

I. Editorial

The readership of the *Bulletin of the History of Archaeology* should take note of two (2) new e-mail addresses for the BHA as noted above. Because of server problems in the past, the BHA has changed its server for e-mail and has added a second address for the transmission of longer materials to the BHA's editorial office. For e-mail correspondence with the Editor of the BHA, please use the address: documents@primary.net. For contributions to BHA issues or for the transmission of longer materials to the Editor, please use the address: docres@primary.net. The BHA's editorial office can read most transmissions that are sent as "attached files" but there might be some instances where the files cannot be accessed and the contributor may be asked forward materials by snail mail.

We are currently thinking about creating a World Wide Web page for the BHA and would welcome any ideas or comments that the readership might have.

We have also added a section to issues of the BHA for listing the deaths of colleagues.

We would appreciate knowing of the same by forwarding to the editorial office the name of the deceased, date of death, and the obituary source (if any) where a "death notice" or obituary may be found.

II. Discourse on the History of Archaeology

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Southwestern (U.S.A.) Archaeological Tree-Ring Dating: 1930-1942

by

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Dendrochronology, the science of assigning precise and accurate calendar dates to annual growth rings in trees (Stokes and Smiley 1968), was the first independent dating technique available to prehistorians. Archaeological tree-ring dating came of age at a time when North American archaeologists concerned themselves primarily with time/space systematics (Willey and Sabloff 1980) and yet had no absolute and independent dating techniques available to guide their analyses. Histories of archaeology typically have not considered the development of archaeological tree-ring dating in detail. Willey and Sabloff (1980:112) devote one paragraph to the development of Southwestern archaeological tree-ring dating, as does Steibing (1993:261). Trigger (1989:305) considers dendrochronology (in the sense of the Douglass method) only in light of radiocarbon dating. Textbooks and regional histories of archaeology do a little better in their treatment of dendrochronology, though discussions typically focus on the interpretation of tree-ring dates and not on the developmental history of the technique itself (e.g. Cordell 1984:88-90; Fagan 1991:129-133; Lyon 1996:46; Michels 1973:116; Thomas 1979:190-194). Scott (1966:9) argues that 'the story of the discovery of archaeological tree-ring dating by A E. Douglass and others has been told and retold and is now familiar to scientists and laymen alike.' I beg to differ.

A recently completed doctoral dissertation (Nash 1997a) presents a controlled analysis and comparison of tree-ring sample collection records, archived correspondence, unpublished research documents, and the published literature relevant to the growth and development of North American archaeological tree-ring

dating from 1914 to 1945. Nash (1997a) (1) examined the development of archaeological dendrochronology from 1914 to 1929, (2) offered a detailed chronicle of tree-ring investigations conducted by the four archaeological research institutions that were active in Southwestern tree-ring dating between 1930 and 1942, as well as the attempts to establish tree-ring dating in Alaska and the American Midwest, and 3) placed these chronicles in context by considering how tree-ring dating became incorporated in increasingly sophisticated archaeological analyses prior to the end of World War II and the advent of radiocarbon dating. Nash (1997a) therefore provides a better understanding of how dendrochronology contributed to increasingly reliable interpretations of North American prehistory. In this paper I focus on key developments in Southwestern archaeological tree-ring research at three research institutions between 1930 and 1942. (1)

Setting the Stage: Archaeologist's Reactions to the "Bridging of the Gap"

The A.E. Douglass Collection at the University of Arizona Main Library Special Collections contains numerous congratulatory letters regarding the June 22, 1929, discovery of specimen HH-39, the successful completion of Douglass' Southwestern tree-ring chronology, and the publication (Douglass 1929; see also Haury 1962) of accurate dates for 20 prehistoric Southwestern sites.

Archaeologists were nearly unanimous in their praise:

Completion of your chronology is by all odds the most important thing that has happened thus far in American prehistory (Neil M. Judd, October 24, 1929).

With most sincere congratulations on the splendid results which I understand you have achieved and which I am looking forward with the greatest interest to hearing about at the proper time (A.V. Kidder, November 4, 1929).

Sincerest congratulations on successful closing of [the gap]. Your contribution to archaeological progress in Southwest [is] singularly outstanding (Jesse Nusbaum 19 November 1929).

The more I think about it the more wonderful your achievement seems (Earl Morris, November 22, 1929).

I have just read your most interesting article in the last *National Geographic*, which I believe is the most valuable contribution ever made to American archaeology (J. Charles Kelly, University of New Mexico, November 28, 1929).

I have just finished reading your report of your tree ring study It not only amazes me, but convinces me that your study is the greatest thing in American archaeology that has ever been done. I feel just as excited over your finds as if I had made them myself . . . I am grateful as an archaeologist that you happened into this subject, for it puts that much of our study of the Southwest on a sound basis. . . . I am so excited about the whole thing that I tell everyone around here about you and your discoveries (Paul Martin, December 5, 1929).

I wish to congratulate you upon your great achievement in completing the tree ring series for Southwest archaeology. This is to me one of the great scientific achievements of the time and I am sure will always be so regarded (Clark Wissler, December 10, 1929).

I congratulate you for reaching a happy conclusion in this extremely important task. I consider your discovery one of the most significant in many years and a very remarkable contribution to the archaeology of the SW in particular and also to archaeology in general as it can be applied to other fields as well (E. B. Renaud, January 23, 1930).

I am greatly impressed by the remarkable results you have reached by your unexcelled method of dating (Ernst Antevs, January 23, 1930).

The work is yours and to you alone belongs the credit for having made the most outstanding contribution to American archaeology in the past quarter century (Judd, April 27, 1934).

When one stop[s] to recall the guesses—including those of noted anthropologists—as to the age of the various Pueblos, the historical value of Dr. Douglass' positive dates as ascertained from tree rings becomes overwhelmingly apparent. And one cannot but admire Douglass' great patience and endless enthusiasm in pushing to the end this monumental investigation (C. Hart Merriam of the Carnegie Institution to Gilbert Grosvenor of the National Geographic Society, July 29, 1935).

These statements foreshadow what Emil Haury (1935a:98) later put into print: "It may be stated without equivocation that the tree-ring approach has been the single greatest contribution ever made to American archaeology."

Southwestern archaeologists, especially Junior members of the field, were quickly enamored of the possibilities of tree-ring dating for archaeological research, as well as their careers. By January of 1930, less than two months after publishing his results, Douglass enrolled 15 students in his first course on tree-ring analysis at the University of Arizona. Within two years, three of Douglass' top students had been hired to establish tree-ring dating programs at research centers across the Southwest: Haury was hired by Harold S. Gladwin of the Gila Pueblo Archaeological Foundation to apply tree-ring dating to the eclectic research interests of that institution, John C. McGregor was hired by Harold S. Colton of the Museum of Northern Arizona to date Pueblo II and Pueblo I period sites around Flagstaff, and W. Sidney Stallings was hired by the Jesse Nusbaum and the Board of Trustees of the Laboratory of Anthropology to establish a tree-ring chronology for the Rio Grande Valley. By 1942, each of these dating programs were defunct (Nash 1997a), and Southwestern archaeo-dendrochronology essentially came to a halt until after the war. The Laboratory of Tree-Ring Research at The University of Arizona, at which archaeological dating was not really a priority until after World War II, remains the sole proprietor of archaeological tree-ring dates in North America. In this paper I examine a sample of the many contributions to dendro-archaeological contributions made by the above individuals and institutions (detailed treatments can be found in Nash (1997a).

Emil W. Haury and Dendrochronology at The Gila Pueblo Archaeological Foundation

Emil Walter Haury was hired in the Spring of 1929 as the junior member of the National Geographic Society's Third Beam Expedition, serving essentially as an assistant to archaeologist Lyndon Lane Hargrave, who had been working intensively with Douglass since the previous year. Hargrave, however, had taken a leave of absence from the Museum of Northern Arizona in order to lead the Third Beam Expedition, and was therefore not after the field season ended Haury, on the other hand, had served as Instructor at the University of Arizona during academic year 1928-29, and was interested in finding summer work. He had been somewhat uncomfortable teaching his former classmates (Thompson 1995), so when Douglass and Judd offered him a National Geographic Society-funded assistantship under Douglass in the Fall of 1929, Haury gladly accepted. Over the next nine months, Haury independently reconstructed Douglass' tree-ring chronology and performed all archaeological dating for Douglass, whose only role in a strict archaeological sense was to verify Haury's dates. Archaeological dating had never been a research priority for Douglass (Nash 1997a), and he was tremendously pleased to have a competent assistant. Unfortunately for Douglass, however, the situation would not last.

In the Spring of 1930, Harold S. Gladwin of the Gila Pueblo Archaeological Foundation made Haury an offer that must have seemed to good to be true: He would pay Haury \$250 per month to conduct both archaeological and dendrochronological fieldwork while serving as Assistant Director of Gila Pueblo. In addition, Gladwin offered to continue to pay Haury half his salary while the latter was earning his doctorate at Harvard, on the condition that on successful completion and defense of his dissertation Haury would return to Gila Pueblo to work for a minimum of three years at his original salary. Given that the New York Stock Exchange and other financial markets had collapsed only six months earlier, it is not surprising that Haury accepted Gladwin's offer.

A critical component of Gladwin's overtures to Haury was a promise, to Douglass as well as to Haury, that the latter be able to pursue archaeological tree-ring dating in a close working relationship with the former. Gladwin was interested in obtaining tree-ring dates south of the Colorado Plateau, and therefore sent Haury on a survey of the Mogollon and upper Salt River drainages during August and September. Haury focused on the Sierra Ancha region of east-central Arizona, and to his surprise found some 20 cliff dwellings, an archaeological phenomenon that he had did not expect to be present so far south.

Haury was busy at Gila Pueblo during the winter of 1930-31. Among the more mundane tasks of artifact sorting and tabulation, he dated the many tree-ring specimens he collected the previous summer at the Sierra Ancha sites, the Tusayan Ruin near the Grand Canyon, and the Gila Pueblo Ruin. One immediately pleasing result was the successful dating of the Gila Pueblo ruin (Haury 1935b). Its 185-year long tree-ring record was surprisingly similar to the northern Arizona chronology, and therefore indicated for the first time that sites as far south as the Mogollon Rim and Globe, Arizona, could be dendrochronologically dated. In 1932 Haury returned to excavate Canyon Creek Ruin in the Sierra Ancha with a "multidisciplinary" team (Haury 1934:v) consisting of Russell Hastings, a recent graduate of the University of Chicago and new employee at Gila Pueblo, Solon Kimball, a fellow graduate student at Harvard who later became a prominent social anthropologist, and Daniel Jackson, a Pima Indian. Although Haury was disappointed by the lack of stratified deposits at Canyon Creek, the dendrochronological results were no less than spectacular. After taking three dozen tree-ring cores back to Gila Pueblo for analysis, he informed Gladwin that he could identify the sequence, date, and sometimes the likely season, of construction events at Canyon Creek:

The beam material is all dated and out of it have come some rather interesting results. Cutting dates range from [A.D.] 1326 to 1348. In five rooms the dates of the major beams agreed within each room so that construction dates for them seem practically certain. Summer cuts out-number those trees on which the last ring is completely formed. The rooms at the ends of the pueblo and those built out in front gave more recent dates than the inner rooms, as would be expected. In the one case where both first and second story rooms dated, the upper one was constructed a dozen or so years later than the lower room. Twenty-nine of the thirty-six specimens collected dated (Haury to Gladwin, 12 August 1932).

