Studies in fossil gymnospermous woods—Part X; Three new species of *Araucarioxylon* from Lower Gondwana Strata of Chandrapur District of Maharashtra, India

SHRIPAD N. AGASHE AND M.S. SHASHI KUMAR

*Palaeobotany Research Laboratory, Department of Botany, Bangalore University, Bangalore 560 056, India.*

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**ABSTRACT**


Recent paleobotanical expedition to several Lower Gondwana (Permian) localities occurring in Chandrapur District of Maharashtra has brought to light several well preserved petrified gymnospermous woods. In the present paper three new species of *Araucarioxylon* i.e., *A. aravii* sp. nov., *A. chandrapurensis* sp. nov. & *A. shailae* sp. nov. are described based on distinct anatomical characters.


**INTRODUCTION**

**EX**tensive paleobotanical investigation has been done on Lower Gondwana petrified woods occurring in the Lower Gondwana Strata of central, north and north eastern part of India such as Assam, Bengal, Bihar, Madhya Pradesh and Maharashtra. The main contributions to our knowledge of Lower Gondwana woods from India include the works of Greguss (1955, 1967), Lepekhina (1972), Maheshwari (1972), Lakhanpal *et al.* (1977), Agashe and Gowda (1978).
AREA OF INVESTIGATION

Chandrapur District is encompassed roughly by latitude 18°15' : 15°15' N and longitude 78°65':80°85'E. The district is bounded on the north by Nagpur and Bhadra districts and on west by Wardha, Yeotmal and Andhra Pradesh, and to the south by Andhra Pradesh and on the east by Madhya Pradesh (Geology & Mineral resources of Maharashtra - 1975).

All the rock formations starting from the Archean to the Upper Cretaceous are met in Chandrapur District. The important rivers flowing in Chandrapur District are Wardha, Wainganga and Pranahita (Fig. 1). Stratigraphically and structurally the entire area of Chandrapur District forms a part of the peninsular shield.

It can be seen in Fig. 1 that Sironcha, Chimur, Brahmmapuri and many localities near Chandrapur like Bhandak, Lohara, Ballarpur, Sarandi, Camp IV, Wejgaon, Lathi, Kanhargao, Rangeenapalli and Medaram come under the Lower Gondwana formations. These represent the lower most formations in the Gondawas deposited during the Glacial Period. Deposition started during the Talchir Period, which comprises boulders, pebbles, rock fragments, mud stones, greenish shales, greenish to brown sandstones and clays.

Subsequently there was a thick series of fluviatile deposition of sandstones, shales and coal seams. This group is called as Barakar Series. This series is overlain by rocks of Kamthi Series, which comprises brownish to white shales and clay. These three series are generally met in all the coalfields of Maharashtra. In these areas abundant plant fossils like petrifications, impressions and compressions occur.

MATERIAL AND METHODS

Numerous well preserved petrified woods were collected from different Lower Gondwana localities of Chandrapur District of Maharashtra during our palaeobotanical field trips for the past five years. The present paper deals with the detailed anatomical investigation of three well preserved decorticated petrified woods selected among many species collected.

The petrified woods described in the present paper were collected from Wejgaon, which is a small village situated at a distance of about 60 km south east of Chandrapur and also from Wejgaon-Aravi nala on the outskirts of the village in open fields and dried-up nalas. In nalas the fossil woods have been transported by water to the present place from surrounding areas in past. Many of them might have preserved in-situ. Three new species of petrified woods are described in this paper, are numbered as B.U.P.W. Nos.: 2018, 2028 and 2090. After thorough microscopic observations the three fossil woods were assigned to Araucarioxylon.

Nature of preservation of petrified woods—Although most of the petrified woods investigated in the present work were of silicified type, they were extremely well preserved in certain parts with lot of organic matter. Before sectioning the woods the different measurements of each wood like length, breadth and diameter were recorded as in Fig. 5. In certain cases where the specimens were very big, the woods were...
Fig. 1—Geological Map of Chandrapur District of the Maharashtra.
broken down into small pieces of convenient size using geological hammer. Only well preserved portion of the wood was selected for further sectioning and investigation. Usually woods which are brownish to blackish or part of the wood showing brownish to black colour were well preserved with lot of organic matter. After selecting the woods, several sections in different planes like T.S., T.L.S., R.L.S. were made by employing standard methods of sectioning by using Diamond saw cutting machine and later grinding and polishing the sections by using carborandum powder of grades no. 100 and 400 on grinding lap.

