

SOME PLANT REMAINS FROM PATHARGAMA, RAJMAHAL HILLS, BIHAR

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ABSTRACT

Plant remains from a hitherto unknown locality in the Rajmahal Hills form the subject matter of this paper. The new locality lies at the base of a hill cutting near Pathargama Village. The bed is dominated by *Thinnfeldia indica* Feistmantel. An emended diagnosis of this species has been given. The associated ginkgoalean leaves have been described as *Ginkgo rajmahalensis* (Sah & Jain) comb. nov. To these leaves some *Ginkgo*-like seeds have been attributed. The seeds are much smaller in size than the extant *Ginkgo* seeds, but their mode of attachment is similar. Besides these, *Araucarites* sp. and *Strobilites* sp. have also been recorded.

Key-words — *Thinnfeldia*, *Ginkgo*, Rajmahal Formation, Upper Gondwana (India).

सारांश

पथरगाम, राजमहल पहाड़ियाँ, बिहार से कुछ पादप अवशेष—जेबा-बानो, हरिकृष्ण माहेश्वरी एवं महेन्द्र नाथ बोस

राजमहल पहाड़ियों में एक नये स्थान से प्राप्त पादप अवशेष इस शोध-पत्र का विषय है। यह नया स्थान पथरगाम गाँव के पास एक पहाड़ी की कटान के अधोभाग में स्थित है। संस्तर में थिनफ़ेल्डिया इन्डिका फ़ाइस्टमैन्टेल की प्रधानता है। इस प्रजाति का संशोधित निदान भी दिया गया है। सहचारी गिन्कगोली पत्तियों को गिन्कगो राजमहलेन्सिस शाह एवं जैन नव-सन्धि के नाम से वर्णित किया गया है। इन पत्तियों से कुछ गिन्कगो-सदृश बीज भी संबन्धित किये गये हैं। ये बीज आकार में तो वर्तमान गिन्कगो के बीजों से बहुत छोटे हैं परन्तु इनके संलग्न का ढंग उन्हीं जैसा है। इनके अतिरिक्त अँरैकेराइटिस जा० तथा स्ट्रोबिलायटिस जा० भी अभिलिखित हैं।

INTRODUCTION

THE name Rajmahal Hills is generally used for an area bounded on the north by the Ganga, on the east partly also by the Ganga but mostly by alluvial plains, on the south by the river Dwarka and on the west by the plains of Birbhum and Bhagalpur districts. The principal rivers of the region are the Brahmini, the Bansloi and the Gumani. The general elevation of the hills and plateaus varies from between 150 and 240 m above the mean sea level; individual hills, however, may be as much as 450 m high.

The first detailed geological mapping of the region was done by Ball (1877). Accord-

ing to him the rock-sequence in the area is as follows in descending order:

- ALLUVIUM
- LATERITE
- GONDWANA SYSTEM
 - Rajmahal Group
 - Dubrajpur Group
 - Barakar Group (Damuda Series)
 - Talchir Group
- METAMORPHIC SERIES

In the light of recent status of Indian stratigraphical zonation, the four subdivisions of the Gondwana succession in the Rajmahal Hills should now read as Rajmahal Formation, Dubrajpur Formation,

Barakar Formation and Talchir Formation. First formation belongs to the Upper Gondwana while the last two belong to the Lower Gondwana. Dubrajpur Formation partly belongs to the Lower Gondwana and partly to the Upper Gondwana. The Dubrajpur sequence is characterized by bands of conglomerates, grits and sandstones with inclusions of fine-grained arenaceous beds/shales (Sah & Shah, 1974, p. 447). The formation ranges in time from Upper Permian to Upper Jurassic with a huge palaeontological break encompassing whole of Triassic and Lower-Middle Jurassic. Floristically it has two zones; the lower zone having *Glossopteris* and *Vertebraria* is ?Upper Permian in age, while the upper zone with elements of the *Ptilophyllum* flora is equivalent to the basal 3 lava flows of the Rajmahal Formation.

In this paper, as plant fossils have been described only from the Rajmahal Formation, a brief description of the geology of this formation only is given. According to Singh (1974) the formation consists of about 450 m of basaltic lava flows with thin bands of intertrappean sedimentaries whose total thickness does not exceed 30 m. The intertrappean bands range from 1.5 m to 7.5 m in thickness. According to Singh (1974, p. 460), Ramaswamy (1952-53, unpublished) found at least 15 lava flows with 11 intertrappean beds. The intertrappeans are chiefly composed of hard, white and grey shale, white and grey sandstone, carbonaceous shale and hard quartzose grit (Pascoe, 1959). Locally iron rich bands are present. Only the lower five intertrappean bands are fossiliferous.

The Rajmahal Formation has been variously dated as Liassic (Feistmantel, 1877b), Lower Jurassic (Ball, 1877), Middle Jurassic (Halle, 1913) and Upper Jurassic (Sahni, 1938). Upper Jurassic is the generally accepted age for this formation. Recent K/Ar determinations have, however, assigned an age 100-105 million years (Albian) to the Rajmahal Traps (McDougall & McElhinny, 1970). The mega- and microfloras of the Rajmahal Formation do not support the radiometric age determination.

The flora of the Rajmahal Formation basically belongs to two groups:

Group II—Flora from the intertrappean beds associated with lava flows 4-5 at Nipania. The flora is dominated by conifers

and pteridophytes. Bennettitalean remains are rare.

