LAS TRAMPAS, NEW MEXICO:

DENDROCHRONOLOGY OF A SPANISH COLONIAL CHURCH

by

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PREFACE

Las Trampas, New Mexico is a small farming village located on the high road between Santa Fe and Taos, originally settled ~~in the~~ mid-1700's and very little changed since that time. The central focus of the community is the adobe church of San Jose de Gracia, one of the best preserved examples of Spanish Colonial Period architecture remaining in the American Southwest.

In 1967, when a state highway was being paved through Las Trampas and posed a threat to the old church, members of the community and other interested citizens under the directorship of Mr. David Jones formed the Las Trampas Foundation. This organization was instrumental in having Las Trampas included in the National Register of Historic Places, and it initiated a local group effort to renovate the interior and exterior adobe walls of the church.

Kubler, in his 1940 study on religious architecture in New Mexico, reported two tree-ring dates on beams from Las Trampas which had been collected and analyzed in the 1930's. The precedent therefore had been set for more dendrochronological work at Las Trampas. As the 1967 remodeling progressed, Jones extracted a number of cores from

exposed timbers and sent them to the Laboratory of Tree-Ring Research at The University of Arizona in Tucson. Dr. Bryant Bannister's graduate class entitled "Tree-Ring Dating for Archaeologists", of which the author was a member, made the preliminary analysis of these first specimens.

Few records exist to document the early period of church construction and decoration. Therein lay the purpose of this investigation: to elaborate upon the historical record of Las Trampas by applying the objective approach of dendrochronology in a thorough sampling of all structural wood in the church, a method used extensively in spatial/temporal studies of prehistoric archaeological sites but infrequently used in the expanding field of historical sites archaeology.

I would like to express my thanks to Dr. Bryant Bannister, Director of the Laboratory of Tree-Ring Research at The University of Arizona, for introducing the idea of such a study and for guiding the research as my thesis director. I wish also to express great appreciation to Davy Jones and the Las Trampas Foundation for taking very well-controlled samples and for making it possible for me to make an *in situ* collection. To the Trampasenos themselves, sincere thanks for allowing us access into the "history" of their church.

To Professor Terah L. Smiley, many thanks for his counsel as my major advisor and especially for his thorough editing of this manuscript. I wish to thank Professor Marvin A. Stokes for serving as such a helpful and understanding member of my advisory committee.

For the use of the Laboratory of Tree-Ring Research facilities and to the many individuals there who helped me, I am deeply grateful. Throughout the research, Dr. William J. Robinson's criticism was much appreciated. The help of James Harsha and Marilyn Huggins in preparing the illustrations was invaluable.

My thanks also go to Mr. Fred Mang of the National Park Service for supplying two interior photographs of the church.

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ABSTRACT

Wooden beams and planks from the Spanish Colonial church and other structures in Las Trampas, north-central New Mexico, have been sampled and dated by dendrochronology. Dates of AD 1735 imply Spanish occupation of the area 16 years prior to official grant. Stockpiling of timber for church construction began as early as 1758. Exterior walls were 15 feet high by 1762 and were completed to roof level by 1764. Late in 1776, wood was cut for a dust-guard over the adobe altar and mural. According to clustering of tree-ring dates, a new altar and wooden altar screen were constructed soon after 1785.

Beam re-use was prevalent. Timbers bearing early dates were incorporated into the 1785 altar screen, indicating re-use from within the church or from other pre-1760 structures. A roof viga was later used as a floor plank after reroofing. In domestic buildings, re-use of beams is repeated.

Replacement of beams supporting the balcony was made in the 1860's and 1870's. Tree-ring dates indicate repairs again in the 1930's and 1943.

A survey of the literature pertaining to dendrochronology of historical sites revealed that shaping of

beams and lack of thorough sampling have heretofore hindered successful application. The documentary record of Las Trampas art and architectural history has been further refined by tree-ring dating, and the study reaffirms the potentials for historical sites dendrochronology.

INTRODUCTION

Tree-ring dates can provide information about construction, with precision of one year, in archaeological sites where there has been use of wood retaining a portion of the bark or cambial surface. Dates from such specimens are the dates in which the living trees originally died or were cut. In cases where clustering of dates implies human cause of death, presence of a cambial surface provides the link between the date and the inferred wood-cutting event. Accurate dendrochronological dating of events in the construction of most historical sites has been hampered by extensive shaping of the timber by mechanical or semi-mechanical means. From the point of view of the dendrochronologist, few post-Contact Period sites have the combined advantages of both datable wood and minimally planed wood, which Las Trampas' geographical setting and historic remoteness have afforded.

Previous Applications of Dendrochronology to Historical Problems

The use of dendrochronology in dating historical sites has been widespread, but infrequently has it had depth. This is in part due to the contrast between excavation, which major pre-historic sites have received, and

survey, which "above-ground archaeological sites", in the terms of James Ayres (Arizona State Museum, Tucson, oral communication, 1972), have until recently warranted.

In the late 1930's, during excavation of Awatovi in the Hopi Mesas of northern Arizona by Harvard Peabody Museum, numerous tree-ring specimens were taken from three Spanish mission structures which were established in 1629 and finally destroyed after 1699. The spectrum of tree-ring dates allowed no detailed statement of specific construction, except evidence for a post-Pueblo Revolt re-roofing event on a friary room in 1699, and it served only to confirm the known period of Spanish occupation (Bannister, Robinson, and Warren, 1967). Dates from the historical Awatovi structures are listed but not interpreted by Douglass (1938), Haury (1938), Hall (1951), and Smiley (1951). The archaeological report of Awatovi by Montgomery, Smith, and Brew (1949) makes no mention of dendrochronology except as an indicator of drought periods.

In the early 1930's, W. S. Stallings of the Laboratory of Anthropology in Santa Fe sampled beams from several missions and other historical structures in the Rio Grande area including the church at Las Trampas, then known as Santo Tomas. Reported in Stallings (1937), in Kubler (1940), and in Smiley, Stubbs, and Bannister (1953), the number of dates averages less than four per site, many of

which are not cutting dates. Tree-ring material from several of these and additional historical sites has been re-examined and published. Dates from Laguna Mission, Cebolleta Church, and Zuni Mission are reported in Bannister, Robinson, and Warren (1970). Dates from Acoma Mission are published in Bannister, Hannah, and Robinson (1970). With a lack of tree-ring sampling in depth, few interpretations by temporal clustering can be made. The comment for Zuni Mission in Bannister, Robinson, and Warren (1970, p. 33) typifies the results of dendrochronology at all of these sites: ". . . no definite construction periods are obvious. The scattering of dates may probably be attributed to shaping of beams and to periodic repairs."

An exception to this was the Pecos Mission. Over 200 specimens have been extracted from the ruin, many of them showing cutting dates. Since publication of some of the original dates in Smiley et al. (1953), the site was excavated in detail. The total collection has been reworked and will be published as part of the New Mexico J quadrangle report in preparation at the Laboratory of Tree-Ring Research (W. J. Robinson, Laboratory of Tree-Ring Research, Tucson, oral communication, 1971). Well-controlled interpretations about the construction of individual features at Pecos Mission should be possible.

In 1939, F. H. Scantling at the University of Arizona Archaeological Field School extracted four V-cuts from beams in an abandoned Mormon church near Forestdale, Arizona, which yielded dates within the known five-year Mormon occupation of the site (Scantling, 1940). Re-analysis showed dates of the four specimens to cluster, giving a firm construction date of 1881 (Bannister, Gell, and Hannah, 1966).

Other dendrochronology efforts in historical structures include excavation of Navajo period sites in the Big Bead Mesa, Chacra Mesa, and Star Lake areas (Keur, 1941; 1944; Bannister, Robinson, and Warren, 1970). Tree-ring sampling of hogans from the pre-Fort Sumner period was made in connection with the Navajo Land Claims (Stokes and Smiley, 1963; 1964; 1966; 1969). Constructional and demographic interpretation of the tree-ring dates by the Indian Claims Commission is contained in manuscript form reporting the proposed findings of fact in The Navajo Tribe vs. the United States of America (Indian Claims Commission, 1961).

Recent urban renewal efforts in southwestern cities, coupled with reviving interests in local history, have resulted in "salvage" wood collections from structures being razed or remodeled. The collection from Tucson Territorial Period adobe dwellings is sizable, but due to the poor quality of cross-dating among conifers in their lowest

latitudinal limit in southern Arizona, dating is difficult but not impossible. Tucson Territorial structures had tree-ring dates clustering in the late 1870's, and the chronology was sufficiently adequate to confirm the source area of the wood. Elsewhere, only two beam sections have been sampled from Old Town Albuquerque, but these show good possibilities for further tree-ring dating applications, if a thorough collection of unshaped beams can be made. Dendrochronological records of the above studies made by this author at the Laboratory of Tree-Ring Research are on file for Tucson Urban Renewal with James Ayres, Arizona State Museum, Tucson. For Old Town Albuquerque the dates are on record with Dr. Bainbridge Bunting, University of New Mexico, Albuquerque.

Wood from several historic buildings in Santa Fe has been collected since the 1930's. Dates from many of these are published in Smiley et al. (1953). With the study of more recent collections from Santa Fe, interpretations will be presented in the Laboratory of Tree-Ring Research New Mexico J quadrangle report.

Until the advent of the recent behaviorist approaches to archaeology, the potentials of historical dendrochronology were not fully realized. Often sampling of historical sites was made only because of fortuitous occurrence of historical structures in or near archaeological sites being excavated.

In those instances, wood sampling would be as thorough as the other artifactual material, but little use could be made of the derived dates, as in the case of Awatovi (Montgomery et al., 1949; Bannister et al., 1967). When dendrochronology was applied to such structures as the Rio Grande missions, primary interest was in at least one date or a single cluster per structure (Kubler, 1940). Optimism rested in Douglass' (1939) heartwood/sapwood method for indicating an estimated cutting date from squared timbers found in historical contexts.

> It was found that by adding, when necessary, enough sapwood rings to those already present to bring the total number up to about 120 rings that the compiled "date" correlated well with the "historical construction date" . . . . Exactly what scientific value such procedure may have cannot be determined as yet but the evidence is presented for what it is worth (Smiley et al., 1953, p. 11).

Lack of available tree-ring material has plagued the historical archaeologist, as in the case of the "Lost" Pecos Church (Stubbs, Ellis, and Dittert, 1957). In retrospect, however, the greatest inhibiting factor in the tree-ring dating of historical sites seems to have been a lack of impetus for making thorough collections of all available wood at a site.

With precedent set by J. S. Dean's (1969) investigation of Betatakin and Kiet Siel cliff dwellings involving a total tree-ring sample approach, together with increasing

use of scientific methods in solving historical problems, the groundwork was laid for a more exhaustive historical site study such as that of Las Trampas.

