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FIRST ANATOMICALLY CHARACTERIZED WOOD FROM THE TERTIARY OF MORAVIA: *SPIROPLATANOXYLON* FROM THE AREA OF AUSTERLITZ (SOUTHERN MORAVIA, CZECH REPUBLIC)

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Abstract

TOVÁRKOVÁ, I., GRYC, V. SAKALA, J.: *First anatomically characterized wood from the Tertiary of Moravia: Spiroplatanoxylon from the area of Austerlitz (Southern Moravia, Czech Republic).* Acta univ. agric. et silvic. Mendel. Brun., 2011, LIX, No. 6, pp. 367–372

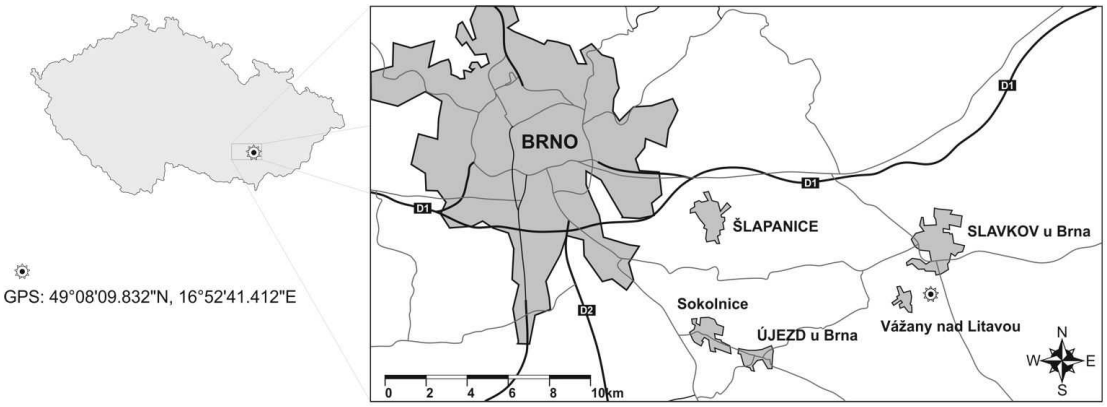
A new silicified angiosperm wood from the alluvial sediments in Vážany nad Litavou (SW of Slavkov/Austerlitz near Brno, Vyškov district) is described. The wood is diffuse-porous with indistinct growth ring boundaries. Vessels are exclusively solitary with helical thickenings and scalariform perforation plates. Rays are very high and up to 18 cells wide, homocellular to slightly heterocellular. Crystals are present in axial parenchyma mostly in chambered cells, rarely in idioblasts. The fossil is attributed to *Spiroplatanoxylon mueller-stollii* Süss. Other species of *Spiroplatanoxylon* are also discussed. Wood anatomical descriptions from the eastern part of the Czech Republic published so far deal either with the Silesian Tertiary or describe only partially lignified probably Quaternary material; therefore the present paper can be considered as the first detailed anatomical description of the Tertiary wood from Moravia.

silicified angiosperm wood, *Spiroplatanoxylon*, Tertiary, Moravia, Czech Republic

The Tertiary silicified wood is quite abundant in Moravia and it was the subject of several publications but without any mention about its anatomical details, e.g., Burkart (1953), Kruťa (1966), Březinová (1970), Buriánek (1997), Karásek (1997), Šmerda (1997) or Přichystal (2009). Továrková (2009, 2011) presented only very recently some anatomical observations in her unpublished Bachelor and Master Theses respectively. The fossil finds are mainly related to the alluvial deposits of rivers such as Svratka, Svitava, Morava, Bečva, Litava or Dyje. There are other wood anatomical descriptions from the eastern part of the Czech Republic but they deal either with the Silesian Tertiary (e.g., Fietz, 1926) or they describe only partially lignified material the Tertiary age of which is highly questionable (see in Opravil, 1969). As correctly noticed by Březinová (1970), the first described Tertiary wood from Moravia was mentioned from Hajany near Brno and attributed to *Quercinium sabulosum* by Unger (1845: 218). Its description however lacks any more precision on its preservation or exact geological setting; moreover its anatomical characterization is very unsatisfactory. Therefore, we can consider this paper describing a fossil platanoid wood as the first detailed anatomical study of any Tertiary permineralized wood from Moravia published so far.