RESULT

Anatomical description of petrified woods—After detailed anatomical investigations and comparison, the woods were designated as the new species of *Araucarioxylon*. The detailed anatomical description of each petrified wood selected in present study along with some of the salient features of the genera to which they are assigned are given below.

*Araucarioxylon*: is a commonly occurring genus of Lower Gondwana gymnospermous woods reported from India in general and Chandrapur District of Maharashtra in particular. It differs from *Dadoxylon* in the absence of a pith and primary xylem (Lepekchina, 1972). As far as we know, more than 51 species of *Araucarioxylon* occur in various parts of world, 15 of these species are reported from India.

Reports of the occurrence of *Araucarioxylon* species from Chandrapur District of Maharashtra are mainly due to the investigations of Agashe et al. (1972-1998) from Paleobotany Research Laboratory, Department of Botany, Bangalore University, who described *A. loharense*, *A. surangii*, *A. lathiense*, *A. kotharensis*, *A. bhivkundense*, *A. wejgaense*. Vagyan and Raju (1981) described *A. nandori* from Chandrapur District.

Emended generic diagnosis of *Araucarioxylon* (Kraus, 1870) emend Maheshwari (1972)

Growth rings distinct to absent, tracheidal radial pitting of araucarian type, usually multiseriate, alternate, hexagonal, sometimes uniseriate and contiguous, cross field pits cupressoid, spiral thickening in tracheids are absent xylem rays are uniseriate, partly biseriate.

*ARAUCARIOXYLON ARAVII* sp. nov.

**Pl. 1.1-8; Fig. 2**

Specific Diagnosis—Decorticated secondary wood with distinct growth rings, rays 1-3 seriate, 2-15 cells high, 3 seriate, rays being rare, tangential pits present, radial pits 1-3 seriate, araucarioid, cross-field pits 1-6 cupressoid.

Holotype—B.U.P.W. no. 2018 with slides deposited in Paleobotany and Palynology Laboratory, Department of Botany, Bangalore University, Bangalore.

Locality—Wejgaon – Aravii nala, Chandrapur District, Maharashtra, India.

Etymology—The present new species of wood has been described as *Araucarioxylon aravii* sp. nov., the specific epithet being derived from *Aravi nala* from where the fossil wood was collected.

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**PLATE 1**

*Araucarioxylon aravii* sp. nov.

1. Transverse section showing growth rings with early wood. x 100.
2. Radial wall showing biseriate, hexagonal alternate pits. x 250.
3. Radial wall showing biseriate, partly triseriate hexagonal alternate bordered pits. x 250.
4. Radial wall showing alternate, hexagonal biseriate pits. x 250.
5. Radial wall showing circular, biseriate, alternate pits with oblique/elliptic pore in center. x 1000.
6. Radial wall showing circular, biseriate, alternate pits. x 1000.
7. Cross field showing two, three, five cupressoid field pits. x 1000.
8. Cross field showing six cross field pits. x 1000.
PLATE 1
**Geological Age**—Lower Gondwana (Permian).

On the basis of generic characters the present wood is assigned to *Araucarioxylon*, it is evident that the present wood belongs to a new species of *Araucarioxylon* as explained below.

**Anatomical Description**—The material consists of a decorticated secondary wood measuring 8 cm in length and 4 x 3.5 cm in thickness. In T.S. the secondary wood shows distinct growth rings (Pl. 1.1). The early wood tracheids are 120-180 cells thick and are mostly rectangular in shape. The tracheids of early wood measure 1.35 x 2.57 mm in size whereas late wood tracheids are comparatively narrower, squarish 4-5 cells thick measuring 0.16 x 0.28 mm in size.

Tangential longitudinal section shows the medullary rays which are 1-3 seriate, commonly uniseriate, 3 seriate rays being rare (Fig. 2a) and 2-15 cells high with average height of the rays being 5-8 cells. Tangential pits are distinct.

