

# ON TWO NEW SPECIES OF *MESEMBRIOXYLON* FROM THE CRETACEOUS ROCKS OF THE TRICHINOPOLY DISTRICT, MADRAS

C. P. VARMA

## ABSTRACT

A collection of about a dozen fossil woods from the Cretaceous rocks of the Trichinopoly district sent by Mr. S. R. Sarma reveals the presence of coniferous woods which have been preserved in limestone. The two woods described in this paper represent two new species of *Mesembrioxylon* Seward, an artificial genus of fossil conifers showing podocarpinean affinities. The new species have been named *M. trichinopoliense* and *M. Sarmai*. The former shows some resemblance with *M. fusiforme* Sahni described from the Tertiary of Queensland while the latter is new.

## INTRODUCTION

THE specimens described in this paper were collected by Mr. S. R. Sarma, then Lecturer in Geology at the Osmania University, Hyderabad, in September 1953 from the 'nala' west of the ninth milestone on Pullambadi-Garudamangalam Road, south of the village Garudamangalam ( $11^{\circ}5':78^{\circ}55'$ ). The exact spot indicated in grid readings is J 708873. The consignment from this locality consisted of about a dozen fossil woods, out of which only two pieces, which looked promising, were selected and studied. These fossil woods are of interest with regard to their mode of preservation and occurrence in these beds. The petrifications have resulted from the replacement of organic matter of the woods by calcium carbonate instead of the most common replacing mineral silica. The structures of the woods are badly preserved, as was expected, because weathering and percolation of solution is easier in the case of limestone than in silica.

The Cretaceous system of the Trichinopoly district comprises (in descending order) the following stages:

Niniyur (Danian),  
Ariyalur (Maestrichtian),  
Trichinopoly (Turonian-Senonian), and  
Utatur (Cenomanian).

The beds exposed in and around Garudamangalam belong to the Trichinopoly stage

of the Cretaceous system and there is no evidence of the fossil woods being derived from any formation other than those from which they have been picked.

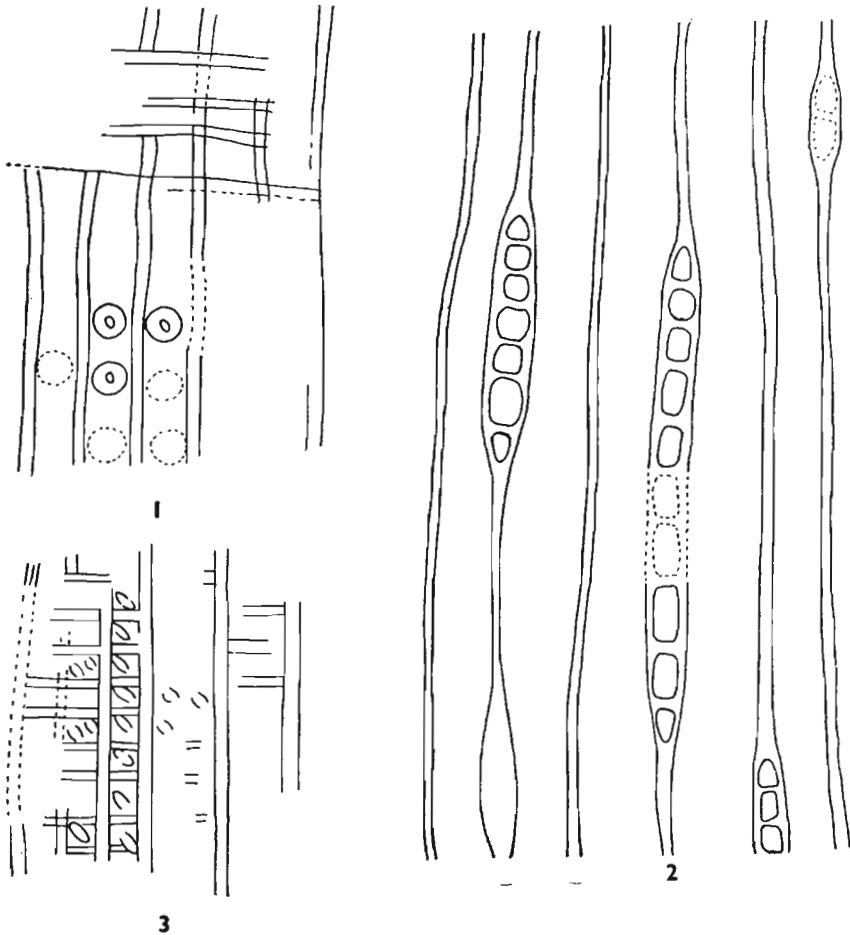
Blanford reported the occurrence of Cycadean woods (not generically identified) from the Cretaceous rocks of this district in 1865. Later, Feistmantel (1877) described a tree-fern from these rocks and named it as *Protocyathea trichinopoliensis*. Krishnan (1949) made a mention of huge tree trunks lying in some areas near Sattanur and Garudamangalam but did not commit himself regarding their affinities. Recently, Aiyengar and Jacob (1952) have described a Cycad (*Pseudocycadeoidea*) collected from Varagur (Trichinopoly stage) which they consider to represent a new genus. No account of the coniferous woods from the Cretaceous rocks of this district is known other than that of Sahni (1931, p. 76) who described two woods from this district and put their age as "Prob. Cretaceous". One wood is described as a doubtful *Dadoxylon* sp. and the other as a "Coniferous wood indeterminable".

