AN UNUSUAL "STONE CIRCLE" STRUCTURE IN FOSSILIZED WOOD

H. O. BEALS
Department of Forestry, Auburn University, Auburn, Alabama

ABSTRACT

The occurrence of unusual circular objects has been noted in a piece of fossilized wood assigned to the genus *Sequoia* in the Taxodiaceae. The wood has been replaced by white, translucent opal and is of such a nature to permit maceration of the cells.

Circular rings were observed in many areas of the wood. They seemed to have no relation to any normal structure of the wood, i.e. bordered pits. They occur on the radial surface of the tracheids.

Comparison was made with known objects of similar appearance occurring in rocks including oolites, lithophysae, and granules. None of the above features could be definitely considered as comparable to the circles in the fossilized wood because of the method of formation and appearance.

A NUMBER of years ago a small piece of fossilized wood measuring about 6 × 1 × ½ in. was acquired by the Department of Geology, Purdue University. No information was available as to its location of discovery or its geologic age, although it is assumed to be Mesozoic. The piece was subsequently acquired by the author for identification and assigned to the Taxodiaceae as belonging to the genus *Sequoia* or *Metasequoia*.

The wood had been replaced by white, translucent opal which was poorly cemented in the region of the middle lamella in such a manner that the individual cells could be easily separated from one another with a razor blade or knife. Whole tracheids and layers consisting of a single tracheid in thickness and up to 15 or more width were frequently obtained almost intact. Excellent preservation of details was observed throughout, especially the bordered pits and tracheid ends.

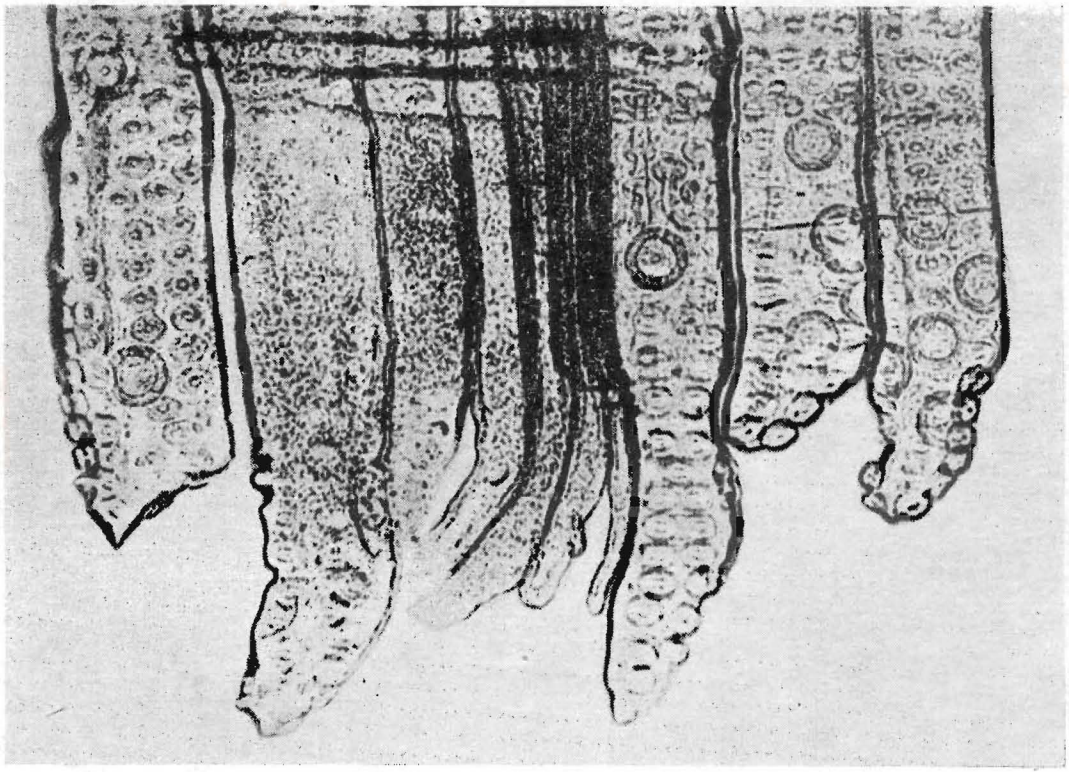
Individual rays and ray crossings sometimes separated and could be observed intact. Tracheid ends complete with inter-tracheid and tracheid-parenchyma pitting offered excellent opportunity to study the nature of overlapping tracheids. Most of the tracheids were solid, the lumina being filled with opal. However, the secondary walls could be distinguished in most cases. A few tracheids seemed to be hollow in some areas, due to incomplete replacement.

