshpur river, North Káranpúra coalfield. (Feistmantel, 1881.)

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
„ *damudica*, Fstm.
„ *retifera*, Fstm.
„ *angustifolia*, Bgt.
Squamæ.

HARDI near, about 15 miles south-east-south of Sohágpur. (Th. Hughes, 1880.)

Vertebraria indica, Royle.
Glossopteris communis, Fstm.
Nöggerathiopsis hislopi, (Bunb. sp.) Fstm.
Voltzia heterophylla, Bgt.
Samaropsis (*?*) seeds.

JUGULDUGGA, inlier $1\frac{1}{4}$ miles north of; Auranga coalfield. (Feistmantel, 1881.)

Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Macrotæniopteris danæoides, Royle.
Glossopteris communis, Fstm.
„ *conspicua*, Fstm.
„ *angustifolia*, Bgt.
Squamæ.

KACHODHAR, about 11 miles west of Sohágpur. (Th. Hughes, 1880.)
Glossopteris communis, Fstm.

SHIRUVELI, east of the village; South Godávari district (W. T. Blanford, Rec. Geol. Surv. of India, Vol. IV, p. 114; 1871). This and the following were overlooked by me when writing my first list. Mention is made of—

Glossopteris (sp?)
Pecopteris (?)
Vertebraria.
Calamites (?)

SINGARAM, rocks near, South Godávari district. (W. T. Blanford, *l. c.* (1881), p. 109.)

Glossopteris (sp.)

TANDWA, Gurhee river, 2 miles south-east of Káranpúra coalfield. (Feistmantel, 1881.)

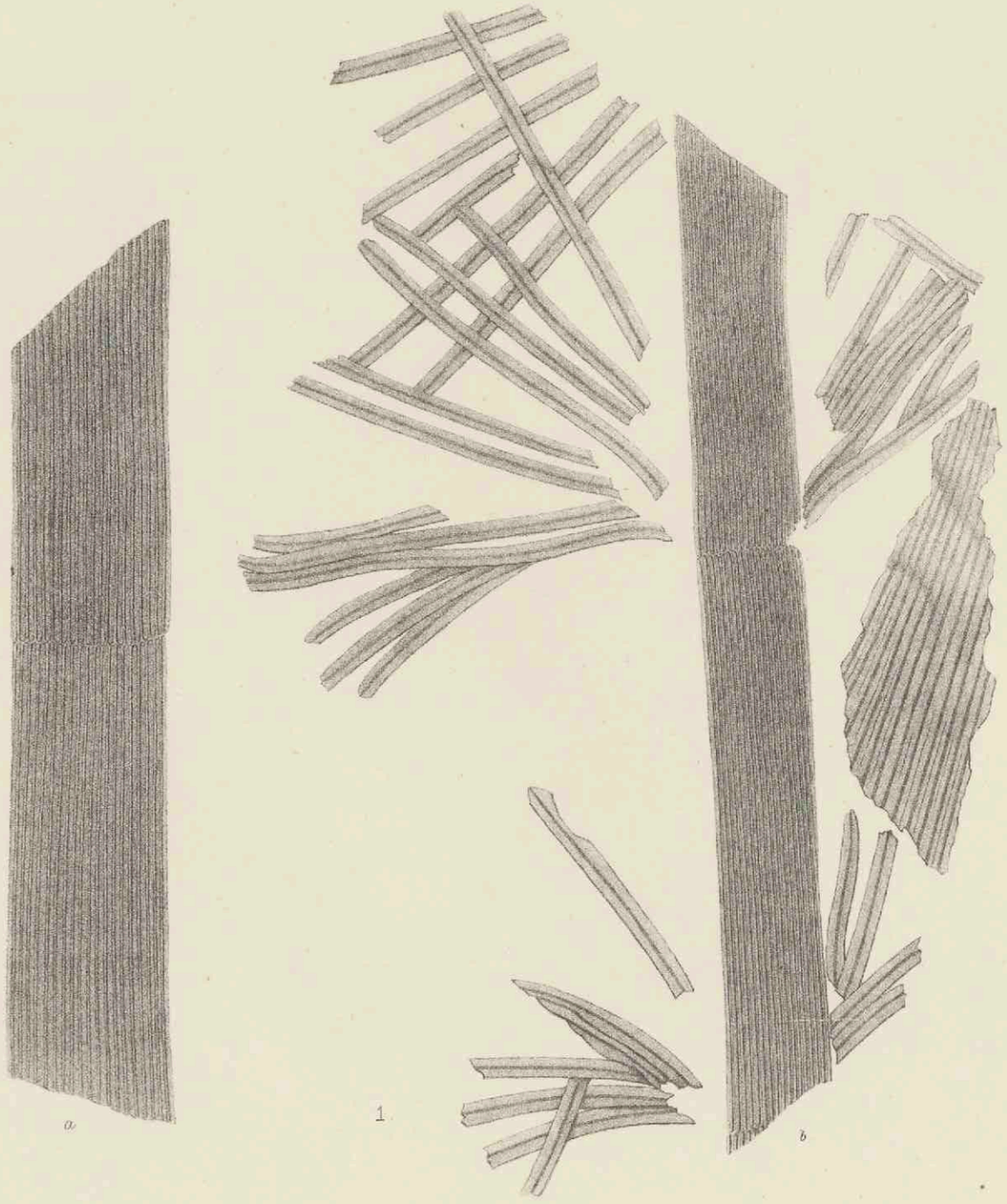
Schizoneura gondwanensis, Fstm.
Vertebraria indica, Royle.
Cyathea (?)
Glossopteris communis, Fstm.
„ *indica*, Schimp.
„ *conspicua*, Fstm.
„ *formosa*, Fstm.
Samaropsis ? winged seeds.

There are a few other fossils from some other localities in the South Rewah basin, which only arrived shortly, and have not been examined yet.

INDEX

(To the second part of Vol. III of the Gondwâna Flora.)

Names in italics indicate synonyms or species referred to for comparison.



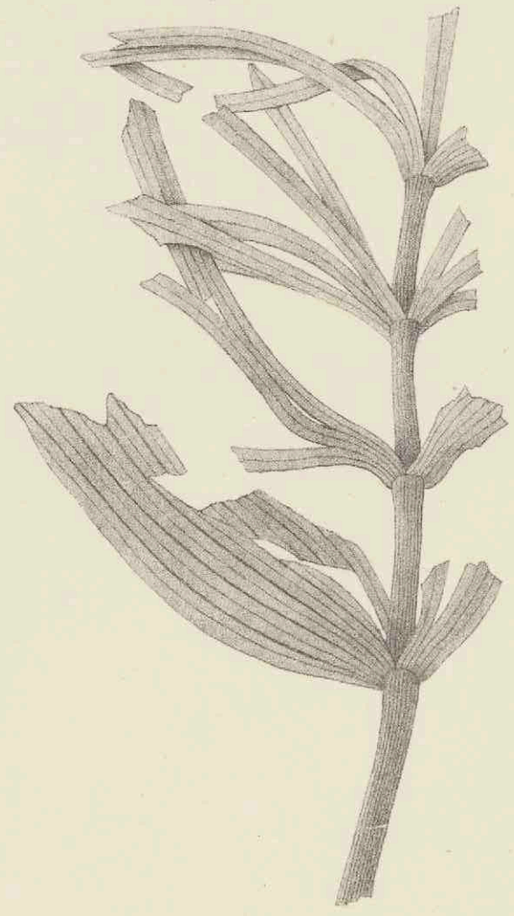


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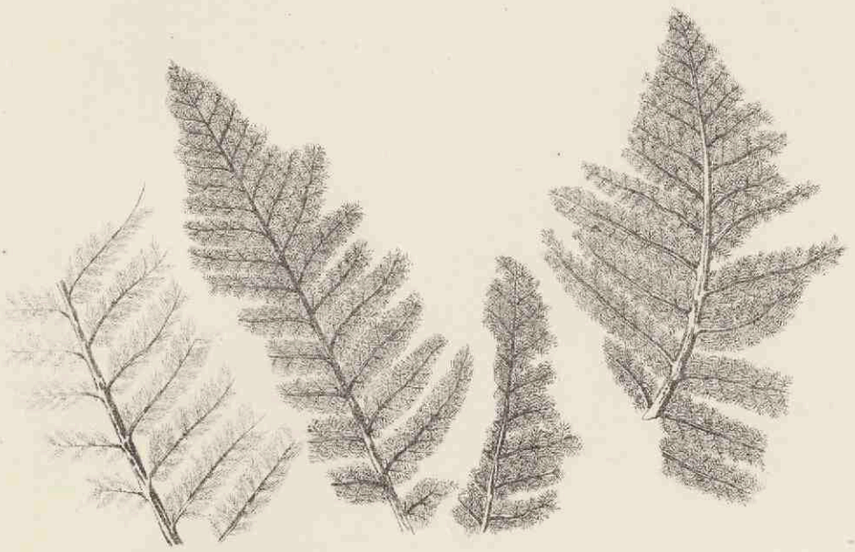
PLATE XVIIA.

PANCHET GROUP.

Figs. 1—6. PECOPTERIS CONCINNA, Presl., page 82. Various fronds of this peculiar fern, resembling so closely its European representative. The specimens show I think clearly that the frond was only bipinnate.

Fig. 7. CYCLOPTERIS PACHYRHACHIS, Göpp., page 84. The specimen is only fragmentary, but still I think sufficient for the above identification; the rhachis of the pinnæ is proportionally thick, the leaflets and the distribution of veins cyclopteroid.

All these specimens are from Maitúr, north-west branch of the Nunia river, north-west of Assensole, Raniganj coal-field.



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7.

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PLATE XVIII*A*.

RANIGANJ GROUP.

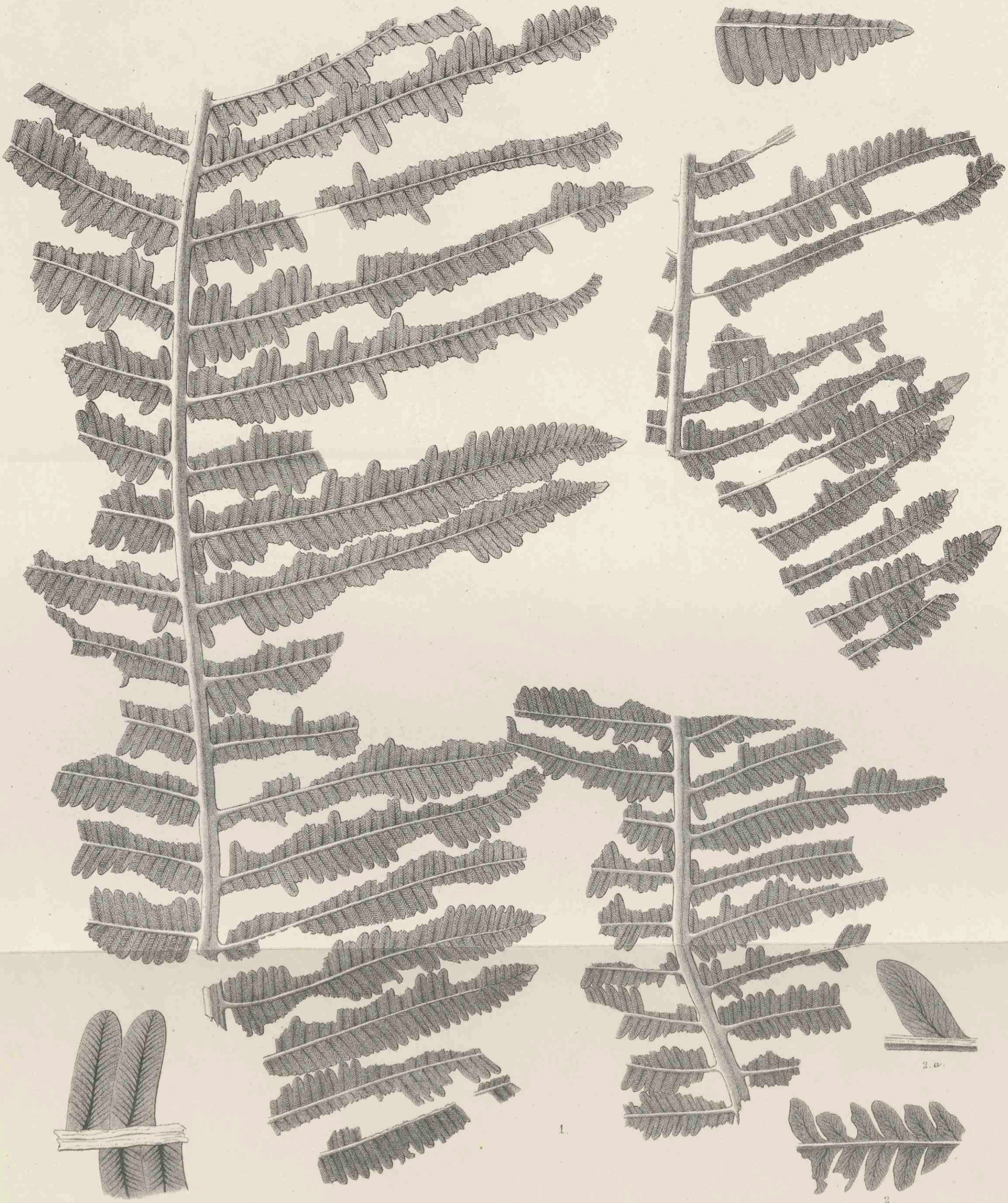
Fig. 1. ALETHOPTERIS PHEGOPTEROIDES, Feistm., page 81. Two fronds of this large and nice fern, the relation of which to the living *Phegopteris* is very conspicuous. The rhachis of the frond is traversed by a middle line, or better said, a thin longitudinal rib, although the draughtsman did it somewhat too regular. I believe them to bipinnate fronds; but even in this case they must have been of considerable size, as the preserved portions appear to be only about one-third of the entire length of the frond.

Figs. 1*a*. & 1*b*. Are enlarged portions of a pinna showing the venation of the pinnulæ.

Fig. 2. ALETHOPTERIS (Polypodium) LINDLEYANA Royle, page 8. A portion of a sterile pinna. It lies with the specimen figured on Pl. XIX*A*., fig. 4, on the same piece of shale.

Fig. 2*a*. Enlarged pinnula showing the venation.

These specimens are from the Raniganj coal-field.



1. a.

1.

2. a.

2.

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PLATE XIX*A*.

PANCHET GROUP.

Figs. 5—8. OLEANDRIDIUM, comp. STENONEURON, Schenk, page 92. Basal (figs. 5, 6) and apical (figs. 7, 8) portions of a tæniopteroid plant referable to the above species.

From near Maitúr, north-west branch of the Nunia river, north-west of Assensole, Raniganj coal-field.

RANIGANJ GROUP.

Fig. 1. ACTINOPTERIS (?) BENGALENSIS, Feistm., pages 114-115. One of the peltate leaves is almost entire, and there is a fragment of another one. The first one exhibits in the centre, what appears to be the point of attachment.

Fig. 1*a*. Shows a portion of the leaf enlarged.

Fig. 2. ASPLENIUM WHITBYENSE, Heer, page 79. Two pinnulæ. One enlarged in fig. 2*a*.

