

Structural Wood Documentation and Dendrochronology in SE Utah:

**Report on the 2011 field work on Cedar Mesa in Slickhorn Canyon
and in Natural Bridges National Monument**

**2011 Discovery Grant (11-5-BLM/NPS) Final Report
Canyonlands Natural History Association**

Federal Partners

Bureau of Land Management, Monticello District
Natural Bridges National Monument, National Park Service

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Introduction

At the request of the BLM (Monticello Office) and to continue our work in Natural Bridges National Monument and the adjacent areas of documenting structural wood in prehistoric sites and mapping their contexts, the wood documentation crew led by the author moved to Cedar Mesa to begin a new area in the Slickhorn Canyon area in July 2011. The sites were visited by the author, rock art recorders Pam and Quent Baker, Dave Manly, and BLM archaeologist Leigh Grench in May 2011 to prepare for our project site work. These sites, although often visited, did not have detailed information about them except for a rock art program led by Sally Cole in past years that found that rock art was ubiquitous throughout the area and often are associated with cliff ruins (Cole 2009). No tree-ring samples had been collected from these canyon sites, probably because of their remote locations, the difficulties of hauling in mapping and sampling equipment, and the lack of contract mitigation work. This report provides primarily information about site conditions, detailed architecture, structural wood remains, tree-ring dates, and basic artifact inventories and rock art presence. It also updates the state site forms for the Bureau of Land Management.

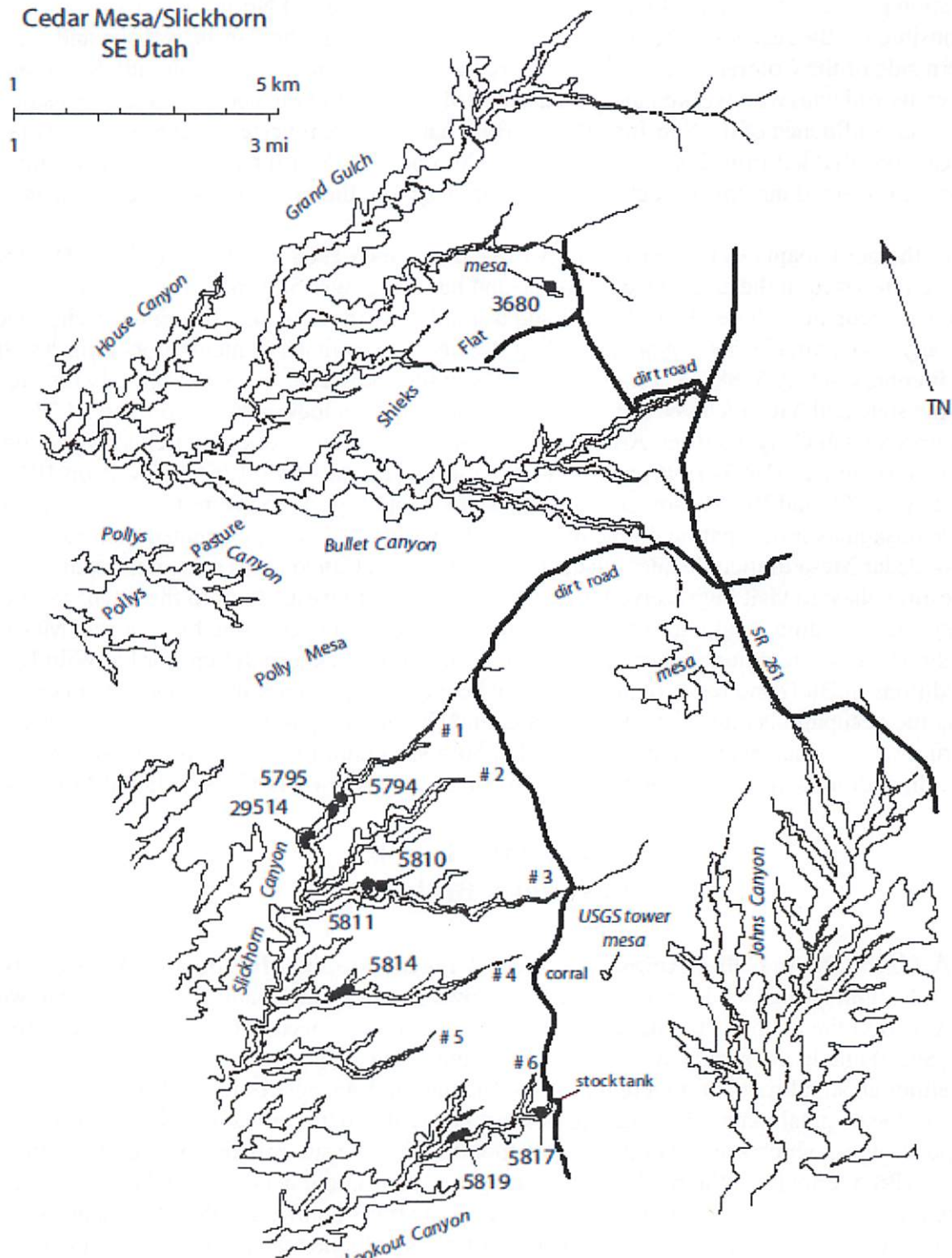
The basic tree cover of Cedar Mesa, in which Slickhorn Canyon drains to the southwest into the San Juan River, is piñon and juniper. There are cottonwoods in the canyons, however. Plant collections gathered from excavations during the Glen Canyon Project in the 1950s and 1960s revealed that there has been no appreciable change in the environment for the past 700 to 900 years (Adams et al. 1961:55–56) or more.

Intact structures are common in the region, but we wished to obtain detailed maps and structural wood inventories for them to preserve in case of deterioration or loss of these important cliff structures to fire, vandalism, natural deterioration from weathering, rock falls, fungi, and animal impacts, as well as for present and future research. In addition, our work is important for understanding the thirteenth-century occupation and final abandonment of this little-known western region of the Upper San Juan area in conjunction with long-term studies being conducted by the Crow Canyon Archaeological Center (Cortez, CO) and by Bill Lipe and RG Matson, who have worked for five decades on Cedar Mesa, as well as by local contract and research archaeologists, including Abajo Archaeology, Crow Canyon, Woods Canyon, Winston Hurst, and others. Finally, the work adds to a large database of prehistoric kiva roofing architecture and other roofed structures, which has rarely been mapped in detail.

Crew: Nineteen volunteers helped to accomplish the 2011 project (**Table 1**: see all *Tables* at the end of the text), most with considerable expertise in mapping and collecting structural wood samples, and wood and artifact documentation. Among these was a four-person crew specifically recording rock art associated with the mapped sites. We spent over 800 person-hours documenting and sampling eight sites in 2011, resulting in 492 elements of structural wood being documented, of which 215 of these were tree-ring sampled. After *Populus* sp. and low-ring count samples were removed, 200 samples were sent to the tree-ring laboratory for dating analysis. Plane table-on-tripod alidade maps or Ushikata Surveying Compass (Model S-25) maps were made of all the sites, as well as for complex structures (i.e., intact kivas), although one (42SA 5819: 4 Shield House) remains to be completed (it has been worked at in 2011 to 2013, and will be again in 2014).

The discussion of the 2011 sites is listed sequentially from their locations north (in the Natural Bridges area) to south in the Cedar Mesa area (Figure 1). A summary of the sites may be found in Table 2.

Figure 1. Sites investigated in 2011 through 2013 in Slickhorn Canyon and on Shieks Flat, Cedar Mesa, SE Utah. Canyons numbered to follow BLM's numbered canyon-hiking trail system.



canyon system directly west roughly paralleling Slickhorn Canyon, saw much exploration and looting of artifacts (e.g., Blackburn and Williamson 1997) as did many, if not all, of the region's canyon cliff sites.

In the 1950s and 1960s, the western canyon areas of Cedar Mesa were investigated during the Glen Canyon survey and excavations while Glen Canyon Dam was being built across the Colorado River at Paige, Arizona (e.g., Adams, Lindsay, and Turner 1961; Jennings 1966). The migration project was handled by two institutions: the Museum of Northern Arizona, who was responsible for the reaches of both sides and side canyons along the San Juan River and the eastern side of the Colorado River below where the San Juan entered the Colorado River, and the University of Utah, who worked the western side of the Colorado River and the eastern side above the confluence of the San Juan River. Both parties were invested in exploring the many side canyons that led from Cedar Mesa into the Colorado and San Juan rivers. None of this, however, impacted the upper reaches of Slickhorn Canyon, the focus of the present project.

One of the participants from the University of Utah between 1968 and 1971, William D. Lipe, became interested in the area of Cedar Mesa, and has spent over 50 years investigating the puebloan occupation there. In 1976, Bill and a small crew investigated the upper reaches and side canyons of Slickhorn Canyon, providing the first survey maps of many of its ruins and their state numbers (42SA 5788–5819). Several of these sites, however, were not initially registered with the state and have received more recent site numbers, including those from the BLM-Earthwatch Utah Canyons Rock Art Project by Sally Cole, which covered Slickhorn Canyon and Cedar Mesa between 1993–1996 and 1998–2000. Lipe (1970a, 1993; Lipe and Matson 1971; Lipe et al. 1977) and RG Matson et al. (1988; Matson and Lipe 1978) were first interested in the earlier Baskemaker occupation on the mesa top and Grand Gulch but expanded their research across Cedar Mesa to include later occupations. Slickhorn Canyon was relegated as an interesting place to visit but received little later research activity aside from the intensive rock art survey and recording conducted by Sally Cole and survey and excavation by Lipe and Matson. Vaughn Hadenveldt, among others, provides trips into the Slickhorn system for his Wild River Expeditions in Bluff and has provided valuable help during our work there. Despite interest in dating the occupations on Cedar Mesa, with Grand Gulch seeing much activity in this regard, no tree-ring samples had been taken from the Slickhorn sites until the present project started in 2011. In addition, we finished up two sites in and next to Natural Bridges National Monument.

The 2011 Sample: The Natural Bridges Area

42SA 6819 (Horse Collar Ruins in Natural Bridges National Monument). We spent two days in Natural Bridges at Horse Collar Ruins, downstream from Sipapu Bridge, to finish work left over from the 2005 visit, where some of the wood had not been documented in the unroofed kiva (Str. 6) and in the rooms in the northeastern unit. The Structure 11 kiva still contains its roof although small parts of it were rebuilt by Nickens and Associates in the 1990s to help stabilize the original materials. The site lies just above the main trail connecting the Kachina and Sipapu Bridges, which sees a fair amount of foot traffic. The site can also be seen from the formal NPS overlook off the road above. Strangely, not a single person visited us while we worked in the site and we did not notice anyone on the trails below. On the other hand, some visitors at the overlook called us in to the authorities as pothunters; a good sign of tourist

participation in regards to ruins protection.

In 2011, we documented the sizes and other metrics of the architectural features at the site, specifically structure sizes and feature (e.g, doorways) locations and sizes to be placed on our site architectural forms. The previous room numbers pose a problem at this site because the former maps split the site into two units, with the rooms in each possessing duplicate set of numbers. Formerly these were map-designated “north” and “south” units, but more accurately should be considered the NE and SW Units (**Plates 1–2**). The Northeast Unit, Room 2, has many pieces of undocumented juniper splints from the collapsed roofing lying inside, although the main roof is missing. The overall dating from our previous work was disappointing, as we had obtained few dates from the site. One of the splints in Room 2 was taken for tree-ring dating

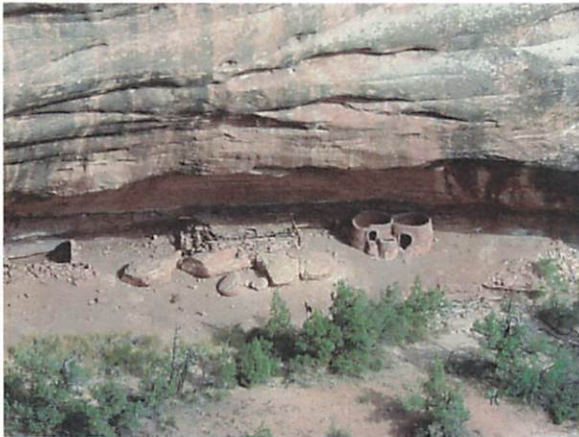


Plate 1. Horse Collar Ruins, SW Unit. Kiva in center. Photo by M. DeSutter June 2006.



Plate 2. Horse Collar Ruins, NE Unit. Room 2 with 2 doorways. Photo by M. DeSutter June 2006.

Horse Collar Ruin
Species (N = 105)

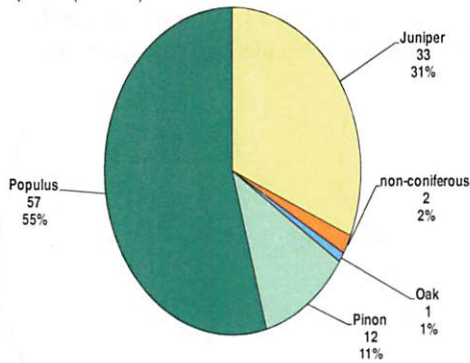


Figure 2. Horse Collar Ruins, structural wood species use. Graph by Eileen Bacha, 2012

as was a vulnerable (to weather and foot traffic) piece of juniper charcoal found 7 m east of the roofed kiva (Str. 11). These were the only two samples taken from the site in 2011, but neither of them dated.

Tree-ring Summary: 112 structural wood elements were recorded at the site, with 43 samples taken (38% of the total) and 15 dated (35% dated), all in the first half of the AD 1200s. Those from the Structure 11 kiva contained 70 pieces of structural wood that revealed construction between 1243 and 1247 (9 dates) with a single repair beam or final harvest at AD 1250+B. The Structure 6 kiva, without roofing, revealed construction dates of the ventilator (and probably the kiva) at AD 1226+r and 1227+G (see **Table 3** for the tree-ring date symbols). Species selection was dominated by piñon, juniper, and *Populus* sp., probably cottonwood (**Figure 2**).

Artifacts. A mere 16 sherds were found at the site, dominated by 7 unclassified indented corrugated, 6 unclassified Mesa Verde Whiteware, and single sherds of McElmo and McElmo/Mesa Verde black-on-whites. Twenty-seven specimens of chipped stone were tallied, including 5 cores, and 1 hammerstone. A piece of malachite was also observed along with 3 small mano fragments. It is clear that the site has been picked over for artifacts but the few ceramics support the early AD 1200s occupation of the site.

42SA 29513 (on BLM land almost on the north boundary line of Natural Bridges National Monument north of Whites Canyon in the Deer Flats area). This granary was discovered in 2009 during mesa-top reconnaissance for possible access into the Stone Mortar/Ledge Runner Site (42SA 6654) on NPS land in the deep side canyon immediately west of the granary. This granary had not been previously inventoried until it was numbered with the help of Leigh Grench and Don Simonis of the BLM in 2011. It is found within a small overhang on the west side of a prominent pinnacle of rock located close to White's Canyon, 600 m to the south (**Plate 3**). In the immediate vicinity of the granary is maiden hair fern (associated with seeps), manzanita, rabbit brush, Mormon tea, cliff rose, narrow-leaf yucca, piñon, juniper, and one Douglas-fir but much of the area around the base of the pinnacle is exposed bedrock.

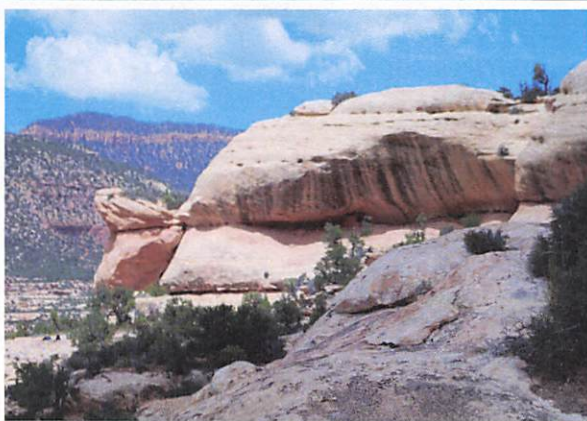


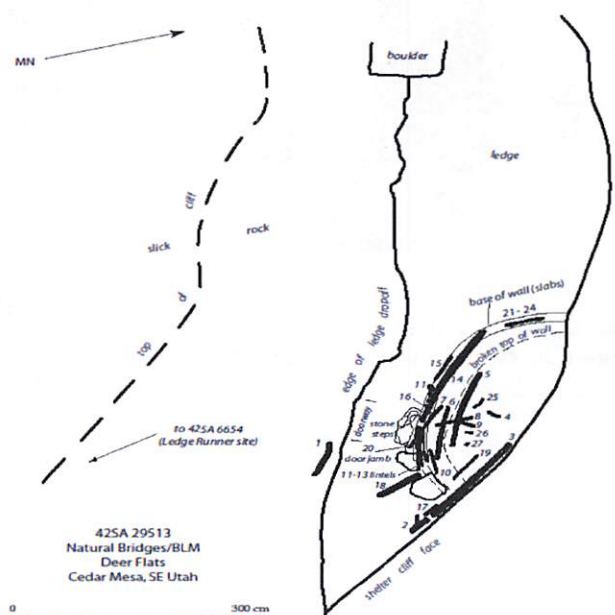
Plate 3. 42SA 29513 overview looking NE. Photo by Cliff Evans, July 2011

Plate 4. 42SA 29513 granary. Note broken end. Photo by Cliff Evans, July 2011.



There was much structural wood (n=27) associated with this granary, both loose (n=16) and incorporated within the walls, with many pieces scattered inside and around the southeast end where vandals had evidently broken out the wall (**Figure 3**; **Plate 4**). All the loose wood undoubtedly came from use within the wall construction. The majority of the pieces used as intramural pieces were within the adobe walls. These appear to have been gathered as deadwood because of their weathered exterior surfaces despite being protected by the cliff overhang and granary walls. The back wall was formed from the natural rock of the high mushroom-shaped pinnacle.

Figure 3. Plan view of 42Sa 29513. Wood is in black. Original by Tom Windes & Nicole LeBrun, July 2011.



The granary interior is 140 by 300 cm with a maximum roof height of 105 cm. The wall construction consists of upright sandstone slabs along its base with mortared unshaped stones for its upper walls (12–15 cm thick), which forms a C-shaped wall. The door faces south (190° true) and is of horse-collar shape, 48 x 48 cm across the opening, and approximately 35 cm above the natural ledge, which is taken up by stone slab steps. The door exhibits small rods for an east door jamb and three lintels/horizontal intramurals.

Tree-ring Analysis: Tree-ring samples were taken from about half of the 27 architectural wood pieces found at the site (n=14; lab samples NBR-1615–1628; **Tables 3–4**), but provided only a single disappointing piñon date of AD 879++vv, which is a loose deadwood wall log that is much too early for the probable granary construction in the AD 1200s. Ten of the samples came from loose wood. There was a mix of species in the sample (piñon=7, juniper=6, and oak=1). Typically, piñon is one of the best species for dating, while juniper is highly variable in its dating success, and oak seldom dates. A range of ring conditions plagued the sample success, which yielded suppressed, erratic, or complacent rings that can be found in trees growing within marginal environments, particularly among juniper trees, or in micro-areas of plentiful moisture. Aside from the architecture, there was no material culture that might have helped place the temporal period of construction for the granary.

The Cedar Mesa Area

42SA 3680. Shiek's & Coyote flats, Fortified Mesa, Cedar Mesa. The Fortress is located on a small mesa overlooking Shieks and Coyote flats and is accessible off BLM dirt road 250 from paved State Highway 261, south of Todie Canyon and the BLM Ranger Station. Bill Lipe and RG Matson, who have worked in the area since the 1960s, were particularly interested in the dating of this site because of its potential for being one of the latest occupied. From the top it provides a wide-ranging 360° view of Cedar Mesa and beyond from the top and may have served as an important center for the local inhabitants. Navajo Mountain is easily visible far to the southwest and the nearby Bears Ears are prominent to the north (**Plate 5**).



Plate 5. The Fortress on Shieks Mesa. Bear Ears in far background. Note viga fragment FS 21 in Room 2 corner. Photo by Criss Swaim in July 2011.

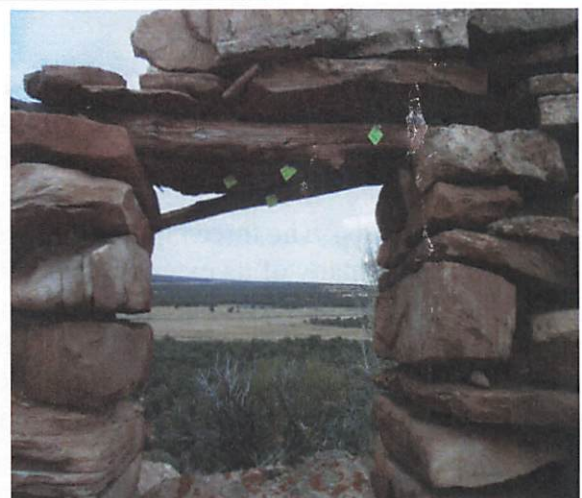


Plate 6. Doorway in the east wall of Room 1. Closest door lintel (green tags) is FS 1. Looking east. Photo by Criss Swaim in July 2011.

The site consists of many large unroofed rooms and open plazas lined with stone walls comprised of very large rocks of local material. Walls lined the edge of the mesa and there were

also rooms built below the mesa top along the ledges below. Most of the cultural material was strewn along the west side talus. A cluster of four single-story contiguous rectangular rooms (Rooms 1–4, overall ca. 8 x 10.8 m), where the majority of the wood was found, was mapped with an alidade and plane table. Room walls were between about 50 and 60 cm thick. The highest remaining walls at the site are part of these four rooms. A map of the entire mesa top was completed in 2012 by RG Matson and his crew (Figure 4), but we mapped the core area in 2011 (Figure 5). The site location and construction looks defensive (Lipe 1970b) but it may also have served as a community center, perhaps for ritual and feasting activities (Fast 2012:50–51, 97; Till and Hurst 2011:10).

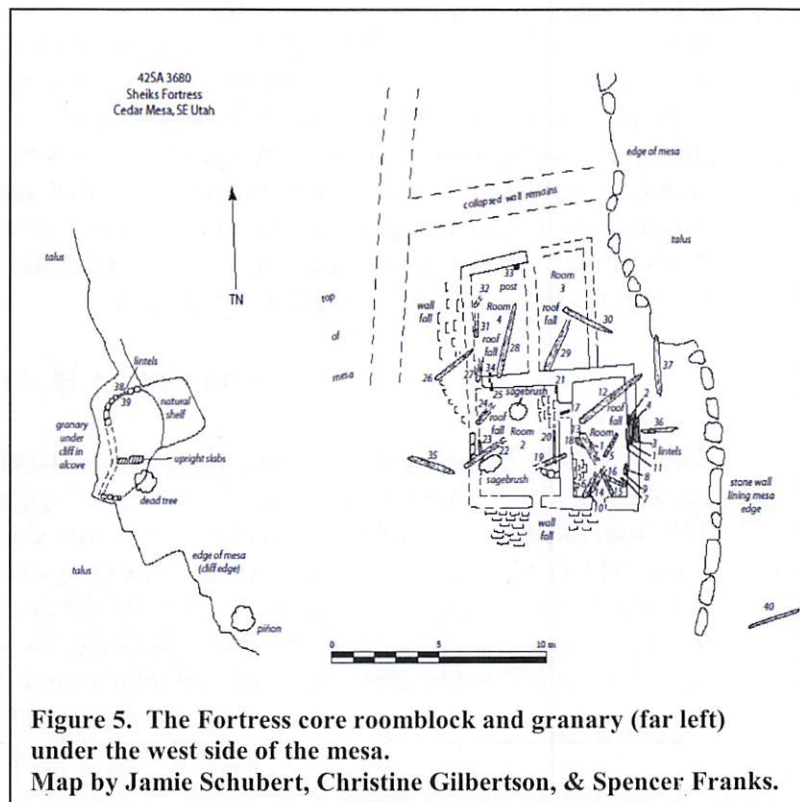
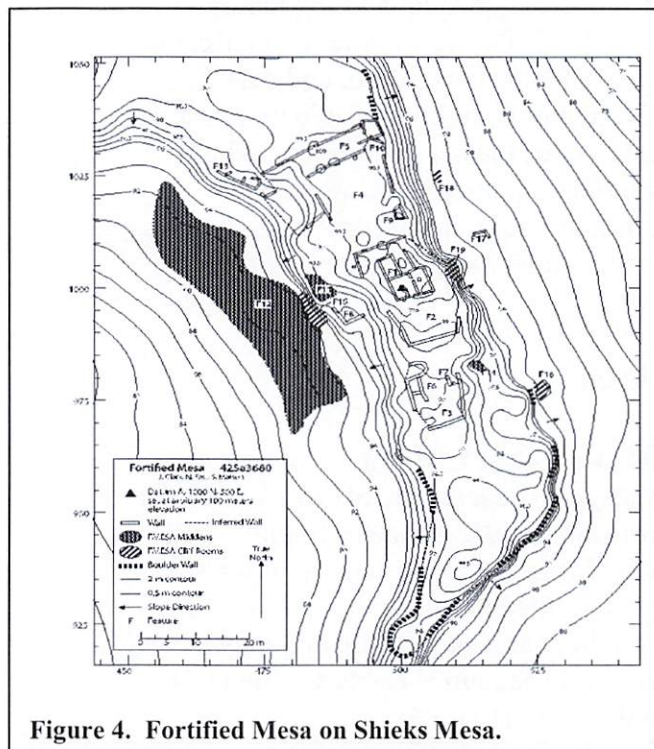


Figure 5. The Fortress core roomblock and granary (far left) under the west side of the mesa.
Map by Jamie Schubert, Christine Gilbertson, & Spencer Franks.

The southeastern enclosed space, **Room 1** (260 x 490 cm N-S; 12.7 m²) exhibits three doorways (in the south, west, and east walls), with the eastern one surprisingly intact and still containing its four wood lintels (Plate 6). All of the door lintels were sampled, yielding only a single deadwood date. Much of the roofing remains (FS 5–18) are still laying among the fallen wall masonry debris. The three biggest timbers, presumably vigas, were sampled but only one dated and it lacked many of its exterior rings. **Room 2**, the southwestern room (ca 380 x 460 cm N-S; 17.5 m²), also had several pieces of roofing in it, FS 19–24 (5 were sampled, yielding three dates). A wall peg (FS 25) extended out from the north wall's west end, but it was not the same wall peg (FS 34) on the opposite side in Room 4. The room had a south doorway and one in the northeastern corner that entered into Room 1. **Room 3**, the northeastern room (ca. 225 x 500 cm N-S; 11.3 m²), yielded just two vigas (FS 29–30) but neither was sampled. **Room 4** (ca. 250 x 450 cm N-S; 11.3 m²), on the northwestern side of the roomblock, also contained some roofing (FS 26–28, 32–33), none of which dated, and an oak wall peg in the south wall near its west end (FS 34) that also failed to date. FS 33 was recorded as a post (11 cm in diameter) but may be a piece of roofing sticking vertically out of the wall rubble. A few other roofing remains, mostly roofing vigas, are found just outside the four rooms (FS 35–37) with another (FS 40) on the slopes below to the east of the rooms; none of these were sampled because of extensive

weathering.

Aside from the four core rooms in the middle of the mesa top, a small irregular-shaped **granary** (maximum ca. 240 x 450 cm; ca. 7.5 m² or less; **Figure 5**) tucked under the cliff ledges to the west 17 m from the core rooms contains two intact north doorway lintels. These were sampled in hopes of obtaining tree-ring dates that would place its year of construction, one of which provided the latest date obtained from the site (AD 1207+vv), a cutting or near-cutting date based on field observation. The granary ceiling was formed by the cliff overhang as was the back wall. An undocumented wall peg extends from the exterior side of the west granary wall.

Tree-ring Analysis (Table 5): Several juniper roof primaries (vigas) and secondaries are found within the four rooms but are badly weathered and split. We documented the relatively intact pieces at the site (FS 1–40) but ignored those that had decomposed into much smaller splinters and chunks. Despite their condition, several of these were sampled with a large $\frac{7}{8}$ " hollow drill bit. The hard juniper wood is likely to yield shattered cores that are easier to glue back together with the $\frac{7}{8}$ " sample pieces than with our smaller cores of $\frac{1}{2}$ "- and $\frac{5}{8}$ "-diameter size. An intact doorway in Room 1 with four juniper lintels appeared to offer the best opportunity for obtaining tree-ring dates indicating the year of construction for the four-room unit but the sole lintel that dated (FS 2) was deadwood, decades earlier than the probable construction.

