INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-3, Issue-1, Jan-Mar-2013 ISSN 2231-4490
Coden : IJPAES www.ijpaes.com

Received: 24t Nov-2012 *Revised: 03rd Dec-2012* *Accepted: 04th Dec -2012*
Research article

A FOSSIL ARAUCARIAN WOOD FROM THE SRIPERUMBUDUR FORMATION, TAMIL NADU, INDIA

D. Kumarasamy

Department of Botany, Annamalai University, Annamalainagar 608 002,Tamil Nadu, India
Email: dr_kumarasamy@rediffmail.com

ABSTRACT: Sriperumbudur Formation is one of the Upper Gondwana rock formations of South India. This rock system contains many plant and animal fossils. Plant fossils include leaf impressions of pteridophytes and gymnosperms and petrified woods of gymnosperms, especially of conifers. In the present work, a piece of petrified secondary wood of gymnosperm was described and it is assigned to a new species of Agathoxylon.
Keywords: *Agathoxylon*, Sriperumbudur Formation, Upper Gondwana.

INTRODUCTION

The upper Gondwana sediments in the Palar basin (see map) are divided into three stratigraphical units *viz.* the upper Satyavedu formation, the lower Sriperumbudur formation and the marine equivalents of there formations namely the Avadi formation, Sriperumbudur formation is characterized by arenaceous and argillaceous rock units comprising of splintery green shale, clays and sandstones with limestone intercalations unconformably overlying either pre-Cambrian basement or Permian boulder beds and green shales. These shales contain impression fossils of plants and animals. Plant fossils includes impressions of leaves of petridophytes and gymnosperms. Apart from the impression fossils, many petrified secondary woods of gymnosperms were found in many localities of this sedimentary rock formation. The plant fossils mostly available in and around Sriperumbudur. The fossil flora of this region have been worked out by [8, 25, 26, 27, 29, 30]. The fossil palynomorphs of this region had been analyzed by [22, 23, 24, 32, 33, 34]. Later the fossil flora of this region was worked out by [9, 10, 11, 12, 13, 14]. Recently the author has collected one piece of poorly preserved petrified secondary (SPR/VK/89) wood from ploughed fields of Vallakotai a village near Sriperumbudur (See Map).

MATERIALS AND METHODS

The petrified wood piece (SPR/VK/89) was sectioned using rock cutting and polishing machine. Thin sections (TS, TLS and RLS) were prepared and they are observed under light microscope. Photographs were prepared using Nikon Digital Camera. All the specimens and slides were deposited in the Department of Botany, Annamalai University, Annamalai Nagar 608 002.