Haury's (1934) dendrochronological analysis at Canyon Creek is the first sophisticated analysis of archaeological tree-ring dates within their architectural contexts, and remains a classic in the field. Importantly, his interpretations were not limited simply to construction sequence and date, for he offered behavioral inferences regarding the wood-use practices of the prehistoric inhabitants of Canyon Creek who had apparently used windfalls as easy sources of construction timber (Haury 1934:19). The heavily scarred surfaces of the major roofing beams indicated that they had been "dragged or rolled for some distance" after cutting (Haury 1934:55). He concluded that prehistoric migrations between A.D. 1327 and 1343 explained the sudden appearance of the cliff-dwellings in the Sierra Ancha, especially since the San Juan region had been abandoned less than one-half century before (Haury 1934).

Haury's convincing dendroarchaeological analysis of Canyon Creek Ruin was also important because the concurrence between architectural, archaeological, and tree-ring data provided potentially skeptical archaeologists with concrete reassurance that tree-ring dating and archaeological analyses might produce complementary results.(2) J. O. Brew of the Peabody Museum congratulated Haury (25 April 1934) about his Canyon Creek analysis, making sure to consider the implications of the analysis with regard to tree-ring dating and the perceived reliability thereof:

Your 'Dating' section is superb. I refer this time not to the manner of presentation, which is straightforward and clear, but to the results. It is the most convincing exposition I have yet encountered. Before I had reached your mention of it in the last sentence I had checked over the dates of 2nd storey [sic], outer, and inner rooms on the ground plan and had found that they came out right. This is truly a beautiful thing, Emil. As you know my skepticism of the validity of tree-ring dating in the hands of a competent analyst has evaporated. That skepticism is not transferred to the operator and has to do with the danger of the technique as applied by half baked or unscrupulous individuals. The credentials and references of a man claiming to read tree-rings cannot be too carefully examined and checked. It is to be hoped that Dr. Douglass, in a desire to assist his pupils in their efforts to rise, does not place the seal of competence upon them before their technique or their sense of responsibility merits it. For their responsibility is great when others place specimens in their hands and rely upon and publish the results of the analysis. Perhaps you would be so kind, when next you write, as to send me a list of the people you consider thoroughly competent in this work. Please do not hesitate to do this because of fear lest you be unfair to some. If you know a man to be incompetent who is, as we might say, "in public practice," I hope you will say so. Otherwise, if a name which I know does not appear on your list I shall merely infer that you have not sufficient knowledge of his work to permit a judgment and can promise you no unauthorized "reading between the lines" [emphasis in original].

By mid-1934, tree-ring dating and analysis became more complicated for Haury as the archaeologists whom he was serving became more sophisticated in their interpretation of the tree-ring dates he and other dendrochronologists provided. It is important to remember that at this time, Douglass was not involved in archaeological tree-ring dating, except to verify dates derived by his students. It was to Haury and Gila Pueblo that most archaeologists turned for tree-ring dating and interpretive advice, and indeed Douglass considered Haury the senior scientist in this regard (Douglass to Haury 15 March 1935). One example suffices to illustrate some of the problems with which Haury and others had to contend.

Paul S. Martin of the Field Museum of Natural History in Chicago excavated Lowry Ruin and surrounding sites in southwestern Colorado from 1930 through 1934 (Martin 1936). In the process he submitted tree-ring samples to three different laboratories, in part because he did not know which laboratory was engaged in commercial, though apparently *pro bono*, archaeological dating (letter Martin to Haury, 8 October 1931, see also Ahlstrom, Breternitz, and Warren 1985). Martin submitted samples to Douglass at the University of Arizona in 1931, Stallings at the Laboratory of Anthropology in 1933, Haury at Gila Pueblo in 1934, and kept some for safekeeping in Chicago as well.

By June 24, 1931, Douglass had derived a date of A.D. 989 for one of the Lowry Ruin specimens (letter J. Nusbaum to Martin). This date in and of itself did not raise many eyebrows, but when Haury checked Douglass' dating of the 1931 samples at Gila Pueblo in 1934, he verified the early date but also derived two cutting dates at A.D. 1106. He inquired of Martin as to their archaeological context (Haury to Martin 14 April 1934), and a week later Martin assured him that the A.D. 1106 dates made sense according to the masonry sequence and ceramic assemblages at the site.

Early the next year Martin received dates on the shipment he sent to Stallings in 1933, and problems arose. Douglass' A.D. 989 date, since re-dated to A.D. 987, came from a room from which Stallings had dated a specimen at A.D. 1090. Without considering the possibility that the earlier beam was reused, Martin asked Haury if there was some way that the earlier noncutting date could be "stretched," by adding missing rings, to reach A.D. 1090. Otherwise, he continued, there would be "a conflict in building dates which I cannot understand and which I shall have to reconcile in some other way, if possible" (Martin to Haury, 14 January 1935). Haury replied in the negative, it being unlikely that the specimen was missing ca. 100 rings. Instead, he suggested three possible sources of error in the dating of the specimen. Either Stallings' date of A.D. 1090 was incorrect, the Douglass/Haury date of A.D. 987 was incorrect, or the log from which the early date was derived was a reused beam. Haury deemed the latter most likely (Haury to Martin, 26 January 1935); Martin countered that the beam reuse hypothesis did not appeal to him because there was too much architectural evidence that all the rooms were built at one time. Martin thus confused the dendrochronological, architectural, and theoretical implications of beam reuse, which is not necessarily evident architecturally, with repair or replacement of a beam, which is more likely to leave an architectural mark.

In the end, Martin published dates for the great kiva and other portions of Lowry Ruin, but he did not stress tree-ring dates in his discussion of the construction sequence (Martin 1936). The construction sequence analysis was based on "bonding and abutments, by faced and unfaced walls, by similarities in masonry techniques, by pottery sequences, and by general impressions" (Martin 1936:194). "Convincing" tree-ring data "supplemented" his analysis (Martin 1936:201). Nevertheless, he appropriately warned that "a date obtained from single logs [sic] is not sufficient for fixing a period" (Martin 1936:198), but he concluded that "it is probable that the Lowry Pueblo was constructed over a comparatively short period of time" (Martin 1936:200). Three subsequently published dates lists offered different dates (for different specimens, however) and ranges of dates for Lowry Ruin: Stallings (1937:3) listed a range of A.D. 1090 - 1104 +/- 1, Haury (1938:3) listed dates of A.D. 1085+x - 1086, and Douglass (1938:11) listed a date of A.D. 987+x. Martin cannot be faulted for his confusion, though Haury (1935a) had already offered a preliminary treatment of archaeological tree-ring dating theory that Martin should (may) have consulted.

Between 1935 and the Spring of 1937, Haury continued the frenzied pace of archaeological research that was characteristic of Gila Pueblo during the 1930s, though his tree-ring research waned somewhat. He did work with Earl Morris on extending the Central Pueblo Chronology back to the Basketmaker periods. In this, his efforts duplicated those of Douglass, who also benefited from samples submitted by Morris. This duplication was due at least in part to growing tensions between Gladwin and Douglass regarding their increasingly divergent views on the nature of and proper procedures for reliable tree-ring dating (see Nash 1997a, Webb 1983). Haury, with loyalties to both, was caught in the middle of the disagreement, and was becoming increasingly uncomfortable at Gila Pueblo in light of Gladwin's extremism. Though he was under contractual obligations to remain at Gila Pueblo for three years after earning his doctorate in 1934, it is telling that he resigned Gila Pueblo on 26 April 1937 to become Chair of the Department of Archaeology at the University of Arizona. Gladwin graciously accepted Haury's resignation on May 11, 1937: "Our best wishes go with you. We hope you will find just what you are hoping for, and you can always count on us as friends who are deeply concerned in your success."

With the departure of Haury, archaeological "tree-ring dating" (3) at Gila Pueblo entered a new phase. As early as 1932 Gladwin's discomfort with the Douglass system induced him to begin his own study of archaeological wood and charcoal specimens. Between 1932 and 1941 Gladwin experimented with quantitative methods of tree-ring analysis. His subsequent criticisms of Southwestern archaeology, tree-ring dating, and the practitioners thereof is well known (Webb 1983, Downum 1988), and often includes *ad hominem* criticism of Douglass (Gladwin 1940a, 1940b), Colton and McGregor (Gladwin 1943, 1944) and even his former assistant director Haury (Gladwin 1946, 1948). Without going into the details of Gladwin's critique,

three aspects warrant review because his tree-ring data formed the basis of his re-interpretations of many aspects of Southwestern prehistory (Gladwin 1940a, 1940b, 1942, 1943, 1944, 1945, 1946, 1947, 1948).

Gladwin's primary objection to the Douglass system was that the skeleton plot method of dating was "subjective," and that the dates could therefore only be verified by Douglass or a member of his "school" (Gladwin 1942:3). To a certain extent, Gladwin had a point, though he confused "unsystematic" with "subjective." Gladwin felt that his own quantitative method, based on ring-width measurements, was "quantitative" and therefore by definition "objective," but these terms are not synonymous.

Gladwin also believed that archaeological evidence, or his interpretations of that evidence, should be considered more reliable than tree-ring dates when the two apparently conflict (Gladwin 1943:68; 1945:18; 1948:175). That is, he argued that archaeological evidence is the independent variable whereas tree-ring dates are dependent variables. Granted, dendrochronological dating theory in the 1930s was in its infancy, but the Douglass "school" and other archaeologists at least considered the possibility of beam reuse, structural repair, and other contingencies that might lead to apparent discrepancies between tree-ring dates and the archaeological evidence. Haury was Assistant Director of Gila Pueblo when he published "Tree-Rings: The Archaeologist's Time Piece" (Haury 1935a), and Gladwin must have been aware of the increasing sophistication of tree-ring date interpretation.

Gladwin's unflinching adherence to archaeological data seems downright peculiar given that tree rings are now considered the best source of culturally independent dates that archaeologists have (see Dean 1978b).