MATERIALS AND METHODS

The silicified wood specimen has been found by P. Gadas (Masaryk University, Faculty of Science, Department of Geological Science) in Vážany nad Litavou near Slavkov/Austerlitz (49°8'9.832"N, 16°52'41.412"E, see Fig. 1). Other silicified woods



1: *Orientation map showing the position of locality Vážany nad Litavou (GPS)*

are recorded in the broader vicinity of the locality, e.g., in Šaratice or Letošov near Bučovice (Kruťa, 1966, Karásek, 1997, Přichystal, 2009). Geologically speaking, all these localities are situated in the Western Carpathian region in the frontal part of Outer flysh belt formed by rocks of Ždánice-Subsilesian lithotectonic Unit. The Ždánice-Subsilesian lithotectonic Unit in above mentioned locallities is composed of Ždánice-Hustopeče Formation, Upper Oligocene to Early Miocene in age and Menilitic Formation, Early Oligocene in age (Stráník, 1985). The fossiliferous locality in Vážany nad Litavou however represents the Quaternary fluvial deposit of the ancient Litava river (or their small left tributaries) overlying the Oligocene to Miocene flysh of above mentioned Formations. That is why the provenance of the fossil wood itself is not clear and could in fact be very complex covering different Cenozoic or even Mesozoic units (Z. Stráník and V. Kachlík pers. comm.). V. Kachlík observed in 2011 fluvial terrace with numerous well rounded siliceous rocks from the Menilitic Fm., scarce algal lithothamnium limestones of Middle Miocene age and abundant quartz of various type and colours (hydrothermal milky quartz from the crystalline rocks and brownisch microcrystalline one, forming pebbles in conglomerate, which were probably resedimented from older sedimentary rocks). We are unable to depict the exact age of our fossil wood; we however consider it to be surely Tertiary mainly with regard to its overall permineralized (silicified) nature and botanical affinities described hereafter, supported by the record of *Platanus neptuni* from the Menilitic Formation in NE Moravia (Kvaček & Bubík, 1990).

The sample is silicified and was thin–sectioned in the Department of Geological Science of the Masaryk University (MU) in Brno in accordance with standard techniques. Thin sections were analyzed using compound light microscopy. The anatomical elements were described following the IAWA Hardwood List (IAWA Committee, 1989). Remains of all thin sections are housed in the geological collections of the Department of Geological Science, MU Brno.

RESULTS

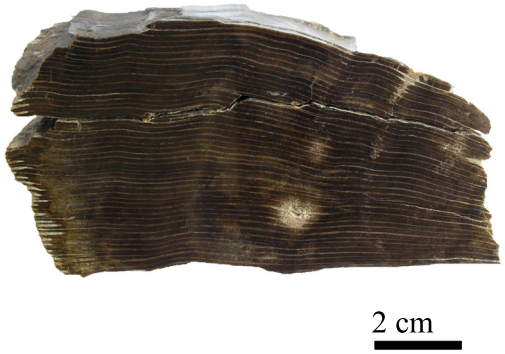
Platanaceae
Spiroplatanoxylon Süss
Spiroplatanoxylon mueller-stollii Süss

Material

One fragment of silicified wood (No. 10 – Gadas, MU) and several thin sections (DR_0062, DR_0063, DR_0064, DR_0065, DR_0066).

Macroscopic description (Fig. 2)

The present wood represents a segment of trunk (black and brown coloured with clearly visible structural details and conspicuous wide rays). The wood is heavily silicified, dimensions: 8.5 cm × 4.5 cm × 4.5 cm.

