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Los Alamos National Laboratory, Los Alamos, New Mexico.

Author(s): Alexander F. Johnson and Stephen R. Hoagland

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Mortandad Cavate Complex Baseline Study
Los Alamos National Laboratory, Los Alamos New Mexico
LA-UR-



Alexander F. Johnson and Stephen R. Hoagland
Resources Management Team
Environmental Stewardship Group

Edited by Hector Hinojosa, Group IRM-CAS

Cover photo: Archaeologist Alexander Johnson records Mortandad Cavate Complex .

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Introduction

This report summarizes the results of a condition assessment of archaeological features associated with the Mortandad Cavate Complex (the Complex) at Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico (Figure 1). The Complex, situated in Technical Area (TA) 5 consists of 163 cavate rooms and rock cut rooms in Mortandad Canyon with associated rock art, stairways, and trails. LANL archaeologists conducted this assessment in 2009 and 2010 as part of the Site-Wide Environmental Impact Statement's (DOE/EIS-0380) Trails Management Program. The Trails Working Group was established in 2004 in response to public comment on the 2003 *Environmental Assessment for the Proposed Los Alamos National Laboratory Trails Management Program, Los Alamos, New Mexico* (DOE/EA-1431). This assessment represents LANL's continuing efforts to evaluate the impact of social trails use on cultural resources situated on Department of Energy (DOE) property Nisengard et al, 2006; Nisengard and Sherwood 2008).

