Wood Tells Its Story to the Scientist Who Can Read It

(Associated Press photo.)
Arthur Koehler, wood technologist of the Forest Products laboratory, Madison, Wis., examining with a microscope samples of the wood used in the construction of the Lindbergh baby kidnaper's ladder.

Tree Rings Like History Pages; Plain Clews on Every Piece of Lumber

By Guy Murchie Jr.

SIX HUNDRED persons sit in a country courtroom intent on the words of the state's witness. It is Jan. 23, 1935, at the trial of one Bruno Richard Hauptmann, Bronx carpenter, charged with the murder of Charles A. Lindbergh Jr. The witness is Arthur Koehler, head of the United States forestry laboratory at Madison, Wis. His testimony may well be the straw that breaks the defendant's back, for he seeks to prove that the kidnaper's ladder was made by the defendant.

How does he go about it, this expert on trees and wood? He examines and considers every minute mark on the ladder. He points out the telltale signature of the individual tools which cut and shaped the wood. He identifies the individual planing mill from which the lumber came, first by determining the make of the planing machines, which left their characteristic markings, then visiting all the mills which used that particular make of planing machine to discover the individual machines which cut the board in question, inevitably leaving behind their personal blade prints. Most conclusive of all, the expert gives testimony to show that one of the ladder's uprights was fashioned from a certain large board taken from the plank flooring of the attic of Hauptmann's house. This last piece of demonstrating is done through the position of nail holes and through the unalterable individuality of the grain of the wood itself.

Not only in crime detection, but in solving many another riddle in wood, does an exact knowledge of wood grain — or tree rings — play a vital part.

Tree rings are the marks of growth in a tree. They are made in each tree at the rate of one a year. Each summer and fall the moist wood just under the bark of the tree turns dark as the sap hardens and as the tree stops growing to take its winter's sleep. Each spring a new lighter layer of wood forms just outside this hard layer and inside the bark, gently forcing the bark outward to give more room. Thus the tree grows, each year's ring forming outside and a little larger than last year's.

Tree Rings Vary with Nature of the Seasons

Naturally these rings are not all the same. A year of frequent rains produces a thick ring of larger, softer, lighter cells; a dry year produces a thin ring of smaller, harder, darker cells. In this manner a permanent weather record is encased automatically within the heart of every tree and bush, plain for any woodsman to read. Of course, the personal experiences of an individual tree affect its rings; a tall, overshadowing neighbor may fall, leaving the tree in sudden sunshine, so that it will begin a new period of more rapid growth, with consequent thicker rings; or a burrowing animal may bruise its roots, thus cutting off part of its food supply. To read the weather chart accurately one must examine a large number of trees at distances far enough apart to be beyond the range of local disturbances affecting growth, such as a forest fire, a swarm of insects, or a local flood. On the other hand, for acquiring certain information not related to the weather the private diary of the individual tree is of great importance.

One of the best examples of practically applied tree ring knowledge is the work now being done by Dr. Gladys Hawley and Roy Lassiter, graduate students of the University of Chicago, with a view to determining the exact dates of the chief events in the history of the Kincaid Indian mounds near Metropolis, Ill. This method of establishing the dates of prehistoric ruins was applied several years ago with great success in Pueblo Bonito, oldest and largest of the great Indian communities in Chaco canyon, New Mexico. In all so far more than fifty ancient ruins in the southwest have been dated by tree rings.

The collected tree cross-sections that bring back to light this forgotten chronology are similar in import to the famed Rosetta stone, the discovery of which provided a key to the written mysteries of ancient Egypt. Methodically compiled by nature's impartial hand, the tree rings form a complete historical record going back in America to times contemporaneous with the conquest of Spain by the Moors. Already we know that certain Pueblo Indian settlements were enjoying their golden ages when William the Conqueror faced Harold the Saxon at the battle of Hastings, and as we unearth more of nature's wooden ledger there is no knowing what we will learn about ancient ruins and ancient doings in all parts of the world.

The manner of establishing this unbroken tree ring record over a period of thousands of years is akin to piecing together a picture puzzle of which the pieces, each duplicated many times, are lying strewn about the world. The more pieces you can gather, the better chance of finding enough adjoining ones to put together a complete picture.

This is exactly the theory and procedure followed by the wood detectives of the southwest. A log to them is a log in more ways than one. Whether it is found buried in clay in the wilderness or supporting the roof of an ancient hut, it is both a log of wood and a log of the arboreal ship beneath whose decks it was originally written in annual instalments. One log cut from a freshly felled tree will perhaps reveal by its rings that its life extended from 1750 to 1935. The year 1770, for example, as shown by the rings of this and other trees hundreds of miles away, may have been a year of great drouth, while 1765 perhaps saw unusual quantities of rain. Now, a section of log found in an ancient Indian hut may have one extra wide ring denoting heavy rainfall, with the fifth ring outside it a very narrow ring, denoting severe drouth.

A comparison between the wood of which the kidnaper's ladder was made (left) and that of a plank taken from Hauptmann's attic (right) formed a vital part of the evidence which led to the German carpenter's conviction. Experts found the grain of both pieces matched in minute detail.

This fact will suggest the possibility that the two rings represent the years 1765 and 1770. By further checking and comparing the minute differences in many other rings representing other years it can be established whether the Indian log really covered in its growth the years 1765 and 1770. If so, the life span of that particular log can be easily determined. Suppose the span turns out to be from 1663 to 1780. Now we have clews to the yearly weather changes as far back as 1663. Another earlier log, by the same checking of the years in which it overlaps the already dated log, will open up still more of the past—and so on, log by log, decade by decade, into the dim history of an unknown world.