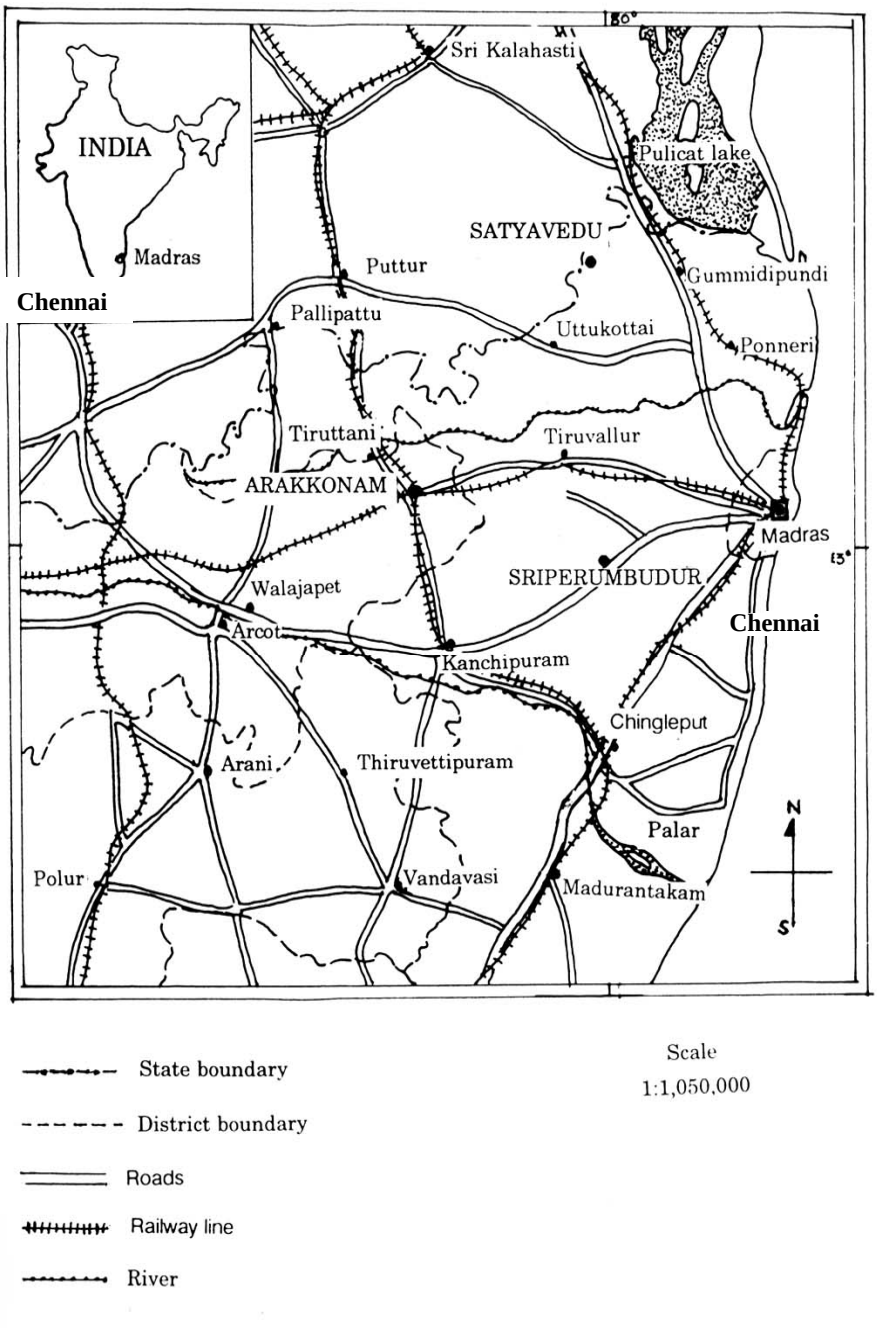
Observation

***Agathoxylon gondwanensis* sp. nov.**

Holotype	:	Specimen-SPR/VK/89
Slides	:	SPR/VK/89/1, 2&3
Type Locality	:	Vallakotai, Kancheepuram Dist., Tamil Nadu, India
Stratigraphic horizon	:	Sriperumbudur Formation, Upp.-Jurassic - Early-Cretaceous
Etymology	:	Named after the Gondwana sediment from where the specimen is picked up.

Map

AREA OF STUDY



Diagnosis

Growth rings distinct, both tangential and radial walls of the tracheid pitted. Radial wall pits uni-biseriate, alternate, contiguous, circular with circular apertures. Cross field pits mostly one, in some fields upto 3, circular, contiguous. Rays simple, uniseriate, 1-39 cells high, xylem parenchyma and resin tracheids are absent.

DESCRIPTION

The study is based on a single piece of decorticated, pycnoxylic wood, measuring 17 cm long and 8 cm wide. The specimen is impregnated with silica. Growth ring distinct, almost straight, almost equal, 600-1275 μm (18-35 cells) wide. All growth rings have more early wood than late wood (four rows of tracheids in average). Tracheids are regularly arranged in radial rows. Transition from early wood to late wood is gradual. False ring frequent (15%). Early wood tracheids 1.9-4.33 mm long, radially 18.0-56.0 μm (average 34.9 μm) wide, rectangular. Tangential pits uni-biseriate, bordered, circular, 11.25 μm wide; aperture circular, 3.75 μm wide. Radial wall pits mostly (> 85%) uniseriate, in some places it is biseriate, alternate; pits bordered, circular, contiguous, 17.5 μm in diameter, aperture circular, 5.0 μm wide. Rims of sanio absent. Tracheids per mm^2 is 210. Late wood tracheids 10.3-33.2 μm (average 22.46 μm) in radial diameter. Rays uniseriate, 1-39 (average 10.9) cells high, homocellular, cells 23.0 μm long and 19.6 μm wide, with dark contents in some. Both tangential and horizontal walls of the ray cells are smooth, but radial wall pits 1-3, mostly 1, elliptical to circular, bordered, podocarpoid, 9.0 μm wide; aperture circular. Ray end wall vertical. Each ray cell crossing 1½ -2 tracheids. Vertical parenchyma, resin tracheids or resin canals are completely absent.

