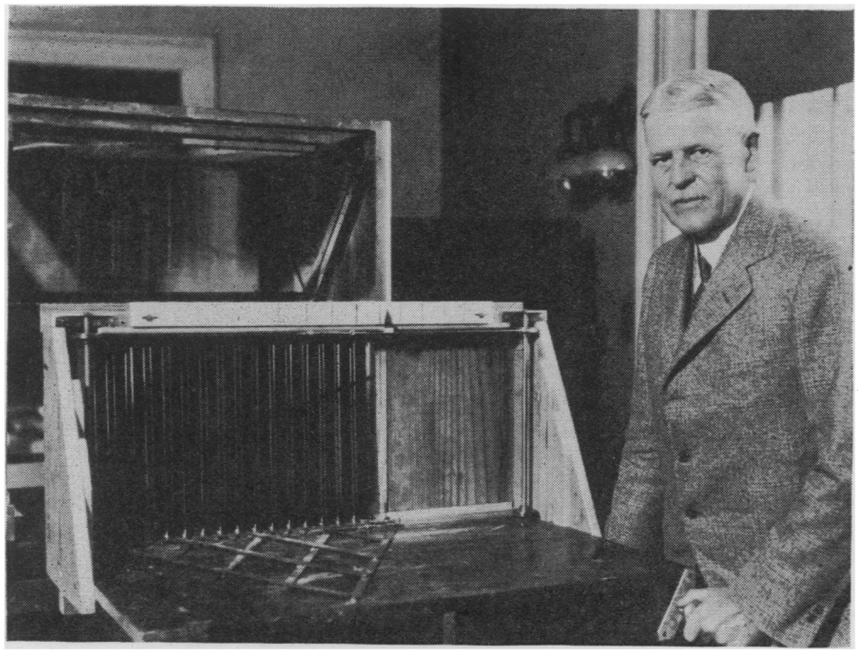
Trees May Close Calendar's Missing Link

Archaeology



PROF. A. E. DOUGLASS, with his cycloscope, for analyzing the cycles that appear in tree rings.

By JAMES STOKLEY

The missing link in the history of ancient America may soon be found.

Studies now under way in the southwest may soon make it possible to tell the exact year in which the early dwellers in these regions, who built such structures as Pueblo Bonito in New Mexico, America's oldest apartment house, did their building. In fact, this calendar will be more accurate than our present knowledge of dates in ancient Egypt.

It is from a study of trees and beams that these structures are dated.

An astronomer, Dr. A. E. Douglass, director of the Seward Observatory, and professor of astronomy at the University of Arizona, is in charge of the work.

Beams from one group of ancient buildings have given an accurate calendar back to the year 1260. Another group of timbers have given a sequence of about six centuries of an earlier period. The missing link comes between the close of the six-century period and the year 1260, when the present series began. All that is now needed is to find beams bridging this gap, which is believed to be about 150 years. Then it will be possible to look at any building constructed by the primitive dwellers in the American southwest at any time since about the year 500 and to tell the date that it was built.

But dating of ancient buildings, though of great importance to the archaeologist, studying the life of these ancient peoples, is not the only thing that may come out of Prof. Douglass' studies. They may go far to revealing new cycles of climate—periods in which floods or droughts may recur—and so help to predict the general weather conditions for years ahead.

The Middle West and South are still suffering from floods. A year or so ago there were extraordinary floods in Vermont, and a few months before that the greatest of all known floods on the Mississippi.

"Were these floods pure accidents in nature's workshop, or did they form part of a series of regular changes which, by careful study, we may be able to predict?" So asks the scientist.

Or again, in Arizona, where Dr. Douglass has done much of his work, there was a great drought from 1899 to 1904, which changed the map of industry in that state. Suppose the coming of that drought had been known beforehand. Then many fortunes might have been saved instead of being lost. Cannot these dangerous climatic conditions be predicted in some way, so that their costly effects may be avoided? What we need to know in such cases is not the weather of tomorrow or of next week, but that of next year, or 1931, or 1939.