Geographical and Historical Background of Las Trampas

The village of Las Trampas, Taos County, New Mexico, occupies a shallow, open valley at an elevation of 7200 feet on the western slope of the Sangre de Cristo Mountains (Bunting and Conron, 1966). Bounded on all sides by Carson National Forest, it lies approximately 15 miles east of the Rio Grande in the Embudo watershed on the permanently flowing Rio de Las Trampas (Figure 1). Translated "River of the Traps", the stream derives its name from beaver trapping at the time of Spanish settlement there (Hillerman, 1970, p. 22).

Bunting (Bunting, Booth, and Sims, 1964, p. 2) observed that in the Taos region, until recently, building material was limited to the immediate resources of earth and trees due to poor transportation and technology. The highly dissected quality of the topography surrounding Las Trampas made access to the valley difficult until the paving of State Highway 76. Implications of this fact for dendrochronological research are evident: that local materials were exploited by the Las Trampas inhabitants at least through the last century, and that the hauling

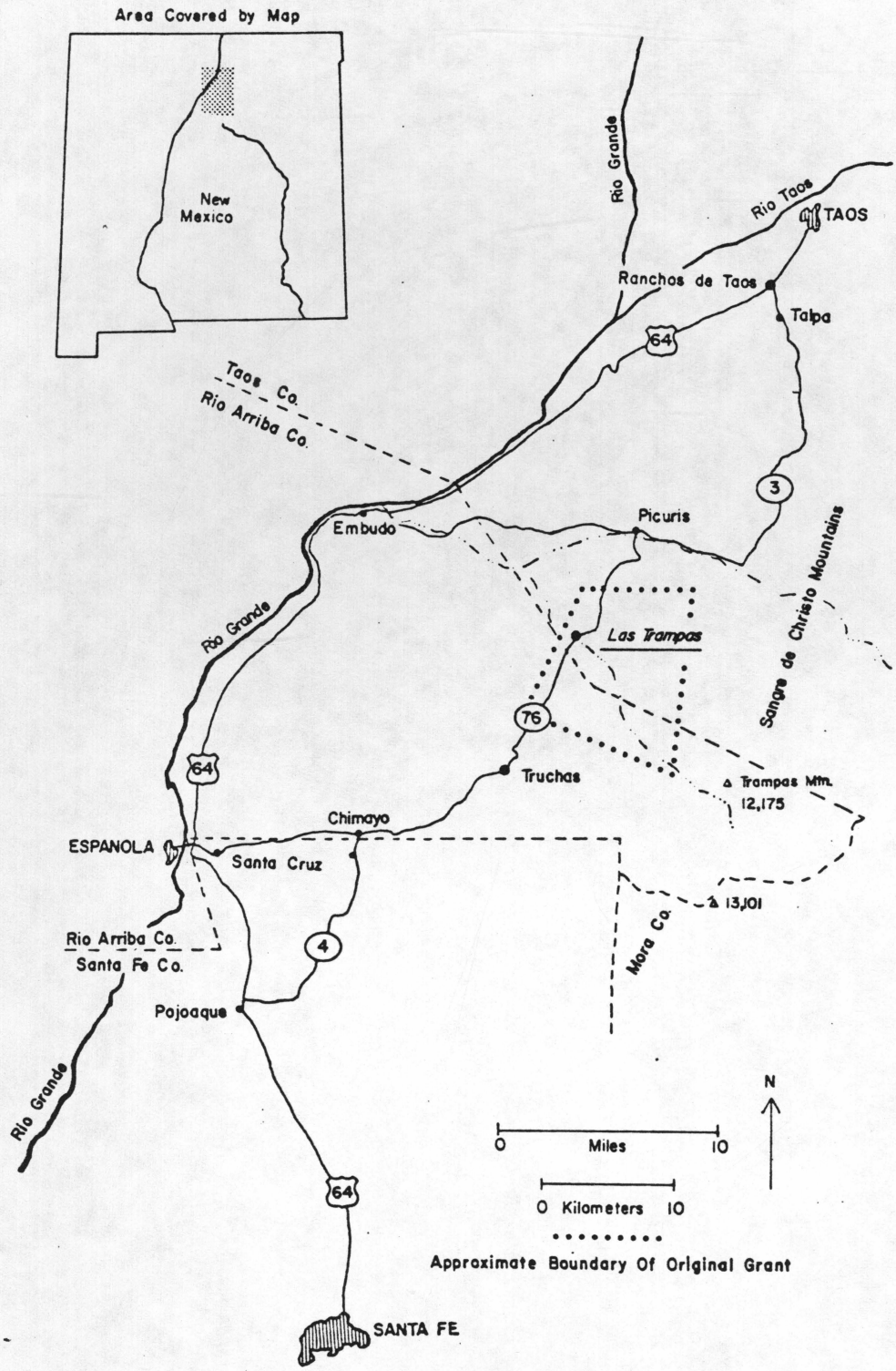


Figure 1. Site location map of Las Trampas, New Mexico.

of milled wood in large quantity from the early sawmills near Santa Fe and Taos was improbable.

Ecological Setting

Las Trampas lies in the boundary region where two biotic zones interfinger, the Transition Zone ponderosa pine forest and the Upper Sonoran Zone pinyon-juniper forest (Merriam, 1890; Whittaker and Niering, 1965). Habitat is different on opposite sides of a single valley where ridge exposure effects moisture storage. Pinyon pine and juniper, characteristic of lower, more xeric sites, are found on south-facing slopes, while ponderosa pine, characteristic of higher, more mesic sites, is found on north-facing slopes. Therefore, at least three species were available for construction purposes in the immediate vicinity of Las Trampas. In the valley floor where fine grained sediment has accumulated, the soil condition favors natural grassland, and historically this factor attracted agriculture.

Ponderosa pine growing near Las Trampas is at the semi-arid lower elevational border of its community range. Such a position is within the region of maximum likelihood of ring-width correlations among trees and of best relationship of growth with climatic variations (Douglass, 1934; Schulman, 1945, p. 10; Fritts, 1966, p. 974).

Available wood with good chances for sensitive series makes the Trampas locality favorable for dendrochronological study.

Mean annual precipitation in the region is approximately 16-20 inches, the greatest amount falling during July and August. Figures of total annual precipitation for the state are highly variable with no repetitive pattern for such fluctuations determinable in the climatic data (Tuan, Everard, and Widdison, 1969, p. 60). Temperatures in the region are more consistent. The July mean near Las Trampas is approximately 62°F and the January mean is 26°F (Pearson, 1931, p. 24).

Several historical accounts mention climatic conditions of northern New Mexico in the past. Useful information still remains after considering the biases engendered by the climatic region from which each writer had come. Bishop Tamaron, traveling from Durango, Mexico in 1760, refers to freezing temperatures in May, abundant streams, and flooding (Adams, 1954). A period of heavy precipitation is reported for 1826-1840 by Schroeder (in Blumenschein, 1968) during which the Taos road at Embudo Pass not far from Las Trampas was rendered impassable. An Anglo-American from the humid East passing through Navajo country toward the end of the arid 1840's era of the "Great American Desert" (Schove, 1961), spoke of its

"universal barrenness" (Tuan et al., 1969). Such accounts attest to the extremes of variation in the historical past seen also in the modern climatological record.

Historical Setting

A skeletal sequence of documented historical events was known about Las Trampas prior to the study. The village was settled in 1751 during the governorship of Cachupin who made a land grant to 12 families (Twitchell, 1914; Kelly, 1941). The approximate boundaries of the grant are delineated in Figure 1. From the time of settlement well into the 1770's, the Comanche posed a threat to settlers in the region north of Santa Fe. For protection against armed depredation (Kelly, 1941), Las Trampas village was laid out in the form of a fortressed plaza. In 1759-60, Don Pedro Tamaron y Romeral, Bishop of Durango, made a visitation to the northern part of his domain in New Viscaya and Nuevo Mexico. According to his journal, translated by Adams (1954), on June 9, 1760 he went through Las Trampas leaving with the inhabitants a license to build a church "inside the walled tenement . . . thirty varas long including the transept". It was to be a <u>visita</u> administered by a friar in residence at neighboring Picuris Mission (Adams, 1954).

The first officially recorded burial in the established church was in 1771 (Bunting, 1970, p. 39), therefore the church was in use at least by that date.

In 1776 Fray Francisco Atanasio Dominguez visited all of the Rio Grande area missions to inventory the resources of each. He recorded the size of visita San Jose de Gracia de Las Trampas, which he referred to as Santo Tomas, the existence of a balcony, an altar niche above an adobe altar, and a choir complete except for the railing. No bell towers were reported (Adams and Chavez, 1956).

The next inventory, made in 1817 by the Visitor de Guevara, mentions a large retable or altar screen behind the altar and a tabernacle upon the altar. No flooring was in the church (Jones, 1969; Bunting, 1970). By 1881 when Bourke passed through Las Trampas and sketched the church, he recorded the presence of milled wooden bell towers (Bloom, 1936). Sawmills had been established in Taos and Santa Fe by the late 1850's (Bunting et al., 1964), and it is reasonable to assume that between then and the time of Bourke's visit, fashionable use of decorative milled wood possibly including flooring had reached Las Trampas.

Reroofing of the church between 1915 and 1917 (1914-1920 according to Jones, 1969) is known by oral communication with an elderly inhabitant (Bunting, 1970),

and again it was reroofed in 1932 by the Committee for Preservation and Restoration of New Mexico Churches (Kubler, 1940). Replastering and restoration to its 1880's appearance took place in 1967 (New Mexico Society of Architects, 1967), and through efforts of the Las Trampas Foundation the village and church were registered as a National Historic Place (National Park Service, 1969; Schroeder, 1970; Owings, 1970). Figure 2 shows the exterior of the church as it appears today.

The particular events occurring between 1760-1776, 1776-1817, and 1817-1881 are of special interest in the tree-ring dating of Las Trampas, as will be later explained.

In the knowledge that conditions were right for cross-dating and that enough specimens were obtainable for drawing valid inferences, the dendrochronology of Las Trampas was attempted using a more thorough approach than previous historical tree-ring investigations.

