

STUDIES ON THE FOSSIL GYMNOSPERMS OF INDIA — PART I  
A NEW SPECIES OF *MESEMBRIOXYLON*,  
*M. MAHABALEI* SP. NOV.

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**ABSTRACT**

In the present paper *Mesembrioxylon mahabalei* sp. nov. has been described from Tiruvakkarai, a village 14 miles N.W. of Pondicherry. This species has some resemblance with *M. Sahnii* and *M. tiruvakkaraiianum* described by Ramanujam (1953) from the same horizon.

**INTRODUCTION**

IN the present paper a new species of *Mesembrioxylon* has been described which is based on a fairly large petrified tree trunk and a number of other smaller specimens collected from Tiruvakkarai, a village about 14 miles N.W. of Pondicherry in the South Arcot District of Madras State. The petrified woods which are described in this paper are listed in the Table No. 1.

The wood numbered as FW 1 is the largest in our collection. Some of the woods such as FW 121, FW 39 and FW 60 listed in the Table 1 were exceptionally well preserved. These woods were collected in an area of about 3 sq. miles near the village Tiruvakkarai. It must be mentioned here that all these petrified woods listed in the Table 1 were studied in detail

anatomically and it was established beyond doubt that all of them belong to the same species. Though these woods come close to some of the species of *Mesembrioxylon* described earlier they have several unique specific characters, hence a new sp. *M. mahabalei* is described.

**DESCRIPTION**

Secondary tracheids of the spring wood are thick walled and usually rectangular to polygonal in shape in cross section (PL. 1, FIG. 1). These tracheids are 25  $\mu$  to 65  $\mu$  in diameter with an average diameter of 50  $\mu$ ; the wall of the tracheids being 5  $\mu$  to 10  $\mu$  thick.

Wherever the growth rings are seen the spring wood is about 14 cells thick and summer wood about 4-5 cells thick. Spring wood consists of tracheids ranging from 35  $\mu$  to 70  $\mu$  in diam. with an average of 46  $\mu$  in diam. Whereas, the summer wood tracheids measure to be 20  $\mu$  to 40  $\mu$ , with average of 30  $\mu$ ; their wall thickness being 5-7  $\mu$ . Xylem parenchyma is scattered through the wood. Xylem parenchyma elements may be isolated or in radial rows of 2-4. These cells are filled with brown or black resinous material. Since all the specimens are decorticated only the secondary wood is preserved. The woods are light yellow to dark brown coloured being infiltrated by siliceous material. Though the growth rings are quite distinct the amount of summer wood is too little or in other words the spring wood is well developed and the summer wood is meagrely developed. The transition from spring wood to summer wood is more or less abrupt. (PL. 1, FIG. 2).

Tangential section of the wood reveals that the xylem rays are mostly uniseriate (PL. 1, FIG. 7: TEXT-FIG. 3) very rarely they are biseriate (PL. 1, FIG. 5; TEXT-FIG. 4). The xylem rays are parenchymatous; the cells being squarish and sometimes filled with dark contents.

**TABLE 1— DIRECTORY OF THE SPECIMENS DESCRIBED IN THIS PAPER**

Sr. No.	Fossil Wood No.	MAXIMUM LENGTH IN cm.	MAXIMUM DIAM. IN cm.	LOCALITY
1.	FW 1	75.0	35.0	Tiruvakkarai
2.	FW 60	8.0	4.0	"
3.	FW 121	20.0	8.0	"
4.	FW 136	21.0	7.0	"
5.	FW 50	7.5	3.5	"
6.	FW 39	9.5	3.5	"
7.	FW 24	7.0	4.0	"
8.	FW 79	6.5	5.0	"
9.	FW 46	5.8	4.3	"
10.	FW 49	3.5	2.7	"

The xylem rays are 30 cells high, the average height being 11 cells. They vary from  $60\ \mu$  to  $650\ \mu$  in length and  $20\ \mu$  to  $50\ \mu$  in width. So in general the rays are fairly long as seen in T.L.S. and they are predominantly uniseriate.