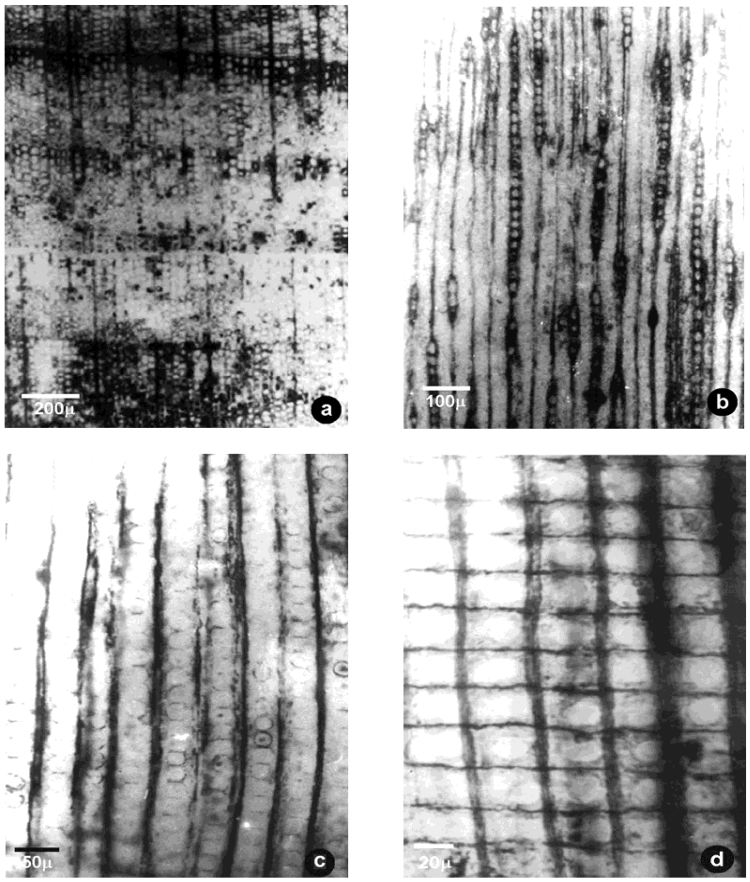


Fig. 1. *Agathoxylon gondwanensis;* (a) Transverse section, (b) Tangential longitudinal section, (c) Radial longitudinal section showing radial wall pits of tracheids, (d) cross field pits.

DISCUSSION

The present fossil wood characterized by wood without axial parenchyma and resin canals, presence of mostly uniseriate (rarely biseriate) pits on the radial wall of the tracheid and 1-3 cross field pits. These characters shows the affinity of this petrified wood with the family Araucariaceae. Today Araucauiaceae has three genera, *Agathis*, *Araucaia* and *Wollemia*, with almost 40 species.

These species are cannot always be distinguished on wood anatomy alone. So the fossil woods of Araucauiaceae are placed under four generic names, *Agathoxylon* [21], *Dadoxylon* [6, 27] *Araucarioxylon* [16, 11] and *Chapmanoxylon* [17]. The characters of the present wood ismore similar to the characters of *Araucarioxylon* (16) so it placed in this genus. Currently, there are two schools of thought regarding the assignment of fossil material to *Araucarioxylon*. One school insists that *Araucarioxylon* Kraus is invalid under ICBN because it is synonym of *Agathoxylon* Hartig [19, 1]. However, the second school argues that the generic name *Araucarioxylon* should be retained to avoid confusion since the name has been used for more than 100 years and is linked to more than 45 species [7].

Although the present author published there new species of *Araucarioxylon* [9], now the generic name *Araucarioxylon* has been shown to be illegitimate [1], so it is considered as appropriate to assign the new araucarian material as species of *Agathoxylon*.

In the Gondwana land, extant araucarians are restricted to the southern hemisphere. All extant araucarians are trees, some that exceeding 60 m in height [15]. During the Mesozoic, Araucauiaceae occurred in both hemispheres, primarily in high latitudes. It has been proposed that Araucauiaceae evolved during tree early Triassic [15]. However, other authors suggest that, based on wood anatomy, they occurred, as far back as the Carboniferous and possibly even Devonian [20]. At least 400 morphospecies have been described and many more not ascribed to a particular species (e.g. *Agathoxylon* sp.) [20]. *Agathoxylon* has been recorded from at least 16 countries (including the continent of Antarctica) of the southern hemisphere from the Jurassic-Cretaceous [20].

