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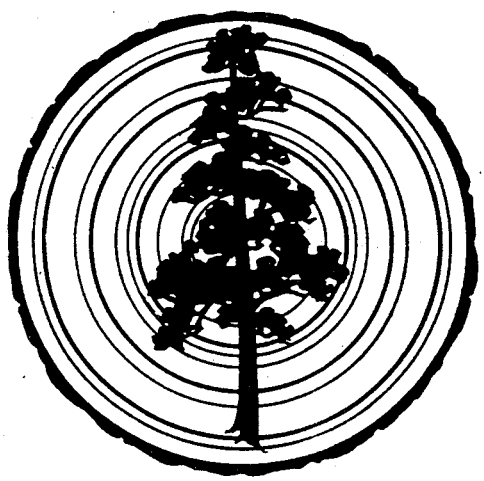

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INFORMATION

AUTHORS

The **Tree-Ring Bulletin** will appear four times a year and will publish papers which are the results of original research on tree rings in their relation to climatology, and to other subjects. No paper which has already appeared will be accepted.

Manuscripts should be typewritten in double spacing. The Editor reserves the privilege of returning to the author for revision approved manuscripts and illustrations which are not in the proper form for the printer.

In reporting tree-ring data authors are requested to submit their data in a table such as appears on the back page of this number. This will cut the cost of publication very greatly.

Until funds are available authors will be requested to pay the cost of illustration which may be line cuts or half-tones, but must be drawn or printed on white paper, and mounted with paste, not glue.

Each author will be given, free of charge, twenty-five copies of the Bulletin in which his article appears. Reprints may be procured at cost with or without covers if ordered at the time the galley proof is submitted.

Manuscripts and illustrations should be sent express prepaid or by registered mail to the Managing Editor, Dr. Harold S. Colton, Museum of Northern Arizona, Flagstaff, Arizona.

SUBSCRIBERS

Should recent subscribers wish to complete their files of Tree Ring Bulletin by beginning their subscription with July 1934, Vol. 1, No. 1, please advise the managing editor immediately and the back issues will be forwarded. Subscriptions received at any time up to July 1935 will be so considered if the subscriber requests.

Errata—On page 8, Vol. 1, No. 1, at the top of the table the eighth and ninth headings are confused and should read, "sap heart date," and "rings lost at outside," respectively.

ACCURACY IN DATING—I.

A. E. DOUGLASS

An important purpose of this Bulletin is to encourage a careful examination and report upon the essential features involved in dating and to place such information before other students working in the same field, for their aid or comment. To this end, the table on the last page has been arranged under various headings suggested by experience. We cannot yet be sure that it is in final form to give the best service.

Some features are so fundamental that they may be taken for granted in the table. For example, it is presumed that the tree rings are sensitive enough for dating purposes. This sometimes fails of recognition in one's early work. The tree ring chronology in its early days was derived from trees about five miles southwest of Flagstaff, Arizona, growing in favorable locations near Woody Mountain. Today we would call those rings "complacement, yet datable." We would add that such rings are safe and difficult rings to use in dating problems; safe, because double rings and missing rings in such records are very rare; and difficult because the rings are so much alike, one after another, that very small rings on which to base correct dating, are hard to find.

Fortunately a large proportion of the rings in prehistoric beams display superb dating qualities. The ancient pueblo Indians did much of their house building just outside the forest, at the lower edge, and sought their logs from the neighboring forest border, a part of the forest in which a vital struggle for moisture was unending. In such places, the variation in width from ring to ring is very conspicuous and double and false rings are more frequently encountered. Certain small rings are even absent in

some trees. The detection of doubles requires careful judgment, combined with the constant use of magnifying power of X40 to X60. The absence of a ring is discovered by comparing many specimens together, or by searching about the circuit of a section. In such rings well identified, the dating has the highest reliability.

All this is fundamental and constitutes the chief experience needed by the student in the identification of ring sequences. The best protection from error is "memory" dating: that is, going over a sequence until it is in the mind and then reviewing each specimen by memory. Thus the building of a local chronology may become more important than the dating of an individual piece, for it establishes the idiosincracies, if any, of that particular locality. A statement of the number of missing rings gives an index of the difficulties of obtaining that date. On the whole, the errors from these sources are rare and largely disappear when the date is actually established.

Up to the moment of reaching an actual date of the sequence, the work has been a study of individual rings. Now it approaches the liason zone between ring dating and archaeology and even climatology. The cutting date is desired by the archaeologist as desirable information regarding his ruins, and the age of the tree and its type of reaction by the student of climate. The weathering of logs and the breaking of charcoal interfere with reaching a true cutting date, more correctly called a "bark date," which mean simply the last growing year of the tree. Beams used in house structures for three or four centuries have lost part of their sapwood, and thus the final ring is not present. The loss may be gauged by taking the date of the beginning of the sapwood, that is, the sap-heart contact, and adding a correction for the probable total amount of the sapwood. This again is a somewhat varying quantity, and we need improved formulas for determining its amount. Extensive data have already been collected on this point. So, in the table of dates the sap-heart date is given when possible. A very important variable involved in the size of the sapwood is the mean ring size; hence in the table, data are supplied for computing this item.