In radial longitudinal section the pits are found on the radial wall of the xylem rays. The outstanding feature of this species is the presence of single pit in the cross pit field (PL. 1, FIGS. 6, 4; TEXT-FIG. 2). The pits are distinctly bordered and oval in shape. The border is uniform in thickness being  $2.5\ \mu$  thick. The lumen is also oval in shape, however, where the wood is crushed or compressed the pit in the cross pit field looks crescentic shaped. The pits are always consistently obliquely placed. The lumen is about  $10\ \mu$  in width and  $15-20\ \mu$  in height. The pits are of taxodioid type.

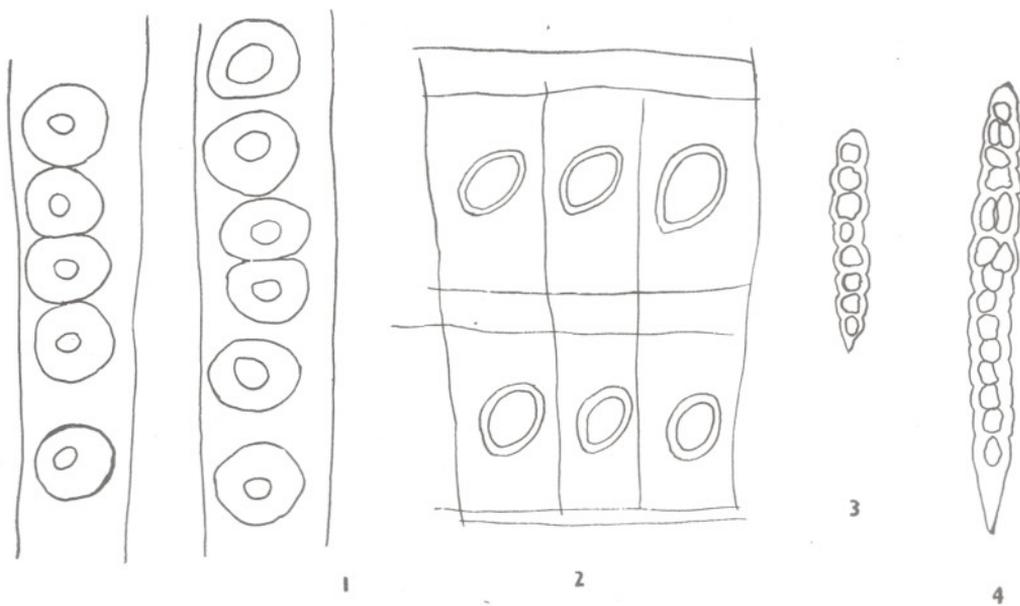
Secondary tracheids measure  $250\ \mu$  to  $750\ \mu$  in length and  $30\ \mu$  to  $40\ \mu$  in diameter. Pits are found only on the radial walls of the tracheids. The pits on the radial walls are distinctly bordered and strictly uniseriate (PL. 2, FIG. 3; TEXT-FIG. 1). The

average diameter of the pits is  $20\ \mu$ . These bordered pits are usually contiguous, rarely they are separate. Bars of sanio are absent. In some tracheids the radial wall is torn apart and gives false appearance of tertiary spiral thickening. The scratched radial wall looks similar to that of the compressed woods of modern gymnosperms (PHILLIPS, 1941). Here it should be also mentioned that at some places the silica crystals with their polygonal bandings give false appearance of spiral thickening but the truth is revealed after changing the focus of the microscope.

*Mesembrioxylon mahabalei* sp. nov.

*Diagnosis* — Growth rings fairly prominent; transition from spring wood to summer wood very abrupt; xylem parenchyma scattered and filled with resinous brown or dark contents; radial walls of tracheids with uniseriate circular bordered pits, contiguous or separate.

Radial walls of ray parenchyma pitted, Cross pit-field with single ovoid taxodioid pit with distinct border, uniformly thick  $2.5\ \mu$ . Xylem rays predominantly uni-



TEXT-FIGS. 1-4 — *Mesembrioxylon mahabalei* sp. nov. 1, tracheides showing uniseriate bordered pits on their radial walls.  $\times 600$ . 2, a radial section showing cross pit-fields with single ovoid pit with border.  $\times 600$ . 3, Uniseriate medullary ray as seen in tangential section.  $\times 150$ . 4, biseriate medullary ray as seen in tangential section.  $\times 150$ .

