

Supplementary Materials: Atlas of wood types from the Bruneau Woodpile, Idaho

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The Bruneau Woodpile has long attracted amateur collectors, who appreciate the site for its abundance of wood with interesting external forms and an apparent diversity of wood types (**Figure S1**). A recurring question among these collectors has been, “What kind of woods are these?” While attempts have been made to identify the woods based on polished cross sections [1], there has been little effort to use thin sections for identifying the wood types of the Bruneau Woodpile.



Figure S1. Tumbled limb section from the Bruneau Woodpile. Larry Dillon specimen, Mike Viney photo.

During the course of this study, some two hundred specimens of wood were examined with the best example of each type selected for thin sectioning. Under microscopic examination it is clear that the wood from this site is only poorly preserved. While the cross sections are generally good under low power magnification, the wood is highly mineralized and much of the fine cellular detail needed for identification is not preserved, especially in radial and tangential sections. Another complicating factor is that the deposit is a jumble of small diameter woody fragments which, in addition to mature wood from trees, may represent wood from limbs, shrubs, roots, or vines. These factors make positive identification of the woods problematic, but even so, the diversity is notable and therefore it was felt important to document these woods and the features that are preserved in thin section.

Identifications were made with the aid of Panshin & De Zeeuw, 1980 [2], Hoadley, 1990 [3], and the InsideWood Database [4,5]. Descriptive terminology for angiosperm woods follows the IAWA List of Microscopic Features for Hardwood Identification [6]. Helpful advice and suggestions were provided by Dr. Elisabeth Wheeler of North Carolina State University, whose assistance is gratefully acknowledged. Specimens were provided by the author, Rick Dillhoff, Mike Viney, Larry ‘Doc’ and Nancy Dillon. Thin sections slides are on deposit at the University of Washington Burke Museum, Seattle, WA, USA. All specimens are shown in transverse section, scale bar = 500 μm .

Wood types from the Bruneau Woodpile

Conifers

- Cupressaceae (Cypress family)
- Pinaceae
 - Piceoxylon* (Spruce/Douglas fir type)
 - Pinus* sp. (Pine)

Angiosperms

- Berberidaceae
 - cf. *Berberis* (Barberry/Oregon grape type)
- Fabaceae
 - cf. *Robinia* (Black locust type)
- Fagaceae
 - Quercus* sp. (White oak group)
 - Quercus/Lithocarpus* (Live oak group)
- Juglandaceae
 - Carya* sp. (True hickory type)
- cf. Salicaceae
 - Populus/Salix* (Poplar/willow type)
- Sapindaceae
 - Acer* sp. (Soft maple group)
- Ulmaceae
 - Ulmus* sp. (Elm)

Undetermined angiosperms

- Undetermined hardwood 1
- Undetermined hardwood 2
- Undetermined hardwood 3
- Undetermined hardwood 4

