

NOTES ON SOME UPPER GONDWANA PLANTS FROM THE ATHGARH SANDSTONES, CUTTACK DISTRICT, ORISSA*

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ABSTRACT

Some interesting plant impressions are described out of the collections made by the author since 1967 from some new localities and excepting a few, rest of the forms are going to be reported for the first time from the Athgarh sandstones (Jurassic, Rajmahal stage) of Cuttack district, Orissa. These include some filicales like *Gleichenia*, *Sphenopteris*, *Coniopteris*, *Onychiopsis* and *Cladophlebis*; Cycadophyta like *Nilssonia*, *Taeniopteris* and *Ptilophyllum* and Coniferales like *Araucarites*. The plant remains being very much fragmentary and preserved obscurely their specific identification is either difficult or doubtful in some cases.

INTRODUCTION

THE "Athgarh sandstones" constitute the northernmost exposures of the East coast Gondwana. They occupy the low lying hills west of Cuttack City and are exposed westwards from Naraj (20°28': 85°46') for a distance of about 12 miles. The north-south extension of the Athgarh sandstones is about 25 miles and the exposures are seen both on the north and the south bank of the Mahanadi. They comprise carbonaceous shales, arenaceous shales (white, pink and yellow), fireclay, sandstones, grits and conglomerates. Generally plant fossils are preserved in more shaly bands while sandstones and grits are devoid of them.

The first works on the geology of the Athgarh sandstones are those of Blanford, Blanford and Theobald (1859) and Blanford (1859 and 1872). V. Ball (1877) collected for the first time some plant fossils from a hill north of the Mahanadi. These were described by Feistmantel (1877a). In recent years Adyalkar and Nageswara Rao (1960 and 1963), Jain (1967), Pandya and Patra (1968) and Patra and Patnaik (1970) have contributed something to enrich the knowledge of plant fossils from the Athgarh sandstones.

