

Scope of Work

Sampling of Structural Wood at the Montezuma Castle Cliff Dwelling, AZ O:05:14 (ASM)



Matthew Guebard
Park Archeologist
Montezuma Castle National Monument
Tuzigoot National Monument

INTRODUCTION

Montezuma Castle (MOCA) is a 20 room cliff dwelling associated with the Southern Sinagua archeological culture and approximately dated to the Honanki and Tuzigoot Phases (A.D. 1125-1400). Declared a National Monument in 1906, the site is an uncommonly well preserved example of prehistoric architecture. Montezuma Castle is an iconic structure deeply associated with the public's perception of Arizona prehistory. Surprisingly, the site has been the focus of few archeological and architectural studies. As a result, very little is known about the construction, occupation, or current condition of the site.

The well preserved architecture, especially intact wooden ceilings, presents an opportunity to study many aspects of prehistoric life. These studies will strengthen the unnecessarily weak interpretation of the site currently presented to park visitors. The proposed study will more adequately define the significance of the MOCA cliff dwelling, thus strengthening its legitimacy as an important structure. This data will also contribute to the long term management of the site. Information collected from the study will create a baseline of current condition and wood deterioration at the site. Identifying and understanding wood deterioration will allow park staff to appropriately maintain the site for the enjoyment and benefit of future researchers and visitors.

The proposed project is the evolution of a small study conducted with the assistance of Dr. Robert Blanchette and the University of Minnesota (UMN). Blanchette was invited to visit the site and assist with interpreting humidity and temperature data collected between 2009-2010. Additionally, Blanchette was asked to collect several small samples to identify the presence of soft and dry rot fungi. As the project progressed, it became apparent that the information Dr. Blanchette provided was invaluable for the management of the ruin. As proposed in this scope of work, the continued collection of condition data will inform management decisions intended to effectively control active fungal growth.

Blanchette's work also recovered several previously unrecorded species, including a Ponderosa Pine (*Pinus ponderosa*), Ash (*Fraxinus* sp.) and Douglas Fir (*Pseudotsuga menziesii*). Douglas Fir and Ponderosa Pine are known to yield cutting dates capable of informing archeological interpretations of construction sequencing, functional use, and social behavior within archeological sites (Schulman 1956, Speer 2010). With the prospect of acquiring cutting dates, the park began consulting with Tom Windes, dendroarcheologist at the Maxwell Museum of Anthropology, to determine the possibility of refining broadly inaccurate construction dates. In addition to construction sequencing, tree-ring sampling also presents the opportunity to collect data on the prehistoric environment affecting construction decisions.

This scope of work proposes to continue the UMN's study of wood condition and species identification as well as sample beams with chronometric and environmental data. The opportunity to collect a large sample of condition information at the Montezuma Castle site cannot be overstated. Condition information will provide a baseline for future monitoring and may identify previously overlooked areas of deterioration. Samples collected for condition assessment will also inform species identification. Species identifications will inform archeological interpretations of prehistoric resource availability, wood choice and room use.

Nominated to the National Register of Historic Places under Criteria A, C, and D, the Montezuma Castle archaeological district is significant for many reasons. Under Criterion A, significance includes the "social history...decline and eventual abandonment" (Anderson et al 1978:3) of the MOCA site. Under Criterion C significance is defined as a "rare survival of Hohokam buildings embodying distinctive characteristics of a type, period and method of construction (Anderson et al. 1978:3). Additionally, significance is defined under Criteria D as the ability to yield information important to the study of

prehistory. As discussed below, the site's information potential has been overlooked due to certain assumptions about the species of wood at the site.

Technological advances resulting in the reanalysis of wood, however, create new opportunities to refine existing information. This information will strengthen and update existing qualities of significance defined in the 1978 National Register of Historic Places Registration form. For example, the refinement of chronometric data using tree-ring cores will strengthen the site's association with events defined under significance criterion A. Similarly, Blanchette's 2010 study shows that additional sampling will provide condition information, species identifications and environmental data capable of redefining the site's significance and drastically altering our current understanding of the Montezuma Castle site.

The following scope of work identifies four major goals for the proposed project. These involve pertinent management and research needs including 1) condition assessment, 2) species identification, 3) tree-ring dating, 4) tree age and seasonality. To achieve these goals, the scope of work proposes to collect small samples throughout the dwelling. Each sample will provide condition data and species identification. Additionally, the project also proposes to collect seven 5/8 inch tree-ring cores to investigate construction dates, tree age, seasonality and environment. Information acquired from the proposed project will improve our understanding of the MOCA site and assist in the preservation of a unique archeological and architectural resource.

