

**Final Report
Cottonwood Cave (5MN519) Assessment Project
Montrose County, Colorado**

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Prepared for

USDA Uncompahgre National Forest
ARPA Permit No. NOR442 (expired 4/1/2013)

History Colorado State Historical Fund
Project No. 2012-AS-005

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December 2013

Abstract

Located along a tributary of the San Miguel River, in Montrose County, Colorado, Cottonwood Cave (5MN519) is a rockshelter with stratified deposits and rock art imagery. The Cottonwood Cave Assessment Project, supported by a grant from the History Colorado State Historical Fund, was developed in recognition not only of the site's potential to provide valuable data addressing the prehistoric transition to agriculture in western Colorado, as demonstrated in previous work by Hurst (1948) and Stiger and Larson (1992), but also of the site's vulnerability to vandalism and unauthorized excavation. The project involved the test excavation of two 1m² units, the mapping and re-recording of the site, including extensive rock art documentation, and AMS dating of plant and animal remains, including maize.

Stylistically and chronometrically, the Cottonwood Cave rock art dates from Basketmaker II into Basketmaker III and possibly early Pueblo I times. Close relationships with San Juan Basketmaker II are evident, particularly with eastern populations at the Falls Creek Shelters (Adams et al. 2011), but also with rock art attributed to Basketmaker II-III populations in the Cedar Mesa and Moab, Utah areas to the west (Charles and Cole 2006; Cole 2009). Pueblo II/III use of the shelter is suggested by a probable celestial ceiling, presumably made by Pueblo II and possible Pueblo III residents of nearby Weimer Ranch and Cottonwood Pueblo sites (Gruebel et al. 2006; Hurst 1948)

Calibrated AMS dates (2 sigma) of 40 B.C.-A.D. 70 (bone), 35 B.C.-A.D. 84 (maize and yucca), and A.D. 675-773 (maize) augment the earlier date estimation of 403-53 B.C. (maize) (DARG 2013; Stiger and Larson 1992), demonstrating a considerable occupation history, not to mention a long record of maize use at Cottonwood Cave.

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Introduction

Cottonwood Cave (5MN519) is a stratified prehistoric rock shelter with rock art, situated along a tributary of the San Miguel River in Montrose County, Colorado, on public land administered by the USDA Uncompahgre National Forest. Although located north of the greater San Juan culture area, Cottonwood Cave exhibits evidence of Basketmaker II occupation. The Cottonwood Cave Assessment Project was developed in recognition not only of the site's potential to provide valuable data addressing the prehistoric transition to agriculture in western Colorado, but also of the site's vulnerability to vandalism and unauthorized excavation. Funded by a grant from the History Colorado State Historical Fund (Project No. 2012-AS-005) to Dominquez Archaeological Research Group (DARG), the project was directed by Carole L. Graham and Sally J. Cole, with Michael S. Berry, of DARG serving as principal investigator. The fieldwork was conducted with much appreciated guidance and assistance from Forest Service archaeologists Leigh Ann Hunt and Elizabeth Lane and in compliance with ARPA Permit No. NOR442. This final report expands upon preliminary information provided in Graham and Cole (2013b) and presented at the Big MACC archaeological conference, held at Crow Canyon Archaeological Center, in Cortez, Colorado in February 2013 (Graham and Cole 2013a).

Excavation, mapping, and rock art documentation tasks were undertaken from July 13 to 16, 2012, under the direction of Cole and Graham. Graham and Cole completed additional site mapping and rock art documentation on November 3, 2012. Crew members during the July session included Mona Charles, Laura Lantz, David Hencmann, and Michelle Phair. Charles, Hencmann, and Phair assisted with test excavations as well as with site mapping; they also worked post-field to finalize the site maps. Laura Lantz assisted with rock art recording and mapping, both during the field session and afterward, finalizing drawings, maps, and other documentation. On November 3, Chuck Cole helped with mapping and rock art documentation. In addition, DARG archaeologists Curtis Martin and Holly Shelton visited the site in mid-October 2012 to map the site's location using a Trimble Geo XT GPS unit, which has sub-meter accuracy.

Previous Work

In August of 1947, Professor C. T. Hurst, of Western State College, directed an archaeological field expedition at Cottonwood Cave and at nearby Cottonwood Pueblo. The results of these excavations were published the following year in *Southwestern Lore*, the journal of the Colorado Archaeological Society (Hurst 1948). At Cottonwood Cave, the field school participants excavated a trench at the south end of the alcove, which produced artifacts such as yucca sandal fragments, feather-wrapped yucca cordage, and maize cobs and kernels. Hurst interpreted the excavated material as being representative of Basketmaker culture. A bundle of whole maize ears and shelled kernels, wrapped in juniper bark, was also found in the trench, in a pit sealed with a large, thin, flat rock (Hurst 1948:15-18; Hurst and Anderson 1949).

In the early 1990s, shelled kernels from the maize bundle were submitted for conventional radiocarbon dating, yielding a date of 1980±70 BP. Using the C¹⁴/C¹³ ratio data available at the time, the authors estimated a calibrated date of 2220±80 BP or 270 BC (Stiger and Larson 1992), but a more recent calibration puts it at 403-53 B.C. (2 sigma) (DARG 2013). The bundle was recently re-examined by Karen Adams, as part of comparative studies conducted for the Falls Creek Rockshelters Reevaluation Project. Adams found the Cottonwood Cave maize to be very similar to that recovered from Basketmaker II contexts at the Falls Creek Rockshelters (near Durango, Colorado), suggesting a "shared maize source" (Adams and Paterson 2011:l-14). Stiger also radiocarbon dated maize from Tabeguache Cave, another alcove site in the same region that had been investigated by Hurst (1941,1942), obtaining results of cal. 345 BC - 69 AD (Beta-76546) (Stiger 1994).

Research Design

Data from the proposed assessment project have the potential to address research questions important to our understanding of early agricultural societies and their origins in western Colorado. The temporal extent of Basketmaker II occupation at the site--as yet unknown--as well as the temporal extent of possible Archaic occupation of Cottonwood Cave, can be assessed through the recovery of short-lived plant specimens, such as maize kernels, from stratified deposits in the site and subjected to radiometric dating techniques, specifically accelerator mass spectrometry (AMS). These AMS dates would contribute to a greater knowledge and understanding of Basketmaker II origins as well as settlement and subsistence patterns, particularly on the northern periphery of the greater San Juan culture area (see Lipe 1999; Lipe et al. 1999; Wilshusen 1999).

Along with rock art style and iconography, site structure, and features, the radiocarbon dates resulting from a new assessment of Cottonwood Cave would be studied and compared with data from other Basketmaker II sites, and in particular, the results of the recent reanalysis and assessment of the Basketmaker II-affiliated Falls Creek Rockshelters, near Durango, Colorado (Adams et al. 2011).

In order to collect materials suitable for AMS radiocarbon dating from intact cultural contexts, limited excavations within Cottonwood Cave were proposed. These excavations included a 1 m x 2 m test unit to be placed in the looted area in the central portion of the alcove, to be excavated to sterile, non-cultural deposits. It was to be dug using arbitrary 5 cm levels or stratigraphically, if individual strata could be distinguished. The walls of the test unit were to be documented with photographs and scaled profile drawings. Also proposed was the relocation and exposure of up to 2 meters of Hurst's 1947 trench at the south end of the alcove to recover datable material. In addition, this section of trench wall would be photo-documented and mapped in profile. Identification of the original trench would involve careful flat shoveling in the area of the 1947 excavation, followed by removal of trench backfill to expose the trench walls. Flotation

samples for macrobotanical analysis were to be collected from each stratum of the test unit and the exposed trench wall.

Samples for radiocarbon dating and recovered artifacts were to be processed and analyzed according to material type and condition. Plant specimens would be identified to genus and species prior to submission for AMS dating. Recovered artifacts would be analyzed and documented prior to curation at the Museum of Western Colorado in Grand Junction, Colorado.

In addition to recovering datable specimens for AMS dating, it was proposed that mapping data be collected to produce an accurate, updated site map. The map would incorporate details of the 1947 Hurst map and also show the locations of all rock art panels and other site feature as well as the excavation proposed here. Preliminary fieldwork has shown that Hurst's original baseline drawn map is very accurate. The new map would preserve the record of Hurst's work and place it in the context of newer investigations as part of the proposed assessment. Also, all rock art panels would be documented with photographs and detail drawings where necessary. An updated site form for the site would also be prepared.

It was not anticipated that that human remains would be encountered during these limited excavations. However, if they were encountered, excavation activity would have immediately ceased, and directives in the Forest Service NAGPRA Plan of Action, pursuant to 43 CFR 10, would have been followed.

Methods

Field

Site Survey and Mapping. Features and artifacts at Cottonwood Cave (5MN519) were inventoried for the present project during fieldwork in July and November 2012. The lead project field investigators initially examined the site in 2010, in company with Glenn and Margaret Stone of Grand Junction, Colorado. The findings were compared to information reported by Hurst (1948) and it was evident that additional, systematic documentation and mapping were required to update the site records and provide a context for condition assessment and interpretation. To preserve lines of evidence, the baseline-drawn, plan view site map published by Hurst was scanned, field checked, and adapted for use. Internal accuracy was determined by pulling a baseline tape and verifying the shape and scale of the rear rockshelter wall as well as the relative positions and dimensions of the shelter floor, interior overhang, drip-line, and major features, including fallen boulders. Differences were observed between the True North-arrow, north derived from the baseline aspect, and the 2012 compass-north (E10° declination) (Hurst 1948: Plate II). The discrepancies are attributed to a forced horizontal alignment of the map onto the published page. A similar situation was observed with regard to Falls Creek Shelters (5LP1434) site maps published by Earl Morris and Robert Burgh (1954) (Cole et al. 2010).

Hurst (1948) mapped the southern and central portions of the rockshelter that included his excavation trench, a stacked rock wall, one set of rock paintings (on the ceiling of an interior overhang), and petroglyphs on a fallen boulder. He did not map the full physical context and boundaries of the site and did not show the location of or document additional rock art. The present project expanded the Hurst map to show the rear wall and ledges to the northeast where rock paintings occur and incorporated the relatively flat, vegetated bench outside the shelter overhang to the east. The additions were point-plotted using compass, tape, and a SONIN Multi-Measure Combo PRO instrument with target. All visible surface artifacts were documented with photographs, descriptions, and measurements.

The 2012 project plan map is supplemented by a map made by David Hencmann and Michelle Phair using a pocket transit and stadia rod. The diagram shows locations and relative elevations of the test excavation units, seven rock art panels, and selected artifacts (see Appendix A).

Rock Art Documentation. Cottonwood Cave rock art was recorded by mapping, high resolution digital photography, drawings of selected imagery, and written descriptions of panels and component elements. Representative pigment, paint, and background colors were identified by comparison with Munsell Soil Color charts. Rock art in the seven wall and boulder panels and one portable panel is described on Colorado Cultural Resource Inventory Rock Art Component Forms with attached photographic prints and drawing copies (Appendix H). The descriptive information is outlined in table form (Appendix C).