Gladwin's third objection to, or misunderstanding of, the Douglass technique relates to the distinction between cutting and noncutting dates, the latter of which he erroneously called "incomplete" (Gladwin 1945:30 see also Gladwin 1943:55). Gladwin thus failed to recognize the distinction between "precision" and "accuracy." Noncutting dates are as "complete," i.e. "precise," as cutting dates when they are properly crossdated. Whether they are "accurate" depends on what question is being asked. Noncutting dates are accurate if one is interested only in the growth date of the outside ring on a particular specimen, they are less "accurate" if one is interested in archaeological questions, such as determining the date when the tree was felled, or the date of a construction event. Properly crossdated noncutting dates are not, however, "incomplete" (see Dean 1978a). To be fair, Gila Pueblo does not receive the recognition it deserves for its support of Haury's dendrochronological contributions between 1930 and 1937, particularly his dating of Canyon Creek (1934) and the attendant contributions to archaeological tree-ring dating theory (Haury 1935a). Having provided Haury's salary, logistical, analytical, and administrative support, Gladwin and Gila Pueblo rightfully deserve as much recognition for Haury's contributions there as Neil Judd and the National Geographic Society deserve for Douglass' successful bridging of the gap. Ignoring for the moment whether Gladwin's technique was methodologically flawed, which it was, it is unfortunate that his peculiar demagoguery precluded constructive engagement between the Douglass "school" and the Gladwin "school," for some of his criticisms of the Douglass technique, in spirit if not in letter, were echoed by other archaeologists of the day. Unfortunately for Gladwin, patience, practice, and persistence can lead to expertise in the Douglass method of tree-ring dating, stubborn determination and unlimited finances can not.

Dendrochronology at The Museum of Northern Arizona

The Museum of Northern Arizona in Flagstaff was established in 1928 by Harold S. and Mary-Russell F. Colton in conjunction with the Flagstaff Woman's Club and the Flagstaff Chamber of Commerce (Downum 1988:98). Harold Colton, by training a zoologist, had been conducting systematic archaeological surveys in the Flagstaff area since 1916 and was interested in providing the local citizenry with their own collection of artifacts and specimens that could be used to explore the relationships between human behavior and the environment (Downum 1988:100). Employees of the Museum of Northern Arizona made significant contri-

butions in this regard especially after John C. McGregor was hired as Dendrochronologist and Curator of Archaeology in 1930. MNA's archaeological tree-ring dating over the next decade focused on the dating and archaeological definition of Pueblo II, and then Pueblo I, sites in the Flagstaff area, the dating of the eruption of Sunset Crater and, perhaps most importantly, the dating of ceramic types that still provides the basic chronological framework for northern Arizona (Downum 1988).

One of the first employees hired by Colton was Lyndon Lane Hargrave, formerly a student in biology at the University of Arizona and the sole participant in the National Geographic Society's Second Beam Expedition of 1928. Hargrave was hired as Assistant Director of the Museum of Northern Arizona on February 1, 1929. Only ten weeks later, however, Colton was pressured by Douglass and Judd to release Hargrave for the summer to act as the senior field member of the Third Beam Expedition. Colton acquiesced and released Hargrave, who graciously saw his absence from the Museum as an opportunity for an old friend and fraternity brother, John C. McGregor. Colton had inquired of Hargrave who might serve as an able replacement, and McGregor's name came to mind. Hargrave told McGregor that Colton might offer him the job of Acting Assistant Director of MNA in his absence, and Hargrave "depended" on McGregor to accept, partly because he hoped McGregor would do a better job in the office than he had, for Hargrave was more at home in the field. Three weeks later Colton offered McGregor a job, but it was a temporary position as Acting Curator of Archaeology rather than Acting Assistant Director (Colton to McGregor, 7 May 1929). McGregor rejected Colton's offer for reasons that are not entirely clear, and the Museum seems to have made it through the summer without an Assistant Director. MNA's fieldwork was largely postponed until the following year (Downum 1988).

In April 1930, Hargrave and Colton finished plans for five months of fieldwork in Deadman's Flat northeast of Flagstaff in the upcoming season (Downum 1988:106; Hargrave 1930:1). The goal of their research was simple: "to investigate Pueblo II, a little-known period in Southwestern archaeology" (Anonymous 1931a:2). Hargrave again thought of his friend McGregor, who was completing Douglass' tree-ring class in Tucson. Hargrave wanted McGregor to serve as his assistant (Hargrave to McGregor, 13 April 1930), and in June, McGregor joined the MNA staff as Curator of Archaeology and Dendrochronologist. He immediately began work on the many charcoal samples collected during Hargrave's May fieldwork in the Medicine Valley.

On June 1, 1930, Hargrave, assisted by Katharine Bartlett and a team of excavators, examined a number of Pueblo II sites (Hargrave 1930:1; Downum 1988:106). Their work began along Lower Walnut Creek, then moved to Wilson Pueblo and Medicine Cave northeast of Flagstaff. They tested or excavated at least 16 sites, including Medicine Fort (NA 862) and Medicine Pithouse (NA 1680), two sites that would later figure in Gladwin's critique of MNA's work (Gladwin 1943). Dendrochronology figured prominently in their research for they only excavated burned structures in which construction beams could reasonably be expected to be preserved *in situ* (Hargrave 1930:3). On the basis of archaeological evidence and the extant Douglass tree-ring chronology, Hargrave estimated the date for the Pueblo II dwellings to between A.D. 500 to A.D. 700 (Hargrave 1930). With this estimate, while not too far from the actual dates later derived by tree-ring analysis, Hargrave followed the paths of Kidder and other archaeologists of the day to overestimate the age of Southwestern ruins by at least a couple of centuries.

No matter how successful the 1930 fieldwork on the definition of Pueblo II occupations was, it was quickly overshadowed by the discovery that Sunset Crater had erupted during the time of prehistoric pueblo occupation in the Flagstaff area (Downum 1988:107). In June, Major Lionel F. Brady found black-on-white sherds lying on the surface of volcanic ash from the last eruption of Sunset Crater. He concluded that people must have been in the Flagstaff area during the as yet undated eruption. McGregor discovered an ash lens in the fill of a pithouse he was excavating at site NA 1296; Hargrave discovered a similar lens in another site, NA 860A. Hargrave subsequently excavated site NA 1653, near where Brady had discovered the sherds, and found two pithouses that were completely sealed beneath thick deposits of ash. Dating of the eruption of Sunset Crater thus became a major focus of MNA's tree-ring research (Brady 1932, Downum 1988:108).

In January 1931, results of McGregor's dendrochronological analysis were being verified by Douglass. Hargrave checked Douglass' conclusions on the basis of the archaeological evidence, and wrote McGregor on 14 January 1931:

I am pleased to learn that Dr. Douglass is getting results and that he is delighted with the material. I have checked the numbers of his last group, namely: NA 917, 894, 906, and 919, and find that all are from the large pithouse by the fort. I would have expected the cutting dates to be close. So far there has been no crossdating between any two sites, and recognizing archaeological differences between many of them, I must agree with you that a hundred years is far short of the time covered by the beam material we have collected. A hundred years for the [Medicine] Fort is ample, even after allowing for the growing period of the beam trees. I am anxious to have him work on some of the other sites.

Hargrave also seems to have directed Douglass away from potentially erroneous dating on the basis of contextualizing archaeological evidence.

Regarding [Douglass'] thought that possibly the Lower Walnut specimen might crossdate with the [Medicine] Fort material, I can hardly agree with him. I was a member of the party and did some hard work grinding the core out. I am familiar with the pottery complex, and it is much later than that of the Medicine Cave region. In fact, the entire division of Pueblo II characterized by small masonry houses intervenes between the Lower Walnut specimen and the Fort. The specimen in question is a core from a pine beam in an early Pueblo III kiva in a cave. The pueblo closely associated with this beam is even later than the Wilson pueblo. With this evidence, that has been substantiated so many times in the field, I would be greatly surprised if a crossdate is found.

When informed of Brady's June 1930 discovery of sherds on the Sunset Crater ash, as well as the discovery in 1930 of pithouses filled with ash, Douglass immediately recognized this new application of dendrochronology and expressed his interest. He hoped that he might find an assistant to help him in the Sunset Crater research, especially because Haury had left for Gila Pueblo and McGregor had decided to stay at the Museum of Northern Arizona during the academic year: "The possibilities of your discoveries last summer of ruins with volcanic ash in them are tremendously attractive and I am anxious to work that line to the very limit, for it is a most important one. John McGregor has done good work with those specimens, and I regret that he will not have time to register this coming semester for special work in them" (Douglass to Colton, 22 January 1931). Colton responded that on further analysis, the Sunset Crater problem had become even more interesting. The foundation for Colton's "Black Sand Hypothesis" (Colton 1960) is clearly evident in the following passage:

Our work on the Sunset ash fall has taken another twist. We find that in the area where there was a light fall of ash late Pueblo II and early Pueblo III sites are abundant. Outside of this area of the fall they are scarce. This suggests that the ash made a mulch which made agriculture, by Hopi methods, possible over a limited area After the winds stripped the land of ash, putting it into the canyons and the lee side of mesas, the country in late Pueblo III again became uninhabitable (Colton to Douglass, 28 January 1931).

Dating the eruption of Sunset Crater ultimately proved to be one of the successes of the MNA tree-ring dating program (McGregor 1936), though it was not an easy task. An initial estimate (Colton 1932) placed the eruption between A.D. 700 and 875. A second estimate narrowed the possible range to between A.D. 875 and 910 (McGregor 1936). This estimate was later revised to A.D. 1046 and 1071 (Colton 1945) on the basis of increasingly refined archaeological data and dendrochronological analysis. As Downum (1988)

points out, these corrections, rather than indicating McGregor's incompetence or the invalidity of Douglass tree-ring dating as Gladwin (1943) had argued, instead provides an excellent example of the self-correcting nature of scientific research, especially in sciences such as archaeology that operate with a database that is by definition incomplete.

Fieldwork at MNA in 1931 was as intense as that in 1930. The primary goal was, as noted, to date the eruption of Sunset Crater. Secondary goals included further definition of Pueblo II occupations in the area, bridging the gap between a new, local, and undated "Type I" tree-ring chronology and the dated Flagstaff chronology, and the exploration of the relationship between Pueblo II and Pueblo III sites (Downum 1988). Some 700 tree-ring specimens were collected from 48 pithouses and masonry structures in Medicine Valley northeast of Flagstaff that were either tested for charcoal or completely excavated (Anonymous 1931b).

The "Type I" dating sequence was successfully tied into the dated chronology in 1931, and while Douglass was pleased with this accomplishment, the dating confirmed, in Colton's words, "our worst fears" about the late dating of Pueblo II in the Flagstaff area (Colton to Douglass 25 November 1931). Hargrave (1930:3) had publicly announced his speculation that the sites would date between A.D. 500 and 700, but the tree-ring evidence in the Type I chronology suggests dates fell significantly after AD. 700. After some reflection and a return to the archaeological data, the implications of the Type I dating no longer seemed quite so unreasonable to Colton, however.