1) CONDITION ASSESSMENT

Environmental data has been collected at Montezuma Castle since January 2009. This data consists of temperature and relative humidity readings collected on Hobo U23-001 shuttle data loggers. The results of data collected from January 2009-February 2010 are summarized in a short report by Blanchette and Held (2010). As Blanchette and Held report, the average ambient humidity for all rooms monitored during this period is approximately 55%. Several extended periods of above average humidity (60%-100%) are recorded, most notably during months of winter precipitation.

Research conducted by Blanchette in various climates indicates many types of soft rot fungi are active in wood with an average 28% moisture by weight ratio (Robert Blanchette Personal Communication 2010). Research conducted by Blanchette and Held at Aztec Ruins National Monument, Chaco Canyon Culture Center and Tonto National Monument suggests that the average moisture to weight ratio required to sustain arid strains of soft rot fungi are much lower (Robert Blanchette Personal Communication 2010). Therefore, soft rot fungi located within the site may remain active during periods equivalent to the 2009-2010 recorded average.

Although it is clear that soft rot fungi accounts for very slow deterioration, moisture accumulation caused by leaking roofs, pooling water and wicking damp may accelerate the pace of damage substantially. Many issues, such as leaking roofs can be well controlled with preservation maintenance. However, preservation maintenance is only performed once condition issues are recognized and assessed. Additionally, National Park Service funding cycles and pre work planning needed to perform maintenance activities often account for several months or years in which no preservation maintenance is performed. Inactivity associated with identification, assessment and funding acquisition of maintenance activities may account for extended periods of accelerated damage to individual or small groups of individual wood specimens. Therefore, the favorable environment recorded in 2009-2010 cannot be guaranteed for all wood located within the site. As such, an effective and proactive monitoring plan must be based on the condition of the wood, not the assumption that environmental conditions will remain absolutely favorable.

Implementing a successful monitoring plan is completely dependent on the field crew's ability to identify problematic areas. This identification is made difficult by a number of problems including low lighting

and sooting on all prehistoric wood elements. This project proposes a complete baseline condition assessment of all prehistoric support, primary and secondary beams to allow the park to monitor locations with previously identified soft and dry rot fungi. Furthermore, condition information collected from this project will allow for preservation decisions to occur expeditiously and proficiently with individual wooden elements.

SAMPLING METHODOLOGY

Consultation with the Arizona State Historic Preservation Office (AZ SHPO) identified several concerns with the extraction of tree-ring cores from the site. Most notably, the AZ SHPO was concerned with the number and invasive nature of proposed samples. In response to the SHPO's concerns, the monument has worked with the UMN to plan for the collection of minimally invasive samples. Each sample will consist of a small ($>1\text{cm}^2$) sliver of wood collected from 163 individual beams. Samples will be taken from all previously unsampled support, primary and secondary beams (See Appendix 1). Only one sample will be taken from each beam. The small size of each sample will allow field technicians to collect from in descript locations such as inside cracked beam sections, below grade and above eye level. Samples will be analyzed using a combination of Scanning Electron Microscope (SEM) techniques and light microscopy. These techniques will identify the condition of wood on a cellular level.

2) SPECIES IDENTIFICATION

Species identification of all wood was completed by the University of Arizona, Laboratory of Tree Ring Research (LTRR) in 1988. At that time, species were identified in the field using visual characteristics such as color, bark type and wood density. Identification at the site was made difficult by the fact that the majority of wood has no remaining bark and carries a heavy layer of soot. Wood, like other prehistoric building materials may have been obtained from nearby sources such as the Beaver Creek riparian area. Understandably, technicians working with LTRR assumed that the majority of wood used in roof sections were taken from this nearby area. As a result, LTRR identified the majority of wood as Arizona Sycamore (*Platanus* sp.) (Jeffery Dean Personal Communication 2010).

A small random sample collected in 2010 has shown that a rather large percentage of specimens recorded in 1988 were misidentified. In fact, 3 of the total 13 (23%) samples collected in 2010 were misidentified by LTRR in 1988 (Blanchette and Held 2010). Although it is unlikely that this high of error percentage will be found throughout the dwelling, it does show that additional misidentified species likely exist. For this reason, the collection of species information throughout the site is important. Species identifications will identify trees with the ability to inform interpretations of prehistoric behavior and provide cutting dates associated with prehistoric construction events.

The inventory of tree species at the site may display patterning indicative of intentional choices in construction material. Individual rooms may display higher frequencies of certain species based on room function (i.e. habitation/storage/ceremonial). Species identification thus provides a wealth of data capable of explaining both simple and complex behaviors as well as environmental determinants affecting wood choice. Patterning may therefore be associated with a simple preference in wood choice, or the availability (or nonavailability) of certain species near the site. As such, wood choice may also represent the health of the local prehistoric environment by indicating which species were readily available or highly sought after.

SAMPLING METHODOLOGY

Species identifications can be acquired using samples collected for condition assessment. No additional sampling is required.