Group I—Flora from the intertrappean beds associated with lava flows 1-3 from below and from the upper floral zone of the Dubrajpur Formation. It is dominated by Bennettitales and Filicales. Remains of Equisetales, Lycopodiales, Coniferales, and a few Ginkgoales are also present. Associated are found fish scales and a few unionids.

MATERIAL

The megafossils described in the present paper were collected from a hill exposure (Text-fig. 1) near the village Pathargama (25°0'21"N. lat.: 87°41'34"E. long.). The fossils are preserved as impressions in a buff-grey splintery shale.

Besides the species described in the paper, several well known and common plants have also been found at Pathargama. These are *Sphenopteris* sp., *Taeniopteris spathulata* McClelland, *Ptilophyllum acutifolium* Morris, *Pterophyllum* sp. and *Elatocladus tenerima* (Feistmantel) Sahni.

Genus — *Thinnfeldia* Ettingshausen

Thinnfeldia indica Feistmantel, 1876

Pl. 1, figs 1-6; Pl. 2, figs 8, 9; Text-figs 2A-D

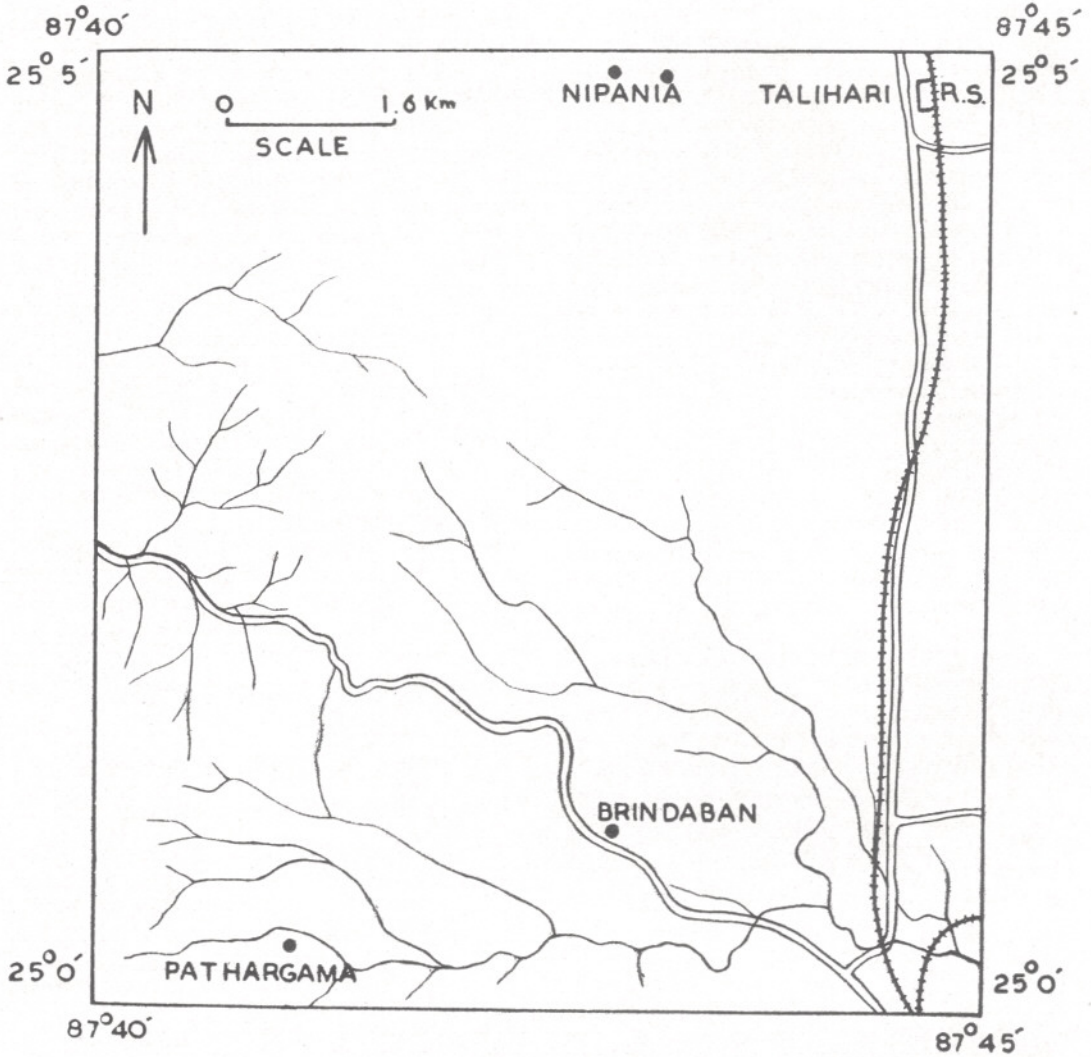
1876 *Thinnfeldia indica* Feistmantel, p. 35.

1877 *Thinnfeldia indica* Feistmantel, p. 35, pl. 39, figs 1, 1a; pl. 46, figs 1, 2, 2a.

1914 *Thinnfeldia indica* Feistmantel: Antevs, p. 36, pl. 5, fig. 3.

1970 *Thinnfeldia indica* Feistmantel: Gururaja & Pant, p. 387.