Digital photography provides baseline documentation of the Cottonwood Cave rock art. All panels were digitally photographed in 2010 and 2012 under a variety of light conditions. The photographs show overviews and sections of panels and details of individual elements and groupings. Camera images were light-corrected and sharpened using Adobe Photoshop Elements 9 and Infrared Effect was applied to selected pictures to further enhance visibility. Glenn E. Stone applied D-Stretch technology to a sample of digital images and provided copies for analysis.

Given the constraints of project field time, drawing was restricted to illustrations of reasonably intact, distinct, elements with potential to address questions of style, chronology, and cultural and social significance. Fragile and often fragmentary rock paintings were emphasized over petroglyphs that are indeterminate (in Panel 1) or well preserved and highly visible in photographs (in Panel 5). Due to the eroded and uncertain nature of many, probably most, rock paintings at the site, only Panel 6 was drawn in its entirety. Other drawings show selected elements and groups of elements in Panels 2, 3, 4, and 7. The drawings are on archival-quality Bristol paper and observations with regard to element setting, formal qualities, condition, techniques of manufacture and colors, and relationships among elements are noted and keyed. When used in conjunction with photographs, the drawings offer valuable analytical information.

An extensive and detailed assemblage of digital photographs of Cottonwood Cave rock art are burned on plain and archival-gold CDs (tiff and jpeg formats) for submission to the USFS-Uncompahgre National Forest, Delta, Colorado. Contact sheet-image catalogs are appended. The digital images show petroglyphs and rock paintings in Panels 1–7 and Portable Panel 1. Representative rock art images are corrected for lighting and sharpness and uncorrected versions are included for comparative purposes and future analysis. Examples of Infrared Effect and D-Stretch–applied images are also included. Images are grouped by panel to facilitate access to the data. Photographs are labeled by camera image number(s), site number, panel number and portion (overview or detail), and, as applicable, an image-panel series number (1, 2, etc.). Ancillary labels specify information with regard to uncorrected image status, Infrared or D-Stretch technical properties, and photography credits. A key to the labeling abbreviations is provided in a Microsoft Word file on each CD.

Test Excavation. Excavations consisted of two contiguous 1 m² units in a disturbed area in the central portion of the alcove. They were dug stratigraphically or in 5 cm levels within strata, using a local string datum set near the southern, uphill side of the units. The excavations were documented with notes, photographs, and sketch maps. After being sifted through 1/8-inch wire mesh to collect artifacts, all excavated fill was saved on tarps for later backfilling and artifacts were carefully preserved for later analysis. Fire-cracked rock from each excavated level or stratum was weighed. Prior to backfilling, the walls and floors of the excavated units were documented with photographs and a profile map was drawn of the south wall of the combined units. Landscaping cloth was placed in the excavated areas before backfilling and the ground surface was restored to its original contours to prevent erosion.

Lab

Lithic Analysis. Data from the ground stone and flaking debris analyses are provided in Appendix F. All of the excavated stone tools were analyzed according to material type, weighed, and measured; in addition, notations about the type of use or modification were made. The flaking debris was weighed and counted in groups, based on material type (see Gerhardt 2001) and the presence or absence of cortex. A list of material types is provided in Appendix F.

All of the analyzed flaking debris was hand-manipulated through a series of nested U.S. Standard testing sieves with square stainless steel mesh. A SG 1 artifact is one that will not pass through 25.0 mm mesh, a SG 2 artifact will not pass through 12.5 mm mesh, and so on. The horizontal aperture measurements for each size-grade (SG) are as follows: SG 1 = 25.0 mm, SG 2 = 12.5 mm, SG 3 = 5.6 mm, SG 4 = 2.8 mm, SG 5 <2.8 mm.

Macrobotanical Analysis. Taxonomic identifications for plant specimens believed to be short-lived species, potentially suitable for AMS dating, were made by Dr. Karen Adams, who graciously volunteered her time and expertise. The results of her work are

presented in Appendix F. Other samples, such as burned wood and coprolites, that could be human but are more likely bovine, are available for future analysis.

Faunal Analysis. Basic sorting and preliminary analysis of all animal bone was undertaken by David Hencmann. Where possible, bones were sorted into large and small mammal classes, identified as to bone type, and carefully examined for evidence of burning and processing, as well as possible pathologies. The results of his work are presented in Appendix F.

Disposition of Artifacts and Project Documentation

All materials resulting from the project, including excavated materials, copies of excavation notes, maps, rock art documentation, photographs, and digital files will be permanently curated at the Museum of Western Colorado in Grand Junction, Colorado.

Results

Site Mapping & Re-recording

As anticipated, the 2012 fieldwork demonstrated the accuracy of Hurst's 1948 baseline drawn map. A new project map (see Appendix A) incorporates details of the Hurst map while also showing the locations of the 2012 excavated test units, features (rock art panels and artifact concentrations), and isolated artifacts identified during survey.

Seven rock art panels (Panels 1–7) on the rockshelter wall and large boulders and one “portable” panel (Portable Panel 1) on a ground stone (also Artifact 22) were identified during survey and plotted on the project map. The panels are numbered from southwest to northeast and comprise spatially related images bounded by definitive rock contours (cracks, corners, and recesses), stains and mineral accretions, and blank, unembellished, areas. The left and right (as faced) boundaries of wall or cliff panels (Panels 1–4, 6–7) are plotted and projected from the floor level on the plan view map. Panel 5, on the south face and edges of a freestanding boulder, and Portable Panel 1 (also Artifact 22) are designated by generalized, single plots. Rock art panel locations and relationships among panels and other archaeological features and associated artifacts are illustrated on annotated photographs attached to applicable Colorado Cultural Resource Inventory Rock Art Panel Component forms (see Appendix H).

Two concentrations of artifacts, one at the south end of the alcove (Artifact Concentration 1) and the other in the central portion (Artifact Concentration 2) were identified and mapped (see Appendix A; Figure 1, Appendix E). The locations of an isolated mano (Artifact 18) between the concentrations and a ground slab (Artifact 22, also designated as a rock art panel, PP1) in Concentration 2 were mapped. Very few, if any, of these surface artifacts are likely to be in their original context, given the many years of visitation and disturbances at the site. The southern concentration coincides

with the location of Hurst's 1947 trench, so it is presumed that many of the artifacts in this area originated in the trench or from subsequent unauthorized digging in that area. Descriptions of the artifacts, along with photographs of most, are provided with the updated site form in Appendix H.

Artifacts 1–17 were noted in the southern concentration. They include a biface fragment, a scraper, three flakes, a chopper, four ground sandstone slabs/blocks, two complete metates, three metate fragments, and two burned logs or tree roots. Surface artifacts in the central part of the alcove include a chopper, three mano fragments, two complete manos, one complete metate, three ground stone fragments, and one complete ground slab with grooves and bird track imagery incised on it. This last was also designated as a rock art panel, Portable Panel 1, and is described in more detail in the following section (also see Appendices B and C). In this same area is a subrectangular chert or quartzite cobble (Artifact 28) with three natural circular features on one surface that, in combination, resemble the eyes and mouth of a face—with traces of a reddish pigment possibly present (Figure 2, Appendix E).

Rock Art Condition Assessment

Preservation of Cottonwood Cave rock art ranges from good to extremely poor. Petroglyphs (most in Panel 5) generally are well preserved. Paintings in Panel 6 are on the ceiling of an interior or secondary overhang approximately 5.5 m above the rockshelter floor and appear intact. They are easily viewed from below and studied in detail through binoculars. The panel is protected from wind and rain, inaccessible to livestock and to humans without climbing aid, and is not obscured by mineral deposits.

Paintings in the northeast section of Panel 4 and in Panel 7 are in good-to-moderate condition. The Panel 4 elements are high on the rockshelter wall, and well preserved images in Panel 7 are in sheltered recesses of the low overhanging cliff and are inaccessible to livestock.

Rock paintings in Panels 2, 3, and the southern section of Panel 4 generally are in poor condition. Most occur at adult eye-level near the center of the rockshelter. It is likely that Panel 4 had the largest number of painted elements at the site but it appears that most have been all or partly obliterated by erosion from rain, seeps, wind, rock spall, and/or touching and rubbing by livestock and humans. Some imagery is obscured by moisture stains and mineral accretions.

Rock Art Descriptions and Interpretative Analysis

Illustrations. Representative illustrations of Cottonwood Cave Panels 1 through 7 and Portable Panel 1 are in Appendix B and supplementary digital images are on file at USFS Uncompahgre National Forest, Delta, Colorado, and the Museum of Western Colorado, Grand Junction, Colorado. A table summarizing descriptive data for each of the panels can be found in Appendix C. Examples of comparative rock art styles and

images are referenced and selectively illustrated for the present discussion in Appendix D.

Panel 1. The subject panel is located on an expanse of wall in the southwest section of the rockshelter within a narrow passageway created by fallen rock slabs. Elements comprise red streaks or splotches, incised/grooved indentations or marks. Graffiti is also present. The red coloration may be natural (hematite) or surface oxidation from nearby fire(s) and may be prehistoric or historic in origin. The petroglyph marks may have been intentionally made or were created by falling rock or unintentional human or animal activities.

Panel 2. Black (very dark gray) paintings of indistinct forms (possible linear motif) and a fragmentary quadruped and broad-shouldered anthropomorph comprise the panel. The elements are approximately 10 cm–40 cm in length and are on the vertical face of a large boulder in the southwestern section of the rockshelter and face the rear wall. The anthropomorph holds a sticklike item resembling an atlatl. Black broad-shouldered anthropomorphs also occur in Panels 4 and 7 at Cottonwood Cave, and a similar figure is at Tabeguache Cave I, a Basketmaker II site located approximately 11 air miles to the northeast (Hurst (1940, 1941). Broad-shouldered figures and atlatl forms (held and shown separately) are typical of Basketmaker II-III style rock paintings and petroglyphs in the greater San Juan culture area (Cole 2009, 2011b; Daniels 1954; Grant 1978; Schaafsma 1980).

Panel 3. White rock paintings in this panel are on the rockshelter wall in the south-central section. Fragmentary, indistinct, and unidentified elements and graffiti are present, and portions of the background rock are broken. Better preserved elements are generally small (~9 cm – 40 cm in length) and include two white broad-shouldered human figures with ducklike headdresses and multiple quadrupeds (some with large, branching antlers). One striped quadruped resembles petroglyphs of the Archaic-based Glen Canyon Style 5 (Cole 2009; Turner 1963, 1971) (see Figure 1, Appendix D). Ducklike headdresses and broad-shouldered anthropomorphs are common and distinctive subjects of San Juan Basketmaker II-III style rock art (see Figure 2, Appendix D).

Panel 4. The panel is on the rockshelter wall in the center-north section and is the largest panel at the site in square meters and probably had the largest number of elements prehistorically. The painted elements are generally small ranging from less than 10 cm to approximately 40 cm in length. Paint colors are black (very dark gray), white, and red. Indistinct and fragmentary paintings are present, and there is a significant amount of graffiti. Black and white anthropomorphs and quadrupeds with branched antlers and black turtle- and frog-like animals and linear motifs predominate in the southern and central part of the panel. These are on a variety of rock facets (vertical, sloped, and overhead). Rows and groups of red finger-swipes (or lines) and dot motifs are high on the wall at the northern end of Panel 4.

Polychrome quadrupeds in Panel 4 are black and white. The dark pigment superimposes the white and may have been added during separate events. A row of four pale white and dark gray quadrupeds have thick, bright white rear-ends and faces that obviously superimpose the other colors; three of the animals have striped bodies similar to those in Panel 3.