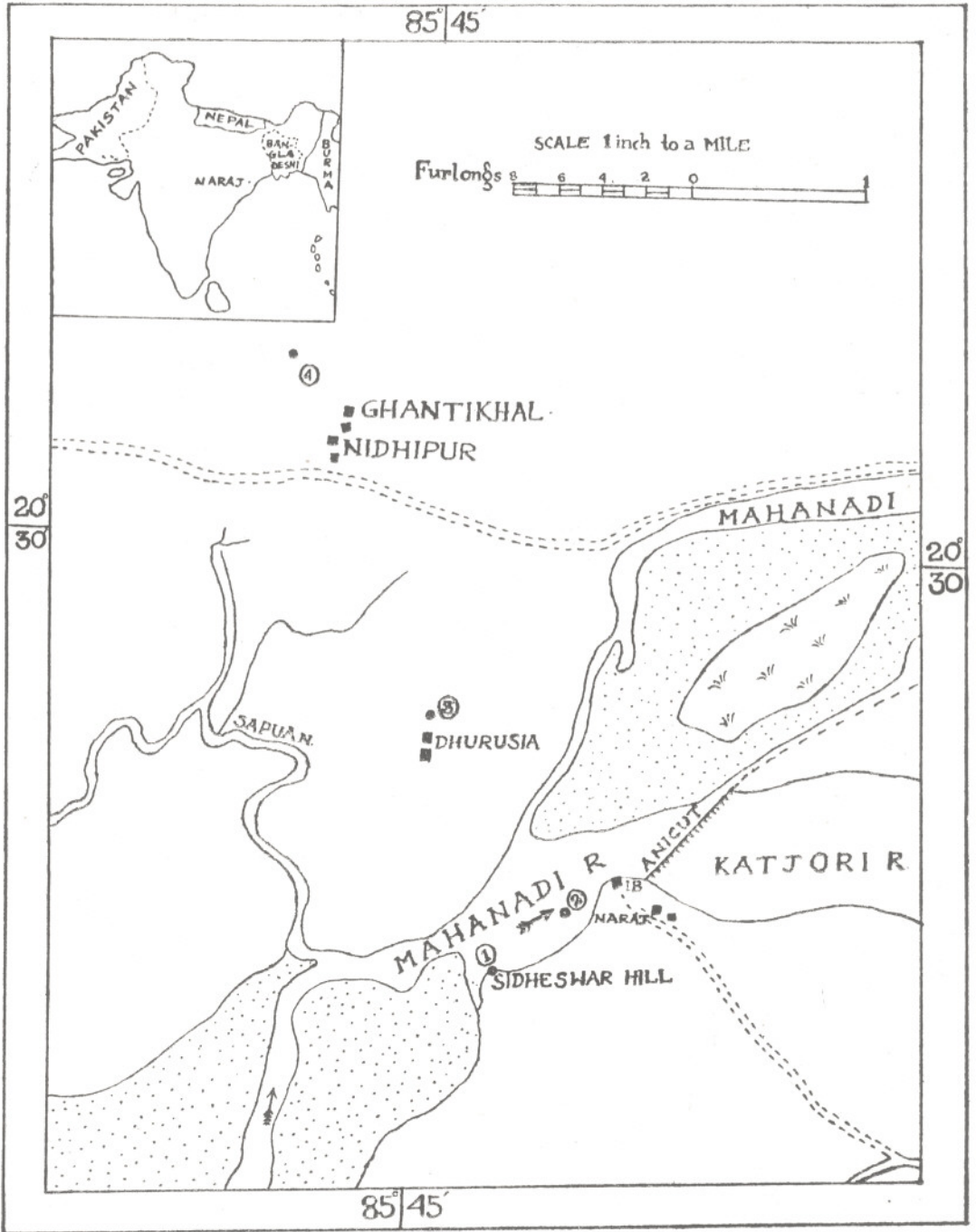
MATERIALS AND METHODS

The present paper deals with plant remains collected since 1967 onwards from

the carbonaceous shales of the Sidheswar hill (20°27'54": 85°45'25", Locality 1, sheet No. 73 H/15), yellow shales on the south bank of the Mahanadi, about 200 yds. west of Naraj I. B. (20°28'10": 85°45'47", Locality 2, sheet No. 73 H/15), white shales near Dhurusia (20°29'2": 85°45'. Locality 3, sheet No. 73 H/11), about 1 mile from the north-bank of the Mahanadi and from pink shales about $\frac{1}{2}$ mile north-west of Ghantikhal (20°32'52": 85°44'16", Locality 4, sheet No. 73 H/10). The map represented in text Fig. 1 shows the hitherto known or newly discovered fossil localities. The first collection was made from the carbonaceous shales of Sidheswar hill which are considered by Ball (1877) to be unfossiliferous (Patra & Patnaik, 1970). A newly constructed railway line connecting the Howrah-Madras main line at Barang in the south with the Neergundi-Talchir line at Raj Athgarh station in the north has cut across some hillocks of the Athgarh sandstones to the north of the Mahanadi. This railway cutting has brought to light the white and pink fossiliferous shales near Dhurusia and Ghantikhal respectively. A rich occurrence of plant impressions in the yellow shales of Naraj and the pink shales of Ghantikhal particularly has been encountered, out of which a few selected specimens are included in this paper.

The plant fossils comprise mostly impressions. They have been preserved in the carbonaceous shales, yellow and pink ferruginous shales and white siliceous shales. The carbonaceous shales are well-bedded but soft and brittle, while the other type of shales are almost massive with variable textures. Preservation of plants is to some extent better in yellow and pink shales. Some plant remains from the carbonaceous shales seem to be carbonized, but due to certain difficulties cuticular preparation has not been attempted. The materials have been identified only megascopically. Mostly they are fragmentary and specific identifications are often difficult or impossible.