Overall, we took 17 samples (43% of the total) with 6 dating (a 35% success). Except for a single item of oak (a wall peg), the sample was all juniper and comprised almost entirely of door lintels, roof vigas, and latillas. As elsewhere for the project, the samples were plagued with erratic and compressed growth rings that hampered dating success. There were also three samples with short ring series that failed to date. One sample with 50 rings dated but all others were more than century old of those that dated. Most of the sample was observed in the field with badly weathered exteriors and assigned "vv" codes to indicate that an unknown number of exterior rings had weathered away. The single east door lintel in Room 1 that dated (AD 1152++vv) exhibited only a few outer rings weathered away, at most, but the "++" laboratory designation reveals that it was collected as deadwood; its date provides little for interrupting construction at the site except that deadwood collection at the site and elsewhere on Cedar Mesa and in Natural Bridges was a common procurement strategy.

Two of the samples dated in the early 1200s that mark probable death or near-death dates when the wood was first harvested. A viga in Room 2 dated at AD 1202+vv and a door lintel from a granary tucked under the short cliff face on the west side of the site from the roomblock dated at 1207+vv, which, from field observation, is designated as a cutting date. Although this lintel was a mere 4.5 cm in maximum diameter, it contained over 121 growth rings. The Room 2 viga that dated was 23 cm in maximum diameter and contained about 158 growth rings. Such is the enormous range of ring growth in juniper specimens; even a very small piece of juniper can exhibit many rings and date. Overall, recorded juniper (37; 97% of the sample) dominated but with one element of oak (3%).

Summary: Although this site appears to have been built and occupied contemporaneously with many of the early AD 1200s sites in the area, its location, construction, and layout suggest that it served as an important center for the neighboring area without evident domestic habitation. No kivas were observed but the many large, masonry-lined open areas suggest that a number of separate kinds of special activities may have taken place here. The site

ceramics (Fast 2012:Table 3.3) are dominated by indented corrugated, McElmo and Mesa Verde black-on-whites, and Tsegi Orangewares. Along with the sparse tree-ring dates, the ceramics place the construction and use of the site in the very late Woodenshoe phase (AD 1165-1210) and early Red House phase (AD 1210-1270)(see Lipe 1993:Table 1.1; Matson et al. 1988:247; or McVickar 2001:Table 8.2 for phase descriptions).

42SA 5794 (on the bench above Perfect Kiva; also NA 14,988, Utah V:12:2),

Cedar Mesa. Eight to nine stone-masonry granaries were built in two groups under the uppermost cliffs below the mesa top off BLM Hiking Trail #1, in the main, northernmost part of Slickhorn Canyon. Two plane table and alidade maps were made of these nine rooms, but little was left of three granaries. In the 1970s, Bill Lipe designated these rooms as site S-T-1-2. Their relatively close proximity to Perfect Kiva just below on the next major cliff bench suggests their association with the inhabitants of Perfect Kiva, who probably farmed the associated mesa top, as the adjacent canyon bottom is far too narrow for farming in the immediate area (i.e., Matson and Lipe 1978:9–10).

Rooms 1–4 and 8–9 (**Figure 6**) are located just under the caprock, off the trail that leads down the mesa point here to the 1st bench below (continuing along the mesa-top-edge trail takes you another few hundred meters to the trail down to the 1st bench below and the access to Perfect Kiva by going far out the bedrock point overlooking the canyon and back into the shelter where the kiva is located). Contiguous storage Rooms 1–2 and 8–9 are located along the west side of the break in the cliff down from the mesa top while contiguous Rooms 3–4 are on the east side of the same tiny northeast-facing alcove.

Figure 6. Storage Rooms 1-4 at 42SA 5794. Original field map by Jamie Schubert, Christine Gilbertson, & Spencer Franks, 20 July 2011.

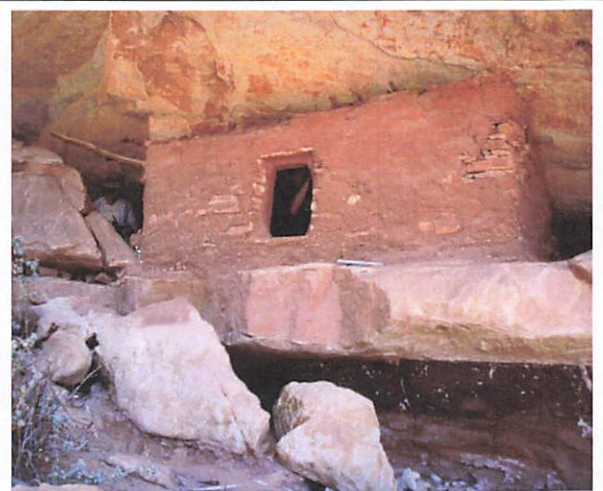
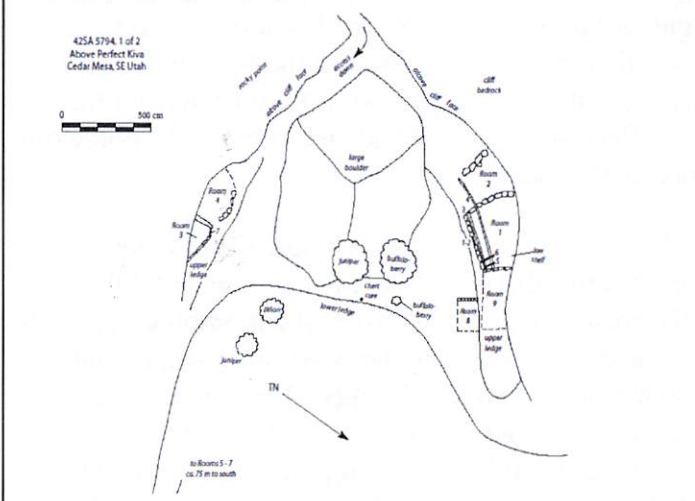


Plate 7. Room 2 granary at 42SA 5794. Photo by Christine Gilbertson, July 2012.

Room 1 (Plate 7) is a large intact room (inside dimensions: 160 wide at the northeastern end and 280 cm across the southwestern end, and 328 cm long) with a southeast-facing doorway (40 cm wide, with 2 door lintels) built against the cliff face. Two main beams (FS 3–4) along the SE side of the room are covered by numerous juniper splints and there are two smaller secondary poles (FS 5–6) perpendicular to the main beams. Viga FS 4 extends about 160 cm outside the room, overhanging **Room 2** (ca. 170 by 220 cm), for which little remains of the walls and no roofing is present. A small natural shelf against the cliff face along Room 1's northwestern corner is 90 cm long and 30 cm wide and about 10 cm above the bedrock floor.

Associated with Room 1 is a Mancos/McElmo jar sherd, an indented corrugated PIII rim sherd, and a chipped stone flake. On the bedrock below Room 1 to the south is a chert core. Another indented corrugated sherd was found near Room 3. In the alcove, there are juniper and piñon trees and buffaloberry.

Rooms 3 and 4 are located opposite Rooms 1 and 2 on the other side of the tiny cove by about 13.5 m. These two rooms with doorways are mostly intact. **Room 3** (ca. 100 x 200 cm; ca. 1 m²) is roughly triangular in shape and appears to have been built first with Room 4 added onto it on the southwestern side. Both rooms have bedrock ceilings. The northwest-facing doorway (33 wide x 43 cm high) has a single wood lintel (FS 7), while **Room 4**'s door (36 wide x 50 cm high) opens to the north-northeast and is without structural wood. Room 4 is about 160 by 280 cm in floor size (ca. 4.5 m²) but is missing part of its west masonry wall.

Rooms 5 and 6 (Figure 7) are about 75 m to the south of the 1st cluster of storage rooms along the same cliff forming the mesa point but on the back side of the Rooms 1–4 cluster. These two rooms are located under the cliff face along a small ledge about 2–3 m up from the flat bedrock bench. The two intact rooms are attached, with Room 6 built against Room 5. On the lower bench just to the east is a pile of stone that appears natural (i.e., it is not a cairn).

Room 5 is the largest room (144 x 340 cm; 4.9 m² and 113 cm high) with an intact roof (Figure 7; Plate 8). Inside, about 12 cm of sandy fill covers the bedrock floor; the inside chamber is heavily sooted. A central juniper post (FS 11; sampled) holds up a main beam of juniper (FS 12) anchored in the south wall that terminates on top of the post. This arrangement holds up two juniper roof primaries (vigas: FS 13–14), which were sampled. These are covered with thick juniper splints (the largest [FS 17] was sampled), and, in turn, are covered by a layer of thick adobe. The doorway (49 wide x 57 cm high) opens towards the southwest and contains 3 lintels (FS 8–10; all were sampled and FS 8 dated but was of deadwood). The stone door slab lies directly in front, where it has been broken into two pieces presumably from careless historic handling. A natural bedrock shelf 60 by 140 cm and 30 cm high is found along the cliff wall. The basal courses of masonry along the eastern end of the south wall have lost their mortar and are decomposing.

Room 6 (Figure 7; Plate 8) is a smaller room (ca. 100–143 cm wide and 200 cm long; 2.4 m²) and 47–80 cm high to the slanted bedrock ceiling, which also forms the northeastern wall of Room 5. Three upright basal slabs form part of the masonry south wall. A doorway in this wall contains the stone closing door slab, which must be carefully removed to prevent breakage. Two rods of piñon (FS 15–16) comprise the lintels for the doorway, which faces southwest. There is no cultural material associated with these two rooms; both rooms are covered inside with a layer of windblown sands.

Room 7 is a small (ca. 80 x 90 cm; 0.7 m² and 25–80 cm height to slanted rock ceiling) structure appended to Room 6 on the latter's west end but is missing most of its walls. Only a low masonry wall remains to mark its west end but there is no remaining stone to mark its south wall, whose location is estimated. There is no wood associated with this partial granary nor is there any sooting evident.

Room 8 is on the shelf below Room 1, but there is little left of it except for a linear

scatter of wall rubble for the west wall. Its size is estimated to have been about 100 cm by 140 cm N-S (1.4 m^2) and perhaps $105 \pm \text{ cm}$ high. The ledge on which it was built limits the north-south extent of the room to a maximum of 140 cm.

Room 9 is on the same ledge as Room 1 and probably once butted against Room 1's northeastern wall. There are no masonry remains. A few mud lines on the cliff face mark the approximate former extent of the room to the northeast about $280 \pm \text{ cm}$. The ledge constricts its width to 160 cm N-S ($<4.5 \text{ m}^2$ of floor area) and the cliff face formed the rough unsooted ceiling of the room between 62 and 110 cm in height. A small part of the cliff face within the room area had been mortared over.

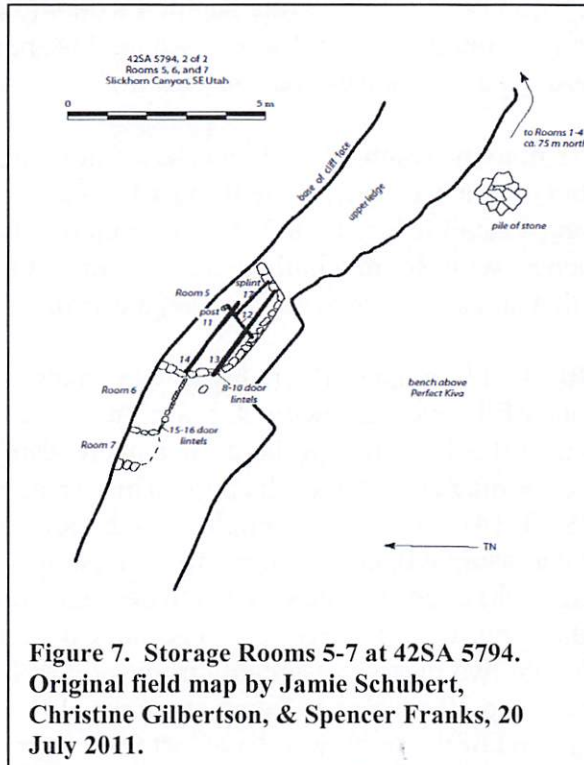


Figure 7. Storage Rooms 5-7 at 42SA 5794. Original field map by Jamie Schubert, Christine Gilbertson, & Spencer Franks, 20 July 2011.

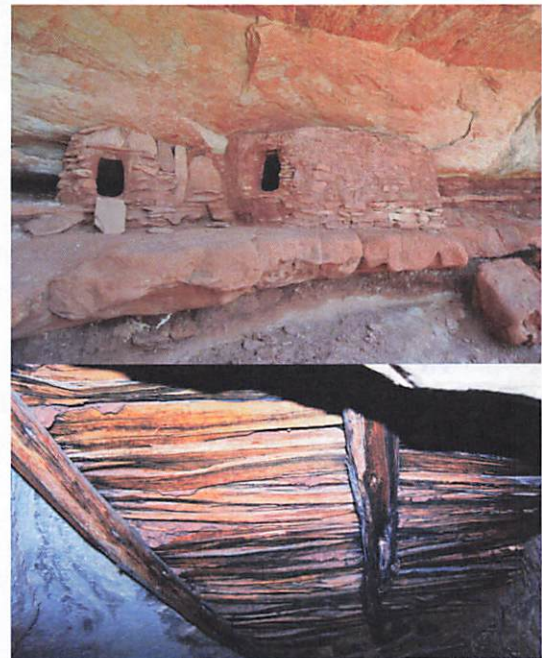


Plate 8. Upper: Storage Rooms 5 (right) & 6. Lower: inside roofing for Room 5. Photos by Kay Barnett, 23 July 2012.

Summary of Tree-ring dating (Table 6): All wood structural elements were documented for the six rooms (FS 1–17), of which 12 were sampled (71%). All are juniper elements except for a single piñon (FS 15), but only 2 dated (17% success): an intramural (FS 3) in Room 1 and a door lintel in Room 5 produced dates. The latter, of juniper, was a deadwood date of AD 1045++vv but the juniper intramural dated at AD 1241+B, indicating that Room 1 was probably constructed in 1241 or shortly afterwards; the few ceramics also suggest an AD 1200s use. The cluster of granaries of similar masonry style associated with Room 1 suggests that all may date to the early 1200s. The second grouping associated with Room 5 may also be coeval in construction time, but it is uncertain if all were built in the same period along with the Room 1 group.



Plate 9. The ladder pulled from Perfect Kiva, now in Edge of the Cedars Museum, Blanding. Photo by T.Windes Feb 2011.

42SA 5795 Perfect Kiva. This well-known hiking destination on the 2nd bench down from the mesa top from the BLM's Slickhorn Trail #1 had previously not been mapped in detail nor architecturally documented. It was first documented by Bill Lipe in 1967. Mapping and documenting this site was a high priority for the project, particularly in light of the near perfect condition of the kiva (part of the entry has been repaired). In 1985, Nickens and Associates did some repair work at the site, including the kiva's West Bench Recess roofing, and moved the original ladder to inside the kiva but did not place stones around the top to outline the kiva area (see Metzger et al. 1986). The reader should note that there is another intact kiva in nearby Bullet Canyon, also known as Perfect Kiva, which was stabilized and partially rebuilt in the 1980s or 1990s.

When Vaughn Hadenfeldt visited the site in the 1970s, there was no circle of rock outlining the kiva perimeter on the surface and the original kiva ladder was still in place. This ladder (**Plate 9**) was later removed by the BLM to prevent its loss from theft, and it is curated in the Edge of the Cedars Museum in Blanding, Utah, with a wobbly replacement taking its place. The stone outline of the kiva may also have been placed at the same time. The ladder was sampled as FS 230–236 and measured by the author and Cliff Evans in 2012.

The site (**Figure 8**; **Plate 10**) is located under a large rock shelter overlooking and directly above the northern-most extension of Slickhorn. Access can be made either from the lower ledge that follows the canyon along the west side, from the mesa top trail across the canyon on the east side, or from the well-used north/west-side trail leading down the mesa from the parking area to a point overlooking the canyon southeast of the site perhaps 200 m and then dropping down two ledges onto the bench on which the site was built. This latter route requires some agility to get down (and back up) the ledges and drop-offs.

Part of the shelter area has a low collapsed masonry wall that once? crossed the trail into the site, followed by a high (70–130 cm) second dry-laid masonry wall (**Figure 8**) about 11 m long that retains the deposits in which the kiva was built. The latter area appears to have been filled with sand to level it off and to provide the depth in which to build the underground kiva. This area is elevated above the surrounding bench areas. Overall, the site is composed of a kiva, three granaries, and a living room, plus a number of adobe ghost outlines along the shelter cliff face from previous structures.

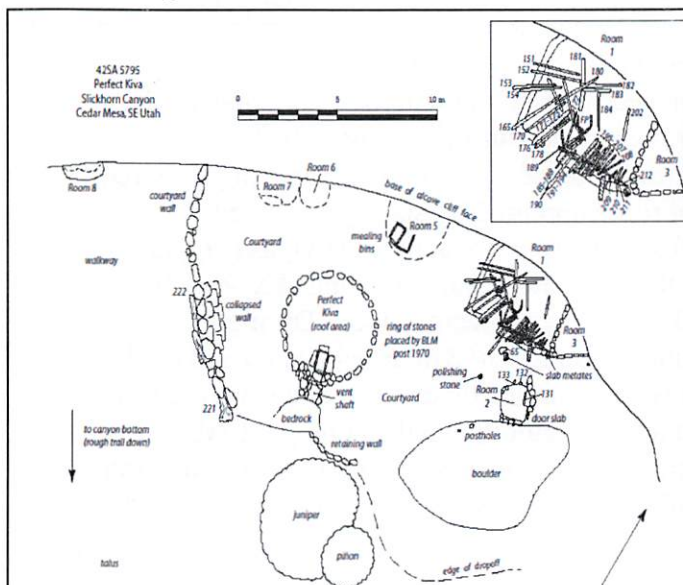


Figure 8. Perfect Kiva site plan, 42SA 5795. Map by Jamie Schubert, Christine Gilbertson, & Criss Swaim, 12 July 2011.

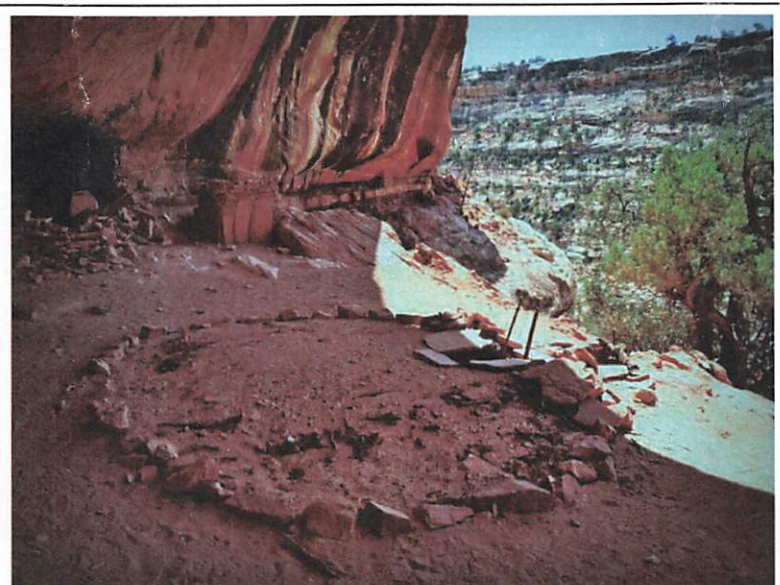
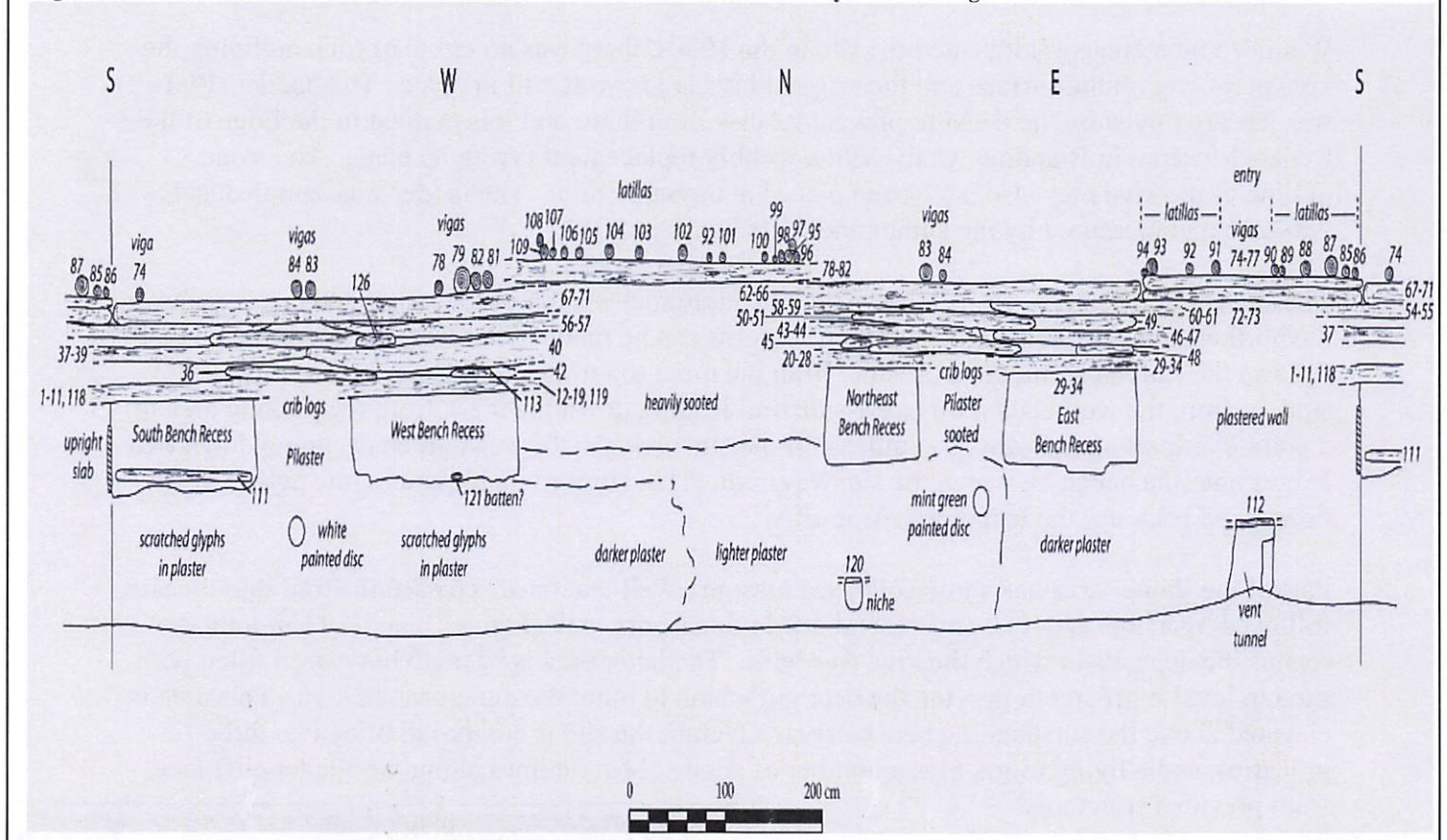


Plate 10. Looking north across the kiva to Rooms 1-4. Note heavy sooting on ceiling of Room 1 at far left. Photo by Blayne Brown, Jul 2011.

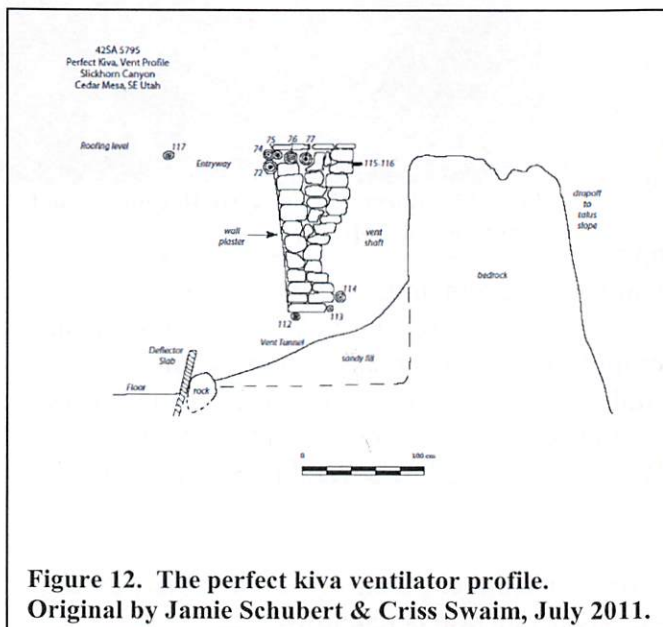
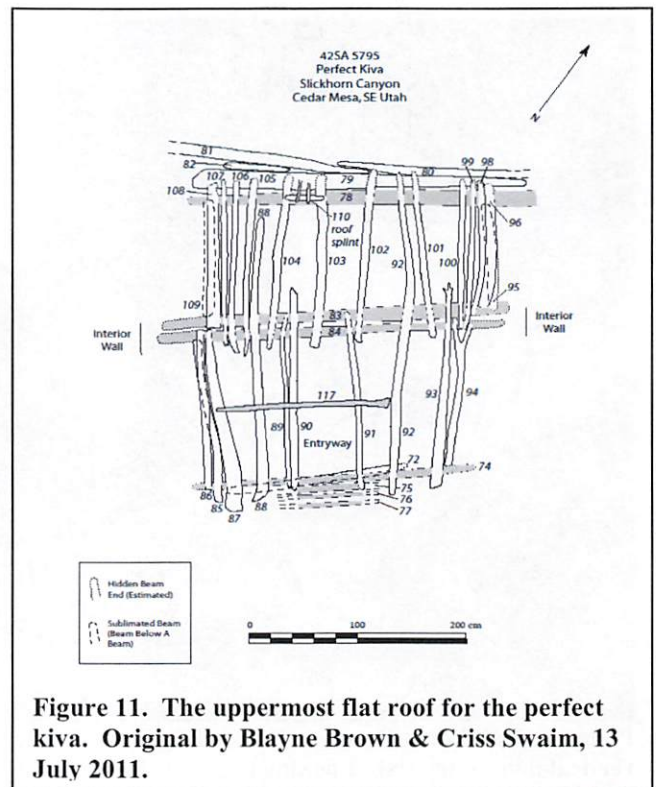
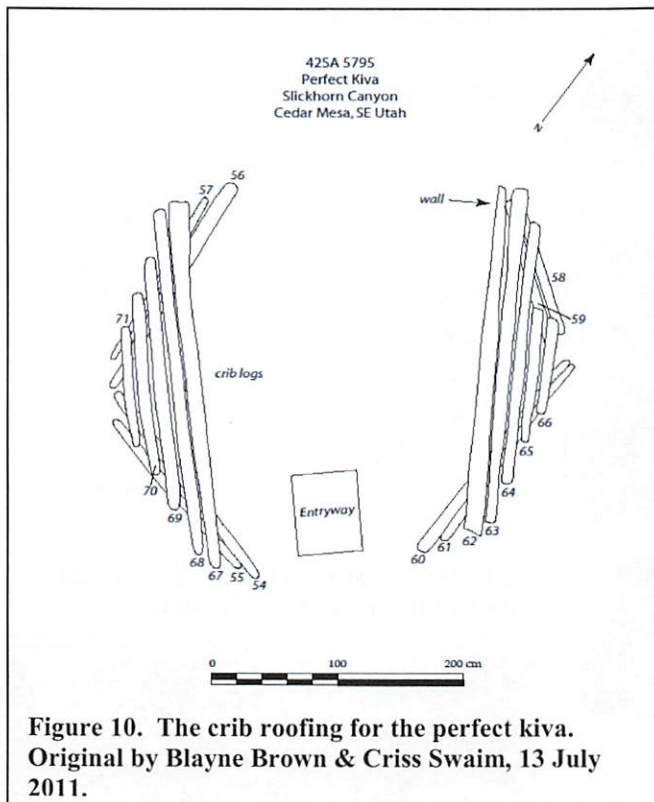
Kiva 1 (385 x 405 cm, 200 cm inside height; 12.3 m²) is visible from the surface via a circle of stones (**Plate 10**) placed to prevent visitors from walking across the roof, and the slightly raised structure of the entry hatch, with two historic ladder poles extending out. The structure is heavily sooted and contains several layers of tan plaster, with the outermost revealing two painted circles (**Figure 9**) and many etched drawings, some of which are sandal glyphs (see Bellorado 2011; Bellorado et al. 2013). There are two pilasters and two longer stretches of wall (or perhaps two very long pilasters) that leave four roofed recesses between them (see **Table 7** for measurements of site various features).