Two partially eroded, black anthropomorphs with broad shoulders are shown holding items that variously resemble a jackrabbit or small human with a rabbit-ear headdress, a handle-like loop, and rope or snake. One partially eroded gray anthropomorph with a rectangular body is juxtaposed with a quadruped with forward-pointing horns and elongated body that may have been embellished by dots or lines. White anthropomorphs include one with a possible antler headdress; the figure appears to walk and has exposed (clawlike) toes. Other white figures appear to run.

Similar, small black and white anthropomorphs and quadrupeds occur on a variety of facets at Falls Creek Shelters (5LP1434), a Basketmaker II site near Durango, Colorado; red finger-swipes also appear at the site (Cole 2011b; Daniels 1954; Morris and Burgh 1954) (see Figure 3, Appendix D).

Panel 5. Panel 5 boulder is in the north-central section of the rockshelter and petroglyphs occur on the upper face and edges. Elements comprise pecked cupules, a stylized-segmented bear paw-print, "U" motif, lines, and a possible human form; an etched wavy line with scallops (on the boulder edge); pecked and chipped notches; ground slicks; and a stipple-pecked area. Similarly worked boulders are reported from Ancestral Pueblo sites on Cedar Mesa in Utah (BLM-Earthwatch Utah Canyons Rock Art Project-Cedar Mesa database 2003) and at Painted Hand Pueblo, Canyons of the Ancients National Monument, Colorado (Cole 2005). Segmented bear paw print motifs are well represented on the Uncompahgre Plateau where they are associated with the Archaic-based Uncompahgre Complex and also occur at Ancestral Pueblo and Fremont sites in western Colorado and eastern Utah (Cole 2009, 2011a; Wormington and Lister 1956).

Panel 6. The subject rock paintings are on the ceiling of an interior overhang in the central section of the rockshelter, and a crack divides the panel into two roughly equal parts. The painted elements are in shades of red and white and comprise geometric motifs and designs including a red cross-motif, row of lines, straight and curved linear motifs, fanlike forms, rakelike forms, grids, hatched lines, sunburst motifs, and finger-swipes.

The imagery resembles two stylistic expressions that are widely separated in time. The first, and most similar to the complex of images in Panel 6, is the Abstract-Geometric Tradition attributed to Archaic populations on the Colorado Plateau. Monochrome and polychrome paintings of this tradition are not common but are represented in western Colorado and eastern Utah (Cole 2009). Subject matter shared with Panel 6 is linear motifs and rows of lines, rakelike forms, finger-swipes, hatched lines, and sunburst motifs (see Figure 4, Appendix D).

A second expression possibly related to Panel 6 is variously described as star or celestial ceilings (also known as “Navajo stars”). The best known examples are near late Pueblo II–Pueblo III alcove sites in the San Juan culture area. These, like Panel 6, are painted on shelter ceilings (Cole 2004, 2009; Grant 1978; Schaafsma 1980, 1992). Shared imagery includes crosses, finger-swipes, lines, linear motifs and designs, and sunburst forms. Crosses are dominant motifs in celestial ceilings and are interpreted as star or planet representations by historic Hopi (Cole 2004; Smith 1952). Celestial ceilings are typically less crowded and complex than Panel 6 and have multiple cross-motifs but the overhead setting and prominent display of a cross-motif strengthen the possibility that Panel 6 had similar meaning and function at some point in time (see Figure 5, Appendix D).

Panel 7. Paintings in Panel 7 are located in the northeastern section of the rockshelter on rear wall and overhanging cliff above a narrow ledge. Some elements are overhead. Panel access is restricted by the narrow ledge and low ceiling, making it difficult for more than one or two people to view the small black and white paintings. The location is definitely private in contrast to Panels 2–6 and may have had special significance over time. A similar situation exists at Falls Creek Shelters (5LP1434) where predominantly black and white elements occur in three small spaces with low ceilings. This contrasts with other, highly visible paintings at the site (Cole 2011b).

Panel 7 subject matter includes black and white anthropomorphs, black linear geometric motifs (sunburst, rake, other), and black quadrupeds approximately 5 to 20 cm in length. Indistinct, fragmentary, and unidentified images are also present. Element superimpositions indicate white motifs were made somewhat later than black ones. The geometric motifs appear to have been made separately and possibly earlier than nearby anthropomorphs and animals and may be components of the Archaic Abstract-Geometric Tradition. The most discernible anthropomorphs are of two basic types, broad-shouldered with down-turned arms and slender-bodied with out-stretched arms.

A black broad-shouldered figure with a peaked head or headdress is on the overhang ceiling and must be viewed from below the ledge or while lying down. The figure is very similar to black Basketmaker II-III style figures painted on the ceilings of small spaces at Falls Creek Shelters (5LP1434) (see Figure 6, Appendix D). Graceful black figures with outstretched arms at Falls Creek evoke similarly posed white figures in Panel 7. These images are all on ceilings of small spaces as well (Cole 2011b) (see Figure 7, Appendix D).

Portable Panel 1. Artifact 22, a ground stone slab with petroglyphs on one side, comprises the panel. It was found in Artifact Concentration 2 in the center-north section of the rockshelter in front of Panel 4. Petroglyphs include a finely-incised bird-track motif and a similar but less complete form, and a flag or pennant-like form; a group of etched or grooved lines with no discernible pattern; and a smoothed/ground area. Bird-track motifs commonly appear in Ancestral Pueblo rock art and are used historically by western Pueblos as clan signs and to symbolize birds significant in oral histories (Cole

2004, 2005; Fewkes 1897; White 1932). In the present situation, the track may signify ownership of the artifact.

Test Excavations

Location. Two contiguous 1m² test units (TU), were excavated in the central portion of the site, in an area that appeared to have been illegally excavated (see maps in Appendix A). TU 1 was closest to the back wall of the alcove and TU 2 was to the immediate east, the units forming a trench perpendicular to the alcove's long axis (Figure 3, Appendix E). Tables 1 and 2 provide a summary of artifacts, fire-cracked rock, animal bone, plant remains, and other materials recovered from TUs 1 and 2, by stratum and level.

Stratum 1. The uppermost stratum consisted of a very loose, ash-stained, fine sand with large chunks of sandstone roof fall, and modern organic debris such as pine needles and bark, oak leaves and acorns, and rodent feces. Probable bovine coprolites found in this stratum also demonstrate disturbance to the deposition. A likely looter's pit, a roughly oval depression with large chunks of wood charcoal, was present on the surface in the western half of TU 1. In each TU, Stratum 1 was excavated as single unit, generally about 6 cm in thickness, though a thicker deposit, about 18 cm, was present along the south wall of TU 1. In TU 2, large sandstone slabs and blocks were exposed during excavation of this stratum.

Stratum 2. The underlying stratum was a much more consolidated reddish brown sandy silty loam, which allowed for excavation in 5 cm levels. While evidence of disturbance was much reduced in this layer, probable bovine coprolites indicate some churning has occurred, primarily to the upper level. Several large pieces of animal bone were found among the large rocks exposed in Stratum 1 and removed in the first level of Stratum 2 (see Figures 4 and 5, Appendix E). In TU 2, only two 5 cm levels were dug, as a possible prepared floor or use surface was encountered in the first level and completely exposed in the second (Figure 6, Appendix E). The surface is slightly lighter in color and has a higher clay content than the sediments above. The thin layer may not be continuous across the unit. The surface is similar to Basketmaker II floor surfaces excavated by Earl Morris at the Falls Creek Rock Shelters near Durango, Colorado (Morris and Burgh 1954).

In TU 1, excavation revealed that the looters' pit had been dug into a probable hearth pit (Feature 1), ringed with pieces of fire-cracked rock and a partial oxidation rim. Numerous pieces of wood charcoal were encountered in the fill. The exposed feature covered most of the western portion of the unit (see Figures 7-9, Appendix E). The jumbled nature of Feature 1 makes interpretation difficult. It was clearly the site of fire-related activity, perhaps a roasting pit, based on the large quantity of fire-cracked rock in and adjacent to the pit. From its stratigraphic position, use of the feature postdates that of the possible use surface or floor, but its age is unknown at present. Animal bone recovered from the feature's fill could be used for AMS dating. It is possible that use of

the feature is related to the larger pieces of animal bone found in the upper part of Stratum 2 in TU 2; this could also be explored via AMS dating.

Also in TU 1, a rodent burrow was discovered in the southeast corner of the unit, which continued into the southwest corner of TU 2 in Stratum 2, Level 2. The Feature 1 fill and rodent burrow contents (largely shredded bark and oak leaves) were completely excavated and their fill was screened separately from the general surrounding levels. Three 5 cm levels and a partial fourth level were excavated within Stratum 2 in TU 1. The possible floor or use surface was exposed in the southeast corner in Level 3 and exposed further in Level 4, but was not completely uncovered. A profile map showing the stratigraphy of the test units can be found in Appendix E, Figure 10.

With concurrence from Uncompahgre National Forest archaeologists Leigh Ann Hunt and Elizabeth Lane, excavation ceased with the exposure of the possible floor or activity surface, less than 50 cm below ground surface.

Table 1. Artifact and Sample Summary, Test Unit 1

Location	Artifacts/Samples	Qty	Description
Stratum 1	vegetal samples	2	unburned yucca seeds—likely modern, wood charcoal
	bone fragments	152	
	flakes	61	
	ground stone fragments	4	
	fire-cracked rock	1400 g	
Stratum 2 Level 1	bone fragments	73	
	vegetal samples	2	wood charcoal; burned twigs
	flakes	20	
	ground stone fragments	2	
	fire-cracked rock	2140 g	
Stratum 2 Level 2	vegetal samples	2	burned twigs; wood charcoal
	flakes	4	
	bone fragments	36	
	piece of adobe	1	mud with impressions
	mano fragment	1	one-hand mano
	ground stone fragment	1	
	fire-cracked rock	660 g	
Stratum 2 Level 3	bone fragments	9	
	vegetal sample	1	wood charcoal
	fire-cracked rock	600 g	
Stratum 2 Level 4	vegetal samples	2	maize cob fragment; maize kernel
	flakes	5	
	bone fragments	27	
	fire-cracked rock	3840 g	
Feature 1 Fill	vegetal samples	6	wood charcoal; seeds—likely modern
	bone fragments	28	
	flakes	7	
	ground stone fragment	1	
	fire-cracked rock	3840 g	
rodent burrow	bone fragments	15	

Table 2. Artifact and Sample Summary, Test Unit 2

Location	Artifacts/Samples	Qty	Description
Stratum 1	vegetal samples	3	yucca leaf; wood charcoal; maize cob fragment
	bone fragments	193	
	flakes	89	
	metate fragment	1	
	mano fragment	1	
	ground stone fragment	1	
	fire-cracked rock	840 g	
Stratum 2 Level 1	flakes	38	
	bone fragments	126	includes antler
	vegetal sample	1	wood charcoal
	coprolite	2	probable bovine
	mano fragments	2	
	metate fragment	1	
	fire-cracked rock	3200 g	
Stratum 2 Level 2	flakes	20	
	vegetal samples	3	various seeds, including maize kernel; wood charcoal
	bone fragments	48	
	coprolite	1	probable bovine
	fire-cracked rock	2000 g	

Relocation of Hurst's 1947 Trench. The other part of the excavation plan, detailed in the research proposal, was to relocate the trench excavated by C. T. Hurst during his initial exploration of the site in 1948. Upon learning that Hurst's trench had not been backfilled at the time of his excavation, and that the area had been subject to undocumented, non-archaeological excavations, this component of the plan was cancelled, also in consultation with Uncompahgre National Forest archaeologists Leigh Ann Hunt and Elizabeth Lane. The general consensus being that within the time and financial constraints of this grant project, it would be difficult, if not impossible, to locate an intact trench wall suitable for profile mapping.