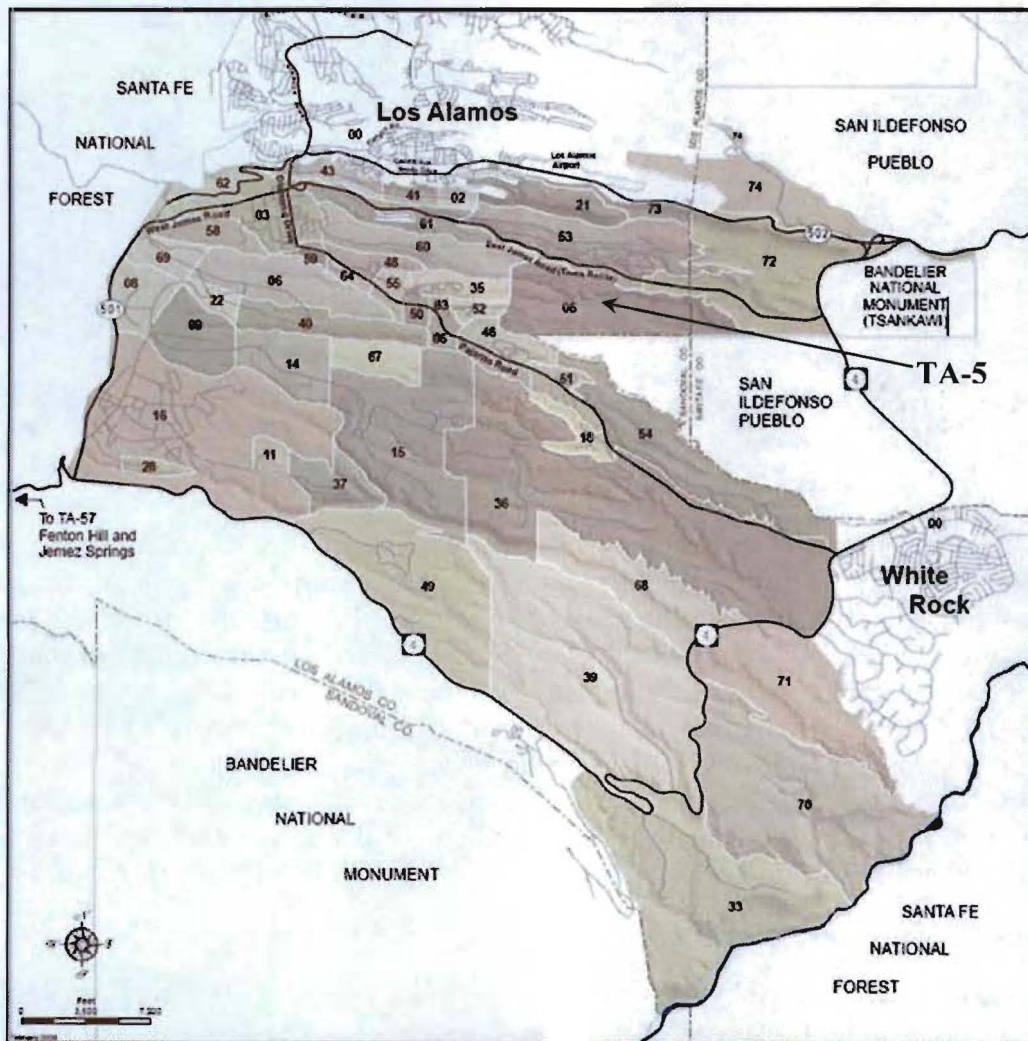


Figure 1. LANL with Technical Area 5.

The Mortandad Cavate Complex (LA 12609B) is one of four Ancestral Pueblo sites that the DOE and LANL plan to nominate as a National Historic Landmark. The Pueblo of San Ildefonso recognizes the site as ancestral and considers the site a traditional cultural property as defined by the National Historic Preservation Act (NHPA) and its implementing regulations. The site dates to the Ancestral Pueblo Late Coalition and Early Classic Periods (A.D. 1225-1350). The distribution of archaeological features at the site follows the east to west orientation of Mortandad Canyon. Some of the cavates have been used as ceremonial rooms with rock art carved into smoke-blackened walls, ceilings, niches, and nooks (Figure 2). The Mortandad petroglyphs are so rich that Steen (1977) used them to develop the definition of what he termed the *Mortandad style*, which features light gray tuff colored petroglyphs surrounded by soot-stained, blackened surfaces. Cavate 163 (Mortandad cave Kiva) was used by Steen to define this style; it is well preserved and protected by a steel cage.



Figure 2. Cavate with rock art and plaster.

The 2009-2010 Mortandad Cavate condition assessment was conducted to determine the impacts of public/recreational use of this trail to the cultural resources in response to requests for public tours of the site. The last public tour took place as part of LANL's participation in New Mexico Heritage Month in May 2007. Approximately 1000 people visited the site during that tour. With significant interest in public tours and compliance requirements for education, outreach, and consultation, the Resources Management Team recommended development of a baseline, which could be used for comparison to determine if features were being impacted by public tours. The National Park Service and others have conducted extensive research and worked with public input on the relationship between public access, recreation, and archaeological site preservation on the Pajarito Plateau and elsewhere (see Bousman 1974; DOI 2000; Provencher, S. 1998).

The Mortandad Cavate Complex

The Pajarito Plateau was formed by a series of large volcanic ash flows erupting from the Jemez Mountains about one million years ago. The ash consolidated into a soft rock resulting into what is referred to as *Bandelier tuff*, which through erosion, gradually dissected into the thirteen canyons upon which LANL and the Los Alamos townsite reside. The south-facing sides of the canyons frequently erode and fracture into vertical cliff faces. Between the twelfth through

sixteenth centuries, people living on the Pajarito Plateau carved chambers into the tuff face, these referred to by archaeologists as cavates.

By definition, a cavate or rock cut feature exhibits evidence of human modification (Figure 3). This evidence includes excavation marks, a shaped or modified entryway, floor or wall plaster, internal features including grooves, niches, sooting, or external features (e.g., viga holes, hand/fooholds, or staircases). Cavates, rock cut features, and other associated architectural features are carved into the soft tuff and are subject to degradation, resulting primarily from erosion. The Mortandad cavates, compared with others on the Pajarito Plateau, are relatively stable, as the tuff in this area is less friable than other tuff outcrops. Although the floors, walls, and roofs remain relatively stable, some of the Mortandad Canyon cavates are eroded and plaster and sooting that may have been present is now gone. The existing cavate deterioration indicates that the outer layer of tuff can crumble and/or spall off when touched or walked on (Figure 4).