Radial longitudinal section reveals the radial pits which range from 1-3 seriate, mostly 2 seriate araucarioid, sometimes pits are found in groups of 2 or 3. The bordered pits are arranged in various manners. Biseriate and triseriate hexagonal pits are alternate or sub-opposite (Pl. 1.2-4; Fig. 2b). Biseriate circular pits are opposite, uniseriate (Pl. 1.5, 6; Fig. 2c), radial pits are contiguous. The bordered pits are circular as well as hexagonal with distinct border. The maximum diameter of bordered pit is 11.2 mm and shape of pit: pore is spherical and diameter of pit pore is 4 mm. The cross field pits are 1-6 cupressoid, spherical – oval in shape, commonly 2-5 pits occur per field. The average diameter of cross field pit is 6.2 mm (Pl. 1.7, 8, Fig. 2d).

**Discussion and Comparison**—The petrified wood described above shows generic diagnostic characters of *Araucarioxylon* Krausk (1870), emend Maheshwari (1972) in having cupressoid cross-field pits and araucarioid radial pits.

The present specimen or B.U.P.W. no. 2018 differs from all the described species of *Araucarioxylon*, but resembles some species of *Araucarioxylon* in some of the anatomical characters. In having a maximum number of 6 cross-field pits the present specimen resembles *A. nandori* (Vagyani & Raju, 1981) and *A. weigaeense* (Agashe & Shashi Kumar, 1996) but differs from the described species in medullary ray and radial wall pitting characters.

However, this new species of wood does not have any resemblance with *A. mohgaoensis* (Lakhanpal et al., 1977) in cross-field pitting and medullary ray characters. The only similarity is in radial wall pitting. In both *A. mohgaoensis* and the present wood, the radial pits are 1-3 seriate mostly 2 seriate.

The present newly described wood differs from *A. kothariensis* (Agashe & Prasad, 1984) in radial wall pitting and cross-field pitting characters. In both *A. kothariensis* (Agashe & Prasad, 1984) and in *A. aravii* sp. nov. medullary ray is 1-3 seriate with the average height of 8 cells. The comparison of new species with all the described species of *Araucarioxylon* has been shown in comparative Fig. 5.

The present new species of wood has been described as *Araucarioxylon aravii* sp. nov., the specific epithet being derived from Aravi *nala* from where the fossil wood was collected.

**ARAUCARIOXYLON CHANDRAPURENSIS** sp. nov.

Pl. 2.1-9; Fig. 3

**Specific Diagnosis**—Decorticated secondary wood with distinct growth rings, 1-2 seriate medullary rays, mostly uniseriate, 2-36 cells high, tangential pits present, 1-3 seriate araucarioid radial pits, cross-field pits 1-7 cupressoid type.

**Holotype**—B.U.P.W. no. 2028 along with slides deposited in Paleobotany and Palynology Laboratory, Department of Botany, Bangalore University, Bangalore.

**Locality**—Wejgaon – Aravi *nala*, Chandrapur District, Maharashtra, India.

**Etymology**—The present wood is described as a new species of *Araucarioxylon*, *A. chandrapurensis* sp. nov., the specific name is given after Chandrapur District, from where the wood is collected.

**Geological Age**—Lower Gondwana (Permian).

On the basis of generic characters the present wood is assigned to *Araucarioxylon*. It is evident that the present wood belongs to a new species of *Araucarioxylon* as explained below.

**Anatomical Description**—The material consists of decorticated secondary wood measuring 10.4 cm in length and 5.2 x 4.9 cm in thickness with distinct growth rings. In T.S. the growth rings are clear (Pl. 2.1). The early wood tracheids are 80-120 cells thick and rectangular in shape. The tracheids of early wood measure 2.20 x 2.62 mm in size, whereas late wood tracheids are comparatively narrower, 2-4 cells thick measuring 0.14 x 0.46 mm in size.
**Araucarioxylon chandrapurensis** sp. nov.

Fig. 3—Araucarioxylon chandrapurensis sp. nov. a. T.L.S. showing uniseriate medullary rays. x 100. b. R.L.S. showing uniseriate, biseriate and triseriate circular alternate pits. x 250. c. R.L.S. showing uniseriate, biseriate, triseriate circular alternate and opposite pits. x 250. d. Cross field showing two, three, four, five, six and seven field pits. x 400. e. R.L.S. showing uniseriate/partially biseriate circular pits and three-four seriate hexagonal alternate pits and cross-field showing four, five, six and seven field pits. x 250.

