TREE-RING
BULLETIN

VOL. 24 JANUARY, 1962 NOS. 1-2

CONTENTS

PUBLISHED BY THE TREE-RING SOCIETY
with the cooperation of
THE LABORATORY OF TREE-RING RESEARCH
UNIVERSITY OF ARIZONA

Subscription $2.00 per Volume

Manuscripts and inquiries should be directed to the Laboratory of Tree-Ring Research, University of Arizona, Tucson, Arizona.

EDITORIAL

The Tree-Ring Society is planning a full schedule of events in connection with the 27th Annual Meeting of the Society for American Archaeology which will be held on the campus of the University of Arizona in Tucson, May 3, 4, 5, 1962. On the morning of May 5, our Society is sponsoring a symposium on tree-ring dating. As presently conceived, an informal panel will discuss a variety of subjects including a survey of tree-ring dating throughout the world, new techniques in the collection and analysis of materials, future prospects of expanded activities, the training of dendrochronologists, and new applications of tree-ring data. Audience participation will be encouraged and it is expected that free discussion will make this session of value to all. After the symposium, the Tree-Ring Society will sponsor a luncheon, followed by a business meeting with President John C. Mc.Gregor presiding. In the afternoon an open house in the Laboratory of Tree-Ring Research will give delegates a chance to inspect the Laboratory's facilities and to view its current research projects. It is earnestly hoped that all Tree-Ring Society members, both with and without archaeological backgrounds, will take advantage of the unusual opportunities afforded and will plan to attend the symposium, the luncheon, and the open house.

Regular publication of the *Bulletin* is obviously still a problem and the cause remains the same—lack of manuscripts. Although the situation seems to be slowly improving (we optimistically forecast release of Nos. 3-4 of this Volume sometime this spring) there nevertheless exists a continuing need for publishable material and we once again urge Society members and their colleagues to submit tree-ring research papers to us. Because of the *Bulletin's* delayed deadlines, confusion has arisen in regard to the accounts of certain subscribers. To correct this condition, individualized statements will be sent to all members shortly after the mailing of this issue.

B. B.

TREE-RING DATES FOR CUTTING ACTIVITY AT THE CHARCOAL KILNS, PANAMINT MOUNTAINS, CALIFORNIA*

C. W. FERGUSON and R. A. WRIGHT

ABSTRACT

Growth-ring studies were made on material from 28 pinyon *(Pinus monophylla)* stumps, cut in the late 1800's, near Charcoal Kilns, Panamint Mountains, Death Valley National Monument, California. Comparative material for tree-ring dating of the stumps consisted of increment borings from adjacent pinyon, limber pine *(Pinus flexilis)*, and bristlecone pine *(Pinus aristata)*; and from cross sections of two recently cut pinyon stumps and of numerous stems of big sagebrush *(Artemisia tridentata)*. Cutting in the period 1876-1879 is indicated by tree-ring dating for 26 trees presumed to have been utilized as material for the nearby Charcoal Kilns.

In the latter half of the nineteenth century, considerable woodcutting was carried on in the Wildrose Canyon area of the Panamint Mountains, Death Valley National Monument, California (Wallace and Taylor 1955). A settlement was established around Charcoal Kilns where charcoal was prepared for the Modoc Smelter. According to information posted at the Charcoal Kilns by the National Monument staff (M. H. Ryan, personal communication):

> These kilns were built in the late 1860's or early 1870's to supply charcoal for the Modock Smelter nearly 30 miles away in the mountains west of Panamint Valley. At that time charcoal was by far the best and cheapest ore-reducing fuel available in this remote area.
>
> Three hundred men are said to have been employed here felling pinyon pine and juniper and firing it in the kilns. The wood was cut into four-foot lengths and then hauled to the kilns on crude drag sleds.

Known literature contained no exact references to the time of cutting activities in the Charcoal Kilns area, and this lack prompted an investigation to determine the possibility of dating the lumbering by tree-ring studies of the stumps. The basis for such dating was provided by dendrochronological studies in the immediate vicinity. Tree-ring studies of the bristlecone pine *(Pinus aristata)* in the Panamint Mountains were made by Schulman and Ferguson (Schulman 1956, Appendix C). Substantiating collections were made of limber pine *(Pinus flexilis)* and pinyon *(Pinus monophylla)*. Big sagebrush *(Artemisia tridentata)* from three sites in the Panamint Mountains was collected and dated by Ferguson (1960). The main comparative chronology for the dating of big sagebrush was provided by a mean ring record of thirteen trees consisting of four bristlecone pines, two limber pines, and four pinyons from the Panamint Mountains and two bristlecone pines and one limber pine from the White Mountains, 120 miles to the northwest (unpublished data on file in the Laboratory of Tree-Ring Research; Ferguson 1960). Additional comparative material was provided by the chronology for bigcone spruce *(Pseudotsuga macrocarpa)* in southern California (Schulman 1956).

Both pinyon and Utah juniper *(Juniperus osteosperma)* occur in the vicinity of the kilns. Stumps of these species are easily differentiated by the more resinous nature of the pinyon and by the lobed form of the juniper with its shreddy bark still retained in protected crevices. The pinyon was considered to be the potentially more usable species, and, in 1958, segments were collected from eight stumps on the slope immediately west of Thorndike Camp in the upper reaches of Wildrose Canyon at an

*Arizona Agricultural Experiment Station Journal Article No. 681. Research supported by National Science Foundation Grant G-5568 and conducted with the cooperation of the Laboratory of Tree-Ring Research, University of Arizona, Tucson, and the Death Valley National Monument. All specimens mentioned in this report are on deposit at the Laboratory of Tree-Ring Research.

elevation of 7,450 feet and about one mile by road south of the kilns (T19S, R45W, S35, Telescope Peak Quadrangle, Inyo County, California, 15-minute Series, U. S. Geological Survey, 1952). The pieces of the stumps ranged from four to ten centimeters in width and contained from 168 to 257 years of tree-ring record, a series of sufficient length to establish their dates despite the fact that in no instance did a segment contain the total radius. Ages of 400 years were indicated by the size of the stumps and by ages shown by cores from adjacent trees. Cross sections were prepared for examination by sanding with a belt sander. Critical areas, near the outside, were surfaced with a razor blade.