Such predictions must be based on the actual repetition of storm or drought at certain intervals, which are called cycles. Weather cycles are already familiar to all of us. We know that in six or seven months the weather will become colder and another winter will be upon us. Four or five months after that spring will come, and the weather will become warmer again. This is the annual cycle that we call the year. What is needed is a sort of super-year that will tell when to expect particularly bad winters or especially dry summers. A short time ago this very matter was studied at a Cycles Conference held at the Carnegie Institution in Washington, and in which Prof. Douglass played a prominent part.

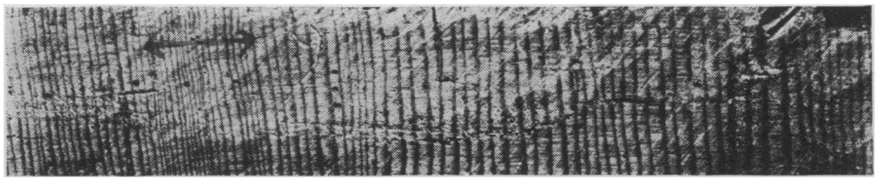
His work has been concerned with the historic background on which other investigators in this field must base their work. For he is showing how the climate has changed in the past, and has invented an ingenious instrument which he calls the "cyclograph" to help make these cycles apparent.

Let Dr. Douglas tell in his own words how this has been determined by a study of the annual rings in trees, especially in the pine trees of the southwestern states, where the continually dry climate keeps the trees perpetually a little short of water.

"We see these rings in the grain of wood, usually badly distorted from the way the wood is cut," said Prof. Douglas the other day. "They show better in the end of a large beam and best on top of a smooth stump. Each year a complete layer or annual ring of wood is laid on, all about the trunk and branches of a growing tree, just under the bark. The late summer or autumn growth is darker in color and forms a distinguishing feature of each ring. If years were all alike, the rings would usually be all alike in thickness, but in actual fact years differ greatly in the amount of rainfall and other climatic conditions, and occasionally fires and pests injure the tree, or a falling tree nearby lets in more sunlight and so helps it.

"It is evident (*Turn to next page*)

Calendar's Missing Link—*Continued*



RINGS IN YELLOW PINE. The ones closely packed together show the drought that occurred in Arizona in the years 1571-1593.

that we must be able to distinguish such local effects as those just mentioned, from the more valuable climatic history in trees. This again is easily done by comparing a number of trees together. If, for example, we count back from the bark in ten trees and in nine (or even in all ten) we find a small ring at, say, five years: that means a drought five years ago and is a definite climatic effect. But if we find a certain ring small in only one of the ten, it is a local effect in that tree and not climatic.

"Aided by the generosity of the University of Arizona and the Carnegie Institution of Washington last year, I studied climatic effects in pine trees over a large western area extending from the eastern slope of the Rocky Mountains to the Pacific Coast and lying between the Columbia River on the north and the Mexican border on the south. Without going into the many interesting details it was found that the three main divisions of this great area, namely, the Sierra Nevada Mountains, the Northern Arizona Plateau and the Pikes Peak region, while differing slightly in special points, all showed the same cycles. These proved to be very nearly simple fractions of 34 years, an interval which has long been known as three times the 11-year sunspot cycle. It is called the Brücknor cycle after its discoverer. This result of the western cycles depends upon more than 50,000 measures of tree rings and long, well-checked analyses by an instrument called the cyclograph, designed and constructed for the purpose.

"This not only was evidence found for climatic cycles, but these cycles showed relation to well-known solar changes. This fact was very interesting to me because this study was started years ago from a conviction that solar variations are reflected in the weather, and by weather into tree growth.

"So this study of climatic cycles became a study of climatic history found in trees. Of course, the longer we can make this history the better tests we can make of any theory of climate. Hence the great Sequoias of the Sierra Nevada Mountains in California have become very valuable for this purpose.