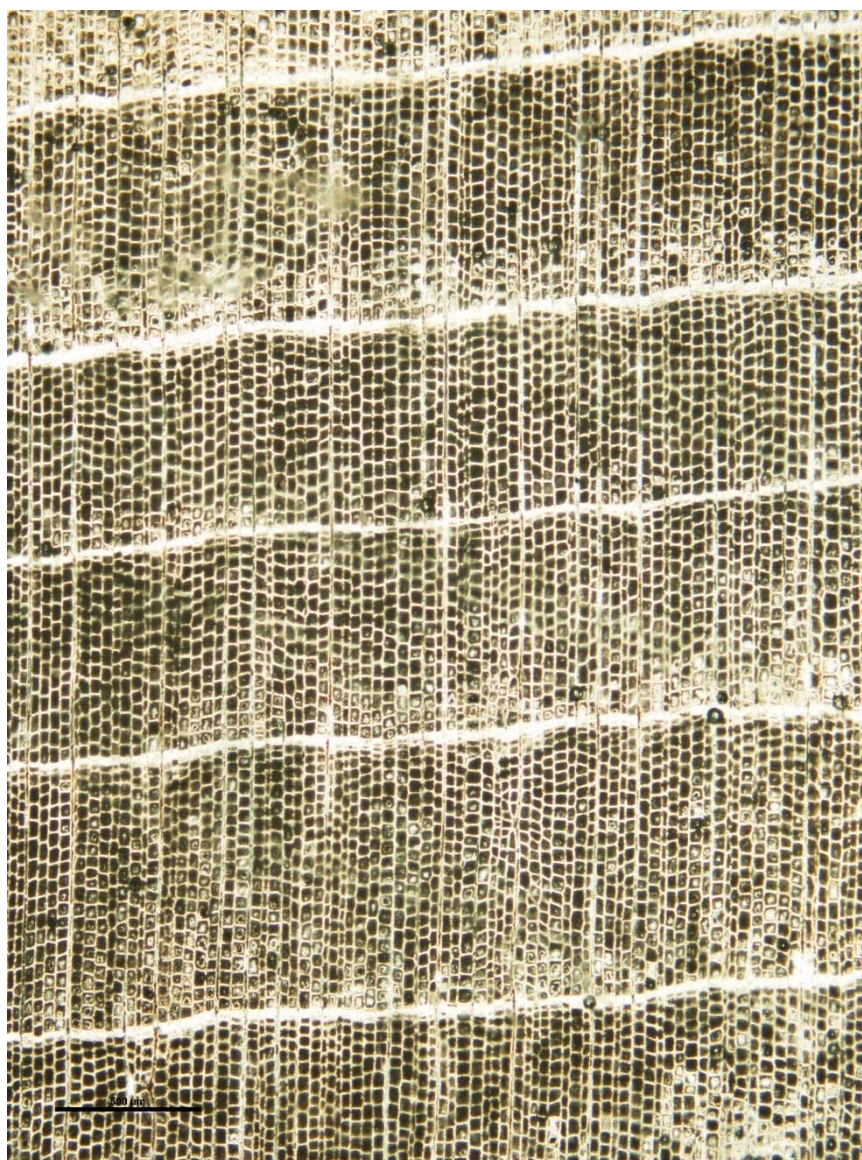


Figure S2. Cupressaceae (Cypress family) UWBM PB98590.

A large percentage of the wood found at the Bruneau Woodpile is made up of conifers lacking resin canals. It is likely that multiple conifer types are represented by these woods, but without adequate preservation it is impossible to adequately identify many of the specimens.

This specimen (**Figure S2**) is attributed to the cypress family based on its relatively large, isodiametric tracheids (45 μm mean tangential diameter), coarse texture, lack of resin canals, and narrow latewood band, similar to modern redwood and bald cypress. Critical features that could separate the wood further, such as the presence/absence of axial parenchyma and cross field pitting were not preserved.

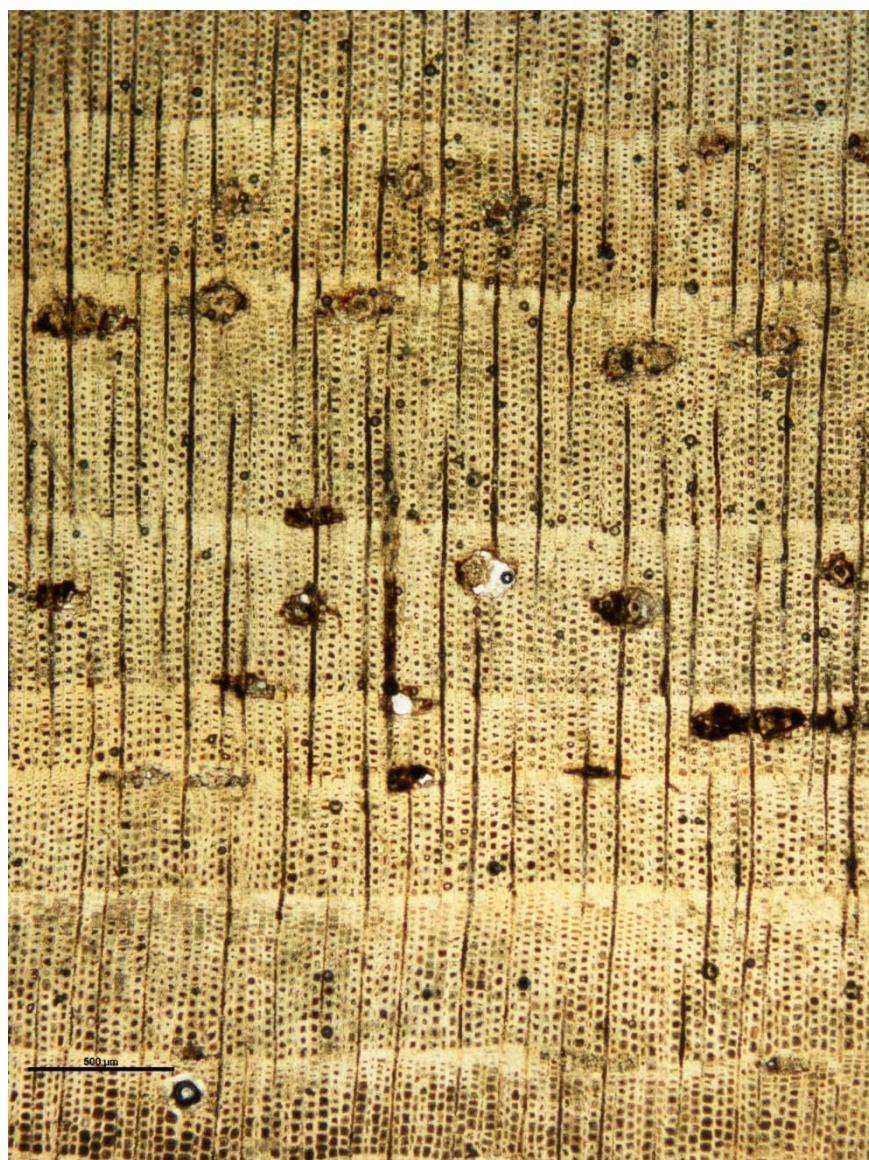


Figure S3. *Piceoxylon* UWBM PB98565.