When John dated pithouse NA2002 as late as [A.D.] 1116 we thought it improbable. Since then Lyndon has studied the pottery from the site and found a part of a Tusayan polychrome bowl which had been imbedded in the floor. Tusayan Polychrome was not found associated with any other pithouse. Also sherds of an unnamed black-on-white which characterizes the transition from Pueblo II to Pueblo III were abundant. We must conclude that some people were still living in pithouses even while others a few miles NW were building masonry houses....The dates of Medicine Fort NA 862 fit better into the scheme of things. It means that masonry came into use in the region after 1000 and was used in the construction of granaries and forts before masonry dwelling rooms were built (Colton to Douglass 25 November 1931).

McGregor provided another perspective on the perplexingly late dating of Pueblo II in the Flagstaff area.

With the discovery of these astonishingly late dates we were thrown into an uproar, but now have gone after a more careful study of pottery types and are more reconciled to it. It is giving us some very neat problems and some information which is most valuable on the effects of peripheral culture. This is certainly going to prove most valuable to archaeology and will rather certainly shake some definitely preconceived ideas (McGregor to Douglass, 27 November 1931).

The Museum of Northern Arizona's 1932 fieldwork concentrated first in cliff dwellings in Walnut Canyon, then moved to additional sites in the Flagstaff area including Turkey Tank Fort (NA 113), Turkey Tank Caves (NA 117), Clarke's Caves (NA 811), Jack Smith Alcove Houses (NA 408, 409, 1295), Elden Pithouse (NA 1531), Bonito Terrace (NA 1570), Coyote Range Pithouse (NA 1959), NA 2055, 2056, 2057, 2058, and Bonito Park (NA 1814) (Hargrave 1932). While they were still unsuccessful in dating Sunset Crater (McGregor 1932), they had again collected a large amount of Pueblo I and Pueblo II beam material. They inferred that they were closing in on the true date of the eruption by bracketing it ever more closely, and the feeling at the end of 1932 was that the eruption occurred sometime between A.D. 1000 and 1100 (Douglass to McGregor 1 July 1932; Stallings to Douglass, 21 October 1932).

In March of 1933, McGregor officially became Curator of Dendrochronology at MNA. Douglass suggested that his first task be an intensive and applied reanalysis of already dated material that would yield the true

date of eruption. He informed McGregor that this was “a perfectly gorgeous subject, one promising to strike important conclusions with a minimum amount of labor and [if worked out with conservative and conscientious judgment]” (Douglass to McGregor 8 May 1933). Douglass later expressed his desire that McGregor use the dating of the eruption of Sunset Crater as a Master’s Thesis (15 June 1933). McGregor entered graduate school at the University of Chicago in the Fall of 1933 but did not, however, pursue the subject as a Master’s degree candidate. Important developments in archaeological tree-ring dating occurred before his departure, however.

McGregor felt as early as 1932 the need for a formal conference of dendrochronologists to systematize chronology nomenclature (Stallings to McGregor, 18 January 1932). In 1933, Emil Haury echoed McGregor’s concern for standardization in the presentation of tree-ring data and the need for a conference, although he lamented the fact that he had been out of tree-ring dating for nearly two years and might not have anything new to contribute (Haury to McGregor, 31 January 1933). In 1934, Jesse Nusbaum of the National Park Service suggested that a conference be called to address grievances with regard to destructive sample collection practices on National Park Service land. Whatever the final reason for its calling, the first Tree-Ring Conference was held June 11 and 12, 1934, at the Museum of Northern Arizona (Anonymous 1934; Colton 1934; Douglass 1934; Glock 1934b).

With Douglass serving as Chair, the first Tree-Ring Conference approved the following agenda:

1. Requirements in permits by Government
2. Checking dates before publication— a) errors made b) credit for dating
3. Photography of ring sequences— will have photos and probably models to show.
4. Recommendations regarding advanced courses
 - a) Archaeology
 - Doubles and false rings, charcoal and dating estimates, sapwood-heartwood contact and wearing, illumination and photography, pinyon reading and wood identity
 - b) Cyclology
 - tabular records, curves, etc., smoothing, crossdating and correlations, growth climate relations
5. Reports of difficulties by each worker
6. Discussion of suggested problems

Attendees included Douglass from the University of Arizona, his assistant Glock representing the Carnegie Institution, Stallings for the Laboratory of Anthropology, McGregor, Colton, and Ned Spicer for the Museum of Northern Arizona, Haury for Gila Pueblo, Louis Caywood for Mesa Verde National Park and Gordon Baldwin of the Arizona State Museum (see Haury to Gladwin 15 June 1934; Anonymous 1934). Dendrochronologists notably missing from the conference were Florence M. Hawley, who at the time worked for both the University of New Mexico and the University of Chicago (Nash 1997a), and Harry T. Getty of the Arizona State Museum.

Significant results of this conference include the formation of a *Tree-Ring Bulletin* for the prompt and standardized release of tree-ring data of all kinds, a formal statement delineating how tree-ring samples should be removed from archaeological beams, and the agreement amongst all present that no tree-ring dates should be released without “the checking of two individuals,” which meant the dendrochronologist who did the dating and Douglass, who did the verification.(4) Haury proposed a “uniform system of releasing dates” designed by Gladwin and Kidder that apparently did not meet with much favor for reasons that remain unclear (Haury to Gladwin, 15 June 1934). Douglass was named Editor-in-Chief of the *Tree-Ring Bulletin*, Glock Assistant Editor, Colton Managing Editor, and McGregor Assistant Managing Editor

(Anonymous 1934). In another testament to the archaeological interest in tree-ring dating during the 1930s, McGregor reported on December 7, 1934, that the *Bulletin* had 80 subscribers, including subscriptions "from the most unexpected quarters and people" (McGregor to Stallings).

Museum of Northern Arizona fieldwork in 1934 focused on further archaeological definition of the Pueblo I period around Flagstaff (Downum 1988). The dendrochronological focus of that research was to extend the San Francisco Mountains tree-ring chronology back "beyond the lower limits of Pueblo II . . . prior to about 800 A.D." (Spicer 1934:17). Approximately 175 charcoal specimens were collected in the vicinity of Baker Ranch, northeast of Flagstaff (Spicer 1934:18). Hargrave worked from early June to late August on the Rainbow Bridge Monument Valley Expedition, a stated goal of which was to gather tree-ring and architectural data (Hargrave 1935a). Unfortunately, no tree-ring specimens were collected by the expedition that year, ostensibly because of a personnel shortage and the Tree-Ring Conference (Hargrave 1935a:26).

In the spring of 1935 MNA's research contributed to the extension of Douglass' basic Southwestern chronology. This allowed for the first time solid dating of the Pueblo I occupation north of Flagstaff (McGregor 1935) as well as the Basketmaker III horizons on which Earl Morris had been working. Haury offered McGregor congratulations for his contribution in the Douglass/Morris effort, adding that "I am simply consumed with curiosity as to where Morris' Basketmaker II date falls. Let me know as soon as the gates are dropped" (Haury to McGregor, 20 March 1935). Hargrave was again ensconced in research in Tsegi Canyon and Dogoszhi Biko, while Colton and McGregor engaged the Sunset Crater research. This time, however, McGregor sought to date the eruption indirectly by crossdating artifact assemblages from sites under the ash with securely tree-ring dated archaeological sites along the Little Colorado River (Downum 1988:128).

In May of 1936, McGregor informed his former department head at the University of Chicago, Fay-Cooper Cole, that Douglass was finally ready to publish dates for Basketmaker sites, and considered the implications of that dating:

Our whole concepts of archaeology are changing so rapidly and violently that we are almost literally going "round and round." Just today I received the manuscript from Dr. Douglass which will release the dates on all of the early cultures here in the southwest and for the first time date the Basketmaker stages. Morris has agreed to give a paper on the culture associations to accompany it in the *Tree-Ring Bulletin*. This is the greatest contribution to the history of southwestern archaeology to date I am sure for now we can make all our comparisons on the basis of time, and it is not too much to expect that we shall soon be writing histories of the prehistory here. Add to this the Mogollon culture and its influences in various directions at a very early date and you can see why we are all working so feverishly now.... The rate at which information is accumulating is almost overwhelming... I cannot help laughing when I look back a few years to the time when we felt everything, at least in general, was pretty well understood [McGregor to Cole, 24 May 1936].

Archaeological investigations by the Museum of Northern Arizona in 1936 were restricted to Twin Caves Pueblo in Tsegi Canyon and Winona Ruin east of Flagstaff, though some additional testing was conducted at the Citadel at Wupatki National Monument. This concentration of effort reflects a shift in research emphasis away from dating Sunset Crater toward more detailed definition of local culture units in the Flagstaff area (Downum 1988:129). Only 172 tree-ring specimens were collected during the 1936 season (Colton 1937).

The correspondence record from 1937 to 1940 indicates that the Museum of Northern Arizona continued to direct efforts at the definition of local culture units. Colton, McGregor, and Hargrave were engaged in their own projects, and while tree-ring dating continued to be conducted by McGregor, MNA received only six specimens in all of 1937 (Colton 1938). Laboratory research was conducted and published, but no great

changes or controversies in archaeological tree-ring dating or interpretation are evident. Watson Smith, who had been working at Awatovi with J. O. Brew, asked McGregor to date wood from that site and others investigated by the Rainbow Bridge - Monument Valley Expedition (21 October 1937). McGregor was the obvious choice for this task because of his familiarity with the ring sequences in the area, but for reasons that are not stated in the correspondence, he refused the job (McGregor to Smith, 13 November 1937). Brew subsequently tried to have Haury date the specimens, but he too was also busy, and tried to foist the task off on Getty (Haury to Brew 12 October 1937). Getty never analyzed them and the Awatovi specimens ultimately went to the Laboratory of Anthropology for analysis by Ned Hall. In 1937, McGregor submitted to Haury for publication in the *Tree-Ring Bulletin* a list of ruins dated by the Museum of Northern Arizona over the previous six years (McGregor 1938a). Haury's comments on McGregor's date list are interesting from the perspective of archaeological tree-ring date interpretation, as he tried to understand the relationship between tree-ring date ranges and actual site occupation dates.

In most cases the date range covers a relatively short span of years which, in general, can be taken as the construction period. In a sense the range also gives the duration dates, as in most structures—late ones at any rate—there was probably some building as long as there was occupation. Where the range of dates is long, I can see that construction cycles might fall within the range—and it would be very valuable to show this.... My [date] list [for Gila Pueblo (Haury 1938)] is also completed ... this list will be worth its weight in gold because it should serve as a basis for some interesting discussions by ourselves as others. . . It's high time, I feel, that we get into more interpretation [Haury to McGregor 10 July 1937].