Emended Diagnosis—Fronds simply pinnate, shape as a whole broadly lanceolate, largest available frond measuring 12.0 × 6.8 cm. Rachis flattened, up to 0.5 cm broad, gradually narrowing towards apex, surface having fine longitudinal striations. Pinnae variable in size, shape and mode of attachment; attached laterally to rachis at an angle of 40°-55°, alternate or subopposite, sparse, lanceolate, gradually narrowing to a bluntly acute apex; largest pinnae measuring 5.0 × 1.0 cm, smallest pinnae 0.8 × 0.5 cm (average 2.0-4.0 × 0.8-1.0 cm) in size. Acroscopic margin truncate, basicopic margin decurrent, running downwards along lateral side of rachis and almost



TEXT FIG. 1 — A map of Purnea and Santhal Parganas Districts, Rajmahal Hills, Bihar showing the locality Pathargama.

joining acroscopic margin of pinna below; decurrent basiscopic margins of pinnae forming narrow wings on lateral sides of rachis. Pinnae margin at base almost entire, towards middle and apical region wavy or undulated. Midrib feebly marked, sometimes evanescent towards apex, placed slightly above middle region. Lateral veins fine, numerous, forking at all levels, forking 1-3 times, mostly twice, arching and reaching the margins, sometimes a few basal lateral veins arising directly from rachis, number of veins per cm 20-22.

Lectotype — G.S.I. no. 4511 (Feistmantel 1877a, pl. 39, fig. 1).

Occurrence — Buskoghat, Burio and Pathargama in the Rajmahal Hills, Bihar.

Age — ? Upper Jurassic.

Discussion — Doludenko (1969, 1971, 1974) merged the genus *Thinnfeldia* Ettingshausen with the genus *Pachypteris* Brongniart and considered the former as a junior synonym of the latter. We have here described our specimens under *Thinnfeldia* because we do not know anything about their cuticular structure. Also unlike the



TEXT-FIG. 2 — *Thinnfeldia indica* Feistmantel. A, B.S.I.P. no. 40/1248, a few pinnae showing venation $\times 2$. B, B.S.I.P. no. 112/1248, specimen showing alternate arrangement of pinnae and their venation $\times 1$. C, B.S.I.P. no. 41/1248 $\times 1$. D, B.S.I.P. no. 23/1248 $\times 1$.

type species of *Pachypteris*, viz., *P. lanceolata* Brongniart (1828) all our specimens are unipinnate and each pinna has a comparatively distinct midrib with numerous lateral

veins which are forking 1-3 times. Most species of *Pachypteris* are bipinnate (although Harris, 1964 included the once pinnate leaves of *Pachydermophyllum papillosum*

Thomas & Bose, 1955 under *Pachypteris*) and in them the midribs of the pinnules are usually not so prominent. The lateral veins, too, are obscure, very few in number and arise at a narrow angle. In our opinion these differences, in external features, have enough justification to describe our specimens under the genus *Thinnfeldia*. We think that in case of Gymnosperms uni- and bi-pinnate leaves should not be included under the same genus. Moreover, if we go only on cuticular features, quite a few species of *Otozamites* will have to be merged with *Ptilophyllum*. Similarly, some of the species of *Gangamopteris* will have to be included under *Glossopteris* and *vice versa*.

The original description of *Thinnfeldia indica* was based on a specimen from Buskoghath and two specimens from Burio. Now many more specimens have been collected from Pathargama. The fossiliferous bed at the base of the Pathargama hill is overwhelmingly dominated by *T. indica*. Most of them resemble the original figured specimens of Feistmantel (1877a) but a few show a slight variation. In some specimens the angle of emergence of pinna is much more than in the others (Pl. 2, fig. 9). Such fragments perhaps belong to the middle region of the frond. There are a few fragmentary specimens (Pl. 1, fig. 5) which have rather small pinnae. The position of midrib, too, varies from frond to frond. In majority of the pinnae the midrib is situated slightly above the middle region, while in others the midrib is more medianly placed. Like *T. chunakhalensis* Sah & Dev (1958) it is most likely that *T. indica* was also imparipinnate (Pl. 2, fig. 8).

Comparison — The present specimens match the specimens of *Thinnfeldia indica* described and illustrated by Feistmantel (1877a) from Buskoghath and Burio, Rajmahal Hills. In general morphology of pinnae *T. indica* resembles *T. chunakhalensis*. The former has mostly larger pinnae with feebly marked midrib and numerous closely set lateral veins. In *T. chunakhalensis*, pinnae margin is straight and they have a strong midrib with fewer number of lateral veins which fork more regularly. Here the lateral veins, a little away from the point of emergence, fork once and then each of these veins divide once again closer to the margin. *Thinnfeldia* cf. *T. lancifolia* described by

Sharma, Surana and Singh (1971) from Amarjola, Rajmahal Hills has somewhat similar pinnae as *T. indica* but in the former species the lateral veins are much less in number and the venation pattern is more like *T. chunakhalensis*. The overall pinnae shape is also quite unlike *T. lancifolia*. *T. speciosa* Ettingshausen figured and described by Gothan (1912) and later described by Doludenko (1969) as *Pachypteris* aff. *speciosa* (Ettingsh.) Andrae has narrower and elongated pinnae and it has fewer lateral veins.

Genus — *Ginkgo* Linnaeus

Ginkgo rajmahalensis (Sah & Jain) comb. nov.