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TEXT-FIG. 1 — Map showing the known or new fossiliferous localities of the area investigated in the Athgarh sandstones, Dist. Cuttack, Orissa.

DESCRIPTION

FILICALES

Genus — *Gleichenia* Smith*Gleichenia* sp.

Pl. 1, Fig. 1

Only one fragmentary specimen (Pl. 1, Fig. 1) in the collection from the carbonaceous shales of the Sidheswar hill (Locality 1) is referred to the genus *Gleichenia*. The specimen preserves the apical portion of a pinna measuring 7 mm × 1.5 mm, which bears some complete pinules. The pinnules are alternate, closely set, contiguous and attached obliquely to the pinna and with their entire breadth. The size of the pinnules gradually decreases towards the tapering apex of the pinna. The pinnules are small with approximately same length and breadth. They are more or less wedge shaped, with entire margins and rounded apices. Midribis not seen in pinnules.

The specimen is too fragmentary and deficient in most of the vital characters for specific identification. It is also not ascertained whether the pinnules are fertile or sterile. However, the general nature of the pinnules is comparable with those of *Gleichenia gleichenoides* (Oldham & Morris) (Bose & Sah, 1967, Pl. 2, Fig. 24). Further the pinnules of my specimen are not at all comparable with those of *Gleichenites* sp. (l.c. Fig. 45) in which they are bigger in size and the length is more than twice the breadth. Moreover, the pinnules in my specimen have more round apices than in *Gleichenites* sp. Therefore, the present specimen is put under *Gleichenia* sp.

Genus — *Sphenopteris* Brongniart*Sphenopteris* sp.

Pl. 1, Fig. 2

Single incomplete specimen obtained from the white siliceous shales of Dhurusia (Locality 3) is referable to the genus *Sphenopteris*. The specimen (Pl. 1, Fig. 2) measures 1.8 × 1.3 cm. The rachis is stout and cylindrical. It bears alternate pinnules which are not contiguous with one another. The pinnules are cuneate, possessed two or three lobes and gradually spread from base towards apex. Venation not visible.

The specimen is too incomplete for specific identification. Although the general shape and lobing of my specimen resembles to some extent with those of *Sphenopteris hislopi* (Surange, 1964, p. 115, Fig. 73) its imperfect nature does not permit it to be identified as *S. hislopi* with confidence. Therefore it is kept as *Sphenopteris* sp.

Genus — *Coniopteris* Brongniart? *Coniopteris* sp.

Pl. 1, Fig. 3

A fragmentary specimen from the white siliceous shales near Dhurusia (Locality 3) is referred to the genus *Coniopteris*. The specimen (Pl. 1, Fig. 3) measures 3.2 × 2.1 cm and preserves the pinnae on one side of the rachis which is not distinctly visible. As it seems, the frond is bipinnate. The pinnules are arranged alternately on the slender pinna axis. Venation not at all visible. The specimen is too imperfect even for generic identification. However, in general appearance it looks like *Coniopteris hymenophylloides* (Surange, 1964, p. 104, Fig. 65B). But the incomplete nature and bad preservation of my specimen does permit only to put it doubtfully under the genus *Coniopteris*. So it is named as ? *Coniopteris* sp.

Genus — *Onychiopsis* Yokoyama*Onychiopsis*? *paradoxus* Bose & Sukh Dev

Pl. 1, Figs. 4-5

Two fragmentary specimens referable to the species *Onychiopsis*? *paradoxus* from the yellow shales near Naraj (Locality 2) are shown in Figs. 4 & 5. The frond is bipinnate with a distinct main rachis (Pl. 1, Fig. 4). Pinnae are arranged alternately and start from the main rachis with small acute angles. Both sterile and fertile(?) pinnules might be occurring in the specimens (Pl. 1, Figs. 4 & 5). They are somewhat wedge shaped and lobed. The margin of the lobes entire. Venation very faintly marked.

