

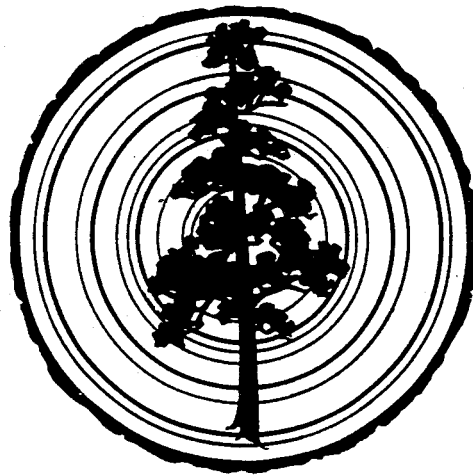
TREE RING BULLETIN

VOL III

OCTOBER, 1936

No. 2

A Quarterly



CONTENTS

Effects of a Volcano Cinder Fall on Tree Growth.....	J. C. MCGREGOR
Dates From Five Kiva House, Utah.....	W. S. STALLINGS, JR.
Dates from Tsegi and Nalakihi.....	J. C. MCGREGOR
Estimated Ring Chronology IX (600-750).....	A. E. DOUGLASS

PUBLISHED BY THE TREE RING SOCIETY

HAROLD S. COLTON, Managing Editor
Museum of Northern Arizona
Flagstaff, Arizona

\$1.50 Per Year

50 Cents a Copy

THE TREE RING SOCIETY

DR. A. E. DOUGLASS, President

H. T. GETTY, Secretary and Treasurer

Main office, University of Arizona, Tucson, Arizona.
Editorial office Museum of Northern Arizona,
Flagstaff, Arizona

BY-LAWS

- Article 1—The name of this association shall be the Tree Ring Society.
- Article 2—There shall be two classes of active members,
(a) those who are contributing to basic research in dendrochronology
(b) honorary members who have contributed in special ways to tree-ring studies.
- Article 3—Prospective members must be proposed by two members of the society and elected by a two-thirds majority of the members present at a meeting duly called by the president.
- Article 4—The officers of the society shall be a president and secretary to serve for a term of one year.
- Article 5—The Tree Ring Bulletin shall be the official organ of the society, the board of editors of which shall be appointed by the president.
- Article 6—These by-laws can be amended at any duly announced meeting of the society.

EDITORIAL BOARD OF TREE RING BULLETIN

A. E. DOUGLASS, University of Arizona
WALDO S. GLOCK, Carnegie Institution of Washington
HAROLD S. COLTON, Museum of Northern Arizona
JOHN C. MCGREGOR, Museum of Northern Arizona
EMIL W. HAURY, Gila Pueblo
W. S. STALLINGS, Jr., Laboratory of Anthropology
FLORENCE M. HAWLEY, University of New Mexico

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 Vol. I. No. 1. 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 Editor, Dr. A. E. Douglass, Tree Ring Laboratories, University of Arizona, Tucson, Arizona.

SUBSCRIBERS

All correspondence having to do with subscriptions must be addressed to the Managing Editor, Dr. Harold S. Colton, Museum of Northern Arizona, Flagstaff, Ariz.

THE EFFECTS OF A VOLCANIC CINDER FALL ON TREE GROWTH

BY J. C. MCGREGOR

For some time the Museum of Northern Arizona has been interested in the effects of the eruption of Sunset Crater on the life of the prehistoric Indians who were inhabiting the region at the time of the volcanic activity. Colton (1932), has shown that the distribution of late Pueblo II sites and early Pueblo III sites corresponds to the distribution of the volcanic ash. (1) He also showed that the lower limit of *Pinus ponderosa*, and *Juniperus monosperma*, drop approximately 1000 feet in altitude in the ash fall region. This suggests that the volcanic ash is an important ecological factor in the distribution of present day forest, and gave rise to the thought that measurements of tree rings from trees growing in the ash covered area when compared with trees growing nearby in soil not covered by ash might throw important light on this unusual distribution of the pines.

Although both A. E. Douglass, (1928), (2), and G. A. Pearson, (1931), (5), had previously noted certain effects of cindery or volcanic soil on the growth of trees, particularly the Western Yellow Pine, and F. W. Haasis, (1921), (3), has noted the effects of cindery soil on the growth of Western Yellow Pine seedlings, no specific work had been done on this problem at the beginning of our investigation. It is because of this fact that the results herein contained are felt to be of some interest.

