GENERAL SCIENCE NOTES

HOW RAPIDLY CAN WOOD PETRIFY?

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Petrified wood is possibly the fossil type with which most people have greatest familiarity. One of the most frequently expressed questions among a group visiting a petrified wood exposure is "How rapidly does petrification occur?" The answers to such questions have often expressed speculation, but seldom have been based on dependable data.

Anne C. Sigleo in a paper entitled "Organic geochemistry of silicified wood, Petrified Forest National Park, Arizona" that appears in the September 1978 issue of *Geochimica et Cosmochimica Acta* (42:1397-1405) demonstrates that silica mineralization is an impermeation or void-filling process in which mineral matter is deposited in cracks, openings between cells, and spaces left by cell fluids. This process takes place while the wood is relatively intact. Consequently petrified wood preserves the original pattern of cell structure, and often contains carbon and organic compounds. For noncarbonaceous petrified wood the organic material was degraded and removed subsequent to mineralization. The most probable mechanism for wood silification as proposed by Dr. Sigleo is hydrogen bonding between silicic acid [$Si(OH)_4$] and the hydroxyl functional groups in cellulose.

Silica mineralization evidently takes place within the chemical (impurity concentration) and pH (acidity-alkalinity) range of most surface waters. Dr. Sigleo cites experiments which indicate that silica deposits at the rate of 0.1 to 4.0 millimeters per year on wood immersed in alkaline springs at Yellowstone National Park;[1] fresh twigs will partially silicify within 24 hours at room temperature in a sodium metasilicate solution at concentrations of 5-10 parts per thousand;[2] fresh wood can be silicified within a year by alternate immersion in water and ethyl silicate.[3] The latter process does not represent naturally occurring

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FIGURE 1. The writer examines an unusually large petrified tree stump having a diameter of about 4 meters. This upright stump extends from near the foot of the author to the left part of the picture. It is partially covered by moss and lichens. This is one of the largest petrified trees found in Yellowstone National Park and is located in the Specimen Creek area.

conditions. Ethyl silicate is used because in the presence of water it decomposes and releases a high concentration of monomolecular silicific acid within the wood tissue. Also of interest but not mentioned by Sigleo is the observation that plant tissue silicifies after several years of immersion in jars of water containing 750 parts per million of silica.[4]

These examples provide some possibilities regarding the formation of petrified wood and suggest that wood could become petrified within a few years if it remained saturated with water that had percolated through a layer of fresh volcanic ash.

ENDNOTES

1. Allen ET. 1934. The agency of algae in the deposition of travertine and silica from thermal waters. American Journal of Science 28:373-389.
2. Drum RW. 1968. Silicification of Betula woody tissue in vitro. Science 161:175-176.
3. Leo RF, Barghoorn ES. 1976. Silicification of wood. Harvard University Botanical Museum Leaflets 25:1-47.
4. Vail JG. 1951. Soluble silicates, vol. 1. NY: Reinhold.