Tangential longitudinal section shows medullary rays which are 1-2 seriate, mostly uniseriate 2-36 cells high on an average height of 15 cells. Tangential pits are distinct (Pl. 2.2; Fig. 3a).

Radial longitudinal section reveals the radial pits which are 1-3 seriate, araucarioid mostly 2 seriate with distinct pit pore in centre. Radial pits are arranged in various manner. Biseriate circular pits are alternate or sub-opposite, but biseriate circular pits are oppositely placed in some areas. Triseriate circular pits are alternately placed. Uniseriate pits are contiguous, while biseriate and triseriate hexagonal pits are alternate (Pl. 2.4; Figs 3b, c, e). The maximum diameter of radial pit is 10 mm and that of pit pore is 3.84 mm. The cross-field pits are 1-7 cupressoid, spherical, oval, commonly 2, 4, 5 pits occur per cross field (Pl. 2.3, 5-9; Figs 3d, e).

**Discussion and Comparison**—The petrified wood B.U.P.W. no. 2028 is assigned to *Araucarioxylon*, as it shows the diagnostic characters of *Araucarioxylon* by having cupressoid cross-field pits and araucarioid radial wall pits. The present specimen differs from all the described species of *Araucarioxylon* by having a maximum number of seven cross field pits, but it resembles few described species of *Araucarioxylon* in other anatomical characters.

The new Araucarian wood resembles *A. mohgaoensis* (Lakhanpal et al., 1977) in medullary ray and radial wall pitting characters, but differs from *A. mohgaoensis* (Lakhanpal et al., 1977) in cross-field pitting characters. In new species of wood and *A. mohgaoensis* (Lakhanpal et al., 1977), medullary ray is uniseriate 2-36 cells high, the average height of the ray is 8-15 cells. Radial wall pits 1-3 seriate, mostly 2 seriate, contiguous alternate. The new species of fossil wood resembles *A. surangei* (Agashe et al., 1981), *A. nandori* (Vagyan & Raju, 1981), *A. bhivkundense* (Agashe & Prasad, 1984), *A. wejgaardense* (Agashe & Shashi Kumar, 1996) in medullary ray characters, but differs from all the four species of *Araucarioxylon* in radial pitting and cross-field pitting characters. The new species of Araucarian wood and *A. nandori* (Vagyan & Raju, 1981), *A. surangei* (Agashe et al., 1981), *A. bhivkundense* (Agashe & Prasad, 1984), *A. wejgaardense* (Agashe & Shashi Kumar, 1996) resemble each other in having 1-2 seriate medullary ray mostly uniseriate 2-35 cells high on an average height of the ray is 8-15 cells. The comparison of new species of wood with all the described species of *Araucarioxylon* prompted us to describe the present wood as a new species of *Araucarioxylon* as shown in comparison Fig. 5.

**ARAUCARIOXYLON SHAILAE** sp. nov.

Pl. 3.1-10; Fig. 4

**Specific Diagnosis**—Decorticated secondary wood with distinct growth rings, 1-2 seriate mostly uniseriate, 2-46 cells high medullary rays, tangential pits are distinct, 1-3 seriate araucarioid radial pits, 1-8 cupressoid cross-field pits.

**Holotype**—B.U.P.W. no.: 2090 along with slides deposited in Paleobotany and Palynology Laboratory, Department of Botany, Bangalore University, Bangalore.

**Locality**—Wejgaon Village, Chandrapur District, Maharashtra, India.

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**PLATE 3**

*Araucarioxylon shailae* sp. nov.