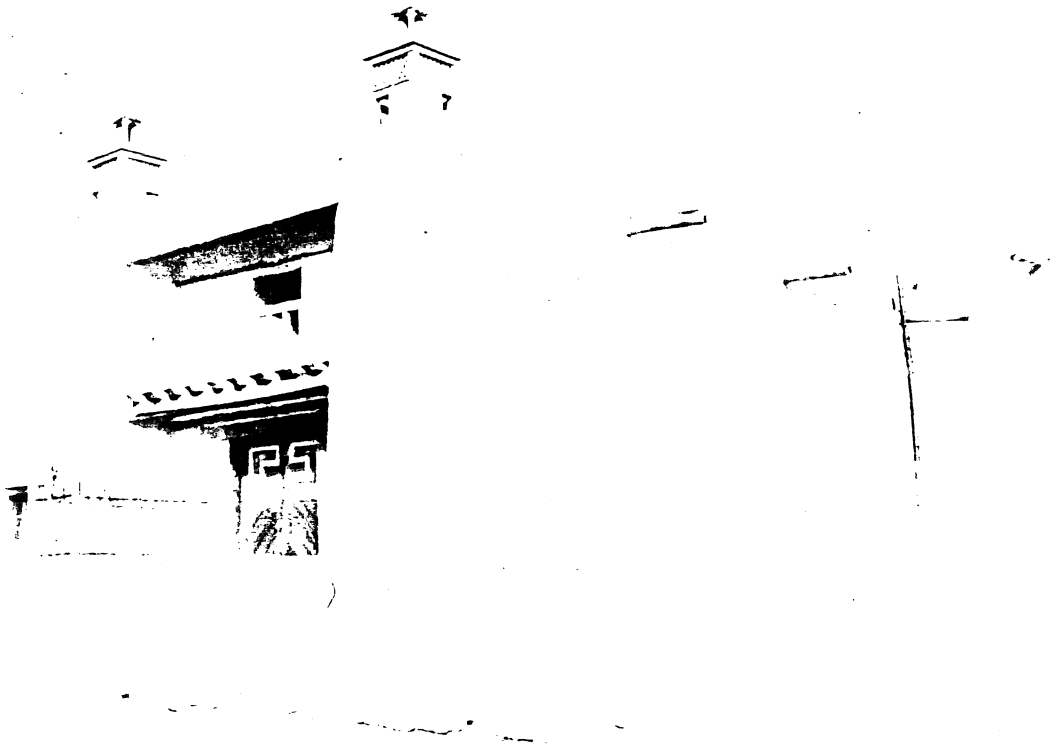


Figure 2. The Church of San Jose de Gracia de Las Trampas in 1970.

EXTRACTION, PREPARATION, AND CROSS-DATING ANALYSIS

The church at Las Trampas is in continuous use, thus cores were taken only where and when access could be afforded. Collection procedure was therefore not as systematic as collection from an unoccupied archaeological site would have been. Specimen examination and computer analysis were performed according to strict dendrochronological methodology at the Laboratory of Tree-Ring Research, The University of Arizona.

Field Collection

Field collecting at Las Trampas began in 1932 as part of the Rio Grande missions study made by W. S. Stallings (Kubler, 1940). He obtained three squared beam sections numbered RG-376,-392, and -393 (Table 1, p. 22) which are curated in the Laboratory of Tree-Ring Research. His provenience records of a possible fourth specimen numbered RG-375 are unclear, and there is no indication of the specimen's present location. The three were re-analyzed as part of the total collection.

Recent collecting of the LTR series of specimens (Table 1, p. 22, LTR-1 through LTR-14) began with renovation in 1967 under the direction of David Jones. The design was

to collect *in situ* wherever wood was accessible and displayed a cambial or near-cambial surface. Immovable architectural beams were cored by using an electric drill equipped with a ½-inch hollow bit. Where a beam or plank was removable, a cross-section sample was taken from one end before placement back into position.

When preliminary analysis was complete and the areas for further investigation were established, specimens LTR-15 through LTR-28 were collected in November, 1968 from the altar screen and the choir loft *tablitas*. A collection of cross-sections from modern logs in a local woodpile (the LTM series) was made for the purpose of verifying the archaeological chronology. Related tree-ring material from the church and from other old structures in the Las Trampas community were sampled through April, 1969. These specimens constituted the remainder of the LTR series.

Preparation and Cross-Dating Procedure

In the laboratory beam sections and ½-inch cores were sanded perpendicular to the vertical grain using a 400 grit polish. Microscopic examination of the variations in ring width was made with a 45-power stereozoom microscope. Glock (1937) and Stokes and Smiley (1968) have

described in detail the skeleton plotting and cross-dating procedure followed in this analysis.

Dating of the Rio Grande (RG) specimens and the LTR specimens LTR-1 through -14 was first undertaken as a class project at The University of Arizona. The good quality of internal cross-dating was soon apparent. A characteristic pattern of wide and narrow rings evident in most of the specimens over a 50-ring interval made a firm basis for the site chronology. The closest regional composite chronology against which to match and date the Las Trampas floating chronology was the Rio Grande Area Master. Tree-ring index values for this chronology are published in Smiley et al. (1953). Illustrated in the Appendix are cross-dated plots of selected specimens from Las Trampas fitted against the most up-to-date composite chronology from archaeological sites in the immediate area of Las Trampas.

Computer Analysis

Computer analysis of the specimens was undertaken to incorporate Las Trampas chronology information into the standardized form used in the synthesis project being completed and published by the Archaeology Section of the Laboratory of Tree-Ring Research. The synthesis project has been sponsored under National Science Foundation Grants GS-247, GS-908, and GS-2232 awarded to The University

of Arizona with Dr. Bryant Bannister as principal investigator. Results will be used in many inter-site archaeological and paleoclimatic studies.

Seventeen specimens most representative of the Las Trampas chronology were measured to 1/100 mm on the Addo-X ring increment measuring machine which prints raw data onto calculator tapes.

The first program through which the data were run, entitled RWLST, plots raw ring-width values and calculates 20-year running means which are used in the process of fitting growth trend curves to the data for obtaining standardized departures from the mean. Thirteen of the 17 measured specimens displayed regular growth trends on the RWLST print-out and were selected for running on the next program.

The second program, entitled INDXA, calculates the closest fitting curve to the tree-ring data and computes deviations from the mean (Fritts, Mosimann, and Bottorff, 1969). With the mean set at 1.0, these deviation values (or indices) are the standardized figures used in multivariate dendroclimatological analyses.

A supplemental program, entitled TRPLOT, was run for the purpose of plotting the index data in a visual expression of cross-dating. The master chronology and

specimen series illustrated in the Appendix are reproduced directly from this program.

THE TREE-RING CHRONOLOGY AND INTERPRETATIONS

Of the total collection of 75 archaeological tree-ring specimens from the church and from other historical features in the settlement, 61 specimens were dated. A significant percentage of the specimens were observed to be from the same original timbers, as will be explained in Comments, Table 1. In the interpretation procedure, an unweighted array of dates was obtained by recording one date for each original tree grouping. A total of 42 different trees are represented in the dendrochronological record, and of these, 33 are datable. Twenty-five of the dated trees are from the church. The grouped dates are listed by provenience (Table 2) for the purpose of drawing inferences about the sequence in which each feature was constructed. The dates are also rearranged chronologically for the entire site (Table 3) to determine the major periods of building activity.

Results of the Dating Analysis

Table 1 lists the tree-ring specimens in order of collection and contains the results of both the field and laboratory analyses which are relevant to interpretation of dates and to specimen identification.

Table 1. Tree-ring dates from Las Trampas, New Mexico.

Symbols for column headings:

Spec. No.	- specimen catalog number, Lab. of Tree-Ring Res. file
Sp.	- species of tree
Form	- form of specimen collected: cross-section, ½" core, wood fragment
mm Rad.	- radius in millimeters, maximum distance from innermost to outermost ring
Date	- calendar date of innermost and outermost ring
Growing Season	- complete or incomplete, distinguished by presence or absence of latewood cells
Heart/Sapwood	- approximate date of boundary between dark interior storage tissue and light nutrient transport tissue seen in cross-section

Symbols for specimen number and species:

RG	- Rio Grande area collection by W. S. Stallings
LTR	- archaeological spec. from Las Trampas collected by Las Trampas Foundation, Douglass Collection, Lab. of Tree-Ring Res.
LTM	- Las Trampas modern specimens
PP	- Ponderosa pine
POP	- Populus; here, aspen, Populus tremuloides
PNN	- Pinyon pine, Pinus edulis

Symbols with inside dates:

year only	- no pith ring present
p	- pith ring present
np	- curvature of inside ring indicates that it is near pith
fp	- curvature of inside ring indicates that it is far from pith
ip	- pith ring present; due to difficult nature of ring series near center, an exact date cannot be assigned; date obtained by counting back from earliest dated ring

Symbols with outside dates:

B	- bark present
G	- beetle galleries present on outer surface of specimen
L	- surface patination present on cambial surface
c	- outermost ring continuous around circumference; symbol used only with full section
r	- less than full section present, outermost ring continuous around available circumference
v	- no direct evidence of true outside on specimen; within a very few years of cutting date by subjective judgment
vv	- no way of estimating how far last ring is from true outside
+	- one or more rings may be missing near end of series, presence or absence cannot be determined because specimen length does not provide adequate check
++	- ring count necessary; beyond a certain year's ring, cross-dating could not be rigorously matched against master chronology

The symbols "B", "G", "L", "c", "r" indicate cutting dates in order of decreasing confidence, unless a "+" or a "++" is also present.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside		Date Outside	Growing Season	Heart/ Sapwood	Comments*
RG-375	Trampas(?)	PP	--	--	--		--	--	--	Unclear cataloging records
RG-376	Trampas	PP	beam shaped	152	1692p	-	1823vv	--	ca.1746	--
RG-392	Trampas	PP	beam shaped	187	1622np	-	1793vv	--	ca.1685	--
RG-393	Trampas	PP	beam shaped	185	Same as RG-392			--	ca.1685	Specimen dates 1622-1793vv
LTR-1	San Jose de Gracia church, N wall transept, ext. scaffolding	PP	X-sec	68	1701p	-	1762cL	inc.	all sapwood	--
LTR-2	church, N wall transept, ext. scaffolding	POP	X-sec	49	1709p	-	1758cB	comp.	all sapwood	--