This wood (**Figure S3**) is assigned to the form genus *Piceoxylon* based on the presence of small to medium resin canals (mean tangential diameter 65 μm) solitary and in tangential groups with thick walled epithelial cells. Modern genera that have this feature include Douglas fir (*Pseudotsuga*), spruce (*Picea*), and larch (*Larix*). Douglas fir can be separated from the others by the presence of spiral thickenings in both earlywood and latewood tracheids, however this feature was not preserved in the Bruneau specimens examined.

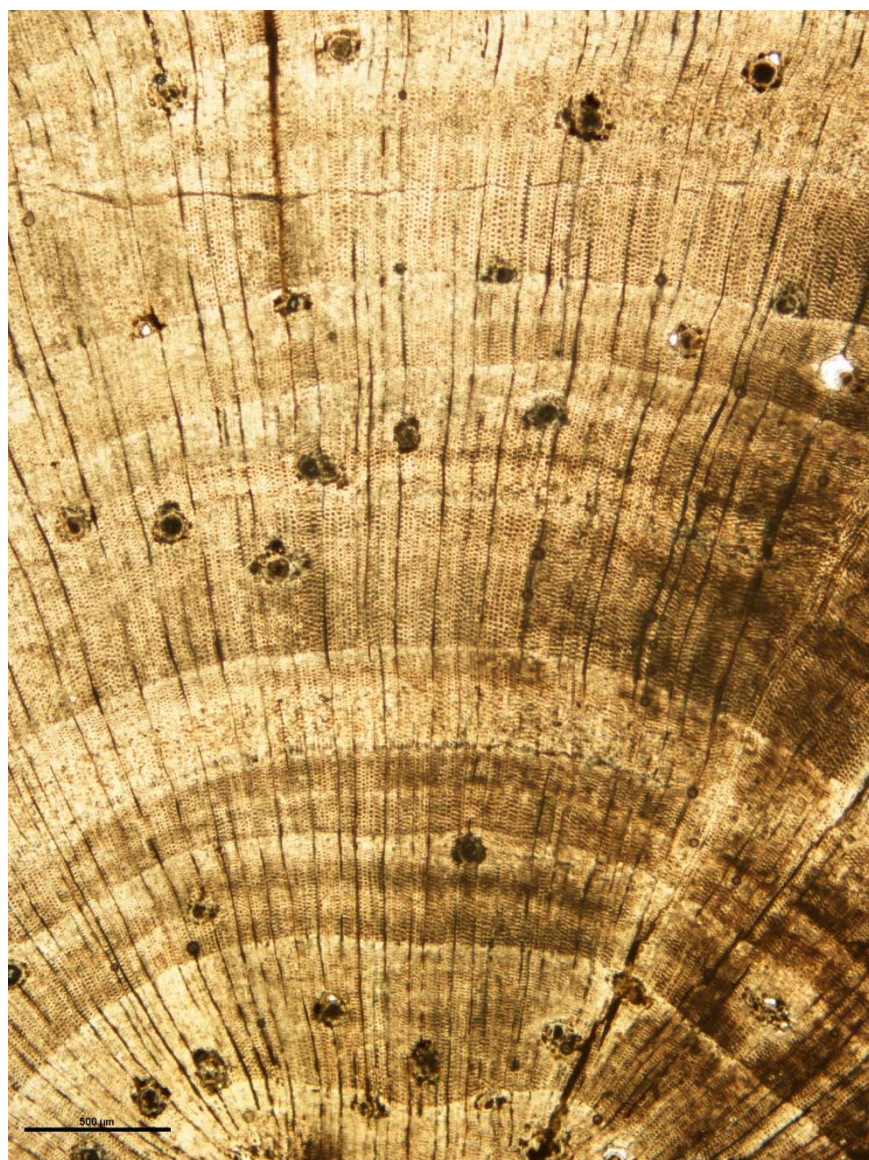


Figure S4. *Pinus* sp. (Pine) UWBM PB98568

The presence of relatively large (mean tangential diameter 87 μm), solitary resin canals surrounded by thin-walled epithelial cells mark this wood as a pine (**Figure S4**). The epithelial cells in this specimen are mostly degraded, but present in some areas.