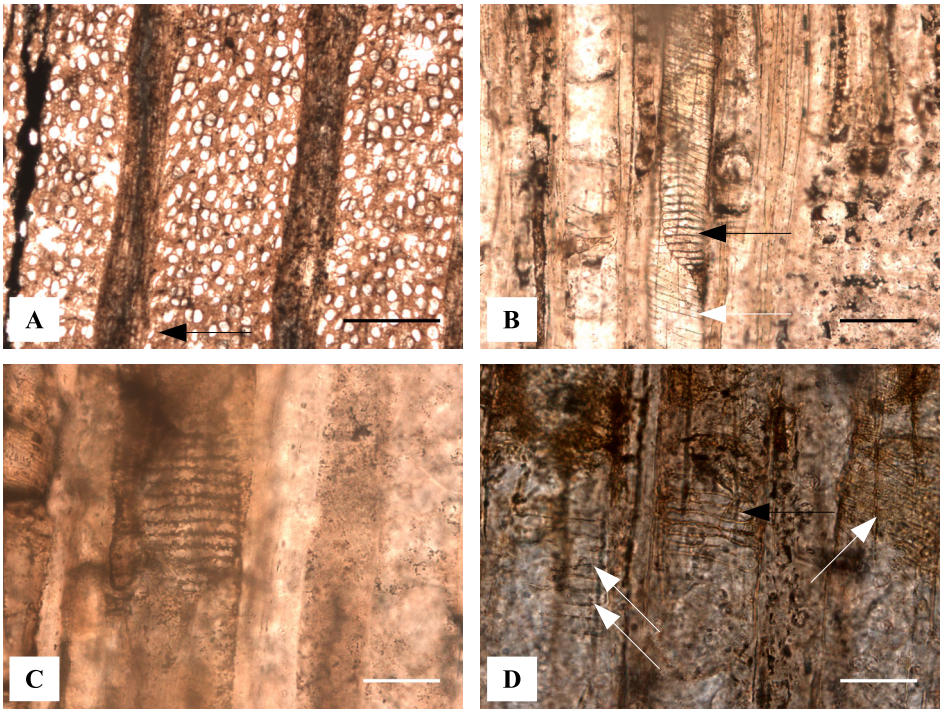


2: *Macroscopic observation of silicified wood: Spiroplatanoxylon mueller-stollii Süss (No. 10 – Gadas, MU)*

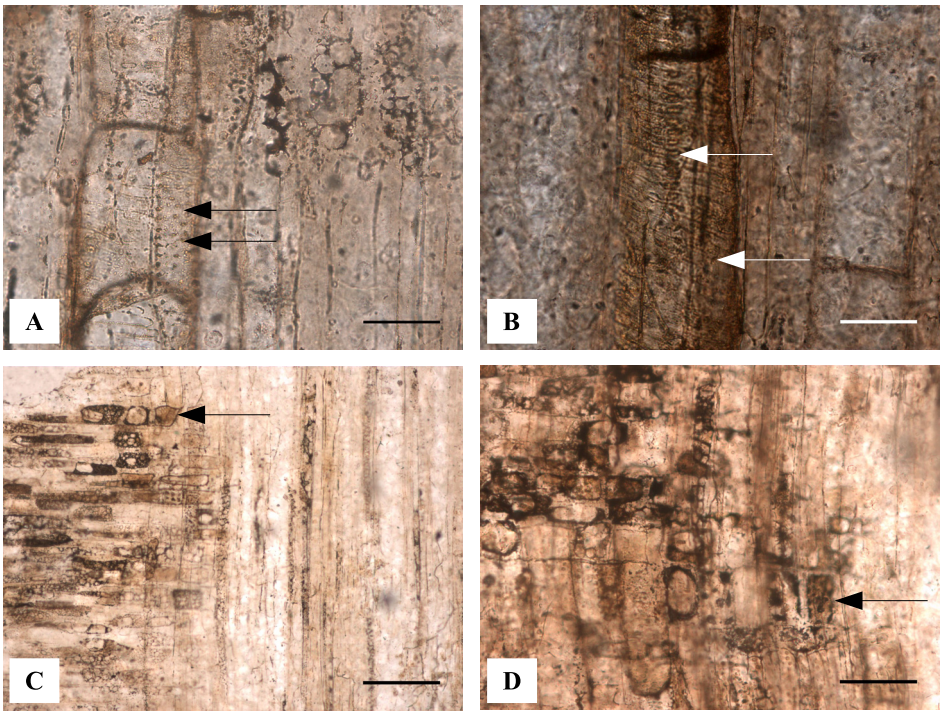
Microscopic description (Figs 3–5)

Wood: diffuse-porous with almost indistinct growth ring boundaries marked by enlarged ray cells.