The remaining factor that influences the estimation of cutting time is the loss of rings at the outside of the specimen. This can often be judged by the continuity of ring or rings around the outside circuit and hence it is important to know whether the specimen was a whole section or what fraction of a section, whether the outside was damaged, or the rings badly crowded, or if other conditions existed that made estimation of loss difficult.

Perhaps the most difficult cause for solution is the charcoal fragment. Here there is no sign of its sap-heart contact. If there is a good circuit, continuity of outside rings, that is, if the same identical ring can be traced around the circuit of the tree, then reason exists for estimating small loss, if any, at the outside. If the rings grow rapidly smaller at the outside, then there was probably little loss and the true date is not far off. The compensating feature in charcoal is the great number of pieces. Hence the value of "combing" a group thoroughly, and dating every possible piece, and then of plotting on a time scale the length of each ring series identified. Such a plot establishes relationship in time between fragments and points to approximate dates that have important value.

This, then, is the origin of the separate items in the table of dates. Filling in the table insures that the investigator has looked up and thought about these items which bear so heavily on accuracy in dating.

NECESSARY INFORMATION ON TREE-RING SPECIMENS FROM LIVING TREES

WALDO S. GLOCK

Tree-ring specimens attain their highest value for climatic and ecologic purposes when they are accompanied by complete notes on location, facts concerning the tree, soil, topography, and plant relations. It is not at all uncommon to find that the climatic value of an excellent specimen has been seriously vitiated by the lack of adequate notes descriptive of the immediate surroundings of the tree during its growth.

The appended outline is printed by way of suggestion to serve as a guide to those people who so kindly send us many valuable specimens and to indicate to tree-ring workers the nature of the information essential to climatic and ecologic studies. Specimens accompanied by complete notes, no matter by whom collected, may prove of surprising worth and the Tree-Ring Laboratory at Tucson is always deeply grateful for any materials sent to it.

Numbers 1 to 19 constitute field notes in the main and must necessarily be made at the time the collection is secured. Numbers 20 to 25 are essentially the result of laboratory study which may be carried on equally well at any time. The entire list, numbers 1 to 25, comprises the information greatly to be desired for catalog purposes in the Tree-Ring Laboratory.

1. Specimen Number. 2. Date. 3. Species.
4. Geographical location.
5. Type of specimen (i.e. increment core, boring, V-cut, square-cut, section).
6. Condition of tree.
7. Diameter of tree (parallel to direction of specimen).
8. Height above base of tree.
9. Direction of taking specimen (1. Compass. 2. Relation to slope).
10. Topography (General. Specific for specimen).
11. Altitude (Above sea. In relation to surroundings).
12. Drainage lines.
    1. Permanent or intermittent.
    2. Relation of tree to drainage lines and height of tree above drainage line.
13. Soil (Nature, Depth, Porosity).
14. Bedrock (Type, Dip, Proximity to surface).
15. Relation to surrounding trees and vegetation.
16. Date of last ring.
17. Purpose of collection.
18. Photographs (General area. Individual tree or stump).
19. Collector.
20.* Approximate number of rings.
21. Number of sap rings.
22. Total width of sapwood in centimeters.
23. Type of ring growth (Complacent, Sensitive, etc.).
24. Average ring size.
25. Nature of specimen (Injured. Whole. Reaches center, etc.).

*Numbers 20 to 25 to be added in the laboratory for catalog purposes.

CLIMATE AND HUMAN HISTORY

EMIL W. HAURY

The cause and effect of the movements of people is always a fertile field for speculation. Where chronological factors are lacking, explanations may be very difficult to set forth and, whether right or wrong, their worth depends solely upon the limits imposed by the facts. Our knowledge of population shifts in the Southwest has come largely through a penetrating study of material culture, particularly ceramics, but we see in the main only the effects of such moves. The cause—or causes—on the other hand, arem ore obscure and hence more difficult to explain; yet the determination of the cause may be more important to one's study than the outcome.

The student of the Southwest has come into possession of means, through tree ring researches, that contribute materially to any such an explanation. These are, first, a reliable chronological element that assists in bringing the observed phenomena into proper alignment and, secondly, a weather record of the past 1500 years which, if properly read, may shed light on human activity.

Some of the most outstanding shifts of Southwestern people took place a few centuries before 1540 A. D.—towards the close of the thiro and during the early part of the fourth stage of Puebloan development. These movements may be roughly dated as having occurred between A. D. 1250 and 1350.

