

A FOSSIL WOOD OF *SONNERATIA* FROM THE TERTIARY OF SOUTH INDIA

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ABSTRACT

A fossil dicotyledonous wood from the Cuddalore Series (Middle Tertiary) of South India is described. Anatomically, it is very similar to the modern wood of *Sonneratia* Lin. especially with *S. apetala* Ham. and has been named as *Sonneratioxylon preapetala* sp. nov.

INTRODUCTION

FROM the Tertiary rocks near Pondicherry a large number of silicified woods belonging to the various families of Angiosperms and Gymnosperms have been described as already mentioned by the author (AWASTHI, 1966). Further investigations of the silicified woods of this area have yielded many new types which show marked similarity with some of the modern genera and species of the dicotyledons. One of them, which is being described in the present paper, was collected by the author in 1963 from a ravine near the village Chinnakottaikuppam, about 8 km. north-east of Pondicherry.

DESCRIPTION

FAMILY — SONNERATIACEAE

Genus — *Sonneratioxylon* Hofmann, 1952

Sonneratioxylon preapetala sp. nov.

Pls. 1-2, Figs. 1-10; Text-figs. 1-3

The specimen described here is a piece of secondary wood measuring about 6×6 cm. in length and diameter. The preservation is fairly good and the colour of the cut surface varies from yellow to brown.

Topography — Wood diffuse-porous (PL. 1, FIG. 1). *Growth rings* not seen. *Vessels* visible to the naked eye as crowded pin points, small to medium (mostly medium-sized), solitary as well as in radial multiples of 2-4 (PL. 1, FIGS. 1 & 3), evenly distributed, about 28-50 vessels per sq. mm.; tyloses present, thin walled. *Parenchyma* absent. *Xylem rays* fine, 16-24 μ in width, each separated by 1-6 tangential rows of fibres, uniseriate, rarely biseriate due to

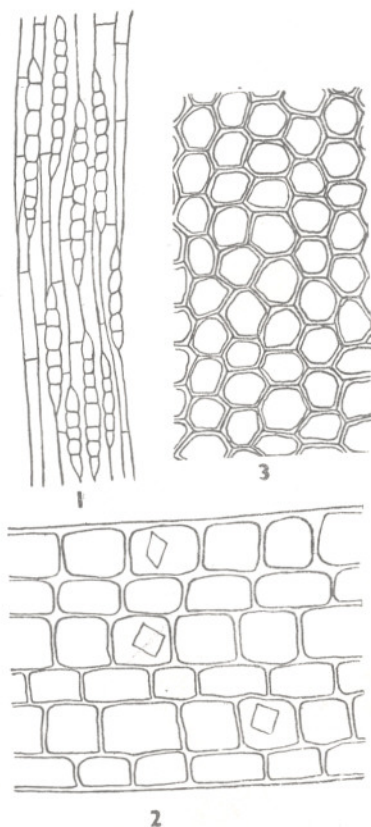
pairing of procumbent cells in the median portion; ray tissue heterogeneous; rays homocellular to heterocellular, consisting of procumbent cells with some square cells (PL. 2, FIGS. 5 & 7; TEXT-FIG. 1), sometimes alternating with each other; rays 3-20 cells and 105-600 μ in height. *Fibres* aligned in radial rows between two consecutive xylem rays.

Elements — *Vessels* circular to oval, those of radial multiples flattened at the places of contact (PL. 1, FIGS. 1 & 3), t.d. 45-150 μ , r.d. 45-165 μ ; thin-walled, common walls 4-6 μ in thickness; vessel-members medium in length, with truncated or slightly tapered ends (PL. 2, FIG. 5); perforations simple; intervessel pits medium to large, 6-8 μ in diameter, circular or oval, vested, apertures lenticular (PL. 2, FIG. 9); vessel-ray pits not seen. *Ray cells* thin-walled, procumbent cells 14-20 μ in tangential height, 20-80 μ in radial length, usually filled with dark gum-like contents; square cells 32-48 μ in tangential height, 28-40 μ in radial length, often containing solitary crystals (TEXT-FIG. 2). *Fibres* oval to angular in cross-section (TEXT-FIG. 3), 17-24 μ in diameter, septate (PL. 2, FIG. 5; TEXT-FIG. 1), thin-walled, common walls about 2 μ in thickness; pits not seen.

AFFINITIES AND DISCUSSION

Comparison with the Modern Woods — Absence of parenchyma and presence of vested intervessel pits are the most important features of the present fossil wood. Taking into consideration other important anatomical characters also, such as medium-sized vessels with 2-4 multiples, uniseriate xylem rays with crystalliferous square cells and thin-walled septate fibres, it shows closest resemblance with the woods of *Sonneratia* Linn. (METCALFE & CHALK, 1950; PEARSON & BROWN, 1932).

