

PETRIFIED CONIFERS WITH ANOMALOUS SECONDARY GROWTH FROM THE RAJMAHAL HILLS, INDIA

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Abstract

Petrified conifers collected from the Mesozoic rocks of Rajmahal Hills, Bihar show anomalous secondary growth. In a diarch araucarian root *Araucamyelon pakurense* the secondary growth of one side divides and re-orientates at right angle to the normal one. The stems show various kinds of unequally lobed and eccentric secondary growth. Morphological and ecological significance of such anomalies are discussed.

Introduction

The petrified conifers frequently occur in southern localities of Rajmahal Formation (Gupta, 1966). Majority of them belong to the families Podocarpaceae and Araucariaceae. Petrified woods and twigs of Cupressaceae, Taxodiaceae and Taxaceae are also known (Sahni, 1928, 1931; Bhardwaj, 1953; Sah & Jain, 1964). The conifer wood is pycnoxylic, concentric and with regular growth rings. However, during investigation a number of woods have been found to possess anomalous secondary growth.

The material in the form of silicified cherts was collected from a number of localities, e.g., Nipania, Sonajori, Hiraniduba and Chilgojuri in the Rajmahal Hills. Sections were prepared by the usual method and stained in aqueous safranin.

Description

ROOT

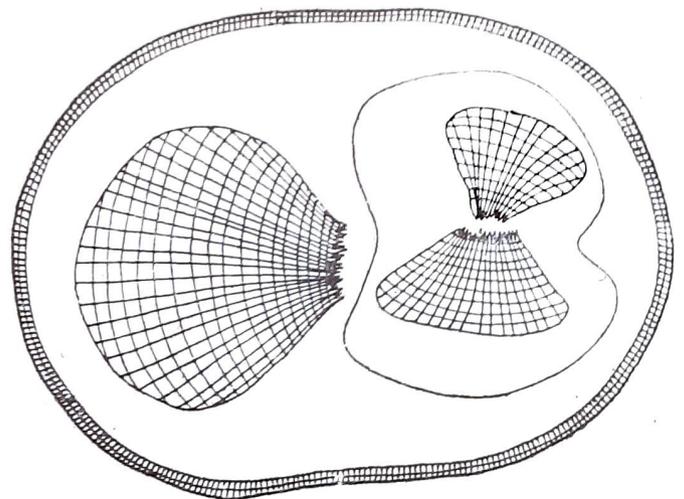
Araucamyelon pakurense Bohra & Sharma 1980 occurs frequently at Sonajori, is a typical diarch root with well-developed fan-shaped secondary wood. One of the specimens in the present collection shows anomalous growth. There is a distinct periderm layer surrounding the cortex (Pl. 1, fig. 1; Text-fig. 1). The secondary xylem of one side is normal and fan-shaped, while that of the other side is divided into two (Pl. 1, fig. 2)

and oriented at right angle to the normal one (Text-fig. 1). Each divided portion has fan-shaped secondary xylem (Pl. 1, fig. 2). The tracheids are arranged in radial rows. The two anomalous portions are surrounded by a thick periderm layer.

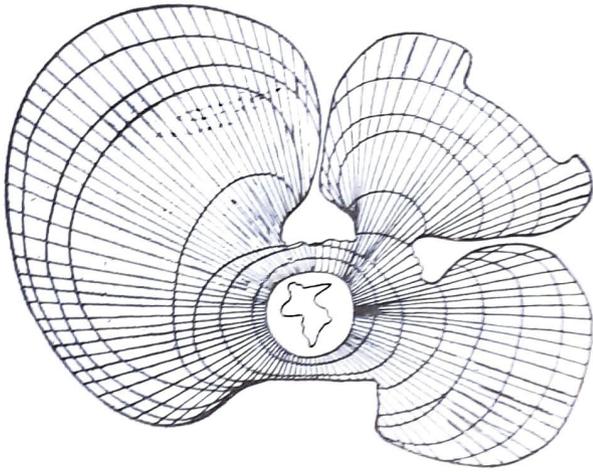
STEM

A number of coniferous stems in the collection show anomalous secondary growth (Pl. 1, figs 3, 4; Text-figs 3, 4). Only cross-sections could be examined.

Stem type 1 (Pl. 1, fig 3). There is a small parenchymatous pith. On one side of it is a narrow zone of secondary xylem



Text-figure 1—*Araucamyelon pakurense*. An anomalous root with one side xylem divided and re-oriented at right angle to the normal one. X 36.



Text-figure 2—Stem type-4. An anomalous stem with lobed, splitted secondary wood. X 36.

with 2-3 growth rings while on the other side a well developed secondary xylem having 9-10 annual rings is visible. Splitting is also visible at one point in secondary xylem.

Stem type 2 (Text-fig. 3)—In the central region secondary growth is regular with concentric growth rings surrounding a narrow, circular pith. Outer portion of the secondary wood becomes eccentric and bilobed giving C-shaped appearance (Pl. 2, fig. 4). Growth rings are also distinctly visible in the anomalous portion of the secondary wood. Cortex is not preserved.