Although my specimens are not very well preserved, they are described in some detail because they permit of a generic and specific identification of the woods. Practically no work has been done on the fossil woods, though occurring abundantly in this area, perhaps because in most of the woods the anatomical details are not nicely preserved; but with a little luck and labour one is very likely to find pieces which would show generic and specific characters.

## DESCRIPTION

*Mesembrioxylon trichinopoliense* sp. nov.

*Diagnosis*—Growth-rings prominently seen on weathered surface. Under the microscope they are visible as narrow, irregular and ill-defined rings. Resin canals absent, wood parenchyma rarely seen. Bordered pits present only on radial walls of the



TEXT-FIGS. 1-3 — *Mesembrioxylon trichinopolyense* sp. nov. 1, a number of tracheids showing uniseriate, separate, circular, bordered pits on their radial walls with circular to elliptical pores. On the upper side are seen a few partly preserved medullary rays crossing them.  $\times 280$ . 2, medullary rays as seen in tangential sections.  $\times 280$ . 3, a radial section showing 1-2 simple, fusiform pits in the field.  $\times 280$ .

tracheids. Pits uniseriate, circular, separate or rarely contiguous and slightly compressed. The pits mostly measure  $16 \times 16 \mu$  with a circular pore about  $3 \mu$  in diameter. Bars of Sanio absent. Medullary rays uniseriate, usually 2-6 cells high with a maximum height of 10 cells. One or two simple, fusiform pits in the field, each about  $9-13 \times 3 \mu$ .

*Locality* — Garudamangalam, Trichinopoly district, South India.

*Horizon* — Trichinopoly Stage (Turonian-Senonian), Cretaceous.

Registered No. B.S.I.P. Coll. 8019.

*External Features and Preservation* — The fossil wood numbered 8019 measured about

4 cm. long and 5.5 cm. broad at its widest part before cutting and represented only a portion of a branch. The innermost parts of the transverse sections of the wood appear to represent a portion very near the pith region which is not preserved here. The branch of which the fossil was a part must have been at least 11 cm. in diameter excluding the pith and cortex. The organic matter of the wood has been replaced by calcium carbonate. This fact at once becomes clear, when the fossil is treated with hydrochloric acid. When the sections are viewed under the microscope, the cleavage planes characteristic of calcite are seen. These slides, when examined under the

petrological microscope, also give a positive test for calcite.