It had been nearly two years since Haury's first treatment of archaeological dating (Haury 1935a), and theory was still clearly on his mind, if not on everybody else's. In the emphasis on tree-ring dating theory, however, Haury was still at least two decades ahead of the pack (Ahlstrom 1985, Bannister 1962, Dean 1978a, Smiley 1955).

In 1938, Hargrave's field research focused on "ethnic" problems in the area west of the San Francisco Peaks (Downum 1988), where tree-ring dating could not be applied because of the lack of datable tree-species. Colton and Hargrave (1937) had recently published their *Handbook of Northern Arizona Pottery Wares*. McGregor's research focused on dating the prehistoric ceramic types listed in their handbook (McGregor 1938b). Colton and Hargrave (1937:26) described McGregor's success in this effort as "one of the greatest advances in Southwestern archaeology in the last ten years" because it provided archaeologists who were not trained in dendrochronology the ability to obtain date ranges for their sites on the basis of identified ceramic assemblages.

McGregor (1938b) differentiated three kinds of dating for the ceramic types on the basis of the dating's interpretive reliability: primary dates are based the tree-ring dates themselves, secondary dates are derived from the direct association of tree-ring dates and pottery types, and tertiary dates are derived from the association of pottery types identified at undated sites. Stallings was appreciative of McGregor's effort, for "too many of the dates referred to pottery types have been by guess and or by God, without any analysis of the factors underlying the dating" (Stallings to McGregor 13 April 1939).

In 1939, MNA excavations were again in full-swing. McGregor and Benjamin Wetherill excavated or tested some thirteen sites in and around Ridge Ruin, and continued excavations at Winona Ruin, which McGregor had been excavating for MNA and the Arizona State Teacher's College since 1936. The dating of these sites assumed greater importance as the excavation neared completion. Douglass reminded McGregor that there was still a weak point in the Flagstaff chronology ca. A.D. 1250 -1350, and suggested that he therefore target his sample collection activities accordingly (21 May 1939). On June 17, McGregor sent Douglass a number of specimens from Winona and nearby sites for date verification (UofA SC DC Box 75 Folder 11).

When he had not heard anything by late December, he again appealed to Douglass for help, citing the interpretive significance of Winona and Ridge Ruins. "The entire [Winona and Ridge Ruin] report should hinge about the dates from the tree ring material, so I am more or less at a standstill until I can get some dates which are releasable. Hence this note to find the status of the material I sent you. [I am] particularly interested in specimens from NA 2133A [a component of Winona Ruin]. This would give us the beginning of Hohokam culture in this section of the north, and is of utmost importance" (McGregor to Douglass, 28 December 1939, UofA SC DC Box 75, Folder 11). Because of Douglass' failure to verify the dates in due time, the report was published with a minimum of tree-ring dates.

In late winter 1941, McGregor received correspondence from C.T. Hurst of Western State College in Gunnison, Colorado (10 February 1941 JCMP.MNA Box 304 Folder 22), who was excavating Tabogauche Cave in west-central Colorado (Hurst 1940, 1941). Hurst was interested in doing his own tree-ring dating, and hoped that McGregor's Flagstaff chronology, or a chronology based on the Mesa Verde sites alone, might be more appropriate for his purpose than Douglass' Central Pueblo Chronology. Despite a valiant effort, Hurst and his colleagues met with little success. "Sixteen cross-sections were made for the various [pinyon and juniper] timbers found in the cave.... In the laboratory, two well-trained but unnamed] assistants spent from one to three hours daily on the Tabogauche wood for 5 months and have succeeded in definitely crossdating only three of the pieces. Great difficulties were encountered in incomplete rings, missing rings, irregular rings, double-rings, lenses, and other irregularities that necessitated cross checking from piece to piece. However, on the basis of this study, we confidently state that the completely determined logs were felled in the 4th Century (348, 361, and 372 A.D.)" (Hurst 1941:11).

In October, 1942, McGregor became Acting Director of the Illinois State Museum in Springfield, and active dendrochronological research ceased at MNA. As early as mid-1940, however, McGregor and Colton were becoming more involved in their own "Gladwin debate" (Downum 1988, Nash 1997a; Webb 1983). Gladwin's attack on MNA archaeology and dendrochronology is rooted in the 1931 dating of sites in the Medicine Valley northeast of Flagstaff, especially Medicine Fort (NA 862) and Medicine Pithouse (NA 1680), for Gladwin firmly believed the dating of these sites to be in error. His critique soon expanded to a debate regarding the nature and dating of the prehistoric occupations of the Flagstaff area as a whole (Gladwin 1943). This debate is too complex to examine in this paper, but one clear and important effect of Gladwin's critique is that it provided Colton and the MNA with the impetus to undertake a needed and thorough review of Flagstaff area archaeology. This review led to the publication three years later of Colton's *The Sinagua* (1946), and ultimately led to the accurate dating of Sunset Crater (Colton 1945). Overall, archaeological tree-ring dating enjoyed a prosperous career at the Museum of Northern Arizona. Dating and chronology building occurred throughout McGregor's tenure there from 1930 to 1942: the Flagstaff Type I series was added to the Central Pueblo Chronology in 1931, Pueblo I and Pueblo II period sites in the Medicine Valley were successfully dated by the mid-1930s (McGregor 1938a), and McGregor dated a significant number of northern Arizona ceramic types by 1937 (Colton and Hargrave, 1937, McGregor 1938b).

Dendrochronology at The Laboratory of Anthropology

Archaeological tree-ring dating at the Laboratory of Anthropology was initially directed at the construction of an independent chronology for the Rio Grande Valley. Douglass recognized the need for a separate Rio Grande chronology as early as 1927, when he responded to Judd that he was "at a loss on some of the specimens from the Rio Grande Valley for many of them are harder to date than I expected" (24 June 1927). Jean Jeançon and Oliver Ricketson had collected specimens in the area for the First Beam Expedition in 1923, and A.V. Kidder had been submitting specimens to Douglass from his excavations at Pecos Pueblo since that year as well. While Douglass could identify his Flagstaff sequence in living trees from the Rio Grande valley, he was not comfortable with the crossdating in prehistoric specimens. Indeed, Douglass'

discomfort with the Rio Grande specimens was severe enough that he withheld publication of prehistoric dates from Pecos in his National Geographic report of 1929 (Douglass 1929). He explained his decision to Kidder in late October 1929: "It seems to me on the whole that for inclusion in a final list like that the Pecos date should have received a careful comparison with other Rio Grande material. I shall not feel satisfied about the Rio Grande area until it receives a complete chronological study from modern trees back as far as one can go. It has I know many points of similarity to the Flagstaff area and I believe the dates I sent you are all correct, but in final statement I hold them subject to checking with other Rio Grande material" (28 October 1929).

The Laboratory of Anthropology's (LoA) possible role in the development of a Rio Grande Valley tree-ring chronology was considered by the Board of Trustees almost immediately after Douglass' (1929) publication (Jesse Nusbaum to Douglass 7 January 1930). It is quite clear that archaeologists at the Laboratory wanted tree-ring dates for their area as soon as possible. Kenneth Chapman obtained from Douglass the equipment necessary to begin collecting specimens on his own (Douglass notes 4 February 1930); Nusbaum sought from the Board \$500 and a car to entice Douglass to conduct relevant fieldwork (Nusbaum to Kidder 10 May 1933).

W. Sidney Stallings, Jr., one of Douglass' best students, was hired by the Laboratory of Anthropology in 1931 specifically to develop a high-quality tree-ring chronology for the Rio Grande Valley, a task that would require his full-time effort over the next two years. After the chronology was completed (Stallings 1933), dendrochronological research at the Laboratory focused on the extension of tree-ring dating to the Basketmaker II period and the establishment of tree-ring sample collection and dating protocols. The Laboratory's Dendroarchaeological Program also welcomed unsolicited archaeological samples for dating throughout the 1930s. After Stallings left the Laboratory in 1938, Edward T. Hall was hired to do the tree-ring dating, and focused his efforts on dating samples for the Peabody Museum's Awatovi expedition and Columbia University's Gubemador expedition. I will here focus on Stallings' contributions.

In the spring of 1930 interested archaeologists understood that there was a good possibility that Haury, under Douglass' close supervision, would attack the Rio Grande chronology. Indeed, Douglass entertained the idea that the Rio Grande might pay his assistant's salary (Douglass to Nusbaum, 5 April 1930). Jesse Nusbaum, as Director of the Laboratory of Anthropology, informed Kidder, Chairman of the Board of Trustees, that "we should make a move on Haury" (9 April 1930). While Kidder examined sources of funding for Haury's position (Kidder to Nusbaum, 15 April 1930) Nusbaum solicited a detailed proposal from Douglass, though Nusbaum estimated that the entire project, including Haury's salary, would cost about \$2000 (Nusbaum to Kidder 16 April 1930). By the end of April, Haury was no longer available because he had been hired by Gila Pueblo (Douglass to Nusbaum, 29 April 1930). By the end of May, McGregor and Stallings were considered as possible alternatives to Haury. McGregor, however, was never really seriously considered because he was committed to teach at the Arizona State Teacher's College in Flagstaff through mid-August (Douglass to Nusbaum, 23 May 1930). Stallings, who had just completed Douglass' tree-ring class, was therefore hired in 1931, after Nusbaum acquired administrative approval and funding from the Laboratory's Board of Directors.

Prior to being hired, Stallings helped his case at the Laboratory by collecting archaeological tree-ring specimens while working at Chetro Kettle with Edgar Lee Hewett in 1930. He also helped secure his chances for the position by collecting specimens on his own volition at the Jemez ruins that year as well (Douglass to Nusbaum, 22 January 1931). Douglass worked with Stallings on the prehistoric materials in Tucson as salary and logistical arrangements were finalized in Santa Fe (Nusbaum to Douglass, 27 January 1931). At the end of March, Douglass noted that he was pleased with Stallings' progress:

Stallings is industrious and making progress. I believe we have excellent tree records going through the [A.D.] 1500's and to [A.D.] 1650. The others begin about [A.D.] 1725. Working on the Rio Grande material in hand. Trying to get modern trees that cover [A.D.] 1650 to 1725. Will come up [to Santa Fe] with Stallings for 10 days in June. He will need a car and an assistant. \$80 to \$100 a month for salary, three months fieldwork and six months analysis (Douglass to Nusbaum, 28 March 1931).

Douglass and Stallings motored from Tucson and arrived in Santa Fe on June 10, 1931; Douglass remained there for ten days to help Stallings set up the tree-ring laboratory. He also examined new specimens from the National Forests and finalized plans with Nusbaum. By late July, Stallings had settled in comfortably and gained the favor of both Kidder, who took a "great shine to Stallings" (Kidder to Douglass, 6 July 1931), and Nusbaum, who commented on his diligent work habits. Mr. Stallings, in my mind, is one of the finest fellows to work with and to have about an institution that I have known for a long, long while, and he is a hard worker, coming here night after night to check up on the last material recovered in his expeditions (Nusbaum to Douglass, 22 July 1931).