Initial examination of the ring series showed inconclusive crossdating throughout the ring sequence. The problem of interpreting micro-ring features characteristic of pinyon growing at the lower limits of its range made crossdating of the eight specimens apparently impossible. Comparable difficulty occurred with the cores from adjacent living trees. When it seemed evident that many annual growth rings were missing in the pinyon material from the Thorndike Camp area, an answer was sought through cores taken from pinyon near Mahogany Flat, 700 feet higher and a half mile south of Thorndike Camp. Four cores, collected near Mahogany Flat by Ferguson on July 9 and 12, 1955, had been dated by Schulman. Innermost ring years, averaging an estimated fifty years from the pith, were 1548, 1561, 1564, and 1632. These four cores, from pinyon of the same age class and lacking a growth trend, were measured and the absolute rather than standardized values were averaged to form a mean of four from 1700 to 1954 (Table 1). This chronology provided a control for the dating of the cores and stump sections from the Thorndike Camp area. Secondary controls were provided by chronologies of bristlecone and limber pines from the 10,000-foot zone and of big sagebrush from various sites between 6,800 and 9,600 feet.

TABLE 1. Mean ring widths: *Pinus monophylla,* four 400-year-old trees; Mahogany Flat, Panamint Mountains, California; tabulated in hundredths of a millimeter.

A.D.	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1700	81	59	72	16	40	59	51	10	34	53
1710	57	74	57	20	51	51	09	55	73	87
1720	85	68	38	50	72	56	83	87	15	24
1730	37	44	45	51	71	22	56	38	57	41
1740	66	63	55	91	75	107	82	73	43	39
1750	64	40	11	18	10	36	41	22	66	65
1760	83	73	97	73	86	43	89	75	103	92
1770	63	72	54	29	56	85	57	22	58	56
1780	61	70	17	72	97	63	69	75	43	92
1790	74	87	76	64	41	03	41	76	52	70
1800	50	64	75	76	67	25	83	57	83	90
1810	94	104	76	23	50	65	75	87	96	74
1820	38	103	38	37	45	68	69	47	70	29
1830	54	69	94	72	58	28	38	81	98	68
1840	58	28	23	06	32	07	43	13	66	81
1850	84	44	100	85	64	76	06	01	34	41
1860	42	59	66	45	15	36	57	83	98	57
1870	54	56	38	47	78	53	55	38	46	55
1880	42	34	27	21	34	41	35	43	53	41
1890	53	56	46	48	31	59	34	52	16	13
1900	37	76	45	54	23	71	62	63	79	64
1910	51	60	61	42	61	46	70	55	52	50
1920	55	69	64	39	83	38	73	92	61	37
1930	60	45	49	52	50	54	20	58	51	63
1940	64	50	68	71	53	52	83	64	41	61
1950	41	36	53	22	53					

Plotted ring measurements for each of the eight specimens from pinyon stumps are shown in Figure 1 in comparison with the derived mean of eight, the mean of four pinyon cores from Mahogany Flat, and a single specimen of big sagebrush from below Arcane Meadows, which is one and three-quarters miles southwest of Mahogany Flat and 1,200 feet higher. Agreement between all series is good and in no instance do all eight stump specimens indicate a missing ring for the same year. The breadth of material provided an absolute value for many rings that would have been absent on any given radius. Years of minimum growth, critical for dating, are 1773, 1782, 1795, 1805, 1807, 1809, 1813, 1820, 1822, 1823, 1824, 1829, 1835, 1836, 1843, 1845, 1847, 1851, 1856, 1857, and 1858. The ring for 1857 was present on only one specimen, PAN-3. The rings for 1856 and 1858 are often absent and, when present, may vary in relative width about the circuit. The ring for 1866 is of variable width. In the faster growing, more open series, it is of average width, often equal to or greater than the adjacent rings for 1865 and 1867. In contrast, 1866 in a closely compacted ring series is often a microscopic or missing ring.

Bark was not present on any of the eight stump specimens, but evidence that the outermost growth layers had not been noticeably eroded consisted of isolated, eroded lands amid extensive beetle galleries and passageways characteristically formed under the bark of dead trees. Beetle damage was present on specimens PAN-1, -2, -3, -4, and -5. The plotted series in Figure 1 do not include the outermost ring when growth was incomplete. Natural erosion of the wood, combined with beetle damage, in several cases nearly removed all positive evidence of a definite outer ring. This necessitated an intensive search for the outermost ring on each specimen. Dates for the outermost ring year are listed in Table 2. These dates are supplemented by material collected later and described below.

Weight (1960) described the Modoc Mine, for which the charcoal was prepared, as struck in 1875. Birnie (1876; 287-8) examined the mineral resources of the Lookout district in August, 1875, and stated that the district, including the Modoc, was discovered in May, 1875, and that it had been worked since its organization in July. Oliver Roberts de la Fontaine (1931), in his personal recollections, described activities in the Argus and Panamint Mountains. He mentioned visits to the charcoal camps in Wildrose Canyon, although he did not describe the beehive-shaped kilns as such. No actual dates were cited, but 1874 and 1875 were inferred.

The enigma presented by the assumed loss, due to erosion, of even one or two of the last-formed rings in the Thorndike Camp specimens, the high percentage of locally absent and missing rings following 1840, and the indirect evidence in the literature prompted the collection of material from more extensive areas. On September 2 and 3, 1961, outer portions were collected from nine pinyon stumps immediately west of the charcoal kilns, five pinyon and one juniper from the slope to the east of the kilns, and six pinyon from the north slope just below Mahogany Flat.