*Growth-rings* — Externally, the fossil showed markings of the growth-rings throughout the width. When sectioned, it was seen to be represented by an inner zone of almost undifferentiated tracheids and an outer zone showing a number of very narrow growth-rings (PL. 1, FIG. 1). Pith and cortical regions are missing. The late wood elements extend radially from one to six tracheids in width. A very small zone of the late wood tracheids suggests that the tree was subjected to short unfavourable periods. During fossilization the wood appears to have undergone squeezing in different directions. This is evident from the groups of tracheids which are seen with sinuous walls (PL. 1, FIG. 2).

*Details of Tracheids* — Xylem cylinder compactly packed. Early wood tracheids mainly rounded and elliptical, 10-45  $\mu$  wide (more commonly 16-32  $\mu$ ). Late wood tracheids are rectangular to elliptical measuring 3-9  $\mu$  radially and 19-26  $\mu$  laterally (PL. 1, FIG. 2). Cells of the early and late wood tracheids are almost equally thick-walled except that the late wood elements appear as narrow zones and are somewhat darker in colour under the microscope. The radial walls of early wood tracheids show uniseriate, circular, bordered pits (PL. 1, FIG. 4; TEXT-FIG. 1) which are not well preserved. The pits are usually separate, though infrequently they may also be contiguous. Tangential walls of the tracheids are unpitted. The bordered pits may have circular or obliquely elliptical pores, the pits measure 13-20  $\mu$  in diameter and the pores about 3  $\mu$  across. Bars of Sanio and resin canals are absent.

*Medullary Rays* — The medullary rays are simple, uniseriate and usually 2-6 cells high (range 1-10 cells). In tangential section each cell looks rounded to oblong with end cells tapering (TEXT-FIG. 2). The rays in tangential sections are normally crowded and may be seen adjoining each tracheid or a group of only two or three tracheids (PL. 1, FIG. 3). The cell walls are as thick as those of the neighbouring tracheids. The horizontal and tangential walls of the ray cells do not show any pit. Medullary ray cells in tangential section are more commonly rounded to oblong and not broadened laterally.

*Field Pits* — On the radial walls of the medullary rays are seen 1-2 fusiform obliquely placed pits in the field (TEXT-FIG. 3). The pits are badly preserved and observed with difficulty. A good photograph could not be taken. The pits measure about 9-13  $\times$  3  $\mu$ . At places where the medullary rays and the tracheids cross each other, a single circular area in the field is sometimes observed, but this feature is most probably due to the confluence of the field pits because of defective preservation.

*Mesembrioxylon Sarmai* sp. nov.

*Diagnosis* — Growth-rings scarcely visible from outside but seen in section. Resin canals absent, wood parenchyma rarely seen. Pith comparatively very small, about 1 mm. Primary xylem bundles end-arch. Bordered pits present only on radial walls of the tracheids. Pits uniseriate, circular, separate, rarely contiguous and slightly compressed, measuring mostly 13-16  $\mu$  in diameter. Bars of Sanio not observed. Medullary rays uniseriate, usually 3-8 cells high with a maximum height of 18 cells. Pits in the field 2-4 (mostly 4), small, oval to oblong and borderless, in one or two rows, lying in an obliquely vertical position and measure 8  $\times$  6  $\mu$ .

*Locality* — Garudamangalam, Trichinopoly district, South India.