Chronometry

From the recovered plant remains and animal bone, four specimens (see Figures 11-14, Appendix E) were selected for submission to the University of Georgia's Center for Applied Isotope Studies, for AMS (accelerator mass spectrometry) dating (see Appendix G). The resulting dates are provided in Table 4 and were calibrated using OxCal v.4.1.7 (Ramsey 2010; Reimer et al. 2009). Considerably younger than that obtained by Stiger and Larson (1992) from the maize bundle, the newly dated cob and kernel provide evidence of maize use in both Basketmaker II and Basketmaker III times. Dates derived from materials located just above the possible floor or surface—the maize cob and the fragment of burned large mammal bone that appears to have been processed—coincide remarkably and suggest that the surface was used in the decades just before or after A.D. 1. The yucca leaf fragment, of similar age, recovered from Stratum 1 demonstrates the somewhat churned nature of upper deposits in the shelter.

Table 3. AMS Samples and Resulting Dates

UG No.	Material	Provenience	RYBP	Calibrated* Date
12487	<i>Zea mays</i> cob fragment	TU 1, Stratum 2, Level 4, PL 6	1960+/-20	35 BC – AD 84
12488	<i>Zea mays</i> kernel	TU 2, Stratum 2, Level 2	1280+/-20	AD 675 - 773
12489	<i>Yucca baccata</i> leaf fragment	TU 2, Stratum 1	1960+/-20	35 BC – AD 84
15840	Large mammal long bone fragment	TU 2, Stratum 2, Level 2	1980+/-25	40 BC – AD 70

* 2 sigma; reported raw BP date calibrated for this study:
95.4% probability, OxCal v. 4.1.7 Bronk Ramsey (2010); r:5; Atmospheric data from Reimer et al (2009)

Research Discussion

Rock Art - Chronology and Cultural Relationships

Stylistic attributes supported by chronometric data and associated material culture examined in this report indicate Cottonwood Cave rock art dates from Basketmaker II into Basketmaker III and possibly early Pueblo I times. Close relationships with San Juan Basketmaker II are obvious, particularly with eastern populations at the Falls Creek Shelters (Adams et al. 2011). Rock art correlations extend from anthropomorphic and other iconography to colors and image size and placement within rockshelters at the two sites. They are around 70 air miles apart and occupations are generally contemporaneous after approximately 300 B.C. Direct links between the populations over time seem quite possible. Similarities also exist between Cottonwood Cave paintings and rock art attributed to Basketmaker II-III populations in the Cedar Mesa and Moab, Utah areas to the west (Charles and Cole 2006; Cole 2009).

Earlier occupation of Cottonwood Cave is suggested by geometric imagery in Panels 6 and 7 that may be related to the Archaic Abstract-Geometric Tradition. Future research can address that question through additional excavation and/or direct dating of the rock paintings. Links to the Archaic Uncompahgre Complex are not evident in Cottonwood Cave rock art beyond common depictions of rows and groups of quadrupeds (cervids) including animals with large, branching antlers. Distinctive Uncompahgre Style "candelabra" antlers, however, are not represented at Cottonwood Cave (Buckles 1971; Wormington and Lister 1956).

If Panel 6 is a celestial ceiling, it presumably was made by Pueblo II and possible Pueblo III residents of nearby Weimer Ranch and Cottonwood Pueblo sites (Gruebel et al. 2006; Hurst 1948). Knowledge of celestial ceilings and associated practices probably reached the groups through ties to the San Juan region as indicated by material culture. Uncertainty with regard to a Pueblo III presence at the sites, however, raises questions about the makers insofar as celestial ceilings in the San Juan region are associated with Pueblo III occupations such as that at Step House (Hayes 1964). It is possible that Pueblo groups ritually visited and repainted an ancient (possibly Archaic or

Basketmaker) ceiling panel over time. The singular cross-motif may be a relatively late addition.

Site Chronology and Use

The new AMS dates firmly associate occupation of Cottonwood Cave with the Basketmaker II and the late Basketmaker III/early Pueblo I periods (see Lipe et al. 1999). As noted above, the rock art imagery in Cottonwood Cave is indicative of Basketmaker occupation, but also suggests later use during Pueblo II/III. The prevalence of grinding tools in the small sample of excavated artifacts and on the site's surface is certainly indicative of seed processing, but none of the artifacts are complete enough for comparison with collections definitively associated with Basketmaker II, such as those from the Falls Creek Rockshelters or Talus Village (Morris and Burgh 1954), so their potential association with maize agriculture remains undetermined.

Though limited, the assortment of artifacts recovered during the 2012 test excavations compare well with the more extensive assemblage recovered in 1947. From the quantity and depth of material culture encountered by Hurst (1947:13-18), it is clear that Cottonwood Cave has served primarily as a habitation during its history. The rock art evident on its walls and boulders and the presence of the corn cache indicate that use of the shelter had religious/ceremonial aspects as well. While the hint of a possible floor or use surface suggest the possibility of a more sedentary occupation of the shelter around 40 B.C. – A.D. 70 (bone recovered just above the possible use surface), this can only be demonstrated, or disproved, through additional excavation.

Reliance on local lithic materials, such as silicified sediments from the Morrison and Dakota formations (see Gerhardt 2001), is evident in the flaking debris. The small flake assemblage is suggestive of tool manufacture, based on the general lack of cortex and the relatively small size of the flakes. Similarly, the macrobotanical and faunal remains are reflective of the local environment, demonstrating economic use of plants such as yucca, pinyon pine, Gambel oak, and Utah juniper, and of animals such as deer or elk, along with smaller mammals. A larger assemblage would allow for a more nuanced interpretation, as well more substantive comparisons with material culture from other sites.

Summary and Conclusions

The Cottonwood Cave Assessment Project has successfully completed its primary goals, which included limited test excavations to obtain short-lived plant specimens for radiocarbon dating, the collection of mapping data, and the detailed documentation of rock art. Although the excavations were ultimately of a much more limited nature than had been planned, they have demonstrated the presence of intact buried cultural deposits and the site's potential for additional research concerning early agriculture and sedentism in southwestern Colorado. The project has conclusively demonstrated Cottonwood Cave's long association with maize agriculture, as well as its ties to Archaic

and Ancestral Pueblo culture, specifically that of Basketmaker II-III, evident in the rock art contained within.

It is hoped that future excavations will explore the extent and nature of the possible prepared surface and related deposits; this would aid greatly in the interpretation of the materials encountered in the test units excavated for this project. Cottonwood Cave's occupation history, while long, has yet to be conclusively defined. The overall depth of cultural deposits in the shelter was not ascertained by Hurst, so the true antiquity of human use of the shelter remains unknown, at least for the present. Are there Archaic period cultural deposits buried within the site? Likewise, the latest prehistoric use of the shelter has still to be defined. Was the shelter used during Pueblo II and III times, or even later? The direct dating of pigments used in the rock art imagery and the acquisition of additional AMS dates from curated perishable materials recovered from the 1947 trench are avenues of research with high potential to complete the chronology of Cottonwood Cave. As a Basketmaker site situated on the periphery of the Ancestral Pueblo culture area, Cottonwood Cave's role in the development and spread of maize agricultural traditions is indeed significant, and the unfolding of its story should be continued.

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Appendix A: Site Plan Maps

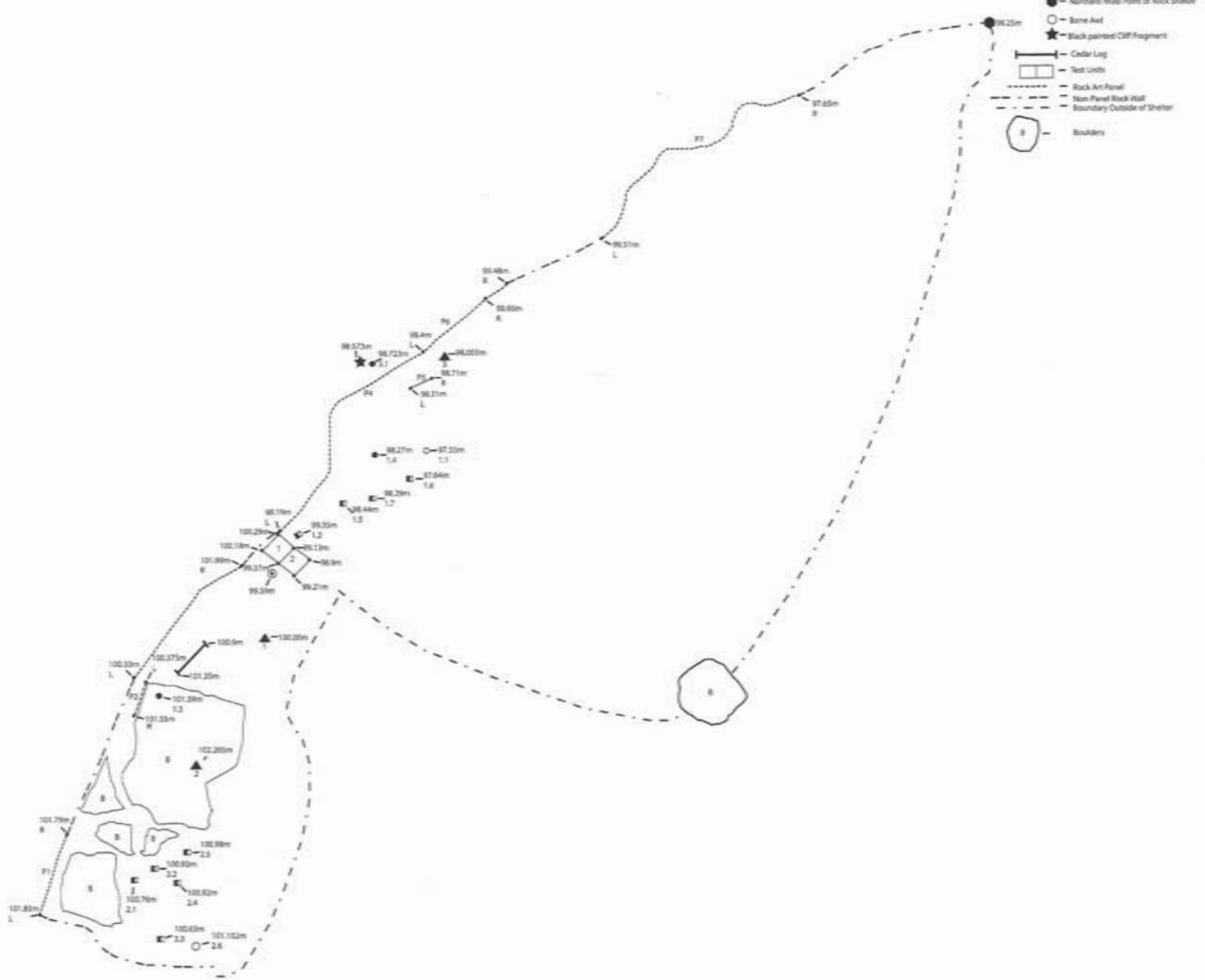
SMNST9
Cottonwood Cave Rock Shelter

D. Henderson



Key:

- ▲ Datum
- Mapping Datum
- ▣ Pecked Stone Slab
- Ground Stone
- Lithic Core
- Northern Most Point of Rock Shelter
- Bone Aul
- ★ Black painted Cliff Fragment
- Cedar Log
- ▭ Test Units
- - - Rock Art Panel
- - - Non Panel Rock Wall
- - - Boundary Outside of Shelter
- Boulders



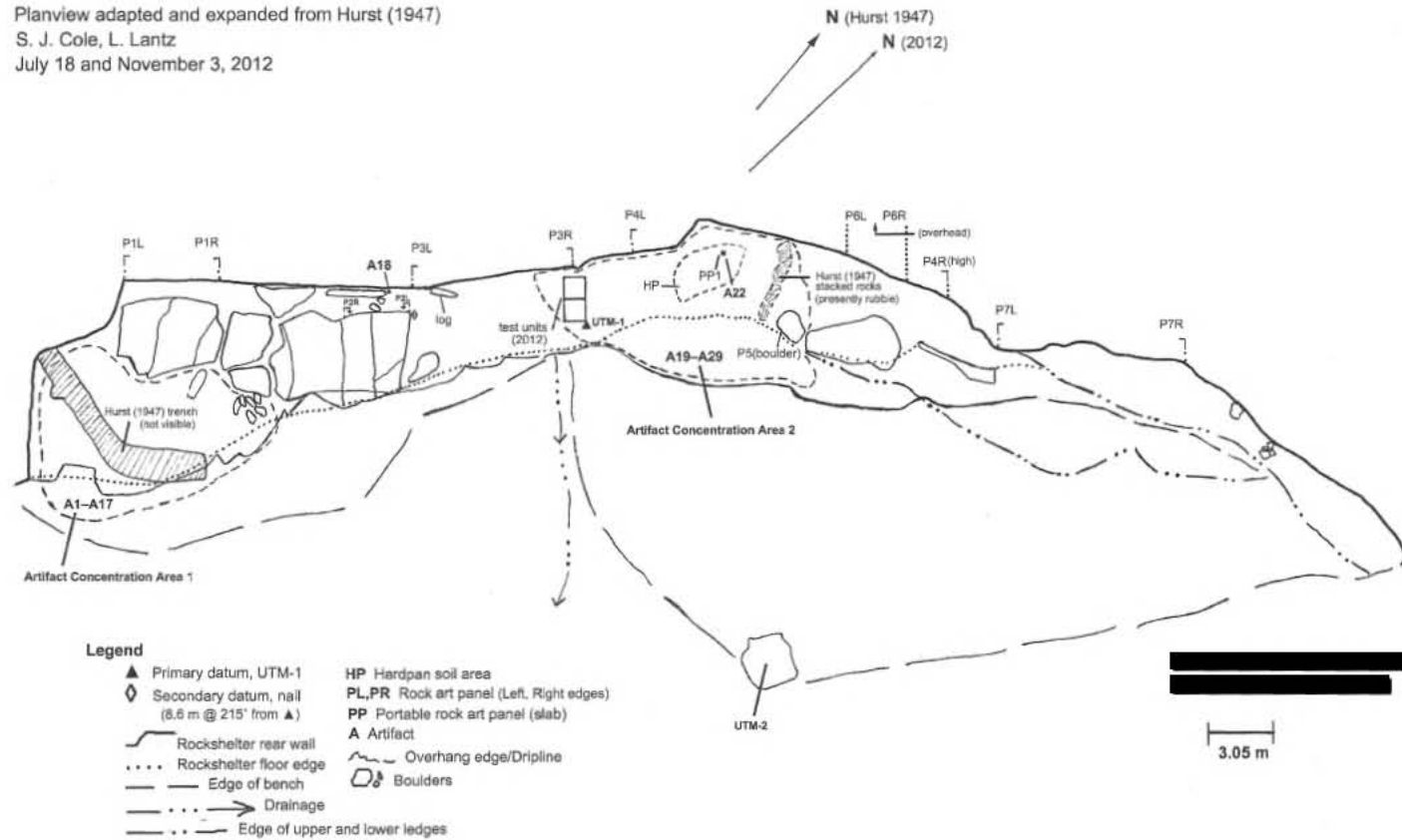
5MN519

Cottonwood Cave

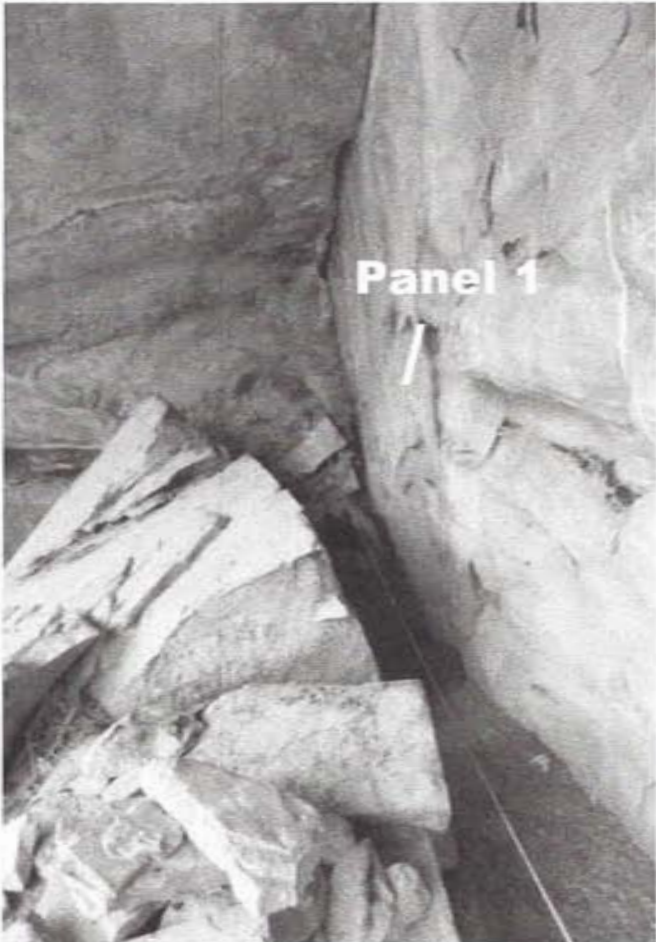
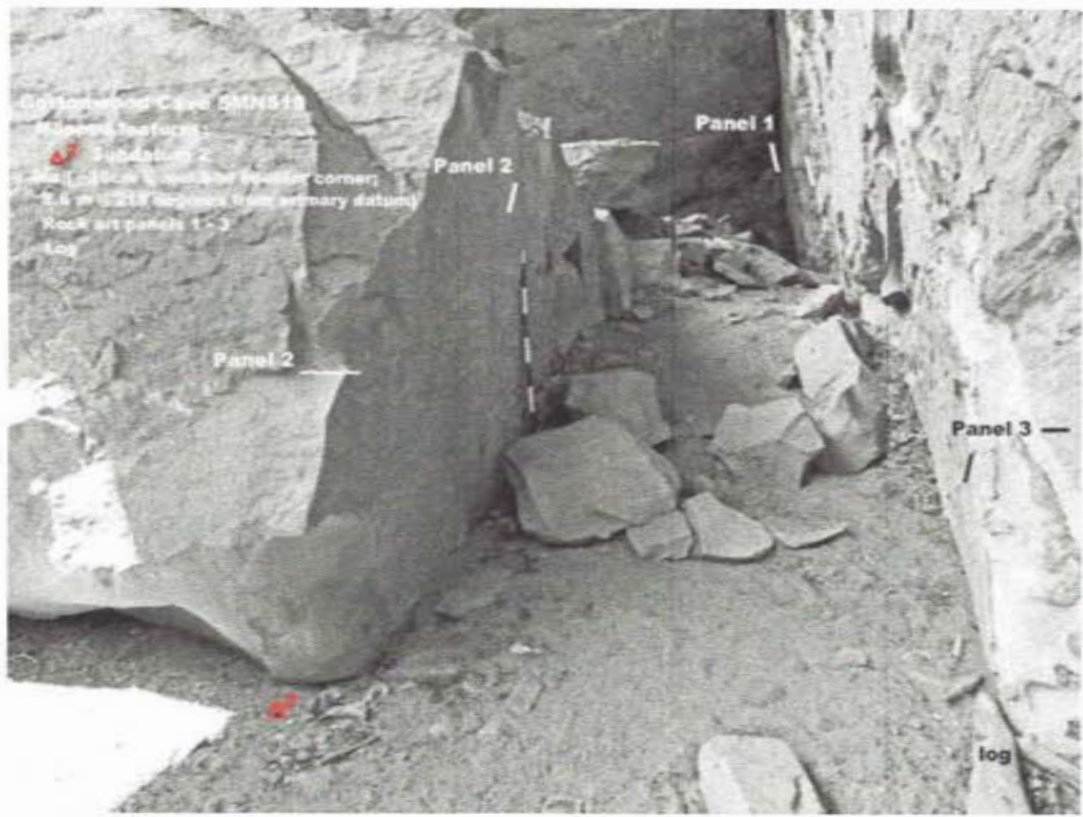
Planview adapted and expanded from Hurst (1947)