In general appearance the present specimens resemble *Onychiopsis paradoxus* (Bose & Sukh Dev, 1959) to some extent. So doubtfully they have been put under *Onychiopsis paradoxus*.

Onychiopsis paradoxus resembles most other species of *Onychiopsis* among the Mesozoic fern fronds. It is a well known Wealden fern.

Genus — *Cladophlebis* Brongniart

Cladophlebis ?*denticulata*

Pl. 1, Fig. 6

Only one solitary specimen in the collection from the white siliceous shales near *Dhurusia* (Locality 3) is referred to *Cladophlebis* ?*denticulata*. The specimen (Pl. 1, Fig. 6) represents a portion of a pinnate frond. The rachis is strong and about 2 mm broad, bearing opposite pinnae. The incomplete pinna measures 4.1 × 1.80 cm. The pinna axis is 1.00 mm broad. The pinnules are alternate, moderate, closely set and somewhat overlapping. The average size of the pinnule is 12 × 3.5 mm. The pinnules are attached to the pinna axis with their whole width of the base and having rounded apices. The midrib of the pinnule is slender and is hardly persistent up to the apex. Secondary veins are present but not distinct.

In general appearance the present specimen resembles *Cladophlebis denticulata* Brongn (Sitholey, 1940, Pp. 6, 1, 7, Figs. 87 & 89). Hence it is doubtfully put under *Cladophlebis denticulata*

Cladophlebis ?*srivastavae* Gupta

Pl. 1, Fig. 7

Single incomplete specimen obtained from the pink shales near Ghantikhal (Locality 4) is referred to the species *Cladophlebis* ?*srivastavae*. The specimen (Pl. 1, Fig. 7) nicely preserves the apical portion of a pinna with a few complete pinnules. The axis of the pinna is slender and a little less than 1 mm broad. The pinnules are small, less than 5 mm in length and 2-3 mm in width. They are alternately arranged on the pinna axis and distinctly separable from one another. They are attached to the pinna axis with a broad base making a wide angle. They are bluntly pointed with smooth margins. Venation is typically of *Cladophlebis* type. There is a midrib from which a number of bifurcating veinlets arise on its either side.

The specimen being only the apical portion of a pinna, nothing can be told about its habit. However, its major characters are similar to *Cladophlebis srivastavae* sp. nov. (Gupta, 1954). Therefore, it is placed under *Cladophlebis srivastavae* with some doubt in specific identification.

Cladophlebis sp. (cf. *C. longipennis* Seward)

Pl. 1, Fig. 8

A fragmentary specimen from the pink shales near Ghantikhal (Locality 4) is referred to *Cladophlebis* sp. (cf. *C. longipennis*). The specimen (Pl. 1, Fig. 8) preserves only a portion of a pinna. The delicate pinna axis bears pinnules of variable sizes. The pinnules are falcate, decurrent at their bases and gradually taper towards apices which are bluntly rounded. No trace of venation is observed.

The specimen under study, though incomplete, is comparable in its general nature to *Cladophlebis* sp. (cf. *C. longipennis*) (Surange, 1964, p. 92, Fig. 56A). Hence it is placed under *Cladophlebis* sp. (cf. *C. longipennis*).

Cladophlebis indica (Oldh. & Morr.)

Pl. 1, Fig. 9

The single incomplete specimen obtained from the yellow shales of Naraj (Locality 2) is referable to the species *Cladophlebis indica*. The specimen (Pl. 1, Fig. 9) represents the apical portion of a pinna. The incomplete pinna measures 3.5 cm in length and gradually tapers towards the apex. The pinna axis is slightly less than 1 mm broad at the base and bears pinnules which are sub-alternate, lanceolate-ovate and gradually taper to form almost rounded apex. The margin of the pinnules are entire. They are attached to the pinna axis by their whole bases and contiguous with one another. Venation is not observed.