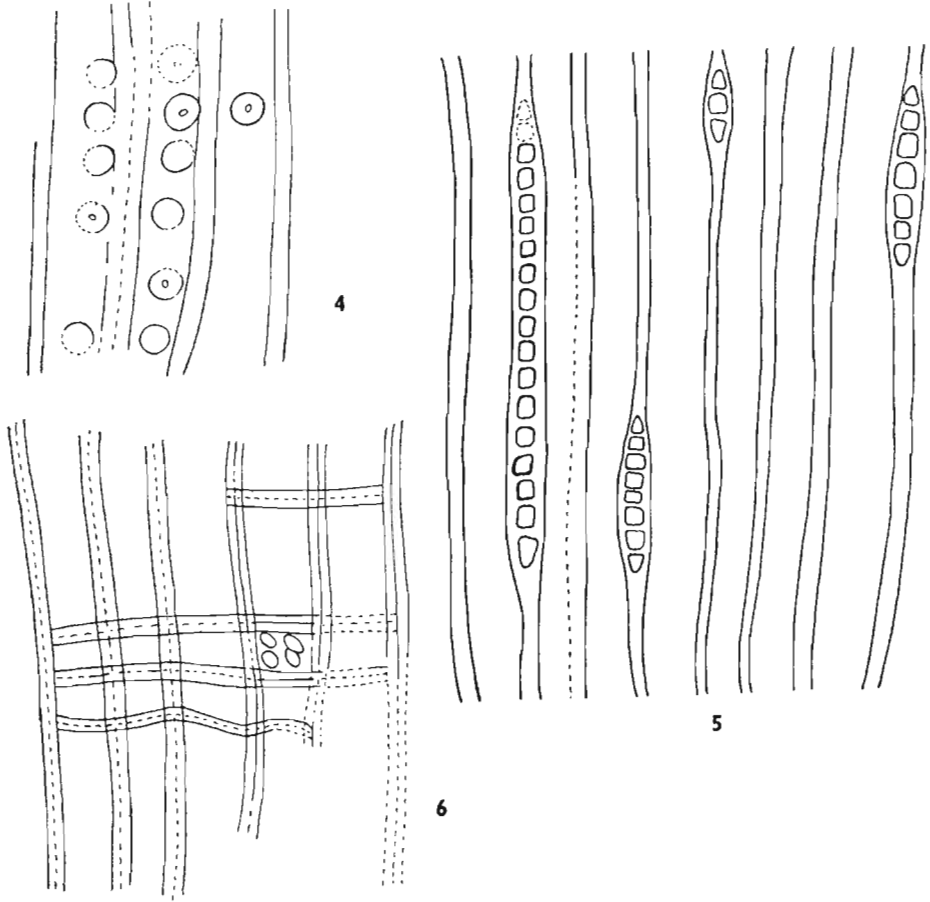
*Horizon* — Trichinopoly stage (Turonian-Senonian), Cretaceous.

Registered No. B.S.I.P. Coll. 8020.

The fossil wood numbered 8020 is also preserved in limestone. It measured 10 cm. long and 6 cm. wide (at its broadest part) before cutting, with its pith eccentrically placed at a distance of about 5 cm. from the outermost part. The section shown in FIG. 7 is from near the narrower end of the wood. Only the pith and a part of the secondary xylem are represented in the fossil. The above facts indicate the fossil wood to be a portion of a branch at least 10 cm. in diameter excluding the cortex.

*Growth-rings* — Externally the growth-rings were not evident but in sections they appear to be fairly equidistant (PL. 1, FIG. 6). The late wood elements present a somewhat similar aspect as in the previous wood and are generally 1-6 rows wide (PL. 1, FIG. 5).

*Pith* — Out of the total thickness of the branch, calculated to be more than 10 cm.,



TEXT-FIGS. 4-6 — *Mesembrioxylon Sarmai* sp. nov. 4, a number of tracheids showing uniseriate, separate, circular, bordered pits on their radial walls with almost circular pores.  $\times 280$ . 5, medullary rays as seen in tangential sections.  $\times 280$ . 6, a radial section showing 4 simple, oval to oblong pits in the field.  $\times 280$ .