Figs. 3, 4. ALETHOPTERIS (Polypodium) LINDLEYANA, Royle, page 80. Two fragments of fertile pinnæ showing polypodiaceous fructification.

Figs. 9—ii. MERIANOPTERIS MAJOR, Fstm., page 84. Apical portions of pinnæ of the frond exhibiting distinctly the thin nature of the leaf substance and the character of the veins.

All these are from the Raniganj coal-field.

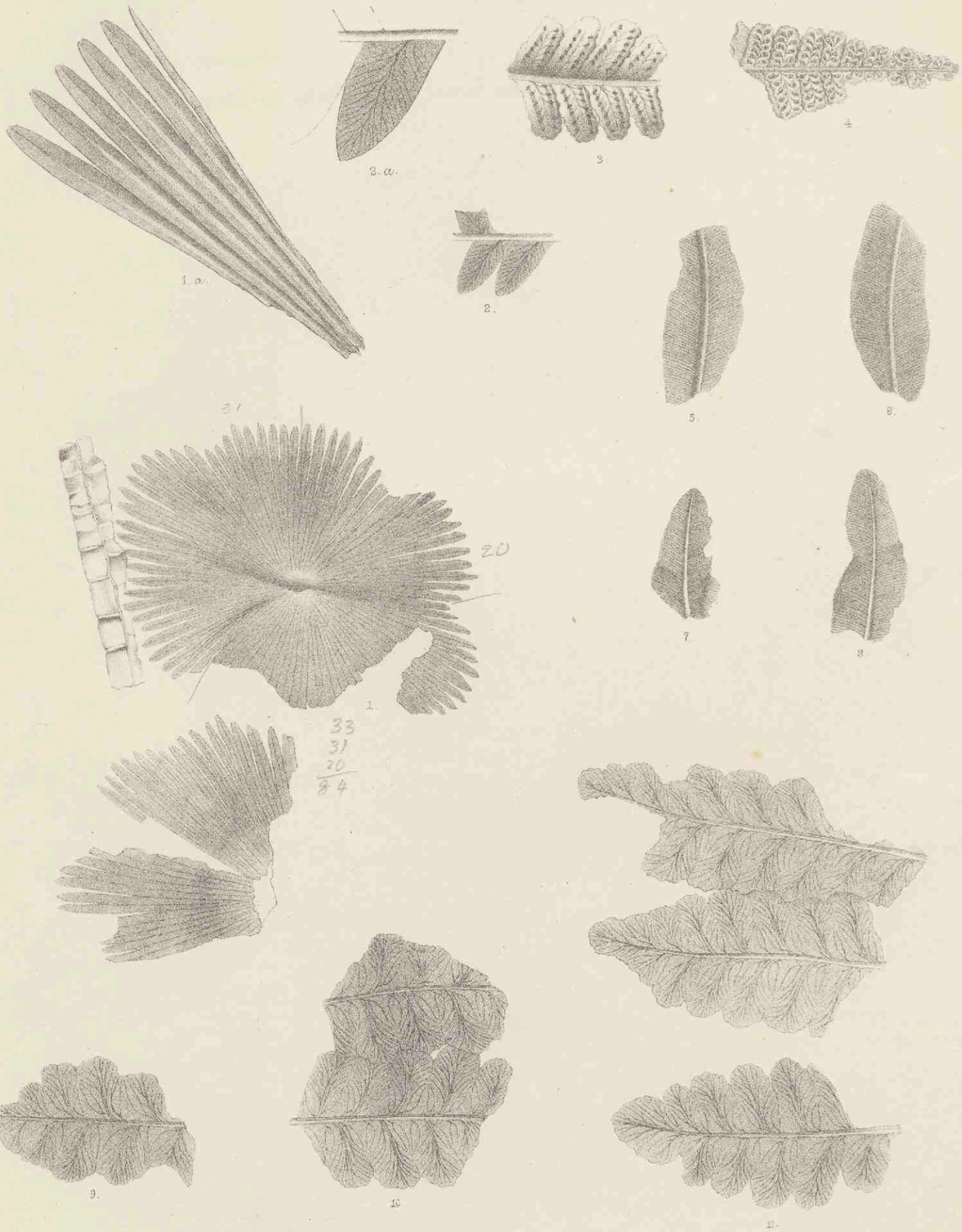

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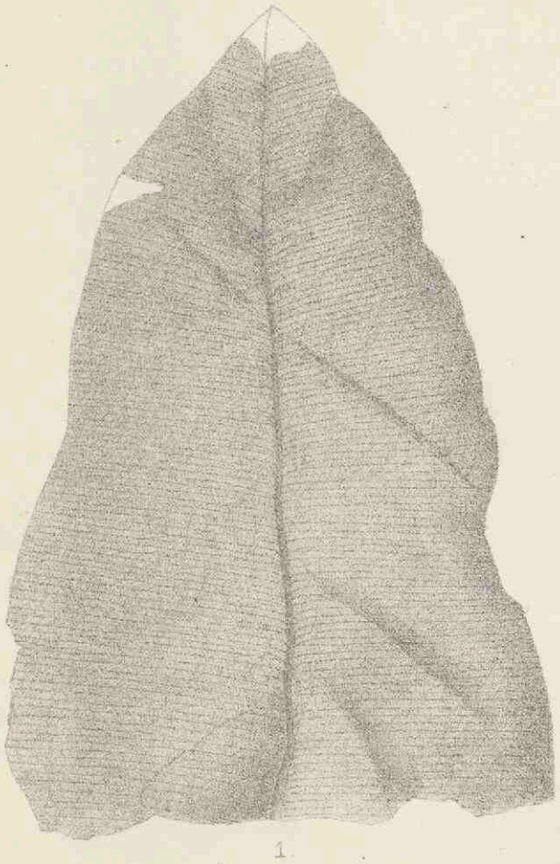
PLATE XX*A*.

RANIGANJ GROUP.

Figs. 1—3. MACROTÆNIOPTERIS DANÆOIDES, Royle, page 88. Portions (apical, middle, and basal) of the leaf, from which a good idea about its size and shape may be formed. The veins, single and forked alternating, are very widely distant, more than in any other species of this genus.

Figs. 1*a*, 3*a*. Enlarged portions showing the venation.

From near Raniganj, Raniganj coal-field.



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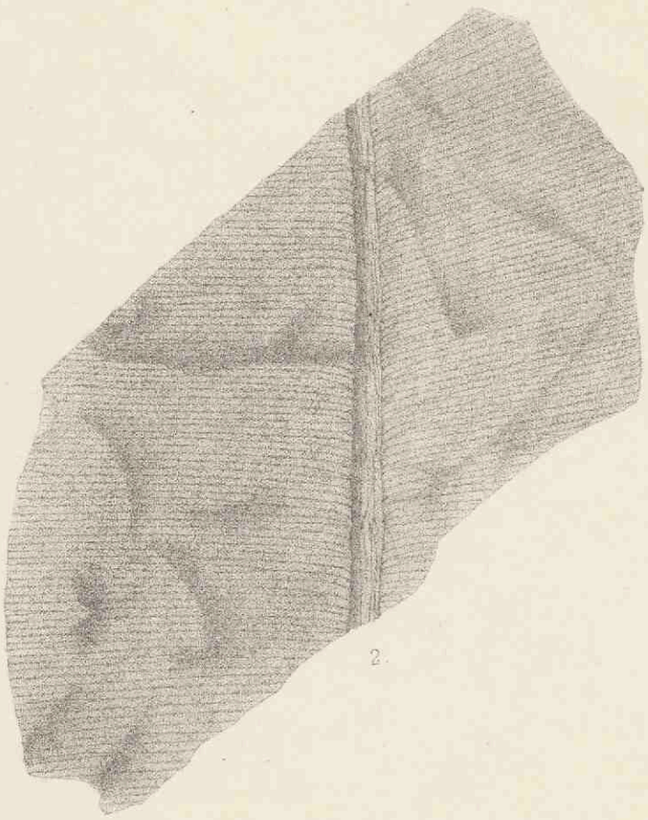

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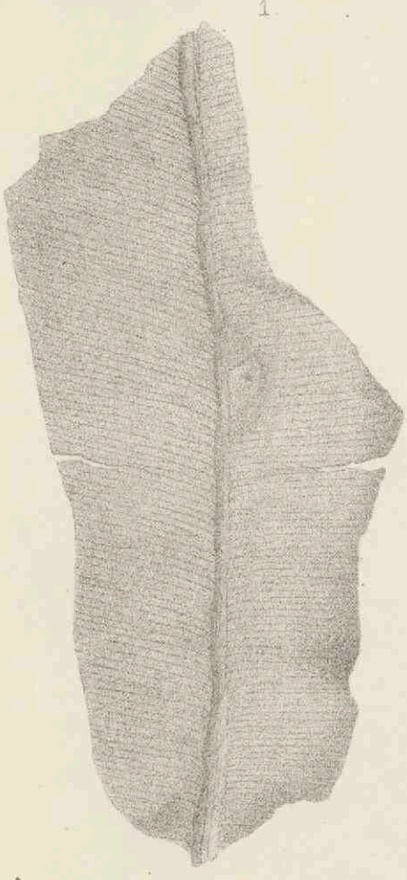

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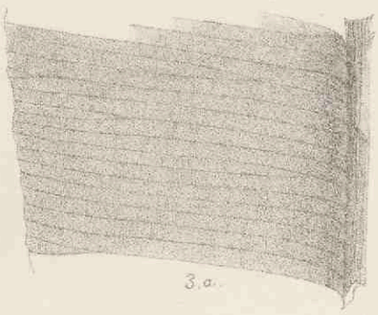

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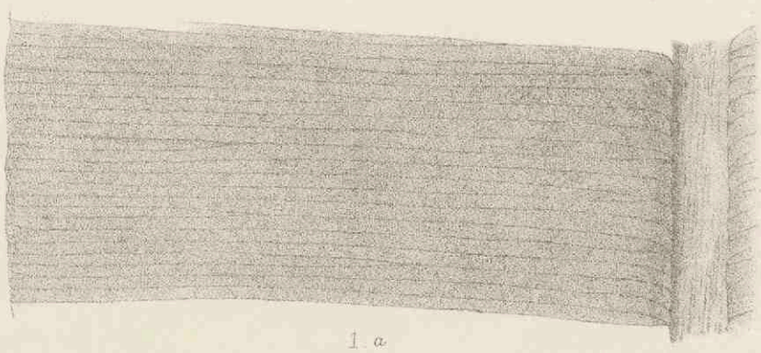

1.a

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PLATE XXIA.

RANIGANJ (Kámthi) GROUP.

Fig. 1. MACROTÆNIOPTERIS DANÆOIDES, Royle, page 88.
The apical portion of the leaf; veins almost horizontal.

From the Jharia coal-field.

Fig. 3. MACROTÆNIOPTERIS FEDDENI, Feistm., page 89. Apical portion of another broad-leaved form with very closely set veins, single and forked.

Fig. 3*a*. A portion enlarged.

From Kámthi, Nágpur area. (Collected by Mr. F. Fedden, Geological Survey.)

Figs. 4—7. ANGIOPTERIDIUM, comp. MC'CLELLANDI, Oldh. sp., page 92. Fragments of pinnæ.

Fig. 4*a*. A portion of the leaf enlarged.

From Kámthi, Nágpur area.

BARÁKAR GROUP.

Fig. 2. MACROTÆNIOPTERIS DANÆOIDES, Royle, page 88. The basal portion of a very large frond, with very far apart veins.

From Burgo, in the Rájmahál hills, on a piece of shale together with *Glossopteris*.

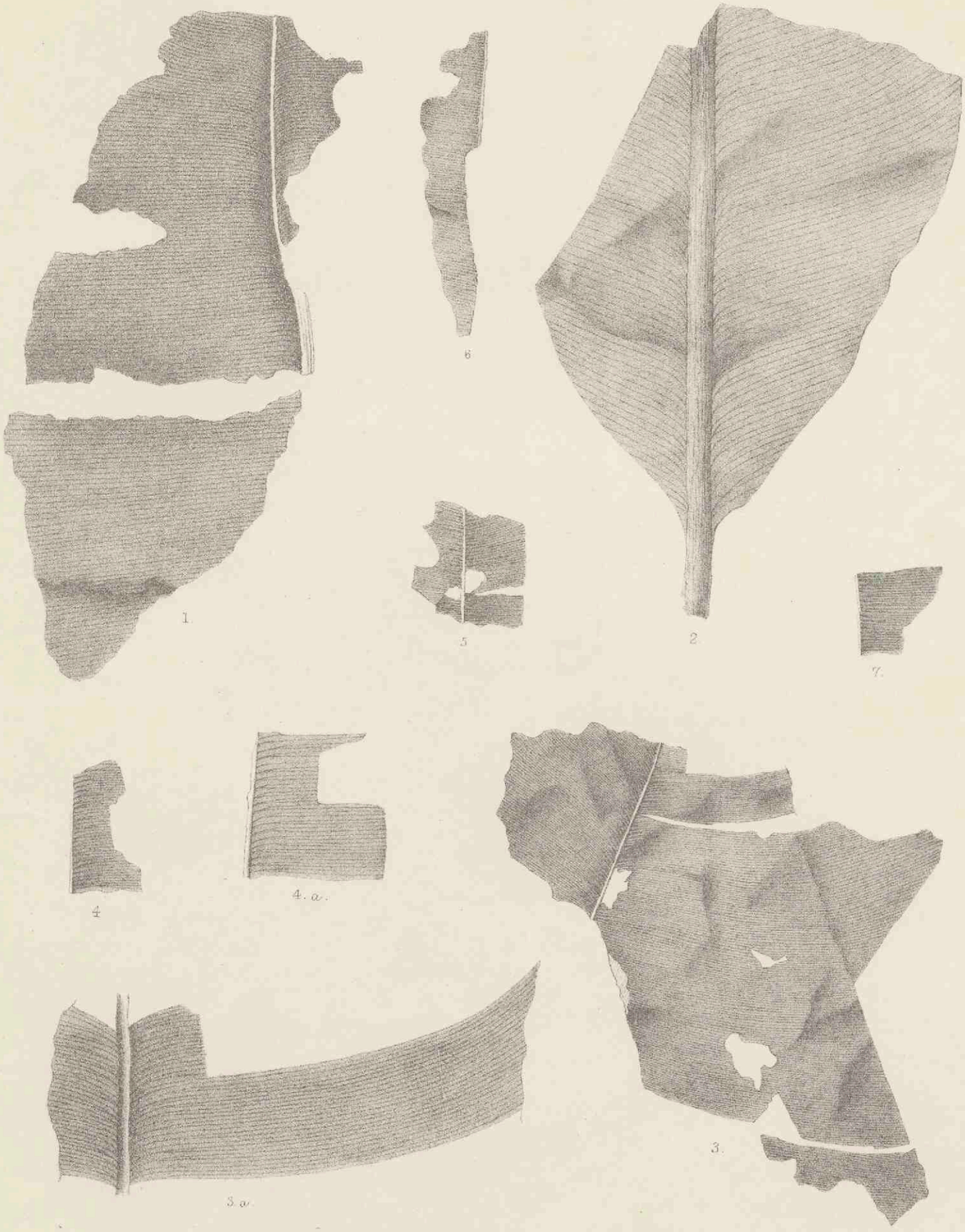

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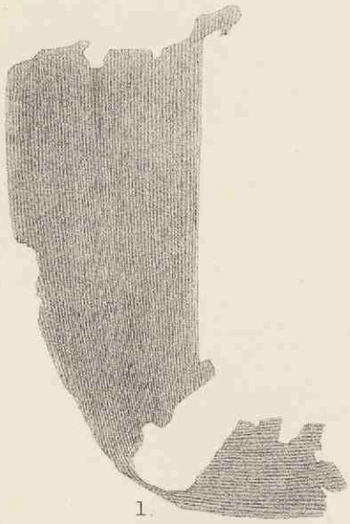
PLATE XXII*A*.