Figure 9. 360° wall elevation inside the kiva at 42SA 5795. Note crib and flat layers of roofing. Wood elements are numbered.



The kiva incorporates a massive amount of structural wood for its roofing (116 structural elements were documented, although the densely packed wood along with half-split and small pieces were difficult to isolate as individual structural elements during the inventory). Each recess was covered with poles, sometimes split in half, followed by two sets of cribbing centered over the two pilasters (**Figure 10**), followed by a flat roof supported by six vigas aligned perpendicular to the cribbing sets, and finally the 20 secondary poles across the vigas (**Figure 11**). A roof entry, 52 by 75 cm, was directly above the ventilator tunnel opening (**Figure 12**). The original ladder (see Paul 2009:52) was replaced by a rickety recent ladder. During documentation and sampling work in the kiva, the unlined squarish/cylindrical sipapu and oval-shaped adobe-lined firepit were filled with sand to prevent foot traffic damage and was filled-in afterwards because access into and out of ladder made it difficult to avoid stepping into the firepit. This firepit has potential for archaeomagnetic dating. We took 58 tree-ring samples from the kiva's structural wood along with three pieces of charcoal found on its roof (FS 123–125) but

only 14 structural elements dated (**Table 8**), with a latest date of AD 1229 B.



Room 1 (Figure 8). A jacal room, 3.1 by 4.2 m and about 13.0 m², was built into the shelter's corner, northeast of the kiva, 4.5 m away. A partially collapsed, low masonry wall enclosed the room, where 56 stout vertical juniper poles (FS 151–211; mostly between 5 and 10 cm in diameter, along with four splints) had once been placed side-by-side along the inside of the low masonry wall that once nearly reached the bedrock ceiling (most poles were between 120 and 200 cm in length/height). These had been covered on the exterior with adobe but all had collapsed into the room mostly in a row along the same alignment as when vertical (**Plate 11**). The roof was sooted above the room and there was a doorway, 60 cm wide, opening south

through the jacal wall. Part of a slab-lined firepit was evident near the room center. We sampled 54 of these posts and other structural elements but only seven dated (**Table 8**), with the latest at AD 1229 vv, but it is a cutting or near-cutting date based on field observation. Sixteen corn cobs were observed in Room 1 although there are probably more under the fallen jacal wall remains.



Plate 11. Habitation Room 1. Note collapsed wall poles & vertical door entry slab. Looking north at the sooted south masonry wall of Room 3. Photo by Criss Swaim, July 2011.

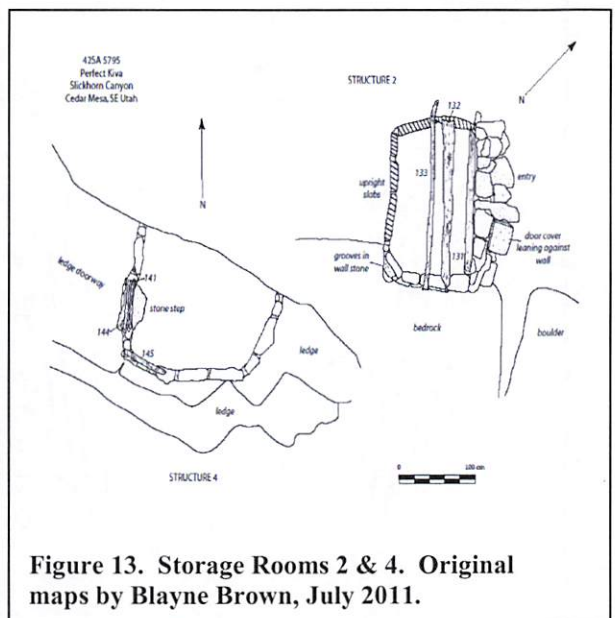


Figure 13. Storage Rooms 2 & 4. Original maps by Blayne Brown, July 2011.



Plate 12. Storage Room 2, south side. Photo by Criss Swaim, July 2011.

Room 2 (Figure 13; Plate 12), 110 by 163 cm (1.8 m²) and 110 cm high inside, is an isolated granary across from and southeast of Room 1 and east of the kiva 6.5 m, built against a large (4.5 x 8.5) boulder. The granary was built with four large vertical slabs, (the largest is 40 by 100 cm in size) along its southwestern and northwestern walls with the upper walls built of adobe and irregular-shaped tabular stones. The remaining walls were of an assortment of tabular and blocky stone masonry with an entry on the northeast side. Three small primary beams (FS 131–133) supported the covering layer of juniper splints and the adobe roofing. The lone juniper viga was sampled but failed to date; the other two were of cottonwood. Nine corn cobs were present within Room 2 and a door slab rests against its northeastern wall. A masonry wall stone in the south outer corner of Room 2 is marked by several horizontal grooves, perhaps for sharpening awls.

The boulder next to Room 2 has two pecked cylindrical postholes 56 cm apart and a mere 2 cm deep, which could not have held substantial poles. Their function is unknown.

Room 3. On the east side of Room 1 was a triangular-shaped masonry granary, 150 x 200 cm (ca. 1.5 m²), which filled in the remaining space left by Room 1 and the curving cliff face (Plate 13). Its two walls reached to the bedrock ceiling. Despite its position next to Room 1, there was not direct entry from the habitation room into the granary, which only had a southeast-facing doorway.

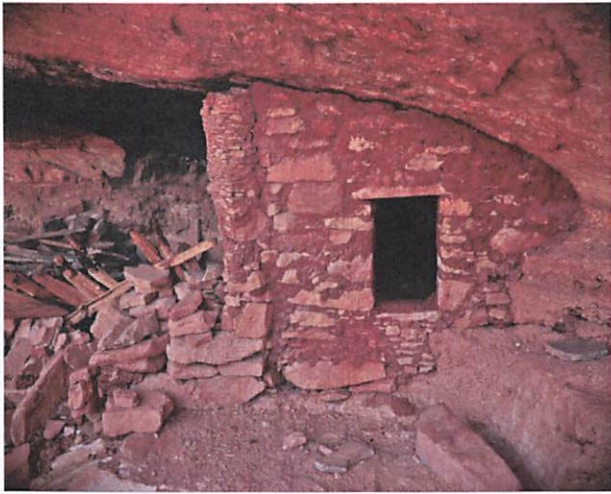


Plate 13. Room 3 at Perfect Kiva, with Room 1's collapsed wall poles on the left. Photo by Blayne Brown, July 2011.



Plate 14. North Mealing Bin at Perfect Kiva; note adobe metate rest fragments in bottom. Photo by Blayne Brown, July 2011

Room 4 (Figure 13), 95 to 141 cm wide and 165 cm long (1.9 m²), is located about 45 m to the southeast of the main site along a narrow ledge above the main bench. It is of masonry but the roofing is missing. A 50-cm-high, 36-cm-wide doorway is located in the west wall that contains three small lintels (FS 142–144) of cottonwood and juniper, and a door slab closing rod of cottonwood (FS 141). There is a weathered (deadwood?) horizontal intramural splint (FS 145) that extends along the western end of the south wall and ties into the west wall. None of these were suitable for sampling.

A number of reddish-brown “ghost” outlines on the walls and shelter ceiling mark prior structures of earlier (Basketmaker?) occupations that had been removed. Ones where we could identify at least some part of a feature were also given room numbers:

Room 5. Just to the west of 2.3 m from Room 1 along the shelter wall is an outline up and across and back down that marks a former structure that reached the rock ceiling. From the wall outlines, this room must have been about 3 m across and built out from the shelter wall about 2 m. Under the ghost line is a pair of contiguous **mealing bins** (Plate 14), placed so that the grinder could brace their (her) feet against the shelter wall about 1 m away. The metates that were once used in the slab-lined bins are missing, although one slab metate (22 cm wide, 22 cm+ long, and 5 cm thick) is presently leaning against the Room 1 south wall exterior next to Room 3. Broken adobe metate rests are present in the bins along with 23 corn cobs.

Less than a meter west of Room 5 are two shallow, roughly circular cavities dug into the base of the shelter wall about 50 cm apart. These appear man-made but of unknown use.

Rooms 6–7 are marked by two structure ghost outlines of reddish adobe on the back wall of the shelter 3 m west along the cliff face from Room 5 and the mealing bins. Eastern Room 6 is about 150 cm across and western Room 7 about 320 cm across. These were probably early granaries before being razed. Outside the west retaining dry wall of stacked stone and about 780 cm from Room 7 is a small feature (**Room 8**) that once sat atop a small ledge at the base of the shelter face, perhaps another granary.

Finally, there is yet another low, short **masonry wall** that crosses the bench to the southwest of the main site that provides the outermost entry into the shelter site (**Plate 15**). It is 16.8 m west (230°) of the main retaining wall's stepped-up entry and has a maximum height of 75 cm, is 30 cm wide, and 170 cm long. There was perhaps another 75 cm of wall, now missing, that would have appended the wall to the cliff face.

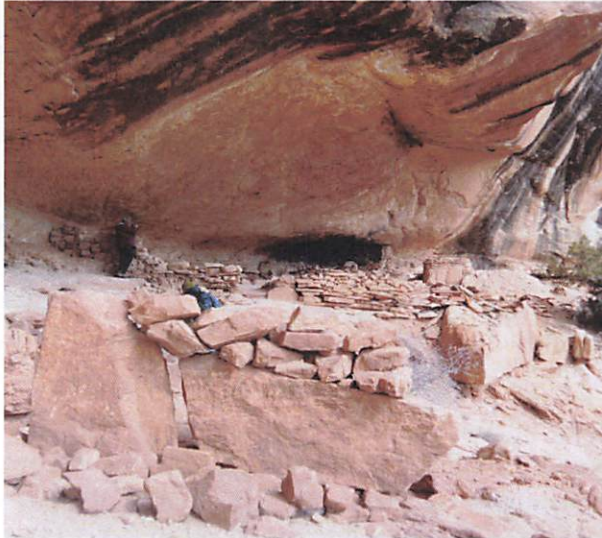


Plate 15. Part of the outer area wall at Perfect Kiva. Main retaining wall is just behind it. Sooted area is Room 1. Looking north. Photo by Nicole LeBrun.



Plate 16. Pictographs in the Perfect Kiva rock shelter. Photo by Blayne Brown, July 2011.

Rock Art. Greater than 100 painted, scratched, incised pictographs and petroglyphs are evident on the rock shelter walls (**Plate 16**), on the kiva's plastered walls, and in a separate cliff face, a small shallow shelter around to the northeast about 70–80 m from the kiva (see the IMACS form for details). A low rock wall about 5 m long crosses the east side of that shelter, which has two panels of pictographs in it.

On the kiva wall between the South and West recesses is a painted 15-cm-diameter white disc 50 cm above the floor, while opposite it on the northeastern wall between the recesses is another of similar size and of light mint-green color, 60 cm above the floor (see **Figure 7**). A number of glyphs are scratched into the outermost coat of sooted tan plaster, including sandal outlines, geometric designs, and numerous scratches.

Artifacts: One wood artifact was found in the kiva. A cottonwood spatula or batten (FS 121), 2.2 x 11.5 x 30.5 cm, lies on the fill within the West Recess. It is uncertain if a search for all artifacts, especially ceramics, was conducted and the tallies subsequently lost or never done. This will be redone in 2014. We should expect considerable loss of artifacts due to the popularity of the site to visitation. There are a few large artifacts, including a metate, still evident but refuse on the immediate site area is sparse. The steep talus slope is rough and there are numerous possibilities for discarded and alleviated refuse to have been trapped on it, which will be searched out.

Tree-ring Analyses and Summary (Table 8): The kiva contained 116 juniper structural wood elements and 58 were sampled (50%). Although the elements for the most part were soot covered, their smooth exterior surface indicated that these mostly exhibited the outer growth

ring. An appraisal of the exterior ring was made by the author in the field for every sample collected, which may differ considerably from the external growth-ring observations made at the tree-ring laboratory. The latter has only a very small piece of the outermost ring in each core sample to observe; cores comprise the near entirety of the sample collected. For the most part, samples were selected from wood surfaces with cutting or near-cutting date potential. A mere 14 of the kiva samples (24%) dated, but mark two decades of wood harvesting between AD 1200 and 1220, as well as the collection of deadwood dating in the previous century (AD 1158 and 1178). Our small sample indicates some major wood harvesting occurred between AD 1204 and 1223 with dates at 1227+vv and 1229 B marking the possible last years of wood harvesting and when construction might have first commenced. An archaeomagnetic date from the two firepits might provide a terminal date for the occupation, but the few site artifacts indicate that it was a short one.

Results from habitation Room 1 were similar. We took 54 samples from the 62 documented for the room (an 87% sample), but a mere 7 of these dated (13% success). Two pieces were deadwood (AD 1176++ and 1203++B) but the latter was collected during the period of harvesting. Cutting and near-cutting dates range between AD 1200 and 1212, with a terminal cutting date of AD 1229, marking the likely year or so of construction.

The single dated specimen (FS 222) from the shelter inner retaining wall was clearly deadwood based on field observation (it has uncut limbs), which dated at AD 1127+vv (a near-cutting date) but it is not relevant to the interpretation of the primary harvesting and construction at the site. Juniper was the overwhelming choice for use at the site (184 of 197 elements with species identified; 93%), with scant use of *Populus* sp. (11; 6%), and piñon (2; 1%), while five more oak and willow elements were used to make the perfect kiva ladder (Figure 14). Few stone-ax cuts were observed among the site's structural elements (Figure 15), as most elements were either broken at the ends (in Room 1) or hidden from view (in the kiva).

Figure 14. Perfect Kiva site structural wood elements by species. Graph by Eileen Bacha, 2014.

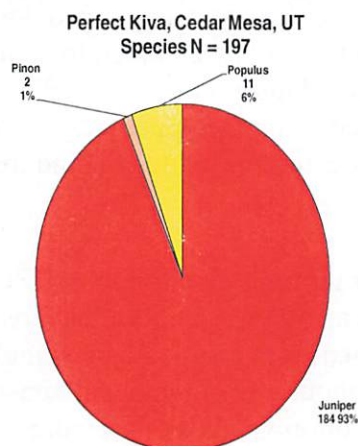
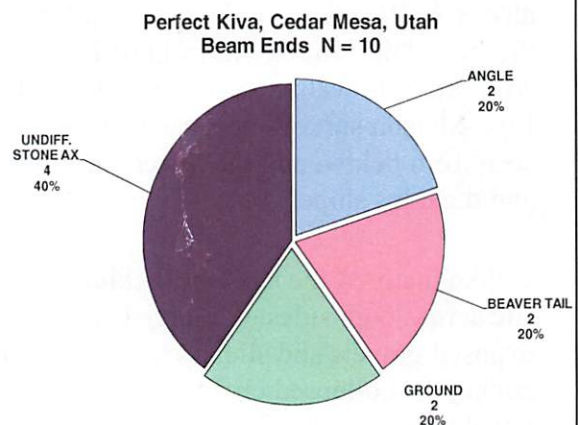


Figure 15. Perfect Kiva site structural wood beam end ax-cuts. Graph by Eileen Bacha, 2014.



Despite the limited dated sample, the kiva and Room 1 results are similar and suggest a long period of tree harvesting and stockpiling between about AD 1200 and 1223 (13 dates) before construction in AD 1229. This suggests that the cutters lived in close enough proximity to warrant an extended work period over the years and had knowledge that any neighbors would unlikely to hinder the construction process (such as with theft or other vandalism) while the

workers were absent.

An extended collection of harvesting and construction is not unheard of; a kiva in Long House at Mesa Verde National Park took three years to harvest wood and build (Street 2001:162) while a cribbed kiva at NA8013 in Cross Canyon, northeastern Arizona, may have taken much longer (Dean 1971). Dean (1971) had a wealth of dates from the Cross Canyon kiva (112 samples; 90 dates), which he argued was built in AD 1011 (15 cutting/near cutting dates) and then repaired in 1023–1024 (with 10 cutting dates). But the period between 1011 and 1019 yielded six more cutting or near cutting dates, similar to the continued cutting we have for the kiva at Perfect Kiva, though from a much smaller sample. The Perfect Kiva is well protected from the elements, so that repairs to the main structures would seem highly unlikely, especially over so short a period after the initial harvesting had taken place. After all, the kiva roof is still intact without any evidence of deterioration and hasn't needed roof repairs since.

Both the kiva and Room 1 yielded terminal dates at AD 1229 (1 each), which probably mark the last efforts of gathered construction wood. By being elements within the primary construction, these two dated samples may mark the year of last construction when the many elements cut over the years were mixed together during the final site construction.

The size of the site and the numbers and types of features indicate that occupation of the site was limited to one nuclear or extended family, although the lack of refuse suggests that the occupation and use of the site was a limited one. Although there is evidence of an earlier occupation of several small storage structures, which had been razed, there was nothing that could place these structures temporally except that they predated the present structures. They were probably Basketmaker.

42SA 29514. The Blue Man/Square Kiva Site. **Location:** Down canyon from Perfect Kiva (42SA 5795) in the canyon bottom of Slickhorn, along the north side, is a huge occupied alcove well-back from the main wash (**Plate 17**). When we visited the site, we plunged down the steep talus directly in front of Perfect Kiva to the canyon bottom below and then took about 25 minutes to walk down canyon to it. This site was not discovered during the 1960–1970s Lipe-Matson surveys because there is little architectural evidence along the upper ledge when seen from below, and the lower part of the site, with much architecture, is hidden behind trees and the talus slope.

Unlike many of the sites in Slickhorn, there is adequate land for farming directly opposite the site across both sides of a large bend in the main drainage. The arroyo/wash bottom is mostly exposed gravels and slickrock, with seasonally large pools formed from rains and snow melt among the collapsed cliff boulders choking the canyon bottom about a 15-minute walk upstream. Local tree cover is dominated by piñon and juniper with a few cottonwood trees growing along the canyon bottom.

Plate 17. Overview of the Blue Man/Square Kiva site, 42SA 29514, looking east. View of the northeastern end of the Upper ledge and the lower small alcove where room 1 is located. The square kiva and Rooms 1–4 are along the lower cliff face just beyond the alcove by the short trees. Photo by Chris Gilbertson, July 2011.



Features: This site is built within a large cove on the north side of the canyon along the base of the talus and along a high ledge directly above the talus. The lower section along the talus consists of a Pueblo II-III house with a nearly intact roofed square kiva, and two associated large unschooted rooms and a small granary (**Rooms 2–4**) along the lower cliff face (**Figures 16–17**). A short distance away (15 m) to the west and slightly lower on the talus is a semi-subterranean structure (**Room 1**) built below a small alcove weathered into the cliff face.

Figure 16. 42SA 29514, lower cliff face, west end, showing the plan of Room 1. Original field map by Claire Jones, Doug Palmer, Cliff Evans, Chris Gilbertson, & Tom Windes, 15 July 2011.

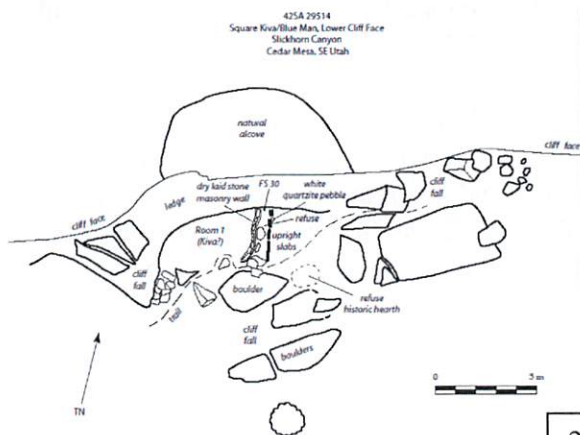
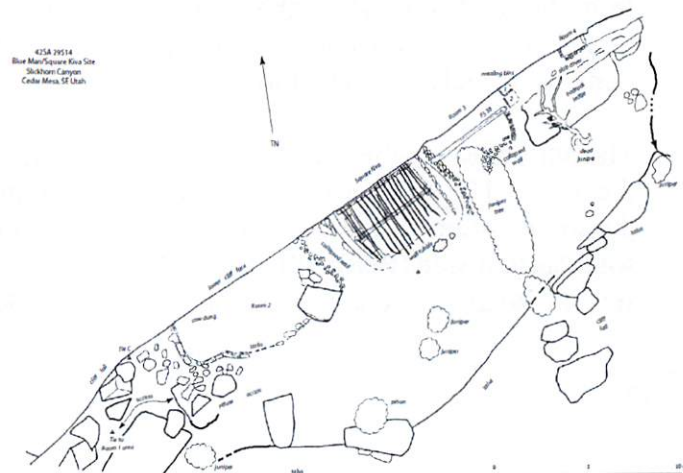


Figure 17. 42SA 29514, lower cliff face, east end, kiva & Rooms 2-4. Original by C. Jones, Nicole LeBrun, Jerry Fetterman, D. Palmer, C. Evans, & T. Windes, 12-14 July 2011.



Along the Lower Cliff Face. The Kiva (Figure 18; Plate 18), a square, 360 by 360 cm structure (13.0 m²), is built along its northwestern bedrock wall against the cliff face and has intact northeastern and southwestern masonry walls with three pilasters along each (Table 9). The weight of the roof and the massive cottonwood roof primary (FS 1) spanning the center of the room has partly crushed the central west pilaster (#2), causing the wall and pilaster to partly buckle. FS 1 has five shims spread across the top to slightly elevate and level several of the roof secondary poles (FS 4–6 supported by shims 36–37; and FS15–17 supported by shims FS 35–33, respectively). Overall, the kiva exhibits two vigas (439 and 445+ cm long) in place overlain with 20 secondaries (*latillas*), almost all of cottonwood and ranging in size from 5.3 to 11 cm in diameter and 147 to 398 cm length. The outline of the southeastern wall is poorly defined and mostly buried. A probable 3rd viga spanned the kiva along the southeast wall but has disappeared, leaving the southeastern roof secondary ends suspended in space (Plate 18). A cottonwood viga (FS 38), 497 cm long and 15.5 cm in diameter, in adjacent Room 3 to the northeast might now hold that missing viga. Its present position appears to be positioned correctly for a roofing viga in Room 3 but it is probably set much too low for that roof.

Figure 18. The square kiva at Blue Man, 42SA 29514. South is at top of map. Field map by Tom Windes & Nicole LeBrun, 16 July 2011.

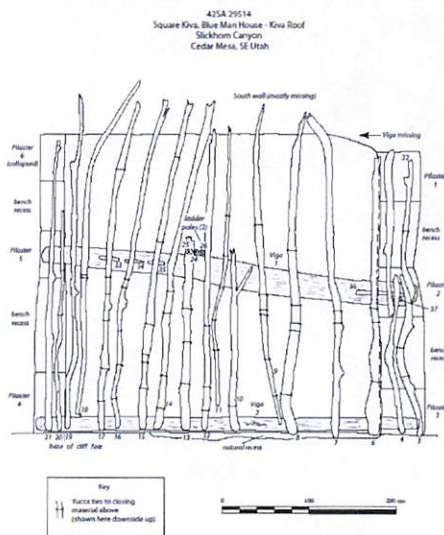


Plate 18. Square Kiva, looking NW across to the small alcove where Room 1 is located. Photo by Kay Barnett, 20 July 2012.

The roof closing material is tied to the latillas underneath, with a total of 50 tie sets, although much of the closing material is missing from the southern third of the structure. Most of the NNW/SSE running latillas extend across the roof. Three small, short poles (128, 142, and 164+ cm long; FS 23–25) lean vertically against the central viga (FS 1)(Plate 18), which may have been ladder poles, however, there is no evidence for a roof entry. Entry must have been made from the south side where the greatest deterioration has occurred. The three poles were sampled in 2012 but two were cottonwood and not sent to the lab. The remainder (FS 25) is of juniper and remains unanalyzed. The roof height above the interior sandy fill is 152 cm.

The outermost southeastern wall has partly collapsed and its rubble fills the southeastern end of the room. The kiva roof and some of the remaining walls will probably collapse soon because the southeastern part of the room is subject to rain and snow and is already unsupported along its southeastern side (Plate 18). Up to three coats of sooted plaster covered the walls, which exhibit several etchings, including sandal outlines (see Bellorado 2011).

There are probably two wooden weaving tools in the kiva but we could only locate one of them, a batten, which was on the east bench shelf between Pilasters 2 and 3. Nicole LeBrun reported that according to Vaughn Hadenfeldt another was tucked into the roofing when they visited the site a few days prior to our mapping and sampling there. This was not relocated.

Room 1 (Figure 17; Plates 19-20), about 244 by 480 cm (ca. 11.7 m²), is built into a natural eroded area that cuts into the stepped bench cliff face directly below a small shallow alcove. It lies separated from the other features along the natural route up to the site from the canyon bottom if one approaches west up the side arroyo that empties the larger cove area. There are only built walls along its northeast side, which consists of an interior, dry-laid masonry wall backed by natural fill and a wall of upright slabs along its surface exterior. There was probably a masonry wall along its southern side, which has collapsed down slope. No roofing is evident for this room and it may never have been roofed. Its size suggests a habitation room but no floor features are evident, although sand fills the room.

Some AD1100s refuse is found between its two east walls including a few sherds, a possible ax fragment, and a noticeable large oblong river-cobble polisher of white quartz, similar to the small “lightning” stones common during the Pueblo IV and V periods in the northern Rio Grande. Just below to the southeast is another small concentration of refuse and a burned area, which appears to be of historic use. There was a partly burned dead tree branch lying among the charcoal; a stone-ax-cut tree-ring sample (FS 32) from the burned area failed to date.

Room 2 is an irregularly-shaped room (Figure 17; Plate 21), 198–325 by 630± cm NE-SW; 19± m²) built against the cliff face immediate west of the square kiva upslope from Room 1. It incorporates a couple of talus boulders into its stone masonry wall construction. The highest of the room walls (93 cm) is along the southwestern side, but there is considerable wall rubble, boulders, and some refuse just outside the wall exterior covering the trail-access up from Room 1. Along the open southeastern side is a partial row of upright slabs (0-5 cm high) barely visible above the fill and partly curving along the inner masonry wall to the west, which is an odd arrangement if it is the remaining contemporary wall for the room. No masonry wall is left intact along the room’s northeastern side but it is marked by a tumble of masonry-size stones. A cliff face boulder may form part of the room along its southeast side.

No roofing is evident for this room and it may never have been roofed. Its size suggests a habitation room but it is unsooted and no floor features are evident because the room is filled with deep sandy deposits. The presence of dung in the northwestern part of the room indicates some damaging cattle presence at the site.

Room 3 (Figure 17), 230± by 350 cm (8.1± m²), abuts the kiva along its northeastern side but is partly obscured by a large, thick low-level juniper tree growing horizontally across it. A single viga (FS 38) of cottonwood spans the back part of the room (which may have derived from the kiva) where it was built against the cliff face, but the remaining walls are marked by collapsed wall rubble; the unsooted room is deeply filled with aeolian sands. Just northeast of the room’s northeast wall are the remains of two contiguous **mealing bins** (#1 north, ca. 50 by 50–80 cm; #2 south, 51–60 by 67 cm) set against the cliff face where the food grinder(s) could be positioned parallel to the cliff and facing southwest to the kiva. These are missing some wall slabs but no ground stone (manos, metates) is in association.



Plate 19. Room 1 at Blue Man. 70cm scale. Photo by Richard Moeller, July 2011.



Plate 20. Room 1 at Blue Man looking SW. Claire Jones taking notes. Note artifacts against outer slab wall. Photo by Chris Gilbertson, July 2011.