Experience with the earlier collection indicated that even an apparently smooth outer surface, presumably formerly covered with bark, may have suffered sufficient erosion to remove all or a portion of the outermost two or three rings. Hence, a search was made for stumps with uneroded outer surfaces or with bark attached. It was found that some stumps, their roots destroyed by termites, had fallen over or even had been washed down slope. Under these conditions the under surfaces were protected, either by the overlying stump or by rocks and soil that had washed against them.

Additional evidence was sought through cross sections from two trees, growing at slightly over 8,100 feet, removed in June, 1959, during the construction of the Rogers Peak access road from Mahogany Flat. The full

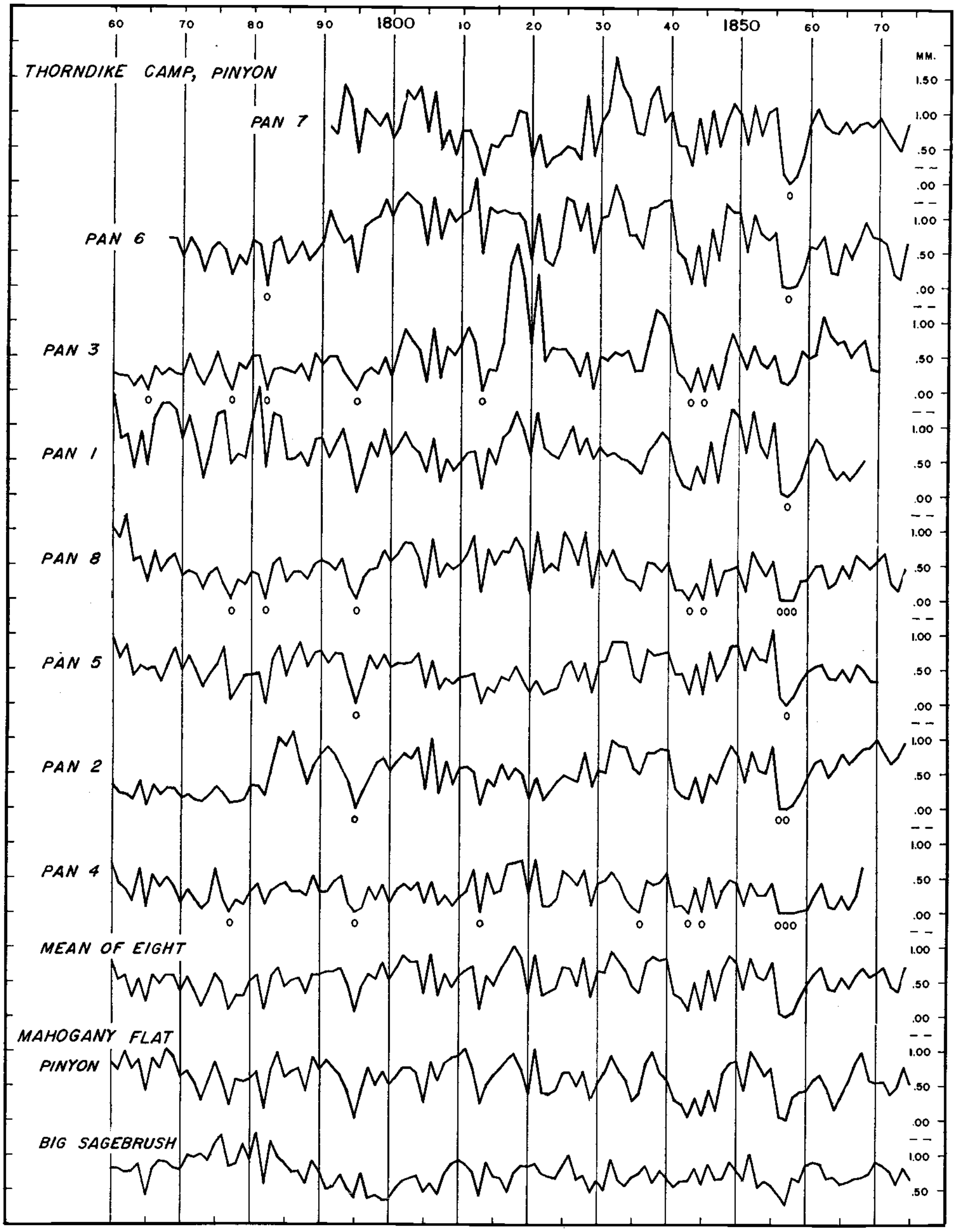

FIG. 1. Plots of measured ring widths for eight pinyon stumps from near Thorndike Camp; a mean of the eight; a mean of four from living pinyon in Mahogany Flat; and of a single specimen of big sagebrush from Arcane Meadows, above Mahogany Flat. Ring widths are expressed in hundredths of a millimeter and are plotted on a vertical scale of 50 millimeters to one centimeter. The "o" symbol indicates a ring missing on the specimen.

TABLE 2. Outermost ring year for material from stumps in the Charcoal Kilns area.