KA'MTHI (Raniganj) GROUP.

Figs. 1—4. MACROTÆNIOPTERIS FEDDENI, Feistm., page 89. Various portions of the frond; fig. 2 apical, fig. 3 middle, fig. 4 lower; veins very closely set, almost horizontal, except in the apical portion, where they are oblique and somewhat curved up. The apical portion, fig. 2, resembles very much the same part in some specimens of *Macrotæniopteris lata*, Oldh. and Morr., from the Rájmahál group, Rájmahál hills.

Fig. 2. Shows the venation.

From Kámthi, Nágpur area. (Collected by Mr. F. Fedden.)



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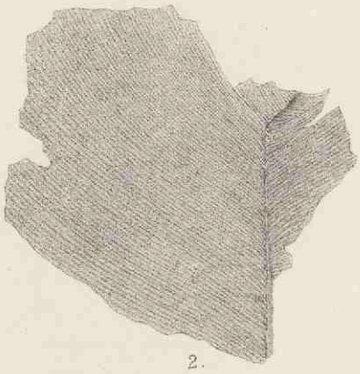

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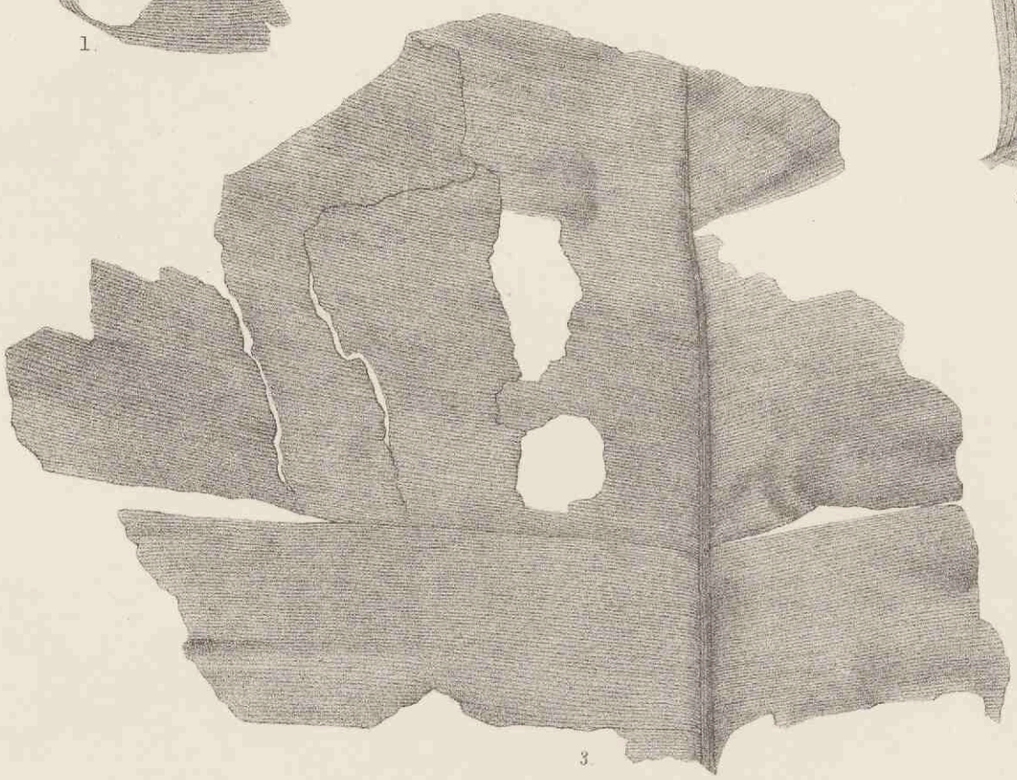

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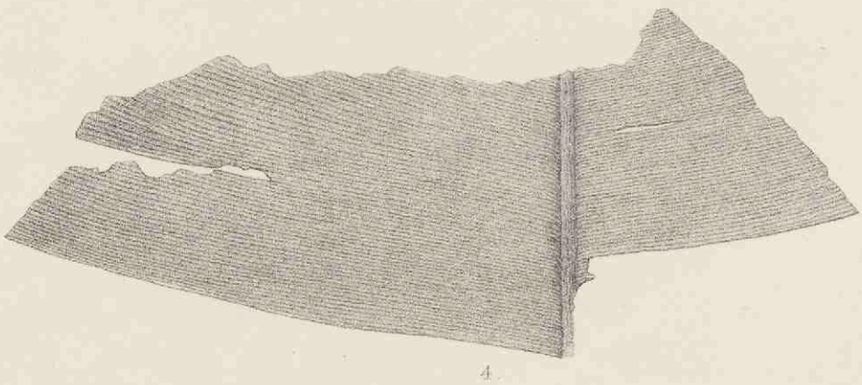

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PLATE XXIIIA.

PANCHET GROUP.

Figs. 7—9. THINNFELDIA, comp. ODONTOPTEROIDES, Morr., sp., p. 85.

Fig. 10. GLOSSOPTERIS INDICA, Schimp., p. 101. Fragment of a leaf in association with the former species.

From the Ramkola coal-field.

RANIGANJ GROUP (Bijori horizon).

Figs. 1—2. DICKSONIA HUGHESI, Feistm., p. 78. Two apical portions of the frond.

Figs. 1*a*, 2*a*. Enlarged leaflets. Fig. 3.—One leaflet of another specimen, with more entire pinnulæ.

From the Jharia coal-field.

Figs. 11 & 11*a*. ALETHOPTERIS (Asplesium) WHITBYENSIS, Göpp. (Heer), p. 79. This specimen, if compared with *Aleth. lindleyana* on Pl. XXXIX*A*, 10—11, appears considerably distinct, and I therefore place it with *Aspl. whitbyense*, Heer: it reminds very much of specimens figured in my Jabalpur Flora.

From the Raniganj coal-field.

Figs. 12, 13, & 12*a*. DICKSONIA (?) HUGHESI, Feistm., p. 78. Small fragments of a pinna.

From the Sátpura basin, near Baricondam.

RANIGANJ AND BARÁKAR GROUP.

Figs. 4—6, 14. In the above group peculiar leaflets occur, four figures of which are given. They all exhibit very nearly the same shape, are covered with small tubercles within and with larger ones along the margin. When examined with the lens, a very fine net venation can be observed in some of them. They appear to be fertile leaflets of some fern, which, however, is impossible to identify. But they are in so far of interest as they occur in the Raniganj and Barákar group equally.

From the Raniganj coal-field (Raniganj group) and Talchir coal-field (Barákar group).

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PLATE XXIV*a*.

RANIGANJ GROUP.

This specimen is figured to show how crowded the fossils are in the shale at certain localities. This is especially the case in the shales of the Raniganj group, wherever it occurs. But it is also so in the Karharbári beds of the Karharbári coal-field.

This specimen is from the Raniganj group of the Raniganj coal-field.

There are represented :—

SCHIZONEURA GONDWANENSIS, Feistm. : leaved branches and stems.
GLOSSOPTERIS ~~COMMUNIS~~ Indica, Feistm. : the leaf in the left corner.
GLOSSOPTERIS INDICA, Schimp. : the other leaves.

Browniana

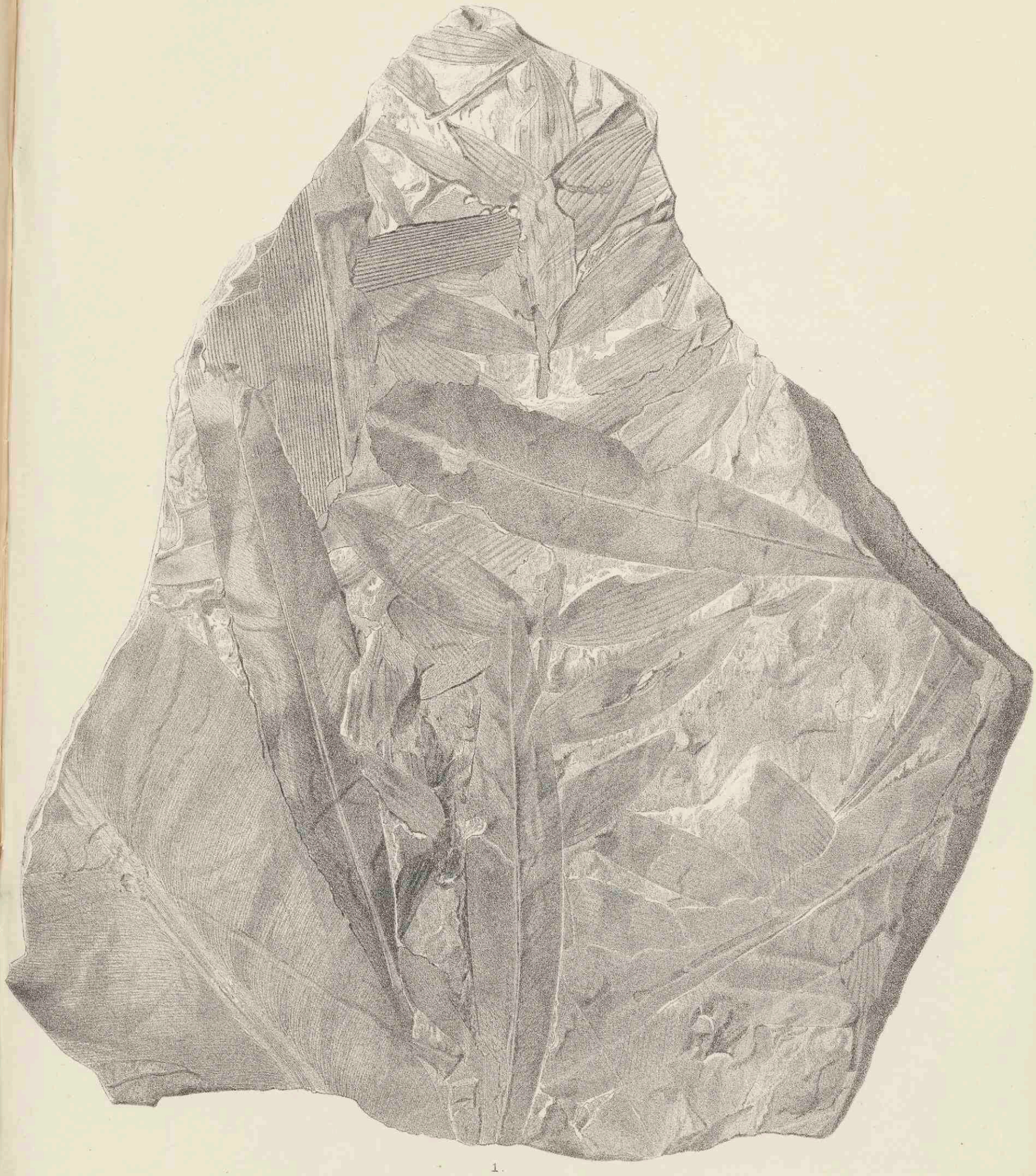

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PLATE XXV*A*.

RANIGANJ (Kámthi) GROUP.

Figs. 1, 2. GLOSSOPTERIS INDICA, Schimp., page 101. From Isápur, south of Chanda, Wardha Valley coal-field.

Fig. 3. GLOSSOPTERIS INDICA, Schimp., page 101. A basal portion of a frond, showing larger meshes close to the midrib, which become oblong and narrow towards the margin.

From the Raniganj coal-field.

BARÁKAR GROUP.

Fig. 4. GLOSSOPTERIS DAMUDICA, Feistm., page 105. A variety with somewhat more oblique veins.

From the Talchir coal-field.

Geol. Surv. of India.

Pl. XXV.A.

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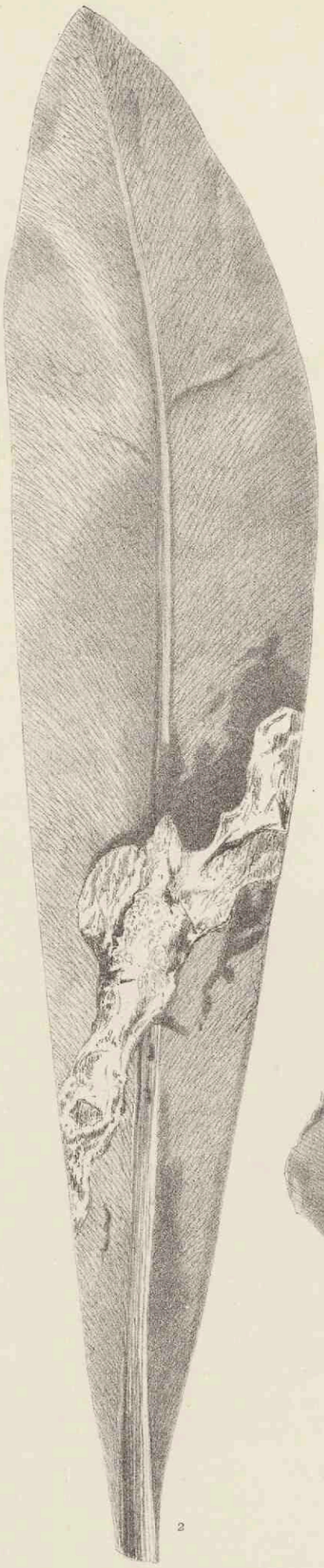

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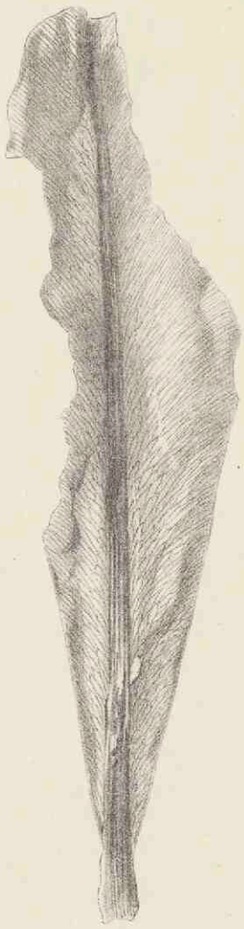

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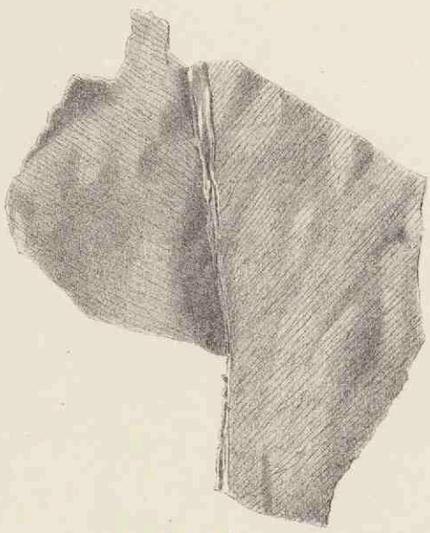

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PLATE XXVI*A*.