Sunset Crater, where the most recent of all volcanic activity connected with the great San Francisco volcanic field, Arizona, has occurred, (Colton, 1932; and McGregor, 1936), (4), is the center of the area studied. The general ground surface consists of old and greatly weathered lava terraces upon which were dropped quantities of coarse cinders, (lapilli and scoria), from the eruptions of the neighboring ancient cinder cones. Following deposition these cinders have been oxidized red, and where moisture penetrated them they have broken down and weathered to form a compact yellow clay, which covers the cinders and penetrates them to a depth of several feet. While this clay was being produced, land surfaces were eroded and sculptured to about their present forms, to produce the conditions preceding the Sunset eruption.

With the eruption of Sunset Crater, almost unbelievable quantities of black basaltic sand, (ash), and lapilli were poured out upon this land surface, spreading about the cone in an ellipse whose major north-south axis was about thirty-six miles, and whose minor axis was about twenty-eight miles, (Colton, 1932). Immediately about the cone, cinders, (ash, lapilli and scoria), piled up to some depth. Toward the periphery of the ellipse only the finer products fell, ash in the form of black sand, for the fine particles of ash were readily transported by the strong prevailing southwesterly winds.

Many of the hilltops were soon denuded of ash, and a few of the tablelands swept bare. But the removal of this material in certain sections caused the formation of dunes in others where some obstacle favored their building. Often a canyon or valley acted as such a trap.

To compare the rings of trees in ash covered areas with those of nearby regions free of ash, small cores were removed from the trees with a Swedish Increment Borer. A total of 184 borings were made by this means. In the collection of these specimens an attempt was made to keep several factors in mind. First; the thickness of the cover of cin-

ders above the clay surface was always noted. Second; the slope and exposure of hilltops, hillsides and flats were carefully noted and an attempt was made to collect specimens from each type of site in equal numbers. Third; an attempt was made to collect about an equal number of young trees, mature trees, and very old trees, thus to equalize the varying effects of age on ring size.

When representative material, growing under varying conditions had been collected, it was decided to measure the last ten rings of every sample. This would include the period of growth from 1922 to 1932, (the latter date that of collection), which would assure corresponding rings and period of growth in every case. Thus the rainfall factor would be controlled, for in a small area we may assume that the rainfall in a given year would be the same in all parts. Ten rings were chosen because that number facilitated computation, and because laboratory equipment for individual ring measurement was inadequate at the time. All of the trees which were collected from one specific section, and which were grown under similar conditions, were then averaged and reduced to the basis of one ring as measured in millimeters. The accompanying table presents the results of this computation.

TABLE OF RING SIZES

Location	Ash depth	Subsoil type	No. of specimens	Aver. ring width mm.
Tuba highway near Sunset Crater	No ash cover	Yellow clay from old cinders	12	.60
Lower Medicine Valley	No ash cover	Sand, Gravel	18	1.00
South side of Crater 45, gentle slope	4" to 6" deep	Old cinders weathered to clay	12	1.56
East side of Crater 45, gentle slope	6" to 10" deep	"	12	1.65
Flat area west of Sunset Crater	10" to 15" deep	"	31	2.14
"	6" to 10" deep	"	23	2.26
Black windblown cinders banked against Bonito flow	6' to 10' deep	Alluvial material	7	2.36
	Over 10' deep	"	8	2.40

Obviously, in all of this work the factor of human error plays a very important part. An example of such a condition is apparent in the bottom line of the table. Here great banks of windblown sand had been piled against the end and side of a tongue of the Bonito Lava flow. The difficulty of determining actual sub-cinder conditions arises from the fact that this flow moved up a valley and dammed what once was an avenue of drainage from the higher backland. Therefore, water is probably now stored against the end of this flow, and would account for the unusual large size of rings of the trees growing at this place. Again, the trees growing in the crevices of the Bonito Flow show extreme ranges of ring sizes. (This data not included in the table). This would indicate that certain cracks in the flow form veritable cups for the retention of all the moisture that falls. As this section of Arizona has a relatively dry climate, (about 15 to 20 inches annual rainfall), any means of conserving moisture is of paramount importance.

A comparison of trees grown in old cinders weathered to clay, with and without an ash cover, is the most convincing of all the material col-

lected and studied. Here most careful observations of cinder cover, drainage, etc., were made.

It would appear fairly obvious that a cover of cinders over a clay or alluvial base greatly increases the size and growth of rings of the Western Yellow Pine. In view of the nearly equal precipitation over the area studied, and the obvious lack of plant food in the unweathered cinders from Sunset Crater, we conclude that the ash acts as a mulch to conserve the scanty water supply.