*Notes under the Comment heading include: tentative - cross-dating is good, however either short length of the specimen or a discrepancy at one position in the series renders the date not absolutely indisputable. Tentative dates are set off in parentheses. erratic - cross-dating was not possible due to changes in relative widths of the rings around the available circumference. complacent - cross-dating was not possible due to a lack of variability of ring widths.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-3	church, altar screen, post at base	PP	½"cor	128	1563	- 1755+G	inc.	ca.1654/ 1655	Composite date for tree; see also LTR-4,-19,-20,20a
LTR-4	church, altar screen, post at base	PP	½"cor	127	Same as LTR-3		--	ca.1654/ 1655	Specimen dates 1563-1745vv
LTR-5	church, altar screen E-W scaffolding beam, spans apse N end	PP	½"cor	92	1678np	- 1782v	comp.	ca.1700/ 1701	Composite date for tree; see also LTR-6,-7; specimen dates 1695-1782v comp.
LTR-6	same as LTR-5	PP	½"cor	100	Same as LTR-5		--	ca.1704/ 1708	Specimen dates 1678-1782v comp.
LTR-7	same as LTR-5	PP	½"cor	85	Same as LTR-5		--	none	Specimen dates 1710-1782v comp.
LTR-8	church, altar screen backing beam	PP	½"cor	86	1714p	- 1785B	comp.	ca.1718/ 1720	Composite date for tree; see also LTR-9
LTR-9	same as LTR-8	PP	½"cor	77	Same as LTR-8		--	ca.1718	Specimen dates 1714p-1785B comp.
LTR-10	church, altar screen back side, top beam	PP	½"cor	76	1712p	- 1782v	comp.	ca.1721/ 1722	Composite date for tree; see also LTR-11,-12; specimen dates 1712-1778v comp.
LTR-11	same as LTR-10	PP	½"cor	81	Same as LTR-10		--	ca.1721/ 1722	Specimen dates 1712-1782v comp.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-12	church, altar screen, E-W scaffolding, spans apse S	PP	½"cor	93	Same as LTR-10		--	ca.1721/ 1722	Specimen dates 1717-1781v comp.
LTR-13	church, belfry. entry girder	PP	½"cor	138	no date		--	--	Complacent
LTR-14	church, W wall int. scaf-folding	PP	X-sec	55	(1730p	- 1762cLB)	comp.	all sapwood	Tentative date, short
LTR-15 a-c	church, loose in choir loft	PP	½" cores	117	1546fp	- 1671vv	inc.	not dis-tinct	Composite date for tree
LTR-16	church, loose in choir loft	PP	¼-sec	100	1401±p	- 1735cLG	inc.	ca.1660	Composite date for tree; see also LTR-25F
LTR-17	church, plank from sacristy cabinet	PP	rad. sec	280	no date		--	--	Complacent
LTR-18	church, bond beam above clearstory, nave/transept jct.	PP	½"cor	83	1876	- 1926vv	--	--	--
LTR-19	church, altar screen, west niche support	PP	½"cor	94	same as LTR-3		--	ca.1664/ 1667	Specimen dates 1640-1752+v inc.
LTR-20	church, altar screen, east niche support	PP	½"cor	101	same as LTR-3		--	ca.1651/ 1654	Specimen dates 1605-1752+v inc.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-20 a	church, altar screen, east niche support	PP	½"cor	71	same as LTR-3		--	ca.1650/ 1654	Specimen dates 1630-1755+G inc.
LTR-21	church, balcony support main facade, 2nd from W	PP	½"cor	82	(1819	- 1870vv)	--	all sapwood	Tentative date
LTR-22	church, balcony support, 2nd from E wall	PP	½"cor	86	1791np	- 1866v	inc.	ca.1795/ 1801	--
LTR-23	church, pulpit floor board	PP	*in situ*	--	no date	vv	--	--	Longitudinal section, not collected
LTR-24	church, choir loft (originally sacristy cabinet)	PP	½"cor	127	no date	c	comp.	--	Complacent
LTR-25 A	church, choir loft tablita, vine design	PP	½"cor	47	1443	- 1701vv	--	not distinct	Composite date for tree; see also LTR-25B,D,G,H,I,K; specimen dates 1564fp-1687vv
LTR-25 B	church, choir loft tablita, vase and vine design	PP	½"cor	38	same as LTR-25A		--	--	Specimen dates 1463-1540vv
LTR-25 D	church, choir loft tablita, red linear design	PP	½"cor	39	same as LTR-25A		--	--	Specimen dates 1586fp-1686vv

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-25 F	church, choir loft tablita, pomegranate design	PP	½"cor	31	same as LTR-16		--	--	Specimen dates 1652-1735c inc.
LTR-25 G	church, choir loft tablita, pomegranate flower	PP	½"cor	60	same as LTR-25A		--	--	Specimen dates 1519fp-1701vv
LTR-25 H	church, choir loft tablita fleur-de-lis	PP	½"cor	46	same as LTR-25A		--	--	Specimen dates 1511fp-1630+vv
LTR-25 I	church, choir loft tablita, fleur-de-lis	PP	½"cor	40	same as LTR-25A		--	--	Specimen dates 1447-1548vv
LTR-25 J	church, choir loft tablita, red vine design	PP	½"cor	100	1541	- 1759+c	comp.	ca.1648/ 1650	--
LTR-25 K	church, choir loft tablita, black and red solids design	PP	½"cor	111	same as LTR-25A		--	--	Specimen dates 1443fp-1664vv
LTR-26	church, floor plank near front entry	PP	½"cor	42	1666fp	- 1764G	inc.	not dis- tinct	--
LTR-27	church, front entry threshold	PP	½"cor	116	no date	vv	--	--	Series does not cross-date

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside		Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-28	church, altar screen scaffold (Plate E of Bunting)	PP	½"cor	103	1620fp	-	1761+G	comp.	ca.1660/ 1661	Composite for tree; see also LTR-41; specimen dates 1620fp-1757vv
LTR-29	church, altar screen, log brace to rear wall	PP	X-sec	60	1747p	-	1785B	comp.	not distinct	Composite for tree; see also LTR-40
LTR-30 a	church, altar screen, filler, W end Plate E	PP	¼-sec shaped	190	1486p	-	1628vv	--	all heartwood	--
LTR-31	church, loose behind altar screen	PP	rad. sec	120	1659np	-	1776G	comp.	ca.1696/ 1699	--
LTR-32	Max Cruz barn, formerly Cruz house	PP	½"cor	100	1705p	-	1819+r	comp.	ca.1718/ 1719	--
LTR-33	Max Cruz mill, E wall, 2nd from top	PP	½"cor	90	1799np	-	1911B	comp.	ca.1839/ 1841	Composite date for tree; see also LTR-34,35; specimen dates 1839-1911B comp.
LTR-34	Max Cruz mill, E wall, 4th from top	PP	½"cor	129	same as LTR-33			--	ca.1818/ 1820	Specimen dates 1799np-1911B comp.
LTR-35	Max Cruz mill, E wall, 6th from top	PP	½"cor	133	same as LTR-33			--	ca.1827/ 1828	Specimen dates 1820np-1911B comp.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-36	church, altar screen, wedge in adobe, E end of Plate E	PP	rad. sec shaped	100	1595	- 1763++rGB	comp.	ca.1635/ 1640	Ring count past 1730; composite date for tree; see also LTR-42; specimen dates 1605fp-1763++rGB comp.
LTR-37	church, loose behind altar screen, roofing material	PP	¼-sec	47	1706fp	- 1776rG	inc.	all sapwood	Composite date for tree; see also LTR-45
LTR-38	church, ceiling behind altar (not original), 3rd beam from rear	PP	½"cor	76	(1833np	- 1885r	inc.)	not distinct	Tentative; composite date for tree; see also LTR-39; specimen date 1842-1884v inc.
LTR-39	same as LTR-38	PP	½"cor	73	same as LTR-38		--	ca.1838/ 1841	Specimen dates (1833np-1885r inc.)
LTR-40	church, altar screen, wedge next to Log II (Bunting)	PP	½-sec	36	same as LTR-29		--	not distinct	Specimen dates 1769p-1785B comp.
LTR-41	church, altar screen, Plate E (Bunting), same as LTR-28	PP	½"cor	42	same as LTR-28		--	none	Specimen dates 1681fp-1761+G comp.
LTR-42	church, altar screen, wedge next to Log I (Bunting)	PP	¼-sec	120	same as LTR-36		--	ca.1635/ 1640	Specimen dates 1595fp-1763++rG comp.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside		Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-43	church, behind altar screen, wedge under bond beam	PP	½" cor	57	1572	-	1643vv	--	all heart-wood	--
LTR-44	church, behind altar screen, wedge next to bond beam	PP	wood frag.	33	1618fp	-	1656vv	--	all heart-wood	--
LTR-45	church, behind altar screen, roofing material	PP	wood frag.	30	same as LTR-37			--	all sapwood	Specimen dates 1722fp-1776rG inc.
LTR-46	church, apse W wall, NW corner ceiling material	PP	rot. wood frag.	30	no date		vv	--	--	poor preservation
LTR-47	Max Cruz house, south side, lintel	PP	½" cor	135	1613	-	1834vv	--	ca.1734/ 1735	--
LTR-48	Max Cruz barn, E wall, formerly roof Cruz house	PP	½" cor	106	1804np	-	1898r	comp.	ca.1827/ 1828	--
LTR-49	Max Cruz barn, S wall	PP	½" cor	114	1795np	-	1898rB	comp.	ca.1803/ 1804	Composite date for tree; see also LTR-50
LTR-50	Max Cruz barn, same as LTR-49	PP	½" cor	113	same as LTR-49			--	ca.1803/ 1804	Specimen dates 1795np-1898rB comp.

Table 1. Tree-ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-51	Max Cruz barn, uppermost log, formerly Cruz house	PP	½" cor	102	1795p	- 1889r	comp.	ca.1819/ 1820	Composite date for tree; see also LTR-52,-53; specimen dates 1803-1889v inc.
LTR-52	Max Cruz barn, same as LTR-51	PP	½" cor	71	same as LTR-51		--	all sapwood	Specimen dates 1823-1889r comp.
LTR-53	Max Cruz barn, same as LTR-51	PP	½" cor	50	same as LTR-51		--	ca.1819/ 1821	Specimen dates 1795p-1830vv
LTR-54	Max Cruz barn, W half, S wall, 7th log up	PP	½" cor	93	1828np	- 1898B	comp.	ca.1830/ 1831	--
LTR-55	Cruz feed tray, sawed plank, formerly flooring Cruz house	PP	½" cor	116	1705fp	- 1827r	comp.	not distinct	--
LTR-56	Max Cruz house, E room, S wall, lintel	PP	½" cor	89	no date	r	comp.	all sapwood	Series does not cross-date
LTR-57	church, threshold main entry, sawed plank	PP	½" cor	80	1900fp	- 1943GB	inc.	all sapwood	Composite date for tree; see also LTR-58
LTR-58	same as LTR-57	PP	½" cor	80	same as LTR-57		--	all sapwood	Specimen dates 1914-1943B inc.
LTR-59	church, loose in choir loft, plank over vigas	PP	radial sec	42	no date	r	inc.	not distinct	No cross-dating

Table 1. Tree ring dates (continued).

Spec. No.	Provenience	Sp.	Form	mm Rad.	Date Inside	Date Outside	Growing Season	Heart/ Sapwood	Comments
LTR-60	church, E bell tower doorway	PP	½" cor	84	no date	vv	--	not distinct	No cross-dating
LTR-61	church, entry baptistry to nave, lintel adjacent to pintle post	PP	½" cor	46	1619	- 1758vv	--	ca.1640	Composite date for tree; see also LTR-62; specimen dates 1619-1754vv
LTR-62	church, same as LTR-61	PP	½" cor	62	same as LTR-61		--	all sapwood	Specimen dates 1644-1758vv
LTR-63	Fermina Leyba house, porch lintel	PP	½" cor	60	no date	vv	--	not distinct	No cross-dating
LTM-1	Jose T. Lopez woodpile	PNN	¼-sec	215	1566np	- 1967rGB	comp.	not distinct	--
LTM-2	Jose T. Lopez woodpile	PNN	½-sec	135 max.	1677np	- 1967rGB	comp.	not distinct	--
LTM-3 a,b	Jose T. Lopez woodpile	PNN	½-sec	217	1691np	- 1918++rB	comp.?	not distinct	--
LTM-4	Tranquilino Lopez woodpile	PP	X-sec	113	no date	rB	comp.	--	Erratic growth
LTM-5	Jose T. Lopez woodpile	PP	¼-sec	193	1840p	- 1966+rB	comp.	ca.1870/ 1871	--
LTM-6	T. Lopez, trough-making supply	PP	rad. sec	150	1838p	- 1968rB	comp.	ca.1866/ 1868	--
LTM-7	T. Lopez, trough-making supply	PP	rad. sec	200	1706p	- 1960+rGB	comp.	ca.1810/ 1815	--

Table 2. Dates listed by provenience.