In order to find out the nearest modern equivalent of the present fossil wood, thin-sections of *Sonneratia* spp., viz. *Sonneratia*



Sonneratioxylon preapetala sp. nov.

TEXT-FIGS. 1-3 — 1. Tangential longitudinal section showing xylem rays and septate fibres. $\times 100$. 2. Ray cells in radial longitudinal section showing crystals. $\times 190$. 3. Fibres in cross-section. $\times 300$.

acida Benth., *S. apetalata* Ham., *S. alba* Griff., *S. griffithii* Kurz were examined critically. Besides, it was also compared with the published description and figures of *S. caseolaris* (Lin.) Engl. (KRIBS, 1959, p. 159, FIG. 316; PANSHIN, 1932, pp. 161-162, PL. 2; SCHNEIDER, 1916, p. 117; REYES, 1938, pp. 347-349, PL. 66, FIG. 3) and *S. pagatpat* Blanco (KANEHIRA, 1924, p. 37; SCHNEIDER, 1916, p. 178, PL. 8, FIG. 58). After a careful study of the authentic slides of *Sonneratia* spp. it has been found that the present fossil wood shows closest resemblance with that of *Sonneratia apetalata* Ham. It can be distinguished from the remaining species of *Sonneratia* in having some seemingly minor but significant differences. In *S. acida* and *S. griffithii* the xylem rays are comparatively higher, i.e. up to 70 cells in

height; whereas in the present fossil wood as well as in *S. apetalata* they are up to 30 cells in height. Moreover, the vessels are bigger in *S. acida* and smaller in *S. griffithii* than those of the present fossil wood and *S. apetalata*. In *S. alba* and *S. caseolaris* the fibres are comparatively thick-walled. The last species, *S. pagatpat* differs in having parenchyma.

Comparison with the Fossil Species —

So far three species of fossil woods of *Sonneratia* are known, viz., *Sonneratioxylon prambachense* Hofmann (1952) from the Oligocene of Austria, *S. dakshinense* Ramanujam (1957) from the Tertiary of South India and *S. dudukureense* Ramanujam & Krishna Rao (1966) from Dudukur, Rajahmundry (Deccan Intertrappean Series). Of these, *S. prambachense* differs from the present fossil wood mainly in having paratracheal parenchyma. The present fossil wood resembles *S. dakshinense* while compared with the anatomical description given by Ramanujam (*l.c.*). However, the types of xylem rays and fibres of his specimen as shown in the photomicrographs raise some doubts as to its affinities with that of *Sonneratia*. In order to remove the doubts the original type slides as well as freshly prepared thin-sections from the type specimen of *Sonneratioxylon dakshinense* were re-examined critically. As a result, a number of anatomical features were found to be somewhat different from those described by Ramanujam. He has described the xylem rays as uniseriate, rarely biseriate and fibres as septate; but on re-examination of his type slides the xylem rays were found to be 1-3 (mostly 2) seriate and the fibres non-septate. Moreover, the specimen upon which the description is based is a small silicified immature wood having a central pith and primary xylem. Even in the immature stage the fossil wood has got rays up to 3 seriate and it is very likely that they might be broader in case of mature one. Whether it was a mature wood or a twig, none of the wood of *Sonneratia* has got xylem rays more than 1-2 seriate. Thus Ramanujam's *Sonneratioxylon dakshinense* cannot be a wood of *Sonneratia* and it needs re-investigation.

The other species, *S. dudukureense* shows gross resemblance with the present fossil wood. Since only a short description of the anatomical features is given, it is not possible to say whether the fossil wood

under investigation and wood from Dudukur are similar or not. Moreover, there is no mention about the resemblance of Dudukur fossil wood with a particular species of *Sonneratia*.

Besides the above mentioned three species of *Sonneratioxylon*, there are two more fossil records which have been referred to *Sonneratia*. These also appear to be of doubtful affinities. Verma (1950) described a fossil wood from the Deccan Intertrappean Series of Mohgaon Kalan in Madhya Pradesh. He tentatively referred to it as *Sonneratia* like. His fossil specimen cannot be a *Sonneratia* wood because it has got aggregate xylem rays with 1-3 gum canals which are not found in any of the sonneratiaceous woods.