The specimen being fragmentary nothing can be told about its habit. However, excluding venation which is not preserved in the present specimen, it resembles *Cladophlebis indica* (Surange, 1964, p. 88, Fig. 52) in all other aspects. Hence it is put under *Cladophlebis indica*.

CYCADOPHYTA

Genus — *Nilssonia* Brongniart*Nilssonia* (*Anomozamites*?) ?*fissa*

Pl. 2, Figs. 10-11

One incomplete specimen from the yellow shales of Naraj (Locality 2) is referred to *Nilssonia* (*Anomozamites*?) ?*fissa*. The specimen (Pl. 2, Fig. 10, 11) preserves only a portion of a simple frond. It is characterized by a broad rachis of about 4 mm width. Some network like structures are preserved on the rachis. The lamina is dissected into several unequal segments on either side of the rachis. The dissecting furrows are continuous from the margin of the lamina up to the rachis. These dissecting furrows are undoubtedly primary and natural as the margin of the lamina at the point of dissection is very evenly rounded and not at all angular as usually seen in banana leaves which are torn to segments secondarily by the action of wind. The maximum width of the lamina from rachis to either margin is 5-6 mm. The lamina is further characterized by very fine parallel veins which arise from the rachis almost at right angles. Some of the veins are bifurcated before reaching the margin of the lamina.

The specimen under study is only a small fragment of a frond measuring only 3.0 cm in length. It seems the frond is of moderate size. It is comparable to some extent with *Nilssonia* (*Anomozamites*?) *fissa* (Sitholey, 1963, p. 19, Pl. 7, Fig. 45) in its segmentation of the lamina but the segments do not show any trace of forking at their tips. Therefore it is doubtfully placed under *Nilssonia* (*Anomozamites*?) ?*fissa*.

Genus — *Taeniopteris* Brongniart*Taeniopteris spatulata* McClell.

Pl. 2, Figs. 12-14

These three incomplete specimens of this genus are present in the collection from the yellow shales of Naraj (Locality 2). They constitute the narrower forms of this genus and have been accommodated in the species *Taeniopteris spatulata*. Two varieties of this species can be distinguished in the collection on the basis of the proportionate

width of the midrib to lamina (Gopal, Jacob and Jacob, 1953).

Taeniopteris spatulata var 'a'

Figure 12 represents a narrow form of leaf which measures 1.4 cm in width while the midrib is of 2.5 mm breadth. Fine parallel veins arise from the midrib at right angles. Bifurcation of the veins not distinguishable. Margins of the lamina entire.

Figure 13 represents another form of the same variety as described in Fig. 12. In this case the width of the leaf is 1.6 cm while the midrib is 3 mm wide. A network like structure is preserved on the midrib. Parallel veins arise from the midrib almost at right angles. The margins of the lamina is entire.

Taeniopteris spatulata var 'b'

The frond included in this variety (Pl. 2, Fig. 14) is characterized by proportionately narrower midrib than in those described above. The width of the lamina is 1.0 cm with a narrow midrib measuring 1 mm only. Very fine parallel veins arise from the midrib almost at right angles. The margins of the lamina are not dissected.

Genus — *Ptilophyllum* Morris

Four incomplete specimens collected from the yellow shales near Naraj (Locality 2) are referred to the genus *Ptilophyllum*. Cuticular study of the fronds which is considered as the vital point for specific identification of *Ptilophyllum*, has not been done. So on the basis of the external features a provisional name has been suggested.

Ptilophyllum catchense Morris

Pl. 2, Figs. 15-18

Four specimens are referred to the species *Ptilophyllum catchense* Morris (Pl. 2, Figs. 15-18). Out of them Figs. 15 & 16 reveal some distinct features for which they have been described in detail.