In northeastern Arizona, particularly in the Kayenta district, the bark dates of beams used in the construction of houses ending a long occupation carry readings that fall well into the last decades of the 1200's, the most recent being 1284 from Kietsiel (1). Numerous dates have been obtained (2) for the earlier part of this century and for the preceding centuries, indicating a more or less continuous progress in building. Then, with the lack of dates after 1284, a rather abrupt cessation of building is implied and, with it, a desertion of the immediate area. Going east, we find similar conditions prevailing on the Mesa Verde where, after about 1275, houses were no longer built in the protecting cliff recesses, and it is to be rightly inferred again that there was a general exodus from the Mesa Verde even if only by the remnants of a culture which may have reached its height some time before.

On coming south from the two regions just mentioned, large ruins appear which carry dates well into the 1300's and 1400's. To cite but a few as examples, there are Kawaiku, Kokopnyama, Chaves Pass, Showlow, and Pinedale ruins. It is not to be denied that many, if not all, of these larger villages had beginnings which antedated the quick discontinuance of building activity in the north, but thereafter there was a tendency to centralize in larger and more closely knit communities in those regions not affected by withdrawal. Passing still further south into east-central Arizona below the Mogollon Rim, we find an extensive territory of rugged land, well watered, and offering much in the way of natural protection to cliff dwellers, but little in the way of arable land. In this region large surface pueblos and cliff houses occur in abundance, and they are all late. The last assignable dates in each of the thirteen ruins in the Sierra Ancha region range between 1308 and 1348, and the earliest dated log from this series of sites is 1248. Of an aggregate of 73 bark dates, only ten come before 1300, the remainder falling between 1300 and 1348 (3). This is to say that, while building activity began here before 1300, the real expansion did not come until after the turn of the century.

At approximately this time, an increment of the Pueblo people—the Saladoans—who were allied to those in the Sierra Ancha started a southward and westward movement which took them to the southern limits of Arizona and brought them into intimate contact with the Hohokam whose focus lay in the Gila Basin. Tree ring dates from ruins representing this period of mingling have not been obtained, yet, on ceramic grounds, it is clear that this southwesterly expansion was bound up with the trends already outlined for the north.

Over a territory some 300 miles in length this major disturbance took place, the thrust being to the south. As a cause for setting this in motion a number of possibilities may be adduced, such as the appearance of hostile neighbors to the north, search for better lands, local unrest begun by one or several forces. There is one potential cause intimately connected with tree ring studies which merits attention. This is a period beginning in 1276 and lasting for the remainder of the century when there was less rainfall than during the preceding and succeeding years. The effects of this dry cycle are to be traced in logs from southwestern Colorado in a southerly direction through central Arizona. If the greatest diminution in the ring size over this period indicates the most acute drought conditions, then this prevailed in the northern part of the area, precisely where we saw that building activity came to a close first. And this, it is clear, was within a few years after the dry cycle began. Beginning about this time and lasting into the early part of the 1300's, people living in the drainage of the Little Colorado drifted into the well-watered territory below the Mogollon Rim which, previous to this time, had but a sparse population; other people, in turn, pushed still further to the south and west into desert lands. Why they should elect to make this move in the face of a dry period may be difficult to explain, yet two possibilities suggest themselves: first, that they were being crowded by the thrust of their northern neighbors, and, secondly, that they were attracted by the resident Hohokam, who, owing to their mastery of the land by irrigation, were able to combat the effects of years lean in moisture and to maintain a food supply.

The centralization of people in large communities after 1300, as evidenced by the Jeddito Valley ruins, Chaves Pass, Kinishba, and others, and the effort to place homes in inaccessible places, as in the Sierra Ancha, introduced another factor that may be linked with this chain of happenings. Could it be shown that the drought extended far beyond the territory now recognized, i.e., northward, to cover some of the area occupied by nomads, it would not be difficult to imagine the unbalancing effect that it would have had upon a people dependent upon the chase. Their wider search for food would ultimately lead them to the well-built houses of the Pueblos. Added to the existing crisis, this made it increasingly difficult for the Pueblos to live where they were, and desertion seems to have been the course they followed.

It is, of course, not possible to declare, at this time, that the drought was the main cause for what has been briefly outlined. So closely, however, are the phenomena related chronologically that an entire independence is difficult to imagine, and it does not seem that crucial periods in both weather and Pueblo history should occur simultaneously through coincidence. A larger number of dated ruins and a checking of the evidence for movements or other significant events will doubtless help to determine how

far reaching the effects of the drought were on the Pueblo people.