Plate 21. Room 2 looking west towards Room 1 alcove. Photo by Richard Moeller, July 2011.

Room 4 (Figure 17), 55 by 98 cm (0.5 m^2), is a small masonry storage cist built against the cliff face about 5 m northeast of Room 3. Nearby, a slab cover lies on the ground in three pieces and may have served for a cover over the cist, whose interior can only be reached through the top opening which is held up by internal horizontal rods. If one proceeds a short distance northeastward, a talus of large boulders covered with trees, allows access up to the ledge above.

Along the Upper Ledge (Figures 19–20; Plates 17 and 22)

This is reached by unmodified trails snaking up the high sandy ledge and dune area in front of the western end of the large cove but also to the east immediately past Room 4 about 20–30 m and up a steep talus and rocky spit that reaches the Upper Ledge. The upper ledge extends west around the entire cove and beyond but only a strip of about 200 m reveals cultural materials and architecture. It is 24 m above the kiva but greatly increases in relative elevation to the west over the head of the main arroyo that drains the cove area. We made an intensive search for artifacts along the Upper Ledge and at its base around the cove but found little.

Figure 19. The northeastern part of the Upper Ledge (42SA 29514) with its rock art, “gateway” (Room 5), and other features (F). Original by Claire Jones, Doug Palmer, Christine Gilbertson, & Cliff Evans, 15 July 2011.

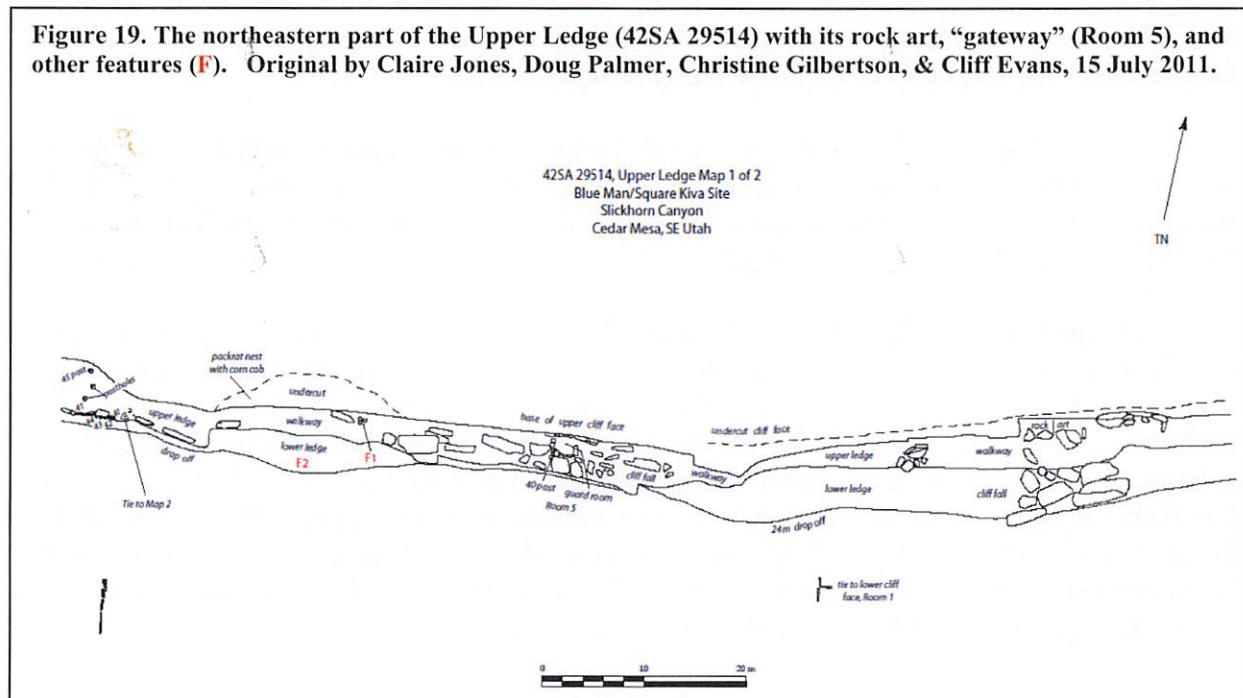
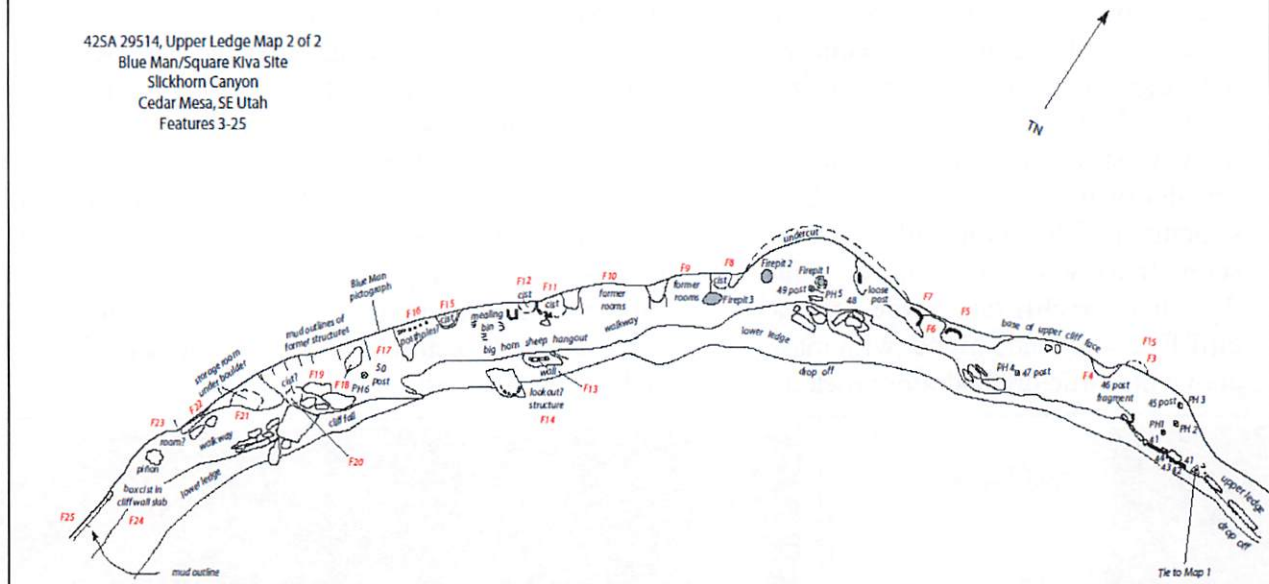


Figure 20. The southwestern part of the Upper Ledge (42SA 29514) with its many features (F). Original by Claire Jones, Doug Palmer, Christine Gilbertson, & Cliff Evans, 15-16 July 2011.



The sparse architectural and artifact remains associated with the occupation indicate that there was a dense early use made of the Upper Ledge, which may have been Basket-maker/Pueblo I except for Room 5 and some rock art motifs. For the amount of architecture that once occupied the Upper Ledge, the lack of cultural material is surprising. It is also surprising that so much destruction of the Upper Ledge architecture took place without any physical additions by later occupants; there is a lack of architectural debris at the base of the cliff. The many reddish-brown adobe wall lines along the cliff face, however, attest to the many features (in red on the plan maps), mostly cists or small storage rooms, that once existed (Figures 19–20; Table 10). From the scant remains, the cists may have once been domed adobe structures.



Plate 22. Looking west along the Upper Ledge of 42SA 29514, the Blue Man/Square Kiva site. Photo by Richard Moeller, July 2011.

The Upper Ledge is a favorite resting spot for bighorn sheep, who left a large amount of drop-pings along the center and western sections of the ledge. We were surprised to see a bighorn ram while working there, who came up close to the base of the cliff face to observe the human trespassers on the ledge above. Interestingly, a number of ancient big horn sheep pictographs are painted along the cliff face above where the sheep have been resting.

Room 5 (Plates 23–24). This is the first feature encountered at the northeastern part of the Upper Ledge, aside from a large rock panel near the point of access from the east side above the square kiva area. There is little cultural evidence further west for 44 m until reaching a U-shaped block-masonry “gateway” structure, 140 by 217 cm E-W, that was unroofed and built across the ledge, evidently to control access. This structure is directly above the kiva and probably was built by the inhabitants of the structures below. It has a high doorway (the upper part is missing) in the west wall with an oak post (FS 40) in its SW corner, which was sampled but did not date. The doorway, 77–83 cm wide and over 77 cm high, has its sill 30 cm or so above the ledge. The structure is filled with wall rubble and appears to have had no east wall aside from a large stone set partially across the east side (Plate 23). The highest remaining wall is 154 cm high. Although the cliff face borders the north side of the structure, a narrow natural ledge along the cliff face was made higher with masonry. There is early Basketmaker-style rock art directly above the structure and more rock art along the ledge to the west.

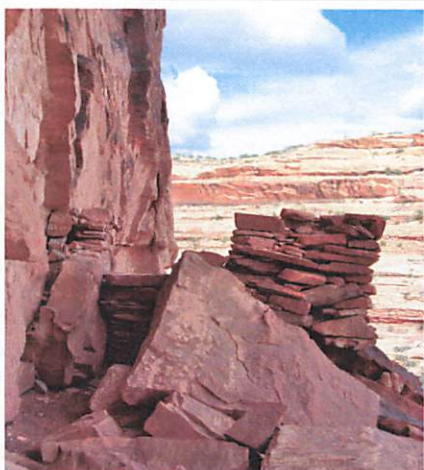


Plate 25. The gateway room on the Upper Ledge above the square kiva. Looking east through the doorway. Photo by Kay Barnett, July 2012.

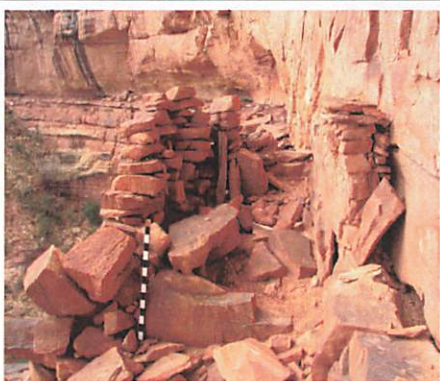


Plate 26. The gateway room on the Upper Ledge. 70-cm-vertical scale. Looking west. Post in room (FS 40) did not date. Photo by Richard Moeller, July 2011.

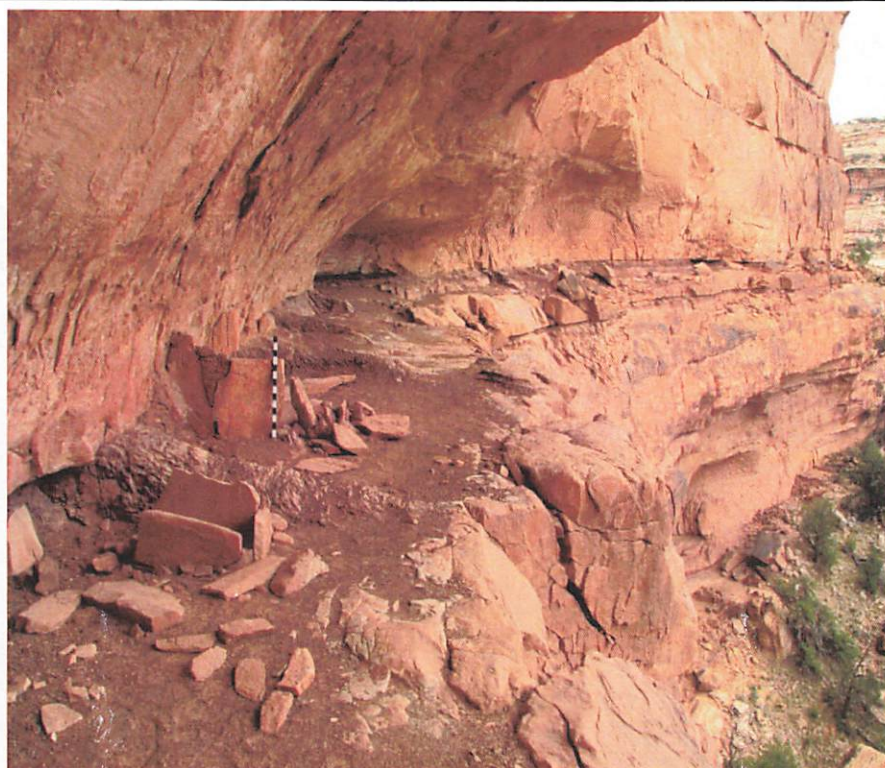


Plate 27. The middle part of the Upper Ledge. 70-cm scale next to Feature 11 cist slabs. Mealing Bin 3 in foreground, left. Looking northeast. Photo by Richard Moeller, July 2011.

The remaining cultural evidence along the ledge appears to be earlier, based on the style of architecture (adobe and jacal) and the almost total lack of ceramics. Along this area, approximately 140 m length, are many corncobs. There is another rock art panel about 25 m west of the masonry structure along the ledge where the floor has been undercut horizontally for 100 cm along the cliff face, which is filled with pack rat material and a corn cob. Thirteen meters further west is a series of three postholes (PH 1–3) across the width of the ledge with others following intermittently.

The row of three postholes is adjacent to an area of the ledge where four pieces of wood were placed to help stabilize a short, low masonry wall (mostly missing) built along the outer cliff ledge. This is the only evidence for a retaining wall bordering the Upper Ledge (the Ledge Runner Site [42SA 6654] in Natural Bridges exhibits much lining of the upper ledges). The large horizontal deadwood pine intramural (FS 41) underneath the low masonry wall was sampled but did not date. Underneath and associated with FS 41 are three smaller pieces of wood of unknown species (FS 42–44) that were too dangerously placed to sample.

There is little cultural evidence to the east of the alcove, where the ledge swings south (**Plate 25**), but much exists west of it for another 100 m. The middle and western part of the ledge is the center of activities, where there are ghost outlines for about 15 former adobe or jacal structures (mainly storage cists), along with a mealing bin (MB 3; **Plate 25**), three firepits in a cluster (**Plate 26**), and, overall, six postholes. The many cists were carved partially into the dense reddish-brown natural deposits that jut out onto the ledge at floor level. None of the features exhibit sooting except for Feature 21.

Six postholes are spread along 74 m of the flat ledge, which is mostly between 4 to 6 m wide. Cottonwood stubs (FS 45, 47, 49, and 50) extend from four of the six postholes (ca. 12–17 cm in diameter), while two loose stubs (FS 46 and 48), one with a chunk of adobe attached, undoubtedly came from the remaining postholes (were these stubs pulled out by visitors?). The Upper Ledge slab-lined mealing bin (MB 3), 39–45 by 68 cm and 16 m southwest of the nearest firepit (FP 3), contains a mano but no metate. The bin had been built about a meter from the back cliff face, providing space for a grinder with support for the feet and back against the cliff face. The small space left for the grinder indicates that the kneeling grinder was female or sub-adult. Two dismantled slab and adobe cists flank the mealing bin, which contains a corncob and an early plain gray sherd. Above these features are eight or more painted bighorn sheep figures.

Nearly across from the mealing bin on a small, dangerous-looking ledge 2.5 m below the main ledge are the remnants of a masonry wall on top of a slab boulder sticking out beyond the cliff face. The purpose for this structure is unknown; we did not attempt to reach this feature.

There is a small shelter (Feature 21) under a cluster of fallen cliff slabs at the southwestern end of the Upper Ledge that is heavily sooted (**Plate 27**), perhaps a special-use or storage room. There is a small bit of masonry left within the structure but little else. Finally, about 13 m southwest beyond the sooted room under the rock slabs is a small cist box (Feature 24) built on top of a narrow slab ledge along the back main cliff face and the mud outlines of another former cist beyond that.



Plate 26. Firepits 2–3 along the middle of the ledge. FP 3 in background with 70cm scale just in front. Photo by Richard Moeller, July 2011.



Plate 27. At the southwestern end of the Upper Ledge looking NW is a small sooted room that probably served for storage (Feature 21) (center of photo). The small cist box (Feature 24) mentioned above is located just off the photo to the left. Photo by Richard Moeller, July 2011.

Rock Art: At the east end of the upper ledge roughly above Room 4 are the densest rock art panels ([Plate 28](#)), recorded by Sally Cole and her team several years ago and again by Pam and Quent Baker, Leigh Grench, and David Manley during our project. But there are many more, mostly pictographs, along the Upper Ledge cliff face along the southwestern ledge area, including the Blue Man pictograph ([Plate 29](#)). The blue paint was obtained along the ledge deposits that are exposed below the pictograph.



Plate 28. Petroglyphs at the east end of Upper Ledge. Photo by Richard Moeller, July 2011.

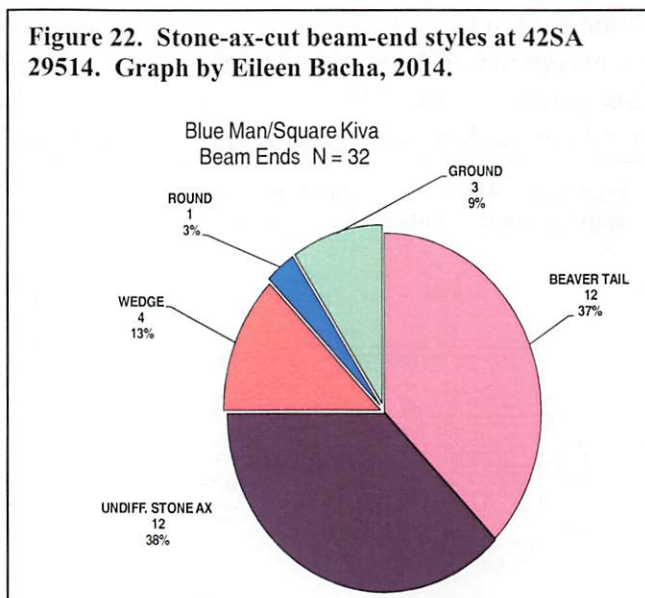
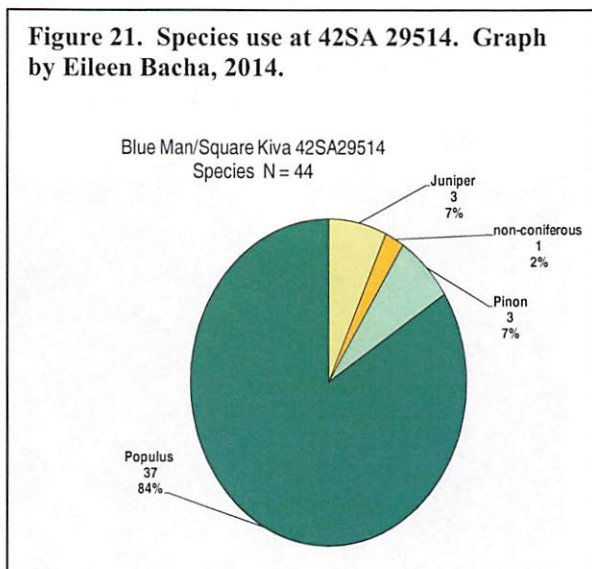


Plate 29. Blue man and other pictographs along the southwestern Upper Ledge. Photo by Richard Moeller, July 2011.

Structural wood. The site was a disappointment for tree-ring material as the vast majority associated with the upper and lower sections is undatable *Populus* sp.; many of the elements still retain cottonwood bark. The use of cottonwood for structural elements is rare, especially when used for the kiva vigas and latillas in the square kiva and for the posts set along the upper ledge. Cottonwood is immediately available just below the site in the wash. We documented 50 pieces

of structural wood and sampled sixteen of them (38% sample) but none dated. Some were cottonwood and not sent to the lab but the others, a mix of oak (1), erratic and suppressed piñon (3), and juniper (7) were also undatable (Figure 21). Species for six elements could not be determined. Three more samples were collected in 2012 but have not yet been analyzed. The kiva contained most of the site wood (33; 67%), which was almost all cottonwood (31 of 33; 94%). A cottonwood weaving batten (FS 27) was found in one of the recesses between Pilasters 2 and 3 and another may be hidden in the roofing.

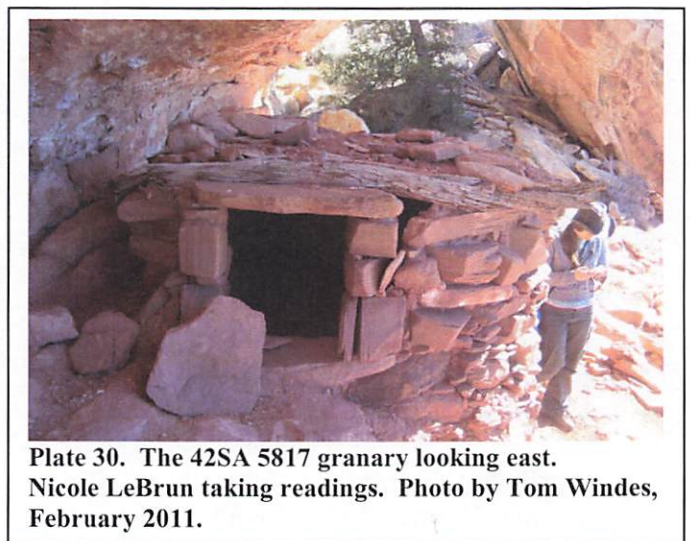
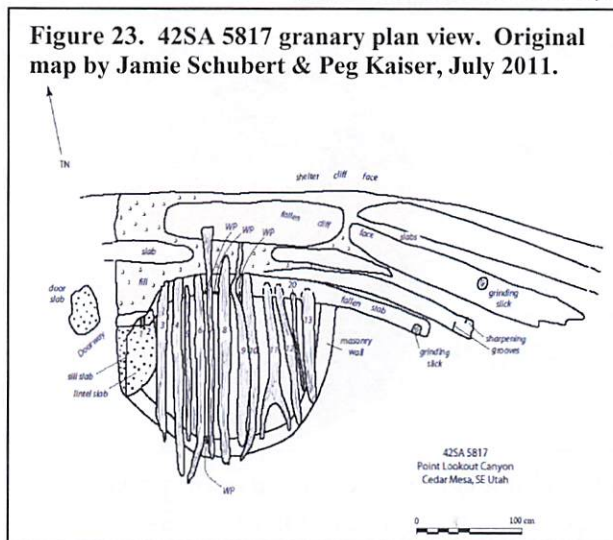
Compared to Perfect Kiva, up-canyon, there were many stone-ax-cut beam ends visible, the majority from the kiva roofing (Figure 22). Because of the flat style, kiva-roof construction, the majority of the beam ends could be seen. These are almost all once freshly-cut *Populus* sp. elements. There is a general lack of deadwood use at the site.



Artifacts: Eighty-five sherds were tallied at the site, which is the vast majority still present; almost all are associated with the lower cliff face features. These are dominated by 24 unclassified indented corrugated (32%), 22 unclassified Mesa Verde Whiteware, some plain Rosa-looking grayware (8; 9%), Mancos (2) and McElmo (3) and McElmo/Mesa Verde (2) black-on-whites (8%), and Tsegi Orangeware (8%), including a Tusayan Polychrome. Two sherds of Red Mesa Black-on-white (2%), a Corez Black-on-white, and two Mancos Corrugated jar rim sherds were also tallied as well as two Chapin Gray sherds (2%). These suggest at least two or three occupations at the site: during the BMIII-PI period, mainly along the Upper Ledge, and perhaps in the late AD 1000s/early 1100s and in the period between AD 1175 and 1250, mainly along the lower cliff face.

There is also a number of other cultural materials: chipped stone (34, mostly Cedar Mesa Chert), a broken corner-notched and a basal fragment from two projectile points, a core, a hammerstone/core, a flake tool of pink quartzite, an igneous flat cobble in two halves, a white quartz floor polisher (17.5 x 13.5 x 7 cm) next to the Room 1 east wall (Plate 20), a pendant, a pecking stone, two manos (one- and two-hand), an igneous ax fragment (7+ x 9.5 x 1.8 cm), a bone awl tip, a calcite bead, seven corn cobs, and a squash peduncle. Compared to Perfect Kiva, just up-canyon, this is a prolific amount of material.

42SA 5817, granary at head of Point Lookout Canyon, Cedar Mesa. This is an intact isolated masonry storage granary (Figure 23; Plate 30), 127 by 170 cm inside, located under the north canyon rim within a small shelter near the head of Point Lookout Canyon, a canyon system immediately southeast of Slickhorn and accessible from the same dirt access road as Slickhorn. The structure is along BLM's Trail #6 in the Slickhorn area near the termination of the road, where the trail first drops into the head of the canyon past an earthen dam. The structure is roofed with 11 juniper and a couple of piñon poles (FS 3–13), of which 4 were sampled. It was covered by a secondary layer of adobe and juniper splints, of which one splint was sampled (FS 20)—the one mostly likely to provide a near cutting date, but it failed to date. Most of the roofing, which revealed much weathering despite its protected location, is probably scavenged deadwood. The only two dates came from the roofing poles and these, indeed, were deadwood and dated in the AD 900s (924++B and 994++vv_v). This structure was probably built in the AD 1200s but the lack of cultural material fails to assist in interpreting its period of construction and use except that it dates after AD 994. No other cliff ruins exist in the nearby area, although a three-room granary (42SA 5818; with cottonwood doorway lintels: Lipe 1976 survey form), is found not far down canyon near the first north junction for a side canyon.



A doorway with two broken lintel stubs (FS 1–2) opens on the west, down-canyon side of the granary. Three broken wall pegs (FS 15, 17–18; 14 and 19 mm in diameter, of non-coniferous wood) are in situ, two in the north wall and one in the south wall. They are near the top of the walls and above the floor 112–113 cm. A small wood intramural, 19 mm in diameter, is in the north wall. Nearby are two grinding slicks and two bone-awl? sharpening grooves on top of several fallen narrow upright natural slabs. The site was mapped using a Brunton compass, tape measures, and an engineer's scale.

Artifacts. A shaped doorway slab lies on the ground just in front of the doorway and a corn cob was found stuck in the roofing. Sherds and chipped stone were not observed.

Tree-ring analysis (Table 11). Twenty pieces of wood were recorded for the granary and five sampled (20% of the sample) with two dating (40% success). All were in situ except for a single loose piece (FS 19), which was not sampled. Roofing poles (FS 3 and FS 5), the former of piñon (10.2 cm in diameter) and the latter of juniper (11 cm in diameter), dated at 994++vv and 924++B, respectively, but the “++” codes indicate dying or dead trees were that collected for the roofing rafters, which do not date the construction. Unfortunately, all of the element species and

beam-ends were not recorded in 2011, but these will be completed in 2014.

42SA 5819. 4 Shield House, Point Lookout Canyon, Cedar Mesa. This large site is located above the canyon bottom on the north side in Point Lookout Canyon, BLM's Trail #6 in the Slickhorn area. It contains about 14 rooms and small granaries, two large sooted cavates, a possible kiva or kuhu, and walled walkway ledges. The site was named by the author for the four large shield pictographs on the cliff walls above the eastern ledge; work the following year on the western part of the site, however, yielded more, but smaller, shield pictographs. The site covers about 300 m overall along a wide ledge at the east and west ends but with two cavates in-between but connected by a dangerously narrow, eroded set of narrow ledges. One can, alternatively, closely approach along the western section of ledge to the western cavate, but access is blocked to the cavate by a cliff projection and a stout masonry tower with two long poles extending out over space from its upper masonry wall (**Plate 31**). In 2011, only the eastern half was mapped and documented during the four days that the 5-person crew spent there. More work was done in 2012 and 2013, and hopefully the remainder completed in 2014. There is much standing architecture at the site (**Plate 32**) but few artifacts and limited use of large structural wood aside from the many tie poles within the retaining walls fronting the two cavates, most of which was gathered as deadwood.

Plate 31. Overview of 4 Shield House, the east end & the 2 cavates. Looking north. Photo by Criss Swaim, July 2011.