A glance at the table will bear out these conclusions. It will be seen here that the most ideal conditions for tree growth were represented in areas where about six to ten inches of rather fine cinders, or ash, covered a clay surface, and the drainage slopes were gentle with no prominent valleys.

BIBLIOGRAPHY

- (1) Colton, Harold S.—Sunset Crater, the Effect of a Volcanic Eruption on the Ancient Pueblo People. *The Geographical Review*. Vol. XXII, No. 4, 1932. Pp. 582-590. Broadway at 156th St., New York.
- (2) Douglass, A. E.—Climatic Cycles and Tree Growth. Volume II, Carnegie Institution, 1928. Washington, D. C.
- (3) Haasis, Frederic W.—Relations of Soil Type and Root Form of the Western Yellow Pine Seedlings. *Ecology*, Vol. II, No. 4, October, 1921. Pp. 292-303.
- (4) McGregor, J. C.—Dating the Eruption of Sunset Crater, Arizona. *American Antiquity*, Vol II, No. 1, July 1936.
- (5) Pearson, G. A.—Forest Types in the Southwest as Determined by Climate and Soil. United States Department of Agriculture, Technical Bulletin No. 247, August 1931, Washington, D. C.

DATES FROM FIVE KIVA HOUSE, UTAH

BY W. S. STALLINGS, JR.

The material which this communication concerns, consisting of two beam cross-sections, was deposited with the Laboratory of Anthropology in the summer of 1936, by Mr. Deric Nusbaum, at that time with the National Park Service, and Mr. Zeke Johnson, Custodian of Natural Bridges National Monument. Mr. Nusbaum and Mr. Johnson provide the following information regarding the provenience of the specimens.

Five Kiva House is located in a cave on the west side of Westwater Canyon three miles southwest of Blanding, Utah. Associated with the five circular, subterranean kivas from which the ruin takes its name are some twenty-odd ground floor rooms. Mortar marks on the roof of the cave near its two ends suggest that rooms formerly rose to two stories in these places. Although smaller sites are numerous, Five Kiva House is the only site as large as this in the vicinity and is, accordingly, easily identified. The cave has been used as a picnic ground by the local inhabitants with the result that the ruin has been considerably mutilated. Walls are still standing, however, and structural timbers yet can be found in place. Both of the timbers concerned here were fragments, found in fallen debris.

The specimens are pinyon, in sound condition; both have excellent records, although one is quite short; and both were cut between the growing seasons of 1243 and 1244.

A small collection of sherds from the site, kindly supplied by Mr. Johnson, contained Pueblo I and Pueblo III material, dividing about equal-

ly. The structure just described and the beam specimens are to be associated with the later horizon. The Pueblo III sherds belong to the Mesa Verde complex, but the small number and their condition do not justify further comment. A more detailed examination of the site might be instructive and the dates are recorded with the chance that they may prove helpful in chronological investigations of the regional archaeology.

Clerical data regarding the two specimens and measured widths of their rings are given below. (1) Duplicate specimens are deposited in the Laboratory of Anthropology and the Tree-Ring Laboratory, University of Arizona. It will be noted that the center rings (1115-1179) of LA-U4 are congested; the two absent rings occur in this congested group. One is apparently that of 1166. The identity of the other is not so clear, but it is probably that of 1175 and for present purposes it is so assumed. The inside dated rings as listed are also the center rings.

Specimen Number	Form of Specimen	Inside Dated Ring	Outside Dated Ring	Rings Absent In Sequence	Approximate Radius mm.	Heartwood-Sapwood Date	Rings Lost On Outside	Bark-Date
LA-U3	F.sect.	1200	1243*	0	32	?	0	1243-44
LA-U4	F.sect.	1155	1243*	2	60	?	0	1243-44

* Ring of complete width.

TABLE OF ORIGINAL MEASURES (mm.)