Stallings conducted four months' fieldwork in 1931, collecting samples from living trees, stumps, and archaeological sites on National Forest, National Park Service, state, and private land in order to build the Rio Grande tree-ring chronology. The research was analogous to Douglass' effort to develop the Central Pueblo Chronology during the 1920s, but Stallings had the benefit of Douglass' dendrochronological experience and expertise to guide him. He filed detailed progress reports were filed with Douglass on July 7, August 5, August 25, September 7, and September 15. Stallings provided Nusbaum with a more comprehensive report that included statements about the strategy behind each phase of the research. In 1931, Stallings

Collected 324 living tree specimens from the northern, middle, and southern ends of the Rio Grande drainage, including the southeast Jemez Mountains, the Valle Grande, the Santa Fe Plain and the Galisteo Basin, the southern Manzano Mountains, the Pecos drainage, the Ojo Caliente drainage, the Gatinas Mountains, and the Rio Fernandez de Taos and the Rito de la Olla near Taos.... [Dated the following] historic sites: Palace of the Governors, Pecos Mission, Jemez Mission, Quarai Mission, Abo Mission, Tabira Mission.... [Sampled the following] pre- and proto-historic sites: Tsia, a site near Angostura, Pecos Pueblo, Pueblo of San Cristobal, Tyuonyi, Puyé, Tsankawi, Tsherige, Kotyiti, Hupobi, Howiri, Posi, Te'ewi, Poshu, PueWo She, Blanco, San Pedro Viejo, Tung-ge, Purai, Unshagi, Frijolito, Navawi, an unnamed site in Rio Puerco drainage, and Pueblo Largo [14 October 1931].

Stallings also noted a scientific 'benefit' of pothunting: the holes left as a result of illicit excavations often revealed whether or not charcoal was present in a site, and therefore saved time for the dendrochronological survey (Stallings to Douglass, 5 August 1931), which would not excavate without evidence of charcoal.

Stallings hoped to establish the Rio Grande chronology back to A.D. 1100 on the basis of the 256 wood specimens and 127 bags of charcoal collected at the sites listed above. While he did not have much Rio Grande archaeological or tree-ring experience prior to his arrival in Santa Fe, his research design was an established one that used the same formula for success that had worked for the Third Beam Expedition. He used the pottery sequence established by Dr. Harry P. Mera, a retired physician and Curator of Archaeology at the Laboratory, to target sites for examination, working serially and stratigraphically from those of known date back to those of unknown date (Stallings to Nusbaum, 14 October 1931, see also Stallings to McGregor, 30 June 1931, and Meeting notes, 5 September 1931).

The Laboratory of Anthropology enjoyed its formal opening in October 1931. A distinguished group of scientists, including Douglass, traveled to Santa Fe for the gala and associated scientific conference. It is possible that Nusbaum and Douglass at that time discussed the possibility of moving Douglass' entire tree-ring research program to Santa Fe. In January 1932, Nusbaum wrote to congratulate Douglass on winning the Research Corporation Merit Prize. He also dropped a not-so-subtle hint. "We rejoice with you, and look forward to the time when you can work at least part of the year with us here at the Laboratory" (7 January 1932, UofA SC DC Box 76, Folder 15). The Laboratory made several serious attempts to entice Douglass to move his laboratory to Santa Fe over the next several years. Nusbaum, as Director, was engaged in a struggle to build the Laboratory's research programs (Stocking 1982), and the addition of Douglass would have been a major accomplishment that would have shifted the center of tree-ring dating from Tucson to Santa Fe.

Stallings recommended to Nusbaum in the spring of 1932 that no substantive fieldwork be conducted in lieu of continued laboratory analysis of the many specimens collected in 1931, though he also expressed his desire to find living trees more than 500 years old to solidify the sequence between A.D. 1436 - 1510 in his chronology. In addition, Stallings also planned the course of his research after the chronology was established. "After crossidentification is accomplished there remains the further laboratory work of measurement of specimens, plotting of curves, arrangement of data, and the photographing of specimens so as to be able to present proof of dating" (Stallings to Nusbaum, 1 April 1932).

On May 15, 1932, Stallings reported to Douglass that he had examined some 1500 pieces of charcoal and 290 pieces of wood "more or less intensely" and that he now had two significant chronologies. These consisted of a "dated sequence for the Jemez Mountain area back to 1510, with some doubt back to 1436, and a late undated sequence of 340 years from the Pueblos of Pecos, San Cristobal, and Quarai." He bridged the gap between the two chronologies on August 8th (Stallings to McGregor, 20 September 1932), and explained to Douglass that the Rio Grande Chronology was well established to A.D. 1200 and that the Pecos Pueblo specimens for which Kidder so desired dates ranged from A.D. 1310 to 1695. He noted that an "intensive drought" occurred in the Rio Grande valley during the early A.D. 1400s, thereby accounting, in part, for the difficulty in bridging his two major chronologies.

Stallings explained his achievement to McGregor one month later:

The tree-ring situation in New Mexico is looking up just at present. On August 8th I got the chronology back to [A.D.] 1200— it may not be early to you, but after working for over a year on the stuff, it seemed to me that [A.D.] 1200 was really antiquity, and dated a few sites from Rio Grande P II I B-on-W sites up. Not for publication- the B-on-W site dates [A.D.] 1310, A Glaze III site, Frijolito, dates [A.D.] 1450, and the last big building period at Pecos and San Cristobal dated from about [A.D.] 1430 to 1450. When Kidder gets out his notes on the distribution of the pottery types in the different Pecos rooms we will have a fair idea of the correlation of dates and pottery from there (20 September 1932).

In a brief exchange in November 1932, Stallings and McGregor addressed the differences between their respective chronologies. McGregor inquired in particular whether the Rio Grande chronology indicated a "drought immediately following the Pueblo Indian revolt; that is, during the years [A.D.] 1680-1690," for according to his studies in Flagstaff, a drought occurred in northern Arizona during that decade (14 November 1932). Stallings considered the sociopolitical and historical implications of such a drought, but replied in the negative.

There is no good evidence of an extreme drought during this time. A few specimens show a slightly smaller set of rings during this time, but it is not an unusually small set. [A.D.] 1680 and 1689 were

flood years; [A.D.] 1685 is small, in many cases absent. The slightly dry spell during this decade appears to have been scattered locally, and even in such spots was not on the whole extreme. All this is contradictory to the testimony of the Indians following the re-conquest, but one must bear in mind that this decade was one of social instability around the [Rio Grande] Pueblo population, which would surely affect to some degree their pursuit of agriculture. Further, such testimony was exactly what the Spaniards wanted to hear, and whether completely true or not, it would have been the politic thing to say (20 November 1932, JCMP MNA MS304 Folder 3).

In the Spring of 1933, Stallings prepared a series of reports and publications. He and Nusbaum made plans to formally announce the Rio Grande archaeological dates in Las Cruces, New Mexico, at the Southwest Division meeting of the American Association for the Advancement of Science, May 1-4, 1933. Though Stallings first needed to have Douglass' verification of his chronology and dates. (Stallings to Douglass, 18 January 1933). Douglass and his wife traveled to Santa Fe in April to achieve this end (Nusbaum to Wissler, 22 April 1933), and Stallings' chronology and dates were quickly verified. Dendrochronological papers at the Las Cruces meeting were read by Getty, Waldo Glock, Hawley, McGregor, and Stallings (Nusbaum to Hauray, 5 May 1933). Getty spoke of his work at Mesa Verde, Glock presented an overview of the Douglass tree-ring method, and Hawley and McGregor presumably presented results of their research at Chetro Ketl and the Medicine Valley sites, respectively (Nusbaum to Finnan, 16 May 1933). Most significantly, Stallings presented the Rio Grande chronology and dating, a remarkable accomplishment achieved in less than two years.

In the meantime, Stallings submitted a report to Nusbaum on the dating of the "Oldest House in Santa Fe," in which tree-ring dating and archaeological evidence were used to debunk the idea that the "Oldest House" was of pre-Spanish origin:

Traditionally, the "Oldest House" is supposed to have been built by Indians before the coming of the Spanish, and to have been taken over and used by them. Tradition has it, further, that the house was the residence of the Indian chief of the presumed pre-Spanish pueblo. There is no material evidence to support this view. In the first place, there is no irrefutable evidence, historically or archaeologically, that the site of Santa Fe was occupied by Indians at the time of the founding of the Spanish settlement. The latest historical information, from recently discovered documents in the archives in Mexico City, indicates that Santa Fe was not founded before [A.D.] 1609, and probably in [A.D.] 1610, by the third governor of New Mexico, Pedro de Peralta. The evidences of aboriginal occupation which were found during restoration of and excavation in the Palace of the Governors undoubtedly dates from the Pueblo Rebellion, when the edifice was occupied by Indians from [A.D.] 1680 to 1694. Black-on-white sherds can be found in various parts of the city today, and such sherds were picked from the walls of the "Oldest House," but villages in which this type of pottery was made had been abandoned and in a state of ruins well over a century before the discovery of America. Positive evidence that the "Oldest House" is of post-Spanish origin is found in that building itself. In the many places where plaster has fallen away and walls are exposed, adobe brick can be seen. The Pueblo Indians did not make adobe brick before being taught by the Spaniards, but used a "puddle" method of construction.

The gist of the above evidence is, then, that the "Oldest House" does not date before [A.D.] 1610, and it might well have been built later. If it was first built in the early 17th century, there is a good chance that the house was at least partially destroyed during the Pueblo Rebellion of [A.D.] 1680.... It was thought that a study of roof beams might yield data on the antiquity of the house. [Seven specimens were collected and dated to A.D. 1741 - 1768.] In summary, there is no foundation except tradition that the "Oldest House" was built in pre-Spanish times. The present roof of the old, lower story was probably built in [A.D.] 1764. Further conclusions [are] not possible until plaster coatings are removed [Stallings to Nusbaum, 8 March 1933].

On September 25, 1933, Stallings filed with Nusbaum his annual report of "The Dendro-Archaeological Project." He noted that in the past year 284 specimens had been dated for the following sites as far back as A.D. 1100: "Palace of the Governors, the "Oldest House" and San Miguel Chapel in Santa Fe, the mission churches at Pecos, Quarai, Abo, Gran Quivera, San Diego de Jemez, and San Juan, the pueblos of Pecos, San Cristobal, Largo, Posi, Hupobi, Frijolito, Tyuonyi, Puyé, Tshirege, Unshagi, Tunque, an unnamed, large Jemez site in the Jemez Mountains, and unnamed sites bearing the LA numbers 251, 545, 27, 309, 8, 76, 1104. The latter six are Pueblo III, Black-on-white sites."