In a number of sections, a most unusual feature in the form of a circular ring (FIG. 1), about one-half the width of the tracheid, was observed. The rings were perfectly circular, usually occurring singly, but sometimes paired, and rarely in groups of up to 7 or 8. They were very uniform in size, although a few were observed that were somewhat larger than average. They appeared to have a heavy external wall which sometimes seemed to be of two or more layers when observed under magnification of 450×.

Dark field illumination showed that the rings sometimes occurred on the inside of the tracheid, but more frequently on the outside as a depression in the contact between two tracheids. Occasionally one ring would appear to cross two tracheids, but for the most part, they were confined to one tracheid. If one occurred to one side of a tracheid, only an arc was visible, the other side apparently being terminated against the side of the tracheid. Even when appearing in this manner, there was no apparent change in form, as the visible portion showed no deformation.

Examination with the petrographic microscope revealed that the rings were of the same mineral as the tracheid walls which was in most cases, opal. However, chalcedony was sometimes present in a few areas. This combination appears to be fairly common in certain types of fossilized wood in which opal and chalcedony occur together indicating a loss in H_2O from the opal.

Speculation as to the cause and formation of these rings ranged from abnormally large pits, through fungal sclerotia and air bubbles. However, due to the almost perfect circular forms produced, an organic cause does not seem to be feasible. The rings have no apparent association with any sculpturing on the cell walls. No visible abnormalities different from the normal components of the cell walls were observed.



TEXT-FIG. 1 — Radial section of fossil Sequoia showing the unusual circular structures on the tracheids. Diameter of the rings is 18-20 μ.

Despite the striking similarities to air bubbles, several objections over-rule this as a cause. Air bubbles introduced into the mounting medium were much larger and even those of a comparable size possessed a much heavier wall and almost no central cavity. Also, as pointed out previously, a number were observed fused and still retained their circular form without apparent overlapping and with no apparent deformation.

These rings were compared with other spherical to ovate features which occur in rocks. Certain igneous rocks such as rhyolite and obsidian frequently possess these rounded structures termed lithophysae (HEINRICH, 1956). Lithophysae, however, usually have a characteristic radial or concentric crystal arrangement of mineral constituents. The formation of lithophysae is presumed to be a rhythmic crystallization of silica in a radial direction about the site of a gas bubble, or the result of devitrification. The gas bubble may be formed during the crystallization of the parent mineral. Lithophysae are sometimes formed from a mineral different from that of the parent mineral.

In comparing the rings in the fossilized wood with photomicrographs of typical lithophysae in obsidian and rhyolite, it was readily seen that the rings in the fossilized wood did not have an origin in crystallization about the site of a gas bubble, nor is the structure similar to that of devitrification 'circles'. They appear to be formed more as a result of a redistribution of silica in the replacement of the tracheids. No crystallization is evident in the fossil wood.

A second form of circular objects occurring in rocks are oolites which form in typically sedimentary rocks. They may be present in rocks containing large amounts of silica, calcium or iron (WILLIAMS *et al.*, 1955). Oolites are formed by the precipitation of the mineral by chemical accretion about a nucleus or centre or by agitation of limy muds on a shallow sea floor. Individual

oolites may be ovoid or spherical and may often result as pseudomorphs after an already existing structure.

Oolites may have a mineral or organic nucleus, but in some the nucleus may appear to be lacking. The deposition is in a radial or concentric manner. Some oolites, owing to replacement, have lost their original structure and show only a crystal mosaic.

False oolites, usually known as granules, differ from oolites in that they have no radial or concentric structure and they are amorphous or microcrystalline. These are found in rocks of a colloidal origin (PETTIJOHN 1952).

Since the original wood structure has been replaced by opal, a colloidal form of silica ($SiO_2.nH_2O$), the probable formation of the rings in the fossil wood is due to the unstable form of opal changing to a more stable form, chalcedony.

Comparisons with photomicrographs of typical oolites, granules, and lithophysae show little resemblance to the rings in the fossil wood. The rings in the fossil wood are evidently of diagenetic origin, but in this case are unusually well developed into the circular form.

No similar rings were found in the available literature. If they have been described previously, the author was not able to find any reference to them in either the geological or botanical journals.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to A. T. Guard, E. W. Stark, and to R. W. Lounsbury for their comments in the preparation of this paper.

REFERENCES

HEINRICH, E. WM. (1956). *Microscopic Petrography, New York.*

WILLIAMS, H., TURNER, F. J. & GILBERT, C. M. (1955). *Petrography, San Francisco.*

PETTIJOHN, F. J. (1957). *Sedimentary Rocks,* Second Edition, *New York.*