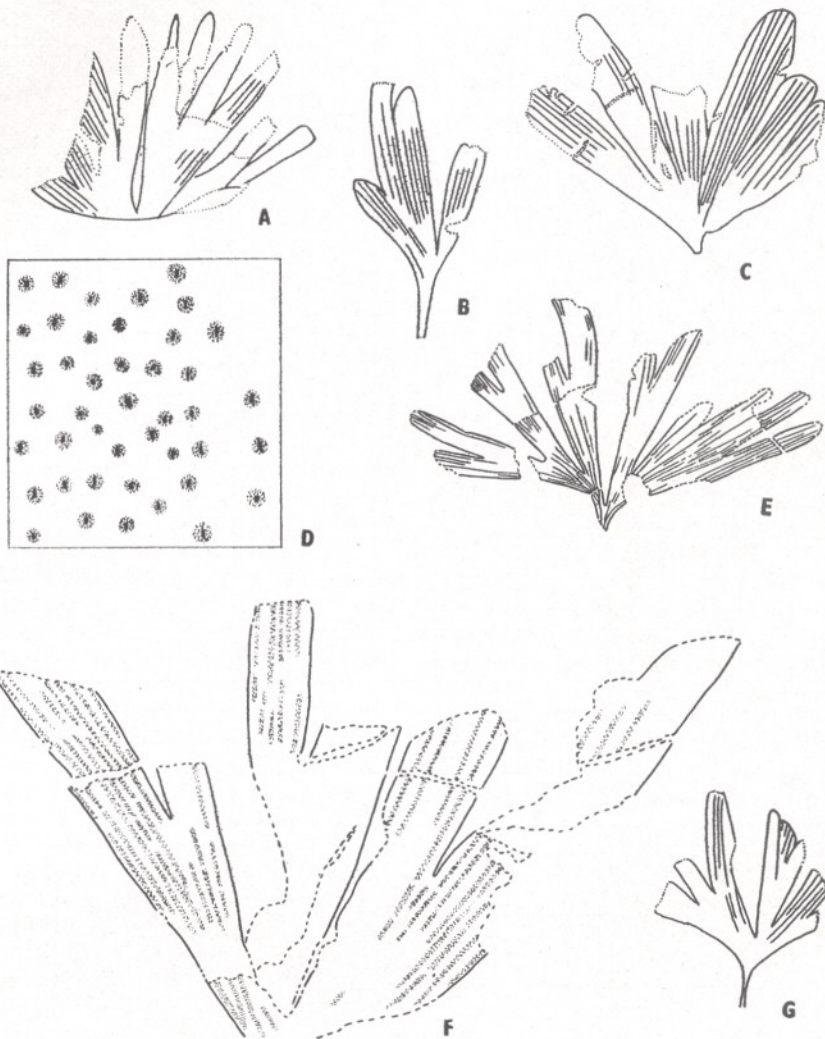
Pl. 1, fig. 7; Pl. 2, figs 10-14; Pl. 3, figs 23, 24; Text-figs 3A-G

- 1952 *Ginkgoites* sp.: Sah, p. 129, figs 1-3.
 1953 ?*Baiera* sp.: Mehta & Sud, p. 51, pl. 1, fig. 1.
 1953 ?*Ginkgoites* sp.: Mehta & Sud, p. 52, pl. 1, figs 2-3.
 1953 *Ginkgoites* sp. 1-3: Sah, p. 55, pl. 1, figs 1-11; text-figs 1-11.
 1963 *Ginkgoites* sp.: Sitholey, p. 28, pl. 9, figs 64-66.
 1965 *Ginkgoites rajmahalensis* Sah & Jain, p. 155, pl. 1, figs 1-13; text-figs 1-9.
 1974 *Ginkgoites rajmahalensis* Sah & Jain: Sitholey & Bose, p. 210.

Diagnosis — Leaves variable in size and shape. Lamina wedge-shaped or obtusely, 2-6 cm long, 2.5-6 cm broad, dissected into a number of segments due to primary incisions. Basal angle of lamina about 140°-160°. Segments linear, spatulate or club-shaped, apex obtusely rounded, margin entire. Sometimes a few segments notched at apex or deeply incised. Veins arising from base of each segment, 8-12 in number, parallel, forked or unforked; when forked — mostly once, sometimes twice, never converging to a point. Petiole prominent, uniformly broad, 1-2.3 cm long, 1-1.5 mm broad.

Cells along veins serially arranged, rectangular, with slightly wavy lateral- and end-walls. Between veins stomata irregularly distributed.

Holotype — No. 28036, Birbal Sahni Institute of Palaeobotany, Lucknow.



TEXT-FIG. 3 — *Ginkgo rajmahalensis* (Sah & Jain) comb. nov. A, B.S.I.P. no. 16690 \times 1. B, B.S.I.P. no. 4910 \times 1. C, B.S.I.P. no. 4907 \times 1. D, B.S.I.P. Slide no. 28036-1, showing stomatal distribution \times 250. E, B.S.I.P. no. G 36/1248 \times 1. F, B.S.I.P. no. 4/1248 \times 4. G, B.S.I.P. no. 4898 \times 1. [Text-figs. 3 A-D, G are from Sah & Jain, 1965]

Occurrence — Sakrigalighat, Maharajpur, Basko, Segarbhanga and Pathargama in the Rajmahal Hills, Bihar.