S. J. Cole, L. Lantz

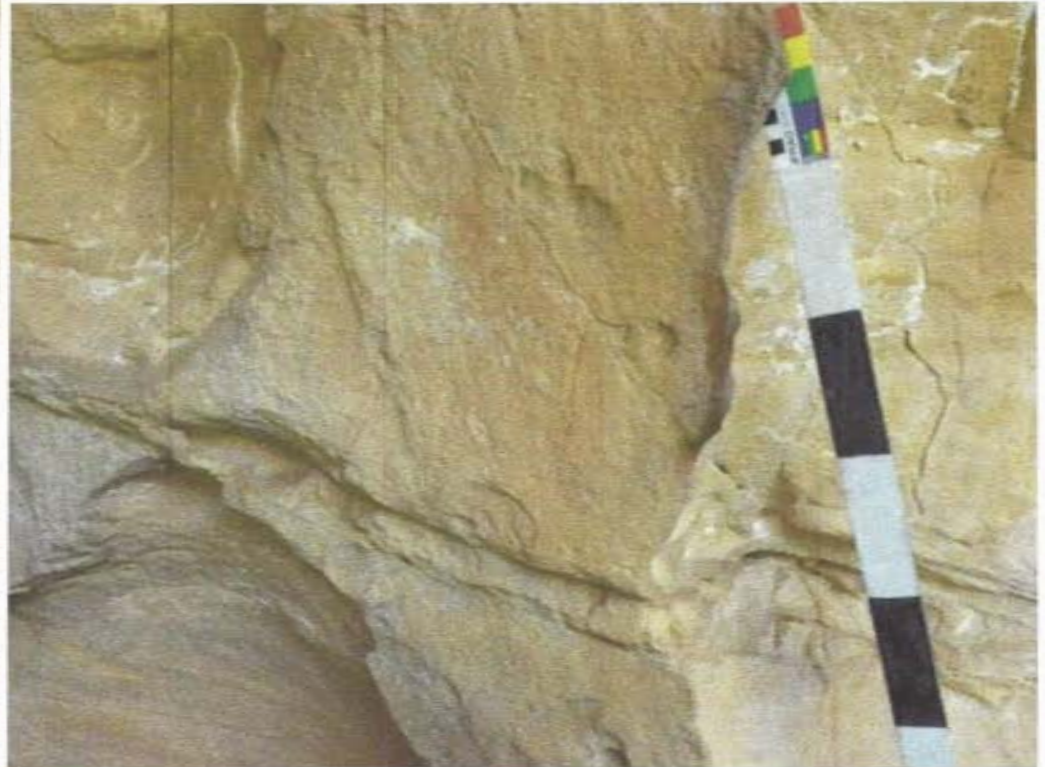
July 18 and November 3, 2012



Appendix B: Illustrations of Rock Art Panels



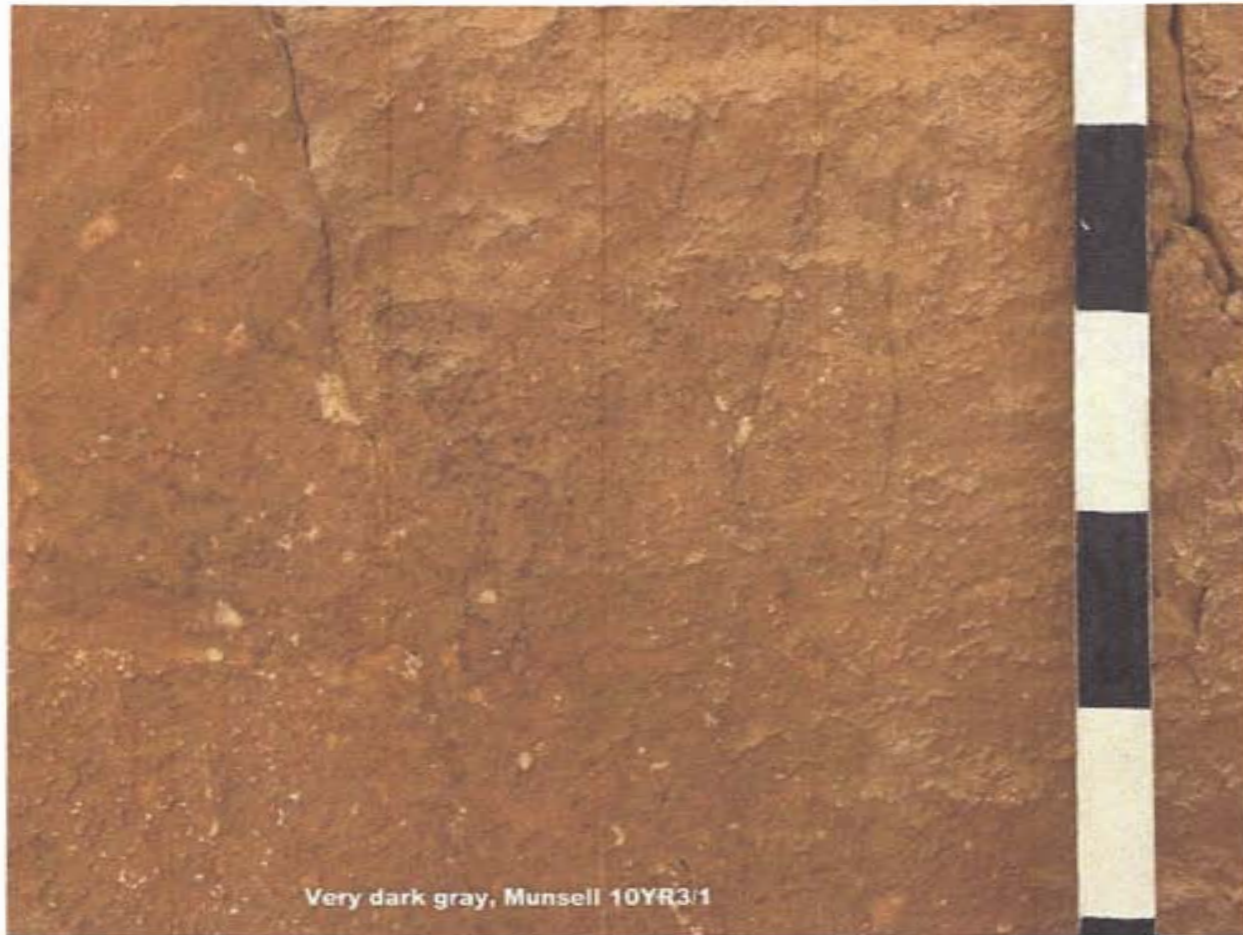
5MN519 Panel 1 location (view SW)



5MN519 Panel 1 details, left (SW) and right (NE) sections



5M519 Panel 2 overview (view S)

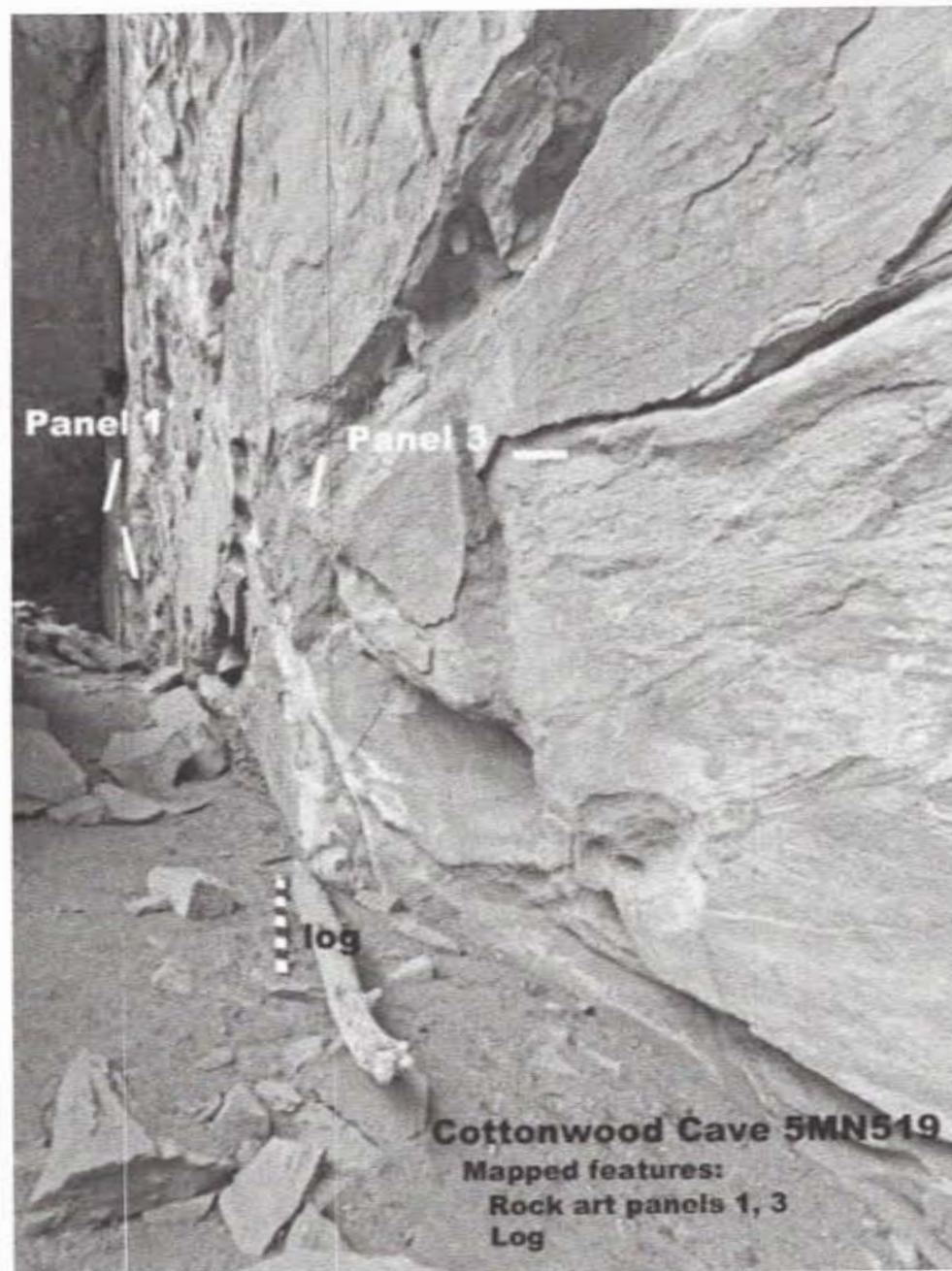


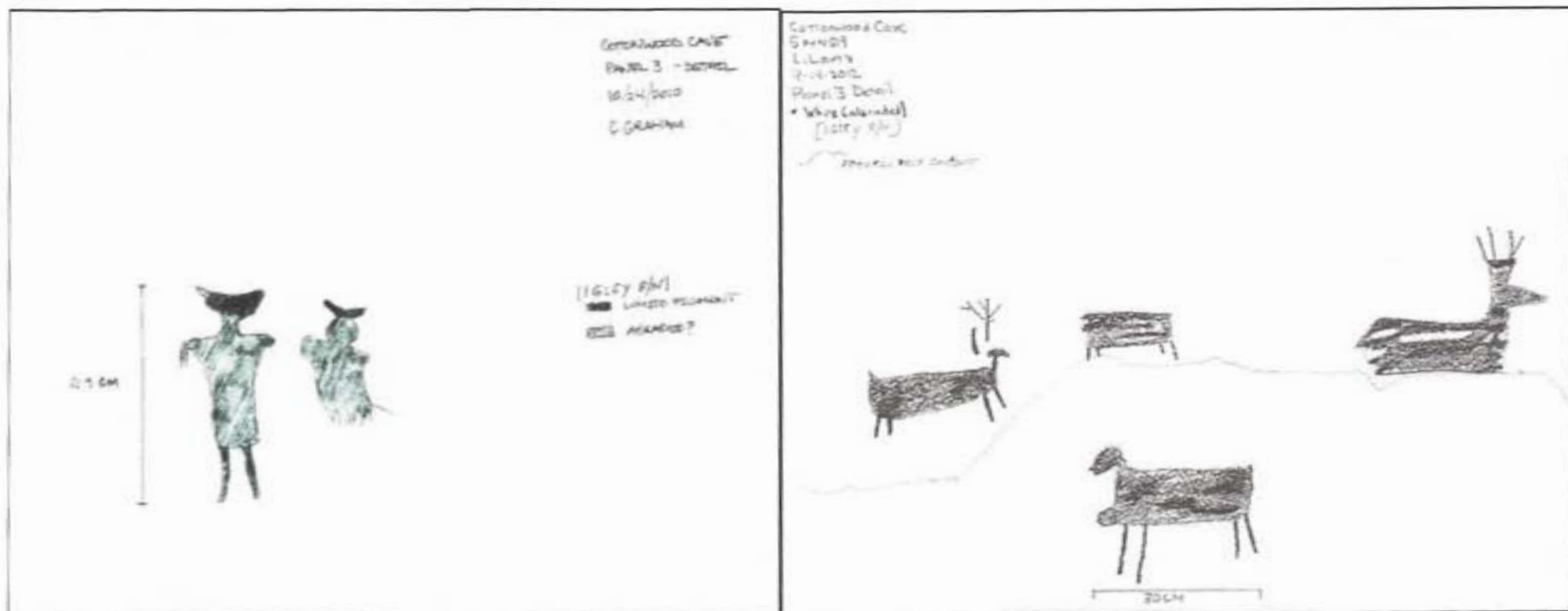
5MN519 Panel 2 detail



5MN519 Panel 2 detail

5MN519 Panel 3 location (view SW)