3) TREE-RING DATING

Species information will inform a list of datable beams at the site. Currently, construction, occupation and abandonment dates are unknown. Unfortunately, by the initiation of formal investigations in the 1920s, much of the material important for dating the site was destroyed or removed. As Keith Anderson lamented in his 1988 architectural analysis, “it seems unlikely that current techniques will yield more than is already surmised, but future researchers may devise a means of determining the age of the site” (Wells and Anderson 1988:229). The reassessment of species identifications at the site provides a means for building a list of datable wood specimens. As already discussed, it is likely that additional species may be found. If this is the case, construction dates for the site will augment information compiled by Anderson and previous researchers.

Currently, dates of A.D. 1125-1400 are used for the interpretation of the site, but were determined using rudimentary ceramic cross dating conducted at Castle A (AZ O:05:96 [ASM]) an archeological site located 100 meters southwest of Montezuma Castle. Although Montezuma Castle and Castle A were contemporaneously occupied, dates for Castle A span a large period of time incorporating at least 150 years. Dates obtained from Castle A were determined by the identification of decorated ceramics collected during a 1935 Civil Works Administration (CWA) funded excavation. As is the case for similarly funded projects of that era, artifacts were quickly removed without detailed field notes. As a result, questions remain about the age, construction sequencing and abandonment of Castle A.

Ceramics recovered during the CWA excavation include varieties representing a wide geographic range and several archeologically defined culture areas. Most notably, decorated ceramics fit into two varieties representing different time periods. Approximately 37% (n=109) of the total decorated assemblage consisted of Walnut Black-on-white (Jackson and Van Valkenburgh 1954: 44). Walnut Black-on-white is a well recognized variety of Little Colorado White Ware dated to the PIII period between A.D. 1100-1250 (Hays-Gilpin and van Hartesvedt 1998). Another notable variety consisted of Jeddito Black-on-yellow, representing approximately 36% (n=93) of the total ceramic assemblage (Jackson and Van Valkenburgh 1954: 44). Jeddito Black-on-yellow is a variety of Jeddito Yellow Ware commonly associated with archeological sites post dating A.D. 1350 (Hays 1991, Nichols 2005) The remaining 27% (n=59) consisted of a variety of wares representing the 11th-16th Centuries (Jackson and Van Valkenburgh 1954: 44).

Jackson reports stratigraphic testing at Castle A was unsuccessful in defining occupational periods and construction dates. As he reports, testing in a large trash deposit immediately south of the site was compromised by the episodic flooding of Beaver Creek (Jackson and Van Valkenburgh 1954: 49). Jackson describes the lack of dates for the site, writing “it is to be regretted that no single definite date can be given for Castle A, or, in fact, for any other ruin on the monument” (Jackson and Van Valkenburgh 1954: 48).

Despite the paucity of provenience data for artifacts recovered at the site, it appears clear that Castle A represents at least two centuries of continuous occupation. The proximity of Castle A and Montezuma Castle has resulted in the logical conclusion that each site was occupied simultaneously. As a result, construction dates and occupational periods for each site have been combined to create one site with a very long occupational history. This approach presents several problems, most notably the assumption that both sites are absolutely contemporaneous.

Research conducted at cliff dwellings throughout the American Southwest has found that the majority were occupied for only a few human generations (~75 years). For example, research conducted at cliff dwellings located within Tsegi Canyon has found that many were occupied for 25-40 years (Dean 1969, 1970). Based on research at these sites, Dean states that “contemporaneity cannot be assumed, even for

different parts of a single site” (Dean 1970: 173). The assumption of contemporaneity at Montezuma Castle and Castle A has created a very long occupational and construction sequence which does not fit well with conventional wisdom regarding the occupation of cliff dwellings throughout the Verde Valley and American Southwest. The long occupation dates associated with Montezuma Castle stand in stark contrast to cliff dwellings throughout the Verde Valley and American Southwest. Without adequate background information, these dates lead to the erroneous suggestion that Montezuma Castle is, in fact, unique for its long occupational period.

SAMPLING METHODOLOGY

Tree-ring coring at the site may provide dates capable of refining the 275 year span currently used to interpret construction and occupation at the site. Core sampling requires the extraction of a 5/8 inch bore drilled to the pith of the wood. Blanchette and Held’s (2010) analysis of wood located two datable samples within room 3-4 (see Appendix 1). Each of these samples will be cored to obtain possible dates. If dated, core samples will become part of the LTRR’s curatorial collections. If undated, core samples will be curated by the National Park Service at the Western Archeological and Conservation Center (WACC) in Tucson. Core samples will be labeled with provenience information and specimen specific sample numbers. All core holes will be filled using a 5/8 inch maple dowel tinted to match the color of the surrounding beam. A sample number will be stamped onto each core plug and extensive photographs of each sample location will be taken using medium format film and digital photographs.

Blanchette and Held will provide the park with a list of all species identifications and condition information for wood at the site. Species information may identify additional beams capable of providing tree-ring dates. These beams may be investigated in the future using similar sampling methods.