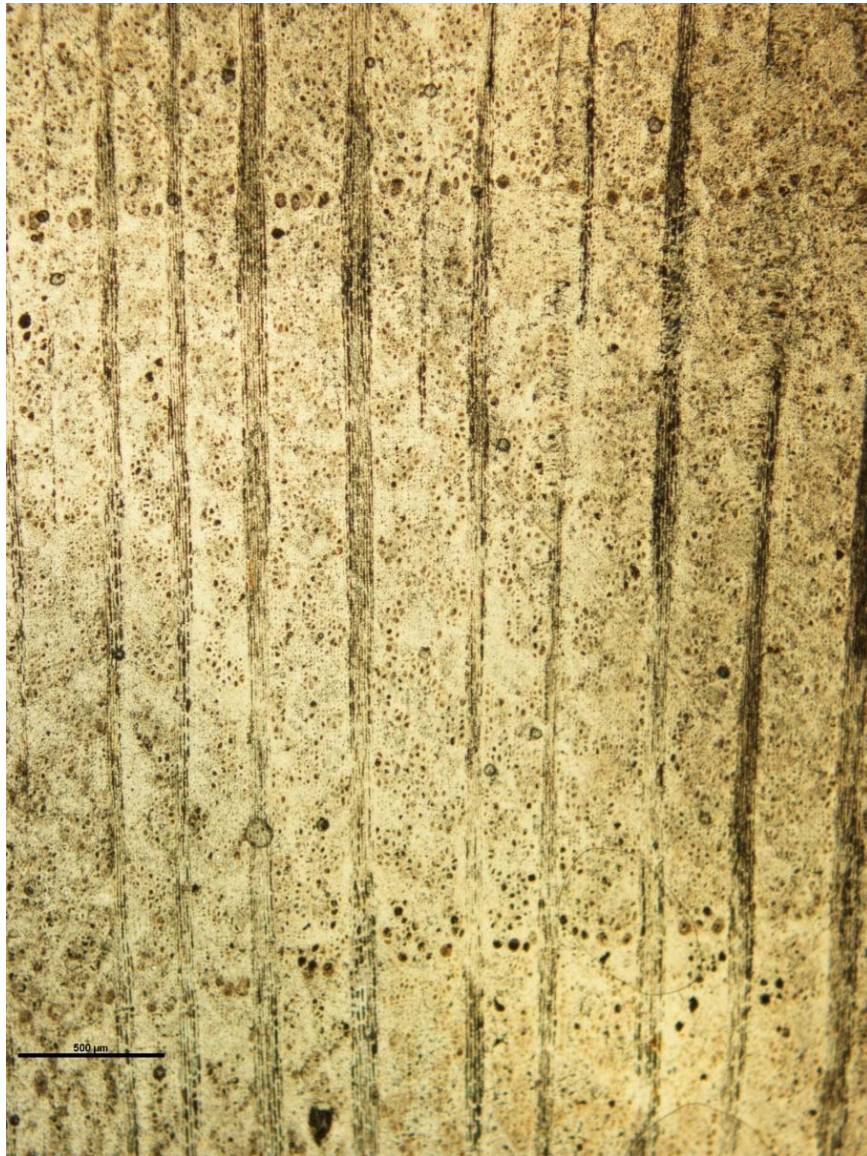


Figure S5. cf. *Berberis* (Barberry/Oregon grape type) UWBM PB98560

The wood in Figure S5 shows features of the Berberidaceae (Barberry family) with its small earlywood vessels, latewood vessels in ulmiform bands, and wide rays that are commonly over 1 mm tall [7]. Fine cellular details such as spiral thickenings in vessels, pitting, and perforation plates were not preserved. Known from a single fragment of mature xylem, approximately 2 × 4 cm in cross section and 7 cm long.

Preserved features: Growth rings distinct. Ring porous with a continuous row of small earlywood vessels, mean tangential diameter of 40 μm with the largest vessels up to 65 μm. Vessels predominantly solitary with rare short radial multiples. Wide latewood zone with groups of small latewood vessels coalescing into radial patterns. Closely spaced wide rays, mostly 6-10 cells wide with occasional narrower rays. Wide rays commonly in excess of 1 mm tall in tangential section. 3-5 rays/mm.