KÁMTHI (Raniganj) GROUP.

Figs. 1—4. GLOSSOPTERIS COMMUNIS, Feistm., page 98. A narrow net venation throughout.

Fig. 3. GLOSSOPTERIS INDICA, Schimp., page 101. Larger meshes towards the midrib, becoming long and narrow towards the margin.

Fig. 2. GLOSSOPTERIS BROWNIANA, Bgt., page 102. Polygonal meshes throughout the leaf. (See also Pl. XXVII *A*., fig. 2.)

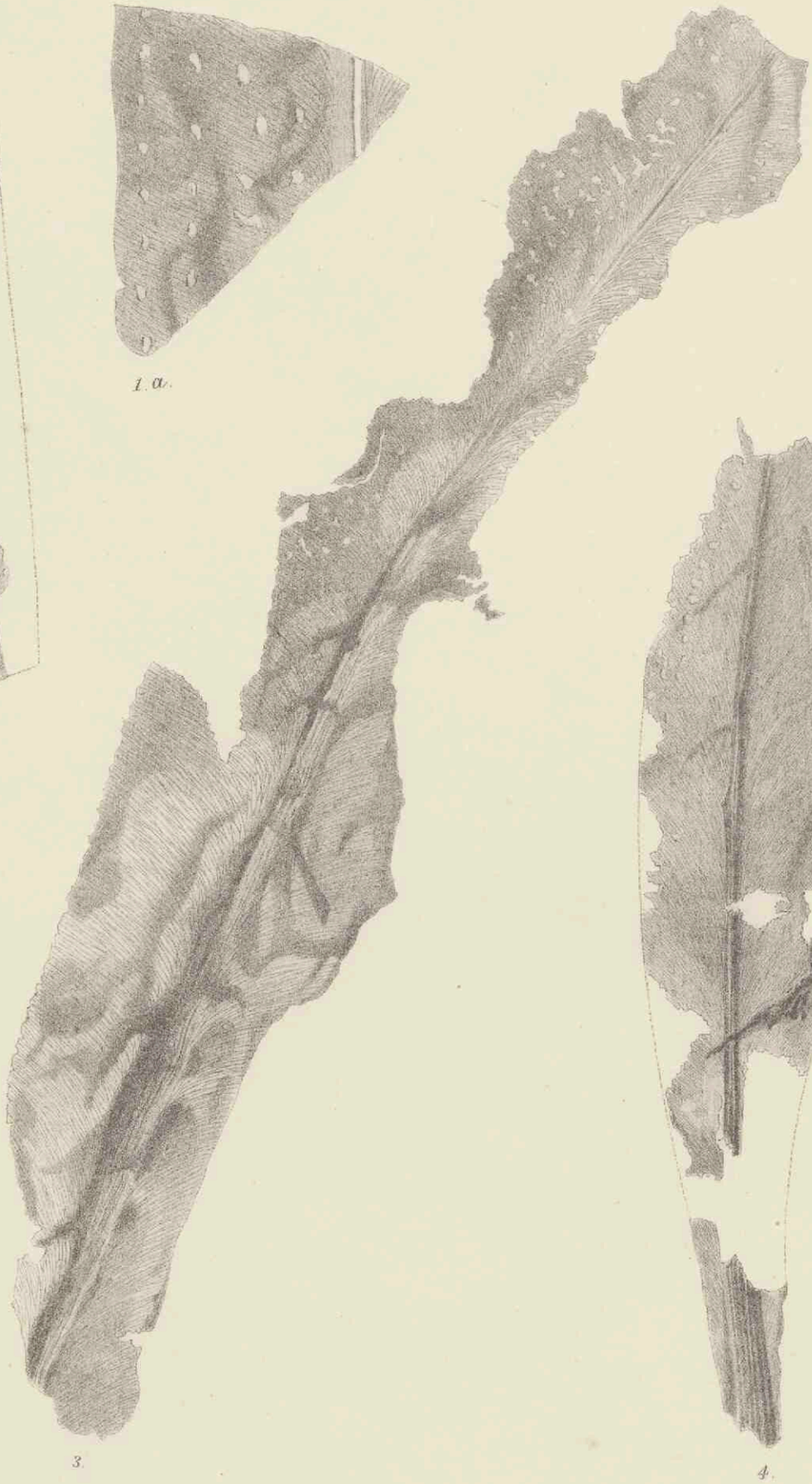
All these leaves show also a fructification, and it is the same in all of them.

All the specimens are from the Nágpur area,—*viz*., figs. 1 and 4 from Silewáda; figs. 2 and 3 from Kámthi.

1.

1.a.

2.



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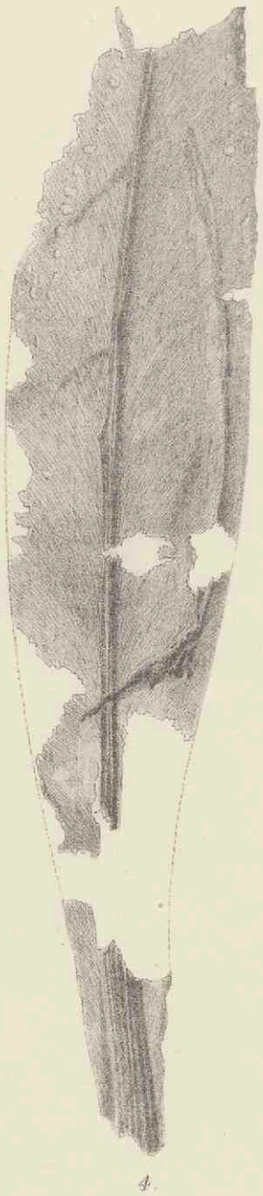

4.

J. Schaumburg Lith.ª

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PLATE XXVII*A*.

KÁMTHI (Raniganj) GROUP.

Fig. 1. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Fructificating.

Fig. 2. GLOSSOPTERIS BROWNIANA, Bgt., page 102. Fructificating. (See also Pl. XXVII*A*., fig. 2.)

Figs. 3—5. GLOSSOPTERIS INDICA, Schimp., page 101. Fig. 5, fructificating; fig. 3, showing well the pointed apex. Both showing well the larger meshes towards the midrib.

From the Nágpur area: figs. 1, 3, 5 from Silewáda; fig. 2 from Kámthi.

Fig. 4. GLOSSOPTERIS BROWNIANA, Bgt., page 102.

From the Raniganj coal-field.

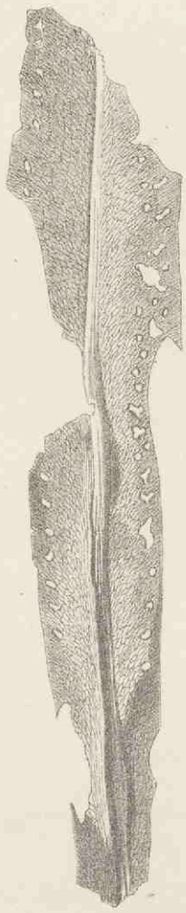
Figs. 6, 8, 9, 11—13. GLOSSOPTERIS ANGUSTIFOLIA, Bgt., page 105. Various, mostly young fronds of this narrow-leaved form, one of those originally described by Brongniart.

From the Raniganj coal-field.

Figs. 7, 10. Basal portions of leaves without a distinct midrib, this being replaced by several distinct veins which are forked and form anastomoses, especially towards the margins. These are characters which necessarily refer these specimens to *Gangamopteris*, although no idea can be formed about the shape or size of the leaf, though they remind very much of some of the long-leaved forms of the Talchir-Karharbári beds.

From the Raniganj coal-field.


1.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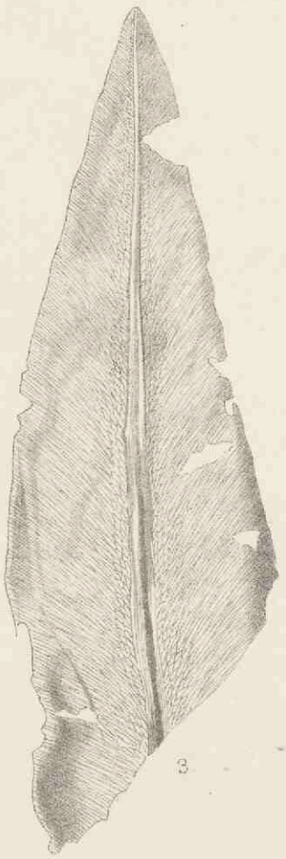
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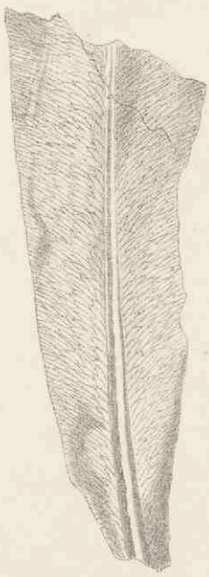
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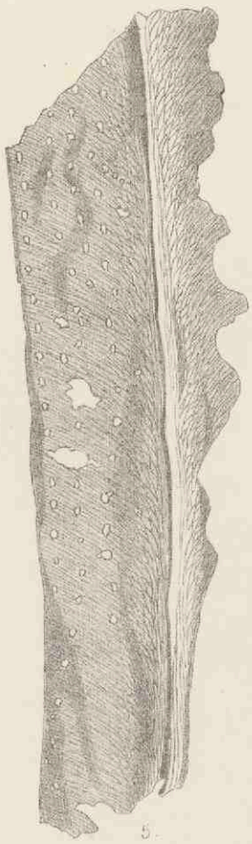
5.


6.


7.


8.


8.a.


9.


10.


11.


12.


13.

J. Schaumburg, Lith.

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PLATE XXVIII*A*.

RANIGANJ GROUP.

Figs. 1, 5, 6, 8, 9. GLOSSOPTERIS CONSPICUA, Feistm., page 104. One of the nicest and most typical forms, with large regularly shaped and sized nets.

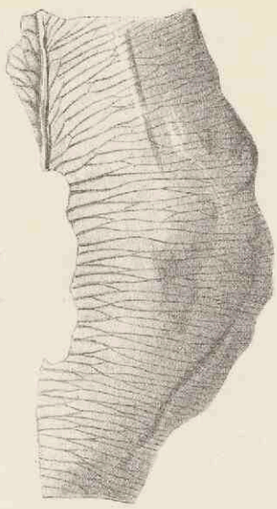
Figs. 2, 7, 10. GLOSSOPTERIS RETIFERA, Feistm., page 103. Nets somewhat smaller than in the former, though equally regular.

Figs. 3, 4. GLOSSOPTERIS DIVERGENS, Feistm., page 104. An oval leaf, with veins diverging (downwards and upwards).

From the Raniganj coal-field.

1.

2.



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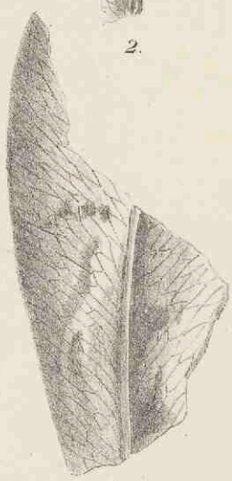

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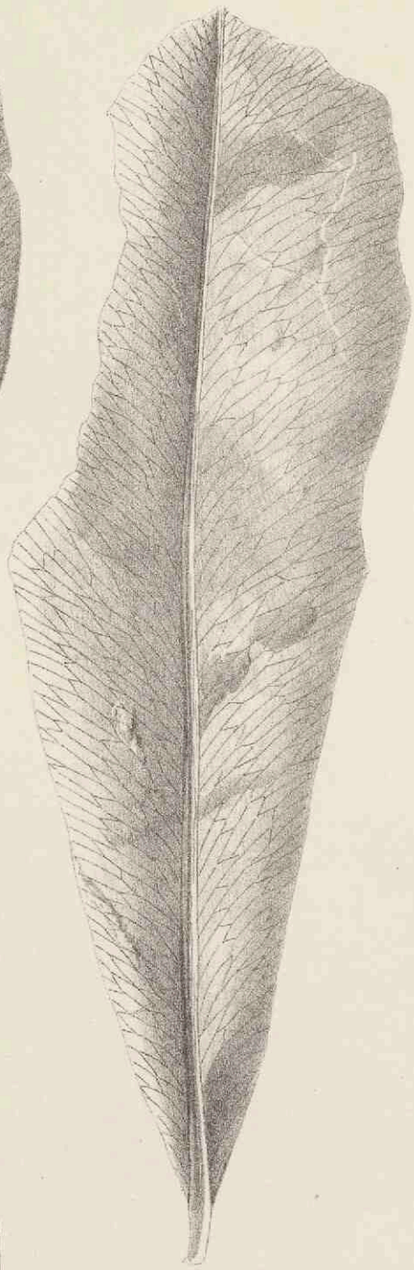
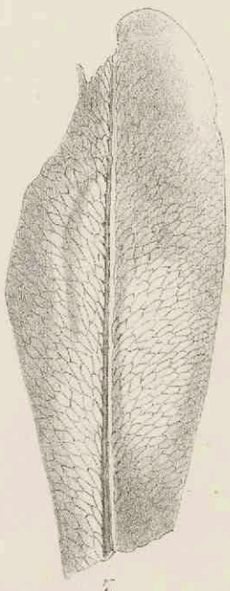


8.

4.

5



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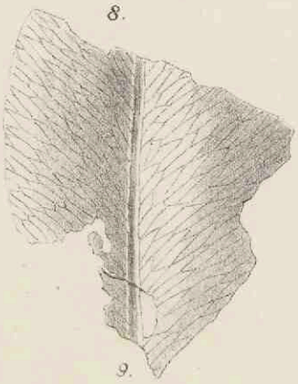

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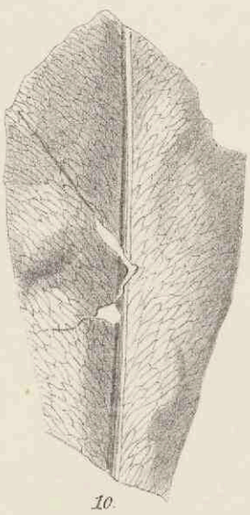

10.

J. Schaumburg Lith.

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PLATE XXIXA.

RANIGANJ GROUP.

Figs. 3, 6, 8. GLOSSOPTERIS BROWNIANA, Bgt., page 102. Nets somewhat larger than in the ordinary form, but hardly justifying a separation.

Fig. 4. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Apical portion.

These specimens are from the Raniganj coal-field.

Figs. 5, 9. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Varieties with a somewhat more straight venation.

