

# Silicified woods from southern Germany (Bavaria)

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A large number of silicified woods have been discovered and collected, in the second part of this century, from Mesozoic and Tertiary sediments of southern Germany (Bavaria). The paper gives a brief account of silicified woods from central Europe.

**Key-words**—Fossil woods, Mesozoic, Tertiary, southern Germany, central Europe.

## MESOZOIC WOODS

*Identification*— In a series of publications on detailed anatomical studies of fossil woods, Vogellehner (1965) reported many wood taxa from the Keuper, Upper Triassic of Franconia (southern Germany). viz., *Dadoxylon*, *Protocupressinoxylon*, *Xenoxylon*, *Coraioxylon*, *Europoxylon*, *Koleoxylon*, *Pennsylvanioxylon*, *Haplomyeloxylon*.

*Scalaroxylon multiradiatum* Vogellehner (1966) can be placed into a group of Mesozoic woods which seems to be the "starting point" of the Cycadales, Bennettitales and angiosperms. The structure of rays is typical for the secondary wood of certain Palaeozoic Pteridophyta and of the primitive Angiospermae, especially the homoxylous Dicotyledonae.

Other Mesozoic secondary woods were described as *Protophyllocladoxylon*, *Podocarpoxyton triassicum* (Selmeier & Vogellehner (1968) and *Xenoxylon* cf. *X. jurassicum* Selmeier, 1968). More information about the Mesozoic macroflora of Franconia is given by Kelber (1990).

*Radioactivity*—Radioactivity of silicified wood fragments, which is due to a small content of uranium, is quite common in spots, situated in the Upper Triassic sediments from north of the city of Bamberg (Franconia). Uranium,  $UO_2^{++}$ , was probably incorporated syn-genetically. The spots show an increase in uranium content in the direction from SE to NW. About 900 fossil wood specimens have been checked on radioactivity (Rumpel, 1979; Rumpel & Zastrow, 1982).

*New collections*—Hundreds of silicified wood pieces, partly big logs of Upper Triassic age, have been found in the last ten years in areas of north Franconia. The material is deposited in the new Botanical Garden, University Bayreuth.

## TERTIARY WOODS

*First publication* —A brown coloured silicified wood fragment, locality Wagenhofen near Neuburg a. d. Donau (river Danube), was the subject of first publication (Felix, 1882, pp 54 -56; *Sapotoxylon gümbelii*). Re-examination of the original slides revealed that *Sapotoxylon gümbelii* Felix (1882) is a juglandaceous wood (Müller-Stoll & Mädler-Angeliewa, 1983; pp.658-663; Abb. 1-3, Taf. 56-57). Twentyfour years later, two samples of silicified woods, discovered in the north alpine area, were related to the genus *Laurinoxylon*, (a) *Ocoteoxylon tigurinum* (Schuster, 1906) and (b) *Ocoteoxylon algovicum* (Schuster, 1909). One silicified wood (a), weighing 700 kg was found in alpine boulders (altitude 1050 m) near the rivulet Dürnbach, NW of lake Tegernsee (South Bavaria).

*Further investigations*—About 40 years later, Prof. Dr. Karl Mägdefrau discovered the first silicified wood and identified it as *Palmoxyton lacunosum* Unger from the Upper Miocene sediments, north of Munich (Mägdefrau, 1956). He further investigated the anatomical structure of the fossil woods collected from southern Germany.

In a series of papers, Selmeier described a number of woods during the second part of this century.



*Collection of plant fossils*—In southern Bavaria there occur thick accumulations of Tertiary deposits, especially of the Upper Freshwater Molasse. The extent of these sediments ranges about 100 km from North to South and 300 km from West to East. The deposits of the Upper Freshwater Molasse contain abundant plant fossils (leaves, fruits, seeds, pollen, woods) and fossil faunas (mammals, reptiles).

Corresponding to the stratigraphic classification (Mein, 1975), it was possible to differentiate fossil localities with typical plant associations (Jung, 1963; Jung & Mayr, 1980) and mammal faunas (Heissig, 1986).

Deposits of bentonite are intercalated in the stratigraphical sequence of the Upper Freshwater Molasse in eastern Bavaria. The glassy particles with an age of  $14,5 \pm 0,8$  million years are resedimented (still-water-locations or aeolin power) and yielded some silicified woods (*Laurus*, *Robinia*). Since 1956 more than 5000 wood fragments, partly big logs (600kg weight), have been discovered and collected in Tertiary sediments north of the Alps. The specimens and slides are partly in private property, e.g., Collection Haberda (Haberda, 1982) and Collection Holleis (Holleis & Gregor, 1986). But most of the material is deposited in the Bavarian State Collection of Palaeontology and Historical Geology, Munich. In April 1991, more than 2000 silicified wood pieces collected by Lang from a classical locality near Wagenhofen (Felix, 1882) were cut and slides prepared by a student (B. Beaury) for further investigation. In addition, field collections by the author yielded about 700 silicified wood fragments predominantly from the locality of Prielhof.

Silicified woods are relatively common in special areas of southern Germany (Jung & Gall, 1978; Haberda 1982; Holleis & Gregor, 1986; Selmeier, 1989 b). So far, we have collected fossil woods from more than 320 different localities (Database available).