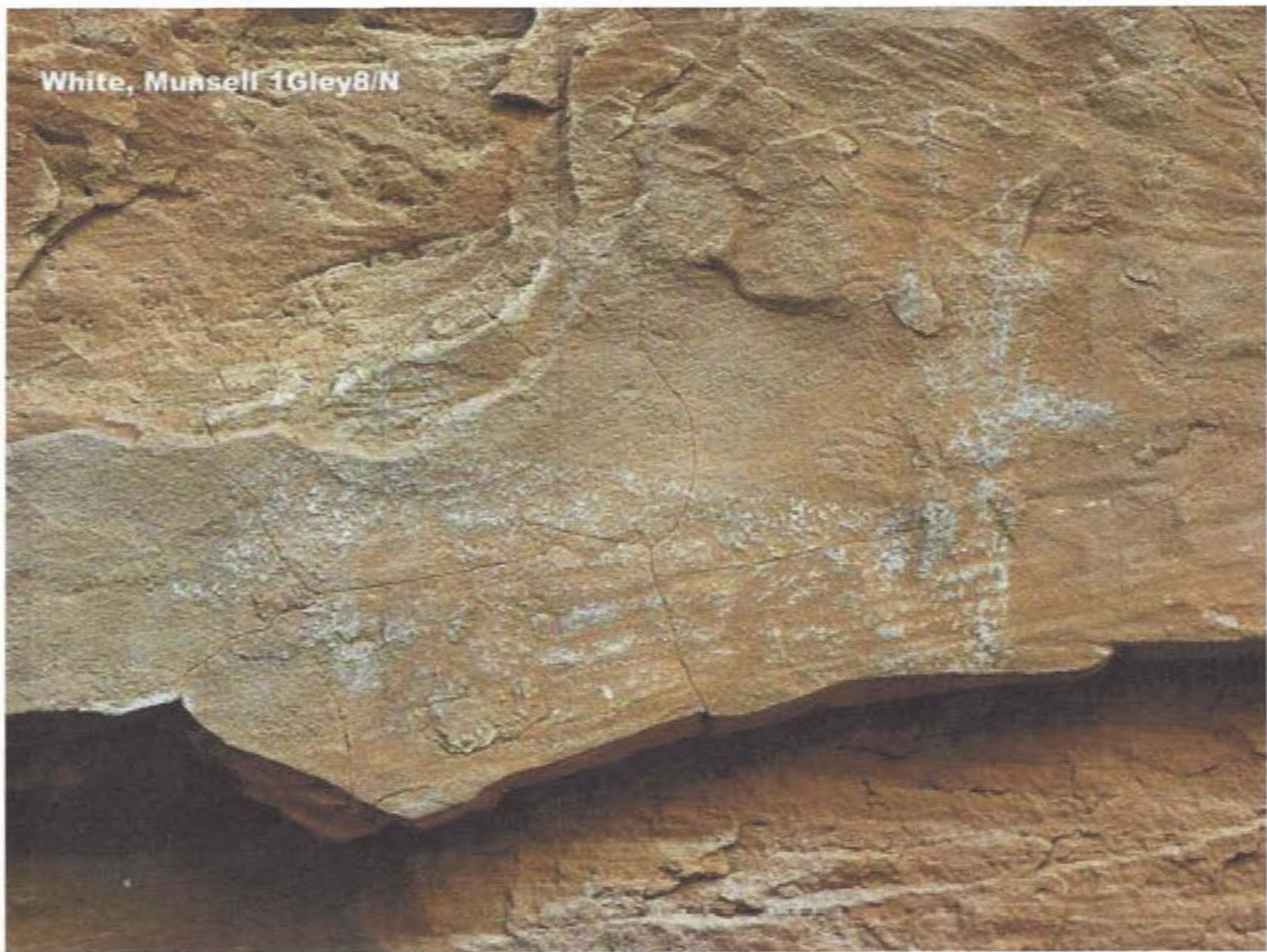




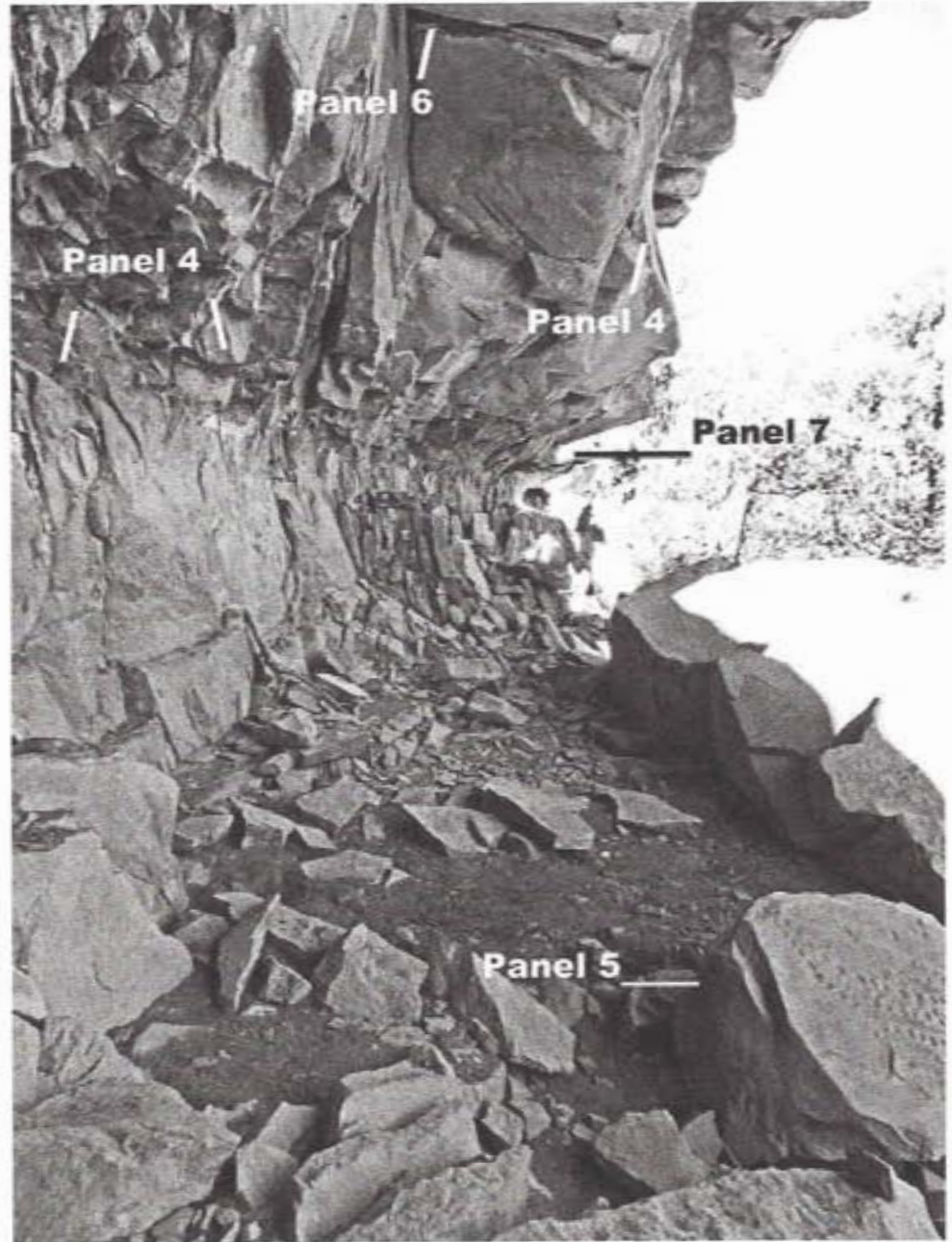
5MN519 Panel 3 details, white paint



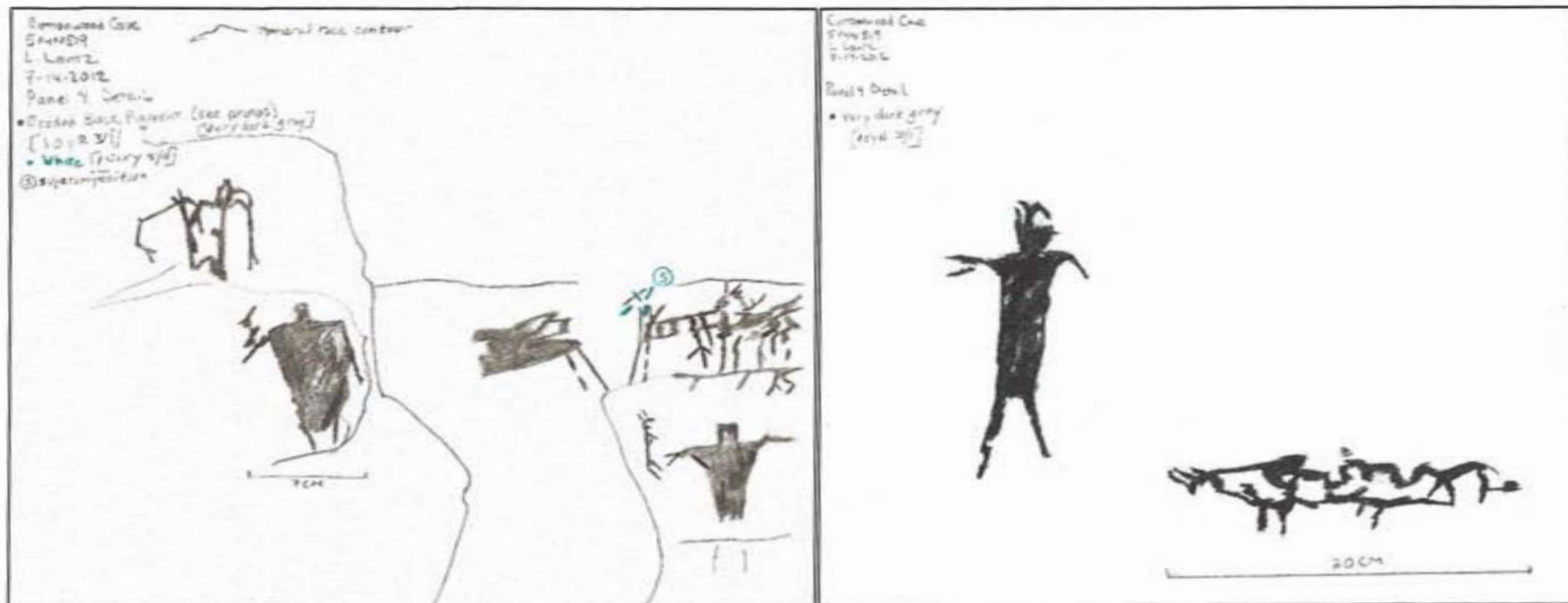
5MN519 Panel 3 detail



5MN519 Panel 3 detail



5MN519, location of Panels 4, 5, 6, 7 (view NE)