Figures 15 and 16 represent incomplete pinnate fronds which narrow towards bases, apex not recovered. Length of the frond (Pl. 2, Fig. 15) is 5.4 cm with a width of 1.2 cm at the broadest portion. Pinnules short and broad measuring 6-7 × 2-3

mm. They are obliquely placed over the rachis almost covering it, arranged alternately, closely set, or slightly imbricate towards the apical region. Margins parallel, apex obtuse, traces of radiating veins are observed.

The above described specimens externally resemble *Ptilophyllum cutchense* Morris (Baksi, 1967, Pl. 1, Figs. 2a 2b). So they are put under *Ptilophyllum cutchense* Morris.

The fragmentary pinnate fronds shown in Pl. 2, Figs. 17-18 are characterized by identical pinnules as described above. They are arranged obliquely and alternately with obtuse apices. The tapering nature of the fronds are not clear in these two specimens as they preserve mostly the middle portions only.

CONIFERALES

Genus — *Araucarites* Presl

Araucarites cf. *macropterus* Feist.

Pl. 2, Fig. 19

Only one specimen obtained from the carbonaceous shales of the Sidheswar hill (Locality 1) has been referred to the species *Araucarites* cf. *macropterus*. The specimen (Pl. 2, Fig. 19) preserves the complete cone with some portion of the scale which surrounds it. The cone measures 3.0 cm in length and 1.9 cm in breadth at the widest part. The cone is wider at the distal portion while it tapers to a narrow proximal end (width 4 mm only). The distal end is almost semicircular. The periphery of the entire cone is even and it looks like an inverted vessel. The scale surrounding the cone is circular and measures 8 mm in width. It is dissected. No seed is visible in the cone.

The present specimen closely resembles *Araucarites* cf. *macropterus* Feist. of Sahni (1928, p. 33, Pl. 6, Fig. 76). Therefore it is placed under *Araucarites* cf. *macropterus* Feist.

REMARKS

The plant remains described above have been collected from four localities out of which locality 1 was reported previously (Patra & Patnaik, 1970). The other three localities are being reported to be fossiliferous for the first time. In between my

localities 3 & 4 another fossiliferous locality (26°30'00":85°44'30") has been described by Adyalkar and Nageswara Rao (1963). It is about 5 furlongs south of the village Ghantidhal (actual name is Ghantikhal). But my locality 4 (26°32'52":85°44'16") is about half a mile north-west of Ghantikhal. Jain (1967) has also described plant fossils from a hill, about one mile south-south-east of Ghantikhal village. So there are three fossiliferous localities near about Ghantikhal. But my locality 4 being one of the three neither coincides with that of Adyalkar and Nageswara Rao nor Jain.

The present paper reports the occurrence of the following four genera for the first time in the Athgarh sandstones. They are *Gleichenia*, ?*Coniopteris*, *Onychiopsis* and *Nilssonia*. Further the paper incorporates three species like *Sphenopteris* sp., *Cladophlebis indica* and *Taeniopteris spatulata* McClell. which have been described by different authors in different times from localities other than the four included here but belonging to the Athgarh sandstones. Lastly it also contains five newly reported species coming under the genera already described from the Athgarh sandstones. They are *Cladophlebis denticulata* C. srivastavae Gupta, C. sp. (cf. *C. longipennis* Seward), *Ptilophyllum cutchense* Morris and *Araucarites* cf. *macropterus* Feist.

The distribution of species described above in space and time, has been given in Table 1 and Table 2 respectively.

AGE OF THE ATHGARH SANDSTONES

It has already been mentioned earlier that the present collection is rather very poor in preservation as well as in the number of fossils. Complete specimens are absolutely rare or absent. Identifications are based on these fragmentary remains. However, a few of them show some characteristic features for specific identification also. Nine forms described above are represented by only one specimen each, whereas the rest three viz., *Onychiopsis* ? *paradoxus*, *Taeniopteris spatulata* and *Ptilophyllum cutchense* are each having two, three and four specimens respectively.