Age — ?Upper Jurassic

Discussion — Sah and Jain (1965) based their description of *G. rajmahalensis* on a large number of impressions from Sakrigalighat, Maharajpur and Segarbhanga. Amongst these, the largest number of specimens are from Sakrigalighat which are preserved as iron stained impressions in a fragile

arenaceous shale. In none of these any cuticular structure could be made out. The study of the surface features is based mainly on a petrified specimen from Basko. Out of this specimen, under reflected light, it is possible to make out the outlines of the cells along the veins. Between the veins only the position of the stomata is faintly marked. Details of the stomatal apparatus are not preserved.

At Pathargama, too, *G. rajmahalensis* is fairly common. Unfortunately, none of

the specimens show any details of the cuticle. Otherwise, they compare with the other specimens described by Sah and Jain (1965).

The generic name *Ginkgo* has been adopted here according to the suggestion of Harris and Millington (in Harris, Millington & Miller, 1974).

Comparison—*Ginkgo rajmahalensis* is quite different from the other known Jurassic-Cretaceous ginkgoean species from India, viz., *Ginkgo lobata* Feistmantel (1877b), *G. crassipes* Feistmantel (1879) and *Ginkgo feistmantelii* (Bose & Dev) comb. nov. (basionym *Ginkgoites feistmantelii* Bose & Dev, 1958, p. 152, pl. 3, fig. 15; text-figs 7A-J). The lamina of *G. crassipes* and *G. feistmantelii* is unsegmented. In the latter species the venation is much coarser as compared to *G. rajmahalensis*. In *G. crassipes* the veins are comparatively close and the characteristic feature is the repeated forking of veins at different levels. *G. lobata* is imperfectly preserved, and it has very few and broad segments. Each segment shows repeated (6-7 times) dichotomy of its veins at different levels.

Harris and Millington (in Harris, Millington & Miller, 1974) have compared the shape of *Ginkgo* sp. cf. *sibirica* Heer with *G. rajmahalensis*.

SEEDS ATTRIBUTED TO *GINKGO*

Pl. 2, figs 15-19; Pl. 3, fig. 20; Text-fig. 4A, B

Description—The collection includes two forked seed bearing axes and several isolated seeds.

Main stalk of the axes about 5 mm long and 3.5 mm broad, bifurcated once, each arm bearing at tip an orthotropous, sessile,

radially symmetrical, ovate seed, 6×5–8×7 mm in size. Each seed having an outer fleshy and an inner stony layer.

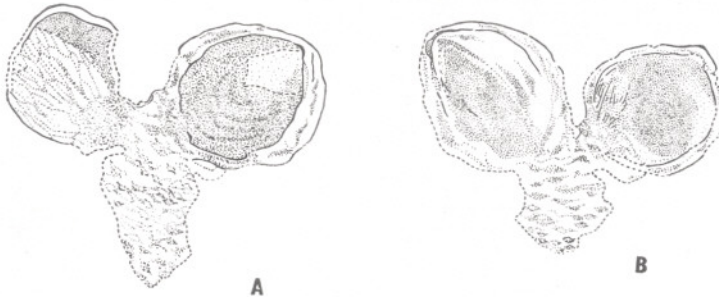
Collection—B.S.I.P. nos. 18/1248, 1/1248, 5/1248, 81/1248.

Locality—Pathargama, Rajmahal Hills, Bihar.

Age—? Upper Jurassic.

Remarks—In the present collection though the forked axes (Pl. 2, figs 15-17) have not been found in organic connection with *Ginkgo rajmahalensis*, yet because of their striking similarity with the ovulate strobili of *Ginkgo biloba* we consider them most likely to be the female fertile organs of the associated leaves of *G. rajmahalensis*.

Comparison—The specimens having paired seeds somewhat resemble the normal ovulate strobili of *Ginkgo biloba* Linn. In both, the seeds are borne on peduncles, the tip of the peduncle bifurcates and each branch bears a single sessile seed. The Pathargama specimens, however, differ from the extant species in the absence of seed "collar". The seeds are also much smaller in size than the normal seeds of *G. biloba*. Some branched specimens, supposed to be parts of ginkgoalean ovulate strobili, have been figured by Heer (1876) and Prinada (1962). Some of the seeds found associated with these specimens resemble the seeds of the present specimens. Harris and Millington (in Harris, Millington & Miller, 1974) have figured a few ginkgoalean seeds from Yorkshire. They have attributed these seeds to *Ginkgo huttonii* (Sternberg) Heer. These seeds in general appearance resemble the seeds described here, but they are more than twice the size of Pathargama seeds.



TEXT-FIG. 4—Seeds attributed to *Ginkgo*. A, B.S.I.P. no. 18/1248 × 4. B, B.S.I.P. no. 1/1248 × 4.

Genus — *Strobilites* Lindley & Hutton*Strobilites* sp.

Pl. 3, figs 21, 22, 25-33

Description — Description is based on several detached megastrobili. Strobili having spirally arranged, crowded, sessile seeds which completely conceal the cone axis. Strobili elliptical in shape, $1.0 \times 0.4-2.0 \times 1.0$ cm in size. Seeds 8-14 in number, variable in size and shape, measuring about $1.5 \times 1-2 \times 1.5$ mm, somewhat ovoid, ? micro-pyles pointing outwards. Seeds showing two distinct layers — outer thin layer and an inner stony layer which is darker in colour and having fine longitudinal striations.