4) TREE AGE, SEASONALITY and ENVIRONMENT

This scope also proposes to use tree-ring core sampling to determine age (tree age at felling), seasonality (when harvested) and environment (conditions affecting tree growth). The age, seasonality and environmental conditions affecting tree growth can be determined using the same sample methodology listed above (5/8 inch cores). Observations at the site illustrate the presence of standardized size ranges for trees used in secondary beams throughout the dwelling. This suggests that prehistoric builders were intentionally cutting trees with very specific diameters and age ranges. The removal of large amounts of trees from bounded geographic and habitat areas would certainly have an impact on the surrounding environment.

Similarly, the seasonality of tree harvesting may provide information on prehistoric construction behavior. Seasonality is often tied to conscious decisions about the “appropriate” time to harvest certain species in certain locations. These decisions may be utilitarian or ideological in nature. Collecting information on seasonality may indicate construction patterns visible within the architecture at the site.

Environmental conditions have measurable effects on tree growth. Extended droughts and changes in available groundwater produce noticeable differences in tree-ring growth (Reichhardt 1990:3). Tree-ring samples may display differences in growth patterns indicating environmental conditions with the capability to impact prehistoric human behavior at the site.

SAMPLING METHODOLOGY

In addition to cores taken from room 3-4, five tree-ring cores will be extracted from room 4-2. Room 4-2 displays the greatest variability in tree size and, presumably, age (See Appendix 1). Cores will be taken from three locations representing standardized secondary beams as well as two large primary beams.

These locations represent size ranges for wood throughout the site. Identified as Arizona Sycamore, tree ring cores from this room will provide species specific information on age, seasonality and environment. Also, as part of room 4-2 samples will also be temporally and spatially discrete. This will create continuity necessary for discerning larger construction patterns and temporally specific behavioral choices.

Extracted cores will be curated at the WACC in Tucson. All core holes will be filled using a 5/8 inch maple dowel tinted to match the color of the surrounding specimen. A sample number will be stamped onto each core and extensive photographs of the each sample location will be taken using medium format film and digital photographs.

CONCLUSION

The sampling procedures discussed require the removal of a minute percentage of wood equaling approximately .0004% of the total volume of wood beams (n=163) at the site. Despite the small amount removed, concerns about the destructive analysis of original material are well founded. The amount of condition information acquired from sampling will offset many concerns by resulting in a successful monitoring plan. Additionally, the acquisition of species identifications, tree ring dates and environmental data will vastly improve the park's current interpretation of the site. Long term curation of cores in NPS and University repositories ensures that a representative sample of wood from the site is stored in a safe and stable environment.

Director's Order 28: Cultural Resource Management, provides guidance for management activities at NPS archeological sites. The policy attempts to balance cultural resource management, research objectives and public interpretation as a means of long term site preservation and public education. The Director's order states, "NPS policy requires that research be driven by management concerns" (USDOI, NPS 1998). Aside from management activities, NPS 28 also advocates projects which improve resource understanding. This concept is particularly important for ongoing interpretation of the site to the general public. Policy guidelines state, "interpretation of archeological resources is accurate, current, relevant to park themes, and consistent with resource management needs (USDOI, National Park Service 1998).

The monument's enabling legislation provides a general sense of the site's importance to the scientific community and general public by stating, "the prehistoric structure known as Montezuma's Castle...is of the greatest ethnological value and scientific interest and it appears that the public good would be promoted by reserving the ruin as a national monument" (USDOI, National Park Service 1906). The idea of scientific interest as a public virtue is clearly evident at the monument, where approximately 600,000-750,000 people visit the site annually. From this perspective, successful interpretation at the monument is dependent on acquiring scientifically credible information, while preserving and protecting the site's overall significance.

The management of archeological sites set aside for public visitation should be driven by resource interpretation and understanding. Unfortunately, current interpretations of the Montezuma Castle structure are surprisingly weak. This scope of work proposes to use various sampling and analytical techniques to inform preservation and management decisions while increasing overall knowledge of prehistoric behaviors associated with the construction of the MOCA cliff dwelling. Ideally, the increased information generated by the proposed sampling strategy will result in a deeper appreciation and respect for Montezuma Castle as an archeological site and work of architecture.