*Identification*—Efforts have been made to identify these fossil woods by thin-sections. In general, the majority of the specimens are not well preserved. But many woods are fragmentary and varicoloured by iron mineral stain which often show very good preservation of anatomical structure.

In the following list only the family and the corresponding modern comparable taxa of fossil woods are specified.

Gymnospermae — Cupressaceae; Pinaceae (*Pinus*); Podocarpaceae — (*Dacrydium*); Taxodiaceae (*Sequoia*)

Dicotyledonae — Anacardiaceae (*Anacardium*); Bombacaceae (*Bombax*); Ebenaceae (*Diospyros*); Euphorbiaceae; Fagaceae (*Castanea*, *Castanopsis* *Lithocarpus*, *Quercus*); Juglandaceae (*Carya*, *Juglans*, *Pterocarya*); Lauraceae; Leguminosae (*Acacia*-type, *Albizia*, *Dichrostachys*, *Robinia*); Loranthaceae (?),

Meliaceae (*Carapa*, *Cedrela*); Platanaceae (*Platanus*), Rosaceae (*Crataegus*, *Prunus*); Rutaceae (*Zanthoxylum*); Salicaceae (*Populus*); Sapotaceae (*Bumelia*), Tiliaceae (*Grewia*) and Ulmaceae (*Celtis*, *Ulmus*).

For further information concerning the above mentioned taxa, see Selmeier (1989 b). A complete review about silicified wood pieces and logs found in Tertiary sediments of southern Germany (Ferns, Gymnospermae, Dicotyledonae, Palmae); for example Gymnosperms (60); Dicots; Lauraceae (135), *Robinia* (78), *Castanea* (43), *Quercus* (24), *Carapa* (11), *Crataegus* (4), *Prunus* (1), *Cedrela* (1), *Populus* (1); Palmae (16).

A comparison of the fossil woods with other plant mega-fossils (leaves, fruits, seeds) reveals that most of them are comparable excepting some taxa which are not yet known. But the number of fossil wood taxa is quite low than the other megafossil taxa. Many of which are known as leaves and fruits (Gregor, 1982).

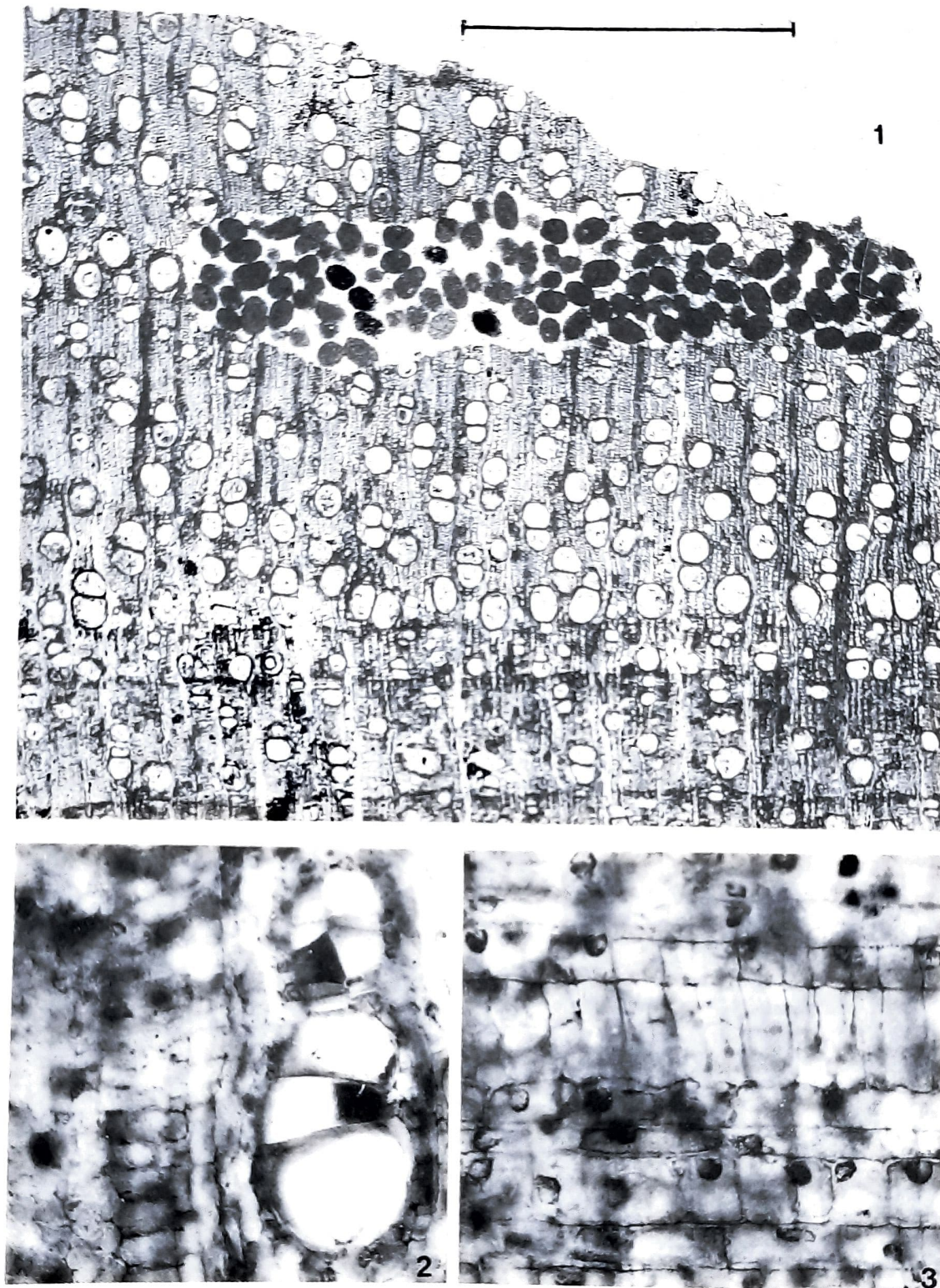
*Locality Rauscheröd* —The sand and gravel exposure of Rauscheröd near the city Passau, Lower Bavaria (Niederbayern), has yielded more than 200 silicified wood fragments (Collection R. Baumgartner and others). The geological age of the wood-bearing sediments (Ortenburger Schotter) is Lower Miocene (Upper Freshwater Molasse), i.e. 18.5 million years old. In terms of Paratethys stages the boundary between Ottnangien and Karpatien falls, according to Mein (1975), within (Mammal Neogene Unit) MN 4 b (Ziegler & Fahlbusch, 1986, p.3). These sediments indicate definite end of the marine and brackish conditions in south-eastern Bavaria and thus document the "Obere Süswasser-Molasse" in this part of the northalpine Molasse Basin.