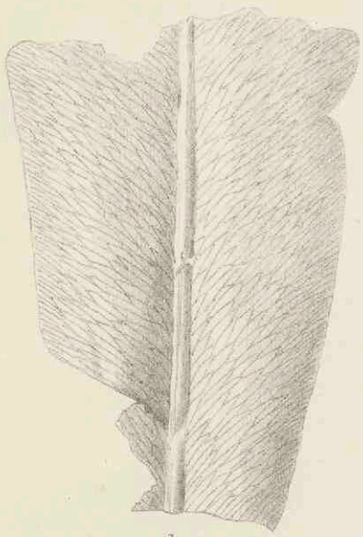
From South Rewah (J. G. Medlicott).

BARÁKAR GROUP.

Figs. 1, 2. GLOSSOPTERIS BROWNIANA, Bgt., page 102. Like figs. 3, 6, 8.

Fig. 7. GLOSSOPTERIS INDICA, Schimp., page 101.

These specimens are from the ferruginous shales of the Talchir coal-field.



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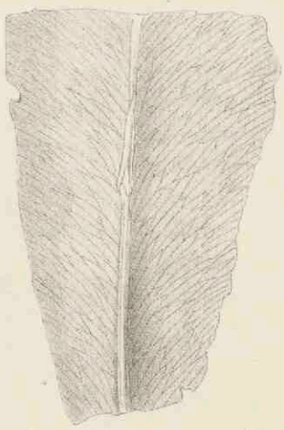

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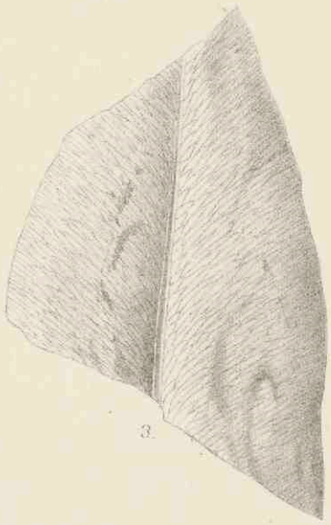

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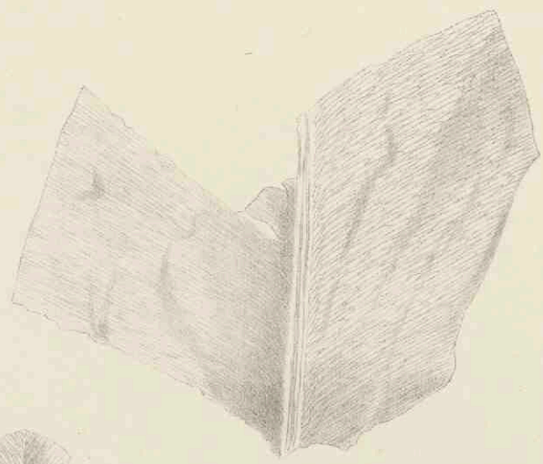

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6.

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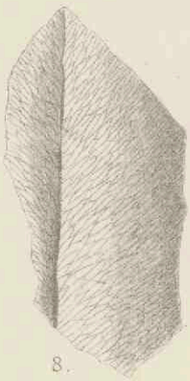

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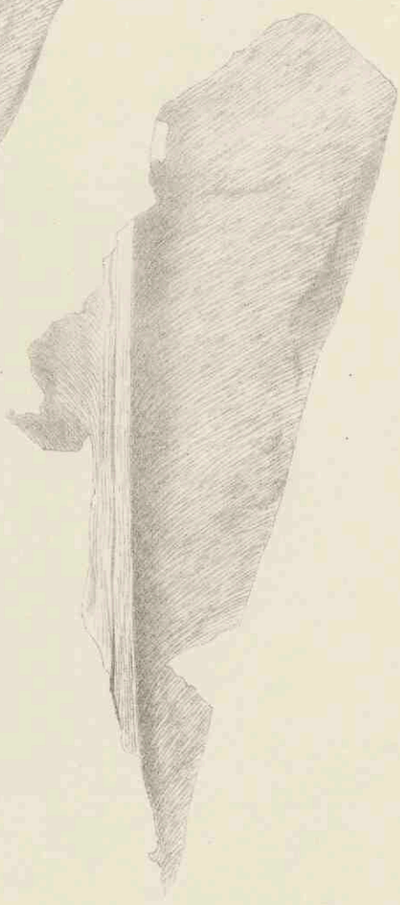

9.

J. Schaumburg Lith.

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PLATE XXXA.

IRONSTONE SHALES.

Fig. 1. GLOSSOPTERIS DAMUDICA, Feistm., page 105. The upper portion, with the apex of a very large frond, of this typical form.

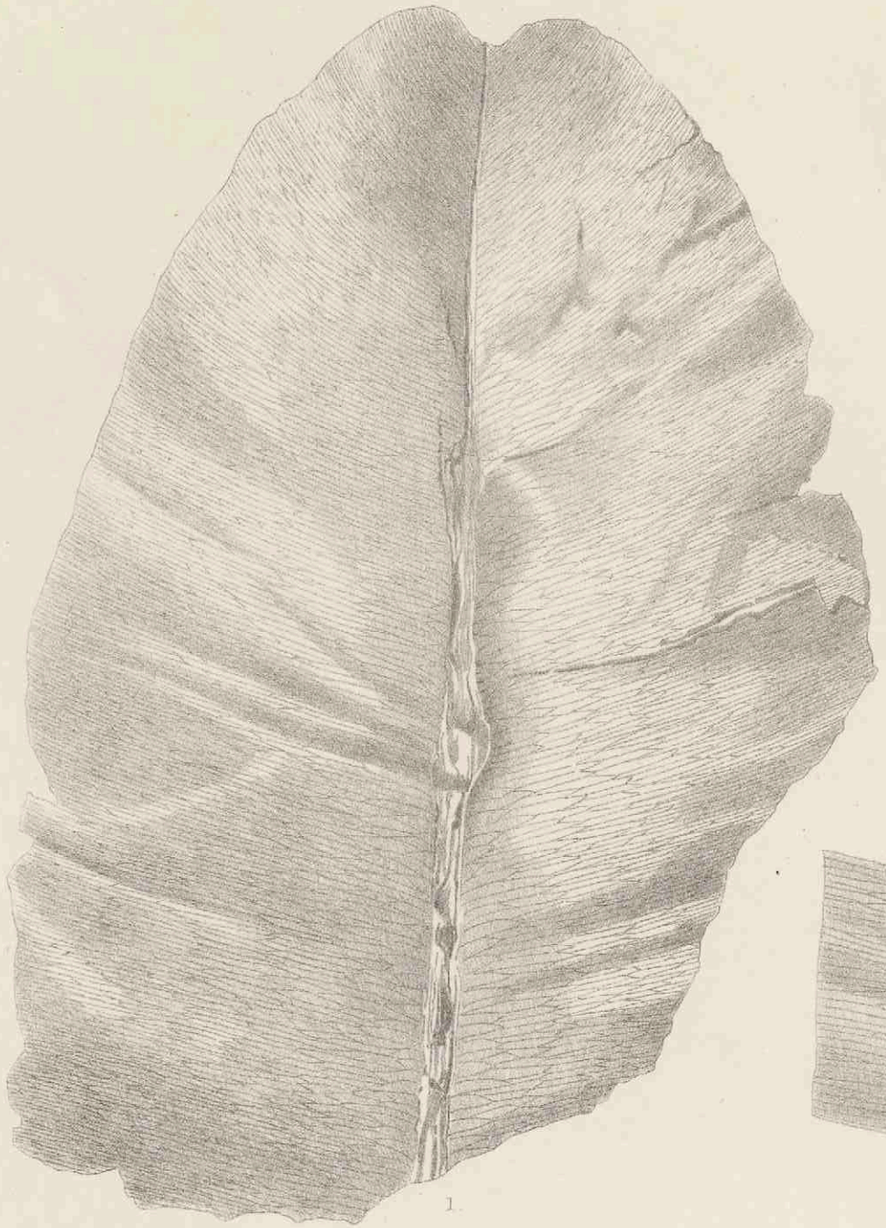
From Kulti, Raniganj coal-field.

BARÁKAR GROUP.

Figs. 2, 2*a*. GLOSSOPTERIS DAMUDICA, Feistm., page 105.

From the Talchir coal-field.

LOWER GONDWANAS.



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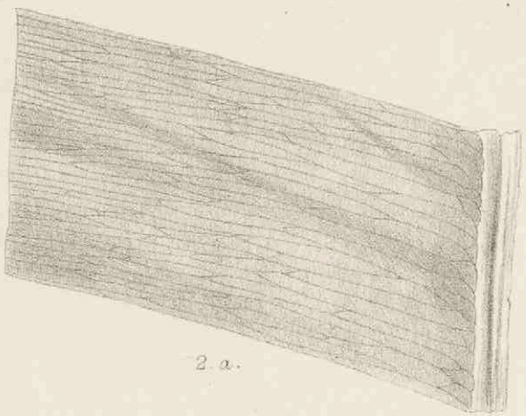

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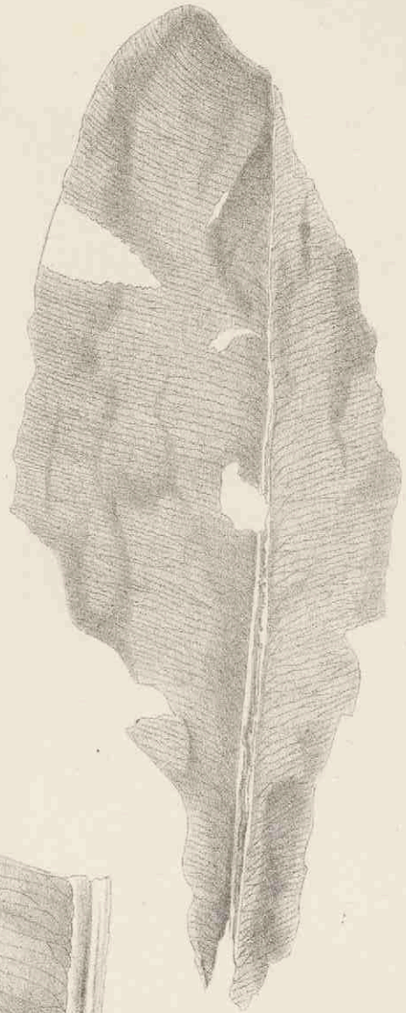


2.

Lith.d by J. Schaumburg.

Printed at Geol. Survey Office.

PLATE XXXIA.

BARÁKAR GROUP.

Figs. 1—3. GLOSSOPTERIS DAMUDICA, Feistm., page 105. In the apical portion, fig. 3, the veins run out to the margins very obliquely, but the character of the nets is the same as in the others.

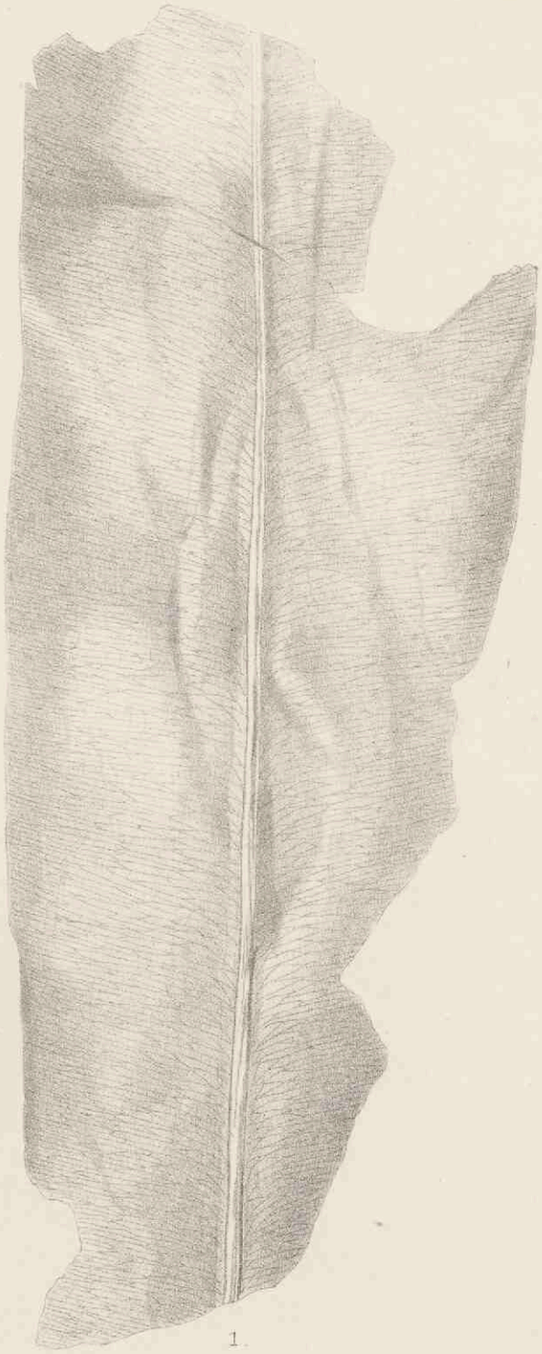
It appears also that the Barákar forms of this species have somewhat narrower leaves than those in the higher groups, while, however, all other characters remain the same.

From Kumerdhubi in the Raniganj coal-field.

Figs. 4, 5. GLOSSOPTERIS, sp., page 104. Fragments of a leaf, showing a peculiar net venation, which, if the leaf were known in a greater portion, would probably show it to be a distinct species, for which I would then propose the name *Gl. ingens*.

From Kumerdhubi, Raniganj coal-field.

2.



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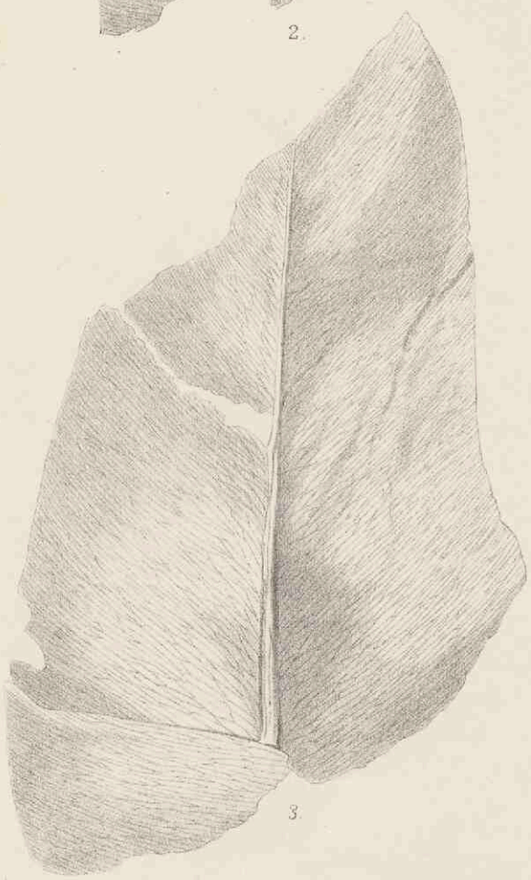

3.

5.

4.

J. Schaumburg Lith.

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PLATE XXXIIA.

