

Research Advances

Fossil Woods from the Early Pennsylvanian Karamaili Area, Xinjiang, Northwest China

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Objective

The Carboniferous is a key period of Earth History. The average global temperatures were high in the early Carboniferous Period. Numerous new plants evolved in the warm, humid climate conditions of this period. When it cooled during the middle Carboniferous, the temperatures and CO₂ concentrations were as low as they are today. The Karamaili area in Xinjiang Uygur Autonomous Region, Northwest China preserved a continuous Carboniferous terrestrial sequence. Sixteen permineralized woods were discovered in the early Pennsylvanian (Bashkirian–Moscovian) Huxingliang Formation in the Karamaili area. Plants are good indicators of climate change. Therefore, it is significant to study the anatomy of these fossil woods to understand the paleoclimate of the early Pennsylvanian in the Karamaili area.

Methods

To demonstrate the internal structure of the fossil woods, microscopic slides were made along the transverse, radial and tangential directions. The anatomy of the wood was studied using a microscope Leica DM2500. Photomicrographs were taken with Weiscope E31 digital camera. Images were processed and stitched together using Adobe Photoshop CS6. All specimens and slides are housed in the Key Laboratory for Evolution of Past Life and Environment in Northeast Asia (Jilin University).

Results

GENUS *Agathoxylon* Hatig, 1848SPECIES: *Agathoxylon* cf. *permicum* Mercklin, 1855

Four well-preserved specimens were studied and they show the same

anatomy. The description here is mainly based on specimen XSHPW03 (GPS: 44°48'41" N, 90°19'4" E). The pith and primary xylem are not preserved. The secondary xylem was well preserved, and it is pycnoxylic, with tracheids and parenchymatous rays.

In the transverse section, growth ring boundary, resin duct and axial parenchyma are absent in all the specimens. Axial tracheids are circular, oval or rectangular. Inter-cellular spaces are absent (Fig. 1a).

In the radial section, the pits on the tracheid walls are

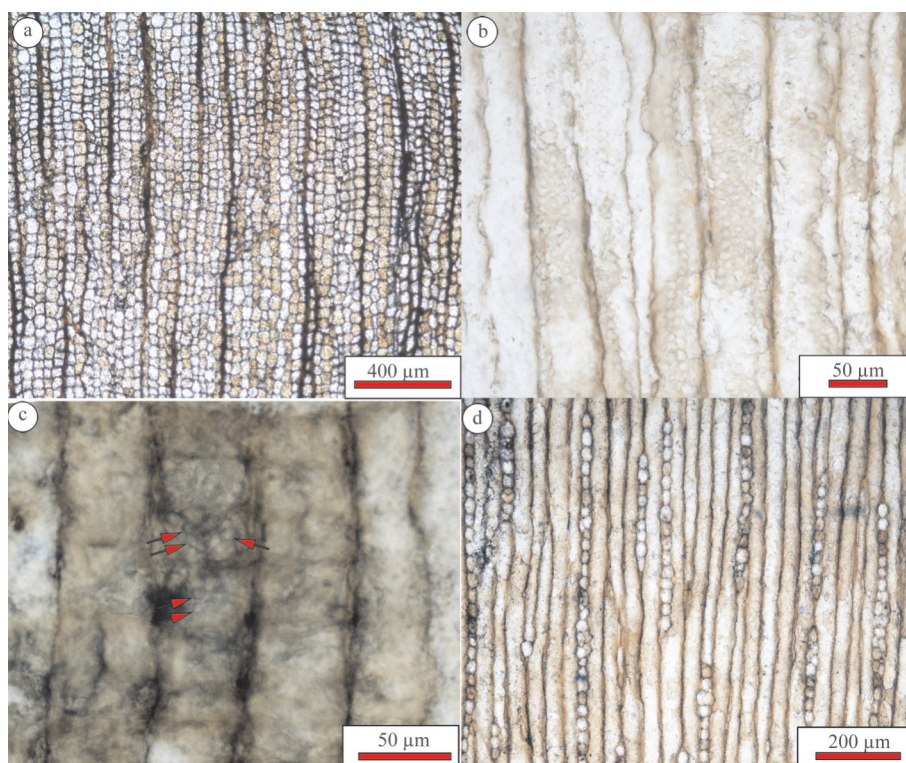


Fig. 1. *Agathoxylon* cf. *permicum* Mercklin, 1855 from the early Pennsylvanian Karamaili area. (a) Transverse section showing the tracheids. Growth rings are absent; (b) radial section showing 2 to 3 seriate araucarioid bordered pits on the radial walls of wood tracheids; (c) radial section showing araucarian-type pits (arrows) in the cross-field units; (d) tangential longitudinal section showing the uniseriate and occasionally biseriate rays.

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bordered and subcircular or oblate in shape. They are araucarioid type and arranged in 2 to 5 seriate, essentially 2 to 4 seriate (Fig. 1b). The ray cells are brick-like and usually span 2 to 5 tracheids. The horizontal and end walls of ray cells are both smooth. There are 5 to 8 oculipores in each cross-field unit. Oculipores are of araucarian-type, with incused elliptic apertures (Fig. 1c).

In the tangential section, xylem rays are uniseriate, in single cells biseriate. When biseriate, ray cells are opposite or alternate. They consist of circular or elliptical parenchyma cells. Rays are 1 to 20, even up to 40 cells high (Fig. 1d).

Discussion

Agathoxylon permicum Mercklin, 1855 was previously discovered from the Permian USSR, but the exact locality is unknown. The characteristics of the present specimens resemble *A. permicum*, but the rays are commonly higher than that in *A. permicum*. Therefore, we determine the specimens as *Agathoxylon* cf. *permicum*.

When trees grow in the environment with fluctuations in the

annual water supply or other environmental changes, the secondary xylem show growth rings. However, the permineralized woods collected from different beds of Huxingliang Formation do not show any growth rings. This observation indicates that the trees grew in warm, humid climate conditions without cold periods or hydric stresses.

Conclusions

The permineralized wood *Agathoxylon* cf. *permicum* Mercklin, 1855 is described for the first time from the early Pennsylvanian Huxingliang Formation in the Karamaili area. The growth pattern of these fossil woods indicates a warm humid climate in the early Pennsylvanian in the Karamaili area.

Acknowledgments

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