Works Cited

- Adams, E. Charles, Miriam Stark, and Deborah Dos
1991 Ceramic Distribution and Exchange: Jeddito Yellow Ware and Implications from Social Complexity. *Journal of Field Archaeology*, 20(1):3-22.
- Blanchette, Robert A. and Benjamin W. Held
2010 Analysis of Prehistoric Wood at Montezuma Castle National Monument. Unpublished Report. On file at Tuzigoot Cultural Resource Office, Clarkdale.
- Dean, Jeffery S.
1969 Chronological Analysis of Tsegi Phase sites in Northeastern Arizona. Papers of the Laboratory of Tree Ring Research, No.3. LTRR, Tucson.
- 1970 Aspects of Tsegi Phase Social Organization: A trial reconstruction. In *Reconstrcuting Pueblo Societies*. Ed. By William Longacre, University of New Mexico Press, Albuquerque.
- Hays, Kelley A.
1991 Ceramics. In *Homol'ovi II: Archaeology of an Ancestral Hopi Village, Arizona*. E.C. Adams & K. Hays (Eds.), pp. 23-49. Anthropological Papers of the University of Arizona, No. 55. University of Arizona Press, Tucson.
- Hays-Gilpin, K.A and E. van Hartesvedt
1998 Prehistoric Ceramics of the Middle Rio Puerco Valley, an overview. Museum of Northern Arizona, Flagstaff.
- Jackson, Earl and Sallie Pierce Van Valkenburgh
1954 Montezuma Castle Archeology. Southwestern Monuments Association Technical Series, Vol.3, Part 1. Gila Pueblo, Globe.
- Nichols, Elizabeth
2005 *Jeddito Black-on-yellow*. Ceramic Field Identification Manual: Aqua Fria National Monument Project. <http://www.musnaz.org/cfim/JedditoYellowWare/JedditoBY/JBYindex.shtml>
- Reichhardt, Karen
1990 Autecology of Arizona Sycamore (*Platanus Wrightii*): A Critically Important Species in Southern Arizona. Unpublished Report. National Park Service, Phoenix.
- Schulman, Edmund
1956 Dendroclimatic Changes in Semiarid America. University of Arizona Press, Tucson.
- Speer, James H.
2010 Fundamentals of Tree-Ring Research. The University of Arizona Press, Tucson.

United States Department of Interior, National Park Service

1906 Montezuma Castle Enabling Legislation. No. 696, December 8, 1906, 34 Stat. 3265

1998 Director's Order 28: Cultural Resource Management. June 11, 1998.

Wells, Susan J. and Keith M. Anderson

1988 Archeological Survey and Architectural Study of Montezuma Castle National Monument.

Publications in Anthropology No. 50. Western Archeological and Conservation Center, Tucson.

Appendix 1: Proposed Sample Locations

ROOM Num.	Num. condition/ species samples (>1 cm²) proposed	Num. dendro samples (5/8 in. core) proposed	Num. of seasonality/ age samples (5/8 in. core) proposed
1-1	8	0	0
1-2	11	0	0
2-1	17	0	0
2-2	24	0	0
2-3	9	0	0
2-4	0	0	0
2-5	1	0	0
3-1	0	0	0
3-2	0	0	0
3-3	7	0	0
3-4	23	2	0
3-5	16	0	0
3-6	0	0	0
3-7	0	0	0
3-8	2	0	0
4-1	18	0	5
4-2	12	0	0
4-3	11	0	0
5-1	0	0	0
5-2	4	0	0
TOTAL	163	2	5

Table 1. Location of proposed samples at MOCA 88A-63 (AZ:O:05:14 [ASM]) by room number and sample type.