Collection — B.S.I.P. nos. P₁, P₂, P₄, 22/1248, 6/1248, 7/1248, 26/1248, 14/1248.

Locality — Pathargama, Rajmahal Hills, Bihar.

Age — ?Upper Jurassic.

Comparison — At first glance the strobili described here show an apparent resemblance to *Carnocites laxum* Srivastava described by Sahni (1948). However, a closer examination shows that the outer seed coats in the two are quite distinct. In the present specimens the outer seed coat is rather thin, whereas, in *C. laxum* the outer layer is very thick and fleshy. The fleshy layers of adjacent seeds in *C. laxum* press against each other in such a way so as to form a sort of compact overall outer layer for the entire strobilus. In the present specimens the upper sides of the adjacent seeds are free and not touching each other.

The present specimens may be compared with *Karkenias* described by Archangelsky (1965) from Argentina in size and crowded and spiral arrangement of seeds. The two, however, differ in the mode of attachment of seeds. In *Karkenias incurva*, the type species, up to 100 pedunculate, curved (atropous) seeds are densely packed and irregularly disposed around a main central axis, while in present specimens the central axis is not seen, seeds are only 8-14 in number and sessile.

Genus — *Araucarites* Presl? *Araucarites* sp.

Pl. 3, figs 34-36

Description — The specimen (Pl. 3, fig. 35) seems to represent a sort of transverse

section of a megastrobilus. It shows 6 seed-scales, perhaps originally arranged in a close spiral around a thin central axis. Scales wedge-shaped, 8-9 mm long and 5-6 mm broad at widest portion. Each cone scale having a medianly placed seed; seed pear-shaped, radially symmetrical, 5 mm long and 3.4 mm broad at the distal end. Seed coat comprising two layers — an outer thin sarcotesta and an inner stony sclerotesta. Scales non-ligulate.

Collection — B.S.I.P. no. P₅.

Locality — Pathargama, Rajmahal Hills, Bihar.

Age — ?Upper Jurassic.

Comparison — The present specimens (Pl. 3, figs 34-35) show some resemblance in general morphology of cone-scales to the araucarian megastrobilus described by Bose and Jain (1964) from Amarjola, Rajmahal Hills. However, in the latter specimen the cone axis is quite thick (1.1 cm in diameter) and a large number of cone scales are arranged spirally around it whereas, in one of the present specimens (Pl. 3, fig. 35), the central axis is apparently thin with only 6 cone-scales being seen in the transverse view. Moreover, in the specimen described by Bose and Jain (1964) the lateral sides of cone scales are broadly expanded to form thin prominent membranous wings arranged in an imbricate and interlocking position while in the present specimens such a condition has not been observed.

Amongst the other known Indian species of *Araucarites*, in size the seed-scales of ?*Araucarites* sp. resemble most the seed-scales of *A. minutus* Bose & Maheshwari (1973). The latter species differs in having smaller seeds. In the present specimen the seeds almost cover the entire upper surface of the scales leaving only about 2 mm wide area all around. In size and overall shape of the seed-scales, the present specimens may be compared with *A. falsoni* Barale (1970) and *A. minimus* Archangelsky (1966); *A. falsoni* differs in having a drawn out tip, whereas in *A. minimus* the scales are ligulate.

DISCUSSION

The plant bed at Pathargama, a newly discovered locality in the Rajmahal Hills, Bihar is overwhelmingly dominated by *Thinnfeldia indica*. Amongst the leaves,

Ginkgo rajmahalensis though much less in abundance comes next. Associated with these two species are *Sphenopteris* sp., *Taeniopteris spathulata*, *Ptilophyllum acutifolium*, *Pterophyllum* sp. and *Elatocladus tenerrima*. Along with these, a large number of fertile organs have also been collected. Most of them belong to the genus *Strobilites*. In fact, their number comes next to *Thinnfeldia*. These strobili do not exactly match with any of the known fructifications and in the absence of definite characters they have been provisionally placed under *Strobilites*. Though no organic connection has been found between the leaves of *Thinnfeldia indica* and this type of fructification, on the basis of their association in large numbers

one may expect them to be related to each other.

The specimens with forked axes (Pl. 2, figs 15-17) and some dispersed seeds have been attributed to *Ginkgo rajmahalensis* (Sah & Jain). But for their smaller size and absence of seed "collar" they do show a good deal of resemblance to the female fertile organs of extant *Ginkgo biloba*.

A comparison of the fossil plant assemblage from Pathargama plant bed with megafossil assemblages from other fossiliferous localities in the Rajmahal Hills reveals that the Pathargama plant bed has clear affinities with the Ginkgo-plant bed at Sakrigalighat and like the latter the plant bed at Pathargama belongs to the floral Group I (see p. 145) of the Rajmahal Formation.

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EXPLANATION OF PLATES

PLATE 1

- 1-6. *Thinnfeldia indica* Feistmantal; 1, (Lectotype-G.S.I. no. 4511 from Buskoghath); 2, (G.S.I. no. 4538 from Burio); 3-6, (B.S.I.P. nos. 47/1248, 112/1248, 56/1248 and 40/1248, all from Pathargama). × 1.
7. *Ginkgo rajmahalensis* (Sah & Jain) comb. nov.; B.S.I.P. no. 32890 from Sakrigalighat. × 1. (From Sah & Jain, 1965).