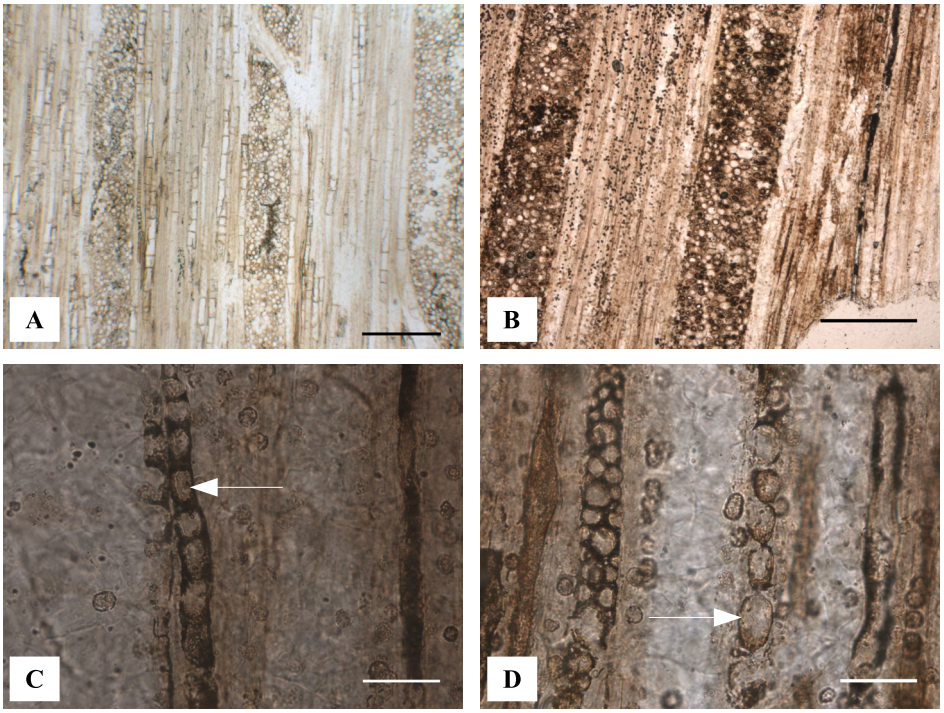
Vessels: 115–130 per square mm, exclusively solitary; tangential diameter 48–77 µm (mean 63 µm), radial diameter 40–97 µm (mean 72 µm); outline angular, vessel walls thin; scalariform perforation plates with 10–20 bars; helical thickenings present;



3: *Microscopic observation of silicified wood: Spiroplatanoxylon mueller-stollii Süss (No. 10 – Gadas, MU)*
A – TS, section DR 0062, diffuse porous structure, vessels exclusively solitary, almost indistinct growth ring boundaries (see arrow), scale bar 500 µm. B – RLS, section DR 0063, vessels with scalariform perforation plates (black arrow) and helical thickenings (white arrow), scale bar 100 µm. C – RLS, section DR 0063, detail of vessel with scalariform perforation plates, scale bar 50 µm. D – RLS, section DR 0063, detail of helical thickenings (white arrows) and scalariform perforation plates (black arrow), scale bar 50 µm.



4: *Microscopic observation of silicified wood: Spiroplatanoxylon mueller-stollii Süss (No. 10 – Gadas, MU)*
A – RLS, section DR 0063, intervessel pits (see arrows), scale bar 50 µm. B – RLS, section DR 0063, detail of intervessel pits and helical thickenings (arrows), scale bar 50 µm. C – RLS, section DR 0063, homocellular to slightly heterocellular rays (see arrow), scale bar 200 µm. D – RLS, section DR 0063, detail of ray: marginal upright cell (see arrow), scale bar 100 µm.



5: *Microscopic observation of silicified wood: Spiroplatanoxylon mueller-stollii Süss (No. 10 – Gadas, MU)*
A – TLS, section DR 0064, multiseriate rays, scale bar 500 µm. B – TLS, section DR 0066, multiseriate rays, scale bar 500 µm. C – RLS, section DR 0063, axial parenchyma cells: detail of chambered crystalliferous cells (see arrow), scale bar 50 µm. D – RLS, section DR 0063, axial parenchyma cells: crystals in idioblasts (arrow), scale bar 50 µm.

tyloses absent; intervessel pits small, opposite and rounded in shape; vessel element length 84–183 µm (mean 133 µm).