The present specimen compares well with. *A. giftii* reported from the same Formation by [9] in having 1-2 seriate radial wall pits on the tracheids, exclusively uniseriate rays and the complete absence of resin tracheids and xylem parenchyma. However *A. giftii* differs from the present specimen in having heterocellular rays, 1-7 pits per field and the absence of tangential pitting on the tracheids. The present specimen also resembles *A. nepalensis* from the early Cretaceous Formation of Nepal [2]. But the latter species differs from the present specimen in the absence of tangential wall pitting on the tracheid walls and the presence of low (1-8 celled) xylem rays. The present specimen is also similar to *A. keriense* reported from the Tertiary Formations of India [31]. But in the latter the xylem rays are low (2-12 cells), the tangential walls of the tracheids are smooth.

The present specimen also compare well with *Agathoxylon* sp. reported from Upper Cretaceous of Argentina [18] in 34.9 μm radial diameter of trachid and predominate uniseziate (> 90%) pits in the radial wall of tracheid. But the present specimen shows mostly one pit per cross field where as the latter specimen shows 2-6 cross field pits per field.

In the presence mostly uniseriate (> 85%) pits on the radial wall of tracheids, mostly one pit per cross field, in the presence of distinct tangential pits on the tracheids, in the presence of long xylem rays this specimen stands apart from other species so this specimen is assigned to a new species.

The structure of wood reflected the climate in which it was survived. Although there are many limitations in the interference of paleoclimate, the secondary woods of gymnosperms and angiosperms of Tertiary period give some valuable palaeoclimatic signals [3,4, 5]. An attempt is here made to deduce climatic implications from the study of growth-rings seen in these woods and also from wood already reported from this Formation.

Most of the petrified woods reported from this formation show ‘C’ type growth rings, in which the early wood more than the late wood and the transition from the early wood to late wood is gradual. This feature indicates that the climate was almost uniform throughout the growing season excepts at its close.

REFERENCES

[1] Bamford, M.K. and Philippe, M. 2001. Jurassic-Early Cretaceous Gondwana homoxylous wood: a nomenclatural revision of the genera with taxonomic notes. Rev. Palaeobot. Palynol. 113, 287-297.

[2] Barale, G., Bossoullet, J. P. and Bose, M. N. 1978. On a collection of Mesozoic plants from Kagbeni Muktinath, Thakkhola valley, Nepal. Palaeobotanist, 25, 32–38.

[3] Chapman, J.L. and Smellie, J.L. 1992. Cretaceous fossil wood and palynomorphs from Williams point, Livingston Island, Antarctic Peninsula. Review of Palaeobotany and Palynology, 74, 163-192.

[4] Creber, G.T. and Chaloner, W.G. 1984a. Influence of environmental factors on the wood structure of living and Fossil trees. The Botanical Review, 50, 357-448.

[5] Creber, G.T. and Chaloner, W.G. 1984b. Climatic indications from growth ring in fossil woods. In: Brenchley P. (Ed.), fossils and climate John Wiley & Sons, pp. 49-74.

[6] Endlicher, S. 1847. Conspectus Coniferarum fossilium. In: S. Endlicher (ed.) Synopsis Coniferarum: 52: Scheitlin & Zolikofer, St. Gall.

[7] Falcon-Lang, H.J. and Cantrill, D.J. 2001. Gymnosperm woods from the Cretaceous (Mid-Aptian) Cerro Negro Formation, Byers Peninsula, Livingston Island, Antarctica: the absorbscent vegetation of a volcanic area. Cretaceous Research, 22, 277-293.

[8] Feistmantel, O. 1879. The fossil flora of the Upper Gondwana: Outliers on the Madras coast. Mem. Geol. Surv. India, Palaeont. Indica. Ser. 2, 1(4), 191–224.

[9] Jeyasingh, D. E. P. and Kumarasamy, D. 1994a. *Araucarioxylon* from the Sriperumbudur Formation, Upper Gondwana, Tamil Nadu, India. Geophytology, 24(1), 43–48.

[10] Jeyasingh, D. E. P. and Kumarasamy, D. 1994b. Occurrence of *Pityospermum* Northorst in the Sriperumbudur Formation, Tamil Nadu. Curr. Sci., 67(5), 305.

[11] Jeyasingh, D. E. P. and Kumarasamy, D. 1995. An unusual pycnoxylic wood from a new Upper Gondwana locality in Tamil Nadu, India. Rev. Palaeobot. Palynol., 74(3/4), 163–192.

[12] Kumarasamy, D. and Jeyasingh, D. E. P. 1995. Some fossil pteridophytic foliage from the Sriperumbudur Formation, Tamil Nadu, India. Phytomorphology, 45(3&4), 175–183.

[13] Kumarasamy, D. and Jeyasingh, D. E. P. 2004. A new species of *Cupressinoxylon* Göeppert from the Sriperumbudur Formation, India. Phytomorphology, 54, 97–104.