the pith is comparatively very small and measures about 1 mm. in diameter (PL. 2, FIGS. 7, 8). The pith is not well preserved and several cracks pass through it. The pith region is roughly circular (PL. 2, FIG. 8) though due to pressure it looks oblong to almost triangular in some transverse sections passing through the pith at other levels. It consists of large, thin-walled, mostly rounded cells. The cell walls of the pith parenchyma have not been preserved well at places but their predominantly rounded nature is discernible and could also be deduced by the presence of triangular areas representing the intercellular spaces. The pith cells generally measure  $42-56 \mu$  (range  $28-70 \mu$ ) in diameter. The protoxylem groups which are endarch do not show themselves pro-

minently but some of them could be seen slightly projecting as rounded angles into the peripheral region of the pith (PL. 2, FIGS. 8, 9). The actual number of protoxylem groups could not be known with certainty.

*Details of the Elements* — Xylem cylinder is compactly packed. The early wood tracheids are mostly  $16-32 \mu$  broad and appear rounded or elliptical in cross-section (PL. 1, FIG. 5). They show various other shapes which are due to the pressure exerted on the tracheids during fossilization. The late wood tracheids appear to be laterally elliptical or rectangular and measure  $3-16 \mu$  radially and  $16-26 \mu$  laterally and may be 1-6 rows wide.

The radial walls of the tracheids show uniseriate, circular, bordered pits with circular pores (PL. 2, FIG. 11; TEXT-FIG. 4). These pits mostly lie separated from each other but are sometimes seen to be contiguous. The pits in the tracheids measure 9-20  $\mu$  in diameter (mostly 13-16  $\mu$ ) with circular pores about 3  $\mu$  wide. Bars of Sanio not observed.

*Medullary Rays* — These are simple, uniseriate, mostly 3-8 cells high (range 1-18). In tangential section the ray cells are oblong or rectangular with end cells tapering (PL. 2, FIG. 10; TEXT-FIG. 5). The rays have walls as thick as tracheids and lumen about 9-16  $\mu$  wide. The horizontal and tangential walls do not show any pit.

*Field Pits* — They are very badly preserved and it has not been possible to get a better photograph (PL. 2, FIG. 12; TEXT-FIG. 6). There are 2-4 pits in each field. Principally there seem to be four pits arranged in two rows or two pits arranged in one row horizontally. The pits are simple, oval to oblong and directed upwards. They measure 8  $\times$  6  $\mu$ . Occasionally, there appears only one, big simple pit in each field which seems to be due to the obliteration of the pits in the field.

I have named this species *M. Sarmai* after my friend Mr. S. R. Sarma who collected it.

*Systematic Position of the Two Woods* — The two woods described above show their closest similarity with the fossil conifer *Mesembrioxylon* in general structure, in possessing uniseriate medullary rays and in having 1-4 simple pits in the field which are obliquely vertical in disposition. Seward (1919, p. 173) created this genus to include the fossil genera *Podocarpoxyton* Gothan, *Phyllocladoxyton* Gothan and *Paraphyllocladoxyton* Holden.

*Specific Comparisons* — The foregoing descriptions of the two woods numbered 8019 and 8020, indicate a good deal of similarity with each other in general structure. But there are some prominent differences shown by the two woods. *M. trichinopoliense* shows very narrow growth-rings, 2-6 (up to 10) cells high medullary rays and 1-2 simple, fusiform pits in the field measuring 9-13  $\times$  3  $\mu$ . Nothing is known about the pith of this species. *M. Sarmai*, on the other hand, shows a very small pith, broader and more regular growth-rings, 3-8 (up to 18) cells high medullary rays and 2-4 oval

to oblong pits, measuring 8  $\times$  6  $\mu$ , in each field.