San Jose de Gracia Church

North wall transept, exterior scaffolding support

LTR-2	1709 p - 1758 cB comp.
LTR-1	1701 p - 1762 cL inc.

West wall, interior scaffolding support

LTR-14	(1730 p - 1762 cLB comp.) tentative

Flooring

LTR-26	1666 fp - 1764 G inc.
LTR-57,58	1900 fp - 1943 GB inc.

Baptistry/nave entry

LTR-61,62	1619 - 1758 vv

Exterior balcony structural supports

LTR-22	1791 np - 1866 v inc.
LTR-21	(1819 - 1870 vv) tentative

Roofing and bond beam above clearstory (Figure 4)

LTR-38,39	(1833 np - 1885 r inc.) tentative
LTR-18	1876 - 1926 vv

Altar screen structural elements

LTR-30a	1486 p - 1628 vv
LTR-43	1572 - 1643 vv
LTR-44	1618 fp - 1656 vv
LTR-3,4, 19,20, 20a	1563 - 1755 +G inc.
LTR-28,41	1620 fp - 1761 +G comp.
LTR-36,42	1595 - 1763 ++rGB comp.
LTR-5,6,7	1678 np - 1782 v comp.
LTR-10,11, 12	1712 p - 1782 v comp.
LTR-8,9	1714 p - 1785 B comp.
LTR-29,40	1747 p - 1785 B comp.

Table 2. (Continued)

San Jose de Gracia Church, continued

Altar screen non-structural material

LTR-31	1659 np	- 1776 G comp.
LTR-37,45	1706 fp	- 1776 rG inc.

Choir loft structural tablitas

LTR-25A,B, D,G,H, I,K	1443	- 1701 vv
LTR-25F, (16)	1652	- 1735 c inc.
LTR-25J	1541	- 1759 +c comp.

Choir loft non-structural material

LTR-15a-c	1546 fp	- 1671 vv
LTR-16, (25F)	1401 ±p	- 1735 cLG inc.

General, subprovenience unknown

RG-392, 393	1622 np	- 1793 vv
RG-376	1692 p	- 1823 vv

Maximiliano Cruz House (and formerly Cruz House)

LTR-32	1705 p	- 1819 +r comp.
LTR-55	1705 fp	- 1827 r comp.
LTR-47	1613	- 1834 vv
LTR-51,52, 53	1795 p	- 1889 r comp.
LTR-48	1804 np	- 1898 r comp.

Maximiliano Cruz Barn

LTR-54	1828 np	- 1898 B comp.
LTR-49,50	1795 np	- 1898 rB comp.

Maximiliano Cruz Mill

LTR-33,34, 35	1799 np	- 1911 B comp.

Table 3. Dates of wood-use activity at Las Trampas.

Specimen	Date	Season	Implications of H/S
	Period Ending AD 1735		
LTR-30a	1628vv		far from cutting date
LTR-43	1643vv		far from cutting date
LTR-44	1656vv		far from cutting date
LTR-15 a-c	1671vv		
LTR-25A,B,D, G,H,I,K	1701vv		
LTR-16,25F	1735cLG	inc.	
	Period AD 1755-1764		
LTR-3,4,19,20,20a	1755+G	inc.	
LTR-61,62	1758vv		near cutting date
LTR-2	1758cB	comp.	
LTR-25J	1759+c	comp.	
LTR-28,41	1761+G	comp.	
LTR-1	1762cL	inc.	
LTR-36,42	1763++rGB	comp.	
LTR-26	1764G	inc.	
	Year AD 1776		
LTR-37,45	1776rG	inc.	
LTR-31	1776G	comp.	
	Period AD 1782-1785		
LTR-5,6,7	1782v	comp.	
LTR-10,11,12	1782v	comp.	
LTR-8,9	1785B	comp.	
LTR-29,40	1785B	comp.	
	Period AD 1793-1827		
RG-392,393	1793vv		near cutting date
LTR-32	1819+r	comp.	
RG-376	1823vv		near cutting date
LTR-55	1827r	comp.	

Table 3. (Continued)

Specimen	Date	Season	Implications of H/S
	Period AD 1834-1860's		
LTR-47	1834vv		far from cutting date
LTR-22	1866v	inc.	
	Period AD 1889-1911		
LTR-51,52,53	1889r	comp.	
LTR-48	1898r	comp.	
LTR-54	1898B	comp.	
LTR-49,50	1898rB	comp.	
LTR-33,34,35	1911B	comp.	
	Period AD 1926-1943		
LTR-18	1926vv		not distinct
LTR-57,58	1943GB	inc.	

The decision of whether or not two specimens were from the same tree was made on the qualitative basis of similar dating and chronology characteristics, heartwood/sapwood boundary, the relative widths of springwood versus summerwood in given years, and the analogous occurrence of false rings. Frequently in archaeological context, lengths of timber cut from the same tree are used as symmetrical elements on opposite sides of a feature, as in the case of the altar screen supports LTR-3 and -19, -4 and -20.

Interpretation of Dates

Clustering of Dates by Provenience

Interpretation of dates begins first by grouping the dates by sub-provenience and by observing periods in which the dates tend to cluster.

Those dates listed with an "r", "c", "L", "G", or "B" outside ring condition and/or surface condition are of primary importance, representing actual cutting dates (see explanation of symbols, Table 1). A date associated with a "v" condition, representing proximity to the year of cutting, is also of value. In order to extract the maximum amount of information from dates on eroded specimens (a "vv" surface condition), the relative distance to the original outer surface was estimated on the basis of an average 120 years of sapwood in pine (Smiley et al.,

1953). Heartwood/sapwood indications are noted in qualitative terms in Table 3.

Table 2 lists the dates from each sub-provenience referred to in the following discussion.

The latest date in the cluster for structural elements in the church wall gives a minimum date on initial construction. The scaffolding element (LTR-1) from a position imbedded within the adobe wall 15 feet above ground level was cut during the summer of AD 1762. The wall was erected to that height at least by that time. Another scaffolding member was cut in AD 1758 (LTR-2) and was either reused from an earlier structure or cut and seasoned for the purpose of church construction. Seasoning would imply a plan for church construction prior to licensing in 1760. The tentative date of 1762 from another scaffold support (LTR-14) tends to substantiate the 1762 minimum date for wall construction.

The only flooring members which had a remaining cambial surface were a plank in the front entry threshold (LTR-57, -58) and a plank on the earthen floor (Figure 3) about two meters inside of the entry (LTR-26). The latter dated 1764, which seemed initially to coincide with the early 1760's construction period. This is interpreted by Jones (1969) and by Bunting (1970) as the date of the first roofing on the church. Re-use of the vigas as floor planks

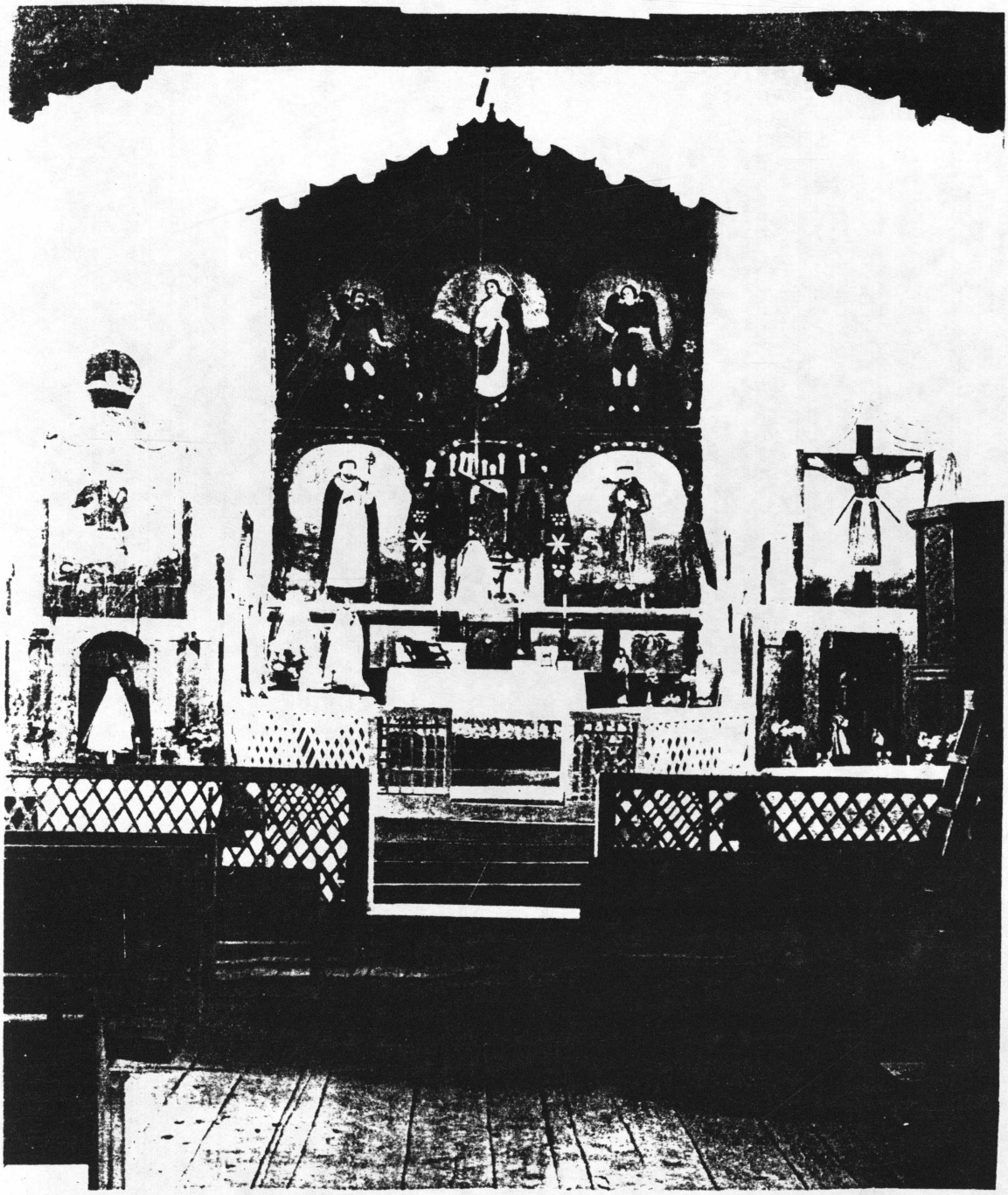


Figure 3. Photograph of the church interior showing flooring in foreground and painted altar screen at the far end of the sanctuary.

Courtesy of F. Mang, National Park Service.

post-dates an inventory made in 1826 (Bunting, 1970). The threshold plank LTR-57, -58 was found to be a recent replacement dating 1943.

For the specimen LTR-61, -62 taken from the lintel over the baptistry/nave entry (Figure 4), the heartwood/sapwood evidence was employed. There are 118 rings from the heartwood/sapwood boundary at 1640 to the outside ring at 1758, hence the true date of cutting must not have been many years beyond 1758. In other words, the AD 1758vv date does not conflict with a period of church wall construction in the early 1760's.