In 1963, Shallom also described some young twigs measuring less than 1 cm. in diameter from the Deccan Intertrappean beds near Nagpur, which she referred to *Sonneratia* and *Duabanga*. In her fossil twigs the parenchyma is absent and fibres are non-septate. In having a combination of these two important features Shallom's fossil woods can neither be *Sonneratia* nor even *Duabanga*, since in the former the parenchyma is absent and fibres are septate whereas in the latter the parenchyma is present and fibres are non-septate. Thus Shallom's fossil wood also needs revision.

Since the present fossil wood shows remarkable similarities with that of *Sonneratia*, it is placed under the genus *Sonneratioxylon* Hofmann and named as *S. preapetala* sp. nov., the specific name indicating its closest similarity with the modern *Sonneratia apetala* Ham.

Present Distribution of Sonneratia Linn. — The genus *Sonneratia* Linn. consists of 6

species of trees, distributed in the mangrove vegetation of Indo-Malayan regions with the general habitat of Rhizophoraceae (WILLIS, 1957, p. 613). In the Indian region there are 4 species, found in the coastal forests of Sindh (West Pakistan), Bengal, South India, Aracan, Pegu, Tenasserim and the Andamans. *Sonneratia apetala* grows in tidal creeks and littoral forests of the Konkan, the Coromandel coast (West coast) of South India, Burma and Ceylon (GAMBLE, 1902).

Diagnosis—Wood diffuse-porous. *Vessels* small to medium (mostly medium-sized), t.d. 45-150 μ , r.d. 45-165 μ , solitary as well as in radial multiples of 2-4, about 28-50 vessels per sq. mm.; perforation simple; tyloses present, thin-walled; intervessel pits medium to large, 6-8 μ in diameter, circular or oval, alternate, vested, with circular or lenticular apertures. *Parenchyma* absent. *Xylem rays* fine, uniseriate, occasionally biseriate due to pairing of procumbent cells through the median portion; ray tissue heterogeneous; rays mostly heterocellular, consisting of procumbent cells and crystalliferous square or upright cells; rays 3-20 cells and 105-600 μ in height. *Fibres* oval to angular, 16-24 μ in diameter, septate, thin-walled, walls about 2 μ in thickness.

Holotype — B.S.I.P. Museum No. 33707.

Locality — Chinnakottaikuppam, about 8 km. north-east of Pondicherry, South Arcot district, Madras.

Age — Middle Tertiary.

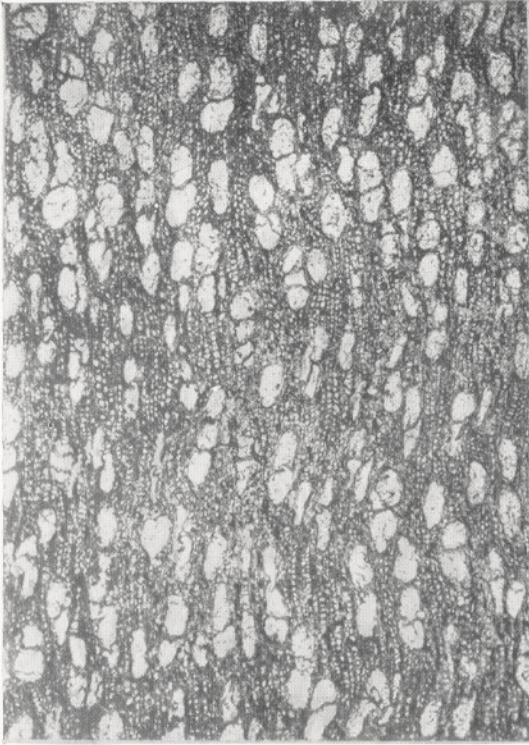
Horizon — Cuddalore Series.