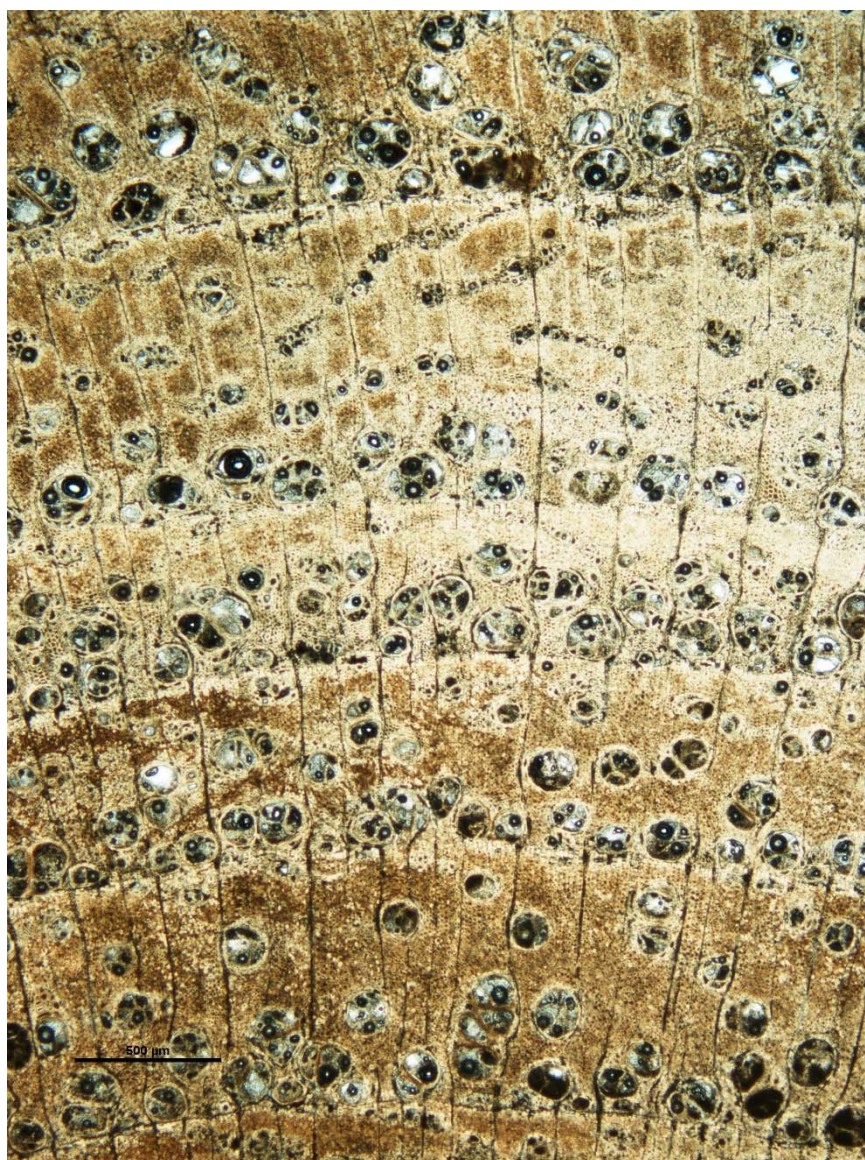


Figure S6. cf. *Robinia* (Black locust type) UWBM PB98587

This wood is tentatively assigned to *Robinia* based on the ring to semi-ring porous nature of the wood with earlywood vessels occluded by tyloses, latewood vessels forming clusters and bands, and uniseriate to multiseriate rays. Panshin & DeZeeuw [2] note that the wood of *Robinia* is commonly confused with that of *Maclura* (osage orange). The tendency of latewood vessels in this specimen to form nestlike clusters and interrupted diagonal bands is more indicative of *Robinia*, however [8]. These woods can be positively separated based on the presence of vestured pits in *Robinia*, but this feature is not preserved in specimens from the Bruneau Woodpile.

Preserved features: Growth rings distinct. Wood ring porous to semi-ring porous, earlywood vessels with a mean diameter of 150 μm and containing abundant tyloses. Latewood vessels small, forming groups and irregular bands. Rays 3-10 per mm, homocellular, with procumbent cells. Rays 1-3(4) seriate. Axial parenchyma abundant, vasicentric, confluent, and in marginal bands.



Figure S7. *Quercus* sp. (White oak group) UWBM PB98591

This wood (**Figure S7**) can be assigned to the oaks based on a ring porous hardwood with large rays up to 20+ cells interspersed with abundant uniseriate rays, and narrow tangential bands of parenchyma. Furthermore, this is likely in the white oak group due to the presence of abundant tyloses and small, indistinct latewood vessels.

Preserved features: Growth rings distinct, wood ring porous with large earlywood vessels and small, indistinct latewood vessels. Earlywood vessels almost exclusively solitary, mean tangential diameter 213 μm , with abundant tyloses. Many fine, uniseriate rays are interspersed with large rays up to 20+ cells wide. Axial parenchyma are visible as uniseriate tangential bands in latewood, but not preserved in vertical sections.



Figure S8. *Quercus/Lithocarpus* (Live oak group) UWBM PB98589

This specimen is assigned to the oaks based on a semi-ring porous hardwood with large rays up to 20+ cells wide interspersed with abundant uniseriate rays and tangential bands of parenchyma (**Figure S8**). It can be further assigned to the live oak group based on indistinct growth ring boundaries and small vessels that form radial patterns across the growth ring. This appears to be a rare type from the Bruneau Woodpile, with only two specimens encountered in our study.

Preserved features: Growth ring boundaries indistinct, wood semi-ring porous with small, solitary vessels arranged in radial patterns across the growth ring. Mean tangential vessel diameter 40 μm, 50-100 vessels/mm². Many fine, uniseriate rays are interspersed with large rays up to 20 cells wide. Axial parenchyma visible as narrow discontinuous tangential bands throughout the growth ring.



Figure S9. *Carya* sp. (Hickory type) UWBM PB98564

This wood is assigned to the true hickories based on the ring porous nature of the wood with large earlywood vessels in a discontinuous row and the presence of narrow tangential bands of parenchyma that occur predominantly in the latewood (**Figure S9**).

Preserved features: Growth rings distinct, ring porous to semi-ring porous wood with earlywood vessels mostly solitary and in radial multiples of 2-3(4). Perforation plates simple. Earlywood vessels large with a mean diameter of 217 μm , tyloses common. Rays 1-3 seriate, mostly 1-2. Ray cells procumbent, 12-15 rays/mm. Axial parenchyma in narrow tangential bands, primarily in latewood, 1-2 cells wide. Fibers thin walled.