Wood Detectives Have Tree Ring Calendar

Already the wood detectives have a precise tree ring calendar extending back more than 1,200 years (to a limited extent as far back as 1300 B. C.), and any archeologist who digs up a ruin in the American southwest readily can tell from pieces of wood used in the ruin's construction whether it was built before A. D. 700 — and, if not, the exact date it was built. In addition to this information, by comparing the local wood diaries with the records over a wide geographical area he can tell many things about what probably happened in that particular locality at that particular time. A forest fire, for example, always leaves its characteristic marks in the tree rings.

Of course, each region has weather somewhat different from other regions, and so its tree ring chart must be separately compiled. On the other hand, there is some degree of correlation between the rings even on opposite sides of the world—probably due to the world-wide effect of sun spots on weather—and this correlation greatly facilitates the working out of other tree ring calendars once the first calendar is established.

The sun spot weather theory, by the way, is well supported by the evidence of the long-term records of the trees. Sun spots are found to be most frequent at intervals of about eleven years. A corresponding cycle is noted in the records of tree rings. An interesting check on this finding is told by Dr. Andrew E. Douglass, leader of tree ring expeditions to New Mexico and Arizona a few years ago. Writes the doctor: "Evidence of the eleven-year sun spot cycle had been easily found in Arizona pine trees. The regularly recurring periods had been recorded for 500 years by tree rings, *except for the interval from 1650 to 1725.* During that seventy-five years the tree rings have no evidence of periodical changes in the weather, such as were to be expected.

"Several years after we had encountered this puzzling fact the late Dr. E. Walter Maunder, an eminent English astronomer, unaware of my findings, wrote to me that he had discovered that *there were no sun spots between 1645 and 1715,* and that if my tree rings did not indicate some effect of this absence of sun spots my work was being conducted on an erroneous hypothesis."

Years of Great Drouths Revealed in Old Logs

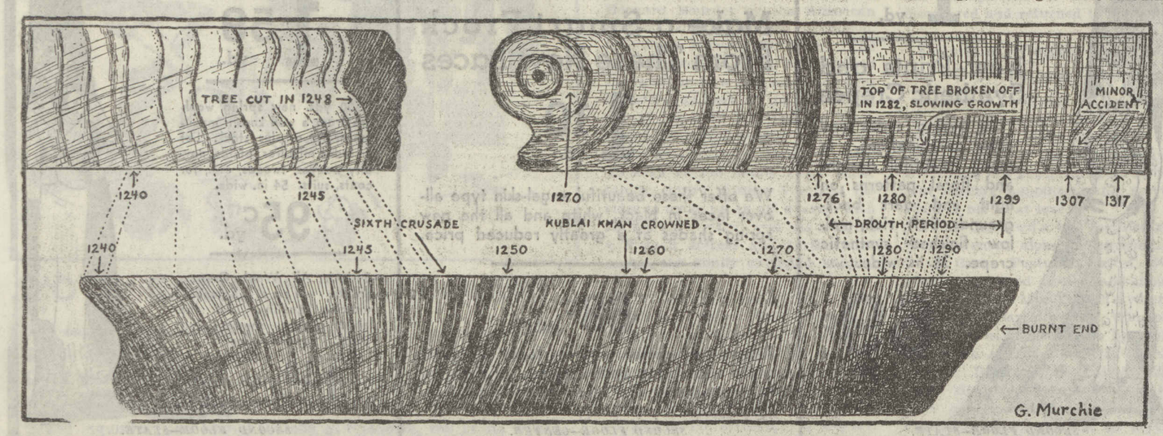
Further illuminating evidence as to periodicity of drouths is revealed by the tree calendars, which definitely point to the years A. D. 840, 1067, 1379, and 1632 as years of excessive drouth in the American southwest. The 1934 drouth does not need tree rings to be remembered. There is a degree of cyclical recurrence to these dates, but the periodic regularity is more apparent in the records for the intervening years, which show that there were pronounced drouth periods from 1276 to 1299, from 1573 to 1593, and from 1880 to 1904.

In the tropics there rarely are annual tree rings, and the petrified remains of wood millions of years old do not show such rings even in what are now temperate regions. This is because the rings are made by changing seasons. It indicates that in the past ages in what are now temperate zones, as in the tropics today, there was perpetual summer.

Petrified wood, of course, is not necessarily very old, and some of it —especially in the "petrified forest" of sun-baked Arizona—shows rings magnificently outlined in brilliant colors. Expert botanists say that the silica contained in volcanic ash may be able to petrify wood saturated with it in as few as ten years.

The difficulty of getting the older tree ring specimens is sometimes very great, as the Indians believe the ancient timbers of their huts contain spirits, which can get out when the wood is cut. It is not necessary, however, to cut a log completely in two. With the proper tools a small boring to the core of the wood can give practically the complete life story of the tree from which that particular log came. In this manner the store of tree ring data is being continually added to, and every year extends our potential knowledge of when and what happened in ancient times.

The oldest living tree—in fact, the oldest living thing on earth—is thought to be a cypress tree in the state of Oaxaca, Mexico. Called the tree of Tule after the village of Santa Maria del Tule, in which it stands, this colossal tree measures 175 feet in circumference, three feet above the ground. Its wood alone weighs 604 tons. It is growing at the rate of about seven-eighths of an inch in diameter a year and is estimated to be between 5,000 and 10,000 years old. Just think what a story this tree could tell to a wood expert if he should get one good look at its insides!



The tree ring calendar is being extended farther and farther into the past as old logs are discovered and matched ring for ring in the years they "overlap" already dated logs. Freak weather often makes several rings in one year.

(Associated Press Wirephoto.)
Koehler as he explained to the jury the tree ring similarity in the two boards.

A detective examining the boards of Hauptmann's garage in search for clews relating to the kidnaping.

This section from a 900-year-old tree illustrates the thrilling adventure story written in every piece of wood.