(1) Douglass, A. E., 1929. The Secret of the Southwest Solved by Talkative Tree Rings. National Geographic Magazine, Vol. LVI, No. 6, pp. 737-770. Washington, 1929.
(2) McGregor. J. C., 1934. Dates from Tsegi. Tree Ring Bulletin, Vol. 1, No. 1, pp. 6-8. Flagstaff, 1934.
(3) Haury, E. W., 1934. The Canyon Creek Ruin and the Cliff Dwellings of the Sierra Ancha. Medallion Papers No. XIV, p. 17. Globe, 1934.

REPORT OF DATES ON THE ALLANTOWN, ARIZONA, RUINS

CARL F. MILLER, JR.

A number of structures were excavated near Allantown, Arizona, during the summers of 1931 and 1932 by Dr. Frank H. H. Roberts, Jr., of the Bureau of American Ethnology, Smithsonian Institution. Charcoal specimens only were secured from these structures, 195 in 1931 and 322 in 1932. These are given a group symbol FR, (Frank Roberts), followed by the number of the piece, e.g.. FR 320. The majority of specimens were pinon with a few specimens of juniper and Douglas fir.

House 4 32, in Dr. Robert's series, was one in a group of four houses. This was a round pit-house, which had such features of a kiva, as ventilator, deflector, sipapu and banquette, but contained large cooking pots, metates, and other vessels belonging to living quarters.

It is believed to belong to that phase of culture known as early Pueblo I. This culture identity is based on the presence of a ware known as fugitive-red ware, as the red pigment which is placed on the outside of vessels, is easily rubbed off and have never been fired to make it a permanent feature of the vessel; also on the presence of a black-on-white ware showing Chaco influence, and globular pitchers having their handles flush with their lips, and a few pitchers with banded necks; and lastly on the absence of any black-on-red or polychrome ware. A gray granulated pottery was also found there, very irregular in shape and possessing very crude attempts at decoration; this is a type best attributed to the Basket-Maker III and is very similar to that found by Dr. Roberts, (1928), in southwestern Colorado.

The dates secured from charred roof beams, in this structure, were worked out by the writer using the Douglass method of tree-ring dating, (1), and fully checked by Dr. A. E. Douglass. Special attention is called to FR 94 whose outermost ring can be traced over half a circuit, without disappearing. This is strong evidence that we have here the true outside surface of this piece, and the date of its actual cutting.

A second and later chronology was found in Kiva 32 G which was located about a mile up the wash from House 1 22. It is associated with a unit-type house of the Pueblo II culture period. This unit-type house consists of six rooms, all joined, and a large paved court with the kiva. The kiva is located north of the court and east of the house. Kiva 32 G was a true kiva as shown by the absence of metates and cooking pots and the presence of paraphernalia used in sacred ceremonies. The roof of this structure was very similar to that shown in an illustration by Dr. Frank Roberts.(2)

In this ruin there was found a black-on-red ware and the first beginning of a polychrome ware. Pottery shapes had assumed the characteristic shapes attributed to Pueblo II culture and technique of decoration was approaching a masterly stroke.

The dates secured from roof timbers of this structure were also

worked out by the Douglass method and fully checked by Dr. A. E. Douglass.

I take this opportunity to thank Dr. Frank H. H. Roberts and Dr. A. E. Douglass for looking over this paper.

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(1) Glock, Waldo S., Tree-ring analysis on Douglass System. Pan-American Geologist, Vol. LX, Aug., 1933.

(2) "Early Pueblo Ruins in the Piedra District Southwestern Colorado," p. 44. Bull. 96, B.A.E., 1930, Roberts, Frank H. H.

Site	Piece Number	Outside Dated Ring	Inside Dated Ring	Approx. Radial Line in MM	Kind of Wood	Type of Specimen	Sap Heart Date	Rings Lost at Outside	Rings Absent Within Sequence	Estimated Bark Date
Allantown House 4/32	FR 83	852	812	30	Pnn	chcl fgr		5	0	857 ± 5
	FR 94	858	749	60	Pnn	chcl ½Sec		0	0	858 ± 0
	FR 119	868	808	45	Pnn	chcl fgr		Prob. 20	0	888 ± 15
	FR 133	881	763	41	Pnn	chcl fgr		0 to 10	0	886 ± 5
Kiva 32 G	FR 150	959	874	74	Pnn	chcl fgr		Poss. 40	0	995 ± 15
	FR 240	974	876	79	Pnn	chcl fgr		Poss. 20	0	994 ± 20
	FR 313	975	870	83	Pnn	chcl fgr		Poss. 20	0	995 ± 10
	FR 245	999	900	88	Pnn	chcl		Poss. 5	0	1004 ± 5
Allantown Kiva 32 G	FR 246	993	867	87	Pnn	chcl fgr		Poss. 10	0	1000 ± 7
	FR 308	1011	874	83	Pnn	chcl fgr		Poss. 0	0	1011 ± 2

Pnn—pinon, chcl—charcoal, fgr—fragment.