BARÁKAR GROUP.

Fig. 1. GLOSSOPTERIS DAMUDICA, Feistm., page 105. Specimen showing the basal portion.

Fig. 2. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Typical form.

Fig. 3. The variety of *Gl. communis*, Feistm., which I distinguished as *sienoneura*. See page 99.

All from Kumerdhubi, near Barákar, Raniganj coal-field.

1

3.

2.a

2

J. Schaumburg, Lith.

Printed at Geol: Survey Office.

PLATE XXXIIIA.

BARÁKAR GROUP.

Figs. 1, 1*a*. GLOSSOPTERIS COMMUNIS, var. STENONEURA, Feistm., page 99.

1*a*. Showing the venation.

Figs. 2, 3, 4. GLOSSOPTERIS INTERMITTENS, Feistm., page 99. Another peculiar form, in which not all veins form nets, some being only forked. Fig. 3 represents this species best, while in the two others the veins are too strongly shown at the point of passing out from the rib.

Figs. 3*a* and 4*a* were given to illustrate the venation, but I am sorry to say that they are misdrawn—an evil which is not always under the control of the author.

Fig. 5. GLOSSOPTERIS BROWNIANA, Bgt. The original specimen at least represents this species, while the drawing is made useless by bad printing.

From Kumerdhubi (1, 5) and Nirsha (2—4), Raniganj coal-field.

1.a.

2.

1.

4.

G. Bronnara

wrongly drawn

4.a.

5.

3.

10 Long

3.a

J. Schaumburg, lithº.

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PLATE XXXIV*A*.

RANIGANJ GROUP.

Figs. 1, 1*a*. GLOSSOPTERIS, probably BROWNIANA, Bgt., page 102. A narrow-leaved variety.

Fig. 3. GLOSSOPTERIS ANGUSTIFOLIA, Bgt., page 105. (See Plate XXVII*A*., the same form.)

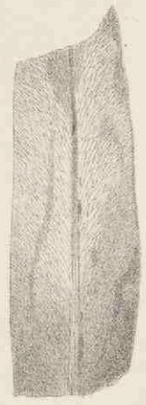
Figs. 2, 2*a*. GLOSSOPTERIS, probably ANGUSTIFOLIA, Bgt. I have not finally identified this form, as it combines with the size and shape of the leaves of *Glossopt. angustifolia*, a venation somewhat abnormal and differing from that of the latter species.

These are from the Raniganj coal-field.

BARÁKAR GROUP.

Figs. 4, 5, 5*a*. ANGIOPTERIDIUM INFARCTUM, Feistm., page 93. A tæniopteroid plant characterised by the great number and closeness of the veins. It appears to belong to the genus *Angiopteridium*.

From Kumerdhubi, Raniganj coal-field.



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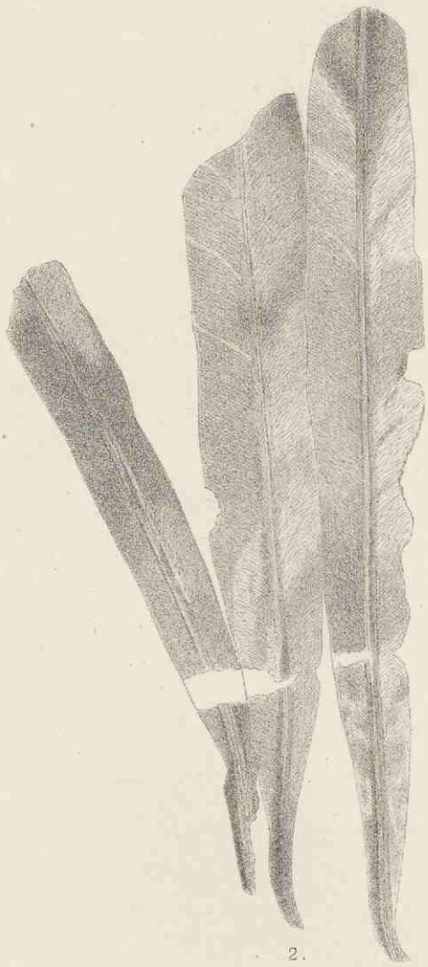
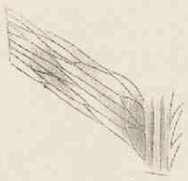


2.

3

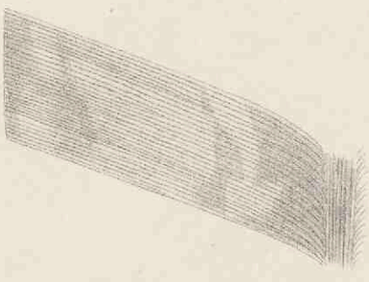
1. a.



2. a.

3. a.

4.



5. a.

5.

J. Schaumburg, Lith.

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PLATE XXXV*A*.

RANIGANJ GROUP.

Figs. 1, 1*a*. GLOSSOPTERIS COMMUNIS, Feistm., and *Gl. indica*, Schimp., pages 98, 101. One leaf lies on top of the other. The larger leaf, with the pointed apex and with the narrower net venation throughout, is *Gl. communis*, Feistm.

The other one, which is below, shows a larger net venation towards the midrib.

Figs. 2, 3, 3*a*. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Very typical leaves; fig. 2 showing well the pointed apex.

Fig. 4. GLOSSOPTERIS INDICA, Schimp., page 101. The veins unfortunately somewhat indistinct in consequence of bad printing.

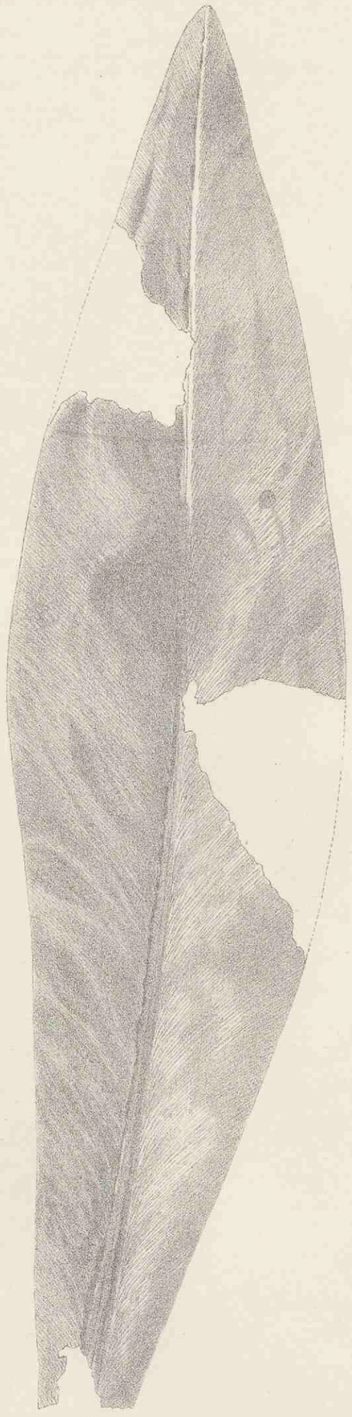
All from the Raniganj coal-field.

Geol: Surv: of India.

LOWER GONDWANAS.

Pl: XXXV. A.

1.



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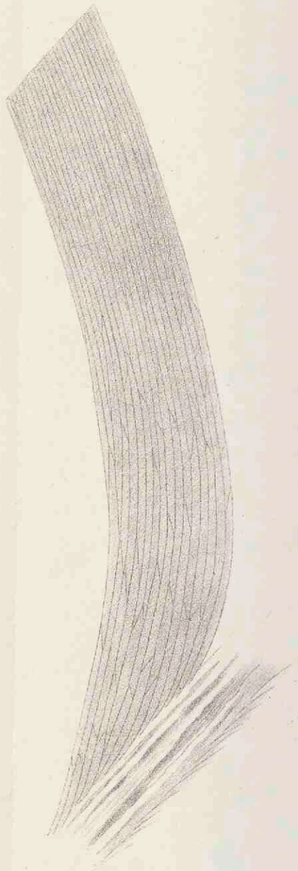
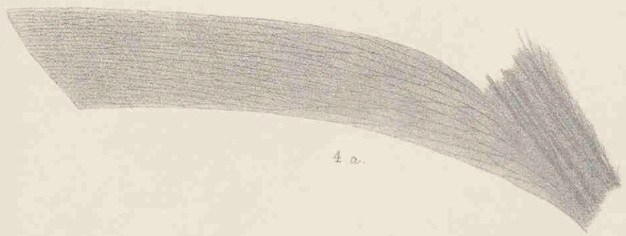


1. a

3.

3. a

4.



4 a.

J. Schaumburg Lith.

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PLATE XXXVI*A*.

RANIGANJ GROUP.

Figs. 1, 2. GLOSSOPTERIS COMMUNIS, Feistm., page 98. Two very fine fronds; fig. 2 almost quite complete. It shows distinctly the characters of the midrib, broad in the basal portion and tapering towards the apex. The midrib in both specimens shows that peculiar celled appearance which I have mentioned in the text, and which I have hitherto only observed in this species.

Both from the Raniganj coal-field.

1

2

J. Schaumburg, Lith.

Printed at Geol. Survey Office

PLATE XXXVII*A*.

KA'MTHI (Raniganj) GROUP.

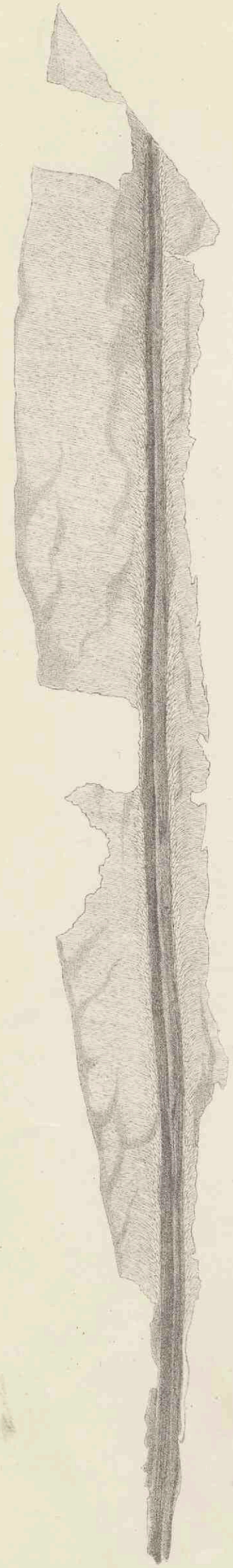
Figs. 1—4. GLOSSOPTERIS STRICTA, Bunb., page 100. I believe these two specimens to represent Sir Bunbury's species; 1*a* show the veins.

Figs. 3, 3*a*. GLOSSOPTERIS COMMUNIS, Feistm., page 98. A portion of a very large specimen, with a thick midrib, longitudinally furrowed below.

These are from Kámthi, Nágpur area.

Fig. 4. GLOSSOPTERIS COMMUNIS, Feistm., page 98. The upper portion of a leaf, with the apex. Veins exceedingly fine.

From Isápur, south of Chanda, Wardha Valley coal-field.



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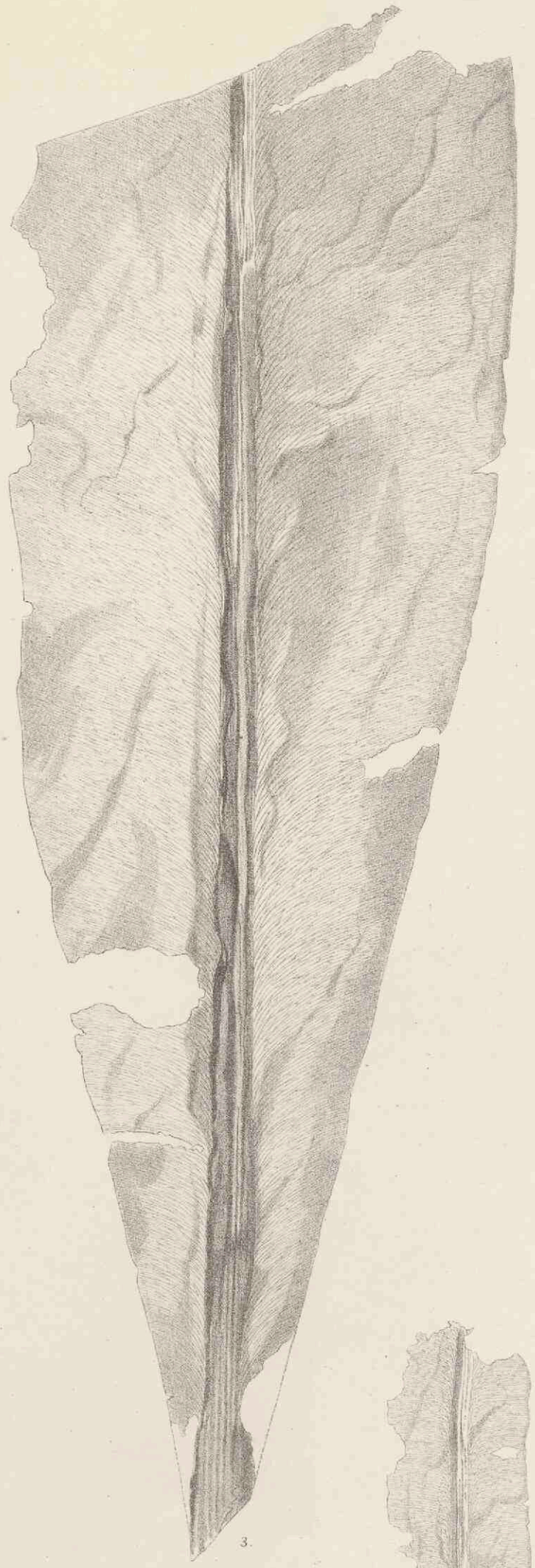
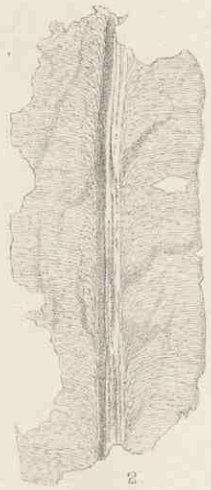


3.

3.a

4.



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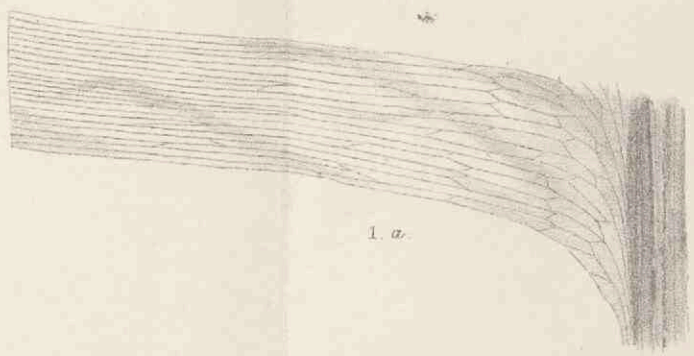


1.a.

PLATE XXXVIIIA.

KAMTHI (Raniganj) GROUP.