Cutting of the exterior balcony beam LTR-22 must have been in the late 1860's or early 1870's. The associated beam LTR-21 has a tentative date of 1870vv. These beams were most likely replacements for earlier beams; the balcony (Figure 5) is known to have existed at least since 1776 (Adams and Chavez, 1956).

The only roofing specimens collected were from beams known not to be replacements from the 1930's restoration. Specimens LTR-38, -39 from the ceiling behind the altar screen tentatively dated 1885 and are representative of a later period of reroofing. LTR-18 is unquestionably a repair timber incorporated into the structure an unknown number of years after the 1926vv date, most likely during the 1930's.

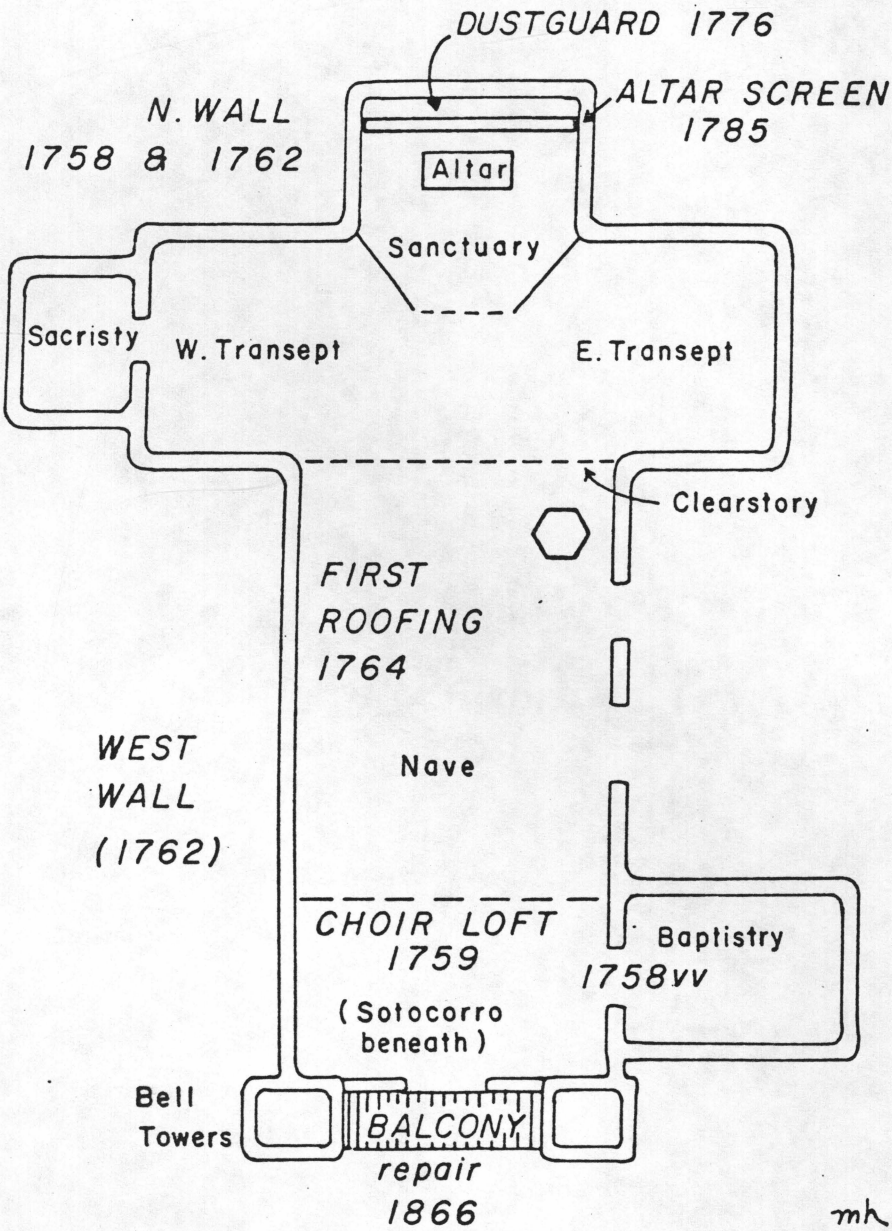


Figure 4. Sketch of the church floorplan with dates of original beams.

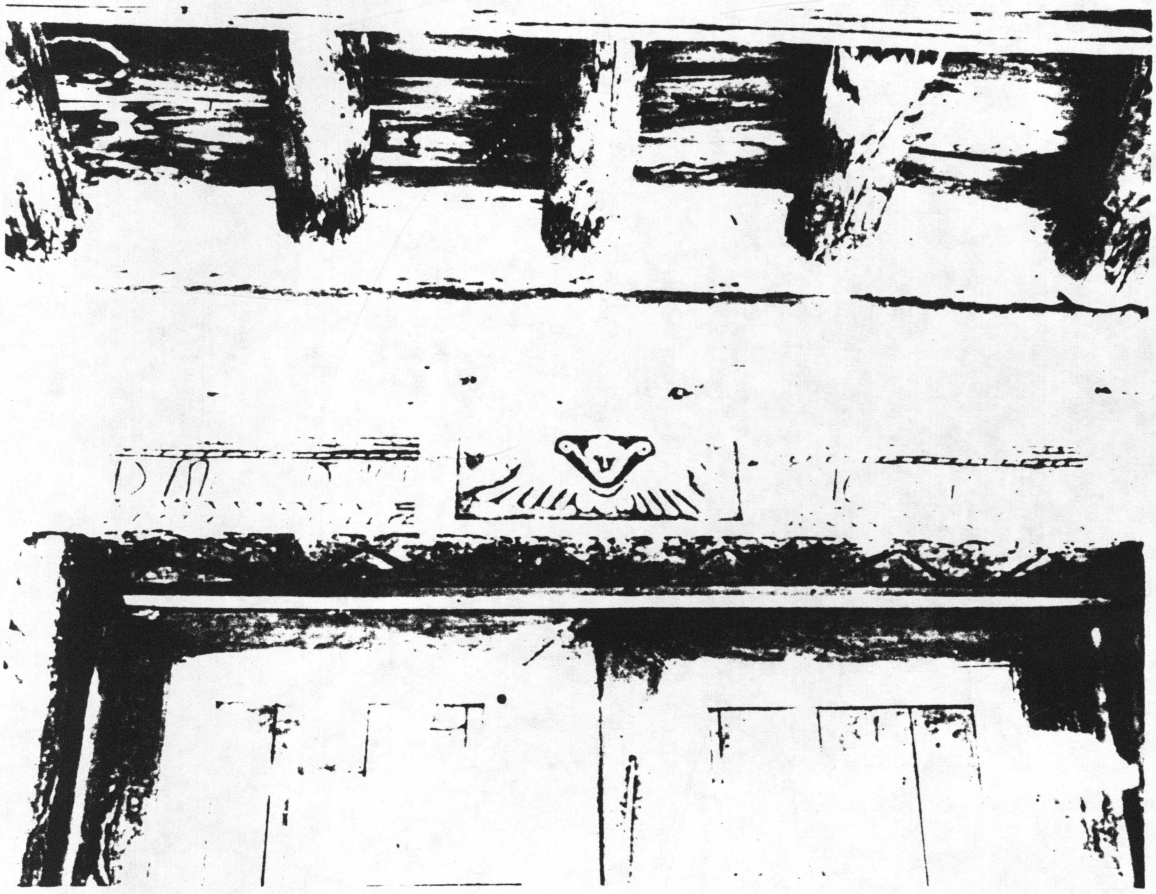


Figure 5. Provenience detail of balcony beams and front entry.

Photograph by M. Ames.

The altar screen, a non-structural feature of the church, yielded a well-defined cluster of dates circa 1785. The earliest dating specimens (LTR-30a, -43, and -44) were all either shaped or eroded. They pre-dated this cluster of cutting dates by many years but were in no way in conflict with it; the heartwood/sapwood boundaries of each indicated a number of rings had been lost from the original surface. The dates of 1755+G, 1761+G and 1763++rGB (LTR-3, -4, -19, -20, -20a; LTR-28, -41; LTR-36, -42) were in both lower and upper altar screen contexts. This fact defers an argument that the lower component of the altar could have been built at the time of initial church construction and that only the upper screen was built in 1785. Moreover, Dominguez reports that the altar was of adobe in 1776 (Adams and Chavez, 1956) and makes no mention of an altar screen. These middle dates therefore represent either re-use of timber possibly displaced by the new screen in 1785 or the use of already dead forest wood. The hypothesis of usage of dead wood can be argued on the basis of the constricted nature of the outer rings (the "+" condition) indicating difficult growth during the last years of the tree's life, and of the presence of beetle galleries formed during exposure in the forest after death of the tree. I contend that the 1755-1763 dates are within the period of greatest community growth, and that the

hypothesis of beam re-use is better supported. The provenience of LTR-36, -42 (1763++rGB) as a wedge in the adobe is also a characteristic of re-used, possibly unsound wood.

Sapling sized logs were found loose behind the altar screen and dated during and after the growing season of 1776 (LTR-31, -37, and -45). Apparently such discarded material is the remainder of a feature rendered obsolete by construction of the altar screen, such as an altar dustguard (or guardapolva) (Jones, 1969).

The choir loft, a structural part of the original building, is composed of hand-hewn primary and secondary vigas spanned by short planks. Paintings on the underside of each plank show from the story below, hence the term tablitas (Figure 6). The date of 1735c suggests either the use of a previously dead tree or re-use from a structure pre-dating the 1751 settlement grant. Jones (1969) has suggested the possibility of Spanish occupation at that time, and it is known that a temporary mission had been established among the Jicarilla Apache in the region as early as 1733 (Hodge, 1907). The date of 1759+c is compatible with the main construction period. Dates from loose material in the choir loft, probably unpainted tablitas, provided no new information.