Fieldwork in 1933 was limited to sample collection at the "Oldest House," excavations at Pueblo Largo in the Galisteo Basin, and test pitting at eight Black-on-white sites on the Pajarito Plateau, at Kuaka-a, and two sites near Lamy, New Mexico. This phase of Stallings' research achieved some closure when he published the Rio Grande chronology later that year (Stallings 1933).

From December 1, 1933, through June 1, 1934, Stallings and his colleague Stanley Stubbs excavated Pindi Pueblo, a Rio Grande Pueblo III site on the Santa Fe River. Labor was supplied by the Emergency Relief Administration and Civil Works Administration. Stallings began excavations at two earlier sites near Pindi three weeks later in order to secure tree-ring materials that would help extend the Rio Grande chronology back before A.D. 1100. During the course of these excavations, Stallings acquired so much tree-ring material that Nusbaum was able to secure Federal Emergency Relief Administration funding for an assistant; he wrote Douglass on August 22 asking if a qualified individual, perhaps Carl Miller, was available (Nusbaum to Douglass, 22 August 1934). The assistant never materialized, perhaps because, trained personnel were not available.

In his annual progress report, Stallings reported that the chronology had not been extended prior to A.D. 1100. On the other hand, the twelfth and thirteenth centuries in that chronology had been considerably strengthened by excavations at the two sites near Pindi Pueblo. Two hundred sixty one specimens were dated that year, bringing Stallings' four-year total to 533. He reported that 13 Black-on-white sites had been dated, as well as 17 Biscuit Ware sites and 17 historic buildings. He also reported in his paper "Pueblos of Historic Times on the Pajarito Plateau, New Mexico," read by a colleague at the AAAS meetings in Berkeley, that "our present ideas of the time element involved in the divisions of Rio Grande Pueblo IV culture must be changed" because tree-ring evidence demonstrated that many supposedly prehistoric sites in the Rio Grande Valley had actually been occupied after European contact (Stallings to Nusbaum, 28 September 1934). Stallings' revelation had implications for historians, who might have to reanalyze Spanish accounts of their relationship to Native American populations in the area.

With the Rio Grande chronology firmly in place, Stallings increasingly turned his attention to the application of tree-ring dates to archaeological problems. In a memorandum to Nusbaum and Douglass some time early in 1935 he related the following approximate dates for the Rio Grande ceramic periods:

- Glaze I: 1375 +/- 75 years
- Glaze II: short or absent
- Glaze III: about 1500
- Glaze IV and V: 1500 to 1700, some lag and overlap
- Glaze VI: About 1700

Despite a four-year search, Stallings had difficulty finding tree-ring material to date the Glaze II period because he could not find any sites that were abandoned while that ceramic ware was in vogue (Stallings, 14 October 1931, "Report of Fieldwork 1931"). In a letter to Nusbaum on January 28, Stallings discussed the Glaze Ware phase dating, the implications of which were not qualitatively different from the ramifications

of the Central Pueblo Chronology: "We have at present an approximate chronological outline of Rio Grande Pueblo IV, with lowest probable dates for the sub-periods. This outline is at variance with older concepts, particularly as regards the later periods, the estimated age of which was inferred from historical (documentary) sources; such towns as Puyé and Tshirege are now known to have been occupied well into the historic period, and the whole development of Rio Grande Pueblo culture has been pushed up considerably in time."

In the same letter, Stallings considered a proposal that Elsie Clews Parsons had made to Alfred Kroeber regarding the use of tree-ring dating in the study of extant and historic pueblo communities. Stallings knew first hand of the difficulties involved in collecting tree-ring specimens in occupied villages, as well as the difficulties of interpreting the data once specimens were dated, due to extensive beam reuse in the area. As such, he argued that additional stylistic dating be conducted before intensive beam-by-beam tree-ring analysis be attempted:

Dates from any (historic) site mean little unless they can be correlated with certain traits which have important chronological values. The difficulties in the way of collecting in the inhabited villages, and the great deal of work entailed—much of which will be of very little immediate value—I believe that the proper procedure at the present time is to date the regional chronological horizons as they have been determined by stylistic changes in pottery, and to apply the approximate dates so obtained to any pueblo or group of pueblos, the main features of the ceramic history of which are known. When such an outline has been formulated, and general historical conclusions drawn, beam dates . . . can then be evaluated as to their possible significance.

Stallings concisely stated this strategy in a letter to Benjamin F. Betts of the Housing Research Project at Purdue University, who inquired about tree-ring dating at Acoma Pueblo. "We have been chronology building with an aim to establishing the sequence of prehistoric and historic horizons, with emphasis on dating of stylistic changes rather than the details of individual sites" (24 April 1936).

For much of 1935, Stallings was engaged in laboratory analysis of the many tree-ring specimens collected during the previous year's excavations, though he did conduct fieldwork at Pindi Pueblo for three weeks in late August and early September. Nusbaum's annual report to the Board of Trustees notes that Stallings derived 125 new dates from 15 sites, leading to a total of 658 dates from 62 sites (31 October 1935).

In early 1936, the Laboratory of Anthropology was in trouble. Jesse Nusbaum resigned as Director in late 1935 to again become Superintendent of his beloved Mesa Verde National Park. He was replaced by Kenneth Chapman, who was already in his 60's and suffering from tuberculosis. The Laboratory's financial situation was deteriorating, and the \$20,000 budget Stallings submitted to the Rockefeller Foundation for his tree-ring program was cut in half. Worse for Stallings from a personal standpoint was that Laboratory funding for his doctoral work was now out of the question. Stallings wrote to Douglass, "as you know the Laboratory intended to send me back to school for a doctorate. This must now be written off the books, but there is a slight possibility that school can be managed by other means. If it does become possible I want to see some sort of report on the Rio Grande chronology finished before I go if that is at all possible" (26 January 1936).

Kenneth Chapman's 1936 report to the Laboratory's Board of Trustees stated that Stallings had extended the Rio Grande Chronology back to A.D. 950, though this extension was still provisional and subject to Douglass' verification (31 October 1936). He had dated material from Pindi Pueblo and the Riana Ruin, excavated by Frank Hibben in 1934, and extended tree-ring dating to south-central New Mexico by dating material from the Three Rivers site collected by Hattie and Burton Cosgrove of the Peabody Museum. Stallings also gathered 132 living tree specimens from Tennessee, Georgia, and other southeastern states during a whirlwind tour in the summer, although the specimens proved of little dendrochronological value since they were from secondary-growth forest contexts (Chapman to Cole, 31 October 1936).

Archival material relating to Stallings' research at the Laboratory during 1937 is meager, though he apparently focused on dating as many specimens as possible before leaving in September to begin graduate studies at Yale University. That year he dated some 300 specimens from 29 sites, leading Director Chapman to note that "the steady increase in the demands of others for the technical services of [the tree-ring] department will make necessary a reconsideration of [that] program" (Chapman to LofA Board of Trustees, 31 October 1937). Chapman was supportive of tree-ring research at the Laboratory but was subsequently replaced as director by H. Scudder Mekeel, an applied anthropologist who did not share his sentiments for dendrochronology. During Mekeel's tenure, the dating program at the Laboratory of Anthropology faded away (see Stallings to Haury, 21 April 1939).

Stallings was at Yale for an entire year (1937-38) and did not resume his tree-ring studies at the Laboratory until September 2, 1938. Chapman noted in his 1938 annual report for 1938 that Stallings had succeeded in extending the Rio Grande Chronology back to A.D. 890, with tentative extension to A.D. 770, and was still working on the publication of that chronology (Chapman to LofA Board of Trustees, 31 October 1938).

In the spring of 1939 Stallings applied to and was accepted by Harvard University. In the meantime, he continued to work on the full publication of the Rio Grande chronology and a number of shorter articles for the *Tree-Ring Bulletin*, the latter especially because Haury had written that he was "getting ready to ditch the *Bulletin* for lack of material" (Haury to Stallings 10 April 1939). Though he was not technically employed as a dendrochronologist, Stallings continued to publish tree-ring dates (Stallings 1941) and general treatments of dendrochronology (Stallings 1939). Unfortunately, he never did publish the long awaited detailed treatment of the Rio Grande chronology (see Smiley, Stubbs, and Bannister 1953). There is no mention of tree-ring dating in the Laboratory of Anthropology Annual Reports for either 1939 or 1940. The report for 1941 states that Stallings used Laboratory facilities to conduct some dendrochronological analysis. This probably related to his study of Spanish Colonial painted santos for the Taylor Museum (Anonymous 1937, Nash 1997b, Stallings 1940, Wroth 1982). Stallings entered the Intelligence School of the U. S. Army Air Corps in mid-1942.

One additional contribution by the Laboratory of Anthropology warrants attention—the extension of Douglass' chronology to the Basketmaker II period. In March of 1935, Douglass was secure enough in his dating of Basketmaker III material to publish his chronology and the archaeological dates they supplied (Douglass 1936, see also Morris 1936). Douglass felt, however, that the early extension of the Central Pueblo Chronology was only reliable for dating purposes back to mid- A.D. 300's. This left Basketmaker II sites undated. Earl Morris therefore wasted no time in contacting Nusbaum at the LofA regarding a Basketmaker II site in southern Utah excavated by Nusbaum and his wife in 1920. Morris hoped that Cave du Pont, one of the few pure Basketmaker II sites known, might be dated through dendrochronological analysis of a number of excavated pinyon specimens luckily cached there by Nusbaum 15 years earlier (Morris to Nusbaum, 5 April 1935). Nusbaum agreed to try to recover the specimens, but argued that the LofA be responsible for the dating; Morris tried to convince Nusbaum that Douglass, not Stallings, should do the dating because he was more familiar with the Central Pueblo Chronology. Stallings ultimately did the dating (Stallings 1941), probably because Douglass was already tired, was focused on cycle analysis, and had left the archaeological tree-ring dating studies to his students (Nash 1997a).

Nusbaum told Morris that he would examine his Cave du Pont correspondence to try to determine who might be available in Kanab, Utah, to retrieve the specimens. He warned Morris, however, that due to lags in material culture development, the Basketmaker II dates at Cave du Pont might actually fall later than the Canyon de Chelly-area Basketmaker II sites that Morris was so interested in (Nusbaum to Morris, 11 April 1935).