Figure 3. Cavate entrance, viga sockets, and rock cut features.



Figure 4. A cavate subject to erosion with spalling and deteriorating plaster and sooting.

The Mortandad Cavate Complex (cavate 163) is different from all others in the complex due to protection efforts conducted by the National Park Service in the early 1970's. These efforts included construction of a cage in front of the entrance in response to vandalism. The cage is locked and access is strictly controlled. The entire Complex is further protected because it is situated on restricted DOE property and is not open to the public. Access to the site is controlled by LANL and the DOE. Currently, National Park Service officers from Bandelier National Monument, as part of an agreement with the National Nuclear Security Administration, Department of Energy, Los Alamos Site Office, patrol the area and help to restrict access.

Each of the Mortandad cavate clusters is associated with hand/foot holds and/or stairways, with at least one providing access to the mesa top. In some cases, several less-extensive hand/foot holds and/or stairs provide access to second and third story cavates. Second-story cavates are common at this site and in some cases, third and fourth story cavates are present. Cavate clusters are bounded by hand/footholds and/or stairways or a pour-over or alcove (i.e., places where water flows down the cliff face). Shaped masonry blocks scatter the talus slope and represent the remnants of exterior/talus rooms, which are less common in Mortandad Canyon than at similar sites on the Pajarito Plateau.

As part of the 2009-2010 condition assessment, cavates and rock cut features/rooms were numbered and recorded. Documentation of site features began at LA 12612A, an Ancestral Pueblo period game pit, where a trail originating along East Jemez Road provides access to the mesa top between Sandia and Mortandad Canyons. The assessment area runs west from LA 12609A along the lower north side of Mortandad Canyon bench to a location approximately 200 meters west of the large drainage west of the Mortandad Cavate Complex.

The approach to the Mortandad condition assessment was that adequate site management should include identification and recording of any existing impacts to the cultural resources and recommendations for additional protection of features. The baseline condition of a cavate is the result of the nature and method of cavate construction, erosion, and vulnerability to vandalism or excessive visitation. This assessment is designed to prioritize cavates based on the baseline condition and determine if there are impacts associated with public access to the site. The baseline can be used to assess and predict future feature deterioration and whether or not it results from site accessibility. The condition assessment included, identification of cavates and rock cut features, a global position system (GPS) location for each feature, completion of a cavate condition assessment form, photographs, and assignment of vulnerability ranking (LOW, MEDIUM, HIGH, or CRITICAL) with respect to impacts that could be associated with public access. A CRITICAL ranking indicated that the cavate and/or an associated feature has significant potential for deterioration resulting from human contact.

General information including feature shape and the presence of associated features was recorded on the condition assessment form, which also included areas to document the presence and condition of plaster, smoke sooting, petroglyphs, and general cavate condition.

Archaeologists drew sketches of each cavate and rock cut room and indicated the location of a cavate relative to other features. This information was used to determine the feature's integrity and to establish a protection priority designation. The exterior of each cavate and rock cut feature was photographed. Photography was used to record internal features, fragile or vulnerable cavate aspects, and evidence of vandalism. Photographs create a visual baseline for purposes of future comparison and potentially to develop a stabilization program. The vulnerability priority ranking

was determined using feature condition, accessibility, the presence of fragile and/or vulnerable sub-features, and the presence of rock art. Fragile and/or vulnerable sub-features include standing walls (Figure 5), petroglyphs carved into plaster, heavily trafficked or eroded hand/footholds and/or steps, and undisturbed cultural floor fill.



Figure 5. Cavate with stacked masonry blocks deemed fragile by assessors.