The RG specimens collected by Stallings dated in the period after initial church construction. The date

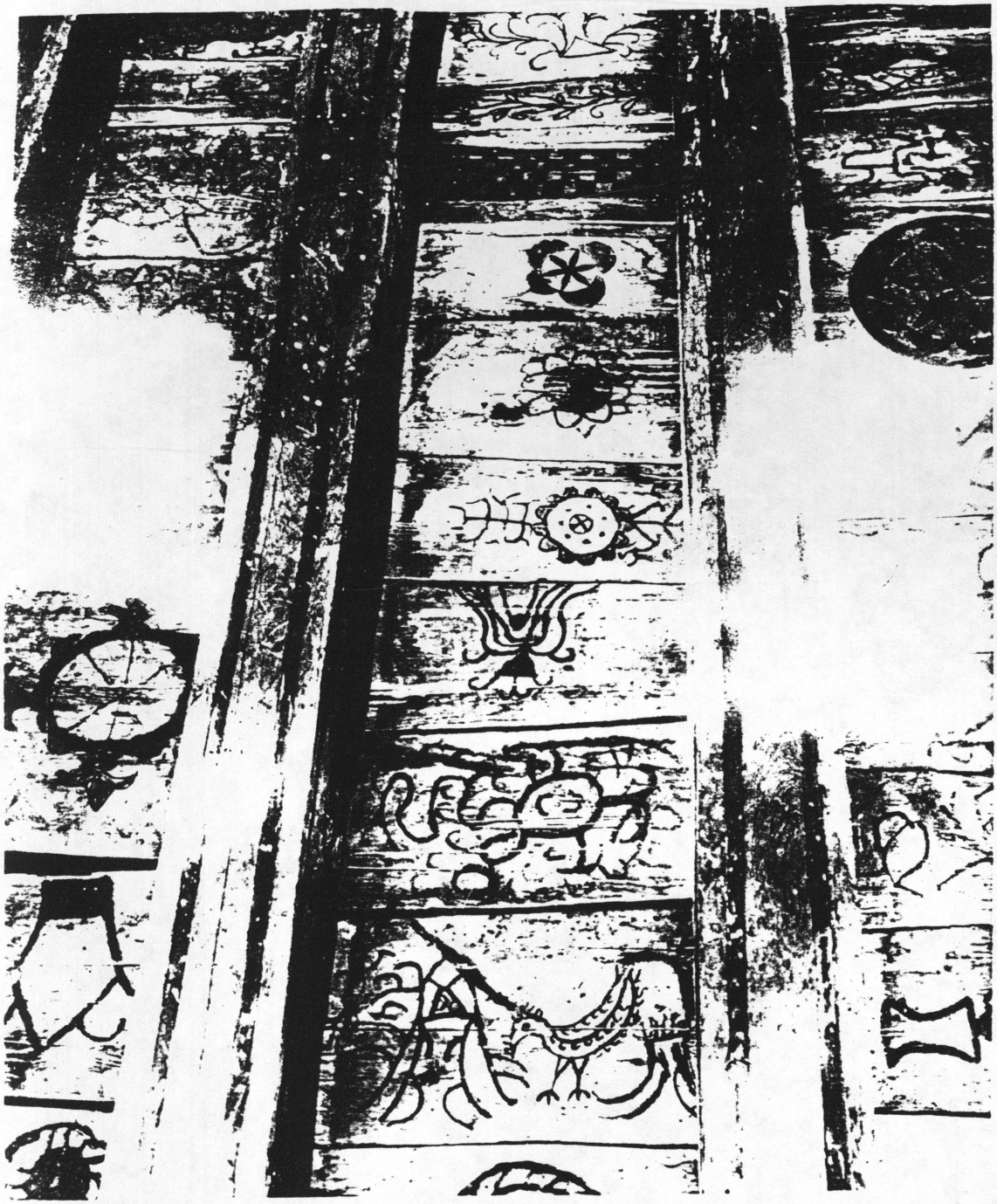


Figure 6. Provenience detail of choir loft tablitas taken from sotocorro.

Photograph courtesy of F. Mang, National Park Service.

1792vv is over 100 years beyond the heartwood/sapwood boundary, and the 1823vv date is almost 80 years from its heartwood/sapwood boundary. This information places the true dates of cutting in the early 1800's and mid-1800's respectively. In any case they were not original elements, and the lack of specific provenience data renders the value of the dates insignificant in this interpretation.

The house of Max Cruz, one of the older families in Las Trampas, contained a wide range of dates. With a striking absence of dating clusters, the only processes accountable are either the opportunistic re-use of wood for repair or the intermittent construction of additions on the house through time. There is no doubt that building activity was taking place in the Cruz household after the summer of 1898; the barn was erected and the house was repaired. Subsequently many timbers from the house were reused in the barn. The Cruz mill was constructed in 1911. The three logs sampled from the mill wall all were from the same original tree and it is highly improbable that they would all appear together again in the same provenience had they been re-used from a previous structure.

Clustering of Dates
for the Site

Another approach to human behavior involved in the construction of the church and other features of the

settlement is to refocus on the tree-ring dates from the entire site to determine the periods of greatest wood cutting activity (Table 3). The period prior to and including 1735 is represented by only one conclusive cutting date, and in this instance the tree may not have died by human agency. The greatest amount of tree cutting activity was between AD 1755 and 1764. It cannot be said that the cutting prior to licensing in 1760 was definitely in anticipation of building the church, but the tree-ring evidence weighs heavily in support of such a hypothesis. Whatever the explanation, it was a period of community growth, clearing of land, or timber stockpiling. A distinct event in the furnishing of the church was marked by cutting of saplings in 1776, an isolated point in time between original construction and later major decorative additions. The period between 1782 and 1785 (tending toward 1785) was a time of acquisition of large timbers for the addition of the altar screen. A scatter of dates from 1793 through 1827 attest to no significant wood cutting events and suggest both slow community increment and incidental repair of original structural material. Repair or remodeling in the late 1860's or early 1870's (Bunting, 1970) is a possible explanation for the non-cutting dates in the 1834-1866 range. The period from 1889 through 1911 witnessed a community expansion as

represented by timber cutting for the dwelling and related outbuildings of the Cruz family. Church renovation from post-1926 through 1943 was the cause of the last local wood cutting activity evidenced by archaeological tree-ring dates.

Non-Chronological Aspects of the Tree-Ring Analysis

Season of Wood Cutting

In order to determine whether the people consistently carried out wood cutting activity during a particular part of the year, the state of completeness of the outside ring of each specimen showing a cutting date was examined. For ponderosa pine the growing season, i.e., that part of the year during which the tree is adding height and girth in the form of a new "ring" or sheath of cells, is from approximately May through September (Budelsky, 1969). In ponderosa pine, if the outer ring bearing a cutting date condition is incomplete, then the maximum period during which cutting could have taken place is from the end of April to the beginning of October of the dated year. If the last ring is complete through its layer of dark latewood cells, then cutting must have taken place sometime after September of the year dated and before May of the following year when growth of a new layer of springwood

cells would be initiated. The sum of all cutting dates including tentative dates are:

		from church only	from Cruz structures
complete outside ring	=	8	7
incomplete outside ring	=	7	0

There is an almost equal number of trees cut during the summer versus non-summer seasons for utilization in the church. Although the sample size is small, one can conclude that construction and decoration were carried out opportunistically during the course of the year. Conceivably such time would have been when able-bodied members of the community had time available to perform non-agricultural tasks and/or when religious needs became an overriding influence.

By contrast, the wood cutting for construction of the Cruz buildings was done in all represented cases during the autumn, winter, or spring. It may be inferred from this fact that secular construction--or at least the acquisition of building material--was performed after the domestic affairs of planting, tilling, and harvesting had been attended to for the year.

Species Utilized

Although the Trampasenos had a minimum of three and most likely five species of timber at their disposal for construction (pinyon pine, juniper, ponderosa pine,

with the addition of aspen from burned areas and Douglas fir from higher elevations), the consistently utilized species was ponderosa. In prehistoric dwellings, pinyon and juniper are frequently used for upright components while ponderosa and Douglas fir are used for horizontal components (Robinson, 1967) due to the differential quality of compressive and tensile strength in each. The greater length and straighter bole of ponderosa and Douglas fir are additional attributes which make the two species more desirable for use as vigas. In the San Jose church, the distance spanning the nave, apse, and transepts warranted vigas 7 meters long, and ponderosa was consistently used for the purpose. In fact it must have been an accepted practice to build exclusively with ponderosa. This practice has continued through more recent renovations. Only one specimen of the entire archaeological collection was other than ponderosa, a large aspen sapling used as a morile or scaffolding support in the adobe. In the modern woodpile (LTM specimens, Table 1), the logs cut in fireplace lengths were predominantly pinyon while the trough-making supply (constructional material) was ponderosa.

SUMMARY AND EVALUATION

The historical record of construction and decoration at San Jose de Gracia church has been enhanced by dendrochronological information. Although some doubt remains in the finer interpretation of a small number of dates, the increased temporal resolution made possible by tree-ring dating shown here indicates promise for further application.

The Revised Historical Chronology

The final step in applying the dendrochronological interpretations is to test their positions within the known historical framework. Table 4 lists the sequence of events known by documented evidence and supplemented by dendrochronology.

According to Jones (1969), it is reasonable to assume that within the 16 years prior to permanent settlement there was seasonal occupation "in order to prove that it was a dependable site for year-round living." The date of 1735 (LTR-16) supports the hypothesis of early occupation. It is also probable in the light of the frequency of re-used timber in the church. After establishment of the village, there followed a period (1755-1759) of community timber cutting. It cannot be proved with the

Table 4. The historical record of the church at Las Trampas supplemented by dendrochronological dates.

Documented Events	Date	Events Dated by Tree-Rings
	1735	possible encamping and tree cutting before permanent settlement
Royal grant to establish village of Las Trampas	1751	
	1755-1759	community construction or accumulation of timber for church construction
Licensing of church	1760	
(stone altar screen in Church of Cristo Rey, Santa Fe, sets precedent)	1761	
	1762	moriles in adobe wall, walls erected to a minimum of 15 feet in height
	1764	roof construction
Visitor Dominguez, inventory includes choir loft, balcony, roof, altar niche, decoration of talco, no record of mural on adobe behind altar	1776 (April)	

Table 4. (Continued)

Documented Events	Date	Events Dated by Tree-Rings
	1776 (summer, autumn, or spring of 1777)	construction of guardapolva over adobe altar (and original mural)
	pre-1785	mural on adobe wall behind altar, native pigment and talco
	1785 (autumn, or spring of 1786)	timber cutting for major interior furnishing: construction of altar screen, re-use of 1755-1763 beams
Visitor de Guevara. inventory includes wooden altar screen at rear of apse, no record of flooring	1817	
inventory, no record of flooring	1826	
oil painting on altar screen (Bunting, 1970)	1860's	
	1866-early 1870's	reroofing, repair of balcony, laying of plank floor with re-used vigas
visit by Bourke, record of bell towers of milled wood	1881	
reroofing (Bunting, 1970)	1915-1917	

Table 4. (Continued)

Documented Events	Date	Events Dated by Tree-Rings
reroofing and restoration, Committee for Preservation and Restoration of New Mexico Churches	1932	probable replacement of bond beam above clearstory
	1943	replacement of threshold
replastering and renovation by the community and Las Trampas Foundation	1967	

present evidence whether these specimens were specifically stockpiled for use in the church or were re-used from structures built at that time. Pre-licensing timbers were used (not re-used necessarily) in primary construction of the church wall and choir loft.

A small cluster of tree-ring dates contain proof of wall construction to 15 feet high by autumn of 1762 at the earliest. Jones (1969) and Bunting (1970) contend that flooring was installed during the major period of decoration and repair in the latter 1860's. The floor planking material was from re-used undamaged vigas comprising the original roof and dating 1764.

As a possible result of Dominguez' visitation in 1776, and perhaps at his request, a canopy over the adobe altar and mural was erected of hides stretched on saplings cut during and after the summer of 1776. A dustguard or guardapolva would have protected the altar dressing and sanctos as well as the mural (Jones, 1969), which Dominguez did not consider important enough to mention (Bunting, 1970).