Fig. 1. GLOSSOPTERIS COMMUNIS, Feistm., page 98. The apex somewhat more obtuse than usually.

Fig. 3. GLOSSOPTERIS STRICTA, Bunb., page 100. The apical portion.

Both from Isápur, south of Chanda, Wardha Valley coal-field.

Fig. 5. GLOSSOPTERIS COMMUNIS, var. STENONEURA, Feistm., page 99.

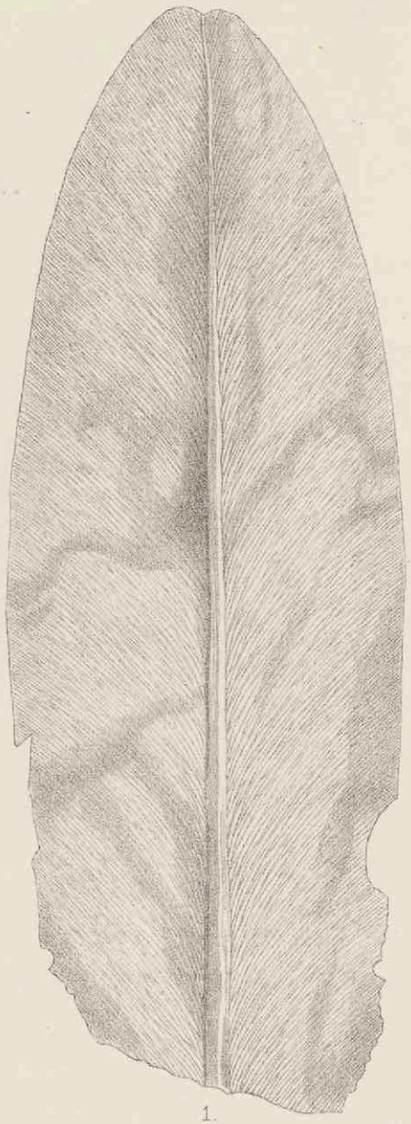
From the Raniganj coal-field.

BARÁKAR GROUP.

Fig. 2. GLOSSOPTERIS COMMUNIS, Feistm., page 98. A middle portion of a frond; the midrib exhibiting again the cellular appearance.

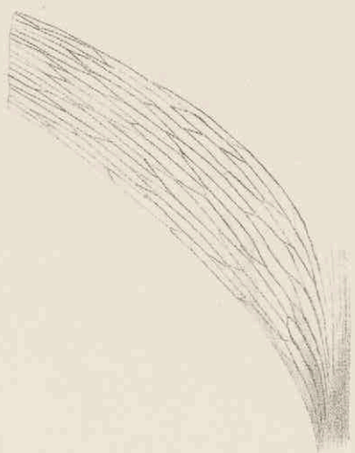
Fig. 4. GLOSSOPTERIS INDICA, Schimp., page 101. A complete but only small leaf, though exhibiting well the characteristic venation.

From Gopálprasád, Talchir coal-field.



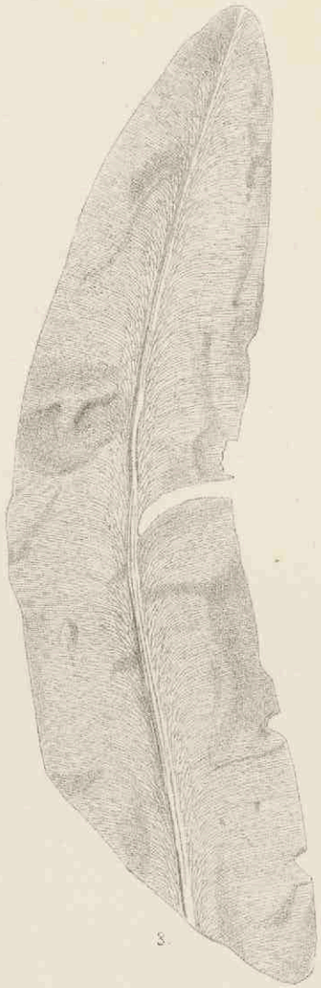
1.

2.



5.a.

5.



3.

4.

J. Schaumburg, Lith.

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PLATE XXXIX*A*.

RANIGANJ GROUP (Bijori horizon).

Figs. 1, 2, 1*a*. GLOSSOPTERIS ANGUSTIFOLIA, Bgt., page 105. These leaves I believe to be the typical forms of the species. It was on these that I observed the narrow longitudinal space along the margin, which is perhaps indicative of the fructification.

Figs. 3—7. GLOSSOPTERIS FORMOSA, Feistm., page 106. A narrow-leaved form, with conspicuous nets; it represents here the *Glossopteris conspicua* amongst the broad-leaved forms.

Figs. 8—8*a*. GANGAMOPTERIS ANTHROPHYOIDES, Feistm., page 108. One leaf only occurred; shows great relation to some species of the living *Anthrophyum*.

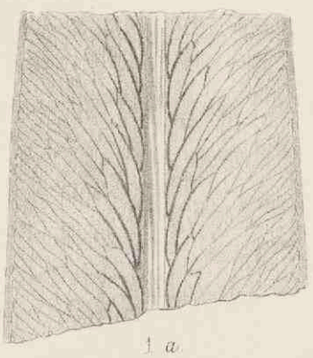
Figs. 10—11. ALETHOPTERIS (Polypodium) LINDLEYANA, Royle, page 80. Fig. 10 I believe to be the top portion of the same species of which fig. 11 is the lower portion. Both show also a distinct appearance from *Asplen. whitbyense*, and if we take the fertile fronds on Pl. XIX*A*., figs. 3 and 4, into consideration, then I think to be justified in referring this species closer to *Polypodium* than to *Asplenium*.

All these specimens are from the Raniganj coal-field.

Figs. 9—9*a*. GANGAMOPTERIS, sp., page 110. A small, roundish leaflet, without a midrib, but with a radiary net venation.

From the Sátpura basin, near Baricondam.

1.



1 a.

10.

10 a.

5. G. formosa

9

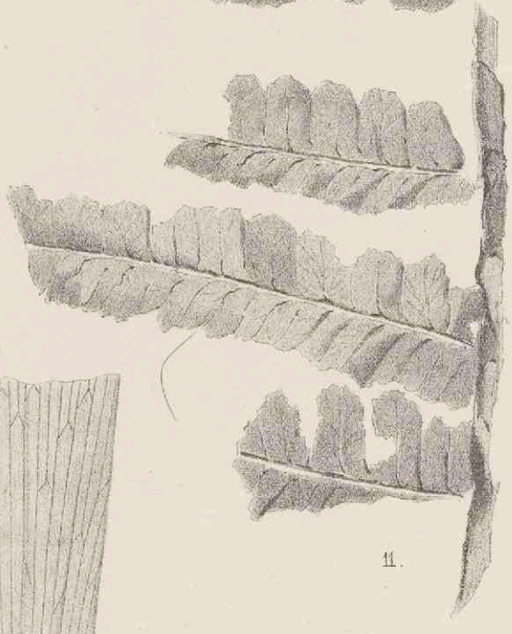
2.

3. G. formosa

6. G. formosa

4. G. formosa

8.



11.

8 a.

7. G. formosa

PLATE XL*A*.

RANIGANJ GROUP.

Fig. 1. SAGENOPTERIS (?) LONGIFOLIA, Feistm., page 113. A fingered leaf, the systematical place of which is not quite certain; the leaflets have a narrow net venation and a midrib vanishing towards the apex.

Fig. 1*a*. Was intended to show the net venation, but the meshes are far too broad for that scale.

From the Raniganj coal-field.

Figs. 2, 3. ALETHOPTERIS (Asplenium) WHITBYENSIS, Göpp. (Heer), page 79. Small pinnæ; the venation indistinct.

Fig. 4. GLOSSOPTERIS COMMUNIS, Feistm., page 98.

4*a*. An enlarged portion, showing the character of the net venation.

These three latter from the Jharia coal-field.

Fig. 5. GLOSSOPTERIS BROWNIANA, Bgt., page 102. 5*a*. An enlarged portion.

Fig. 6. GLOSSOPTERIS DAMUDICA, Feistm., page 105.

These two are from Sohágpur (J. G. Medlicott) in the South Rewah basin.

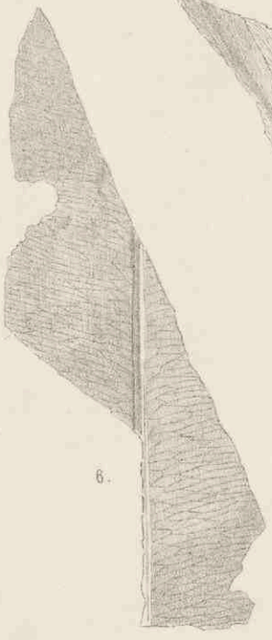
1.

2. a.

3. a

3

2.

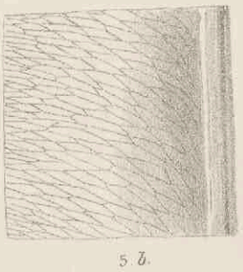


6.

4. a.

1. a.

5.



5. b.

4.

PLATE XLI*A*.

RANIGANJ GROUP.

Figs. 1, 2. GLOSSOPTERIS ORBICULARIS, Feistm., p. 107.

Figs. 3, 4. SAGENOPTERIS POLYPHYLLA, Feistm., page 113. Another fingered leaf, with a conspicuous net venation in the single leaflets, the midrib distinct in the lower portion, though vanishing towards the apex. From this latter character and from the circumstance that it is a composite leaf, I class it for the present with *Sagenopteris;* it is, however, very possible that this species, together with that figured on Pl. XL*A* (fig. 1), form a distinct genus, for which, as said in the text, I would propose the name *Dactylopteris*.

Fig. 7. Is possibly a leaf of a *Sagenopteris*, page 114.

Fig. 8. GLOSSOPTERIS sp., top portion of either a *Glossopt. conspicua* or perhaps *Gl. damudica*.

Fig. 9. GLOSSOPTERIS RETIFERA, Feistm., page 103.

All these specimens are from the Raniganj coal-field.

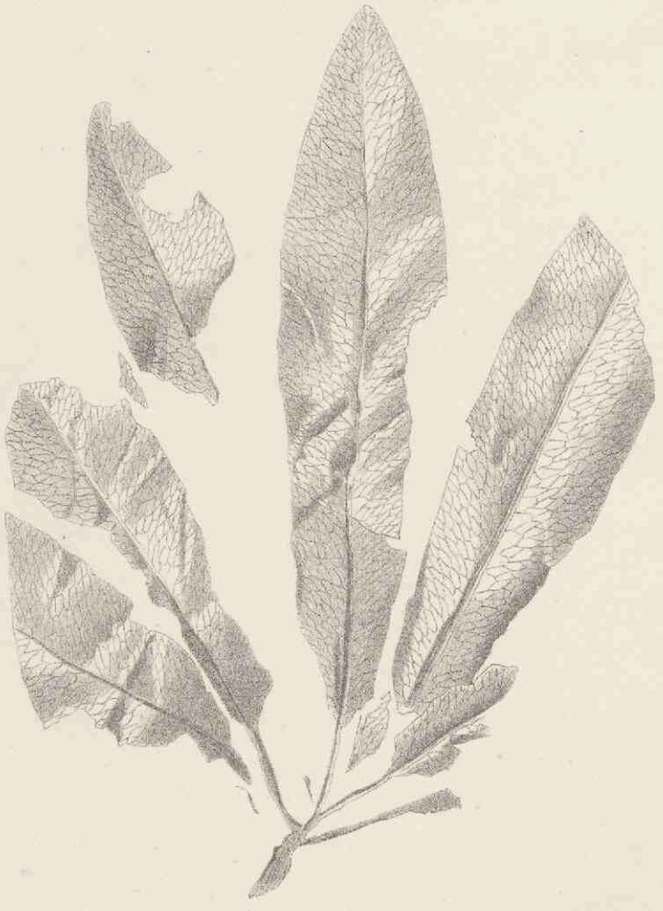
Fig. 5. ANTHROPHYOPSIS sp., page 115. Is wrongly placed, should have been placed vertically.

Fig. 6. SAGENOPTERIS? (or? perhaps a small specimen of *Gangamopteris angustifolia*, Mc'Coy).

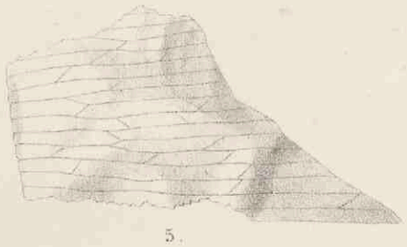
These two latter from the South Godávari district, near Kunlácheru.

1.

2.

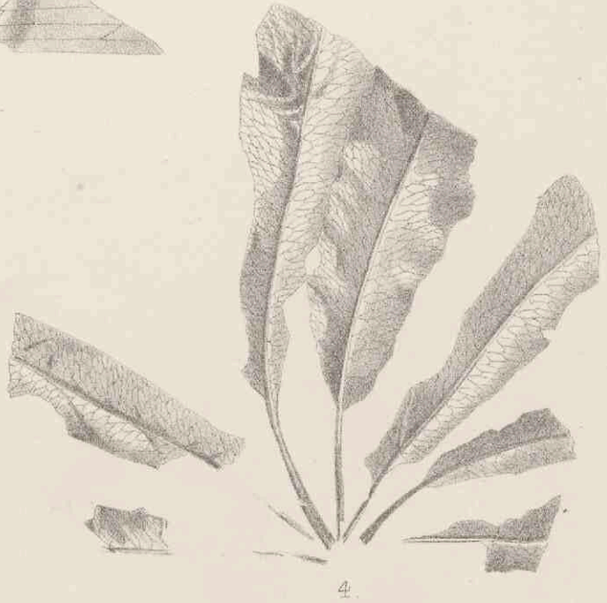


3.



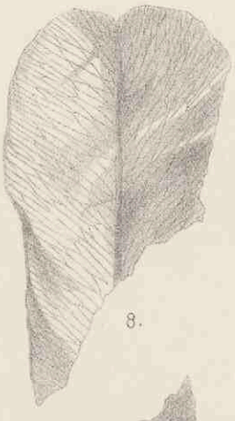
5.

6.



4.

7.



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9.

J Schaumburg, Lith.

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PLATE XLII*A*.

RANIGANJ (Kámthi) GROUP.

This plate contains specimens of a more or less uncertain position, which, however, I yet thought interesting enough to be figured, if it only was for the sake of reference.

Figs. 1, 1*a*. SAGENOPTERIS sp. A lateral (?) leaflet. Fig. 1*a*, the leaflet three times enlarged. From the South Godávari district, near Kunlácheru.

Fig. 2. SAGENOPTERIS, comp. RHOIFOLIA, Presl., page 114. About this identification I think there is but little doubt.

Fig. 2*a*. The apical portion enlarged, showing no midrib.

Fig. 2*b*. A part of the lower portion enlarged, wherein the midrib is still seen.

Figs. 3 & 5. SAGENOPTERIS sp., page 114. Of the same character as that leaf on Pl. XLI*A*., fig. 7.