Specimen (PAN)	*Outermost ring year*	*Comments**
Mahogany Flat		
24	1879	Incomplete; galleries
25	1876	Incomplete; galleries; eroded
29	1876	Complete; galleries
28	1869	Incomplete; galleries; eroded; possible absences
26	1867	Incomplete; galleries; eroded; many absences
27		Dated from 1722 to 1840; too many absences following 1840 to date with certainty
Thorndike Camp		
6	1875	Incomplete; eroded
7	1875	Incomplete; eroded
8	1874	Complete; eroded
2	1873	Incomplete; galleries; eroded
5	1871	Incomplete; galleries; eroded
3	1870	Complete; galleries; eroded
1	1869	Incomplete; galleries; eroded
4	1869	Incomplete; galleries; eroded
Charcoal Kilns, west		
9	1878	Complete; bark attached
16	1878	Complete
10	1876	Complete; galleries
17	1876	Complete; galleries
11	1876	Incomplete; eroded
14	1876	Incomplete; galleries; eroded
12	1874	Complete; eroded; many absences after 1840
13	1872	Incomplete; galleries; eroded
15		Not dated; many absences; resinous; bark attached; galleries
Charcoal Kilns, east		
21	1907	Complete; bark attached
19	1876	Complete; bark attached; galleries
20	1876	Complete; bark attached; many absences after 1850
22	1872	Complete; galleries; eroded
18	1868	Complete; bark attached; galleries
23		Not dated; juniper

*Complete: latewood formed and apparently complete.
Incomplete: latewood of the outermost ring either eroded or not formed.
Galleries: presence of galleries and passageways, formed by bark beetles under the bark of dead or dying trees, on the outer surface of the wood.
Eroded: major portions of the outer surface noticeably eroded by weather; probable loss of one or more rings.

cross sections, collected by M. H. Ryan, were polished to permit the examination of each growth layer completely about the circuit. The larger specimen, 34 centimeters in diameter, had a pith year of 1801. The smaller specimen, 27.5 centimeters in diameter, had a long radius, containing much compression wood, of 18 centimeters. The smaller specimen was much slower growing and had a pith year of about 1650.

In both cross sections, two small rings were present for what had been thought to be 1856 and 1857 in the kilns stumps. Between these two small rings, barely perceptible under a ten-power hand lens, was found an extremely small and locally absent ring for 1857. In the large cross sections the ring for 1862 was larger than average. The addition of 1857 to the chronology of the stump specimens, plus possibly either 1856 or 1858, placed the large ring, previously thought to be 1860 in many specimens, at 1862. This compounded the dating problem in that, in some specimens, three consecutive rings were missing: those for 1856, 1857, and 1858. Evaluation of the present collection suggests a small ring for 1858 in contrast to that in the Schulman chronology.

The plots in Figure 1 and the two modern cross sections were used to date the additional kilns collection. Visual examination, aided by a high degree of familiarity with the short time period involved, permitted the dating of 18 of the 20 pinyon specimens (Table 2). Pinyon specimens for which outer ring years were not reported (PAN-15 and -27) had ring series made difficult by the number of missing rings and by a heavy impregnation of the wood by resin. Portions of the ring sequence dated, indicating a general contemporaneity with the other dates, but the number of missing rings and the presence of resin made dating in the outer decades difficult, if not impossible. The only juniper collected (PAN-23) was not evaluated because of the lack of comparative material.

One specimen (PAN-19) was taken from the fairly extensive cribbing of a hand-constructed road which utilized trees and large limbs of both pinyon and juniper. A bark date of 1878 provides a strong indication that the road was built as a component part of the kilns activity.

An early bark date, 1868 in PAN-18, was from a cut trunk, with some bark still attached, surrounded by living branches arising from below the cut. The form of the cross section indicated that the bark-covered area may have been dead when the trunk was cut. An adjacent eroded surface over an area of expanded rings may have contained growth following 1868. Only the date of 1909 is out of phase with the bulk of the kilns material. Perhaps this noticeably later cutting date may be explained by the presence of a nearby Paiute camp occupied until the late 1930's (Wallace and Taylor 1955).

The two cross sections cut in 1959 showed an open sequence from 1859 to 1876. The width of the eight-year sequence from 1877 to 1884 was less than the average width for a single ring in the previous eighteen years. In that the kilns specimens were at elevations below the site where the two cross sections were secured, radial growth of these lower elevation trees may not have occurred in some of the years in the period 1877-1884. Hence, if trees were cut after 1876, growth rings for these years may not be found, even on bark-covered specimens.

The chronology of all specimens is easily identified in the 1677-1855 period. It is the difficulty and uncertainty of the post-1855 sequence that offers major problems in the correct determination of the cutting date. The present data are not conclusive, because of the possibility of even slight erosion of the outer surface and of the inferred absence of growth rings for 1877 and 1878 in most of the specimens. It would seem, however, that the presence of the ring for 1878 in two specimens from a site immediately adjoining the kilns and for 1879 in a Mahogany Flat specimen would indicate cutting in the area in 1878 rather than in 1876 as suggested by the bulk of the specimens.

In summary, a tree-ring chronology for pinyon in the Charcoal Kilns area has been established. Identification of individual years in the growth-ring sequence is progressively more difficult toward the lower elevational limits of the species, due to the high frequency of occurrence of locally absent and missing rings. Growth-ring studies of material from 28 pinyon stumps near Charcoal Kilns, Thorndike Camp, and Mahogany Flat indicate cutting in the period 1876-1879 for trees presumed to have been utilized as material for the nearby kilns.

Birnie, Rogers, Jr.
1876 Report on Lookout District, California. In *Report of the Secretary of War,* 1876. Vol. 2, Part 3.

De la Fontaine, Oliver Roberts
1931 *The Great Understander.* Compiled and published by William W. Walter, Aurora, Illinois.

FERGUSON, C. W.
1960 Annual Rings in Big Sagebrush, *Artemisia tridentata*. Doctoral dissertation, University of Arizona, Tucson. (L.C. Card No. Mic 60-1585, University Microfilms, Ann Arbor, Michigan).

SCHULMAN, EDMUND
1956 *Dendroclimatic Changes in Semiarid America*. The University of Arizona Press, Tucson.

WALLACE, W. J., and E. S. TAYLOR
1955 Archaeology of Wildrose Canyon, Death Valley National Monument. *American Antiquity*, Vol. 20, No. 4, pp. 355-67.

WEIGHT, HAROLD O.
1960 A Summer Visit to the Panamints. *Desert Magazine*, Vol. 23, No. 7, pp. 8-9, 25-8.