A study of Table 2 reveals that with the exception of *Gleichenia* sp., *Onychiopsis* ? *paradoxus*, *Cladophlebis* sp. (cf. *C. longipennis*),

TABLE 1 — DISTRIBUTION OF SPECIES DESCRIBED ABOVE IN THE FOUR LOCALITIES

NAME OF THE SPECIES	LOCALITIES			
	1	2	3	4
FILICALES				
<i>Gleichenia</i> sp.	×	—	—	—
<i>Sphenopteris</i> sp.	—	—	×	—
? <i>Coniopteris</i> sp.	—	—	×	—
<i>Onychiopsis</i> ? <i>paradoxus</i> . Bose & Sukh Dev	—	×	—	—
<i>Cladophlebis</i> ? <i>denticulata</i>	—	—	×	—
<i>Cladophlebis</i> ? <i>srivastavae</i> Gupta	—	—	—	×
<i>Cladophlebis</i> sp. (cf. <i>C. longipennis</i> (Seward))	—	—	—	×
<i>Cladophlebis indica</i> (Oldham & Morr.)	—	×	—	—
CYCADOPHYTA				
<i>Nilssonia</i> (<i>Anomozamites</i> ?) ? <i>fissa</i>	—	×	—	—
<i>Taeniopteris spatulata</i> McClell.	—	×	—	—
<i>Ptilophyllum cutchense</i> Morris	—	×	—	—
CONIFERALES				
<i>Araucarites</i> cf. <i>macropterus</i> Feist.	×	—	—	—
Locality 1 — South bank of the Mahanadi on the northern flank of the Sidheswar hill (20°27'54": 85°45'25").				
Locality 2 — South bank of the Mahanadi about 200 yards west of Naraj I.B. (20°28'30": 85°45'47").				
Locality 3 — About 1 kilometer from the north bank of the Mahanadi (20°29'2": 85°45'00").				
Locality 4 — Half a mile north-west of Ghantikhal (20°32'52": 85°44'16").				

TABLE 2 — DISTRIBUTION OF THE SPECIES DESCRIBED ABOVE IN THE UPPER GONDWANA GEOLOGICAL HORIZONS OF INDIA

NAME OF THE SPECIES	GEOLOGICAL HORIZON			
	Rajmahal	Kota	Jabalpur	Umia
FILICALES				
<i>Gleichenia</i> sp.	—	—	+?	—
<i>Sphenopteris</i> sp.	+	—	—	—
? <i>Coniopteris</i> sp.	+	—	+	—
<i>Onychiopsis</i> ? <i>paradoxus</i> Bose & Sukh Dev	—	—	+	—
<i>Cladophlebis</i> ? <i>denticulata</i>	+	—	+	+
<i>Cladophlebis</i> sp. (cf. <i>C. longipennis</i> Seward)	—	—	+	—
<i>Cladophlebis</i> ? <i>srivastavae</i> Gupta	+	—	—	—
<i>Cladophlebis indica</i>	+	—	—	—
CYCADOPHYTA				
<i>Nilssonia</i> (<i>Anomozamites</i> ?) ? <i>fissa</i>	+	—	—	—
<i>Taeniopteris spatulata</i> McClell.	+	+	+	—
<i>Ptilophyllum cutchense</i> Morris	—	—	+	—
CONIFERALES				
<i>Araucarites</i> cf. <i>macropterus</i>	—	—	+	—

Ptilophyllum cutchense and *Araucarites* cf. *macropterus* which are the typical members of the Jabalpur stage, the rest seven forms described in the present collection are referable to those already reported from the Rajmahal stage of the Rajmahal series. Therefore, it is evident from the present findings, though obscure in number of forms, that the age of the Athgarh sandstones may range from the Rajmahal stage to the Jabalpur stage (Jurassic to Lower Cretaceous) of the Upper Gondwanas. However, previously it was considered to be equivalent to the Dubrajpur stage (Pascoe, 1959) or the Rajmahal stage of the Rajmahal series of the Upper Gondwanas (Feistmantel, 1877b; Adyalkar & Nageswara Rao, 1963).