1. Transverse section showing growth rings with early wood tracheids. x 100.
2. TLS showing uniseriate and biseriate radial pits. x 250.
3. TLS showing uniseriate and biseriate medullary rays and tangential pits. x 400.
4. RLS showing uniseriate and biseriate circular radial pits biseriate radial pits are opposite, uniseriate / partly biseriate pits are opposite. x 1000.
5. RLS showing biseriate circular radial pits in groups of 2, 3, 4 and uniseriate circular contiguous pits. x 250.
6. RLS showing biseriate circular opposite pits. x 250.
7. RLS showing 3, 5 cupressoid cross field pits. x 1000.
8. RLS showing 2, 4 circular cupressoid cross field pits. x 250.
9. RLS showing 2, 4, 6 circular cupressoid cross field pits. x 400.
10. RLS showing 4 circular cupressoid cross field pits. x 1000.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Genus &amp; Species</th>
<th>Geological Age</th>
<th>Growth ring</th>
<th>Medullary ray</th>
<th>Tangential Border pitting on radial walls</th>
<th>Cross field pits</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>A. arberi</em> (Seward, 1919) comb. nov. Maheshwari 1972</td>
<td>Upper Carboniferous</td>
<td>Distinct</td>
<td>1-21 cells high, usually 6-12 cells high</td>
<td>Absent 1-4 seriate, circular</td>
<td>1-10 oblique</td>
<td>Australia</td>
</tr>
<tr>
<td>2.</td>
<td><em>A. manieroi</em> (Krause &amp; Dolianiti, 1958) comb. nov. Maheshwari 1972</td>
<td>Upper Carboniferous</td>
<td>Distinct</td>
<td>1-47 cells high, on an average of 9-10 cells high</td>
<td>Absent 1-4 seriate, pore elliptical</td>
<td>1-9, sometimes in groups</td>
<td>Brazil</td>
</tr>
<tr>
<td>4.</td>
<td><em>A. gondwanense</em> (Maithy, 1964) comb. nov. Maheshwari 1972</td>
<td>Lower Permian</td>
<td>Distinct</td>
<td>13% rays are 2 seriate, 1-43 cells high, average of 9-10 cells high</td>
<td>Absent 1-5 seriate, alternate / sub opposite</td>
<td>2-8 contiguous / separate, circular-oval in shape</td>
<td>Jharia C.F. (Bihar)</td>
</tr>
<tr>
<td>5.</td>
<td><em>A. parbeliense</em> (Rao, 1935) comb. nov Maheshwari 1972</td>
<td>Permian</td>
<td>Distinct</td>
<td>1-24 cells high, mostly 2-3 cells high</td>
<td>Absent 1-5 seriate, pore circular-oval</td>
<td>8-9 bordered, pores oblique slit like</td>
<td>Parbelia colliery, Bengal</td>
</tr>
<tr>
<td>6.</td>
<td><em>A. loharense</em> Agashe &amp; Gowda, 1978</td>
<td>Permian</td>
<td>Distinct</td>
<td>1-2 seriate, 2-27 cells high, on an average height of 11 cells high</td>
<td>Present 1-4 seriate, round-hexagonal with distinct border</td>
<td>2-9, most commonly 2, 4, 6 pits / field</td>
<td>Lohara, Chandrapur, M.S.</td>
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<td>7.</td>
<td><em>A. latihiense</em> Agashe et al., 1981</td>
<td>Permian</td>
<td>Distinct</td>
<td>Uniseriate, 1-27 cells high on an average height of 5 cells</td>
<td>Absent 1-4 seriate, alternate / separate, contiguous</td>
<td>1-10 cupressoid, circular-oval with thin border</td>
<td>Lathi, Chandrapur, M.S.</td>
</tr>
<tr>
<td>8.</td>
<td><em>A. surangeii</em> Agashe et al., 1981</td>
<td>Permian</td>
<td>Distinct</td>
<td>1-2 seriate, commonly 1 seriate, 1-35 cells on an average of 4 cells high</td>
<td>Present 1-4 seriate alternate, separate contiguous hexagonal</td>
<td>1-11 cupressoid, commonly 2, 4, 6 pits / round-oval</td>
<td>Lathi, Chandrapur, M.S.</td>
</tr>
<tr>
<td>9.</td>