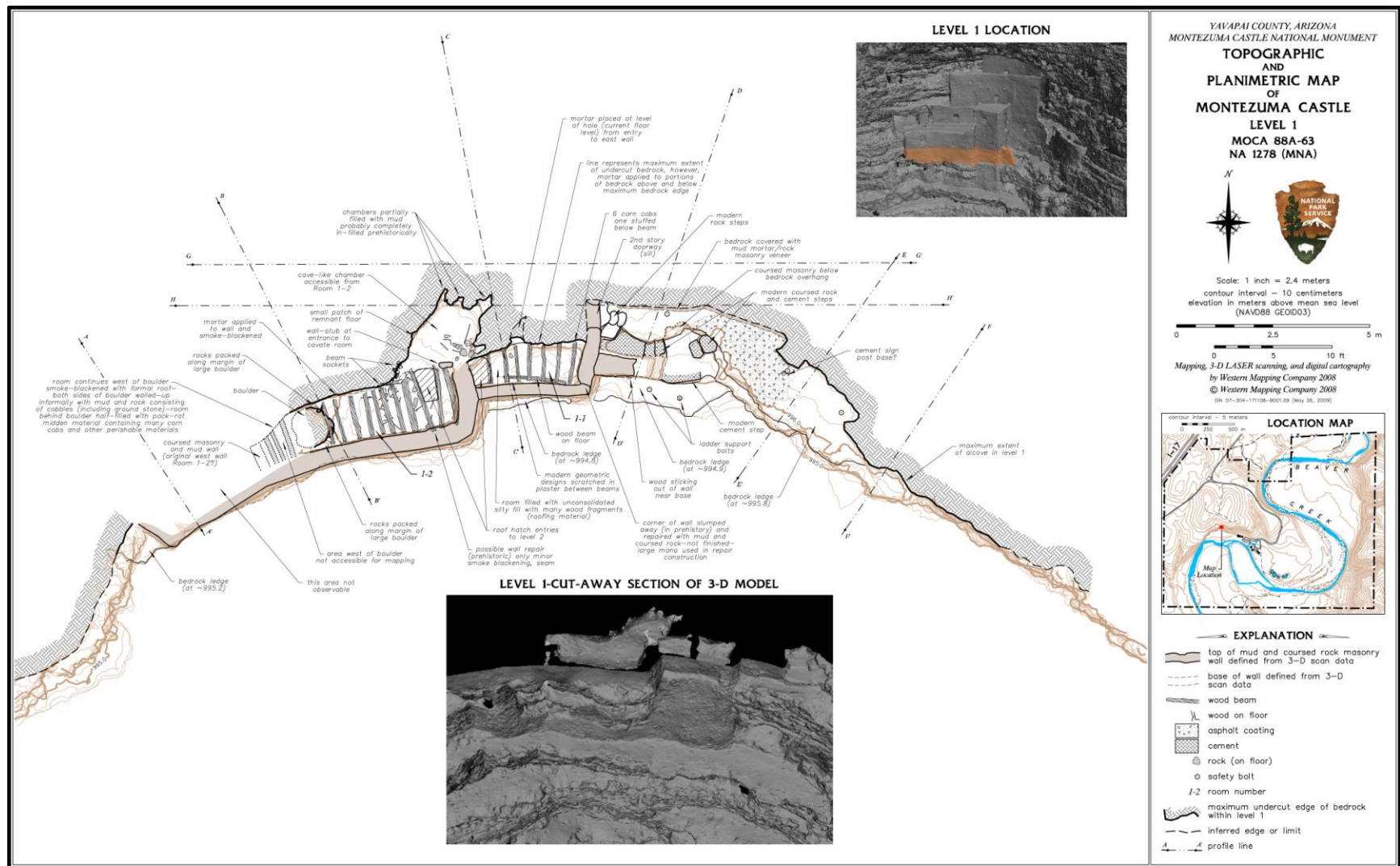
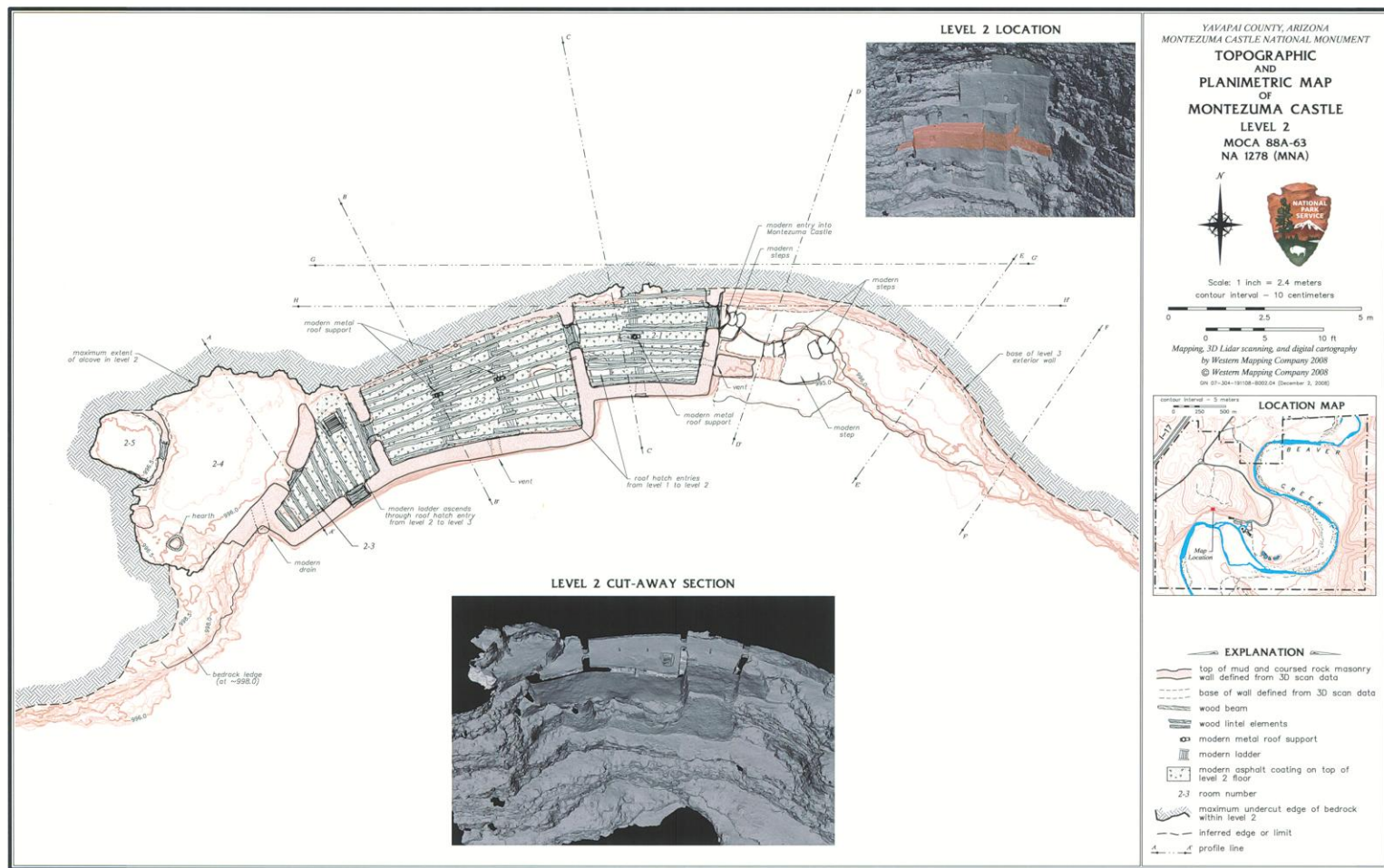