Wood for construction of the altar screen was accumulated by autumn of 1785 or spring of 1786. Many additional beams were re-used from elsewhere within the church or from abandoned domestic structures, a fact

attesting to the conservative use of building material among the residents of Las Trampas.

The oil paintings presently on the hand-adzed surface of the altar screen were executed in the 1860's by an artist from Sonora (Bunting, 1970). Originally the screen was painted in a floral tempera design by Molleno, an artist whose work in New Mexico dates 1804-1845. For this reason Bunting (1970) believes that the altar screen was erected in the early 1800's and that the wood had been obtained entirely by re-use and stockpiling. As a more plausible hypothesis the tree-ring dates, clustering toward 1785 (early 1786), suggest that another folk artist may have executed painting on the screen even before Molleno (Jones, 1969).

Repair of the balcony soon after 1866 coincides with the general time of interior oil painting and reinforces the hypothesis of reroofing at this time. Bunting (1970) notes that the average life span of mud-covered vigas is approximately 100 years.

Evaluation of the Dendrochronological Analysis

The necessary control for a spatial/temporal study such as that of Las Trampas is precise provenience records. The quality of provenience controls recorded in the Las Trampas Foundation collections was excellent. The approach

was made according to archaeological methodology, and with the concurrent work of an archivist, an art historian, and an architectural historian, the relationships of the wood components to emplacement of adobe and to decoration were clear.

Due to limited access into critical architectural areas and to continued usage of the church, only a minimal number of specimens was available for a complete dendrochronological sampling. Analysis would benefit from more datable material from within the adobe walls and from the bell tower entries. The altar screen was the most thoroughly sampled feature and the dates from it provide the maximum information dendrochronology can supply. Exposed tree-ring material in the church is now totally sampled until the next restoration.

Many other features in the community remain to be sampled. Collections from the Cruz structures alone were not as thorough as possible. Other structures of chronological interest include the penitente morada adjacent to the church and the aqueduct of hollowed logs depicted in Wilson (1970). With a total sampling of exposed beams throughout the community, a study of settlement pattern and changing density through time could be accomplished.

The dendrochronological study of Las Trampas has pointed out the inconclusive quality of dating derived

thus far for most other Rio Grande area mission structures (Smiley et al., 1953). In many cases the dates did no more than confirm the known historical sequence and often served only to confuse it by a lack of multiple sampling.

According to Bunting (1970), there are several dwellings in the Taos-to-Truchas, New Mexico area which are contemporaneous with the Las Trampas structures and are of much historical interest.

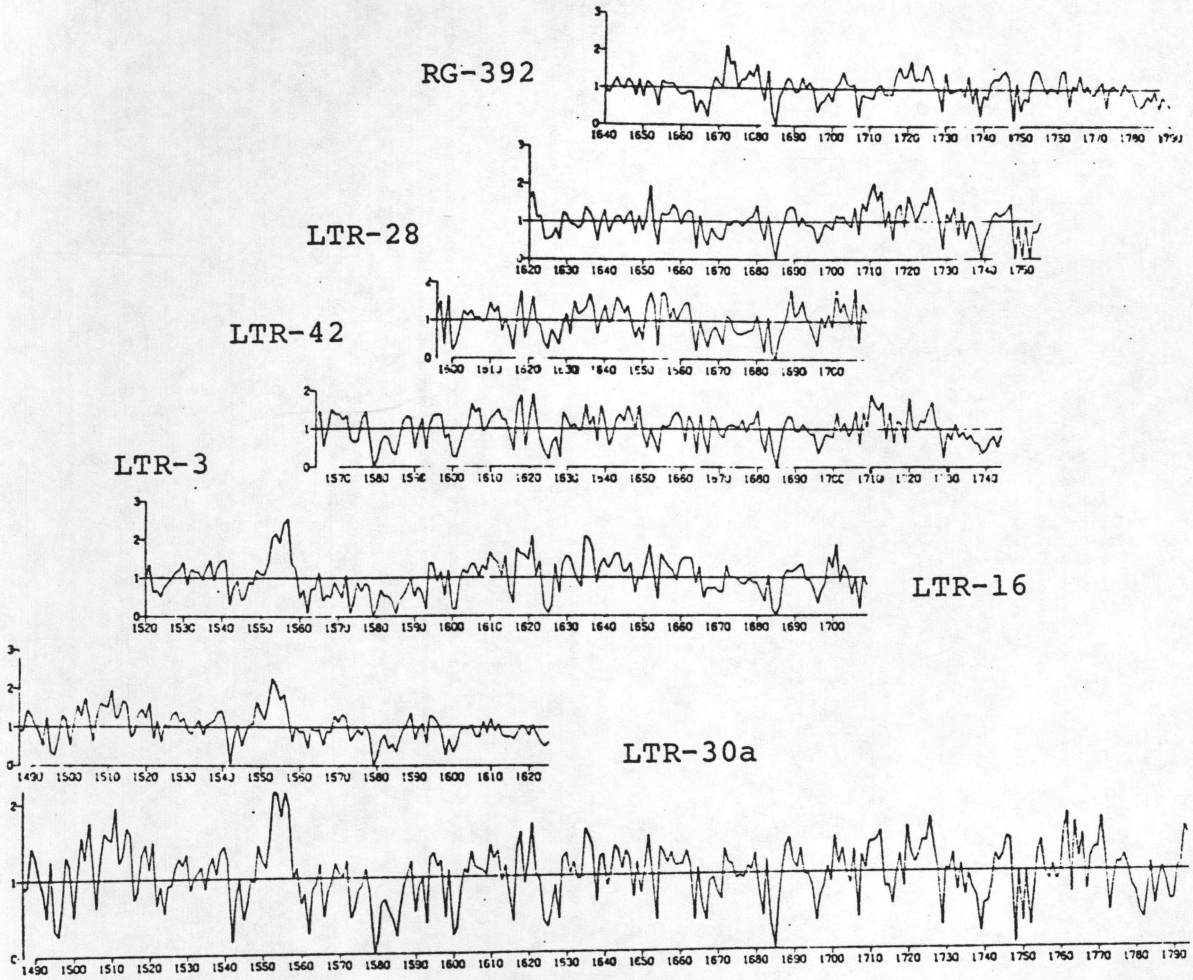
To the architectural historian (Bunting, 1970) the possibility of refining a sparse written record by use of an independent body of chronological data from in situ structural wood elements is invaluable.

The ideal situation for future application of historical dendrochronology is in a site such as Hubbell Trading Post National Historic Site, Ganado, Arizona. The tree-ring chronology has good cross-dating, and more than 400 exposed unshaped beams could provide excellent dating controls.

The dates on the church themselves and their interpretations are the main contribution of this research. It is hoped, however, that historical Southwest studies concerned with Spanish Entrada Period through Anglo-Territorial Period structures, being pursued either from the literary or archaeological approach, might make use of and benefit from the geochronological technique of tree-ring dating.

APPENDIX

PLOTTED INDICES OF SELECTED SPECIMENS AND THE NEW MEXICO D MASTER CHRONOLOGY



New Mexico D Master Chronology

Figure 7. Plotted indices for period AD 1487 to 1790.

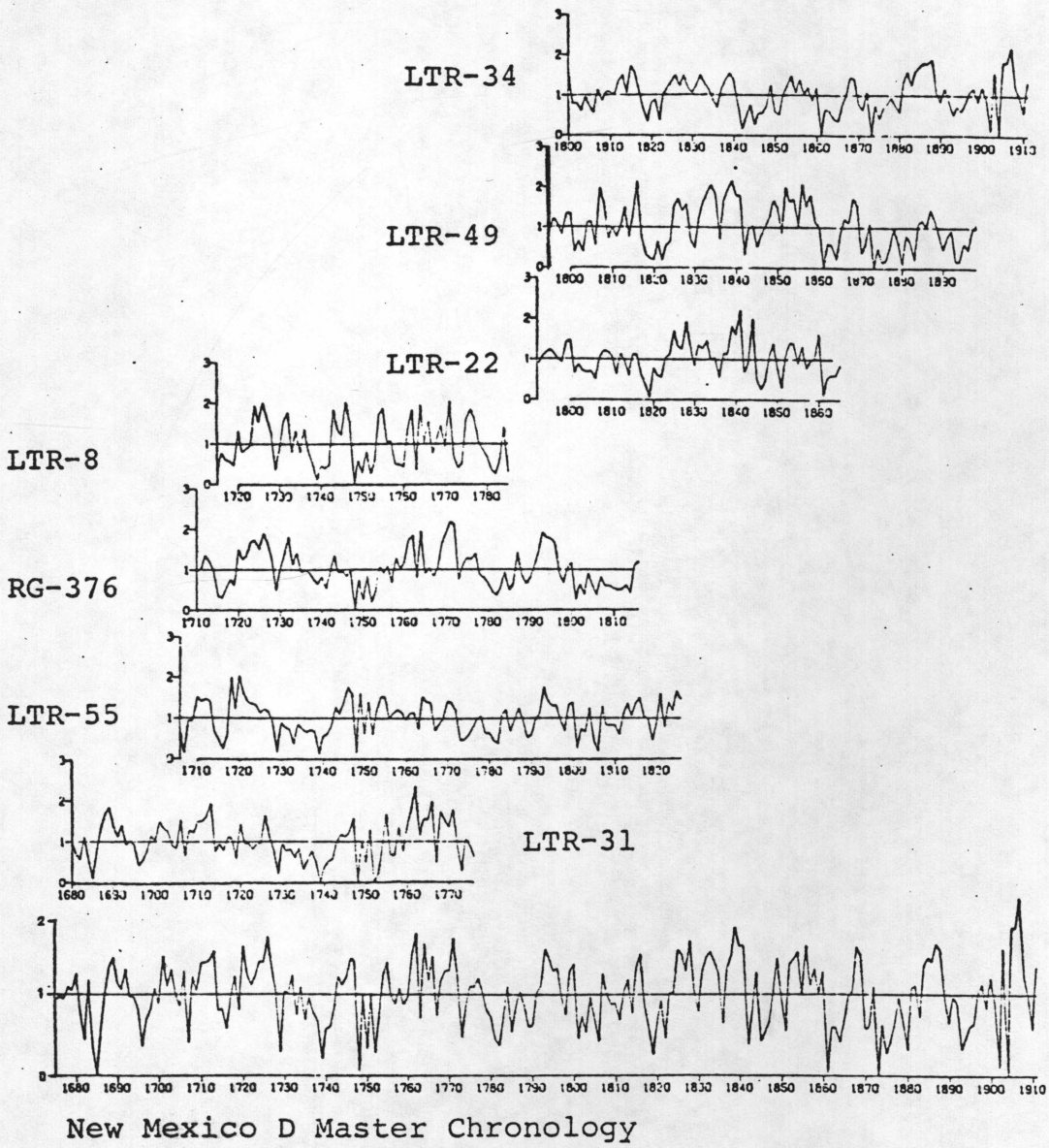


Figure 8. Plotted indices for period AD 1680 to 1910.

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