<td><em>A. nandori</em> Vagyani &amp; Raju, 1981</td>
<td>Upper Permian</td>
<td>Distinct</td>
<td>1-2 seriate, mostly uniseriate 2-30 cells high</td>
<td>Absent 1- multiseriate, free contiguous / hexagonal</td>
<td>2-6, cupressoid</td>
<td>Nandori, Chandrapur: M.S.</td>
</tr>
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<td>10.</td>
<td><em>A. bhivkundense</em> Agashe &amp; Prasad, 1984</td>
<td>Permian</td>
<td>Distinct</td>
<td>1-2 seriate free, 1-33 cells high with an average height of 8 cells</td>
<td>Present 1-2 seriate free / contiguous sometimes in groups of 2, 3, 4</td>
<td>1-8 cupressoid, commonly 2, 4 pits occur / field</td>
<td>Bhivkund, Chandrapur, M.S.</td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Age</td>
<td>Distinct Characters</td>
<td>Present Characters</td>
<td>Location</td>
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<td>11</td>
<td><em>A. kothariensis</em></td>
<td>Permian</td>
<td>Distinct 1-3 seriate, 1-44 cells high with an average height of 8 cells</td>
<td>Present 1-4 seriate, araucarioid free / contiguous radial pits in groups of 2, 3, 4</td>
<td>Wejgaon, Chandrapur, M.S.</td>
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<td>12</td>
<td><em>A. semibiseriatum</em></td>
<td>Permian</td>
<td>Distinct Uniseriate or partly biseriate, 1-24 cells high, rarely up to 38 cells on an average height of 2-9 cells</td>
<td>Present 1-4 seriate, rarely 5 seriate, circular/oval pits, contiguous, sub-opposite or alternate pits</td>
<td>Raniganj Coalfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><em>A. wejgaense</em></td>
<td>Permian</td>
<td>Distinct 1-2 seriate free, 2-34 cells high, with an average height of 8-12 cells, mostly uniseriate</td>
<td>Present 1-2 seriate, mostly 2 seriate contiguous / alternate sub-opposite may be in groups of 2, 3, 4</td>
<td>Wejgaon, Chandrapur, M.S.</td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td><em>A. aravii</em> sp. nov.</td>
<td>Permian</td>
<td>Distinct 1-3 seriate, uniseriate condition is common, 2-15 cells on an average height of 5-8 cells</td>
<td>Absent 1-3 seriate, araucarioid, hexagonal, alternate, bars of sanio seen, mostly hexagonal, biseriate pits are alternate</td>
<td>Wejgaon, Chandrapur, M.S.</td>
<td></td>
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</tr>
<tr>
<td>15</td>
<td><em>A. chandrapurensis</em> sp. nov.</td>
<td>Permian</td>
<td>Distinct 1-2 seriate, mostly uniseriate, 2-36 cells high on an average of 15 cells</td>
<td>Present 1-3 seriate, araucarioid mostly 2 seriate with distinct lumen in center. Circular-hexagonal. 2 seriate pits are alternate / sub-opposite</td>
<td>Wejgaon, Chandrapur, M.S.</td>
<td></td>
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<td>16</td>
<td><em>A. shailae</em> sp. nov.</td>
<td>Permian</td>
<td>Distinct 1-2 seriate, mostly uniseriate, 2-46 cells high on an average height of 20 cells, unis - 60% bi - 40%</td>
<td>Distinct 1-3 seriate araucarioid, mostly 2 seriate uniseriate circular pits are contiguous, biseriate circular pits are oppositely placed, 3 seriate pits are also alternately placed / oppositely place 2 seriate hexagonal pits are alternately placed</td>
<td>Wejgaon, Chandrapur, M.S.</td>
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Fig. 5—Comparative anatomical characters of different species of *Araucaryxylon*.
Geological Age—Lower Gondwana (Permian).