PLATE 2

- 8-9. *Thinnfeldia indica* Feistmantel; B.S.I.P. nos. 72/1248 and 115/1248 from Pathargama. × 1.
- 10-14. *Ginkgo rajmahalensis* (Sah & Jain) comb. nov.; 10, (Holotype-B.S.I.P. no. 28036 from Basko); 11-14, (B.S.I.P. nos. 75/1248, 36/1248, 4/1248 and 35/1248 from Pathargama). × 1.
- 15-17. Seeds attributed to *Ginkgo*; B.S.I.P. nos. 1/1248, 18/1248 and 5/1248 (figs. 15 & 16 part and counter part). × 1.
- 18-19. Figs. 15 and 16 magnified; B.S.I.P. nos. 18/1248 and 1/1248 × 5.

PLATE 3

20. Seeds attributed to *Ginkgo*; B.S.I.P. no. 81/1248. × 1.
- 21, 22. *Strobilites* sp.; B.S.I.P. nos. 14/1248 and 22/1248. × 1.
23. *Ginkgo rajmahalensis* (Sah & Jain) comb. nov.; B.S.I.P. no. 4895 from Sakrigalighat. × 1 (from Sah & Jain, 1965).
24. *G. rajmahalensis* (Sah & Jain) comb. nov., showing a few cells along veins; B.S.I.P. slide no. 28036-1. × 500. (from Sah & Jain, 1965).
- 25-33. *Strobilites* sp.; 25 (B.S.I.P. no. P₁/1248, × 1); 26, (B.S.I.P. no. 26/1248. × 1); 27, (specimen in fig. 26 magnified. × 4); 28, (B.S.I.P. no. 6/1248. × 1); 29, (B.S.I.P. no. P₂/1248. × 1); 30, (specimen in fig. 29 magnified. × 4); 31, (B.S.I.P. no. 20/1248. × 1); 32, (B.S.I.P. no. 7/1248. × 1); 33, (a part of fig. 25 magnified. × 4).
- 34, 35. ? *Araucarites* sp.; B.S.I.P. nos. P₃/1248 and P₄/1248. × 1.
36. The above magnified. × 5.