The presence and condition of plaster and smoke sooting was also an important factor, as these are subject to flaking, crumbling, and spalling, which may be enhanced by human contact (Figure 6). The presence of graffiti and other types of vandalism was recorded, as one incident often encourages additional incidents. Cavates that are easily accessible and contain multiple features, fragile attributes, and well preserved internal rock art were categorized as CRITICAL. Vandalized cavates were also prioritized as CRITICAL. Cavates with stable features, non-fragile rock art and good overall integrity categorized as HIGH priority. Cavates with few internal features and non-fragile attributes were generally categorized as MEDIUM priority, while rock cuts and cavates with little or no viable integrity were categorized as LOW. Cavates and rock cuts deemed unsafe to access or enter due to their location were designated INACCESSIBLE.



Figure 6. Cavate with interior bench and wall niche, note plaster and soot staining.

2009-2010 Mortandad Cavate Complex Condition Assessment: Results

Ninety-nine cavates and 44 rock cut rooms were assessed during the 2009 Mortandad Cavate Assessment Project (Table 1). Fifteen of the cavates were categorized as CRITICAL, 15 as HIGH, 19 as MEDIUM, and 50 as LOW. Twenty cavates were designated INACCESSIBLE. All rock cut rooms received the lowest vulnerability ranking. Recommendations from the assessors are that access to cavates that received a ranking of CRITICAL should be generally restricted. Some cavates, ranked as HIGH, will also require additional restrictions. However, cultural resource managers will take into account the educational benefits of maintaining access to some unique cavates and features and continue to provide controlled access.

Table 1. Priority Cavates

Category	Cavate Number	Criterion
Critical	24	-Fragile floor vent -Impressive diverse interior features -Fragile Plaster
Critical	52	-Excellent rock art -Fragile wall vent to the west of entranceway
Critical	71	-Excellent rock art -fragile entranceway - Access via deteriorated stairway
Critical	80	-Fragile floor plaster -fragile passageway to cavate 81 -Access via deteriorated stairway
Critical	81	-Fragile passageway to cavate 80 -Access via deteriorated stairway
Critical	115	-Excellent rock art -Some evidence of vandalism
Critical	115	-Excellent rock art -Some evidence of vandalism
Critical	121	-Fragile mortar on entranceway -Well preserved rock art
Critical	122	-Fragile floor vent -Access by deteriorated / fragile stairway -Well preserved rock art -Fragile mortar in entranceway
Critical	130	-Well preserved rock art -Fragile plaster
Critical	133	-Well preserved rock art -Fragile mortar in entranceway -Fragile interior plaster in excellent condition
Critical	141	-Fragile mortar in entranceway -Well preserved rock art -Fragile floor vent
Critical	155	-Fragile lintel stone and mortar in entranceway

Table 1. Priority cavates continued

Priority	Cavate Number	Criterion
Critical	162	-Fragile mortar and lintel stones in entranceway -Fragile collared entranceway -Well preserved rock art
Critical	163	-Cave Kiva -Caged and locked

This assessment establishes a baseline for the potential for and actual damage to cavates caused by public access. The ENV-EAQ archaeologists who conducted this assessment project suggest active site management can minimize the impacts to the site. Vulnerability rankings will be used to limit access to certain fragile cavates, while allowing for periodic public access to many of the site’s features. In conducting this study and implementing the recommendations, the Laboratory is in a better position to offer the public an opportunity to learn about, appreciate, and enjoy one of the Pajarito Plateau’s unique and well-known cultural resources.

Fifteen cavates were designated as CRITICAL vulnerability (Figures 7, 8, 9, 10, and 11). Of these, only one, cavate 163, is protected with a cage from potential damage caused by visitors. Designation of a cavate as critical may include the presence of fragile rock art, delicate features and/or vandalism (Figure 12).