Etymology—The present wood is described as a new species of Araucarioxylon, A. shailae sp. nov., the specific epithet is given in honour of Dr Shaila Chandra, Palaeobotanist at the Birbal Sahni Institute of Palaeobotany, Lucknow, for her significant work on Lower Gondwana megafossils.

On the basis of generic characters the present wood is assigned to Araucarioxylon, it is evident from the present characters, the wood belongs to new species of Araucarioxylon as explained below.

Anatomical Description—The material consists of decorticated secondary wood measuring 7 cm in length and 5.8 x 3.2 cm in thickness showing distinct growth rings (Pl. 3:1). The early wood tracheids are 40-80 cells thick, they are rectangular in shape. The early wood tracheids measure 0.5 x 20 mm in size, whereas late wood tracheids are 2-4 cells thick measuring 0.075 x 0.125 mm in size.

Tangential longitudinal section shows medullary rays which are 1-2 seriate, mostly uniseriate, 2-46 cells high with an average height of 20 cells. Uniseriate medullary rays represent 60% and biseriate medullary rays are represented by 40% of total rays. Tangential pits are distinctly circular, contiguous (Pl. 3:2, 3; Figs 4a, b).

Radial longitudinal section reveals the radial pits which are 1-3 seriate, mostly 2 seriate, araucarioid with distinct pit pore in the centre. Radial pits are arranged in various manners. The uniseriate circular pits are contiguous, biseriate; triseriate circular pits are alternately placed. Sometimes radial pits are found in groups (Pl. 3:4-6; Figs 4c-e). The maximum diameter of radial pit is 10.27 mm and shape of the pit pore is spherical and diameter of pit pore is 4 mm. The cross-field pits are 1-8 cupressoid, circular, 2, 4, 5 pits occur/field. The average diameter of cross-field pits is 6.7 mm (Pl. 3:7-10; Figs 4f, g).

Discussion and Comparison—The petrified wood described above shows generic diagnostic characters of Araucarioxylon by having cupressoid cross-field pits and araucarioid radial wall pits. The present specimen differs from all the described species of Araucarioxylon, but resembles some species of Araucarioxylon in certain anatomical characters.

The new araucarian wood closely resembles A. manieroi (Krausel & Dolianiti, 1958; comb. nov. Maheshwari, 1972) in medullary ray characters, but differs from it in other anatomical characters (radial wall pitting and cross-field pitting characters). In both A. manieroi and the present wood medullary rays are 2-46 cells high.

The present wood also resembles A. mohgaoensis (Lakhanpal et al., 1977) in radial wall pitting characters but differs from A. mohgaoensis (Lakhanpal et al., 1977) in other anatomical characters. In both A. mohgaoensis and present wood radial pits are 1-3 seriate.

In both A. bhivkundense (Agashe & Prasad, 1984) and present wood similarity in cross-field pitting is seen, but it differs in other anatomical characters. In both A. bhivkundense (Agashe & Prasad, 1984) and present wood cross-field pits are 1-8 cupressoid.

Although present wood resembles some species of Araucarioxylon as discussed above, but it differs from all the described species of Araucarioxylon in medullary ray, radial wall pitting and cross-field pitting characters. Hence this wood is described as a new species of Araucarioxylon as shown in Fig. 5.

DISCUSSION

Paleobotanical exploration of Maharashtra which was carried out during the past 5-6 years has brought to light several new fossil bearing localities suggesting strongly the existence of highly diversified flora during the Lower Gondwana Period. The real picture of past vegetation may be reconstructed by studying the organic remains of the plants in various forms. Petrified plant material forms the best evidence of the past plant life because of the varied anatomical characters which can be studied from it.

The secondary xylem is very well preserved in all the three species of fossil woods. Pith, primary xylem or cortical tissues are not preserved properly. The xylotomical studies of
woods from Wejgaon and Wejgaon-Aravi nalas exhibit remarkable resemblance. These woods were characterised by distinct growth rings uniseriate to triseriate nature of rays (uniseriate being most common). Uniseriate to multiseriate border pits which are mostly typically araucarioid type in nature i.e., horizontally compressed and hexagonal arranged in groups and cupressoid cross field pits with thin borders. On account of the presence of these characters all the three species of fossil woods have been assigned to genus *Araucarioxylon* Kraus. However, these three woods differ from each other in characters such as thickness and height of medullary rays and number of cross-field pits and hence differs from all the described species of *Araucarioxylon*. The occurrence of these three new species of *Araucarioxylon* and also *A. latihiense*, *A. surangei*, *A. bhitkundense*, *A. kothariensis* and *A. wejgaonense* by Agashe et al. (1978-1997) from Lower Gondwana Horizon of Chandrapur District suggests that *Araucarioxylon* was rather a well established conifer in Chandrapur District during the Lower Gondwana Period. This discovery of 3 new species of *Araucarioxylon* adds to the diversity of gymnospermous vegetation of Lower Gondwana.

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