	0	1	2	3	4	5	6	7	8	9
1150						.20*	.08	.19	.06	.27
1160	.43	.13	.46	.78	.31	.29	.00	.13	.16	.04
1170	.10	.18	.12	.36	.27	.00	.27	.24	.64	.34
1180	1.19	1.05	.91	.65	.73	.66	.06	.72	.49	.28
1190	.63	.40	.54	.64	.62	.78	.64	1.23	.69	.45
1200	1.28 .48†	.64 .43	.80 1.03	1.01 1.60	1.20 1.46	.87 .93	.90 .65	.95 .58	.97 .43	1.68 1.12
1210	1.25 1.35	.95 1.14	1.05 1.03	1.22 1.00	1.30 .98	.80 .56	.70 .32	.74 .37	1.07 .72	1.30 1.00
1220	1.05 .68	.86 .54	1.55 .84	.84 .67	.48 .34	.60 .36	.82 .53	.22 .12	.69 .49	.83 .46
1230	.82 .49	.76 .55	.83 .62	.63 .50	.75 .49	1.08 .70	.93 .56	1.00 .78	1.09 .84	1.10 .97
1240	.82 .58	1.17 .85	1.02 .76	.83 .52						

* Begin LA-U4. †Begin LA-U3.

It is of interest to note that a few features of the present specimens, represented by the configuration of 1186-89, 1220-21, and 1224-25, which deviate somewhat from the standard classic series, occur prominently in the Rio Grande drainage in northern New Mexico.

(1) For comparative sequences see A. E. Douglass, "Dating Pueblo Bonito and Other Ruins of the Southwest," National Geographic Society, Contributed Technical Papers, Pueblo Bonito Series, 1, pp. 62-63, Washington (1935); "Estimated Tree-Ring Chronology," Tree-Ring Bulletin, 2 (2), pp. 14-15, Flagstaff (1935). Major dating criteria in Mesa Verde, Colorado material are listed in Harry T. Getty, "New Dates from Mesa Verde," Tree-Ring Bulletin, 1 (3), p. 23, Flagstaff (1935).

DATES FROM TSEGI AND NALAKIHU

BY J. C. MCGREGOR

In Vol. I, No. 1, 1934, (1) issue of the Tree Ring Bulletin, and in Vol. II, No. 4, (2) of the same periodical, a report was made on dates from several sites located in the Tsegi Canyon and its branches. This material was collected by Lyndon L. Hargrave and party, as members of the Rainbow Bridge-Monument Valley Expenditions of 1934 and 1935 (3). This year, (1936), additional material was collected by Hargrave while a member of the same party. Only one site, N.A. 2536, was visited, and from the material collected here eight additional specimens were readily dated.

This site, N.A. 2536, is known as "Twin Caves Pueblo," and belongs to the Pueblo III culture stage, it being a large Cliv Pueblo. Pottery types common are: Kayenta black-on-white, Kayenta and Tusayan polychromes, and Tusayan corrugated.

Seven additional dates were reported on in the first mentioned paper above. The present group of eight, making a total of fifteen, gives a good picture of the building date of this ruin.

From site N.A. 358, (Nalakihi), a small site of six rooms just at the base of Citadel Ruin near the Little Colorado River northeast of Flagstaff, seven fragments of charcoal were readily datable. As all of these are apparently of Douglas fir, and give an almost identical record

Piece Number	Outside Dated Ring	Inside Dated Ring	Radius in mm.	Kind of Wood	Type of Specimen	Sap-Heart Date	Rings Lost at Outside	Rings Lost in Sequence	Bark Date
N.A.2536									
F.3541*	1102	1041	45	Y.P.	Frag.	1073	?	0	1110+x
F.3547	1104	1052	30	Y.P.	Frag.	1073	?	0	1110+x
F.3527	1269	1176	57	Fir	F. Sec.	1240	few	0	1272±3
F.3522	1272	1163	56	D.F.	¼ Sec.	1242	0	0	1272
F.3529	1272	1224	52	Fir	F. Sec.	1244	0	0	1272
F.3572	1272	1242	43	D.F.	¾ Sec.	1254	0	0	1272
F.3517	1277	1184	55	Pnn.	F. Sec.	None	0	0	1277
F.3521	1278	1236	41	Fir	½ Sec.	1252	few	0	1280±2
N.A.358	* *								
F.4268	1183	1117	23	Y.P.	½ Sec.	No	0	0	1183

* Pieces F.3541 and 3547 appear to be two fragments from the same tree.

** All dates are from Room No. 6, the east room of the unit, from which six other duplicate specimens were secured giving the following dates: F.4263-1183; F.4262-1156; F.4267-1182; F.4271-1182; F.4265-1183; F.4272-1183.

they are assumed to have been fragments of the same piece. For that reason only one detailed report is made of the specimens in the table below, with the additional notation of the duplicates by specimen numbers and dates.