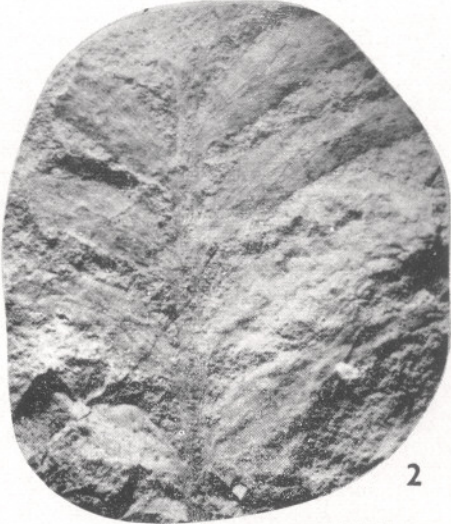


PLATE 1

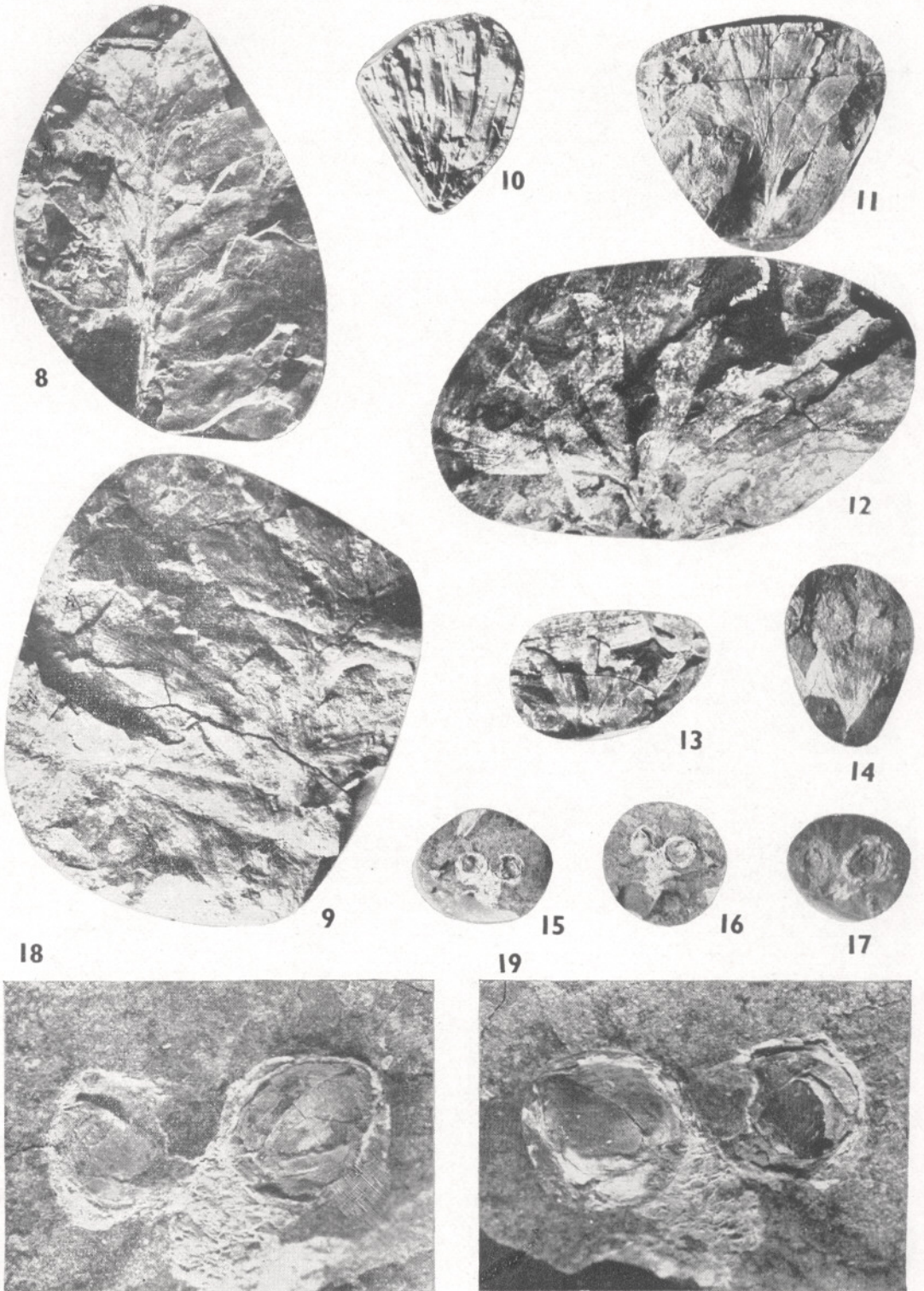


PLATE 2

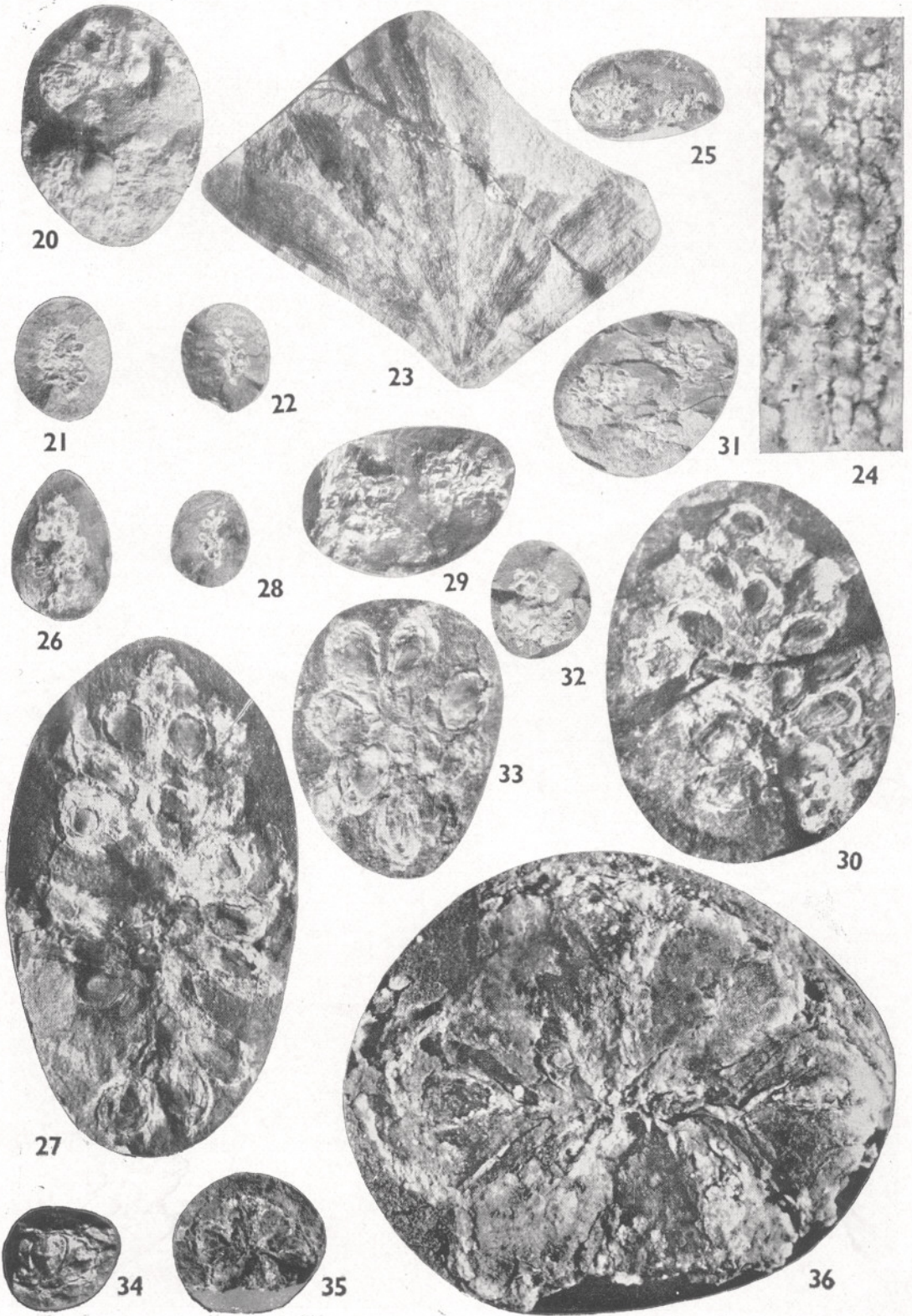


PLATE 3