Rays: homocellular to slightly heterocellular; ray cells 24–37 µm (mean 28) high with radial length 40–105 µm (mean 65 µm); multiseriate rays 12–18-seriate, 246–395 µm wide (mean 340 µm) and 2–9 mm high (mean 5,4 mm), 1–2 per tangential mm; uniseriate rays very rare.

Axial parenchyma: apotracheal, diffuse with crystals present mainly as chambered crystalliferous cells, very rarely as idioblasts.

Fibres: medium-thick walls (thin- to thick-walled), non-septate.

DISCUSSION

The fossil platanoid structure with spiral thickenings was introduced by Süss & Müller-Stoll (1977) and formalized later by Süss (2007) by establishing the morphogenus *Spiroplatanoxylon*. Contrary to the wood of extant *Platanus*, *Spiroplatanoxylon* has both helical thickenings and exclusively scalariform perforation plates in the vessels, and crystals in axial parenchyma cells (Süss, 2007). Our wood shows the characteristics of this morphogenus.

There are twelve species of *Spiroplatanoxylon* described so far including ten combinations and two new species *Spiroplatanoxylon gregussii* and *S. mueller-stollii*, all introduced by Süss (2007). They are quite similar to each other; however they present some important differences comparing to our wood. We observed the original thin slides of S. *bohemicum* and S. *europeanum* and used the published descriptions of other *Spiroplatanoxylon* species (see in Greguss, 1969; Petrescu, 1978 and Süss, 2007). *Spiroplatanoxylon bohemicum* has only homocellular rays with procumbent cells and its rays are significantly shorter and more numerous per tangential millimeter. Moreover, Sakala *et al.* (2010) did not observed any spiral thickening in this species. *S. citronelloides* has shorter rays and vessels with more numerous bars in the scalariform perforation plates (30–50 bars) and abundant tyloses. *S. densiradiatum* has smaller vessels, which are solitary or in clusters, and scalariform perforation plates with 20–35 bars. *S. europeanum* presents a significant decrease in vessel diameter within one growth ring and low vessel frequency per mm². *S. gregussii* has bigger vessels, which are also less frequent per mm² and very abundant tyloses. *S. hortobágyii* has vessels with markedly oval outline in cross-section, and shorter rays. *S. platanoides* differs in having distinctive heterocellular ray with several rows of upright marginal cells. *S. porosum* and *S. romanicum* have fewer vessels per mm² with more numerous bars in scalariform plates; moreover *S. porosum* has significantly longer chains of crystalliferous parenchyma and *S. romanicum* has very high rays. *S. shilkinae* presents more numerous bars in scalariform perforation plates in vessels

and generally thinner rays, which can even be aggregated.

Finally, we can conclude that our sample fits quite well the description of *Spiroplatanoxylon mueller-stollii* Süss by having high vessels frequency per mm² (120), relatively small, mostly solitary vessels, wide multiseriate rays (up to 340 μm) and crystals in axial parenchyma present as chambered cells or very rarely as idioblasts. Therefore, we propose to attribute our sample to this morphospecies. Concerning its botanical affinities, we think in agreement with the results presented by Sakala *et al.* (2010) for the *Spiroplatanoxylon* type of wood from the Doupovské Hory Mts. that our wood must be related to *Platanus neptuni* (Ettingsh.) Bůžek, Holý & Z. Kvaček.

CONCLUSIONS

The present paper provides the first detailed anatomical description of the Tertiary silicified wood from Moravia. The here described wood is heteroxylous diffuse-porous with helical thickenings and exclusively scalariform perforation plates in the vessels. Its rays are very high and wide. There are also crystals in axial parenchyma cells. The sample was identified as *Spiroplatanoxylon mueller-stollii*. This record completes the geographical distribution of the morphogenus *Spiroplatanoxylon* and provides an additional evidence of wood, tentatively linked to the leaves and reproductive structure of *Platanus neptuni*.

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