"One must distinguish between the Coast Redwood — *Sequoia sempirvirens*—and the giant or Mountain redwood—*Sequoia gigantea*—a different species of the same genus. The former coast tree is the one that visitors more often see because it is on or near the main lines of travel but, though very wonderful, it is not quite so big nor so old nor so beautiful in appearance as its cousin up in the higher altitudes where the snows of winter get too deep for travel. But more important for us is the difference in their climatic records. In all study so far the coast tree has failed to show like rings in like years, and so it has not yet been possible to use it in climatic study because its variations represent local conditions. But in the Giant Sequoia the drought years are identical in all the groves through two and even three thousand years. Consequently this sequoia is one of the best, most accurately dated and oldest recorders of climate.

"Fifteen years ago Dr. Ellsworth Huntington of Yale University discovered three trees (that is, stumps) showing over three thousand rings. In 1915 and 1916 I secured radial cuttings from these same stumps, suitable for laboratory study and determined their exact age. And during the past summer while dating a new group from the Soringville groves, south of Sequoia National Park, I found a fourth three-thousand-year tree. Of these four the oldest is 3233 years.

"I have in my laboratory 49 radial samples of these big trees, most of them about 2000 years in age. Their rings have not yet reached the stage of final test for climatic cycles, but they will, I am sure, prove to be superb material on account of their long and sensitive records. But since they have fairly abundant precipitation, their complete interpretation in terms of known climatic factors will be more complex than in the case of the Arizona pines. Naturally, long records of Arizona pine are most desirable, for this tree in that relatively dry climate, gives a very clear record of rainfall and drought.

"The last great drought was from 1899 to 1904. During that time Mormon Lake, the largest natural body of water in Arizona, 4 x 6 miles across, went entirely dry. Hundreds of homesteads and farms were abandoned. Now they have all been taken up again and are producing large crops. The trees show that drought very vividly by a group of very small rings often so small that the separate ones cannot be distinguished, even with a powerful magnifying glass. The trees show also a drought in 1820 and 1748 and perhaps a dozen others which have come down to us in history. The major droughts in the trees seem to have occurred at intervals of about 150 years, the earliest one showing near 1300 A. D.

"At this point the archaeologists enter the game. Dr. Clark Wissler of the American Museum of Natural History in New York was the first to suggest the use of rings in prehistoric beams in the ancient ruins of the southwestern area. At his suggestion Mr. Earl H. Morris supplied a beautiful collection beam from Aztec, New Mexico. Then the National Geographic Society began the splendid help which they have given this study. Mr. Neil M. Judd in charge of their expedition at Pueblo Bonito, New Mexico, began his fundamental collection, on which an extended prehistoric chronology is being based.

"Dr. J. A. Jeancon, then of Denver, and Mr. Ricketson conducted the first Beam Expedition of the National Geographic Society and collected a hundred valuable specimens in the area between the Little Colorado and the Rio Grande Rivers. Dr. A. V. Kidder of Andover, Mass., sent a fine collection from Pecos, New Mexico. Dr. Cummings and Mr. Hargrave of the University of Arizona made most important contributions.

"This large collection of over 1200 specimens was studied in the following manner:

"After smoothing the surface of the specimens and even shaving a part of each with a sharp razor, the wood was touched with kerosene. This brings out (*Turn to page* 329)

Horizontal Rainbows Due to Droplets

Meteorology

Rainbows in the sky are familiar to everybody, but if you are fortunate enough, you may some time be able to see a horizontal rainbow on a calm surface of water. You are most likely to see it following a fog, and if you are particularly fortunate, you may even see a cluster of several horizontal rainbows.

In the *Jounal of the Franklin Institute,* Dr. W. J. Humphreys, professor of meteorological physics at the U. S. Weather Bureau, describes the formation of these strange phenomena, and tells of two people who have seen them in clusters. The bow seems to be right on the surface of the water, and in the case of the cluster, one appears right behind another.

The cause, says Dr. Humphreys, is a layer of tiny droplets of water, resting on the surface of the body of water, but prevented from merging into it by a thin film of oil on the surface. The sun is in back of the observer, and the rays of light are refracted back to the eye by the tiny droplets of water on the surface, just as they are by the drops of water in the sky in the case of the usual rainbow. If the sun is overhead, the horizontal bow appears as a circle. If lower, it is an ellipse, surrounding the observer. If at an angle of 42 degrees above the horizon, it is a parabola, while at a lower angle of the sun it is a hyperbola. All of these curves are what the mathematician calls "conic sections," that is, the curves formed by the intersection of a plane with a cone.