Isolated teeth from the sand and gravel exposures of Rauscheröd (out of ten tons of matrix) represent for the first time a rather extensive micromammal faunas from Lower Bavaria (Ziegler & Fahlbusch, 1986): which include hamsters (Cricetidae), pikas (Ochotonidae), dormice (Gliridae), hedgehogs (Erinaceidae), moles (Talpidae) and sometimes squirrels (Sciuridae).

The number of fossil-bearing localities known in the Upper Freshwater Molasse has increased greatly during the last 20 years. New faunal informations permit development of a detailed stratigraphy for the north alpine Molasse basin within the framework of Mein's (1975) European Tertiary stratigraphy (MN; "Mammal Neogene Units"). In the sequence of MN 4 to MN 9 (climate cooler) two peaks in species abundance (leaf assemblages) are demonstrated which can be attributed to periods of relatively dense woodland before and after a period of open woodland (Jung & Mayr, 1980).

The faunas and the fossil woods from Rauscheröd (Ortenburger Schotter) belong to the uppermost Middle Orleanium, mammal unit MN 4 b. Until today, some





### Plate 1

1. Cross section of *Laurinoxylon* with corpoliths from *Anotrium* sp (Selmier, 1984)

2-3. *Grewioxylon* : (2) Cross section, X115 and (3) Radial section showing tile cells, X185, (Locality Rauschröd, specimen Bg No. 78).



wood fragments of Rauscheröd have been published, viz., *Carapoxylon ortenburgense* Selmeier (1983), *Bombacoxylon oweni* Selmeier (1985), *Grewioxylon neu-materi* Selmeier (1985), and *Carapoxylon* cf. *C. ornatum* Selmeier (1989 a), *Grewioxylon* wood has distinct tile-cells of Pterospermum type, the first record of this exotic shaped ray cells in Europe.

The locality Rauscheröd is of particular interest. It is evident that this locality is rich in quantity and diversity of fossil woods. Preparations supplemented by additional thin-sections have been started this year. Many specimens belong to Meliaceae, resembling *Carapa* and *Entandrophragma*, and to other families (Taxodiaceae, Lauraceae, Euphorbiaceae, Palmae). The climatological limit between the occurrence or non-occurrence of palms in the younger Tertiary sediments is controversial and is discussed by Gregor (1980) and Jung (1981).

*Fossil woods from Austria and Switzerland*—The famous locality Prambachkirchen (Austria) has yielded a great variety of fossil wood taxa (Hofmann, 1944, 1952). In the second part of this century new material of silicified woods from different areas has been collected in Austria. Although new material is abundant, but only a few woods have been described so far, they are *Ilicoxylon austriacum* Selmeier, 1970 and *Quercoxylon furwaldense* (Gros, 1983).

Hundreds of Palaeozoic, Mesozoic and Tertiary woods (Collection Buxtorf) were found near the locality Delsberg (Switzerland). Preliminary examination of these sections of the Tertiary woods provides evidence of the occurrence of Gymnosperms, Lauraceae, Fagaceae, Leguminosae, Ulmaceae and other taxa (Selmeier, 1989 c). A small silicified wood specimen, 9x7x5 cm, 660 gm weight, found in the pontic Vosges gravels near Delsberg, corresponds to *Paradoxoxylon leuthardtii* Kräusel 1955 of Bennettitiaceae (Selmeier & Grosser, 1980).

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