CONCLUSION

I have only begun to study the fossil flora of the Athgarh sandstones of Cuttack

district, Orissa and so far I have covered a small area from which I have collected the specimens described in the present paper. A number of specimens in my collection are yet to be identified. It is very likely that further critical examination of all the type localities and other shaly bands elsewhere may yield richer fossil assemblage. It is now evident that the Athgarh sandstones also contain a flora which is rich both in varieties and forms like other East Coast Gondwanas of India.

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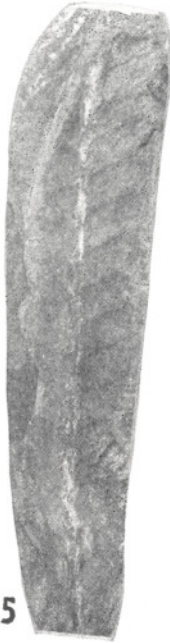
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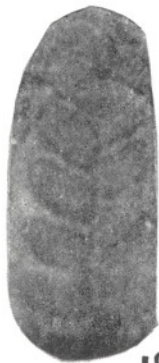
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EXPLANATION OF PLATES

PLATE 1

1. *Gleichenia* sp. Apical portion of a pinna showing some complete pinnules. F.12(Loc. 1). × 5.
2. *Sphenopteris* sp. Fragment of a frond showing strong rachis and globed pinnules. F.60(Loc. 3). × 2.
3. ?*Coniopteris* sp. A bipinnate frond with slender pinna rachis. F.59(Loc. 3). × 1.5.
4. *Onychiopsis* ?*paradoxus* — Bose and Sukh Dev. A bipinnate frond with distinct main rachis. N.168(Loc. 2). × 2.
5. *O.* ?*paradoxus* Bose and Sukh Dev. Another specimen with finer pinnules. N.127(Loc. 2). × 2.
6. *Cladophlebis* ?*denticulata*. The incomplete frond showing strong rachis and opposite pinnae. F.61(Loc. 3). × Nat. size.
7. *C. srivastavae* Gupta. Apical portion of a pinna with some complete pinnules. G₁(Loc. 4). × 1.5.
8. *C.* sp. (cf. *C. longipennis* Seward). A fragmentary pinna showing characteristic pinnules without venation. G.2(Loc. 4). × 2.
9. *C. indica* (Oldh. & Morr.). Apical portion of a pinna showing some complete pinnules. N.129(Loc. 2). × 1.5.

PLATE 2

10. *Nilssonia* (*Anomozamites*)? *fissa*. Portion of a frond having broad mid rib and dissected lamina. N.193(Loc. 2). × 2.
11. *N.* (*Anomozamites*)? *fissa* Counter part to 10. N.193a(Loc. 2). × 2.5.
12. *Taeniopteris spatulata* McClell. A narrow leaf with broad midrib. N.117(Loc. 2). × 1.5.
13. *T. spatulata*. McClell. Another leaf with broad midrib. N.191(Loc. 2). × 2.
14. *T. spatulata* McClell. Narrow leaf with narrower midrib. 141a(Loc. 2). × 1.5.
15. *Ptillophyllum cutchense* Morris. An incomplete frond with tapering base. N.108(Loc. 2). × 1.5.
16. *P. cutchense* Morris. A frond with tapering base & smaller pinnules. N.148(Loc. 2). × 2.
17. *P. cutchense* Morris. Middle portion of a frond with some complete pinnules. F.9(Loc. 2). × 3.
18. *P. cutchense* Morris. Middle portion of a frond showing alternate pinnules. N.148(Loc. 2). × 2.5.
19. *Araucarites* cf. *macropterus* Feist. Complete cone and part of the scale. F.40(Loc. 1). × 1.5.