University of Arizona
Tucson, Arizona

THE RELEVANCE OF DENDROGRAPHIC STUDIES TO TREE-RING RESEARCH*

HAROLD C. FRITTS

ABSTRACT

The annual increment growth measured by dendrographs on three different species is essentially a linear function of tree-ring width. The bark increment remains more or less constant. Records from dendrographs can therefore be employed in studying the environmental and physiological determinants of ring width.

During the past several years the author has been engaged in studies of daily tree growth. Dendrographs (Fritts and Fritts 1955) which were mounted on individual trees were used to record the daily range in size of each tree at a single radius. The dendrograph records were converted to daily growth by employing the equation $G = m_i - m_{pi}$ where G is growth, only when positive, m_i the maximum size for day i, and m_{pi} the maximum size obtained during any day preceding i. Changes occurring when the radial measurement is less than the previous maximum size are recorded as zero growth, so that all values represent only "new" increment and thus can be summed to provide a measure of the total increment. Such a definition is based upon the principle that new cell enlargement occurs only when the tissues are full of water and turgor pressure is high. Thus a series of positive daily growth increments is obtained which can be analyzed in terms of current environmental factors (Fritts 1958, 1960a) or summed up to provide the total annual increment.

However, the dendrograph measures changes in both the bark and xylem areas. This study is an attempt to determine what portion of the year's radial increment as measured by dendrographs can be ascribed to the xylem increment represented by the annual ring width.

Methods and results. The opportunity for this study was afforded by the termination of growth studies on six dominant forest trees near Charleston, Illinois, at the end of the 1960 growing season (Fritts 1959, 1960b). The dendrographs had been on two white oaks *(Quercus alba L.)* and a sugar maple *(Acer saccharum Marsh.)* for four years and on a second sugar maple and two red oaks *(Q. ruba L.)* for three years. A seventh dendrograph

*This study was partially supported by The American Philosophical Society, Grant No. 272—Johnson Fund.

had been mounted for the last growing season on a second radius of one of the white oaks.

When dendrographs were removed from each tree, increment cores were extracted from the measured radius and immediately glued into grooved boards. Several months later, each mounted core was soaked in distilled water for several days until there was no measurable imbibitional swelling during a 24 hour period. Each ring was measured three times and the measurements averaged. The annual ring widths and the corresponding season's increment, as determined from the dendrograph records, are included in Table 1.

TABLE 1. Ring widths in inches and the total year's increment measured with a dendrograph.

Source of Measure	*Year*				
	1957	*1958*	*1959*	*1960*	
White Oak					
1 Ring Width	.074	.107	.068	.086	
Dendrograph Measure	.082	.124	.073	.113	
2 Ring Width	.146	.147	.082	.166	.116
Dendrograph Measure	.150	.141	.083	.172	.121
Red Oak					
1 Ring Width	......	.062	.066	.066	
Dendrograph Measure	......	.071	.076	.071	
2 Ring Width	......	.086	.124	.141	
Dendrograph Measure	......	.099	.131	.153	
Sugar Maple					
1 Ring Width	......	.102	.055	.068	
Dendrograph Measure	......	.108	.051	.075	
2 Ring Width	.043	.083	.048	.045	
Dendrograph Measure	.077	.103	.057	.053	

An analysis of covariance (Snedecor 1956: 394-9) was undertaken to determine the differences existing in the relationships between radial growth and ring width for the three species (Table 2). No significant differences were apparent in either the regression coefficients or the adjusted means, but the deviation from regression was significantly higher for the white oaks and sugar maples (p. = .05). The sugar maple data exhibited the lowest regression coefficient and the highest mean deviation from regression. The common regression line (Table 2) is plotted with the data in Figure 1. The regression equation for the total sample (Table 2) is $Y = 1.005x - 0.0097$ inch, and the correlation coefficient is 0.968.

TABLE 2. Analysis of covariance for ring width as a function of increment measured with dendrograph.

Source of Variation	*b*	*df*	*Deviation from Regression*	*Mean Square*
White Oak	1.025	7	716	102.3
Red Oak	0.969	4	40	10.0
Sugar Maple	0.817	5	773	154.6
Within		16	1529	95.6
Regression Coefficient		2	105	52.5
Common	0.970	18	1634	90.8
Adjusted Means		2	75	37.5
Total	1.005	20	1709	

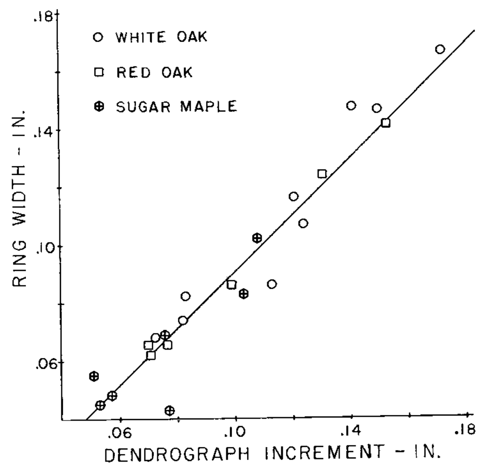

FIG. 1. A plot of the data and the common regression line for ring width as a function of increment measured with dendrograph.

Discussion. These data demonstrate that the dendrograph measure can essentially account for the variation in ring width. The square of the correlation coefficient indicates that only six percent of the variance is unaccounted for. There is approximately a 1:1 ratio, plus a constant of 0.010 inch, in the relationship between ring width and the radial increment in the two species of oak. This indicates that essentially all of the year to year variation is due to xylem growth. The sugar maples exhibit a 4:5 ratio; their deviation from regression is greater, but the variation in ring width from year to year is less. Thus in the sugar maples it may be that both the bark and the ring increment vary. The greater deviation from regression for this species may be due partly to error in ring measurement, as the ring borders were somewhat irregular and indistinct.

Though further study is needed on the relative growth of the xylem and bark elements within the season, the small amount of bark which is formed and the approximate one to one relationship between ring width and the dendrograph record, indicate that the measured daily growth may largely represent the daily xylem increment. Thus, by studying the factors controlling daily radial growth by means of the dendrograph, one should be better able to understand the environmental and physiological determinants of ring width.