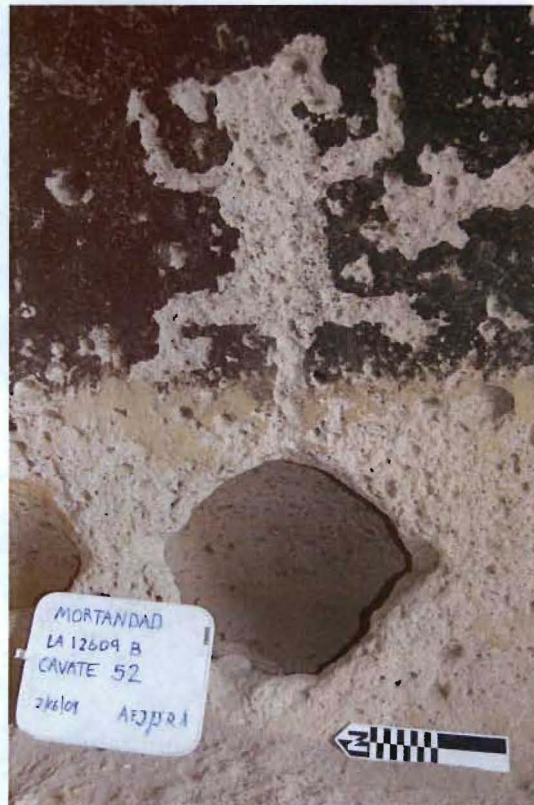


Figure 9. Zoomorphic petroglyph and floor niche feature.

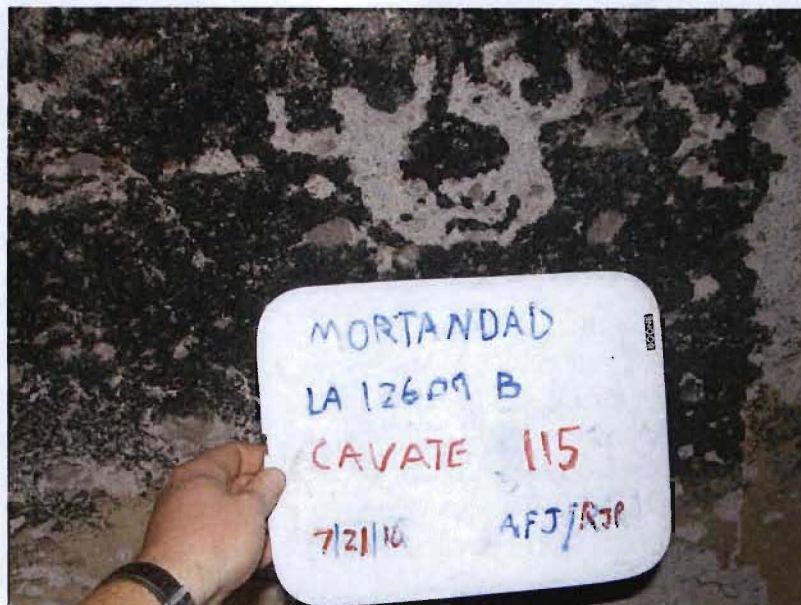


Figure 10. Anthropomorphic petroglyphs.



Figure 11. Fragile floor vent. Note traces of mortar at top of entranceway.

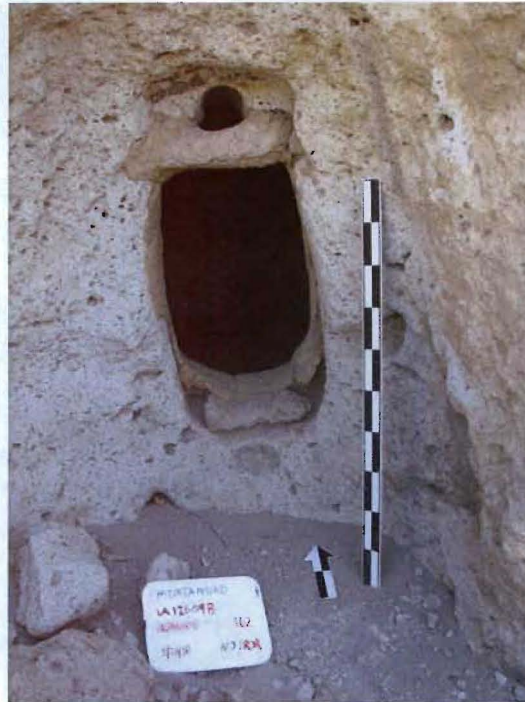


Figure 13. Intact upper and lower lintel stones and collared entranceway.