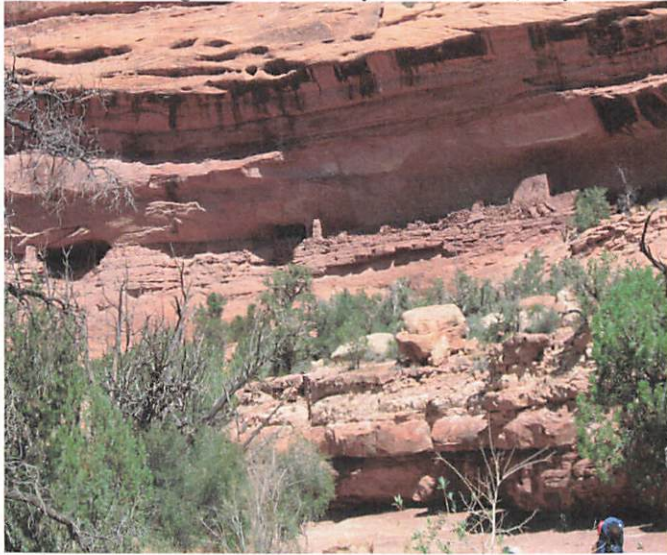


Plate 32. 4 Shield House, east end. Highest room is the 2-story square kiva. Photo by Don Keller, ca. 2011.



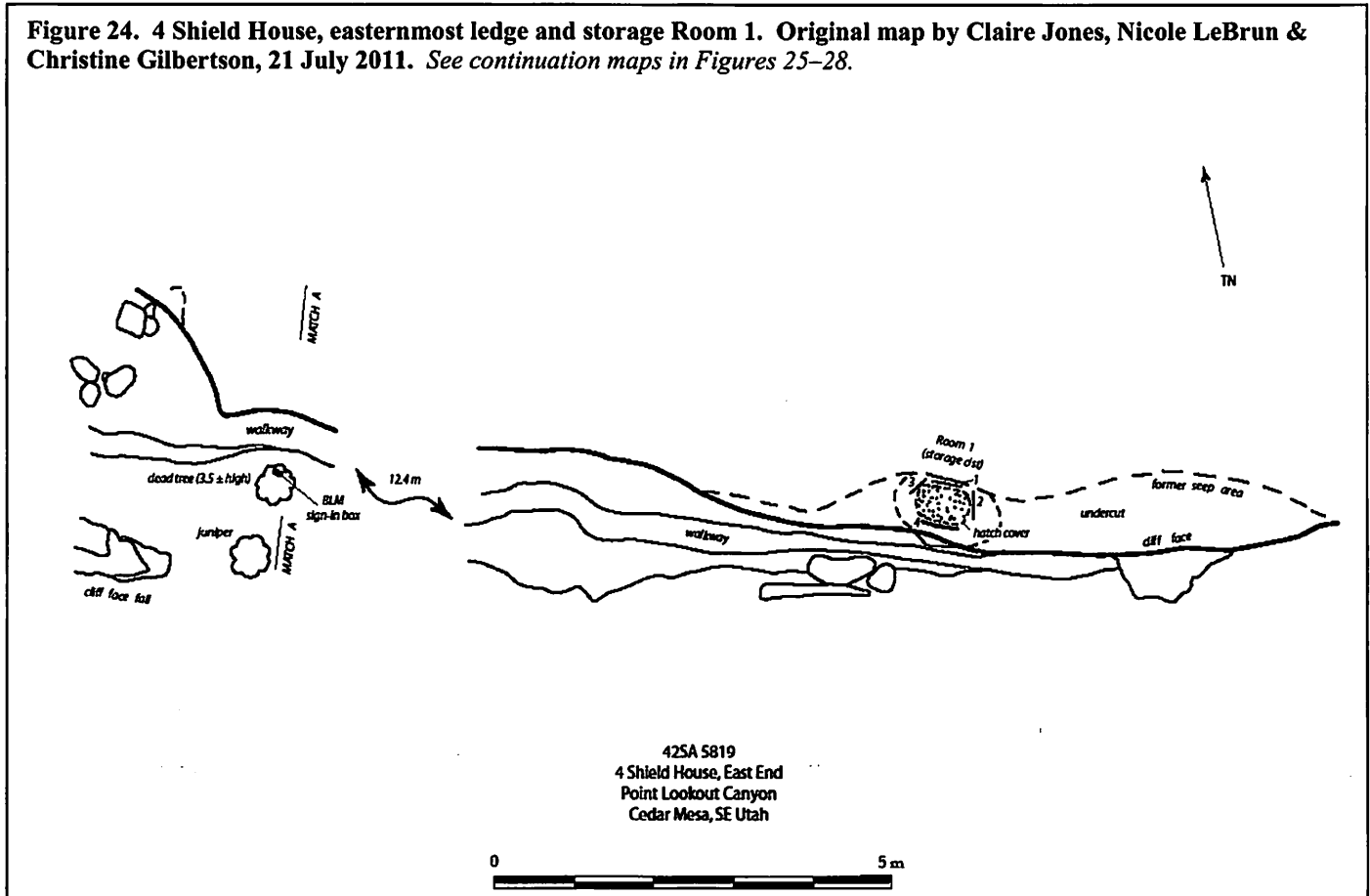
In July, the walkway is in the shade during the day but the westernmost eight rooms catch the early morning sunrise until about noon. The two cavates probably only receive the mid/late morning winter sun; the dense smoke-blackened ceilings in the two cavates suggest that the main habitations spaces were located here. Each has a small jacal granary in the back of the cavate.

Local vegetation includes cottonwood along the wash below and piñon (ca. 60% of the tree cover) and juniper (40%) along the sides and benches, Mormon tea, snakeweed, mountain mahogany, buffaloberry, narrow-leaf yucca, and grasses. The site was built where the canyon floor widens substantial from the narrow rock- and plant-choked upper canyon bottom in which to gain access from the upper trail and mesa top route. From the site area and down canyon, there are ample sandy flat areas in which to farm. The primary architectural features are listed here in sequence from east-to-west, although some features remain to be fully documented. Both

structural wood and loop holes found at the site were numbered separately on the room maps: **wood** is shown in **black** and *loop holes* (LH) are marked as two *dashed* parallel lines.

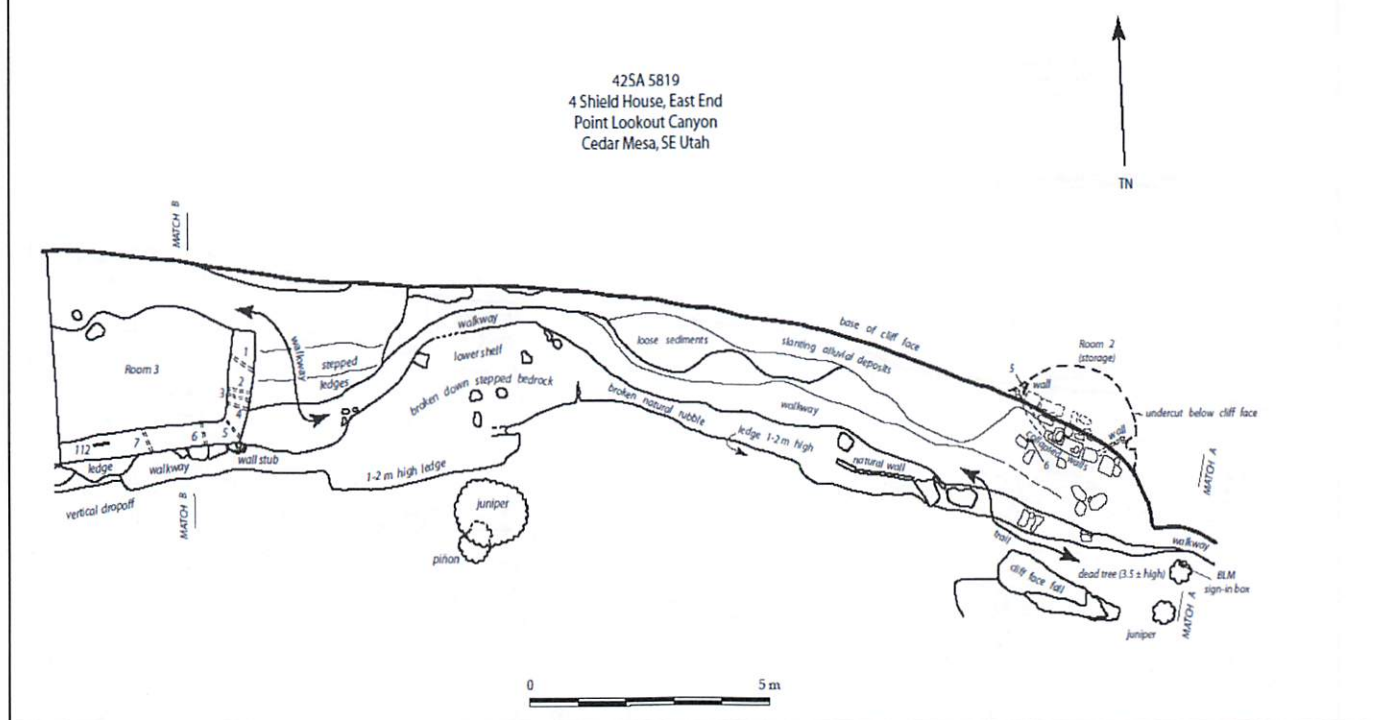
Room 1 (Figure 24): At the eastern end of the site are the remains of an intact small roughly-doomed storage room, $58 \pm$ by 96 cm (ca. 0.6 m²) tucked against the cliff face along a shallow alcove. This structure is located about 30 m east from the main roomblock architecture (Room 3) along the same ledge. A sandstone hatch cover ($51 \times 37.5 \times 2.5$ cm thick) is in place over the granary's oval, adobe horse-collar shaped opening (32 by 25 cm), which is supported by four juniper splints (FS 1–4; none sampled). The inside space is 85 cm high. Two openings at the bottom of its masonry walls are from displaced stones; overall the walls were built of scabbled, tabular mortared stones.

Figure 24. 4 Shield House, easternmost ledge and storage Room 1. Original map by Claire Jones, Nicole LeBrun & Christine Gilbertson, 21 July 2011. See continuation maps in Figures 25–28.



Room 2 (Figure 25): A second small storage facility, $180 \pm$ by 265 cm (ca. 3 m²) and 75 cm high at its mouth, is located about 20 m west of Room 1 along the same ledge/walkway, which consist of a narrow broken-down friable sandstone shelf that gradually widens as it extends west. The room is simply a walled-up recess within the cliff face, utilizing tabular and irregular-shaped stones for the masonry, which has mostly collapsed. Two unsampled loose pieces of cottonwood (FS 5–6) are in the granary, but were first found on the ledge directly in front of the granary and placed in the granary for protection.

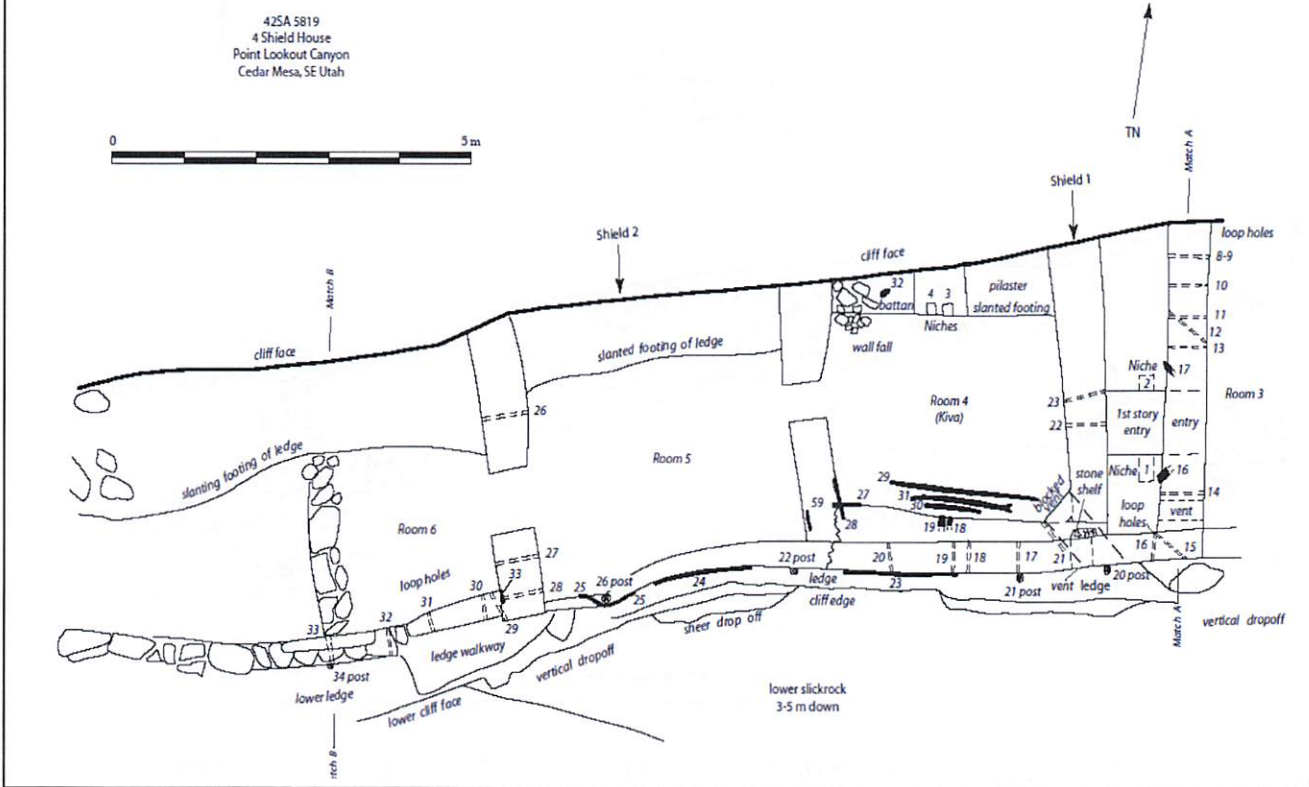
Figure 25. 4 Shield House, eastern ledges, and Rooms 2-3. Loopholes numbered in walls of Room 3. Original map by Claire Jones, Nicole LeBrun, & Christine Gilbertson, 21-22 July 2011. See continuation maps in Figures 24, 26-28.



Room 3 (Figure 25; Plate 33): This is an open, unroofed space, 383 by 424 cm (16.8 m²), enclosed by low masonry walls (49–52 cm high), 49–61 cm thick, along the south and east sides and butted against the kiva (Room 4). This unsooted room was never roofed nor fully enclosed but acts as an entry/open space area next to Room 4 (kiva). Seven Loop Holes (#1–7) penetrate the low east and south walls, which provide cooling breezes if one is lying down in the room and, while flat on the floor, are useful for limited views of the eastern ledge, canyon bottom areas, and potential fields. There are no discernible features in the adobe and bedrock floor. Refuse of charcoal, gourd fragments, corn cobs, and roofing rod fragments within the room have been gathered by packrat activities.

Room 4 (kiva): This rectangular space, 240–255 cm by 323 cm (7.8 m²) (Figure 26; Plates 32–34), may have served as an unusual above-ground square masonry kiva or kulu but has undergone several remodelings to prevent easy ground-level entry. It is a 2-story building, mostly intact, of massive walls 40–90 cm thick with a formal off-centered eastern doorway entry/tunnel roofed with *Populus* sp. lintels (FS 7–15). This is blocked by a thick secondary wall built across the interior, western side of the doorway entry wall. There are three massive east walls built against one another that cross the ledge entry point, which allows main access to most of the site, including the two habitation cavates located to the west. The two inner walls are, at best, only single-story in height but the outer wall, penetrated by numerous loop holes, rises to two stories and can act as a formidable barrier to unwanted access. The structure was burned and then rebuilt. Its innermost eastern wall was added after the room had burned; the high outmost wall had burned on the inside at the 2nd-story level.

Figure 26. 42SA 5819, 4 Shield House, Rooms 4–6. Original map by Claire Jones, Nicole LeBrun, & Christine Gilbertson, 21–22 July 2011.



Despite this hindrance, an 80 by 80 cm space was left open within the middle wall at the end of the doorwall entry so that one must climb up on the shorter interior middle wall top to gain access to the kiva interior, then by stepping across the innermost wall and down the slanting cliff face wall next to the sole pilaster located midway across the northern cliff face. The inner parts of the entry have burned but it is uncertain if this was caused by someone (historically?) building a fire inside the entry.

Remnants of two *Populus* sp. poles (FS 16–17), which once extended at an angle above and at each side but away from the inner top of the doorway (147–152 cm above the floor), are of unknown function. Two rectangular masonry niches are placed opposite one another in the gap left in the middle wall to help provide access up and out of the doorway tunnel end. This is a very unusual entry that can be easily defended. The entry from Room 3 is overlooked by nine small loopholes that penetrate the outermost two-story wall and two others in the 3rd, innermost wall, that blocks off the doorway tunnel at its west end, forcing an upward entry. The exterior masonry of the doorway reveals two tiny holes on either side that may have held willow branch loops in which to fasten a large door cover.

Plate 33. 4 Shield House, looking across Room 3 to the restricted doorway entry into the kiva (Rm 4). Note the many loop holes. Photo by Don Keller, ca. 2011.



Two burned-off *Populus* sp. primaries (FS 18–19) and three loose juniper poles on the floor below them (FS 29–31; sampled but did not date) suggest that the 1st story was roofed approximately 165 cm above the floor, leaving the 2nd story as an open space enclosed with high-walled parapets full of loop holes. There is no evidence of roofing, however, besides the two in-situ viga stubs and the three loose poles on the floor except for the lone pilaster opposite the primaries built against the cliff face. Two horizontal poles (FS 27–28), of piñon and juniper, in the southwestern corner masonry 175 and 185 cm above the floor, are inset into the walls. Each failed to date. Near the top of the 2nd-story south wall is a flat stone that projects outward 11 cm from the wall interior and may have been a small shelf about 35 cm wide.

The north kiva wall was the natural cliff face which slanted straight downward but then angled about 1 m up, precipitously outward towards the floor. Along the center was built a masonry block feature (about 55 by 60 cm) with two small rectangular masonry-lined boxes (niches) placed just below the flat top. It looks to be a pilaster with two niches and is directly opposite the two in-situ burned *Populus* sp. roofing-vigas (FS 18–19; 8.5 and 15.5 cm in diameter). Next to it on the slanting natural wall is a broken and burned triangular-shaped batten (FS 32; 4.5 by 8.2 cm long), possibly of *Populus* sp. like those found in the kivas at Perfect Kiva and Blue Man/Square Kiva.

In the southeastern corner, sloping downward from the floor is a ventilator blocked with stone. At the exterior opening is a vertical *Populus* sp. post (FS 20) set into the narrow ledge walkway below. No floor features are evident in the kiva.

The 2-story square room contains 17 loop holes (LH# 8–23; LH#25 failed to get on the map) penetrating its walls, most of them slanting downward from the interior to the eastern entry area from Room 3. There are more along the south walls of the kiva and Room 6 (see **Table 12**) that overlook a second route of access to the main occupied ledge beyond the kiva (see below). These holes are often found in defensively located features, such as the case here, and considered by some as evidence of warfare (e.g., Varien 2010:10; Kuckelman 2010:183). While most if not all of these here are useless for defense (see also Dean 2010:339), they do provide conduits for cool air flow into the structure—several of the crew noticed this affect during the hot July work days. Dean (2010:339), however, believes, at best, that they served as observation ports, “often commanding tiny fields of view.” In this case, it would have been easier just to stand up and look over the wall to obtain a complete view of the area. Most loop holes (4 of 35; 11%) are between 4 by 4 cm and 11 by 11 cm, and are rectangular in shape.

A narrow ledge that runs along the front cliff edge just a little below Rooms 3–6 can provide separate access to the main ledge by going around Rooms 3–5 and following the rooms along their precarious outside, which then gains a natural stepped entry up into Room 6 (**Figure 26**). This ledge has three intermittent juniper and cottonwood posts (FS 20–22) along one side pressed against the south wall of the rooms, but their function is unclear. Three juniper horizontal intramurals (FS 23–25) embedded into the walls also line this route, and more are found integrated into the low retaining walls that line the outer edge walkway ledge west to the East Cavate (in a fashion similar to that of the Ledge Runner Site [42SA 6654] in Natural Bridges). Below the ledge is a drop-off of 3 to 5 m.

Room 5 (Figure 26), 256–330 cm across and 370 cm long (10.8m²), was unroofed and bounded by two-stones-thick walls (50–65 cm) at the east and west ends, both with approximately centered doorways without tops. The wall along the outer ledge is of variable thickness, 23–30 cm, of scabbled masonry a single stone wide, with two horizontal intramurals (FS 24–25) of juniper and piñon, respectively, embedded along its western end, along with an oak post (FS 26). The slanting cliff face encountered in the kiva also forms the room’s north wall. No floor features are evident and there is no sooting of the walls. The west room wall has three loop holes (#26–28; Table 12) through it, with another in the south wall but missing on our map. None of these serve any observational purpose, where simply standing up provides the best viewsheds.

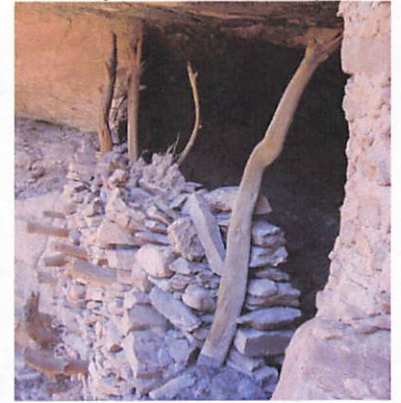
Plate 34. Inside of the kiva, south side showing loose roofing. Photo by Tom Windes July 2011.



Plate 35. Looking west across Rooms 4-6 toward the West Cavate & the doorway wall. Photo by Tom Windes, July 2011.



Plate 36. Looking east across the East Cavate retaining wall. Photo by Criss Swaim, July 2011.



Room 6 (Figure 26), 335 cm across and 225 cm long (7.5 m²), was also unroofed and bounded on the east side by Room 5’s thick walls and to the west by a poorly built masonry wall of little height, which does not extend north over the slanting cliff face as the cross walls did in the kiva and Room 5. This wall has no formal opening through it but it is easily bypassed. The high (213 cm) east wall has three loop holes (LH #26–28) through it. The south wall, 90–103 cm high, is similar to Room 5’s and has four loop holes (LH #30–33) through it.

Ledge Walkway (Figure 27). Beyond Room 6 to the west, the ledge walkway is lined along its outer edge with intermittent low walls of masonry or scattered stones along with clusters of embedded posts (FS 34–36, 40–41, 45–48, 50), supported in part by horizontal intramurals (FS 37–39, 42–44, 49, 51) that are of mixed wood species. Probably the entire ledge edge was once lined but much has since fallen into the canyon below. The ledge walkway area between Room 6 and the cross wall with a doorway entry to the East Cavate is 22 m long and 3 to 4 m wide between the outer edge of the ledge and the cliff face. Along the cliff face, the ledge is bordered by a varying meter-high deposit of reddish-brown caliche-adobe that wanders along in an irregular form. Several rock art panels on the cliff face above are concentrated along this area, including two painted shields. The three biggest painted shields (Plates 37–39) between here and the kiva are between 80 to 102 cm across and 96 to 260 cm above the base of the cliff face; all featured a design of parallel horizontal or vertical bars.

Figure 27. 4 Shield House, ledge walkway between Room 6 and the East Cavate (in 2 sections). Original by Tom Windes, Claire Jones, and Nicole LeBrun, 21 July 2011.

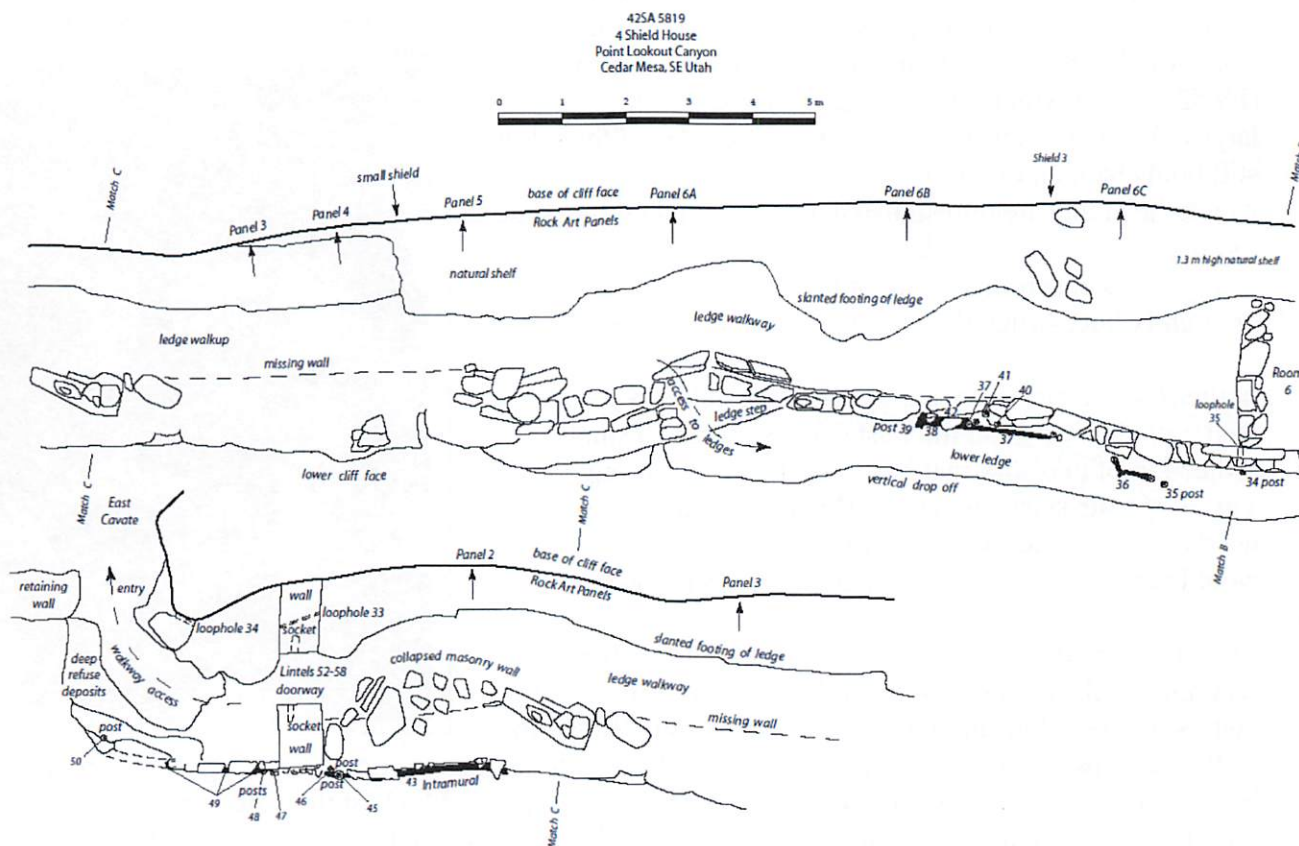


Plate 37. Shield 1 pictograph 80cm across & 260cm above floor in Room 4 (kiva). False color photo by Ben Bellorado, 5 June 2012.

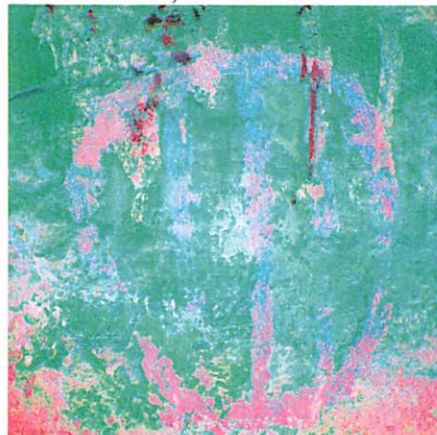


Plate 41. Shield 2 pictograph 96 cm across & above ledge 250cm in Room 5. False color photo by Ben Bellorado, 5 June 2012.



Plate 42. Shield 3 pictograph 102cm across & above ledge 240cm, just west of Room 6. Photo by Ben Bellorado, 5 June 2012.



