DENDROCHRONOLOGY IN TWO MISSISSIPPI DRAINAGE TREE-RING AREAS

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In 1934 the University of Chicago inaugurated work on tree-ring studies in the Mississippi Drainage with the object of eventually being able to date the Indian mounds of that area. The work was suspended from 1935 to the summer of 1937, when a tree-ring laboratory was established and full time work was resumed at Chicago under auspices of the Indiana Historical Society. During the summer, collections of approximately a thousand oaks, cedars, pines, hemlocks, ash, and poplars were made in Wisconsin, Minnesota, Illinois, Missouri, Kentucky, Tennessee, Indiana, and Iowa. These specimens were shipped to the tree-ring laboratory in Chicago, where boxes of specimens taken from the Indian mounds were already collected.

The result of the winter's work on the modern specimens has been improved technique in working with modern oak rings, the tree on which most of the work has been done, development of cross-dating of ash and of poplar in dating in that area, and the compilation of master charts extending back into the 1500's A.D. representing two distinct areas, a northern and a central. The northern area is known to include northern and central Wisconsin, eastern Minnesota, and the edge of Canada. The central area takes in Illinois, Indiana, Kentucky, southeastern Missouri, and Tennessee even to its eastern borders. The exact limits of either area are not yet known, but that problem will be pursued in future collections. The central area is already known to be larger than the southwestern tree-ring area, a fortunate situation when one considers that much of the middlewest has long since lost its virgin timber and good specimens are only available from scattered sections.

Small studies of oak rings in the middlewest have been carried on in limited areas previous to 1934. In going into the study of oak rings on a large scale, it was necessary to develop a technique of bringing the rings into easy visibility and of becoming familiar enough with the growth habits of oaks to be able to interpret the rings. Experiments were made in staining the rings with acids, with dyes, with inks, and with chalk rubbed into the pores of spring growth. None of these proved as satisfactory as cleaning off the surface with a sharp draw knife while the wood was held firmly in a vise. In oaks, as in conifers prepared with a razor blade, the cut should be at about a 45 degree angle from the horizontal. Oak wood is so hard that it cuts cleanly with the draw knife if a slicing movement is used. Punky spots or areas in which the rings are so small that the multiplicity of large pores makes the wood soft must be trimmed later with the razor blade knife.

The cut is oiled with kerosene, and the amount used should be more than that used on softer woods. If the surface is viewed through a thin film of oil, as on an oil immersion slide under a microscope, the visibility of ring structure is greatly improved. Because of the large pores the oil sinks in rapidly and must be replenished frequently. For this a small atomizer has been found efficient. Heavy shawl or bank pins are used for marking the rings, and the prick is put into the porous spring wood. The hard wood of its later growth bends pins before they penetrate.

The oak ring is outlined by a thin growth of summer wood just under the heavy spring pores of the succeeding year. To see this thin outline, the specimen must be held horizontally, as a pine specimen, and tipped back and forth until the rays of the light behind it bring the narrow dark line into the most distinct view. The light should be directly behind the portion of the specimen being examined; even a slight angle between the light and the specimen greatly cuts down the visibility. Most of the oak specimens taken are wedges, and it has been found convenient to cut a small triangle from each end of a shoe box and to set the wedge into the cradle thus provided. The thickness of this exterior line varies in proportion to summer rains, as in certain pines.

Tree-ring studies in oaks are certainly more difficult than in pines, but they offer several advantages. Oak records are apt to be longer than pine records in the middlewest and in the south, providing one finds the right spots from which to collect old oaks. Moreover, oaks rarely, if ever, grow double rings. What appears to be a double ring is sometimes seen as a slightly marked, irregular, indefinite line beneath the obvious exterior line of the ring, but no cases have been found of the oak growing a second set of the large pores that mark the beginning of the spring wood. Hence identification of doubles presents no real problems. Identification of actual rings, however, may present a problem if one counts the rings down one side of a heavy medullary ray and then moves at some point to the other sides. These rays often mark a break in the ring similar to a geological slip; on one side of the ray the edges of the ring are lower than on the other by half or even by the whole width of the ring. Many of the early mistakes made in work on oak rings have been traced to the confusion thus arising. However, if one will get the light red on a well oiled specimen, he can trace the heavy edge of the ring across the hard wood of the medullary ray and onto the other side. In places where identification of rings is difficult, as in areas of very small rings, tracing the outlines on the medullary rays is often of considerable aid. And always it must be stressed that one cannot count oak rings by the large pores that at first glance appear to mark easily read rings; in areas of small rings the count can be made correctly only by identification of the exterior lines. Application of the Eisendrath photographic technique[1] of bringing rings into visibility by fluoresence offers new possibilities for facilitating study and measurement of small difficult rings, either directly or from enlarged photographs.

The white oak has been found to show longer records and greater sensitivity than any other oak examined, the longest record extending from 1937 back to 1569 A.D. The ash, another ring porous tree, closely checks the record of white oak rings where tested. Although work on ash has just been begun, this tree appears to offer even more than the oak, for it seems not to be as subject to the sets of small rings common in the centers of oaks. These small rings are the result of the oak seedling usually being protected by a nurse tree, and the rings remain small until the young tree grows enough to escape into the sunshine. It is true that these areas of small rings are often sensitive even in their smallness. In fact, the oak is much more sensitive in its youth than in its old age, and this fact enables the dendrochronologist to utilize young modern trees for the best modern records and yet to expect good records of ancient periods from the youth rings of old trees.

See p. 7 herein.