Figure 12. Fragile rock art and possible vandalism.

Recommendations

The goal of this project is continued protection of the cultural resources situated in Mortandad Canyon while at the same time allowing scheduled, organized tours to the area. San Ildefonso has visitation requirements as well that will continue to be met. Public access to the area is already restricted in accordance with Trails Working Group implementation of the Group's

mission and to minimize impacts on the site. The follow are a list of specific actions that will contribute to cultural resources preservation and continuing public education and outreach.

1. Tours with a know number of participants must be scheduled and choreographed. Keeping participant numbers low allows LANL archaeologists and security to be properly managed. For tours, a ratio of five visitors to one cultural resources team member is recommended. One team member would be tasked to lead the party and participants should remain on designated routes at all times.
2. Vehicle parking is very limited and will be controlled by LANL security and the Los Alamos Police Department. Bussing tour participants to the area is preferred and the use of private vehicles is prohibited.
3. Notify tour participants prior to the tour to wear closed toed shoes and long pants. A tailgate safety meeting, which includes the tour rules, must precede every tour.
4. Photography is prohibited as per LANL's camera policy.
5. Tour participants should follow the designated route to minimize impacts and erosion.
6. In most cases, the tour will terminate west of cavate number 163 to avoid the majority of cavated characterized as CRITICAL. Cavates that are to be avoided will be marked or flagged indicating restricted access.
7. Tour participants must not climb on or use prehistoric stairways or hand / toeholds as this impacts the cultural resources and promotes safety.
8. Tour participants must leave all artifacts *in situ*, although they may pick up and examine sherds and lithic artifacts. These objects should be placed back where they were initially located. Removal of artifacts from the site is strictly prohibited.
9. Based on the results of LiDAR scans of the five critical cavates described above, the remaining CRITICAL and HIGH priority cavates will be continually monitored subject to additional mitigations when necessary.
10. Post tour assessments of the site to document impacts will be conducted within two weeks of large tours.

Summary and conclusions

As previously stated, a majority of impacts to trail segments and cultural resources result from natural erosion. This impact can be mitigated with erosion controls and management of the area. Other kinds of impacts, including modern disturbances, camping, looting, and vandalism, are relatively rare and the area is not open to the public and the area is patrolled by the National Park Service and LANL SOC. LANL's Trails Working Group and Resources Management Team continue to implement erosion control measures on trails and at sites. Trail users, including LANL workers, have a documented history of notifying DOE and LANL when they witness vandalism, safety issues, and/or misuse of natural and cultural resources. In the majority of situations, when mitigation becomes necessary, assessors suggested rerouting trails, erosion control, and, in a few worst-case scenarios, closure of specific trail segments (Nisengard et al., 2006). LANL's Trails Working Group includes representatives from Los Alamos County, San Ildefonso Pueblo, and Santa Clara Pueblo, the National Park Service and Interested members of

the community (http://www.lanl.gov/environment/outreach/working_groups/tawg.shtml). The Trails Working Group collaborates with Los Alamos County to organize at least one trails maintenance volunteer work party each year. These events provide a venue for interested members to take an active role in protecting, restoring, and educating others about trails, safety, and cultural and natural resources.

In recent years, specific trail segments have been closed in response to security concerns and to protect and preserve archaeological resources, like the Mortandad Cavate Complex, however, trail closures are not the only option and recreational trails use can be beneficial. Such use contributes to the maintenance and preservation of natural and cultural resources and provides opportunities for LANL and the public to better understand and appreciate these kinds of resources. Finally, the Trails Working Group developed a management plan for organizing trails maintenance, which began in 2006 and continues today. This effort, which includes tours of places like Mortandad Cavate Complex, creates an atmosphere for open communication, education, and participation while enforcing site preservation goals. Recommendations made in this report will be implemented by the Trails Working Group and LANL's Resources Management Team to allow for a resumption of outreach tours and to limit future impacts to the cultural resources associated with the Mortandad Cavate Complex.

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