TABLE 2.—SHOWING THE COMPARATIVE CHARACTERS OF THE SPECIES OF *MESEMBRIOXYLON* DESCRIBED FROM TERTIARY BEDS OF CUDDALORE SERIES, INDIA

SPECIES	GROWTH RINGS	MEDULLARY RAY TISSUE	XYLEM PARENCHYMA	BORDERED PITTING	CROSS-FIELD PITTING
<i>M. schmidiana</i> (Schilden) Sahni	Faintly marked	Uniseriate, rarely biseriate, 2-100 cells in height, uniformly thick walled cells	Scanty cells many times longer than broad	Uni-to biseriate, circular, usually separate	One to two large pores, slit like, obliquely vertical
<i>M. Sahni</i> Ramanujam	Well defined	Uni-triseriate, 1-20 cells in height, average height 8 cells; ray cells isodiametric	Lacking	Nearly always uniseriate, circular or just contiguous but not flattened	One to two fusiform pits without border
<i>M. tiruvakkrainum</i> Ramanujam	Faintly marked	Uniseriate, 3-50 cells in height, average height of the ray being 18 cells	Sparse	Uni to biseriate (mostly) large, separate, opposite when biseriate, tangential pitting present	Large single borderless pit fills the field
<i>M. speciosum</i> Ramanujam	Well marked	Uni-biseriate, 1-18 cells high, average height 6 cells	Scattered, filled up with resin	Uni-to biseriate, separate, often contiguous, when biseriate opposite or sub-opposite; rims of Sanio distinct	2-4 small, bordered, border round to oval, aperture slit-like
<i>M. mahabatei</i> sp. nov.	Distinctly marked	Uni-biseriate 1-30 cells high with average height of 11 cells	Scattered, filled up with resin	Uniseriate, circular, contiguous or separate, tangential pitting not seen	Single, ovoid, Taxodioid pit with distinct border of uniform thickness

seriate, rarely biseriate, 1-30 cells high, average height 11 cells, 60  $\mu$  to 650  $\mu$  in length and 20  $\mu$  to 50  $\mu$  in width.

*Holotype* — FW 60 in Fossil Wood collection of Botany Department, Shivaji University, Kolhapur-4.

*Locality* — 1.5 miles North of Tiruvakkarai Village which is 14 miles N.W. of Pondicherry, S. Arcot District, Madras State.

*Horizon* — Cuddalore Series.

*Age* — U. Miocene - Pliocene.

#### AFFINITIES AND DISCUSSION

Number of species of *Mesembrioxylon* have been described from India and abroad from the geological horizons ranging from Jurassic to Tertiary. However, from the Tertiary of India about 4 species namely *Mesembrioxylon schmidianum*, *M. tiruvakkaraiianum*, *M. sahnii* and *M. speciosum* have been described so far. Out of these, first three species have been described based on the woods from Tiruvakkarai locality. *M. sahnii* Ramanujam differs from *M. mahabalei* in possessing uniseriate to biseriate small bordered pits on the radial walls of the tracheids and 1-2 fusiform borderless simple pits in the cross-field and shorter medullary rays. Whereas *M. tiruvakkaraiianum* Ramanujam differs from the present species in having uni-biseriate large radial pits and uniseriate circular bordered pits on the tangential walls of the tracheids, almost uniseriate deep medullary rays and having a single large simple rounded or oval borderless pit filling the cross-pit field.