Gateway Masonry Wall with doorway entry (Figure 27, Plate 35, far background; Plate 40). At the end of the ledge mentioned above is a high, 30-cm-thick masonry wall with a central doorway, 63 cm wide, that leads directly around the ledge where it corners into the East

Cavate. Two small empty masonry niches are in the door jambs opposite one another and Loop Hole #34 extends thru the north part of the wall at a horizontal angle, which is poorly situated for any observation of people. The doorway was roofed with six small juniper and one *Populus* sp. lintels (FS 52–58), of which five were tree-ring sampled. The largest dated at AD 1260++vv, a deadwood date although it still holds bark and presents a smooth outer-ring surface, which the author field-designated as a potential cutting-date sample. Given the 1260 date, I would consider that this element was cut from a dying or nearly dead tree at AD 1260 or slightly later, when the doorway and its wall were built.

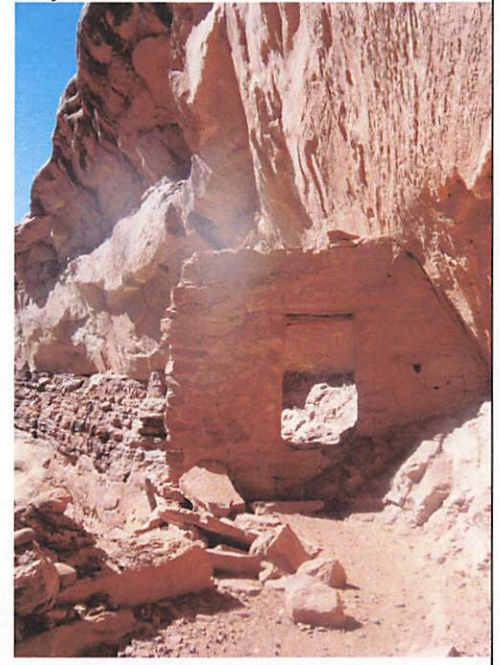
In the short distance beyond between the gateway masonry wall with doorway and the East Cavate there is a small projection of masonry that has Loop Hole #35 through it. This loop hole seems to have little visibility prospects as it is nearly inaccessible for where it has been placed. It is also would seem to have limited function for ventilation.

The final remains of the eastern walkway outer ledge retaining wall extends west from the doorway wall, a few meters before collapsing into the canyon below. Where the walkway turns into the East Cavate, there are deep cultural deposits of ash and vegetal materials but without any visible artifacts except for cordage fragments. Much of this, too, has collapsed into the canyon below, where the natural ledge borders a 2 m drop that eroded out during the formation of the cavate floor. The cavate retaining wall is built across the deeply eroded area, which slants downward towards the mouth and then vertically down over the outer cliff face far below.

East Cavate (Figures 28–30; Plate 41). This large smoke-blackened cavate, contains two prominent features: a high, intact retaining wall across the cavate mouth and a small granary built against the back. Lipe's 1976 survey form shows a stone ring (firepit?) centered just behind the retaining wall about 1.5 m but there is no evidence for floor features now aside from a couple of looters' pits shown on the Lipe map. Overall, the cavate reaches a maximum width of 760 cm (E-W) and 855 cm (N-S), ca. 55 m², from the retaining wall to the back of the cavate. The sooted ceiling generally is between 163 and 238 cm above the exposed bedrock and the work surface.

The **retaining wall** (Figures 28–30; Plates 41–42), rises 321± cm on the south side, where it rests on the slanting cavate bedrock near the cavate mouth. The wall is between about 70 and 80 cm thick where visible and about 6.5 m in length across the top, enclosing almost the entire mouth of the cavate. The top of the wall is about 170–190 cm below the rock ceiling but six poles built into the masonry extend above it, some almost to ceiling level that may have once been filled-in with masonry and wattle-and-daub, which has since fallen out. Presently, on the north interior side, the retaining wall rises between 136 and 145 cm above the intentional fill. On the south side, but hidden from view on the north side, are at least 41 horizontal poles, mostly of deadwood, that are inset, flush with, or that extend beyond the south wall face. The ends of

Plate 40. 4 Shield House, doorway entry into the East Cavate. Note ledge retaining wall along left side & post stub FS 45. Photo by Nicole LeBrun, July 2011.



these logs are probably anchored into the sloping cavate bedrock floor that rises quickly behind the retaining wall, where intentional fill, about 160 cm in depth along the wall interior, has helped level the work area.

Figure 28. 4 Shield House, East Cavate plan view. Original map by Nicole LeBrun, Claire Jones, Tom Windes, & Criss Swaim, 20 July 2011.

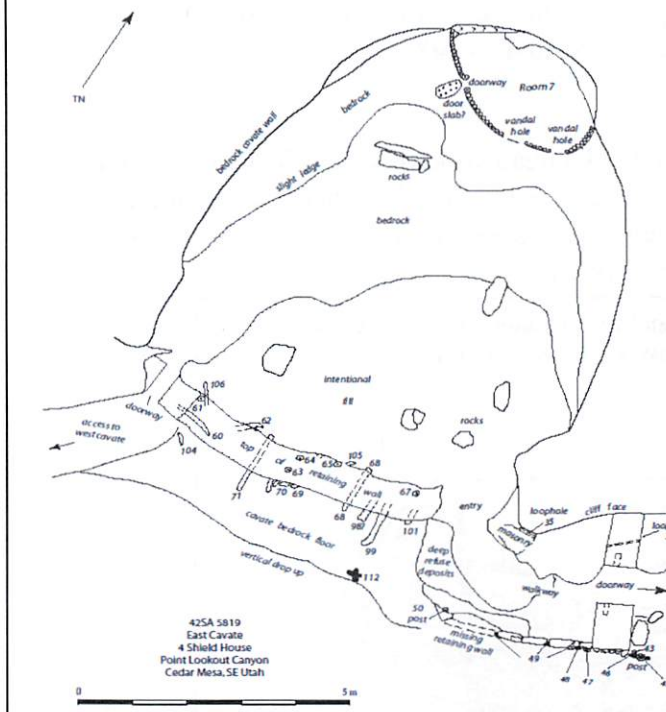


Plate 41. The East Cavate, looking southwest from inside. Photo by Christine Gilbertson, July 2011.



Figure 29. The 4 Shield House, East Cavate retaining wall, looking north at the outside elevation. The wood is in black. Original map by Ben Bellorado, 4 June 2012.

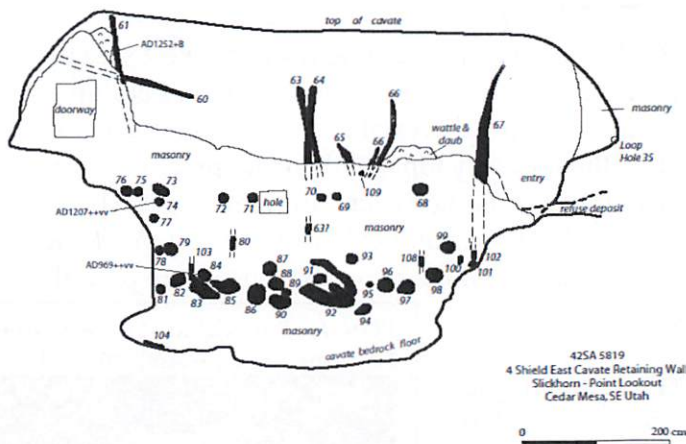
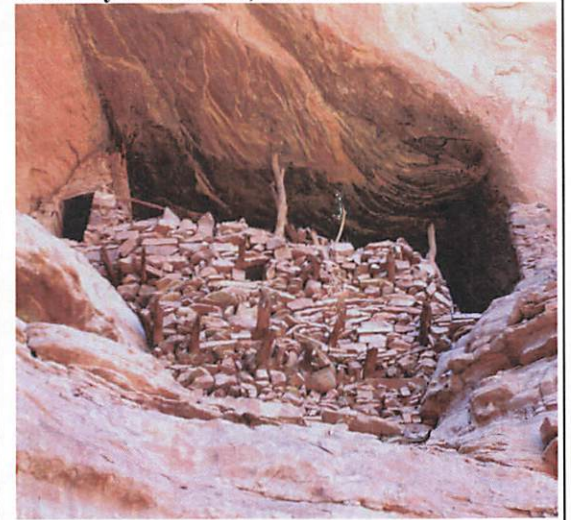


Plate 42. East Cavate retaining wall exterior. Photo by Don Keller, ca. 2011.



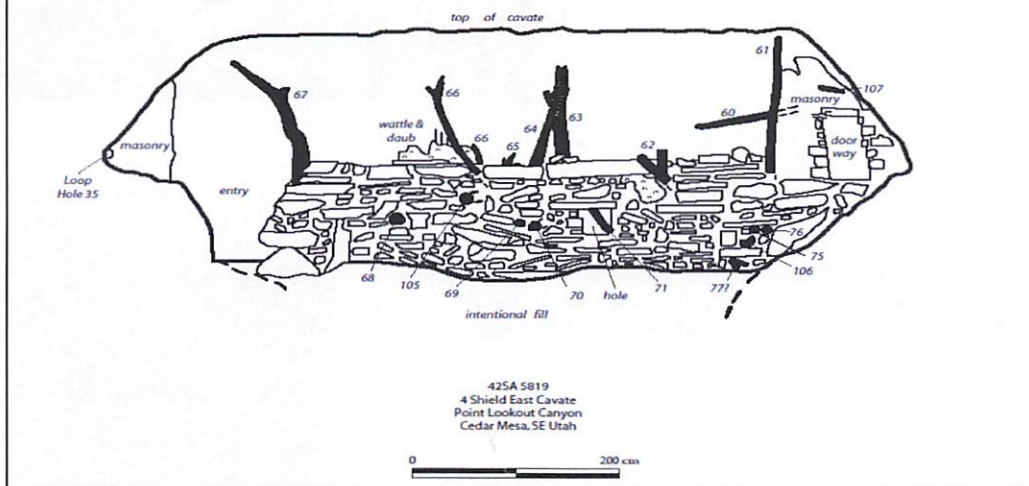
The area behind the wall is filled with dark sand and refuse deposits that helped level the use area. The fill was scattered with corn cobs,

squash rind fragments, charcoal, small stick fragments, and stones, probably gathered mostly by packrats. The fill is between 136 and 145 cm below the inside (north side) of the wall top, allowing easy visibility inside to the canyon and arroyo area below and probable fields, but not if the wall originally was much higher. There is no formal flooring.

The retaining wall structural wood. Overall, we recorded 52 pieces of wood in the wall (FS 60–111) and sampled 14 of them (27%), five with bark. These comprised the biggest (e.g., up to 20 cm in diameter) pieces of wood on site and there was much piñon (36), a promising species for dating, along with 13 of juniper, almost all of them posts. Nevertheless, most appeared to be harvested from dead trees because they were much-weathered and many exhibited beetle galleries, although a small number still retained some bark. Fifty-one percent suffered from some burning, as might be expected from lightning strikes and small forest fires of downed wood. Most of the pole ends were broken and none exhibited ax-work, which attests to their collection as deadwood.

Three dated (21% success of those sampled); one yielded a deadwood date at AD 969++vv, but two dated in the 1200s. One was also deadwood at AD 1207++vv but the other, a 7.3 diameter post in the east end of the wall, is a near-cutting or cutting date with bark: AD 1252+B. This marks construction of the wall by AD 1252 if not shortly afterwards.

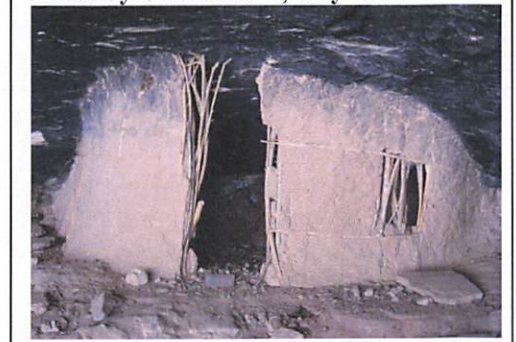
Figure 30. The 4 Shield House, East Cavate retaining wall, looking south at the inside elevation. The wood is black. Original map by Criss Swaim & Christine Gilbertson, 21 July 2011.



A **masonry doorway** (Figures 28–30; Plate 42), 35 cm wide and leading from the west side of the cavate to the access ledge that extends at an angle of 227° to the West Cavate, was built in the west end of the retaining wall. The doorway masonry nearly reaches the rock ceiling and is heavily sooted on its interior. A stone lintel forms the doorway top and there are pieces of wood stuck in the masonry enclosing the doorway, including a small horizontal intramural (FS 107; sampled in June 2012) above the doorway. A long pole (101+ cm; FS 60) extends out from the doorway masonry over the retaining wall, 30–42 cm below, which may have once been part of the upper section of the missing part of the retaining wall.

Room 7, the teardrop-shaped granary (Plate 43) in back of the East Cavate, 237 by 233 cm inside (ca.4.3 m²), is built of wattle and daub. Two holes are broken through the 9–12-cm-thick walls, apparently by vandals, but the small doorway is intact, as is the remaining structure. The walls are upright willows, jammed side-by-side, with cross-lacing to hold them together, and then covered with a layer of exterior adobe. The

Plate 43. East Cavate granary (Room 7). Photo by Criss Swaim, July 2011.



built walls reach the slanting sooted bedrock ceiling, a maximum of 105 cm above the floor, negating the need for a built roof.

Access between the East Cavate and the West Cavate. This is a badly eroded narrow irregular ledge access (**Plate 44**) that leaves from the East Cavate's west doorway and proceeds roughly southwest for about 30 m, where, then, one must crawl up the eroded cliff face deposits into the West Cavate. I have not yet done the final crawl-in yet, so information regarding the West Cavate is not available except that it is very similar to the East Cavate with a massive retaining wall, with embedded wood poles across the front (**Plate 45**), and a small granary (**Room 8**) in the back. There is a masonry tower-like structure (**Room 9**) at the far entrance to the cavate with two long poles extending out from the top exterior wall over the cliff face. This structure prevents safe access to the remainder of the site along the western, south-running cliff face.

Plate 44. The weathered cliff ledge access from the East Cavate to the West Cavate. Claire Jones lounging along the access ledges (right center). Tower room in the West Cavate at top center. Photo by Nicole LeBrun, July 2011.

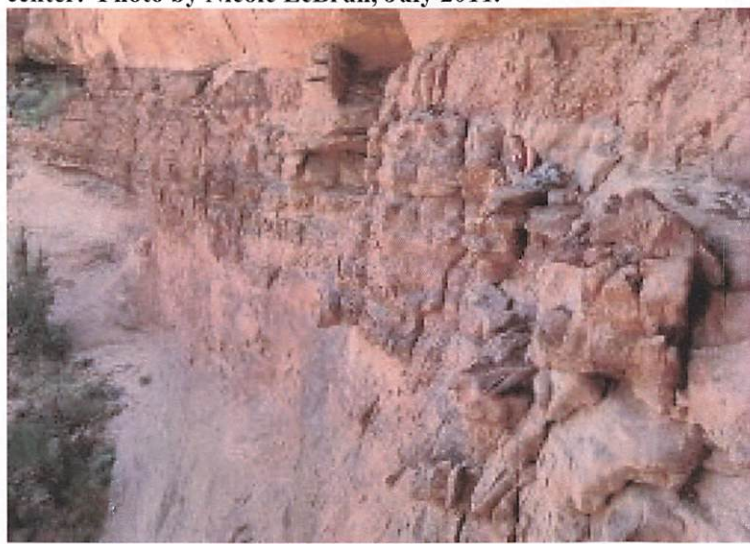
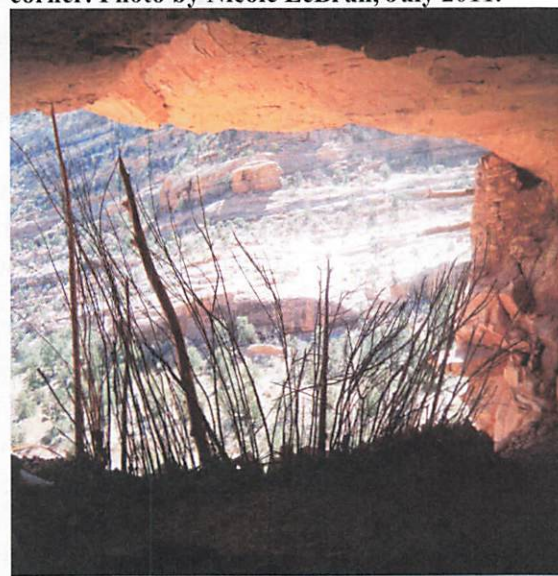


Plate 45. West Cavate looking out from the inside. Note tower-like room in right outside corner. Photo by Nicole LeBrun, July 2011.



West Cavate (Plate 45). There is little to report on this feature because no work has yet been done in it. It appears to be very similar to the East Cavate except that the retaining wall was made of upright slabs and adobe plastered over a few stout wood vertical poles and batches of willows (jacal). There is a small granary (**Room 8**) in the back of the cavate and a tower-like structure (**Room 9**) that prevents further passage from along the far western ledges. Access into the highly sooted shelter was either through the East Cavate or from below by ladder, where the cavate floor is a little more than 2 m or so above the stepped eroded ledges that lead up into the cavate.

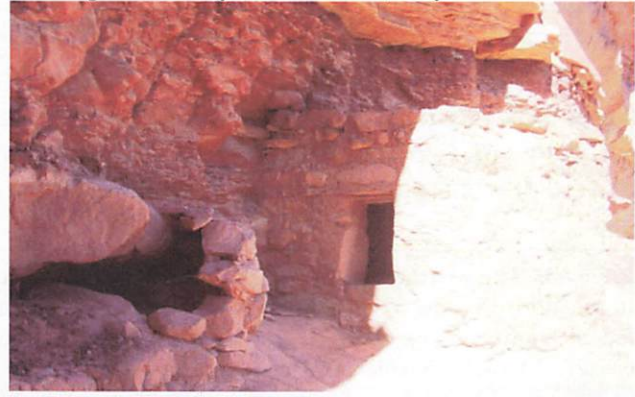
Room 10. A small storage room built along the cliff face past the West Cavate exhibits an exterior off-white-colored plaster that blends in with the surrounding cliff face rock. A number of Basketmaker III images above the room (**Plate 46**) suggest that the room may be Basketmaker in origin, as does its architecture, which contrasts with other masonry features at the site. The structure is a narrow rectangular room with wattle-and-daub southeastern and northeastern walls. Six internal jacal posts of juniper, *Populus* sp., and possibly oak, support the east wall framework, along with a piñon horizontal intramural tied to them (FS 124–130). A

small doorway in the northeastern wall with two small juniper lintels and posts supporting the adobe jambs (FS 120–123) is intact. A post and lintel were sampled in June 2012 but remain unanalyzed. Documentation of the room is incomplete.

Plate 46. BMIII images above storage Room 10. False color photo by Ben Bellorado, June 2012.



Plate 47. Room 12 and a small storage structure under the ledge. Photo by Tom Windes, July 2011.



Room 11. This storage room is undocumented but lies between Rooms 10 and 12.

Room 12 (Plate 47). This intact rectangular masonry storage room, 76–111.5 by 195 cm (ca. 1.9 m² and about 117 cm high) along the same ledge as Rooms 10 and 11, is temporally Pueblo III. Six stout juniper (2) and *Populus* sp. beams (FS 140–146) support the roofing, which are overlaid with closely-packed willow or *Populus* sp. closing rods set perpendicular to the beams. The closing-rod matting is tied to two of the beams with 10 yucca ties. Some beam ends are exposed in the wall exteriors and five had been freshly-cut, exhibiting stone-ax-cut ends. A thick layer of adobe seals the roofing. One tree-ring sample was collected in June 2012 but remains unanalyzed. A doorway in the southwestern wall is lined with stone. Documentation of the room is uncompleted. A used core is found inside the room.

More rooms. Just before the cliff face steps back some distance from Room 12 and then continues southwest to its furthestmost point, before turning 90 degrees northwest to parallel the canyon arroyo, are the scant remains of a few former masonry rooms (2–4?). This area beyond Room 12 provides a relatively broad sand-filled embankment on which the rooms were built. Little is left of these rooms and they were robbed of masonry. These are to be documented and mapped in 2014, hopefully completing work at the site.

Structural Wood Summary: There was much structural wood in this site: 50 (45%) juniper, 38 (35%) piñon, 25 (22%) *Populus* sp., and possibly 1–2 oak (1–2%), and a Douglas-fir (1%) (Figure 31). Thus far, 122 elements of structural wood have been documented (not all with the species identified) for the site and 26 sampled for tree-ring dating (19% of the total; Table 13), although four additional samples have since been taken (30; 22% overall).

There are few observable ax-cut beam-ends (13; 1% of the total; Figure 32) at the site, with five in Room 12, partly because many of the pole ends used in the various retaining walls at the site are hidden from view by masonry or by intentional fill. The largest group of elements, the 47 tie-logs embedded in the East Cavate's retaining wall revealed only broken (47%) and/or burned-out ends (51%), plus 1 rotted end (2%), attesting to their deadwood origins.

Figure 31. 4 Shield House, structural wood species use (N=112). Graph by Eileen Bacha, 2014.

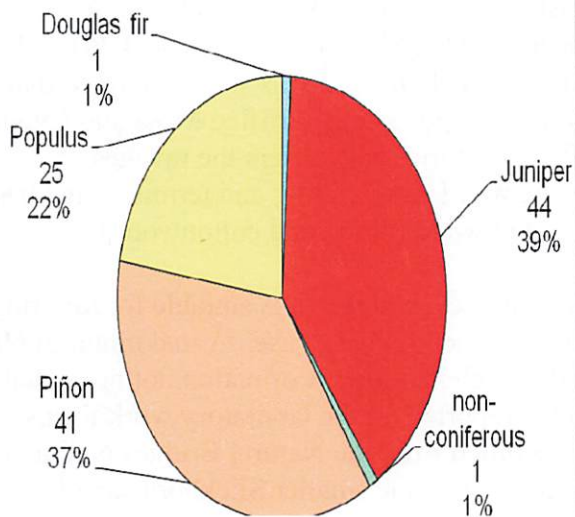
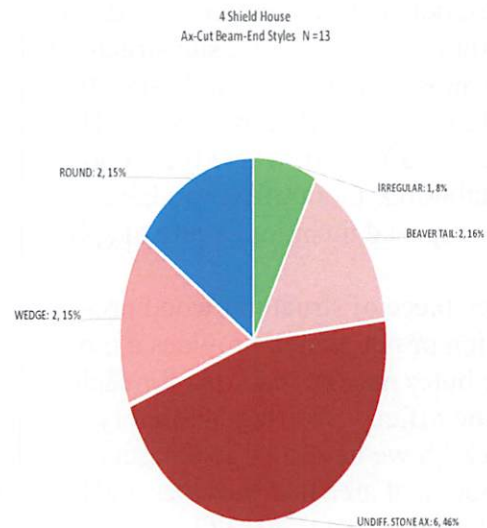


Figure 32. Stone-ax-cut beam-end types of structural wood at 4 Shield House. Graph by Eileen Bacha, 2014.



Although little roofing was left in the Room 4 kiva, an array of horizontal roofing stubs, some carbonized, were sticking out of the walls, but none dated. Also failing to date are 3 loose juniper poles within the room, presumably former roofing elements (FS 28–30). The wide ledge west of the kiva had fragments of retaining walls built along its outer edge supported by an array of deadwood piñon intramurals within or underneath the masonry walls, as well as several upright juniper posts built into the retaining walls. To the west, both cavates had substantial masonry retaining walls built across the front with many horizontal tie poles embedded in them to anchor the retaining wall to the presumed slanting-floor alcove behind them; few are suitable for dating. Along the western cliff face are two granaries with intact wood and adobe roofs and several other undocumented structures. The willows used in these probably were once freshly-cut but are too small and with too few and complacent rings to be tree-ring dated.

Material Culture: An extensive search of the site, including the adjacent rock benches and bottomlands, revealed some cultural material. Sixty-two ceramics were tallied, which are dominated by unclassified indented corrugated body sherds (31; 50% of total). There is also a McElmo Black-of-white jar sherd and several small carbon-painted sherds that are either McElmo or Mesa Verde Black-on-white (12; 19%), and 5 (8%) Mesa Verde Black-on-white, along with 2 (3%) unclassified Tsegi Orangeware. These temporally agree with the mid AD 1200s tree-ring dates. Perishable cultural items, such as yucca ties, are fairly abundant.

Chipped stone is rare (6 flakes) but there is a single limestone pecking stone and one core. In Room 3 was a pendant broken across the top through its drill hole, along with a second pendant fashioned from a Tsegi Orangeware sherd. Roughly 120 corn cobs were noted in East Cavate along with many gourd rind fragments and peduncles, and one squash seed, and another 80 corn cobs in the Room 1 cist and 25 more in Room 3. Two yucca cordage fragments were also noted, along with several square-knotted yucca strands or ties in Room 3. Outside the East Cavate east entry behind the ledge retaining wall (near post FS 45), refuse is prominent and includes four fragments of turkey feather cordage.

2011 Project Discussion

The 2011 Wood Project documented 492 pieces of structural wood visible on the newly visited sites, not counting another 112 documented previously documented at Horse Collar Ruin in Natural Bridges. More site structural wood was documented at Slickhorn in 2012 and 2013. For the most part, all the visible site structural wood was recorded unless it was so deteriorated that little was left of its former size. This is particularly true in open sites (Fortified Mesa and Citadel West/42SA 5810) where the wood has lain exposed for centuries and suffers the ravages of weathering, foot traffic, vandalism, sunlight, bugs (like wood bees), fungi, and termites, that has decomposed them into a pile of splints (juniper) or rotted wood (piñon and cottonwood).

Each piece of structural wood present on a site is documented, whether it is suitable for tree-ring dating or not, which provides a more realistic picture of structural wood use. A maximum of 69 attributes may be recorded for each element of wood, which includes information not presented in the official tree-ring laboratory analysis report but is reported on the laboratory work forms. Luckily, we have a large dataset of structural wood recorded from the Natural Bridges National Monument area that provides a collection in which to compare the smaller Slickhorn sample collected in 2011–2013 ([Table 14](#)).

The most abundant structural wood remains are found in kivas, which typically utilized between 50 and 150 pieces of structural wood for construction. Much of the structural wood procurement was obtained from deadwood (see below), particularly in the lower elements used for the cribbed kiva roofing and its walls. Deadfall wood was probably plentiful in the area, when centuries prior to the constructions, little or no occupations occurred. Stumps, dead trees, including their root balls, and lightning-struck or fire-burned trees provided much of the construction resource materials. Many elements revealed burn spots, burned sections along their exteriors (but not extensively burned), and/or burned-off ends, a further testament to their deadwood origins. This finding was similar to coeval occupations in the 1100s and 1200s within nearby Natural Bridges National Monument at the northern end of Cedar Mesa just below the southwestern side of the Manti-LaSal National Forest, Monticello District. There are few obvious stone-ax-cut beam-ends evident in the sample; are stone axes rare in field collections from this region (except at the Edge of the Cedars Museum and in private collections such as Huck's in Blanding), in part due to looting activities and casual finds? Still, it is clear that ax-cutting for structural wood procurement was rare in the Slickhorn and Natural Bridges area.

The analysis of the structural wood at Slickhorn provides insights into wood selection and potential impacts upon tree-wood resources. Much has been made regarding the detrimental impacts to the local environment in regards to wood usage (e.g., Adams and Boyer 2002:134, 141–142; Kohler and Mathews 1988; Windes and Bacha 2006:1174), which often focuses on firewood. This study provides an in-depth focus on all pieces of structural wood still present in prehistoric sites (except for very rotted pieces) that we have studied on Cedar Mesa, not simply those sampled for tree-ring dating.

We cannot assess the impacts to live trees without some knowledge of harvest tree preference, procurement of live and dead trees, and the structural timber reuse. Tree-ring dates provide some information regarding the presence of deadwood but a closer examination of the structural wood documented for this project is more informative ([Table 14](#)).

Use of Different Tree Species. The three most abundant tree species (*Populus* sp., juniper, and piñon) used at both Natural Bridges and Slickhorn for construction reflect their similar present-day relative abundance in the two areas. *Populus* sp. (cottonwood) was in use at about the same relative frequency in both locations, but was more popular in use among structures built along the lower reaches of the canyon bottom cliffs (Figures 33–34)—undoubtedly because of its close proximity along the canyon bottoms (and not on mesa tops) and a paucity of adequate straight-stem trees in the canyon bottoms. The relatively highest incidence of stone-ax cutting occurs with *Populus* sp. Unfortunately, it is useless for tree-ring dating and is not normally used for roofing construction unless more desirable, straighter species are rare or absent. Its nearest *Populus* sp. family member, aspen, is some distance away (20± miles?) and is unlikely to be present in the Slickhorn area. (Special laboratory analyses are often necessary to distinguish between them when the bark is gone; i.e., Tennesen et al. 2002). Douglas-fir occasionally is used in construction, most often in and around Natural Bridges; some of its nearest stands near Slickhorn are in the upper reaches of Grand Gulch and Kane Canyon (Lipe et al. 1977:56).