*M. trichinopoliense* is not identical with any of the described species of *Mesembrioxylon*; but some species, viz. *M. fusiforme* Sahni, *M. fluviatile* Sahni, *M. Gothani* (Stopes) Seward and *M. aparenchymatosum* (Gothan) Seward, approach it in having 1-2 simple pits in each field. *M. fusiforme* Sahni (1920, pp. 27-28), a Tertiary wood from Queensland shows resemblance in having usually one fusiform pit in the field. But it differs prominently in having 'sometimes even three or four smaller pits', regularly rectangular shape of the medullary rays and transverse end-walls of the ray cells. It also differs in possessing bars of Sanio, besides many other differences in its details. *M. fluviatile* Sahni shows resemblance in having very narrow growth-rings but differs very prominently in showing 1 or 2 oblique simple pits in the field which are much smaller and different in shape as compared to those of *M. trichinopoliense*.

The other wood *Mesembrioxylon Sarmai* is different from all other species of *Mesembrioxylon* described so far in having principally 4, simple, oval to oblong pits in each field besides other characters. It shows resemblance with *M. fusiforme* in the number of field pits which range from 1-4. But *M. fusiforme* differs in having 1-4 long, fusiform pits, regularly rectangular shape of the medullary rays and conspicuous bars of Sanio. With regard to a very small pith *M. Sarmai* shows a parallel with *M. Shanense* Sahni (1937) a Jurassic species from Burma. This species differs from *M. Sarmai* mainly in having very low, 1-2 cells high medullary rays and one (rarely 2) large borderless pit in the field. *M. fluviatile*, which is otherwise quite different has, however, small, oval and oblique field-pits though their number is only 1-2 in each field. For comparative tables of the various species of *Mesembrioxylon* a reference may be made to Sahni (1931), Bhardwaj (1953) and Ramajam (1953).

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## REFERENCES

- AIYENGAR, N. K. N. & JACOB, K. (1952). A preliminary note on *Pseudocycadeoidea*, a new genus of plant fossils from Trichinopoly District, Madras. *Rec. Geol. Surv. Ind.* **82**(2): 325-341.
- BHARDWAJ, D. C. (1953). Jurassic woods from the Rajmahal hills, Bihar. *The Palaeobotanist.* **2**: 59-70.
- BLANFORD, H. F. (1865). On the Cretaceous and other rocks of South Arcot and Trichinopoly district, Madras. *Mem. Geol. Surv. Ind.* **4**(1): 1-217.
- FEISTMANTEL, O. (1877). Notes on Fossil Floras of India — XIV. On a tree fern stem from the Cretaceous Rocks near Trichinopoly in Southern India. *Rec. Geol. Surv. Ind.* **10**(3): 133-140.
- KRISHNAN, M. S. (1949). Geology of India and Burma. *Madras*.
- RAMANUJAM, C. G. K. (1953). On two new species of *Mesembrioxylon* from the vicinity of Pondicherry, South India. *The Palaeobotanist.* **2**: 101-106.
- SAHNI, B. (1920). Petrified plant remains from the Queensland Mesozoic and Tertiary formations. *Queensland Geol. Surv. Pub. No.* 267: 7-38.
- Idem (1931). Revision of Indian fossil plants: Part II — Coniferales (b. Petrifications). *Mem. Geol. Surv. Ind. Pal. Ind.* (N.S.) **11**: 51-124.
- Idem (1937). A Mesozoic coniferous wood (*Mesembrioxylon shanense*, sp. nov.), from the Southern Shan States of Burma. *Rec. Geol. Surv. Ind.* **71**(4): 380-388.
- SEWARD, A. C. (1919). Fossil plants. Vol. IV. *Cambridge*.