For a detailed comparison, reference may be made to Table 2 which gives complete data of the important anatomical features

of the species of *Mesembrioxylon* described from the Tertiary beds of Cuddalore series. Besides the affinities of *M. mahabalei* with above mentioned species from Tertiary of India, the present species has some affinities with *M. indicum* Bharadwaj (1953) from Jurassic of Rajmahal Hills, Bihar. Both have regular growth rings, uniseriate bordered radial pitting of the tracheids and bordered cross field pit. However, *M. indicum* differs from the present species in having shorter medullary rays which are uniseriate, cross-field pits which are bordered and 1-2 in the cross-pit field and resinous tracheids with abundant resin plates. The close affinity of the modern genus *Podocarpus* with that of the form genus *Mesembrioxylon* has been discussed at length by previous workers. In most of my specimens checking or cracking of the radial walls of tracheids was seen prominently. This feature is easily confused with spiral thickening on superficial examination. This checking or cracking is known to be occurring in dry dead woods of modern *Podocarpus* (JANE, 1956). This feature is normally associated with the compression wood.

#### ACKNOWLEDGEMENT

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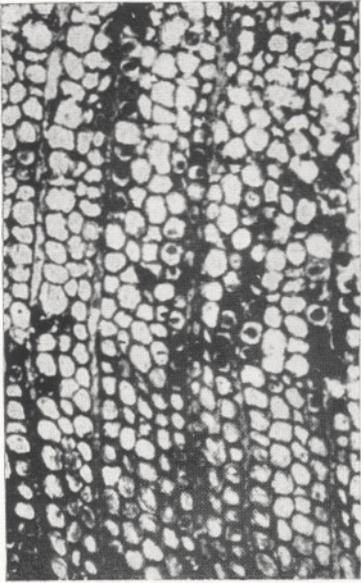
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## EXPLANATION OF PLATE

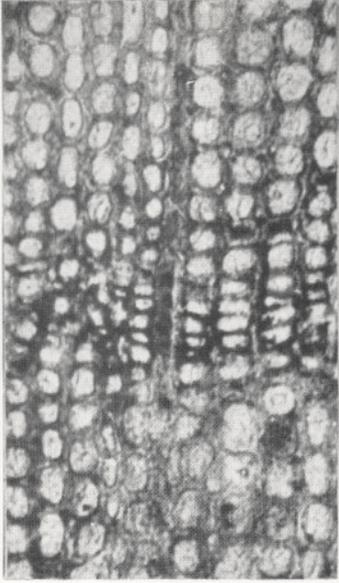
## PLATE 1

*Mesembrioxylon mahabalei* sp. nov.

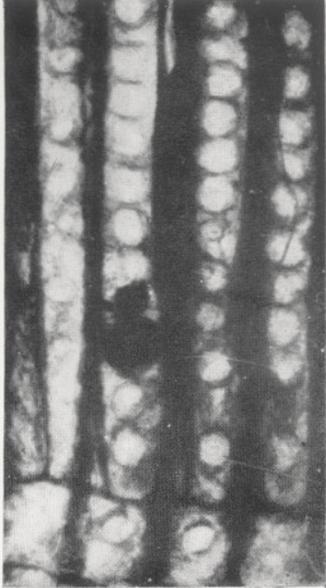
1. A transverse section of the wood.  $\times 110$ .
2. A transverse section showing the spring wood and summer wood.  $\times 125$ .
3. A radial section magnified to show uniseriate bordered pits.  $\times 360$ .
4. A magnified radial section showing single bordered pits in the cross pit-fields.  $\times 340$ .
5. A tangential section showing uni to biseriate medullary rays.  $\times 100$ .
6. A radial section showing single ovoid bordered pit in the cross pit-field.  $\times 190$ .
7. A magnified tangential section showing uniseriate medullary rays.  $\times 200$ .



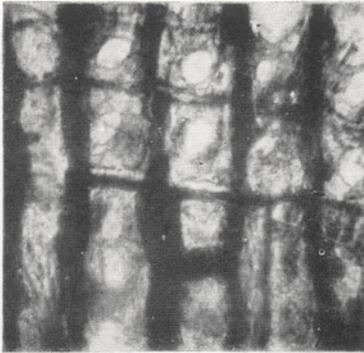
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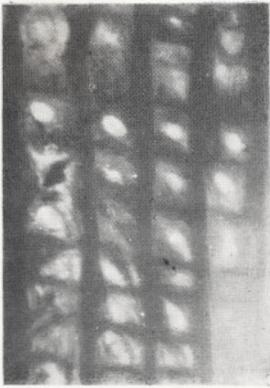
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