Juniper is most often used in overall construction in both areas, while piñon use overall is greater at Bridges but drops sharply at Slickhorn, where *Populus* sp. use exceeds it. At Bridges, piñon is the most dominant species used for structures along the canyon bottoms. This may be the result of the more mesic conditions around Natural Bridges.

In other cultural areas, piñon is seldom used for structural wood (except during Basketmaker III and Pueblo I), probably because of its greater value for other uses. It is a weaker wood in its resistance to natural deterioration, insect pests, and strength. But, the widespread use of piñon at Natural Bridges may result from a greater accumulation of deadwood in the area after centuries of limited long-term habitation of the area, before increased habitation longevity in the late Pueblo II/early Pueblo III period (McVickar 2001:73, Figure 6.11). The use of deadwood is supported by Natural Bridges' general lack of stone-ax-cut limbs and beam ends and its frequently burned elements in our large structural wood sample (Table 14).

Figure 33. Wood species use in the Slickhorn Canyon area.

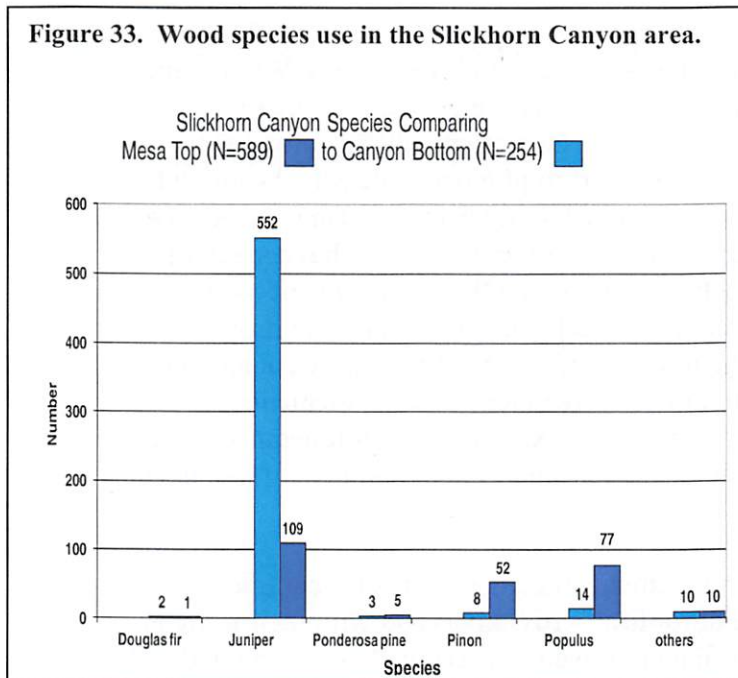
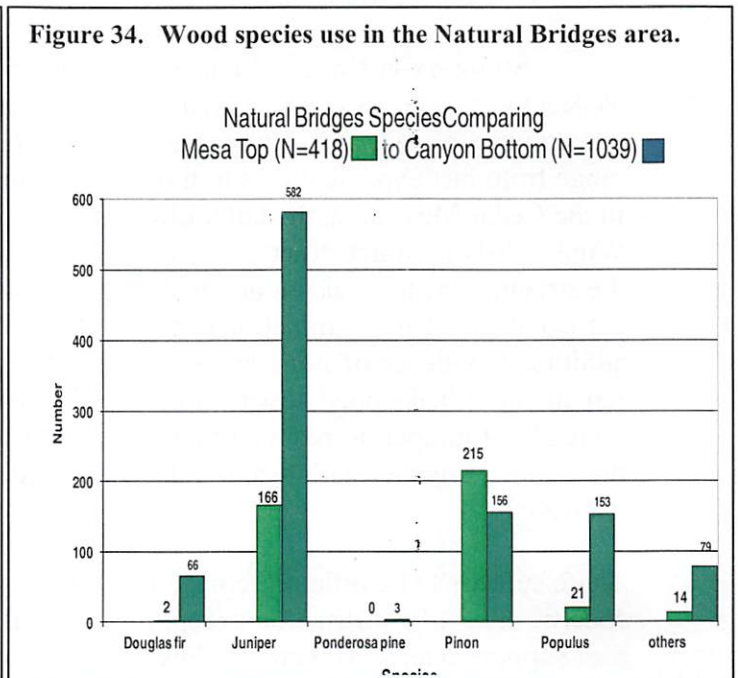


Figure 34. Wood species use in the Natural Bridges area.



Natural Bridges is just below the flanks of a mountain and gets more precipitation than Slickhorn, allowing a greater percentage of piñon to exist along with the presence of higher elevation conifers (ponderosa pine, Douglas-fir) and aspen, which are carried down from the canyon heads from the Bears Ears area during flooding. The average modern rainfall at Natural Bridges is 12.9 inches (328 mm; through 2012; www.ncde.noaa.gov/cdo-web/quickdata) and about the same along the north end of Cedar Mesa, but it decreases at the far south end of Cedar Mesa, near Slickhorn, to about 10 inches (254 mm; Fast 2012: 4). There are fewer piñons towards the south end and, from our tree-ring sample, more erratic growth. Conditions were above normal, however, between about AD 1190 and 1235, with smaller peaks between AD 1250 and 1280, based on the Palmer Drought Severity indexes for the Bridges area (McVickar and Eininger 2001:Figure 2.12). This is when the Slickhorn houses were constructed. Wright (2010:Table 4.1), using tree-ring dates to reconstruction paleoclimate at Natural Bridges (but perhaps not using the samples obtained in more recent years) show a drier Natural Bridges between AD 1000 and 1400, when the mean precipitation was only 9.24 inches (235 mm). This would mean even drier conditions in the Slickhorn area.

Across the Central Mesa Verde Region, juniper is the dominant species used during the puebloan period and used almost exclusively in the late AD 1100s and early 1200s (Varien et al. 2007:297–288, Figure 6), impacting the local woodlands to a lesser extent than earlier occupations. But *Populus* sp. is little used in the central area for construction, while ponderosa pine is the third most-used species after juniper and piñon (Varien et al. 2007:287) because of its abundant use in the subsample from the Dolores Archaeological Program, where ponderosa pine was locally available.

Tree Element Selection. Evidence for exterior condition, ax-cutting marks, burns, limb removal, beam-end condition and treatment, insect damage, and rot are documented for each piece of structural wood to assess its origins from deadwood and live-cut trees, as well as for reuse and damage from fires.

Stone-ax-cutting Evidence. Various styles of ax-cutting of beam-ends (see Windes and McKenna 2001) are evident in many of the structural elements. These provide testimony of human procurement of live trees and the effort taken to secure these elements, as cutting may range from fast expedient cuts to those that require more effort to produce a pleasing beam-end. In the Cedar Mesa area, the latter effort is rarely made for nicely-cut beam ends (in contrast, see Windes 2010). Intact structures, however, such as the kiva at Perfect Kiva, may have many of the structural beam-ends hidden within the construction, minimizing the percentage of total ax-cut wood use. But examination of the cut limb removal for each element, if any, can provide additional evidence of stone-ax use. Sometimes the juniper limbs are only partially cut and the remainder pulled/ripped downward and off. Finally, there is treatment of some elements, typically of juniper, to reduce irregularities and limb bumps by axing-off the protuberances. All these traits, together with beam-end cuts, provide evidence for the minimal numbers of live trees harvested.

There appears to be little preference for stone-ax-cut elements (i.e., use of freshly-cut trees) in specific areas of construction except for the final flat roofing across kivas and with their primary roof support beams. If there is a lower cribbed roofing employed, it is typically of deadwood.

Overall, stone-ax-cut structural elements are rarely piñon (Table 14) but common with juniper and *Populus* sp. (cottonwood) within the two study areas. It is most common for cottonwood elements but exceeded in numbers by juniper. *Populus* sp. was stone-ax-cut in over 45 percent of the overall *Populus* sp. sample in both areas, showing that live cottonwoods, a poor structural wood, frequently contributed to the structural elements used in construction but that it was considered less valuable than piñon and juniper for other needs. Considering the wide spacing of houses in the canyons, however, there may have been little overall detrimental impact to growth of cottonwoods along the canyon bottoms.

The frequency of stone-ax-cutting ranges between a minimum of 24 percent of the total at Natural Bridges and 35 percent in the Cedar Mesa area, which provides some indication of the relative importance for the use of deadwood in the region. While deadwood has been utilized in large quantities for construction across Cedar Mesa, this material is generally acknowledged as uncuttable with a stone axe (Haury 1931: 1931:13; Kunkel 1998:37, 39; O'Bryan 1949:155). Despite this axiom, there is a low amount of stone-ax-cut wood that also exhibits burns at Slickhorn but much higher amounts (from reuse or deadwood?) at Natural Bridges.

Use of Deadwood. During documentation, the author classifies deadwood whenever an element is badly weathered and cracked when located in sheltered areas, has lots of beetle-galleries, and/ or has been burned. Generally for our project, wood in this condition is ignored for tree-ring sampling unless there are few other potential samples worth dating. In the case of piñon, the low rate of stone-ax-cutting and the high frequency of burns and beetle galleries (over 50%) within the overall piñon sample supports that piñon timbers were rarely cut from live trees; at Slickhorn it is barely 19 percent; conversely piñon is one of the best species for tree-ring dating. Although piñon is widely used for fuel, it may also have been selected primarily from deadwood, preserving the live trees for valuable piñon nuts, sap, and future deadwood use, among other things, as well as the nutrients provided the soil from its needles and deadwood decay. For instance, traditionally at Zuni Pueblo, only deadwood piñon was gathered for firewood (Miller and Albert 1993:75) but this pattern has changed in recent years as live trees are now going under the ax and chain-saw (Peter McKenna, BIA archaeologist, Albuquerque; personal communication 2005).

The low frequency of stone-ax-cut trees suggests that most structural elements were collected as reused or deadwood. There is little structural evidence of earlier sites near the sampled sites at Slickhorn, so that reused timbers appear to contribute few elements to the sample there. Reuse may be more common among the Natural Bridges sites. Interpreting the use of deadwood is complicated. The tree-ring laboratory uses a “++” before the terminal date to designate closely compressed rings within the outer part of a sample, which reflects a lengthy diminished growth of an impaired tree, leading to death (see Ahlstrom 1985:56–57, 614–617). This is because the outermost ring cannot be dated when there are many closely compressed rings, within which there may also be many missing rings (Ahlstrom 1985:34–36, 56). This condition is commonly considered by laboratory personnel to mark deadwood.

Some deadwood dates in Figure 35 below (excluding the early ones from the granary sites) are included because they date within in the same period as normal cutting and near-cutting dates. Deadwood dates are often dismissed as irrelevant for dating construction. Their lack of useful temporal interpretation from deadwood dates, however, is not always true. If the element has only a few growth rings, than it may be possible that only a few rings might be missing within

the compressed band and that the given date is close to when the tree died (Ahlstrom 1985:36).

Large samples from Chacoan greathouse constructions (e.g., Windes 2010:90) have shown that harvesting for construction timbers allowed for the rare selection of deadwood only when it was less than 15 years or so earlier than the actual harvest year(s). But greathouses may be a special case. Nevertheless, in our case here, the deadwood dates tend to cluster among the more reliably-dated samples, indicating that they were harvested at or near the tree's natural death in concert with the harvesting of live trees.

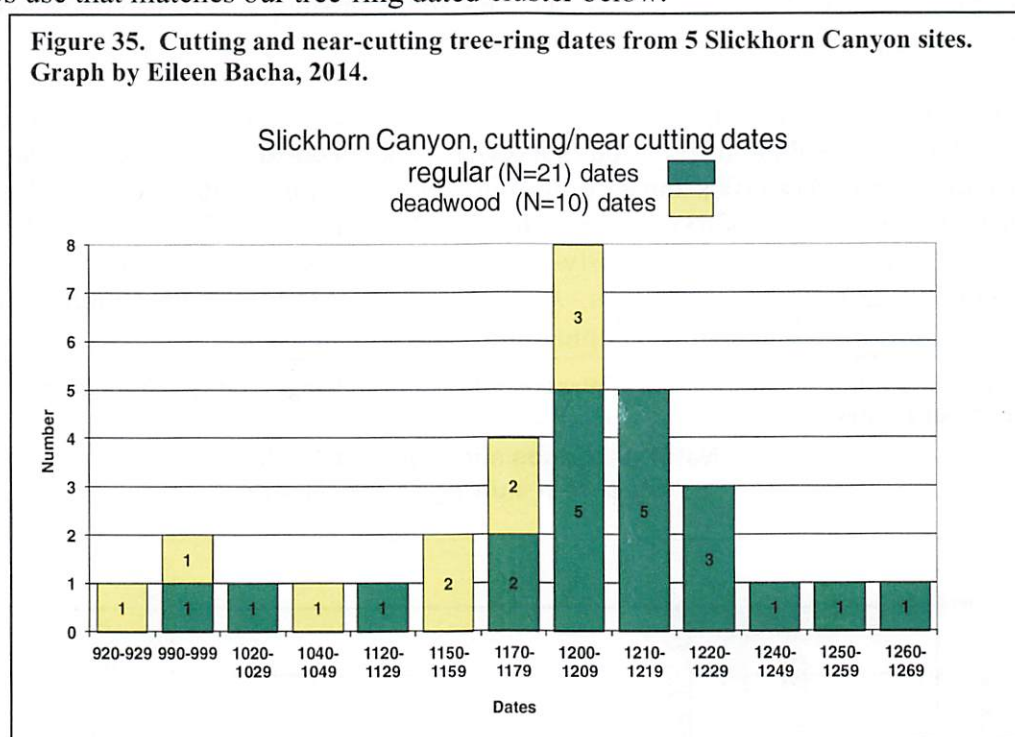
Surprisingly, the prolific use of deadwood also applies to juniper, which shows a low incidence of stone-ax-cutting and moderate incidences of burning and beetle galleries (Table 14). Beetles attack dead and dying trees, as we have seen across the Colorado Plateau during the recent droughts, especially for piñon, but they may also attack freshly-cut trees used for construction, particularly if the bark is left on. The latter may explain why there are some stone-ax-cut elements with "deadwood"-appearing attributes for beetle galleries but it does not explain why so many stone-ax-cut elements are burned. The latter do not appear to be from house fires or cultural activities but rather from small forest fires that leave element ends burned and spot burns along the sides. Seldom does an element display extensive charring. A burned beam-end is common but often is stone-ax-cut at the opposite end. It is uncertain how these two different beam-end conditions exist together, but I do not believe that it marks tree felling by burning.

Burned-out limb stubs are not included in the overall burning evidence for structural elements. Burned limb stubs are most common with juniper in both study areas and this trait has been observed during our work across the Colorado Plateau. But typically the surrounding surface is unburned. It is very difficult to remove juniper limbs without leaving remnant splinters. This may also be true for cottonwood but not piñon, which breaks cleanly across the grain with little effort. It is possible that these nagging limb remnants may have been burned off over a fire as part of element preparation before the bark was removed. At Slickhorn, over half (56%) of the juniper with burned-out limb stubs is associated with evidence of stone-ax treatment but only 35% at Natural Bridges. More telling is the complete absence of other associated burning: 59 percent at Slickhorn and 51 percent at Natural Bridges. While not all burned limb stubs may be attributed to direct human action, certainly much of it was for removing the broken splints. Such behavior was absent in the Slickhorn sample for piñon and cottonwood but, inexplicably, was 9 percent for piñon at Natural Bridges.

Bark on Structural Elements. Within the two project areas, bark was commonly noted on elements but mostly applied to *Populus* sp. use. Bark adhering to piñon was rare, which might be attributed to its loss as deadwood exposed to the elements and beetles rather being left on after construction. But it is unknown why bark is left on in some structures and removed in others—whether its presence served some functional or other use, whether it is a cultural habit, or just less time-consuming to build. It may provide a gauge of the anticipated longevity for site use with short occupations marked by less labor efforts during tree harvesting and construction (i.e., collection of deadwood and lack of element preparation). During our work in Mesa Verde National Park, few structural elements were noted with the bark left on unless they were used as door lintels and wall pegs. For dating, the presence of bark (a "B" symbol following the outer date) is considered the most reliable indicator of the tree-death occurring at the given terminal date unless a symbol of "++" is also given.

On juniper, however, bark often remains for a very long time in the recesses where removed limbs once protruded from the stem. In the field, these are noted as having “limb bark” but samples are seldom taken within the recesses, so that these do not contribute to “bark” dates unless the sample is extracted through bark elsewhere on the element. Typically, core sampling causes the bark to fall off, where its remains are sometimes not evident during laboratory analysis; thus, noting bark and other characteristics of the core and its surrounding surface during sampling is invaluable for reappraising the later laboratory results.

Tree-ring Dating: Unlike Natural Bridges, tree-ring dating success was poor in the Slickhorn area probably because of the poorer response of trees to the drier environment at the lower southern end of Cedar Mesa (making growing conditions for juniper and piñon more erratic) and the prevalent use of non-datable *Populus* sp./cottonwood. Despite the collection of 200 tree-ring specimens, only a meager 37 dated (19% success) from five sites, including a number of deadwood specimens. Cutting and near-cutting dates help to narrow the primary period of site constructions among our small sample at Slickhorn (Figure 35). Of the four sites with cutting and near-cutting dates, Perfect Kiva (42SA 5795) provided the vast majority (n=22). Nevertheless, these help place site constructions into a tighter framework than is possible with only the on-site but often sparse ceramic assemblages. Of the eight sites investigated in 2011, six produced tree-ring dates but two of these yielded only deadwood dates, which do little for their site temporal construction placement. One of the largest sites, Blue Man/Square Kiva (42SA 29514), failed to produce any tree-ring dates, although its late ceramics indicate an early AD 1200s use that matches our tree-ring dated cluster below.

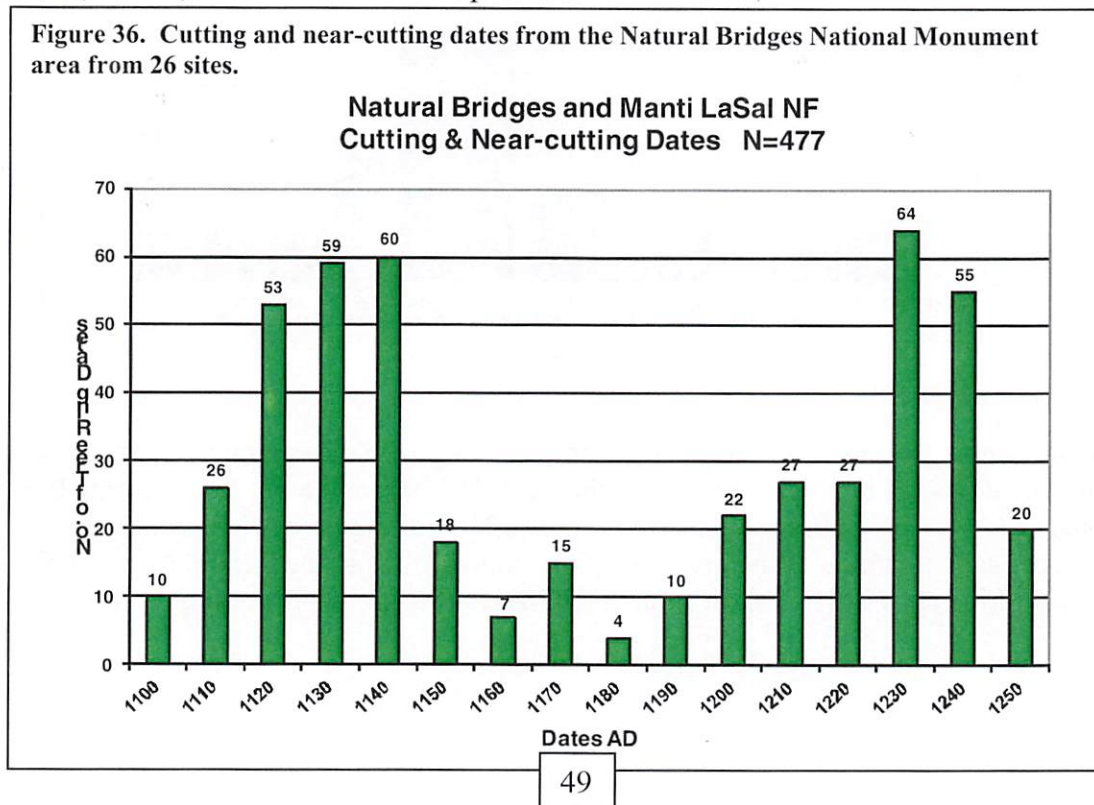


Site Occupation. The small tree-ring-dated sample, along with the ceramics, boost support for construction and use of the Slickhorn sites in the late AD 1100s and early 1200s during the Woodenshoe (AD 1165-1210) and Red House (AD 1210-1270) phases. Migration into the Slickhorn canyons is similar to the increased population growth in the Central Mesa Verde Region (e.g., Lipe et al. 2010; Varien et al. 2007:289), although it appears slightly earlier in the

Slickhorn and Natural Bridges areas, as it also does on Mesa Verde (Windes 2003), at Aztec Ruins (Brown et al. 2008:244, Figure 12.2), and across the interior San Juan Basin. There is some evidence in the canyon cliff shelters of a Basketmaker occupation at Perfect Kiva, Blue Man/Square Kiva, and 4 Shield House, an occupation that dominates the Slickhorn mesa tops (Lipe, Matson, and Powers 1977:43, 48, 67). The late occupation, however, may be a short one with depopulation afterwards, perhaps to the Central Mesa Verde Region (e.g., Glowacki 2010:211; Lipe et al. 2010), which experienced increased population prior to the later widespread depopulation (see Lipe et al. 2010) during the mid- to late AD 1200s.

All of the habitation sites reveal use by a single family or domestic unit or two except for Tadpole House (42SA 5814) in Slickhorn #4, which may have been occupied by three to four or more domestic units and several kivas. It is the largest cliff ruin in the upper Slickhorn Canyon system, has multiple kivas and a possible communal structure out front on an open area of bench, separate from the adjacent estimated 25 to 35 cliff structures—its documentation remains uncompleted. We have documented almost all of the habitation within the upper reaches of Slickhorn and Point Lookout canyons that we know of (except for Polly's Kiva, 42SA 5811, in Slickhorn #4), which provides some idea of the local canyons' population size. Each domestic site has a kiva or kiva-like structure, with a total of 8 to 9 from our five sites. Estimating the number of habitation rooms is more difficult because they have less obvious definitive architecture and space, and few reveal floor features or even sooting, but their estimated numbers (10–12) are close to the number of kivas, so that the number of domestic units can be said to approximate the number of kivas. The basic house size in our study is between one and two households.

Our work in nearby Natural Bridges provides a more robust sample from 26 cliff and rock shelter sites occupied during the Pueblo III period that reveal peaks in construction and occupation during the early-to-mid AD 1100s and early-to-mid AD 1200s (Figure 36). Many of the Bridges sites, such as Big Foot (42SA 6863), Bare Ladder (42SA 6965), and Lightning Ruin (42SA 6967) show an initial occupation in the early-to-mid AD 1110s and a subsequent renewed construction in the early-to-mid AD 1200s. At this point, the AD 1100s occupation is sparsely represented, at best, from our smaller sample of the Slickhorn area sites.



Defensive Sites. Several of our Slickhorn and Natural Bridges must be considered defensive sites, with limited and/or difficult topographic access and defensive features that hinder entry into the site or its rooms. Conflict and warfare increased in the northern San Juan region as have defensive structures (i.e., Varien et al. 2007:286; for a summary see Varien 2010:9–10, but see Dean 2010:338–339). An increase in defensive occupations is also present in the San Juan Basin in the AD 1200s and again during the eastern early Navajo occupation in the 1700s. The Chaco study is informative, in that the conflict between the Navajos and raiding Utes (sometimes accompanied by Comanches) led to a strategy of building hogans in or adjacent to difficult topographies, set back deep in the rincons, often in the same pinnacle sites first occupied in the mid- to late AD 1200s by folks using Mesa Verde Whitewares (see McKenna and Windes 2013). It is clear that early Navajo occupants in Chaco chose to locate their structures close to or on top of the earlier defensive AD 1200s sites. This policy suggests that similar bouts of hostility occurred during both periods where escape was a temporary measure against raiding parties, for food and captives in the Navajo example, rather than wholesale destructive warfare.

Not all AD 1200s sites are defensive sites nor were all of our cliff dwellings in the projects area. In our small sample, defensive sites in Slickhorn—the 4 Shield House and Blue Man/Square Kiva—had defensive architecture, while Citadel West was built on and around a defensive pinnacle and Tadpole House high up in the cliffs. Fortified Mesa can also be considered relatively defensive but it may not be a habitation site; it is dated at about AD 1207.

But 4 Shield House is the most defensively protected site in our sample, as is the Ledge Runner site (42SA 6654) in Natural Bridges, both built in the AD 1250s and 1260s. 4 Shield House has several defensive features that limited unwanted access to the kiva and cavate rooms with particular care made to defensively modify the original doorway into the kiva complex and cavates *after* the kiva had burned. The kiva was the only structure among our sites that revealed burning.

Blue Man/Square Kiva House has a single ledge cross wall with doorway *above* the primary late occupation, which mirrors the Ledge Runners site in Natural Bridges. Both sites had escape routes up to defensible high ledges similar to our Navajo example above. The later had two separate habitation areas with separate access up and linked to a single masonry-lined high ledge but blocked midway by a masonry cross-wall. The primary access to the ledge for one group was through a high masonry wall doorway with loopholes. This latter defense-minded occupation had also been placed well back from the main canyon amongst very difficult terrain and a steep talus. Perfect Kiva was built in a large rock shelter, which is not particularly defensive, but it was built earlier at about AD 1229. The trend appears to be toward increased defense by at least some AD 1200s groups in the Slickhorn area but more limited in the Bridges area at the same time.

The Slickhorn study provides another area to the growing knowledge of the occupation and use of Cedar Mesa and the western San Juan/Mesa Verde region, an area sparsely studied compared to the Central Mesa Verde Region, although this is greatly improving. The study supports previous studies of the late migration and short occupation in the AD 1200s of Cedar Mesa and the subsequent depopulation that followed before the complete abandonment of the overall Mesa Verde Region. The western area provides a less ideal and marginal horticultural area for puebloan farmers than in the Central region, which probably prevented the large population centers seen elsewhere to be established and thrive.

Acknowledgments

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Dr. RG Matson, Shaw University, Canada

Dr. William Lipe, Washington State University, Pullman

Table 1. List of volunteers who worked at the Slickhorn Canyon Sites.

Name	Hometown	Sites: 42SA__	Month/Year
Eileen Bacha	Youngstown, OH	3680, 5795	July 2011
Pam Baker	Moab, UT	3680, 5794, 5817, 5819	Feb, July 2011
Quent Baker	Moab, UT	3680, 5794, 5817, 5819	Feb, July 2011
Cory Breternitz	Phoenix, AZ	3680, 5795	July 2011
Blayne Brown	Phoenix, AZ	3680, 5795	July 2011
Cliff Evans	Albuquerque, NM	3680, 5794, 6819, 29513, 29514	July 2011
Jerry Fetterman	Yellow Jacket, CO	29514	July 2011
Spencer Franks	Franksville, WI	3680, 5794, 5795, 6819, 29513, 29514	July 2011
Christine Gilbertson	Tata Creek, Canada	3680, 5794, 5795, 5819, 29513, 29514	July 2011
Lee Grench	Moab, UT	3680, 5794, 5817, 5819	Feb, July 2011
Vaughn Hadenfeldt	Bluff, UT	5795, 29514	July 2011 (site guide)
Claire Jones	Houston, TX	3680, 5819, 29514	July 2011
Peg Kaiser	Oakland, MD	3680, 5794, 5795, 5817	July 2011
Nicole LeBrun	Hastings, MN	3680, 5819, 29514	Feb, July 2011
David Manley	Durango, CO	3680, 5794, 5817, 5819	Feb, July 2011
Richard Moeller	Santa Fe, NM	3680	July 2011
Doug Palmer	Albuquerque, NM	3680, 29514	July 2011
Jamie Schubert	Fair Oaks, CA	3680, 5794, 5795, 5817	July 2011
Criss Swaim	Albuquerque, NM	3680, 5819, 6819, 29513	July 2011
Tom Windes	Albuquerque, NM	3680, 5794, 5795, 5819, 6819, 29513, 29514	Feb, July 2011

Table 2. Sites investigated during the 2011 BLM/NPS Slickhorn Wood Project.