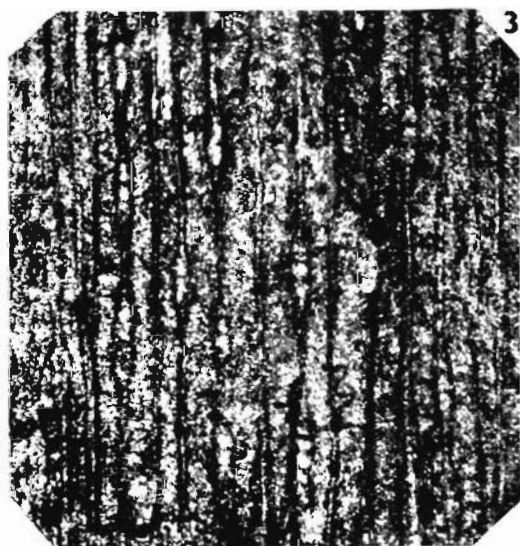
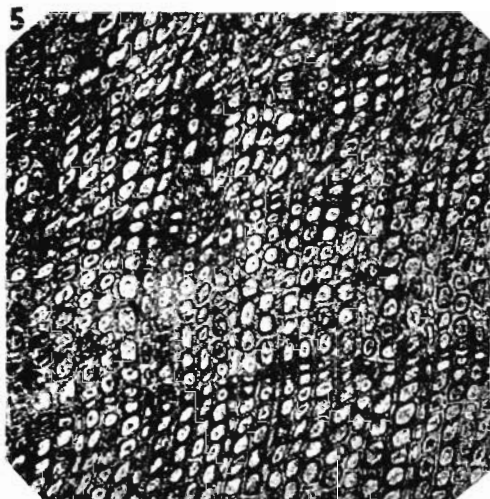
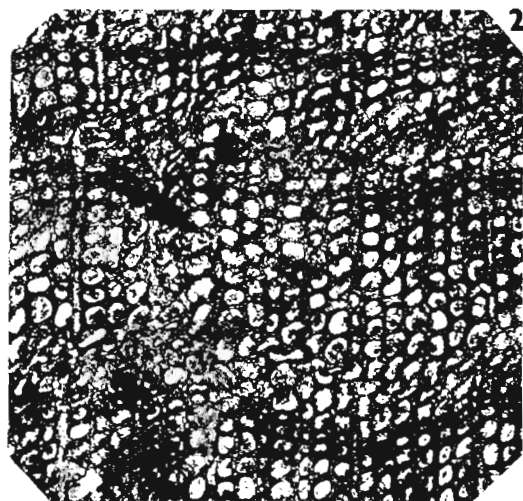
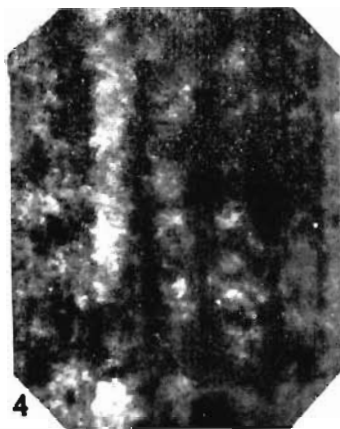
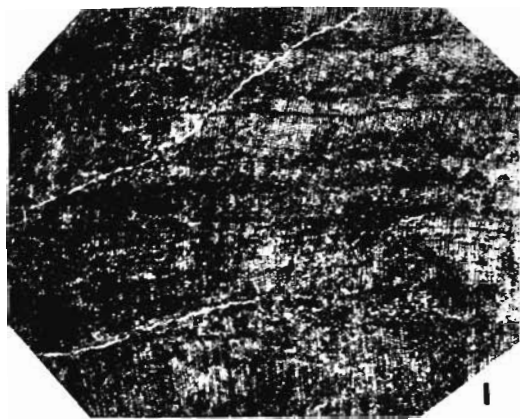
## EXPLANATION OF PLATES

## PLATE 1

1. *M. trichinopoliense* — A transverse section showing very narrow growth-rings.  $\times 15$ .
2. *M. trichinopoliense* — A transverse section showing the relative sizes of the early and late wood elements.  $\times 128$ .
3. *M. trichinopoliense* — A tangential section showing the distribution and uniseriate nature of the medullary rays.  $\times 128$ .
4. *M. trichinopoliense* — A radial section magnified to show the bordered pits more distinctly.  $\times 256$ .
5. *M. Sarmai* — An unusual transverse section showing 3 zones of very close lying late wood elements. It also shows the relative sizes of early and late wood elements.  $\times 128$ .
6. *M. Sarmai* — A transverse section showing the usual width of the growth-rings.  $\times 15$ .