Figure 1. Map showing reflected ceiling plan in rooms 1-1, 1-2. All visible beams will be sampled for condition/species information.



Map X of X

Figure 2. Map of reflected ceiling plan in rooms 2-1, 2-2, 2-3. All visible beams will be sampled for condition/species information.

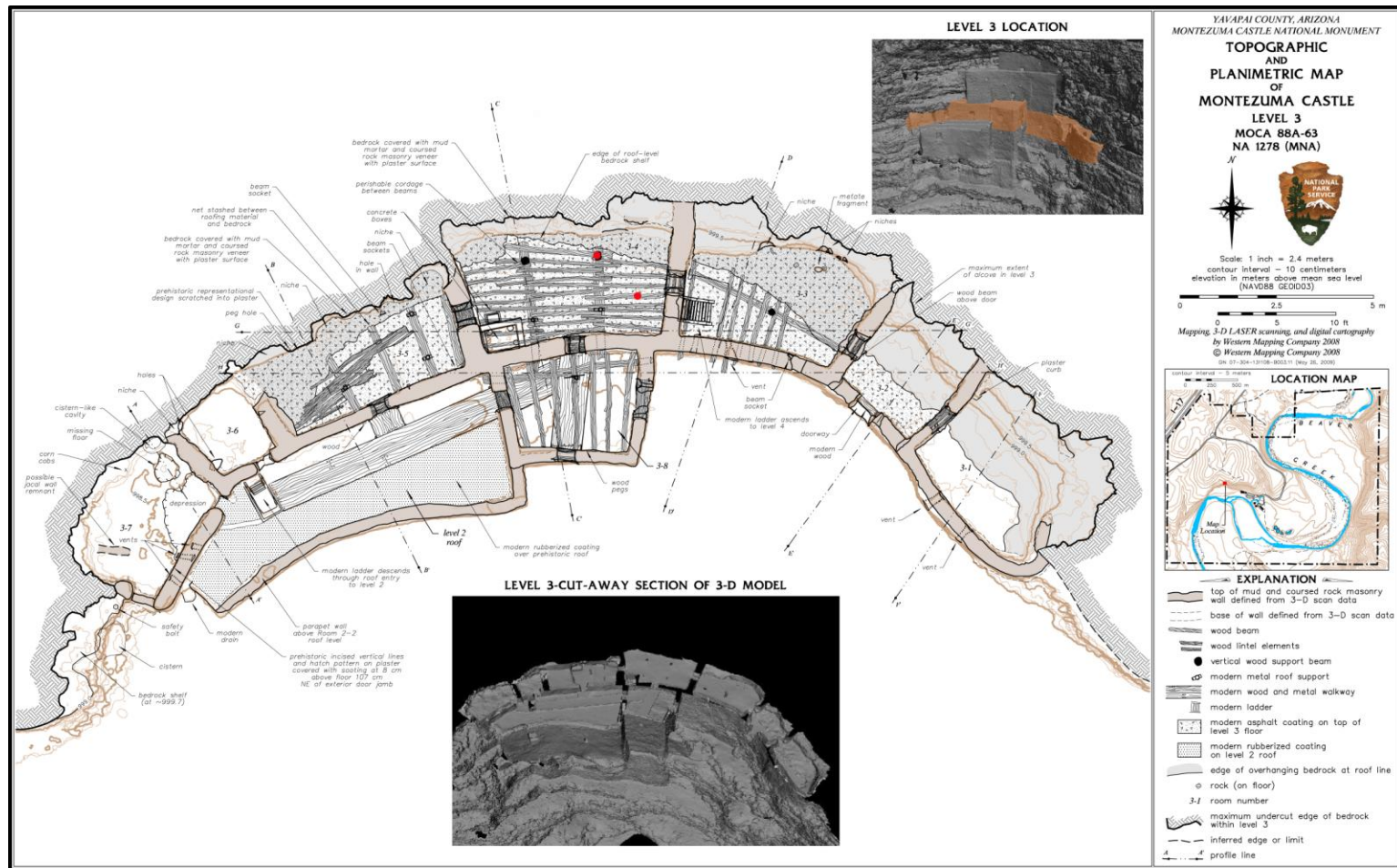