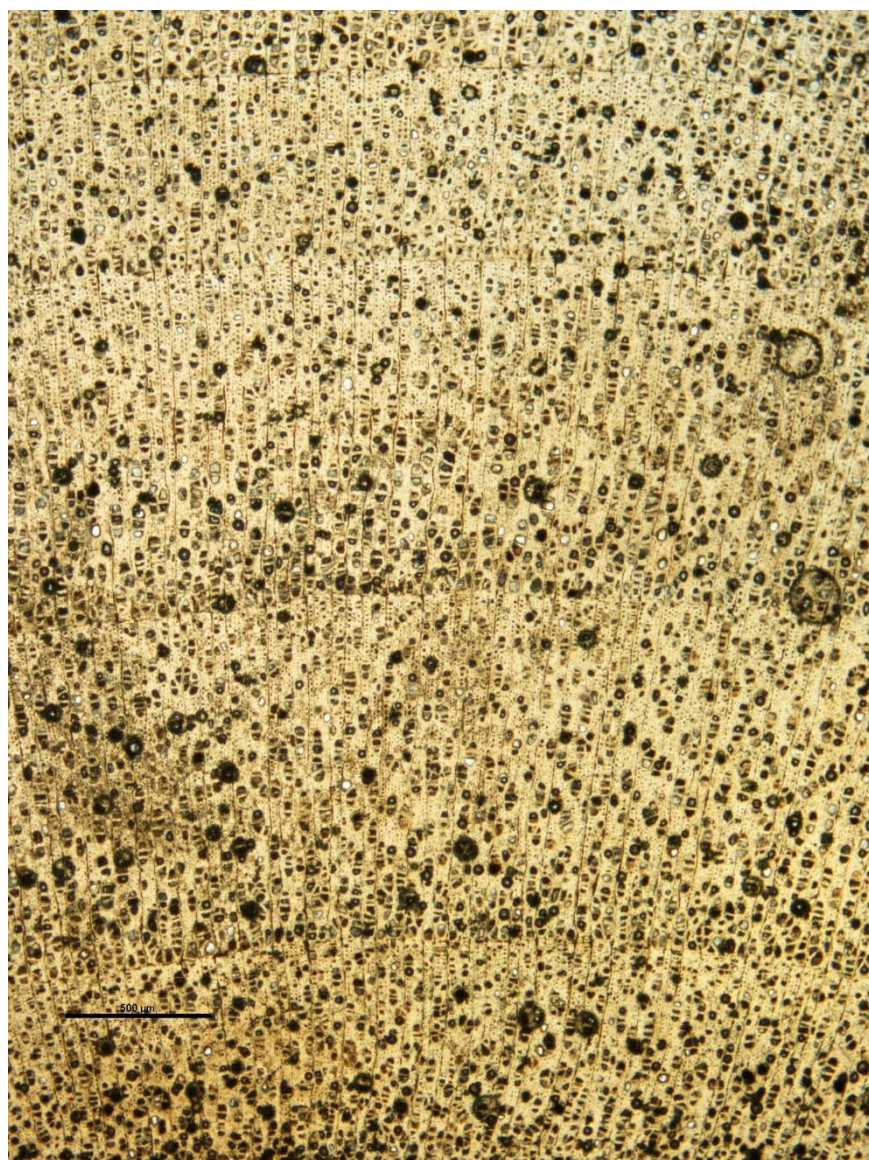


Figure S10. cf. Salicaceae (Willow/poplar type) UWBM PB98557

The wood in figure S10 is assigned to the Salicaceae based on a diffuse porous wood, tending towards semi-ring porous with vessels forming occasional diagonal patterns, uniseriate rays, and no observed axial parenchyma [8]. Although poorly preserved, rays in radial section appear to be homocellular which would indicate *Populus* rather than *Salix*. Both willows and poplars are well represented in the Pickett Creek flora [9], which is in the same geologic formation as the Bruneau Woodpile.

Preserved features: Growth rings distinct, diffuse porous to semi-ring porous, vessels solitary and in radial multiples of 2-5. Vessels tend to form diagonal patterns across the growth ring. Solitary vessels rare. Vessels small with the largest $\sim 50\ \mu\text{m}$ in tangential diameter, mean $31\ \mu\text{m}$. ~ 250 vessels/ mm^2 . Tyloses present. Rays homocellular(?) with procumbent ray cells, exclusively uniseriate, 12-15 rays/ mm . Perforation plates simple. Vessel and ray pits not preserved. Axial parenchyma not observed.



Figure S11. *Acer* sp. (Soft maple type) UWBM PB98558

The anatomical features of this wood (**Figure S11**) are consistent with the maples, with the relatively narrow rays indicating the soft maple group. This type is relatively common at Bruneau with several specimens found during the study.

Preserved features: Growth rings distinct. Diffuse porous hardwood with vessels solitary and in radial multiples of 2-4. Vessels small, mean tangential diameter 47 μm . Rays 1-4 seriate, 5-7 rays/mm. While the longitudinal sections of this wood were poorly preserved, it appears that perforation plates are simple, rays are homocellular, and faint spiral thickenings were seen in some of the less degraded vessels.