FRITTS, H. C.

1958 An Analysis of Radial Growth of Beech in a Central Ohio Forest During 1954-1955. *Ecology,* Vol. 39, No. 4, pp. 705-20.

1959 The Growth-Environmental Relationships of Mature Forest Trees. 1959 *Year Book American Philosophical Society,* pp. 269-70.

1960a Multiple Regression Analysis of Radial Growth in Individual Trees. *Forest Science,* Vol. 6, No. 4, pp. 334-49.

1960b Daily Radial Growth in Mature Forest Trees. 1960 *Year Book American Philosophical Society,* pp. 311-14.

FRITTS, H. C., and E. C. FRITTS

1955 A New Dendrograph for Recording Radial Changes of a Tree. *Forest Science,* Vol. 1, No. 4, pp. 271-6.

SNEDECOR, G. W.

1956 *Statistical Methods Applied to Experiments in Agriculture and Biology.* Iowa State College Press, Ames.

University of Arizona
Tucson, Arizona

DATES FROM THE SITE 1060 PITHOUSE, MESA VERDE NATIONAL PARK

ROBERT F. NICHOLS

ABSTRACT

Seven charcoal tree-ring specimens from Site 1060 yielded outside dates with the range A.D. 544-608. It is concluded that A.D. 608 most nearly represents the time of construction of the pithouse.

Several charcoal specimens, collected from the Site 1060 pithouse excavation described by A. C. Hayes and J. A. Lancaster in the following article, were sent to the Laboratory of Tree-Ring Research at the University of Arizona for dendrochronological analysis. Examination of the specimens during the spring of 1960 indicated that a total of six different specimens of pinyon *(Pinus edulis)* and five of juniper *(Juniperus* sp.) were represented. All six of the pinyon samples and one of the juniper sections were dated (Table 1). As developed by Bannister (1959), the symbols and

TABLE 1. Dated charcoal specimens from the site 1060 pithouse, Mesa Verde National Park, Colorado.

Specimen number	*Form*	*Species*	*Date A.D. inside — outside*	
MV-1002-1	fragment	Pnn	495 p — 562 +	vv
MV-1002-2	fragment	Pnn	494 p — 575	vv
MV-1002-3	fragment	Pnn	518 — 587	vv
MV-1006	¾ section	Pnn	532 p — 608	r
MV-1007	fragment	Pnn	517 p — 579	vv
MV-1008	section	Jun	350 ± p — 544	vv
MV-1009	fragment	Pnn	512 p — 586	vv

All six specimens are charcoal. Pnn—pinyon; Jun—juniper; p—pith ring; ± p—pith ring present, center rings not readable; vv—outside shows extreme erosion, last ring very variable around the circumference; +—possibly one or more absent rings on the outside (A.D. 563 is often very small, therefore could be missing on specimen MV-1002-1); r—outer ring constant over a significant portion of the circumference (probable cutting date).

abbreviations used in Table 1 provide maximum possibilities for archaeological interpretation.

The A.D. 608 outside date of specimen MV-1006 is believed to be a cutting date. The outer ring of this specimen, which does not show the latewood of a complete year's growth and which is very regular around the circumference, indicates that erosion had little or no effect on a large part of the surface of the specimen. Since the latest date from the group is from MV-1006, and because the outside dates of all the other specimens cluster in the few years prior to its date, it is highly probable that A.D. 608 represents the period of construction of the Site 1060 pithouse.

Crossdating of the individual pinyon specimens with each other and with the Master Growth Index of Mesa Verde Pinyon (Schulman 1954, master figure) was, on the whole, very good (Figs. 1 and 2). The consistent absence of A.D. 526 was, however, particularly disappointing. Since the pinyon samples exhibit little evidence of growth trend, the mean for the Site 1060 pinyon is derived from the average of the actual measurements of ring series from individual specimens rather than of standardized values (Table 2). Because the ring widths of specimens MV-1002-1 and MV-1002-2 are relatively very narrow, the measured values are doubled for the computation of the site mean.