Utah State Site # 42SA:	1976 Lipe Site #	Site Name	No. of structures	No. of maps made 2011	Structural wood documented	Wood samples taken (# of dates)	Canyon/Location
3680	CM67-12 CG70-163	Fortified Mesa	rooms =11± walled open areas 5±	2	40	17(6)	Shieks Flat/Cedar Mesa
5794	S-T-1-2	none	storage =9 rock art	2	17	12(2)	Slickhorn Canyon #1/ Cedar Mesa
5795	S-T-1-3	Perfect Kiva	kiva=1 habitation=1 storage =3 rock art	13	200	116(22)	Slickhorn Canyon #1/ Cedar Mesa
5817	S-T-8-3	none	storage =1	1	20	5(2)	Pt. Lookout Canyon #6/ Cedar Mesa
5819	S-T-8-5	4 Shield House	kiva=1 habitation=2 storage=8+ other=4+ rock art	8: <i>site ½ done</i>	109 <i>+ more in future</i>	27(5) <i>+ more in future</i>	Pt. Lookout Canyon #6/Cedar Mesa
6819	NPS	Horse Collar	kivas=2 habitation=3? rooms=12	0	20 new additions	2(0)	Whites Canyon/ Natural Bridges
29513 (new site#)	none	none	storage=1	1	27	13(1)	Whites Canyon/ Deer Flats (BLM)
29514 (new site#)	none	Blue Man/ Sq.Kiva	kiva=1 habitation=2-3? storage = 6++ other = 1(many removed); rock art	6	50 (mostly undatable cottonwood)	8(0)	Slickhorn Canyon #1/ Cedar Mesa
Totals	8 sites		ca. 72+ structures	33	483	200 (38) (41% of total elements) (19% of total sample)	

Table 3. List of tree-ring symbols and abbreviations.^a

Sample types:

¼, ½, e, f, 1-inch = Core sample diameters.

cc = Charcoal (specimen is carbonized).

frag = Fragment (broken or rotted piece).

V-cut = Sample taken as a V-cut in side of element.

wedge = Sample is a wedge-shaped cutting from side or end of element.

xs = Cross-cut sample, often resulting in a complete cross section of element. Provides analyst with the best sample possible.

Species:

DF = Douglas-fir

Jun = juniper

Pnn = piñon

PP = ponderosa pine

SF = spruce or fir (typically blue spruce or white fir).

Pop = *Populus* sp. (aspen or cottonwood)

non-conf = non-coniferous

Ring condition:

Complacent = Little patterning is evident in the sample so that dating is difficult if not impossible. Common among trees with a plentiful precipitation supply, as in growth in washes and mountains (e.g., cottonwood and high-altitude conifers).

Compressed = Outer rings are so narrow that distinguishing patterning or the absence of rings is not possible. In dated samples, a "++" symbol is used. This commonly indicates that the element was deadwood when collected.

Erratic = Ring growth is erratic and difficult to match patterning for dating purposes. Common for juniper growth and may include partial, double, or missing rings.

Missing rings = Two or more growth rings are absent, which can be attributed to erratic growth and/or to drought conditions.

Short = The number of rings is too few to adequately date and cross reference. Usually less than 30–50 rings.

Terminal Ring:

I = Incomplete outer ring (tree died during growing season). Growing season varies by species and area.

C = Complete outer ring (tree died during dormant season). Dormant season varies by species and area.

Date symbols for the inside date: (note: *field observation by author noted in a subscript attached to lab date*).

p = pith present

np = near actual pith (old usage).

fp = far from actual pith (old usage).

p = Pith ring is present but because of the difficult nature of the specimen, an exact date cannot be assigned to it (common among juniper specimens).

Table 3. Concluded

± = The innermost ring is not the pith ring and an absolute date cannot be assigned to it. A ring count is involved.

Date symbols for the outside date: (note: *field observation by author noted in a subscript attached to lab date*).

+ = Cannot be dated with certainty because one to five outer rings may be missing.

++ = The outermost rings of a sample cannot be dated. Typically, the rings are uniformly small, making it impossible to recognize patterning in ring widths or to identify missing rings. This pattern reflects very slow growth and is the mark of a dying tree. Dates with this symbol are considered derived from deadwood.

vv = Definite evidence for a cutting/death date is absent and it is unknown how many outer rings have been lost.

v = A subjective judgment that the outer ring is at or is within 1-5 years of the actual tree death date. Typically considered a death or near death date, but weakest in confidence.

r = Less than a full section is present but the outermost ring is continuous around the available circumference. Considered a death date, but more confident than above.

c = The outermost ring is continuous around the entire circumference. Considered a death date but more confident than above.

L = A characteristic surface patination and smoothness, which develops just under the bark, is present. Considered a confident tree death date.

G = Beetle galleries are present on the surface of the specimen. Considered a death date of greater confidence than above.

B = Bark is present. Considered the strongest affirmation of the actual death date, unless a "+" or "++" is also present for this symbol or those above.

^a Symbols after Ahlstrom (1985) and Windes and McKenna (2001).

Table 4. Tree-ring date from granary (42SA 29513) above Ledge Runner/Stone Mortar House off Whites Canyon, Natural Bridges National Monument/ BLM's Deers Flats.

Location/function	FS #	TRL# NBR-	Species ^a	Age/ Size (max.dia./ cm)	Outer ring condition	Inside date	Outside date ^b
Room 1 (n= 27 total elements; 14 sampled)							
Loose wall log (intramural?)	18	1622	Pnn*	166+/10.3		0714 +p	0879 ++vv _{vv/v}

Notes:

^a Species* = deadwood (++ symbol).

^b Date subscript is author's outer ring field observation *if* it differs from the laboratory analysis (see Table 3).

Table 5. Tree-ring dates (n=6) from Fortress (42SA 3680), Shiek's Flat Mesa, Cedar Mesa.

Location/function	FS #	TRL# NBR-	Species ^a	Age/ Size (max.dia./ cm)	Outer ring condition ^b	Inside date ^{c,d}	Outside date ^d
Room 1 (n=18 total elements; 7 sampled)							
Loose inside room/viga	13	1560	Jun	208+/30.0		0806 _{np}	1013 ++vv
East wall door lintel	1	1555	Jun*	163 / 8.0		0990 ±p	1152 ++vv_v
Loose inside room/viga	19	1562	Jun	158 / 23.0		1045 p	1202 ++vv
Room 2 (n=7; 5 sampled)							
Loose inside room/viga	20	1563	Jun	50+/12.0		1053 _{np}	1102 vv
Loose inside room/viga	22	1564	Jun	108+/15.5		1068 _{fp}	1175 ++vv
West granary under west cliff face below top of mesa (n=2; 2 sampled)							
Door lintel	39	1571	Jun	121+/ 4.5		1087 _{fp}	1207 ++vv_r

Notes:

^a Species* = deadwood (++ symbol).

^b **Outer ring condition** = **Complete** ring indicates tree death during non-growing season (late fall-winter-early spring). **Incomplete** ring = indicates tree death during growing season (i.e., late spring-summer-early fall). Growing seasons vary by species.

^c **Date subscripts** are author's inner and outer ring field observations *if* they differ from the laboratory analysis (see Table 3).

^d **Outside dates in bold** are tree death date or near death date.

Table 6. Tree-ring dates (n=2) from granaries (42SA 5794) above Perfect Kiva, in Sickhorn Canyon #1, Cedar Mesa.

Location/function	FS #	TRL # NBR-	Species ^a	Age/ Size (max.dia./ cm)	Outer ring condition ^b	Inside date ^c	Outside date ^{c,d}
Room 1 (n= 7 total elements; 4 sampled)							
NE &SW walls, viga/ SE wall horizontal intramural	3	1605	Jun	130 /12.1	Complete	1112 ± _{np}	1241 +B
Room 5 (n= 8 total elements; 7 sampled)							
SW wall, door lintel	8	1607	Jun*	084 / 2.5		0962 p	1045 ++vv _{vr}

Notes:

^a Species* = deadwood (++ symbol).

^b Outer ring condition = Complete ring indicates tree death during non-growing season (late fall-winter-early spring). Incomplete ring = indicates tree death during growing season (i.e., late spring-summer-early fall). Growing seasons vary by species.

^c Date subscripts are author's inner and outer ring field observations *if* they differ from the laboratory analysis (see Table 3)..

^d Outside dates in **bold** are tree death date or near death date.

Table 7. The kiva features at Perfect Kiva (42SA 5795).

Feature	Length/Width (cm)	Depth (cm) Left/mid/right	Height (cm)	Above floor fill (cm)	Lintels	Latest Dates
North bench recess	97	53/58/52	52	87	FS 20-28	none
NE bench recess	142	47/47/55	53	85	FS 29-34	none
South bench recess	147	31/--/61	48	73	FS 1-11, 118	1027 B
SW bench recess	128	55/47/47	47	83	FS 12-19, 119	1158++vv
SW pilaster	99	55/61			11 Crib logs (FS 54-57, 67-71, 126)	1211 B
NE pilaster	85	52/47			9 Crib logs (FS 58-66)	1207 B 1217 +B 1229 B
SE wall above vent	--	--	--	--	5 Crib logs (FS 72, 74-77)	1130 vv
NW wall	--	--	--	--	5 Crib logs (FS 80-82, 85-86)	none
Niche	20	20	16.5	7.5	1 splint (FS 120)	none
Vent tunnel	37	102	60±	38	3 irreg.spaced (FS 112-114)	1204++B
Vent shaft	45 x 60		210±	N/A	2 wall pegs (FS 115-116)	none
Sipapu	10 x 10 rect.	15	N/A	-15	N/A	filled in during project.
Firepit	65 x 75	?				filled in during project
Deflector	4 x 20±?		38			
Ladder poles (2)	230, 231	Dia. 1.5-11.2 Dia. 4.5-9.2			FS 230 FS 231	Not available yet
Ladder rungs (3)	57, 58, 58.5	Dia 2.8-2.9			FS 232-234	

Table 8. Tree-ring dates (n=22) from Perfect Kiva (42SA 5795) in Slickhorn Canyon #1, Cedar Mesa.

Location	FS #	TRL# NBR-	Species ^a	Age/ Size (max.dia./cm)	Outer ring condition ^b	Inside date ^c	Outside date ^{c,d}
Kiva (n=126 total elements; 60 sampled)							
Bench recess lintel	9	1438	Jun	180 / 8.6	Complete	0848 ± _{np}	1027 B
Roof entry hatch liner	73	1471	Jun	97 / 8.0+		1034 p	1130 vv _{vv/v?}
Bench recess lintel	15	1442	Jun*	107 / 6.9		1052 _{np}	1158 ++vv_v
Roof filler log	111	1491	Jun*	89 / 5.5		1090 _p	1178 ++vv_r
Ventilator lintel	114	1494	Jun*	88 / 4.3	Incomplete	1117 p	1204 ++B
Pilaster crib log	63	1464	Jun	220 / 11.0	Complete	0988 ± _p	1207 B
Roof latilla	99	1483	Jun	178 / 6.4	Complete	1034 ± _{np}	1211 B
Pilaster crib log	68	1469	Jun	154 / 12.8	Complete	1058 ± _{np}	1211 B
Roof latilla	93	1481	Jun	26 / 9.9	Complete	1186 ± _{np}	1211 +B
Roof closing splint	110	1490	Jun	71 / 3x4.5	Incomplete	1117 p	1213 B_v
Pilaster crib log	64	1465	Jun	164 / 12.6	Complete	1054 ± _p	1217 +B
Pilaster crib log	50	1455	Jun	89 / 8.6		1135 _{np}	1223 +B
Roof latilla	90	1479	Jun	82 / 7.5		1146 p	1227 +vv _{vv/v?}
Pilaster crib log	58	1458	Jun	100 / 9.6	Incomplete	1130 p	1229 B
Room 1 (n=62; 54 sampled)							
Jacal wall post	165	1513	Jun*	114 / 8.4		1063 ± _p	1176 ++B
Jacal wall post	203	1544	Jun	86 / 9.4		1115 ± _p	1200 vv_r
Jacal wall post	176	1521	Jun*	141 / 12.9	Incomplete	1063 p	1203 ++B_{GB}
Roof closing splint	198	1539	Jun	143 / 5.5 x6.0	Incomplete	1064 _{np}	1206 +B
Jacal wall post	162	1510	Jun	69 / 7.0		1140 _{np}	1208 +v_r
Jacal wall post	169	1515	Jun	111 / 6.4	Complete	1102 ± _{np}	1212 +B
Jacal wall post	182	1525	Jun	66 / 9.5		1164 ± _{np}	1229 vv_{v/r}
Plaza Retaining Wall (n=2; 2 sampled)							
Horizontal intramural	222	1554	Jun*	108 / 17.0		1020 ± _p	1127 +vv_{rB}

^a **Species*** = deadwood (++ symbol). FS 222 called in field as deadwood by author.

^b **Outer ring condition** = **Complete** ring indicates tree death during non-growing season (late fall-winter-early spring). **Incomplete** ring = indicates tree death during growing season (i.e., late spring-summer-early fall). Growing seasons vary by species.

^c **Date subscripts** are author's inner and outer ring field observations *if* they differ from the laboratory analysis (see Table 3).

^d **Outside dates in bold** are tree death date or near death date.

Table 9. Features within the kiva at Blue Man/Square Kiva (42SA 29514).

Feature (cm)	Length	Width/Depth	Height ^a	Wood	Assoc. cultural material	comments
Pilaster 1	60	45-50	?	none		Heavily sooted
Pilaster 2	60	40-50	?	"		"
Pilaster 3	55	50	?	"	weaving batten	"
Pilaster 4	70	35	?	"		"
Pilaster 5	55	28	?	"		"
Pilaster 6	58	27	?	"		"
Recess 1 (1 & 2) ^b	80	/43	?	"		"
Recess 2 (2 & 3)	80	/45	?	"		"
Recess 3 (4 & 5)	115	/35	?	"		"
Recess 4 (5 & 6)	60	/27	?	"		"

^a Height of pilasters range from 117 and 145 cm above the floor and fill, above the bench 81 to 112 cm. Bench recesses were between 13 and 46.5 cm above the fill or floor.

^b Recesses are noted, within parentheses, as to location between which numbered pilasters.

Table 10. Features along the Upper Ledge of Blue Man/Square Kiva (42SA 29514).

Feature (cm)	Length	Width	Height /Depth	Wood	Assoc. cultural material	Comments
Upper Ledge						
Room 5	217	140	154	FS 40	Post in SW corner	Above kiva along Upper Ledge Defensive masonry structure. NE-most feature. Rock art further to NE 44m
Firepit 1	38	12	?		Mano, 2 plain gray sherds, burned bone awl tip, squash peduncle, 13 corn cobs	Adobe coping
Firepit 2	83	64	?		3 corn cobs, cobble: (7+x9x6.5 thick)	
Firepit 3	75	65	?			Partial adobe collar 11cm wide. In front of cist F.8
Posthole 1	?	?	?	Empty		A post stub? FS 46 nearby
Posthole 2	12	12	?	Empty		A post stub? FS 46 nearby
Posthole 3	17.5	13	?	FS 45		
Posthole 4	14	14	?	FS 47		
Posthole 5	12	12	?	FS 49		A post stub FS48 nearby (its PH destroyed by vandels?)
Posthole 6	10±	10±	?	FS 50	2 chipped stone	
Mealing Bin 3	68	39-45	28-35		Slab mano in bin: 12+ x 12 x 3 thick (igneous)	Open toward back cliff face. Slab-lined (3 slabs)
Retaining Wall	700±	?	?	FS 41-44	Intramural elements of support wood	Some masonry evident; mostly gone. Built along outer cliff edge.
Misc Features: See Figures 19-20.						
1 stone conc.	76	50				
2 cliff cavity	1900 mouth	365 deep			13 corn cobs	Sooted; packrat nest
3 cliff cavity	200?	60?			16 chipped stone in front of cavity	
4 cliff cavity	218 mouth 90 in back	36 deep	42		Calcite bead: 4mm dia., x 1mm thick	Bead hole: 2mm. Ashy deposits
5 cist imprint	171	71				Reddish-brown deposit dug out
6 cist	250	142				Reddish-brown deposit dug out
7 cist	120	92				Masonry/adobe wall frag on 1 side
8 cist	180±	150±			mano	FP 3 in front. Dug out cist. 3 green figures + 1 anthromorph 161cm above (24x10cm)
9 cist(s): 2?	missing	400±				Dug out area. Next to F.8
10 cist(s): 3?	missing	600±				Dug out area. Next to F.9. Several bighorn sheep images on cliff face above
11 cist(s): 2?	306	136			1 corn cob; 1 plain gray	Slab-lined on 1 side
12 cist	135	102-104				Next to Mealing Bin 3. 8+ bighorn sheep figures above area
13 masonry wall	180±	30±				On lower ledge boulder

Table 10. Concluded

14 masonry wall	150+	30±				Lookout structure? on lower ledge boulder . Fronts Mealing Bin 3
15 cist	280	128				4m to SW of MB 3 along cliff face
Feature (cm)	Length	Width	Height /Depth	Wood	Assoc. cultural material	Comments
16 wall?	300±					Adobe wall stub aligned with 4 postholes. Next to F.15 & 17
17 cist area	223					Blue man anthropomorph above + other blue marks
18 ground boulder top	150±	100±				223cm from F.16
19 series of cists: 5-6?	ca 700	?				Mud outlines on cliff face of 5-6 cists. Rest gone
20 cist	150±	100±				Middle of walkway among boulders
21 room	170	128	77			Under cliff fall. Sooted storage room.
22 rooms (2?)	450±	?				Mud outlines on cliff face of 2 possible rooms
23 cist?	?	?				Large anthropomorph above (117 x 60cm).
24 ledge cavity	39	27	?			"Box" inset on top of narrow natural ledge. Ledge front plastered for 160cm
25 cist	?	?				Mud outlines on cliff face. 338cm from F.24. SW-most feature

Table 11. Tree-ring dates (n=2) from the granary (42SA 5817) at head of Point Lookout Canyon, Cedar Mesa.

Location/ function	FS #	TRL# NBR-	Species ^a	Age/ Size (max.dia./ cm)	Outer ring condition ^b	Inside date ^c	Outside date ^{c,d}
Room 1 (n= 20 total elements; 5 sampled)							
N & S walls, viga	3	1599	Pnn*	153 /10.2		0842 _p	0994 ++vv_r
N & S walls, viga	5	1600	Jun*	165 / 5.8	Complete	0760 ±p	0924 ++B

^a **Species*** = deadwood (++ symbol).

^b **Outer ring condition** = **Complete** ring indicates tree death during non-growing season (late fall-winter-early spring). **Incomplete** ring = indicates tree death during growing season (i.e., late spring-summer-early fall). Growing seasons vary by species.

^c **Date subscripts** are author's inner and outer ring field observations *if* they differ from the laboratory analysis (see Table 3).

^d **Outside dates in bold** are tree death date or near death date.

Table 12. Data on loop/peep holes in masonry walls in 4 Shield House (42SA 5819), Point Lookout Canyon.

Hole #	Feature/ wall	Story	Height above floor (cm)	Width (cm)	Height (cm)	Depth (cm)	Direction°/ Angle up/down	Distance of sighting (est. m)	View through Loop Hole
1	Rm 3 E	1	33	7	6	34	120°/-24°	25	large talus boulder, juniper tree
2	Rm 3 E	1	58	14	7	48	91°/-14°	40	walkway along cliff face, Rm 2
3	Rm 3 E	1	22.5	10	10	47	90°/-07°	10	walkway along cliff face
4	Rm 3 E	1	64	9	8	35	101°/-05°	40	Rms 1–2
5	Rm 3E & S corner	1	07	7	4	55	124°/-24°	8-10	juniper tree bench below
6	Rm 3 S	1	25	10	8	50	176°/-22°	25	main slickrock slope
7	Rm 3 S	1	25	11	12	73	160°/-22°	25	main slickrock slope
8	Rm 4 E	2	118	5	5.5	56	95°/-02°	30	cliff face
9	Rm 4 E	2	70	4	4	61	92°/-34°	5	Rm 3 cliff face
10	Rm 4 E	2	96	4	4	50	91°/-05°	20	walkway along cliff face
11	Rm 4 E	2	113	4	4.5	51	94°/-03°	25	cliff face
12	Rm 4 E	2	78	4	5	72	105°/-42°	5	Rm 3 floor
13	Rm 4 E	2	79	5	4.5	53	76°/-11°	10	walkway along cliff face
14	Rm 4 E	2	57	4	4	50	87°/-32°	5	Rm 3 floor
15	Rm 4 E	2	100	22	23	42	90°/-01°	40	Rm 3 wall, Rms 1–2 & beyond
16	Rm 4 E	2	69	5	5	56	101°/-35°	10	slickrock slope
17	Rm 4 S	2	65	4	4	47	163°/-21°	15	slickrock slope
18	Rm 4 S	2	76	28	14	41 ledge: 75	175°/-14°	150-200	wash, access, cliff face
19	Rm 4 S	2	97	8	9.5	37	181°/-10°	Blocked; 150-200	by packrat nest; cliff face
20	Rm 4 S	2	99	8	10	51	190°/-15°	50	lower flatlands
21	Rm 4 S	2	78	4	4.5	35	148°/-26°	Blocked; 100-200	by packrat nest; lower flatlands
22	Rm 4 S	2	68	5	6	36	196°/-33°	35	talus slope. Missing on map
23	Rm 4 E	1	104	4	3.5	65	100°/+01°	5-8	Rm 3 wall
24	Rm 4 E	1	106	7	5.5	50	79°/+04°	5-8	Rm 3 wall

Table 12. Concluded.

Hole #	Feature/ wall	Story	Height above floor (cm)	Width (cm)	Height (cm)	Depth (cm)	DirectionE /Angle up/down	Distance of sighting (est. m)	View through Loop Hole
25	Rm 5 S	1	43	6.5	12.5	62	148°/-18°	30	talus slope. Missing on map
26	Rm 5 W	1	129	15	10	44	266°/+13°	3	cliff face
27	Rm 5 W	1	94	8	15.5	36	242°/+08°	100	doorway from E. Cavate; ledge access to W. Cavate
28	Rm 5 W	1	104	11	8.5	29	282°/-11°	4-5	cliff edge
29	Rm 6 S	1	92	10	6	20	151°/00°	200+	wash, slickrock, talus
30	Rm 6 S	1	38	10.5	11	23	143°/+09°	100	talus slope, trees
31	Rm 6 S	1	34	8	7.5	18	155°/+12°	100	walkway along cliff face, talus slope
32	Rm 6 S	1	30	11	8	46	195°/-44°	55	talus slope, juniper tree
33	Rm 6 S wall; above W? wall	1	72	8	17	16	175°/+13°	100-300	
34	isolated walkway wall w/ doorway	1	43	6	8	69	245°/+12°	70	cliff face
35	corner of entry into East Cavate	1	16	9	4	51	133° or 313°/-03°	300	walkway doorway to East Cavate; talus slope and slickroc

See references to peep holes: *Leaving Mesa Verde* by Kohler et al.: p.10, 183, 339.

Table 13. Tree-ring dates (n=2) from 4-Shield House (42SA 5819) in Pt. Lookout Canyon, Cedar Mesa.

Location	FS #	TRL # NBR	species ^a	Age (yrs) max dia (cm)	Outer ring condition ^b	Inside date ^c	Outside date ^{c,d}
East Ledge, isolated cross wall with doorway (7 lintels, 5 sampled)							
Door lintel	55	1581	Jun*	213 / 11.0		1048	1260 ++vv_{v/r}
East Cavate, retaining wall across cavate mouth (52 elements, 14 sampled)							
Tie log	84	1594	Pnn*	153 / 11.4		0817	0969 ++vv_{rB}
Tie log	74	1591	Pnn*	209 / 6.3		0999 p	1207 ++vv_v
Jacal post	61	1585	Jun	88 / 7.3	Incomplete	1165 ±p	1252 +B

Notes:

^a **Species*** = deadwood (++ symbol).

^b **Outer ring condition** = **Complete** ring indicates tree death during non-growing season (late fall-winter-early spring). **Incomplete** ring = indicates tree death during growing season tree death (i.e., late spring-summer-early fall). Growing seasons vary by species.

^c **Date subscripts** are author's inner and outer ring field observations *if* they differ from the laboratory analysis (see Table 3).

^d **Outside dates in bold** are tree death date or near death date.

Table 14. Structural wood characteristics of the three primary species utilized at Natural Bridges and the Slickhorn area of Cedar Mesa.^a

Area:	Slickhorn area (9 sites) ^a				Natural Bridges area (28 sites)		
Species:	Piñon	Juniper	Populus		Piñon	Juniper	Populus
Characteristics	No. (%)	No. (%)	No. (%)		No. (%)	No. (%)	No. (%)
Beetle Galleries	15 (23%)	74 (11%)	11 (11%)		130 (30%)	122 (14%)	14 (7%)
Burned beam- end/ per element	10	100	5		115	242	28
Burned sides/ per element	26	82	13		57	187	17
<i>In common:</i> BG + burned	5	35	2		37	50	3
<i>In common:</i> side & end burns	8	31	1		35	91	6
Subtotal with BG &/or burns^b	38 (59%)	190 (29%)	26 (26%)		230 (53%)	410 (46%)	50 (25%)
Bark present ^c	2 (3%)	127 (19%)	23 (23%)		23 (5%)	145 (16%)	72 (36%)
All stone-ax cut elements with side &/or end burns ^d	0	44 (7%)	5 (5%)		17 (28%)	83 (38%)	20 (22%)
Burned limb stubs ^e	0	32 (5%)	0		41 (9%)	113 (13%)	5 (2%)
Stone-ax cut^f (% within species)	12 (1) 19%	234 (17) 35%	49 (1) 49%		60 (13) 14%	218 (25) 24%	91 (7) 45%
TOTAL STR. ELEMENTS (% by area)	64 (7.7%)	664 (80.3%)	99 (12.%)		437 (28.4%)	900 (58.5%)	202 (13.1%)
Area sample totals	827				1539		
Dead wood characteristics:							
“++” deadwood lab dates (of total tree- ring dates) ^g	0 of 6	7 of 33 (21%)	---		7 of 14 (50%)	7 of 31 (23%)	---
Field designated deadwood (% of species)	28 (46%)	62 (9%)	13 (14%)		82 (19%)	177 (20%)	12 (6%)
Stone-ax-cut beam-end &/or limb trim on field designated deadwood (% of deadwood) ^h	3 (11%)	13 (21%)	4 (4%)		9 (11%)	44 (25%)	5 (42%)

^a Charcoal and historic elements not included. Wood sample from Pickett Fork (42SA 1763) included.

^b Subtotals of all elements with bark beetle galleries and/or burns totaled after subtracting numbers of those in common. Probably this is all reused or deadwood.

^c Limb bark (found in depression where limb grows out from juniper stem) not included. Percentage is within total species.

^d Does not include elements with burned out limb stubs (see line below). Percentage of overall stone-ax-cut elements.

^e Not included in ax-cut elements in line above. Not part of burns along the side of an element. Questionable burn calls not included.

^f Total stone-ax-cut elements (questionable stone-ax-cut beam-end elements in parenthesis of total). Questionable stone-ax-cut limbs not included because they are more difficult to identify.

Percent of total stone-ax-cut elements within species which exhibit cut beam-ends and/or cut limbs.

^g No tree-ring dates from *Populus* sp. elements.

^h Uncertain stone-ax-cut limbs not included.