Nusbaum had in fact explored the possibility of recovering the Cave du Pont specimens in 1932 and had obtained approval from the local land owner in February (Douglass to Nusbaum, 23 February 1932). Why he took no additional action until 1935 is unclear, but in the meantime a number of individuals had died, making Nusbaum's sample recovery effort that much more difficult. Wilford Q. Robinson, owner of the ranch when Cave du Pont was excavated, passed away about 1930 (Bowman to Nusbaum, 16 February 1932). Jacob Hamblin, the owner in 1932, passed away by 1935. Nusbaum finally contacted the current landowner, Charlie Plum, and explained the importance of the site and the specimens (25 April 1935 and 15 September 1935). Nothing seems to have come as a result of that contact, and the only mention of the Cave du Pont samples between 1936 and 1939 in the correspondence is a letter from Morris to Douglass on May 22, 1936, in which Morris states that he went to Mesa Verde National Park for the "specific purpose of jogging Nusbaum into further effort to secure the Basketmaker II timbers from Kane County, Utah." Morris' prodding may have worked, for Bannister, Dean, and Robinson (1969) note that Nusbaum collected samples from Cave du Pont in 1936. Gila Pueblo's specimen cards on file at the Laboratory of Tree-Ring Research indicate that Gila Pueblo acquired specimens from the cave in 1937, but these are likely to have been duplicates of the Nusbaum samples rather than original specimens.

On June 26, 1939, Stallings told Douglass that he had obtained a date for one specimen from Cave du Pont, but that he needed a copy of Douglass' early chronology to verify it. On September 12, he reported to Douglass a date of A.D. 217, with a center ring going back to A.D. 92, and sent the specimen to Douglass for verification. Nearly two years later, again delayed by Douglass' busy schedule, Stallings' obtained Douglass' verification, and soon published the date in the *Tree-Ring Bulletin* (Stallings 1941). With this accomplishment dendrochronologists prior to the onset of World War II had successfully dated each of the major and defined Pecos Classification periods, though the applicability of the dates from each period was of course highly variable due to the vagaries of site formation and preservation.

Once established in 1931, tree-ring research at the Laboratory of Anthropology benefited from talented personnel, strong if temporary financial backing, and an interested and supportive Board of Trustees. Stallings was considered one of Douglass' top students, second only to Haury, when he was hired by the Laboratory. During his six-year official tenure as dendrochronologist at the Laboratory of anthropology, Stallings made a number of significant dendroarchaeological contributions. First and foremost, he established to A.D. 950 the first high quality tree-ring chronology applicable to tree-ring specimens from prehistoric and historic contexts in the Rio Grande valley (Stallings 1933). In so doing, he independently verified Douglass' crossdating and chronology building techniques, thus strengthening the methodological basis of archaeological tree-ring dating. He also dated nearly 700 tree-ring specimens from over 60 sites, produced unpublished manuscripts on the history of archaeological tree-ring dating, produced a working glossary of tree-ring dating terminology, and contributed to the design of a number of tree-ring exhibits at museums across the country.

The fact that Stallings completed the Rio Grande chronology in less than two years is testimony not only to his abilities and diligence but to the cooperation of Douglass, Mera, Nusbaum, and others who facilitated his fieldwork and analysis. The Laboratory's contributions go beyond the Rio Grande chronology, however, especially with Nusbaum and Stallings' efforts in the extension of the Central Pueblo chronology to date Basketmaker II sites, as well as other contributions (Nash 1997a). The Laboratory of Anthropology Dendro-Archaeology Program's relatively poor publication record stands as the only serious shortcoming to a decade's research. However, a decade after the last dendroarchaeological research occurred at the Laboratory of Anthropology, Smiley, Stubbs, and Bannister (1953) reanalyzed the Laboratory's samples and finally made the dates available to the interested public.

Discussion and Conclusion

The announcement of Christian calendar dating of Southwestern archaeological sites through the analysis of tree-rings had an electrifying and immediate impact on archaeologists as well as the general public, to whom Douglass' (1929) announcement was primarily addressed. Archaeologists were astonished at how young the classic Southwestern sites actually were, and were immediately forced to revise their interpretations of the prehistoric Southwest, compressing rather than telescoping their relatively dated sequences. While a significant number (15) of young archaeologists at the University of Arizona jumped at the chance to enroll in Douglass' first dendrochronology course, senior archaeologists do not seem to have been quite as interested in learning the technique themselves. Nevertheless, most, if not all, archaeologists who were working in areas where tree-ring dating might reasonably be applied submitted samples to Douglass or one of his students to see if tree-ring dates could be derived.

The precise chronometric data afforded by Douglass' tree-ring chronology immediately compressed the prehistoric time-scale and in so doing disappointed many archaeologists as well as the general public: "[We] have a sneaking sense of disappointment as the pitiless progress of tree-ring dating hauls the Cliff dwellers, and with them the Basketmakers, farther and farther away from the cherished B.C. 's'" (Kidder 1936:143). In moving the estimated date of Basketmaker occupation from as early as 2000 B.C. to AD. 200, tree-ring dates forced archaeologists to reconsider their hypotheses about site contemporaneity, population density, rates of culture change, and rates of population growth. The impact of the absolute chronology is probably best conveyed in the words of a witness.

We found the Southwestern time table sorely in error once tree-time became applicable. As an example, we have the estimates of the mid-1920's for the Basketmakers, the earliest members of what we now call [the] Anasazi, which dated then some 2000 B.C. This was patently an inferred date based on the assumption that cultural progress in the region was slow. Later, with the application of tree-time, and as Basketmaker sites were demonstrably shown to have been inhabited during the early centuries of the Christian era, this figure was cut in half. At once, this threw entirely new light on the rapidity of culture growth, that instead of the slow, measured progress, changes in the Southwest were effected rapidly. The 500-room pueblo of the 12th century assumed to have been to have been the end product of innumerable centuries of tedious groping for better homes, rooted in the individual semi-subterranean house, could now be shown to have developed quickly, in the span of a few centuries. What thus appeared to be true of architecture was therefore also inherent in the growth of arts and crafts. Thus, tree-rings brought a new outlook a changed form of thinking and a search for new provocative factors which may have lain behind this cultural efflorescence [Haurly Unpublished Manuscript, 1946].

Once the chronology was in place, archaeologists working in the region to which that chronology applied could begin to ask increasingly sophisticated human ecological, historical, social, and political questions of their data. They began to make "empirically testable statements" and therefore offer interpretations that could for the first time be proved incorrect (Dunnell 1986:29). In Flagstaff, Colton and McGregor used tree-ring dating to date the eruption of Sunset Crater, thereby facilitating a better understanding of the human ecology of the area, culminating in Colton's (1960) "Black Sand Hypothesis." Tree-ring analysis dated the "Great Drought" to A.D. 1276-1299; archaeologists immediately adopted this event as an explanation for the abandonment of the San Juan region. After the war, Taylor (1958:1) questioned "whether the Great Drought affected the Anasazi culture of northeastern Arizona," but ultimately abandoned the project because he could find no suitably intact sites on which to test his hypothesis. With regard to historic questions, Stallings was able to demonstrate conclusively that some sites along the Rio Grande that were said to have been inhabited prior to the Spanish entrada were occupied during historic times, thus forcing a revision of early historic accounts of the area. Socially and politically, Judd realized as early as 1922 that if

Douglass' crossdating of beams from five large ruins in Chaco Canyon was correct, they were going to be forced to consider much larger population levels than they the previously suspected (Nash, forthcoming). This forced a reconsideration of the level of sociocultural complexity there as well as elsewhere in the Southwest. Archaeologists across the Southwest could also begin to consider in detail their well-developed ideas regarding population movements, expansions, and cultural diffusions. In short, absolute chronology in the Southwest facilitated archaeologists' movement away from two dimensional culture history toward increasingly sophisticated explanations of culture process (see, for example, Schroeder 1947).

Given the successes achieved by Haury, McGregor, and Stallings, as well as others at theirs and other institutions during the 1930s, it is indeed curious that by 1942 archaeological tree-ring dating had become, and remains to this day, the exclusive domain of the Laboratory of Tree-Ring Research at the University of Arizona. The exact reason for the lack of continuity in archaeological tree-ring dating in the American Southwest are complex and difficult to pinpoint, though a number of factors are at least partially to blame. Obviously, American involvement in World War II affected the availability of qualified personnel, but most of the primary participants in the development of archaeological tree-ring dating in the Southwest were too old for the war effort. Only Stallings joined the active duty forces. More importantly, the war effort took away the second-generation students who would have been trained to carry on the efforts of Douglass, Haury, McGregor, Stallings, and other trained dendrochronologists. Secondly, it is clear that the lack of continuous institutional support (Merton 1962:16) is critical to the survival of archaeological tree ring dating, and only the University of Arizona provided such continuity, however tenuous (see Bannister 1963), throughout the 1940s (Nash 1997a). Finally, the development of radiocarbon dating in 1949 almost certainly contributed to the decline in, or at least the failure to resume pre-1942 levels of, archaeological tree-ring research activity. The arguments here are complex and not yet fully elucidated, but radiocarbon dating was heralded as a universally applicable dating technique with few limitations, and it provided dates at a level of resolution that archaeologists were prepared to deal with. There is evidence, and again the arguments have not been fully elucidated (though see Baillie 1995 for a European perspective), that tree-ring dates may be too precise for easy use in many archaeological research questions, especially in areas where the degree of preservation is not high. Whatever the may be for the decline from the "halcyon days" of Southwestern archaeological tree-ring dating, it is clear that the University of Arizona, the Gila Pueblo Archaeological Foundation, the Museum of Northern Arizona, and the Laboratory of Anthropology built the chronometric framework for two millennia of Southwestern prehistory, contributed to the culture history of the region, and laid the foundation for increasingly sophisticated interpretations of Southwestern archaeology.

End Notes

1. Citations for appropriate passages are listed by date only. Nash (1997a) examined unpublished documents at 12 archives; full citations would have encumbered the text. Citations can be found in Nash (1997a) or can be obtained directly by contacting the author.
2. This had been a major concern for archaeologists since Douglass (1929) announced dates for Southwestern sites that cut, by as much as half, the age estimates assigned to Basketmaker and Pueblo occupations by professional archaeologists (Nash 1997).
3. Note that I have not used the term "dendrochronology." Gladwin's sample preparation methods suggested to Douglass that the former was not, in fact, revealing tree-rings at all.
- 4 After the Second Tree-Ring Conference in 1935, Haury, McGregor, Hawley, Stallings, and Getty were authorized to verify archaeological tree-ring dates for specimens from their respective areas (Getty 1935d).

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New Light on the Beginning of the Pecos Conference

by

Richard B. Woodbury

Recently James E. Snead, a Postdoctoral Fellow in the Department of Anthropology at the American Museum of Natural History encountered in the department archives a letter from A. V. Kidder to Pliny E. Goddard. It is from "correspondence file 546 of the department archives, AMNH (A. V. Kidder)". With the approval of David H. Thomas of the Museum, it is published here.

26 April 1926

Dear Goddard:—

Absence from the Museum has delayed my replying to your letter of the 20th.

I hope to be in New York around the 6th or 7th of May and have an opportunity at that time of seeing