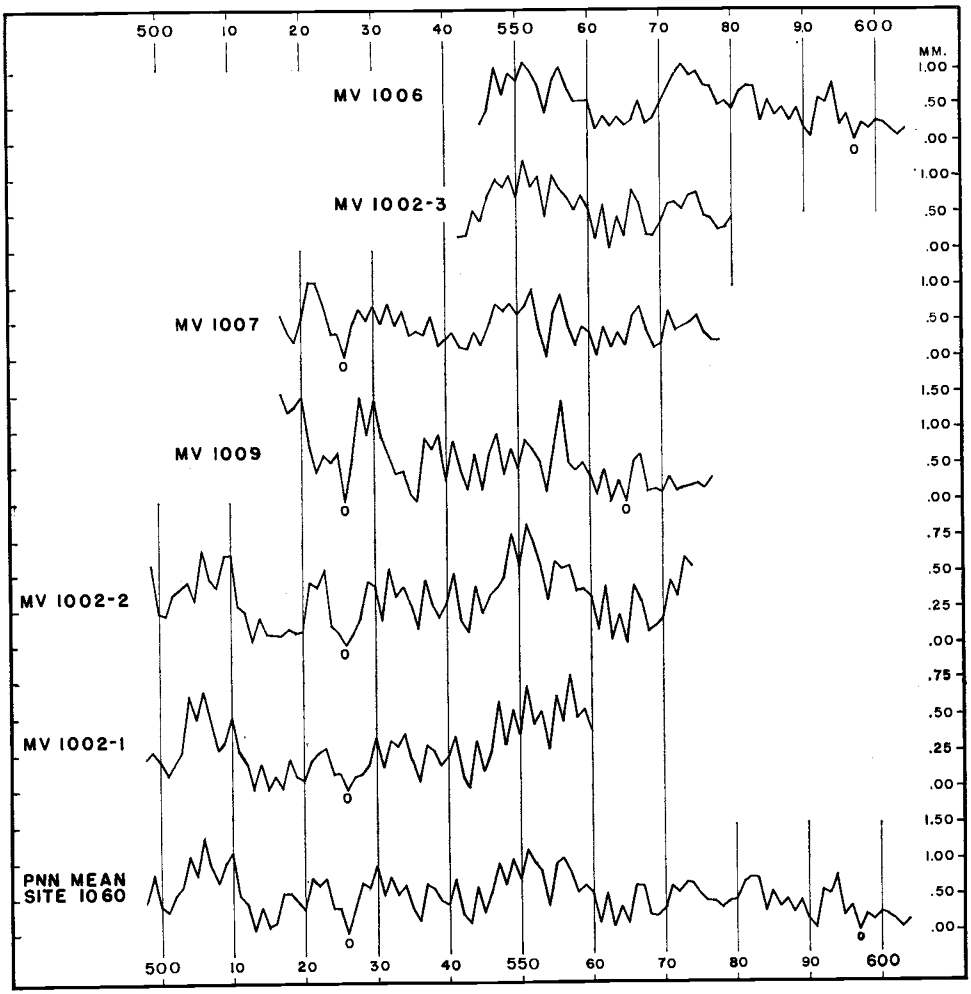

FIG. 1. Measured ring-widths for dated pinyon charcoal from the Site 1060 pithouse. Zeros below the curves indicate absent rings.

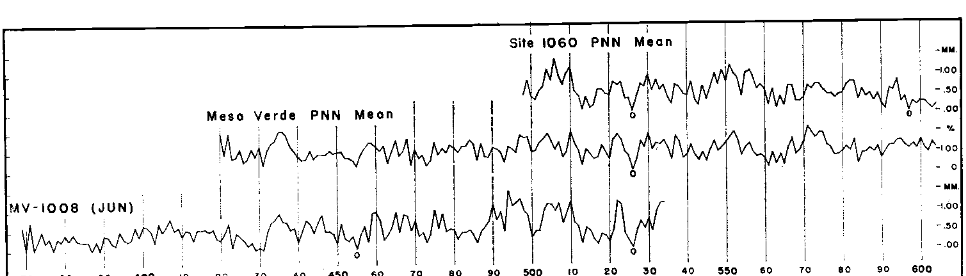

FIG. 2. The Site 1060 pinyon mean and the single dated juniper specimen compared with the standardized Mesa Verde Pinyon Mean.

TABLE 2. Adjusted mean ring-widths of pinyon *(Pinus edulis)* specimens from the Site 1060 pithouse, Mesa Verde National Park, Colorado. Unit .01 mm.

A.D.	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
490									44	82
500	39	31	54	66	109	81	135	94	70	98
510	114	54	42	5	38	10	17	57	57	48
520	133	78	68	76	35	36	0	35	70	63
530	92	52	80	54	67	35	19	67	61	46
540	40	74	27	14	63	30	59	95	68	102
550	75	118	98	84	37	95	103	87	58	66
560	56	14	54	9	37	12	64	64	23	22
570	32	64	56	69	69	52	44	42	33	41
580	44	68	75	74	29	54	36	45	28	43
590	18	3	58	51	79	21	35	0	22	17
600	26	23	17	5	16					

Specimen MV-1008, the only piece of juniper from the group with an interpretable ring record, crossdated exceptionally well with the pinyon master chronology (Fig. 2). It is possible that a centuries-long juniper chronology eventually will be established for the Mesa Verde area.

BANNISTER, BRYANT

1959 Tree-Ring Dating of Archaeological Sites in the Chaco Canyon Region, New Mexico. Doctoral dissertation, University of Arizona, Tucson. (L.C. Card No. Mic 60-484, University Microfilms, Ann Arbor, Michigan.)

SCHULMAN, EDMUND

1954 Dendroclimatic Changes in Semiarid Regions. *Tree-Ring Bulletin*, Vol. 20, Nos. 3-4, pp. 26-40.

University of Arizona
Tucson, Arizona

SITE 1060, A BASKET MAKER III PITHOUSE ON CHAPIN MESA, MESA VERDE NATIONAL PARK

ALDEN C. HAYES and JAMES A. LANCASTER

ABSTRACT

A Basket Maker III pithouse excavated in 1959 provides a cluster of tree-ring dates which terminate at A.D. 608. Features in the structure are typical of pithouses from the same time period in the area, with a north-south orientation and a large southern antechamber having an inclined entranceway. Atypical features include a low bench encircling the main room and the presence of small adobe pellets at the bottom of each of the four post holes.

In September, 1959, an unsuspected archaeological site on Chapin Mesa, in Mesa Verde National Park was revealed by a pipeline trench. Immediate salvage operations by Lancaster and his stabilization crew indicated a shallow pithouse with the wall above the bench along the entire west side destroyed by the ditcher. Excavation help was requested from the Wetherill Mesa Archaeological Project and Hayes and part of his survey group were assigned to the undertaking.

Site 1060 falls into the general pattern of Basket Maker pithouses of the San Juan area in that it consists of a roughly rectangular chamber with rounded corners, large post-holes near the corners, remnants of a partition south of the firepit, and a short passageway into a smaller, raised anteroom (Fig. 1). In outline, it closely resembles Pit House Number 1

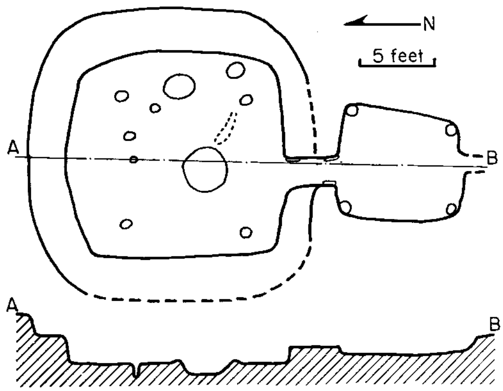

FIG. 1. Plan of Site 1060 pithouse.