[14] Kumarasamy, D. and Jeyasingh, D. E. P. 2007. *Sahnioxylon* (Sahni) Bose and Sah from the Sriperumbudur Formation, Tamil Nadu, India. Phytomorphology, 57, 5–12.

[15] Kunzumann, L. 2007 Araucauiaceae (Pinopsida): aspects in Palaeobiography and palaeobiodiveristy in the Mesozoic: Zoologischer Anzeiger. A Journal of Comparative Zoology, 246, 257-277.

[16] Maheswhari, H.K. 1972. Permian wood from Antarctica and revision of some lower Gondwana wood taxa. Palaeontographica B, 138, 1-43.

[17] Pant, M.M. and Singh, V.K. 1987. Xylotomy of some woods from Raniganj Formation (Permian), Raniganj Coalfield, India. Palaeontographica B, 203, 1-82.

[18] Panti, C., Cesari, S.N., Marenssi, S.A. and Olivero, E.B. 2007. A new araucarian fossil species from the Paleogene of Southern Argentina. Ameghiniana, 44, 215-222.

[19] Philippe, M. 1993. Nomenclature generique des tracheidoxyles fossiles mesoziques a champs araucarioides. Taxon., 42, 74-80.

[20] Philippe, M. 2011. How many species of *Araucarioxylon*? C.R. Palevol. 10, 201-208.

[21] Philippe, M., Bamford, M., McLoughlin, S., Alves, L.S.R., Falcon-Lang, H.J., Gnaedinger, S., Ottone, E.G., Pole, M., Rajanikanth, A., Shoemaker, R.E., Torres, T. and Zamuner, A. 2004. Biogeographic analysis of Jurassic-Early cretaceous wood assemblages from Gondwana. Review of Palaeobotany and Palynology, 129, 141-173.

[22] Ramanujam, C. G. K. and Srisailam, K. 1974. Palynology of carbonaceous shales from a bore hole at Kattavakkam near Conjeevaram, Tamil Nadu, India. Pollen et Spores, 16(1), 67–102.

[23] Ramanujam, C. G. K. and Varma, Y. N. R. 1977. Palynological evidence for the age of Sriperumbudur beds encountered in a bore hole at Orikkai near Conjeevaram, Tamil Nadu. J. Geol. Soc. India, 18(8), 429–435.

[24] Ramanujam, C. G. K. and Varma, Y. N. R. 1981. Hillate spores from the Upper Gondwana deposits of Palar basin, Tamil Nadu. Palaeobotanist, 28-29, 308–315.

[25] Sahni, B. 1928. Revision of Indian fossil plants: part I – Coniferals (a. Impressions and Incrustations). Mem. Geol. Surv. India, Palaeont. Indica n. ser., 11, 1–49.

[26] Sahni, B. 1931. Revision of Indian fossil plants: part II – Coniferals (b. Petrifactions). Mem. Geol. Surv. India, Palaeont. Indica n. ser., 11, 51–124.

[27] Seward, A. C. and Sahni, B. 1920. Indian Gondwana plants: a revision. Mem. Geol. Surv. India, Palaeont. Indica n. ser., 7(1), 1–41.

[28] Seward, A.C. 1919. Fossil plants vol. IV: Glinkgoales, Coniferales, Gnetales. Hafner Pub. Co., New York, London.

[29] Suryanarayana, K. 1953. *Mesembrioxylon tirumangalense*, a new species from the Sriperumbudur group near Madras. J. Indian Bot. Soc., 32(4), 159–164.

[30] Suryanarayana, K. 1954. Fossil plants from the Jurassic rocks of the Madras coast, India. Palaeobotanist, 3, 87–90.

[31] Trivedi, B. S. and Srivastava, R. 1989. Gymnospermous woods from early Tertiary of Chindwara district of Madhya Pradesh. Phytomorphology, 39(1), 61–68.

[32] Varma, Y. N. R. 1983. *Erlansonisporites* potonie, megaspores from the Sriperumbudur beds of Palar basin, Tamil Nadu. Geophytology, 13(2), 235–236.

[33] Varma, Y. N. R. 1984. Gymnospermous palynomorphs from the Upper Gondwana of India. Indian J. Bot., 7(2), 190–197.

[34] Varma, Y. N. R. and Ramanujam, C. G. K. 1981. Palyonology of some Upper Gondwana deposits of Palar basin, Tamil Nadu, India. Palaeontographica B, 190 (1-2), 37–86.