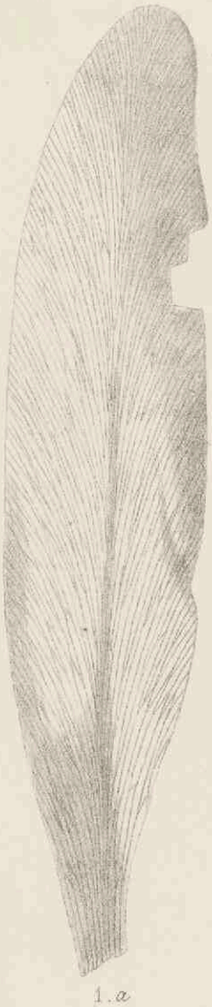
Figs. 3*a* & 5*a*. Are enlarged portions of the respective leaflets.

All these from the Raniganj coal-field.

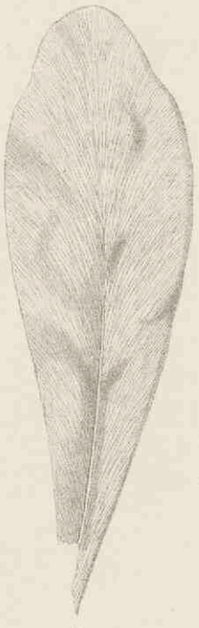
Fig. 4. This leaflet might possibly be in some relation with those peculiar apparently fertile leaflets, figured on Pl. XXIII*A*., figs. 4—6, 14. I have, however, no clue for their determination.

From Guráru, on the Sone river, South Rewah basin (Mr. Ch. A. Hacket).

1.



1.a



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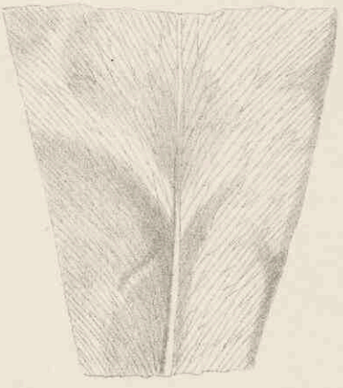
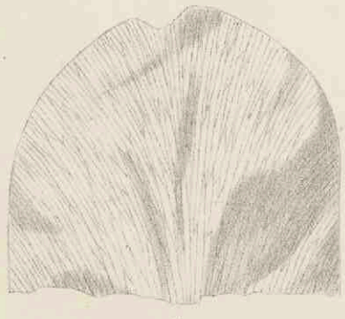


3.a

2.

3.b



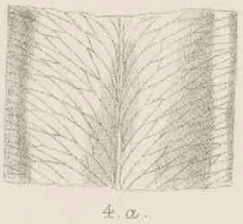
2.a

4

5

5.a

2.b



4.a

J. Schaumburg, Lithª

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PLATE XLIII*A*.

RANIGANJ (Kámthi) GROUP.

Figs. 1, 2. GANGAMOPTERIS WHITTIANA, Feistm., page 109. Interesting for its relation with *Anthrophyum*.

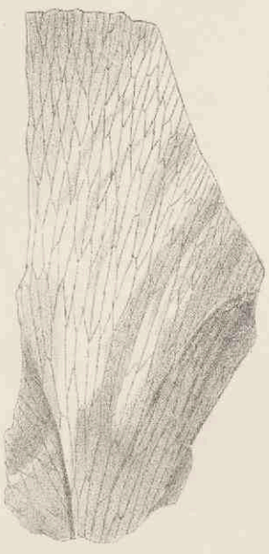
Figs. 3, 4. BELEMNOPTERIS WOOD-MASONIANA, Feistm., page 112. Conspicuous for its relation with a living fern, *viz.*, *Hemionitis cordata*, Roxb.

Fig. 5. GLOSSOPTERIS sp., or SAGENOPTERIS POLYPHYLLA, Feistm.

All specimens from the Raniganj coal-field.

Figs. 6—8. GANGAMOPTERIS HUGHESI, Feistm., page 109. A characteristic form, though I believe descending directly from *Gang. cyclopteroides*, Feistm.

From the Nágpur area, Kámthi.



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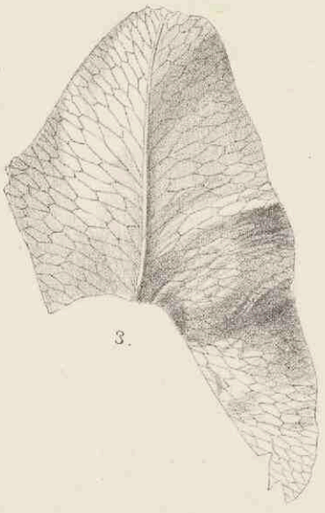
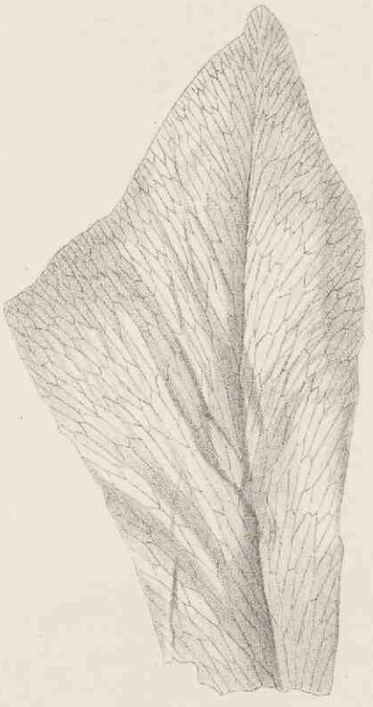
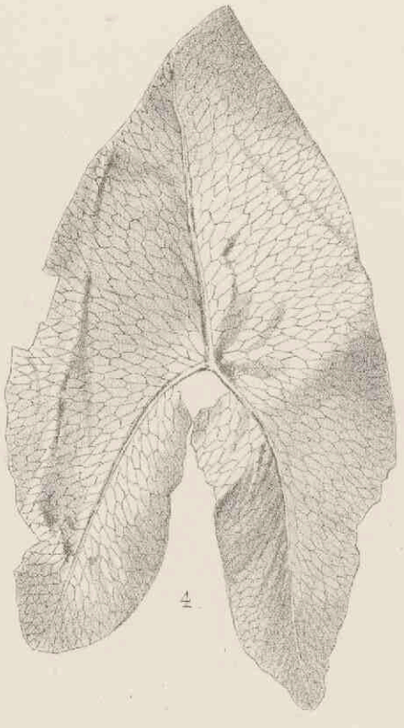


3.



2.

6.



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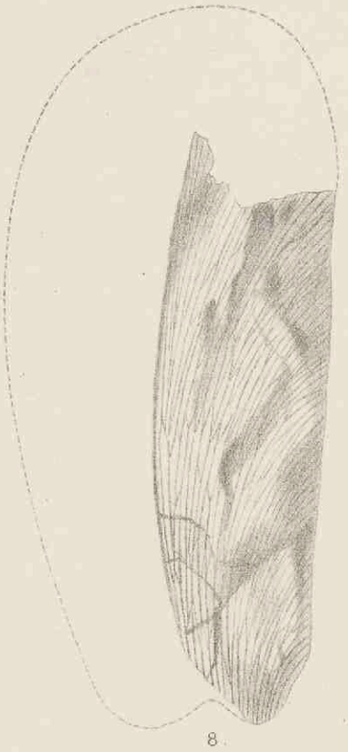

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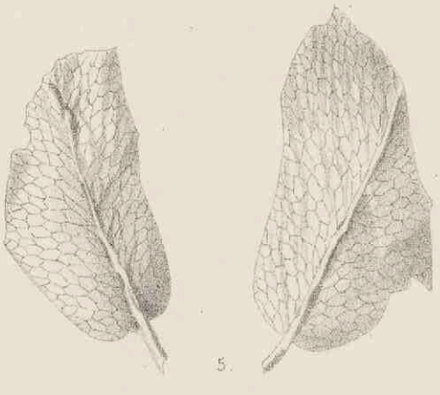
7.



5.

J. Schaumburg, Lith. Printed at Geol: Survey Office.

PLATE XLIV*A*.

RANIGANJ GROUP.

Figs. 1—2. PALÆOVITTARIA KURZI, Feistm., page 91. An interesting fern, with a venation in general after the manner of a *Sagenopteris* (midrib in the lower portion only), but the secondary veins are *tæniopteroid, i.e.*, they form no nets, but are simply forked.

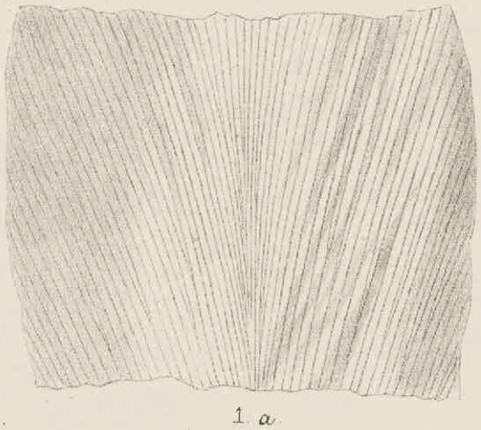
The late Dr. Kurz suggested its belonging to the type *Vittaria*.

Figs. 3 & 4. Show enlarged pieces of the apical and basal portions.

From the Raniganj coal-field.

1.

2.



1 a.

1 b.

J. Schaumburg, Lith.

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PLATE XLV*A*.

RANIGANJ (Kámthi) GROUP.

Figs. 1—11. NÖGGERATHIOPSIS HISLOPI, Bunb. sp. (Feistm.), page 118. Various leaves of this interesting cycadeaceous plant, some of which (see figs. 3 and 11) are such as to suggest a pinnate leaf.

From the Raniganj coal-field (figs. 10—11); South Rewah (J. G. Medlicott, figs. 1—5); Nágpur area at Bháratwáda (figs. 6, 8); Silewáda (fig. 7), and Kámthi (fig. 9).

J. Schaumburg Lith.

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PLATE XLVI*A*.

KÁMTHI (Raniganj) GROUP.

Figs. 1—2. RHIPIDOPSIS DENSINERVIS, Feistm., page 121. Two leaves of this interesting coniferous plant of the family *Salisbureæ*; fig. 2 shows the specimen in which a portion of the stalk is preserved. Fig. 2*a* is a portion of one leaflet enlarged.

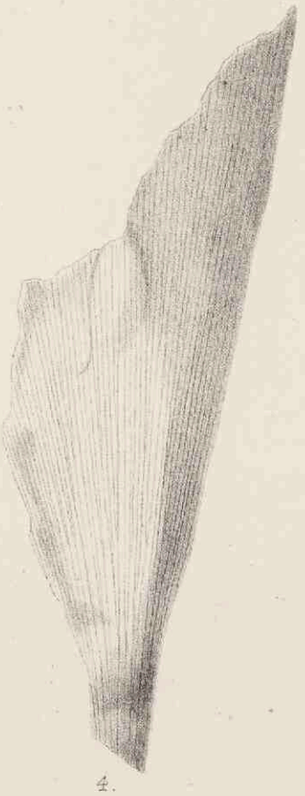
From the South Godávari district, near Kunlácheru.

BARÁKAR GROUP.

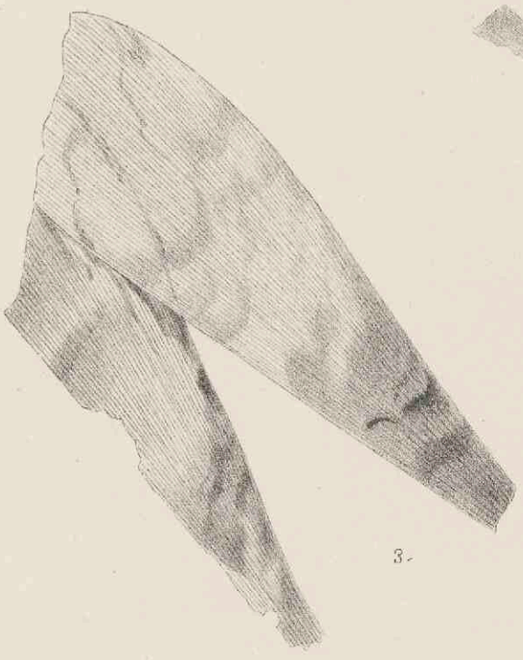
Fig. 3. NÖGGERATHIOPSIS HISLOPI, Bunb. (Feistm.), page 118. Another of those specimens which show two leaves in such a portion, in which they probably were originally attached as pinnulæ to a common stalk.

From Barkoi in the Umrét coalfield, Central Provinces.

1.



4.



3.

2.

J. Schaumburg Lith.

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PLATE XLVIIA.

PANCHET GROUP.

Figs. 11—13. SAMAROPSIS? sp., pages 123-124. Small-winged seeds.
From near Maitúr, nort-west branch of the Nunia river, north-west from Assensole, Raniganj coal-field.

RANIGANJ (Kámthi) GROUP.

Fig. 1. PTEROPHYLLUM BURDWANENSE, Feistm. (Mc'Clell. sp.), page 116. Very important specimen, being a true Zamieæ.
From the Raniganj coal-field.

Figs. 2—4. NÖGGERATHIOPSIS HISLOPI, Feistm., page 118. Fragmentary specimens.
From Kámthi, Nágpur area.

Figs. 8 & 16. SQUAMÆ GYMNOSPERMARUM (Cycadearum), page 119.
From the Raniganj coal-field.

Figs. 9, 10. SAMAROPSIS sp., pages 123-124. Winged seeds.
From the Sátpura basin.

Figs. 14, 15. SAMAROPSIS sp., page 124. Winged seeds.
From the Raniganj coal-field.

Fig. 19. VOLTZIA? scale, page 123.
From the Raniganj coal-field.

Figs. 20, 22, 24. VOLTZIA HETEROPHYLLA, Bgt., page 122. Leaved branches.
South Rewah basin; figs. 20, 22 from the Gopat river (J. G. Medlicott); fig. 24 from Hardi (Th. Hughes).

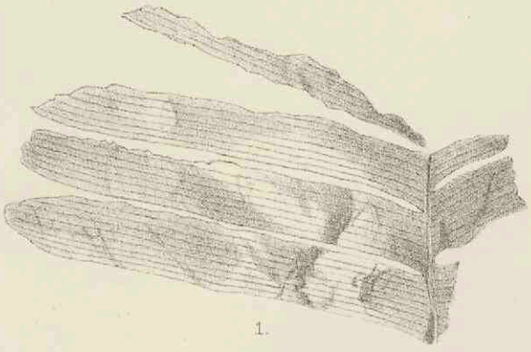
Fig. 23. SQUAMA, page 119.
From Guráru, on the Sone, South Rewah (Th. Hughes).

IRONSTONE SHALES.

Figs. 5—7. CONIFEROUS STEMS of? RHIPIDOPSIS, page 124.
From Kulti, Raniganj coal-field.

BARÁKAR GROUP.

Figs. 17, 18, 21. SQUAMÆ? page 119.
From Kumerdhubi, near Barákar, Raniganj coal-field.


1.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18.


19.


20.


21.


22.


23.


24.

J.Schaumburg, Lith^d. Printed at Geol. Survey Office.