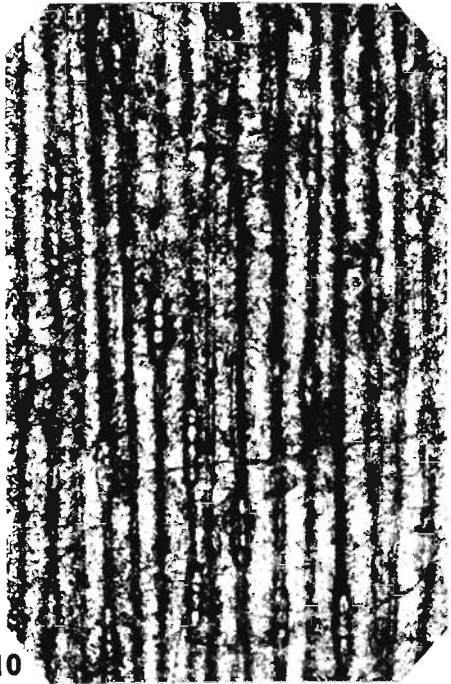
## PLATE 2

7. *M. Sarmai* — A transverse section of the wood showing a relatively very small pith.  $\times 2.5$ .
8. *M. Sarmai* — Part of a transverse section showing the pith region. Due to a crack in the section on the right-hand side of the pith very few xylem elements are seen on that side.  $\times 40$ .
9. *M. Sarmai* — A part of the above section (enclosed in the area marked on the photo) enlarged to show the protoxylem elements projecting as rounded angles into the pith.  $\times 185$ .
10. *M. Sarmai* — A tangential section showing the uniseriate nature and the distribution of medullary rays.  $\times 128$ .
11. *M. Sarmai* — Part of a radial section showing tracheidal pits.  $\times 256$ .
12. *M. Sarmai* — Part of a section showing 4 simple, oval pits in the field, the one near the arrow is less distinct in the figure and the upper wall of this pit has actually coalesced with the pit above.  $\times 575$ .

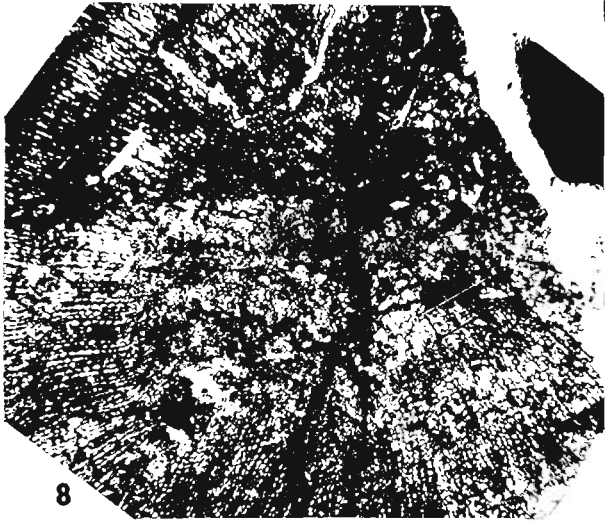




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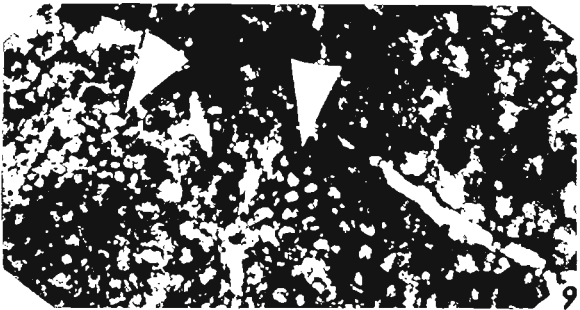
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