Figure S12. *Ulmus* sp. (Elm) UWBM PB98588

This wood is identified as an elm based on a ring porous wood with earlywood vessels in a continuous band and latewood vessels forming wavy bands in the growth ring (**Figure S12**). The single row of earlywood vessels is similar to modern American elm (*Ulmus americana*) [3].

Preserved features: Growth rings distinct. Ring porous with large earlywood vessels in a continuous band 1-2 cells wide. Latewood vessels occur in wavy bands. Earlywood vessel mean diameter 112 μm , almost exclusively solitary with rare radial multiples of two cells. Rays 1-4 cells wide, ray cells procumbent. 5-7 rays/mm.

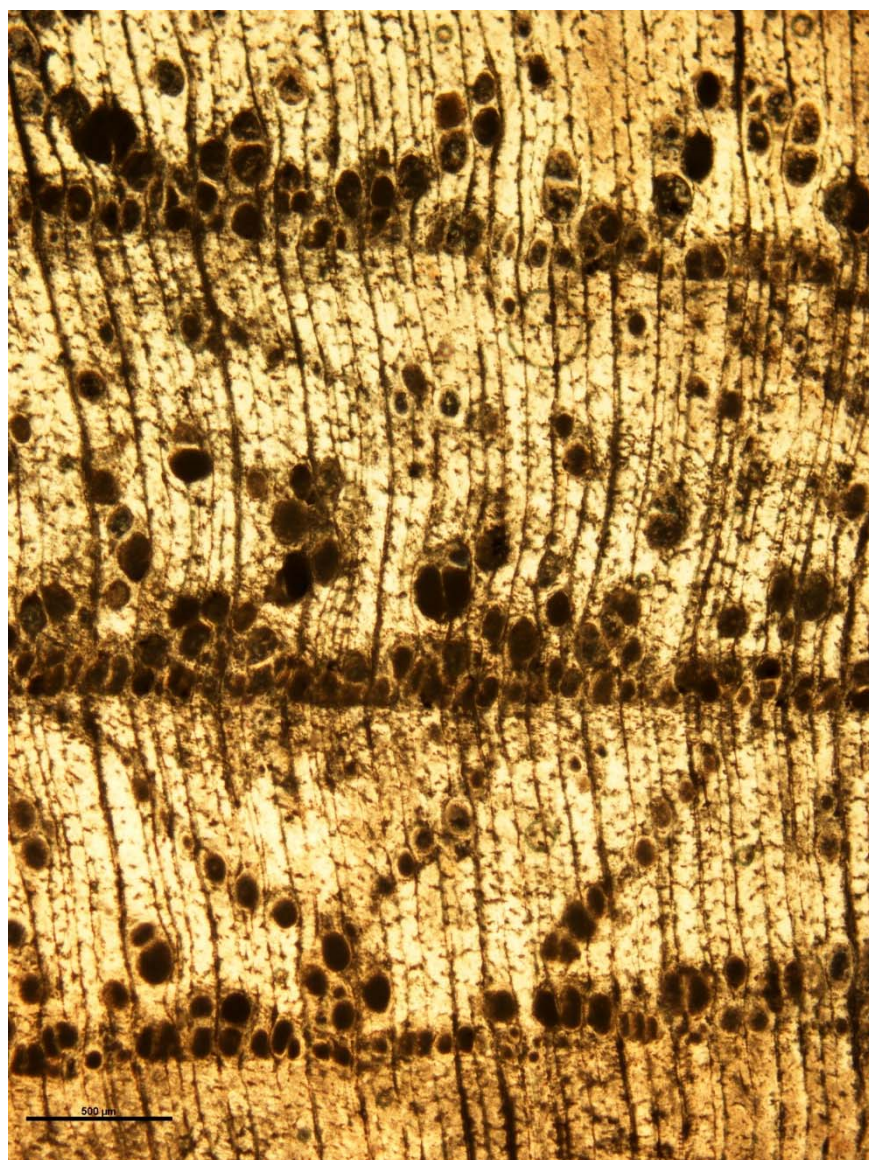


Figure S13. Undetermined hardwood #1 UWBM PB98567

Some features of this wood (**Figure S13**) are consistent with the walnuts (family Juglandaceae), including a semi-ring porous wood with vessels forming diagonal patterns and parenchyma tending to form narrow tangential bands. The continuous row of earlywood vessels is not typical for the walnuts however, and the parenchyma bands are generally not continuous, but tend more towards diffuse-in-aggregate.

Preserved features: Growth ring boundaries distinct. Semi-ring porous with a continuous row of earlywood vessels. Mean vessel diameter 81 μm , largest vessels up to 150 μm . Tyloses present. Vessels mostly solitary with common radial multiples of 2-3. Vessels form diagonal patterns across the growth ring. 20-30 vessels/ mm^2 . Rays 1-3 seriate, 12-15 rays/ mm . Axial parenchyma diffuse-in-aggregate or in uniseriate tangential bands throughout growth ring.