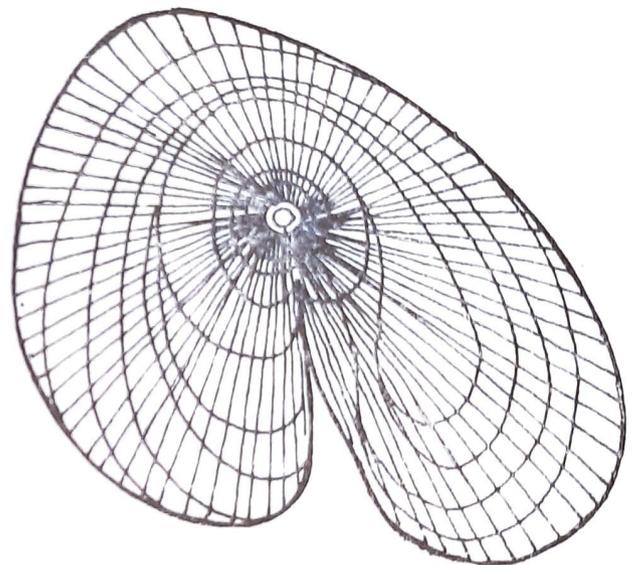
Stem type 3 (Text-fig. 4)—It is an eccentric type of secondary wood surrounding an irregularly lobed pith. Wood is pycnoxylic, growth rings are not seen. Cortex is not preserved.

Stem type 4 (Pl. 1, fig. 4; Text-fig. 2)—It is represented by a number of specimens. All are more or less identical in the anomalous structure of secondary wood. Pith is narrow and irregular in outline. It is surrounded by concentric rings of secondary wood which in the outer portion of the wood split up into three/four unequal lobes (Text-fig. 2). Each lobe has distinct growth rings. The outer boundary of lobes is either entire or with depressions and is made up of periderm like cells. The cells present at the lines of split are also periderm type cells.

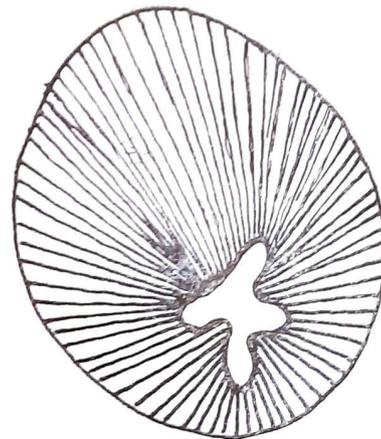
Discussion

Occurrence of anomalous secondary growth is well-known in angiosperms, specially in xerophytic shrubs, e. g., *Salvadora* sp.,

Leptadaenia sp., *Peganum harmala*, *Zygophyllum dumosum*, *Zilla spinosa* and *Artemisia herba-alba* (Ginzburg, 1963). There is no report of abnormal secondary growth in extinct conifers. Anomalous secondary growth does occur in some of the extant conifers (Mehra, 1988) but not of the type described above. Ginzburg (1963) suggested that the splitting of secondary xylem is due to suberization of wood rays and formation of interxylary periderm at the end of each growth ring causes lobing in the wood. In Pl. 1, fig. 3, initiation of fission or splitting of secondary wood is seen probably as a result of suberization of ray cells. However, interxylary periderm could not be observed. Periderm



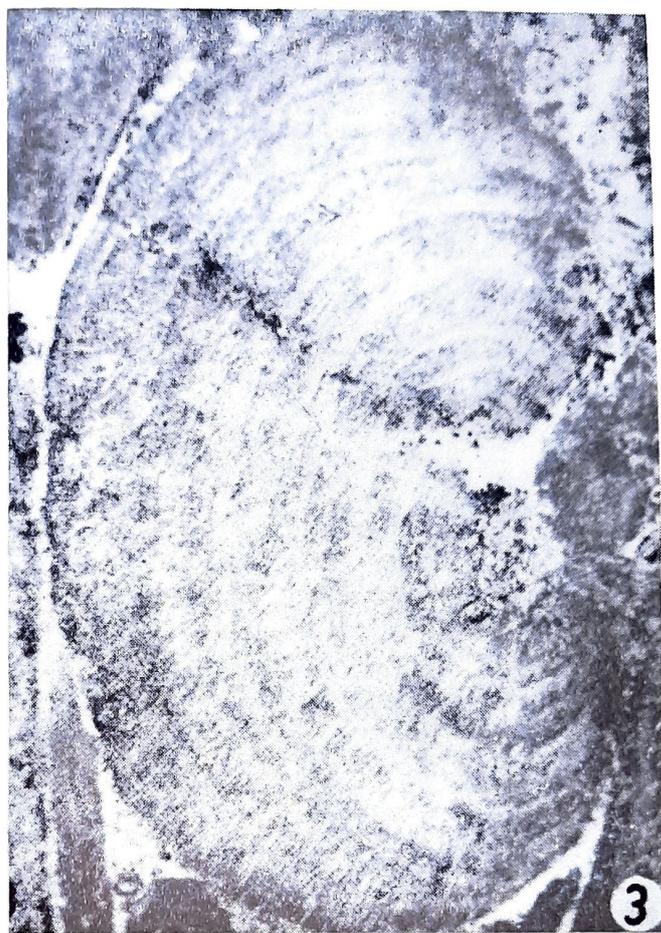
3



4

Text-figure 3—Stem type-2. Anomalous bilobed secondary wood. X 18.

Text-figure 4—Stem type-3. Eccentric secondary wood without growth rings. X 18.



is present only surrounding the wood in stem type 4.

The anomalous anatomy of the *Araucamylon pakurensis* root can not be explained at present. Neither an injury nor a pathological infection is seen in the ground tissue of the root. In nature and structure the secondary xylem in the anomalous portion is identical to the normal one. Tracheids are arranged in regular radial rows.

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Explanation of Plate

Plate 1

1. An anomalous root with one side xylem divided into two and oriented at right angle to the normal one. X 36.
2. Divided xylem facing each other. X 36.
3. Stem type-1. Eccentric, anomalous secondary growth and initiation of splitting. X 81.
4. Stem type-4. Lobed, eccentric secondary wood with splittings. X 18.