The cluster of several bows is formed by reflections from the actual surface of the water, as the sheet of droplets may not be quite in contact with the water surface.

Science News-Letter, May 25, 1929

Student Experiments With Space

Psychology

Alice in Wonderland fell into a topsy-turvy world, but the world that Miss Jane Goldschmidt, of New York, a senior specializing in psychology at Smith College, has recently discovered with the aid of a pair of prism glasses, is almost as bewildering.

How would you like to reach for a glass of water and meet only empty space—to think straight doors were curved—or to see rainbows around the heads of all your friends? This is what happened to Miss Goldschmidt when she set out to investigate the habit of space perception.

Psychologists say that the ability to tell what objects are far away and what objects are nearby is a habit which must be acquired. In infancy the world seems only a confusing blur of color and line. Gradually, however, by reaching for things and in other ways, we learn to see the world in three dimensions, and thus form the habit of space perception.

Miss Goldschmidt decided to investigate the habit further. For three days she wore a pair of prism glasses which moved everything she saw to the left. Straight lines became curved, and everywhere light was bent or refracted as it passed through the prisms into rainbow bands of color. To this new situation, Miss Goldschmidt's old habits of space perception were poorly adapted. She reached for a pencil and felt only her desk. She walked towards a door and struck the wall. Soon, however, she began to form new habits, and could reach for things with hope of success. To learn to walk downstairs took longest of all, but in three days she was completely adjusted to her new world.

When she took off the glasses she had the same difficulties as when she had put them on. All the curves, errors, and bands of color were still present, but reversed. It took her a day and a half to feel at home again.

One of the most interesting results came when she touched a straight surface which, through the glasses, appeared curved. It felt curved as well. This seems to indicate the primacy of sight over touch—a point which has long been debated among psychologists.

This is the first time that the prism glasses experiment has been tried continuously, and Miss Goldschmidt's findings will soon be published. She intends to continue the study of psychology next year at Columbia University.

Science News-Letter, May 25, 1929

The recent finding of a skull and more than 10 bones of an armored dinosaur was the first discovery of this prehistoric monster within the United States.

Vaccine Fails in Cattle

Medicine

Unfavorable results were reported from one of the latest experiments made in this country with the Calmette vaccine against tuberculosis. This protective vaccine, developed by the French scientist, A. Calmette of the Pasteur Institute, has been the subject of heated controversy among scientists in this country and abroad. It was concluded from this latest experiment that the Calmette vaccine does not protect cattle which have been intimately exposed to tuberculous animals, reported the investigators, Dr. W. P. Larson of the University of Minnesota, S. J. Stanard, Commissioner of Agriculture, and W. A. Evans, at the meeting of the American Association of Immunologists.

Science News-Letter, May 25, 1929

Tree Rings—*Continued*

the rings in a remarkable manner. Various specimens were compared together ring by ring till identity was found in the distribution of large and small rings. This gave a continuous sequence of about one hundred rings.

"Other specimens were then compared, trees cut a little later or a little earlier; a part of each would tie in to the hundred rings already known and the remainder would extend the known sequence a little forward or backward as the case might be. In this way, little by little, the prehistoric sequence was extended until now it is 586 years long. In a similar way recent collections from inhabited villages of the Hopi Indians have extended our modern dated rings a century and one half back to the year 1260 A. D.

"Thus, at the present stage of this study, we have 670 years covered by modern rings accurately dated and 586 years represented by rings in the prehistoric sequence. Between these two series is a gap, probably not large, perhaps under 200 years, whose exact duration must be determined by specimens yet to be found. When this gap is filled, not only will we have a superb climatic and solar history of 1254 years, plus the extent of the gap, but also we shall secure a most interesting bit of human history from the rings of trees, for we shall then have the exact dates of buildings of thirty or more of those splendid prehistoric ruins already famous in Southwestern archaeology, and we may have a new clue to the prediction of floods and droughts."

Science News-Letter, May 25, 1929