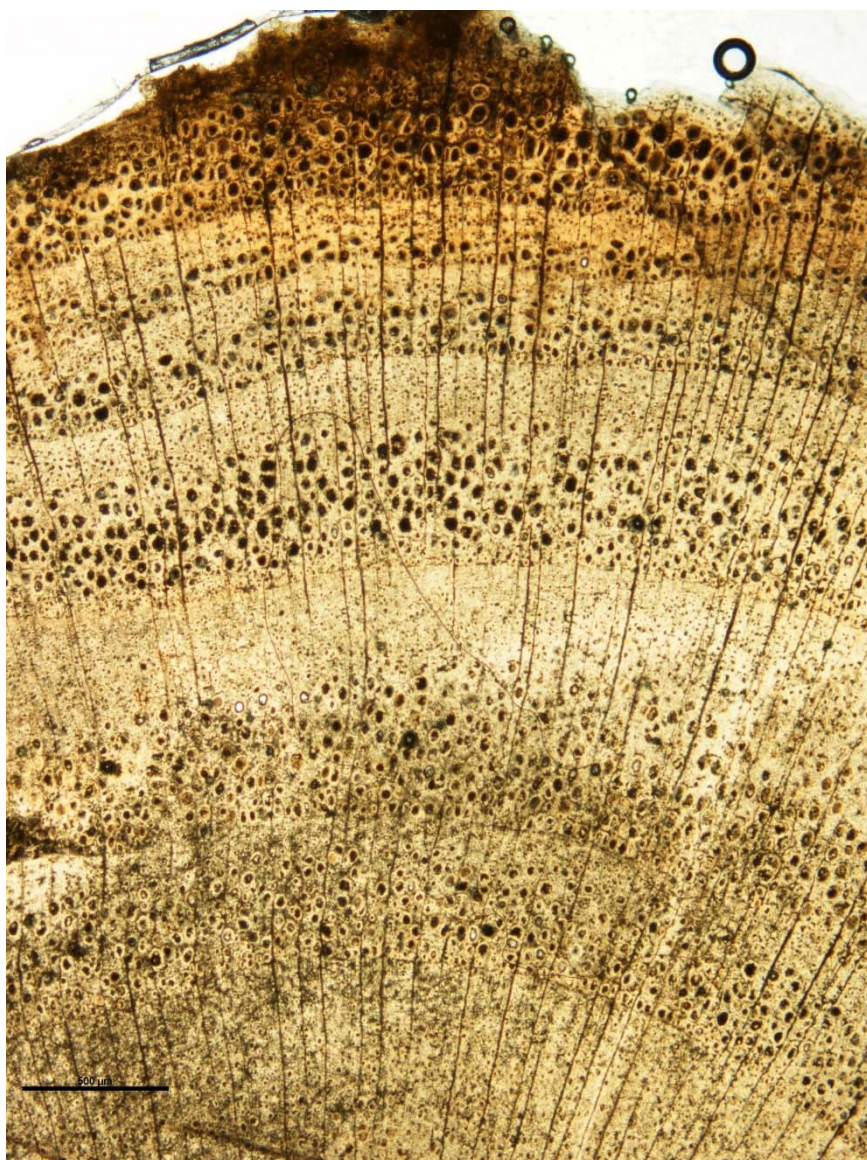


Figure S14. Undetermined hardwood #2 UWBM PB98570

Preserved features: Growth ring boundaries distinct. Ring porous with several rows of small earlywood vessels and much smaller vessels in latewood. Vessels mostly solitary with occasional radial multiples of 2-3 cells. Mean tangential diameter of earlywood vessels 32 μm . Rays 1-2(3?) seriate, 10-15 rays/mm. Axial parenchyma not preserved/observed (**Figure S14**).



Figure S15. Undetermined hardwood #3 UWBM PB98576

Preserved features: Growth rings distinct. Diffuse porous, vessels solitary or often in radial multiples of 2-4, usually 2-3. Radial multiples are especially common in latewood of some growth rings. Vessels small with a mean tangential diameter of 31 μm , approximately 200-250 vessels/mms. Rays exclusively uniseriate, 11-13 rays/mm. Rays apparently homocellular with procumbent cells (**Figure S15**). Known from a single complete stem section approximately 2 cm in diameter, containing pith plus nine growth rings.



Figure S16. Undetermined hardwood #4 UWBM PB98556

The wood in **Figure S16** likely represents a woody vine based on the high percentage of area occupied by vessels, vessels of two diameter classes and wide frequent rays [8]. There were several examples of this type, all of which were small diameter stem sections up to 3.5 cm.

Preserved features: Growth ring boundaries generally indistinct. Predominantly large vessels with a mean tangential diameter of 181 μm, solitary and in short radial multiples, with rare longer multiples up to eight cells. 9-15 vessels/mm². Much smaller vessels are interspersed with the larger vessels. Tyloses common. Rays multiseriate, up to 10 cells wide, 3-4 rays/mm.

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