(Smiley 1949), roughly one and one-half miles to the north, and Pit House B (Lancaster and Watson 1942), also nearby. The house had burned, and from the dearth of furniture, one would assume that it had been abandoned prior to the fire.

The main chamber was a little over 13 ft. in width and averaged 3 ft. in depth below the level of the ground at the occupational period. The walls were unplastered but were apparently packed and smoothed. A bench 1.7 ft. above the floor circled the room. Benches are the exception in early pit-houses and when they do occur are usually narrow. This one was unusual in that it had an average width of 2.4 ft. No traces of sidewall post-holes were found but a charred pinyon pole sloped from the bench to the floor just south of the large southeast post-hole, suggestive of a pole from bench to roof timbers that had fallen to that position with the collapse of the roof.

The floor was hard-packed earth and contained the usual features. A circular firepit, a trifle southwest of room center, had a rounded collar of adobe approximately .2 ft. high. A small sipapu midway between the firepit and north wall was filled with clear sand. Four post-holes, averaging .7 ft. in diameter and 2 ft. in depth, were set in from the rounded corners of the room by a distance of 1.8 to 2.3 ft. Four small pits or cists on the east side of the room contained room fill and were otherwise undistinguished. A wing-wall or partition separating the south end of the room from the remainder was indicated by a barely perceptible ridge of slumped adobe running from the firepit toward the southeast post-hole. No slabs or traces of jacal were present and although no deflector was found, it may have been removed for reuse when the house was abandoned.

The passageway to the anteroom entering the south wall just west of center was 1 ft. above the floor level, 3.5 ft. long and 1.7 ft. in width. A sandstone slab reinforced the wall at three corners. Broken pieces of burned rock on the floor of the main room indicated the existence of the fourth reinforcement. The floor of the passage was plastered and smoothed throughout its length and was continued over a rounded step down into the anteroom.

The anteroom itself was spacious, measuring 7 by 9 ft. A post-hole in each corner was flush with the wall and contained the charred remains of a large post. The holes, from 1.5 ft. to 1.6 ft. deep, had a slight incline toward the center of the room. The floor, .85 ft. above the level of the main room, was hard-packed clay covered with a skift of yellow sand. The amount of charcoal near the floor and the red-baked adobe of the walls indicated a substantial structure. Charcoal specimens of this roofing debris yielded seven tree-ring dates, including a cutting date of A.D. 608 (see preceding article by R. F. Nichols). In the center of the south wall of the anteroom was an opening 1 ft. wide with a floor sloping up sharply toward the surface. On the floor in front of the opening lay a thin sandstone slab which may have been used as a door stop.

The question of whether a pithouse antechamber was a foyer or a storage room and ventilator has sometimes been raised. The feeling among most workers in the field has apparently been that it served the purpose the word indicates and probably had a hatchway onto the roof. Roberts (1929) postulated a ground floor entrance on the southwest side of the antechamber of House A at Shabik'eschee, and in Pit House B at Site 13 on Alkali Ridge, Brew (1946) found what appeared to be a door slab in the same relative position. It is interesting to note that this is the one structure at Alkali Ridge with post-holes in the antechamber. The antechamber at Pit House C, Site 2 in the Ackmen-Lowry area (Martin 1939) consisted of a passageway 5 m. long with a bulge or swelling near the middle. There was no step up from the main room to a raised floor but rather a gradual slope up to the south end of the passage to within 30 cm. of the old ground level. This "antechamber-entrance-way", to use Martin's term, suggests an entrance at the south end at ground level, with a short step down to the sloping floor. Site 1060 then provides additional evidence of ground level entry to early pithouses.

Another interesting feature of Site 1060 was the presence of four to six small pellets of adobe at the bottom of each of the four post-holes in the antechamber. In size they ranged from 1 to 1.75 in. in length and from 1 to 1.25 in. in width and were roughly spherical or cylindrical in shape. Several were formed by fusing two or three rolls of adobe. Finger impressions were apparent on two of them. They could have been dropped in after the post was in place but before the earth was tamped around it.

Pottery definitely associated with the floor was plain gray and La Plata Black-on-white. Some sherds of both types had a fugitive red exterior. The only other artifacts in the floor fill were two hammerstones and an awl made of the split cannon bone of a mule deer. On the floor of the main chamber were found the left femur, tibiotarsus, and tarso-metatarsus of a turkey (identified by Lyndon L. Hargrave, Southwest Archeological Center, Globe, Arizona).

The date, the pottery and the general structure of the house would place it in the Basket Maker III or Modified Basket Maker period.

BREW, J. O.
1946 Archaeology of Alkali Ridge, Southeastern Utah, with a Review of the Prehistory of the Mesa Verde Division of the San Juan and Some Observations on Archaeological Systematics. *Papers of the Peabody Museum, Harvard University*, Vol. 21.

LANCASTER, J. A. and D. W. WATSON
1942 Excavation of Mesa Verde Pit Houses. *American Antiquity*, Vol. 9, No. 2, pp. 190-8.

MARTIN, P. S.
1939 Modified Basket Maker Sites in the Ackmen-Lowry Area, Southwestern Colorado, 1938. *Field Museum of Natural History, Anthropological Series*, Vol. 23, No. 3.

ROBERTS, F. H. H., JR.
1929 Shabik'eschee Village, A Late Basket Maker Site in the Chaco Canyon, New Mexico. *Bureau of American Ethnology, Bulletin* 92.

SMILEY, T. L.
1949 Pithouse Number 1, Mesa Verde National Park. *American Antiquity*, Vol. 14, No. 3, pp. 167-71.

Wetherill Mesa Archeological Project
Mesa Verde National Park, Colorado