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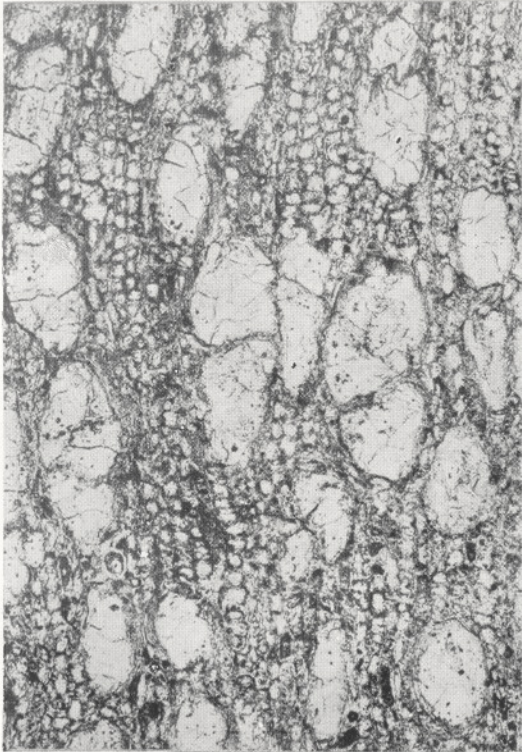
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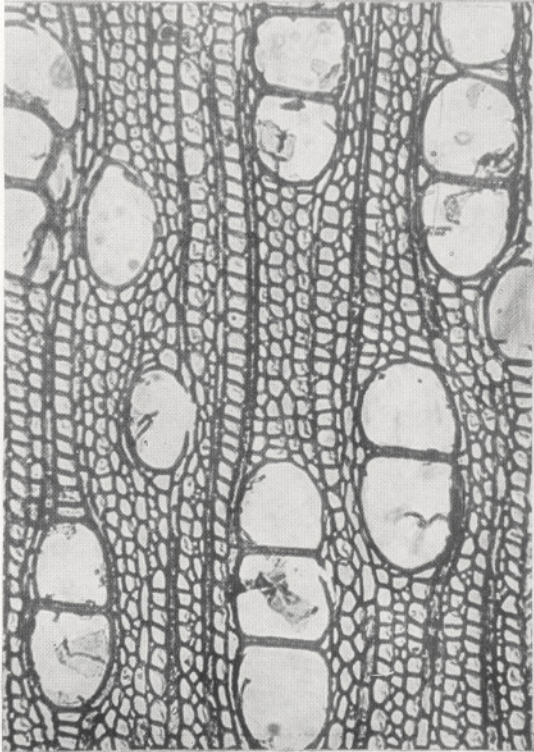
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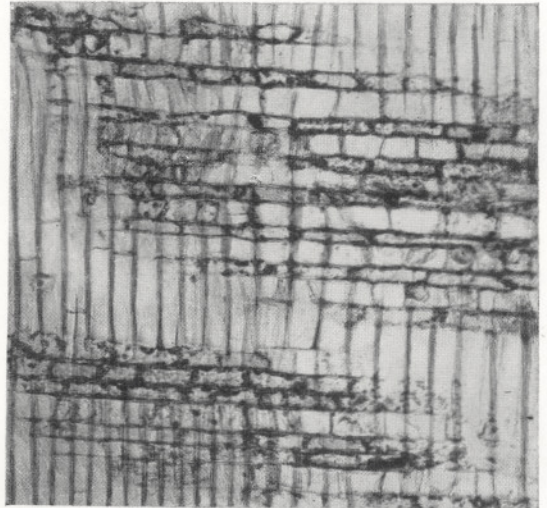
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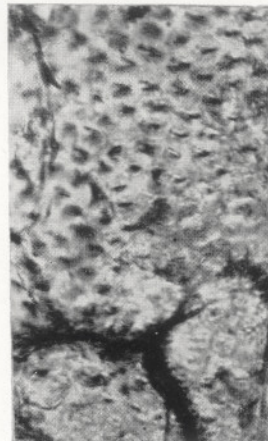
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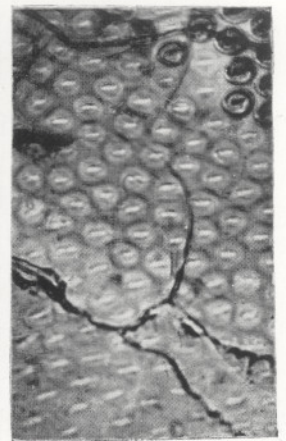
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EXPLANATION OF PLATES

PLATE 1

1. *Sonneratioxylon preapetala* sp. nov., cross-section showing type and distribution of vessels. × 35.
2. *Sonneratia apetala*, cross-section showing type and distribution of vessels similar to those of fossil. × 35.
3. *Sonneratioxylon preapetala* sp. nov., cross-section magnified to show the vessels and absence of parenchyma. × 102.
4. *Sonneratia apetala*, similar cross-section showing vessels and absence of parenchyma. × 102.

PLATE 2

5. *Sonneratioxylon preapetala* sp. nov., tangential longitudinal section showing uniseriate xylem rays and septate fibres. × 115.
6. *Sonneratia apetala*, tangential longitudinal section showing similar rays and fibres. × 115.
7. *Sonneratioxylon preapetala* sp. nov., radial longitudinal section showing heterocellular xylem rays. × 115.
8. *Sonneratia apetala*, radial longitudinal section showing similar heterocellular xylem rays. × 115.
9. *Sonneratioxylon preapetala* sp. nov., vested intervessel pits. × 510.
10. *Sonneratia apetala*, vested intervessel pits. × 510.