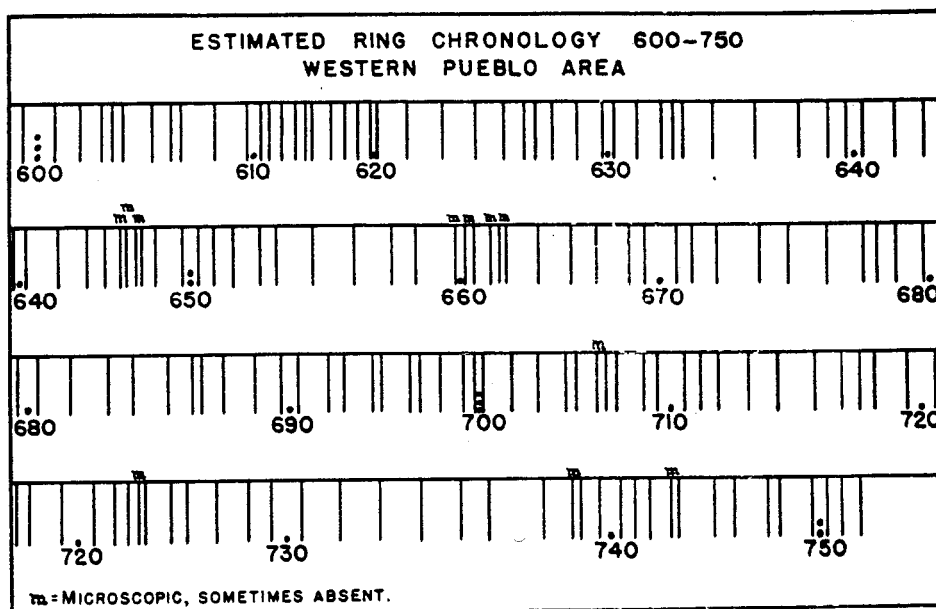
"Nalakihi" was excavated by Dale S. King as a C.W.A. project under the direction of the Museum of Northern Arizona during the winter of 1934. It is a small surface masonry structure which has now been partially repaired and restored. Like many of the other sites in this area it belongs to the first part of Pueblo III stage of culture, and gives approximately the same dates as the latter series from Wupatki. Types of pot-

tery typical are Flagstaff black-on-white, Tusayan polychrome, Tusayan corrugated, Verde black-on-grey, and Verde gray. It is very interesting to note that Dr. Douglass reports the securing of two dates of 1192 and one of 1260 from Citadel proper, thus indicating that Citadel and Nalakihi were originally built at approximately the same time. (4)

Dates listed are from East Room or Number 6.

BIBLIOGRAPHY

- (1) McGregor, J. C.—Dates from Tsegi. Tree Ring Bulletin, Vol. I, No. 1, Flagstaff, Ariz., July 1934.
- (2) McGregor, J. C.—Additional Dates from Tsegi. Tree Ring Bulletin, Vol. II, No. 4, Flagstaff, Ariz., April 1936.
- (3) Hargrave, L. L.—Report on Archaeological Reconnaissance in the Rainbow Plateau Area of Northern Arizona and Southern Utah. U. of Cal. Press, Berkeley, Cal., 1935.
- (4) Douglass, A. E.—Dating Pueblo Bonito and Other Ruins of the Southwest. National Geographic Society, Pueblo Bonito Series No. 1, Washington, D. C. 1935.



SPECIAL RINGS—600's

A.D.	to micro: or, 646 micro	696 smallish
600	and 645 and 7 smallish:	698-700 sometimes smallish
---	rarely 643-4 are also	700 small (Johnson Canyon)
603 very small	smallish	704 micro and occasionally
604 small	651 smallish	absent
605 large	655-9 big	706 micro
606 small	658 smallish among big rings	707 small
607 small	660-4 small groups with big	709 smallish
611-620 JCD Signature: all	rings each side. 662	712 smallish
small	often larger than others	713-6 large
611 very small	669 smallish	717-8 sometimes very small
615 very small	671 small	721-4 small
620 very small	673 usually big	724 often very small
622-4 big	677 small	727-737 large series
625-6 smallish	680 sometimes smallish	738 small to micro: often
630 small	683 sometimes smallish	absent
633-4 small, often micro	686 very small	739 small
635-6 big	687-9 large	740 big
630-40 small: 640 sometimes	690 small	741-4 small group, 741, 742 and
micro	692 smallish	744 being smaller
645-7 etc. variable group: some-	694 small	746 very small
times 645 and 647 small		748 very small, rarely absent