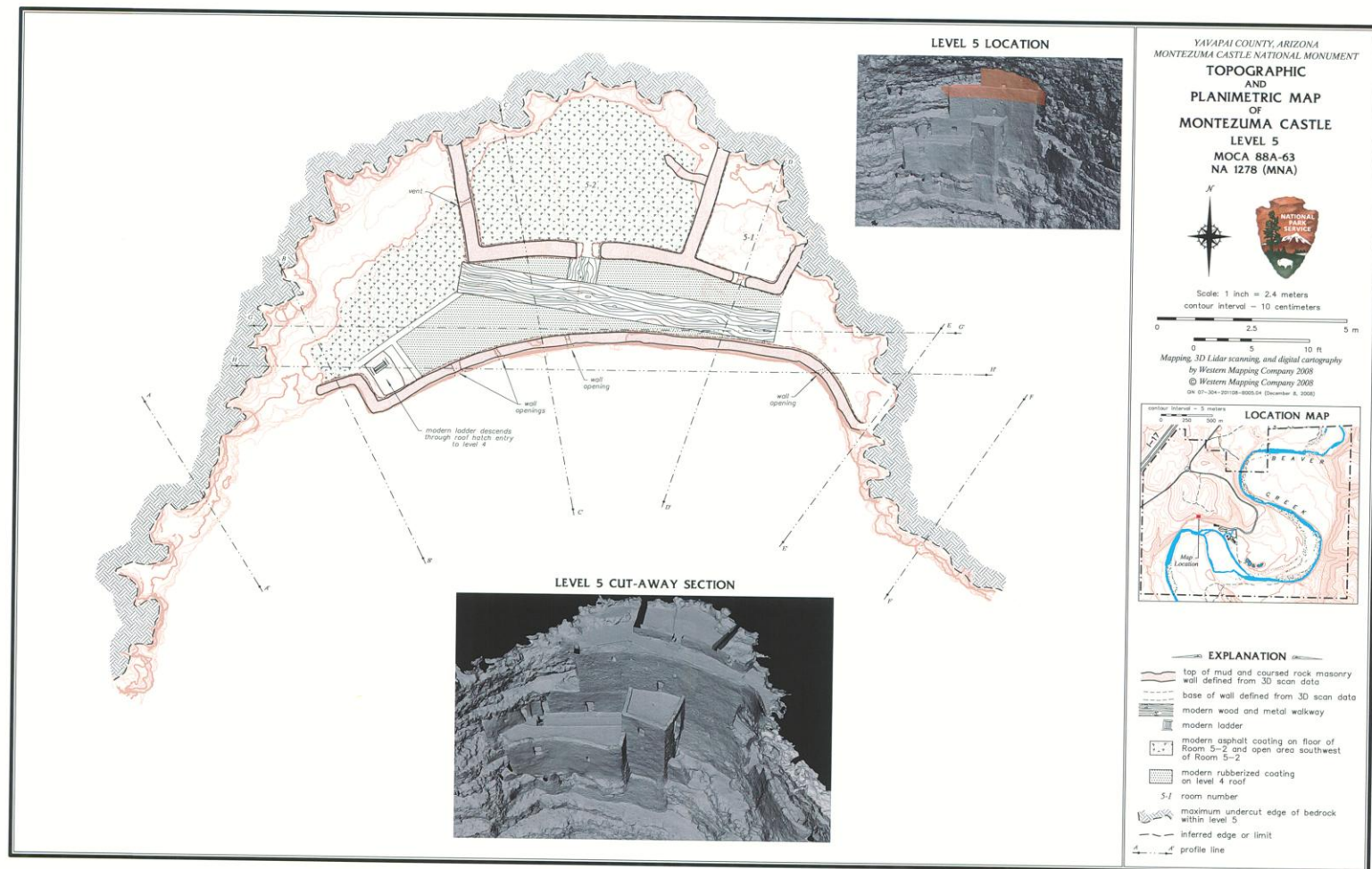


Figure 3. Map of reflected ceiling plan in rooms 3-3, 3-4, 3-5, 3-8. All prehistoric wood (n=48) will be sampled for condition/species information. Red dots illustrate the location of 5/8 in. tree-ring cores.



Map X of X

Figure 5. One condition/species sample will be taken from room 5-2 lintel.