Oak dating, at least at present, should be done principally by groups, as one dates difficult groups of southwestern pinons. Specimens from Indian mounds have been set aside until the ground work for the area was well covered, but to test the actual possibilities of dating with oak rings the material from an old log cabin of unknown building date was cut. The logs were found to cross date with themselves, and to check against the master chart and against the actual wood of the modern specimens. The log cabin specimens dated themselves with no more difficulty than ordinary difficult specimens of southwestern pine. The dates were checked by Douglass. In this central area, the pine record has been found to check that of the oaks, which means that the two species can be used in recognizing and studying the idiosyncrasies of each other. They can each be used to extend the master chart and a specimen of either species can be dated on one chart.

Hemlock and pines have both been examined in the northern studies; the two trees do not check each other in growth records. Hemlock is difficult to cut clearly because it is so soft, but the records are long and sensitive, and cross-date well. The hemlock masterchart is completed back to 1550. The oldest hemlock record so far examined goes back to 1490. A good collection of hemlock sections was obtained from a paper mill at Wisconsin Rapids. Pine and hemlock borings are carried in hollow bamboo tubes to the laboratory. Stave mills in the South were found to be most cooperative for collecting oak specimens.

Field work in the summer of 1938 will be planned to more definitely locate broader lines of the two new tree-ring areas, to check some of the least investigated spots in these areas, to increase modern ash and poplar collections, and to find more very old modern ash, oak, and hemlocks to be used in extension of the two master charts. Small but distinct regional variation in records within the large areas must be distinguished and comparisons with precipitation and temperature records made statistically. A self-plotting measuring machine of new design has been built by Dr. J. Workman in the physics department of the University of New Mexico for measuring the rings of specimens reaching to two and a half feet in radius, and a new tubular borer for taking cores from living oaks up to the same radius is under construction in Chicago.

Until May, 1938, laboratory work was concentrated upon modern trees. At that time Dr. A. E. Douglass came to the Chicago laboratory, checked the mastercharts, and returned to Tucson with some sample specimens of wood for the Arizona laboratory. With his approval, cross-dating of pine and oak specimens from the mound collections of Tennessee, Kentucky, Illinois, and Wisconsin is being carried on, the better specimens carrying approximately one hundred rings of such sensitivity as to insure eventual dating. The usual technique of chipping the surfaces of charred specimens preserved with gasoline and paraffin was found to work fairly well for oak, but pine posts buried for some hundreds of years in damp soil broke apart, ring from ring when chipping was attempted. Even preservation of these water logged specimens was relatively unsuccessful until, with the aid of T. M. N. Lewis of the University of Tennessee, it was found that if the wood was first very securely wrapped around the circumference and covered over at the ends with bands of cheesecloth and then immersed in a solution of warm gasoline saturated with paraffin, the wrapped wood took on some firmness.

Days or weeks later, as the water still remaining in the wood slowly dries out, the specimen should be re-immersed in the solution, the soaking varying as experiment proves necessary.

When the specimen is to be studied, the heavy paraffined cheesecloth wrapping is cut from one end but left covering the rest of the surface for protection. If the wood is still damp it should be left to dry for two or three days, after which the surface may be carefully cut with a razor blade.

Our photographer, Mr. Eisendrath, experimented with hardening this surface with bakelite dissolved in acetone. The solution, scarcely thicker than water, is poured onto the surface, into which it quickly sinks, especially if the wood is well compressed horizontally by tight wrappings or by rubber bands over the wrappings. After two or three applications of the bakelite the wood is set aside to dry for several hours. The bakelite penetrates one half inch or more without difficulty, provides such body to the wood that it can be cut as cleanly as fresh wood, and holds a surface that may be photographed. Heating the bakelite to crystalize it impairs the surface for cutting and for observation. Experiments with other substances that might be used on wet wood in the field are being made, but the combination of firm wrapping, adequate field preparation in warm gasoline saturated with paraffin, and laboratory preparation with bakelite in acetone has proved so successful that we do not hesitate to recommend it to others working with wet or with dry charcoal.

SOUTHWESTERN DATED RUINS: IV

Chaco Canyon, New Mexico

By FLORENCE HAWLEY SENTER

Site	Period	Type of Masonry	No. of Specimens	Range of Dates
Chetro Ketl*	Pueblo III	Inferior wide banded with core	33	931-1102
		Narrow banded with core	81	925-1066
		Spalled blocks with core	11	1060-1116
		Fine unbanded with core and spalled blocks with core	19	911-1103
Talus Rock Shelter	Pueblo III		2	1101
East Dump of Chetro Ketl	Pueblo III			
Stratum 4 (1)			10	921-1054
Stratum 3			44	929-1119 (2)
Stratum 2			1	1090 (2)
Talus Site I of Chetro Ketl	Pueblo III	Narrow banded with core	7	1018-1032
		Inferior wide banded with core	2	1066-1076
Hungo Pavi*	Pueblo III	Fine wide banded with core	5	1048-1064
		Spalled blocks with core	1	1004
Kinklizin	Pueblo III	Spalled blocks with core	1	1084
Kinya-a	Pueblo III	Spalled blocks with core	6	1097-1106
Kinbiniola*	Pueblo II	Spalled blocks with core	2	1119-1124
	Pueblo II	Unfaced slab	4	941- 943
Penasco Blanco*	Pueblo III	Unfaced slab	7	898-1055
	Pueblo III	Fine wide banded with core	6	1051-1062
	Pueblo III	?	1	996
Pueblo Pintado	Pueblo III	Fine wide banded with core	2	1060
Tsinklitzin	Pueblo III	Spalled blocks with core	2	1111
Una Vida	Pueblo III	Spalled blocks with core	1	987
	Pueblo III	Fine wide banded with core	1	1048
	Pueblo III	Unfaced slab	6	847- 950
Wijiji	Pueblo III	Fine wide banded with core	1	1027
Leyit Kin	Pueblo III		18	1011-1045