5MN519 Panel 4 details (left, white and dark gray paint; right, dark gray paint)



5MN519 Panel 4 detail



5MN519 Panel 4 detail (head and antlers)



5MN519 Panel 4 detail infrared)



5MN519 Panel 4 detail



5MN519 Panel 4 details



5MN519 Panel 4 detail



5MN519 Panel 4 detail



5MN519 Panel 4 detail



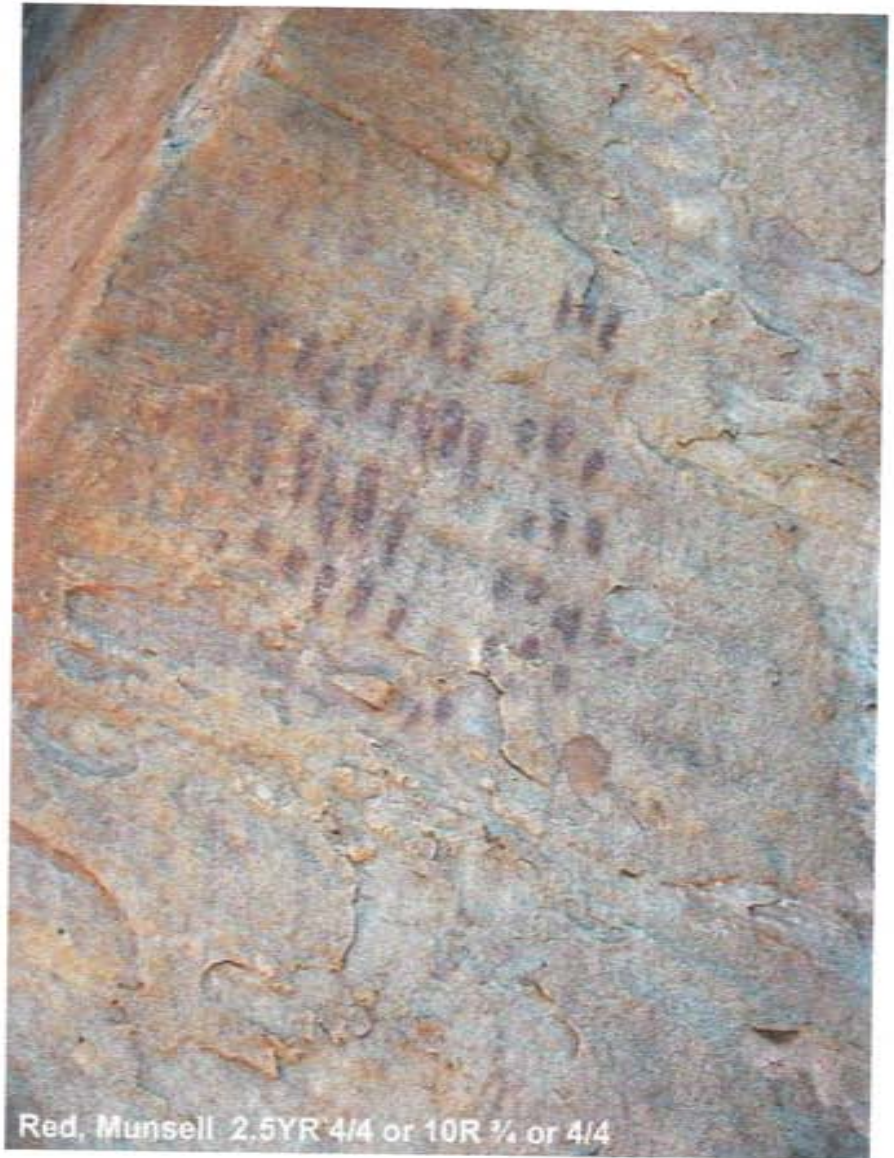
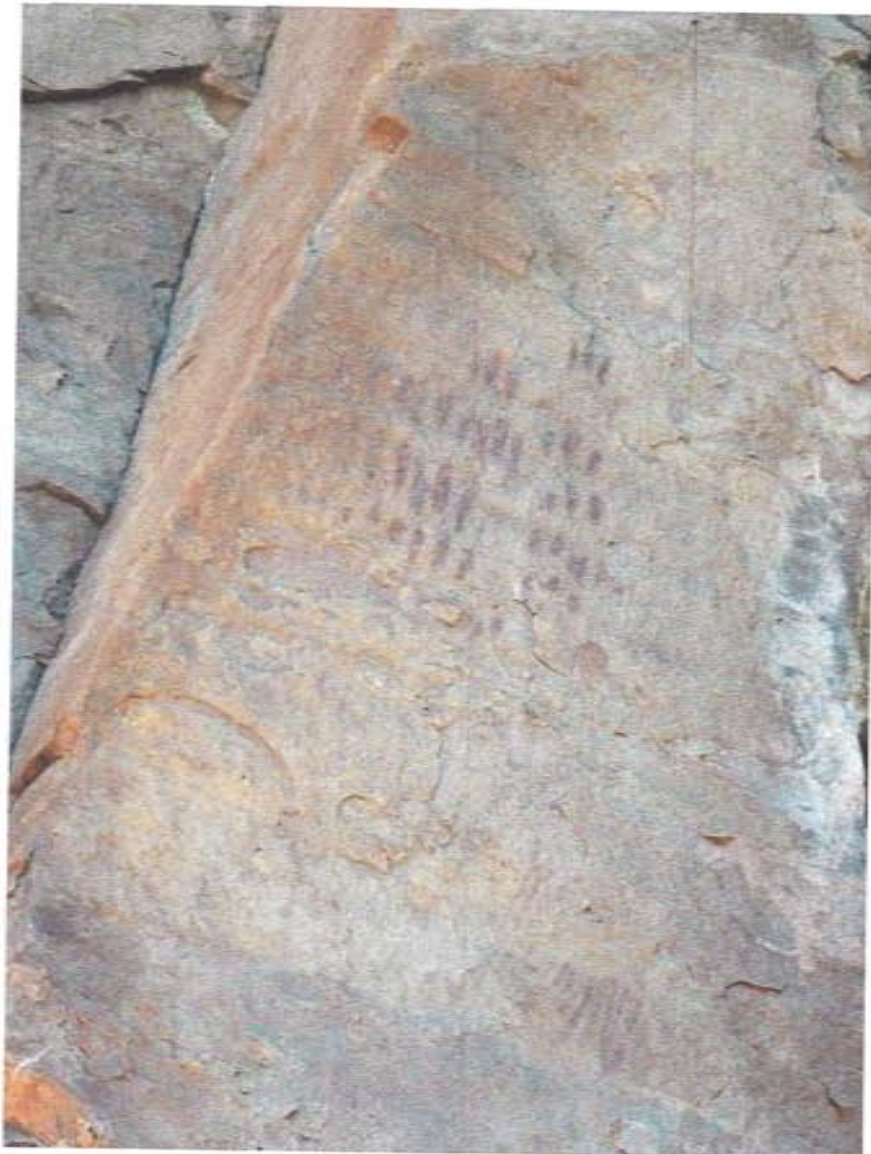
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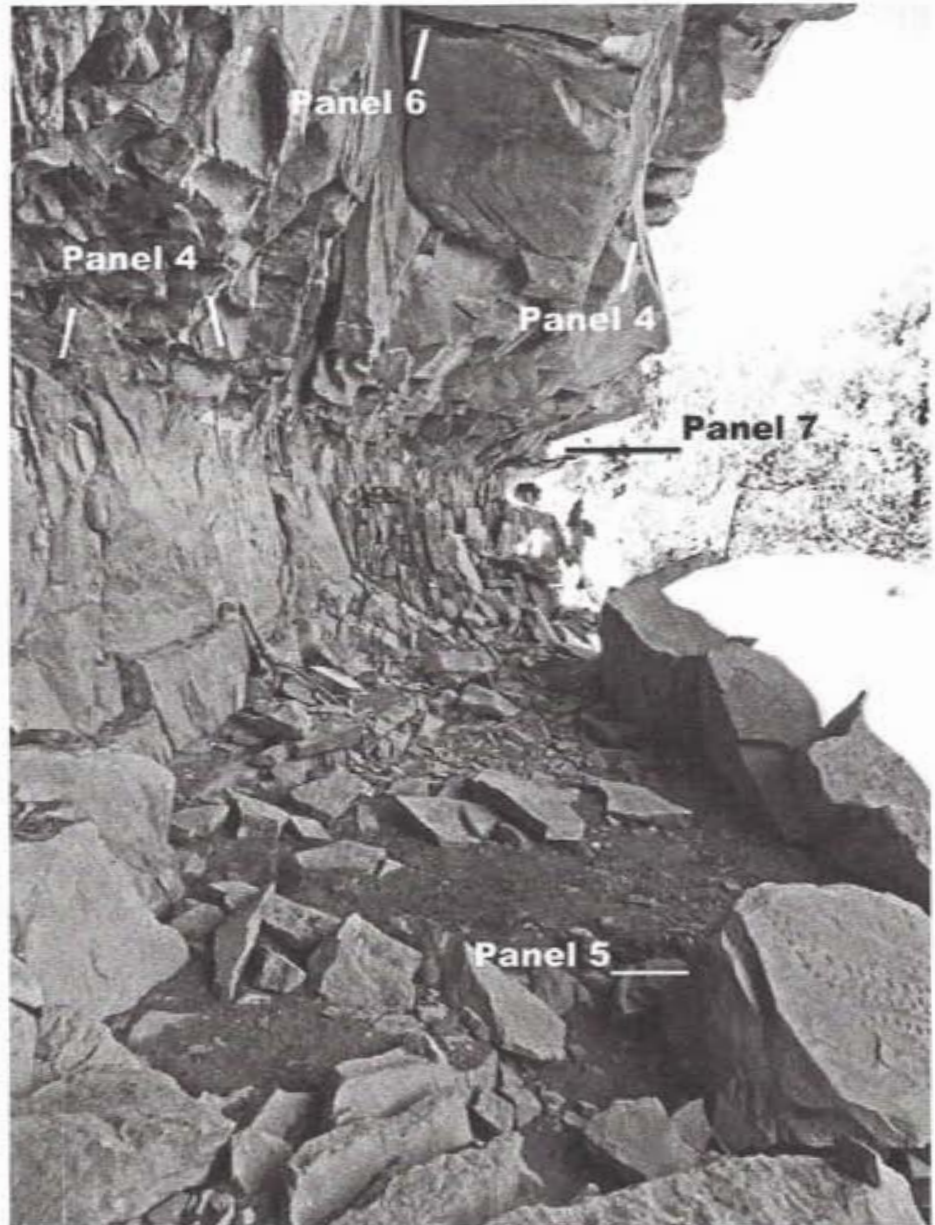
5MN519 Panel 4 detail



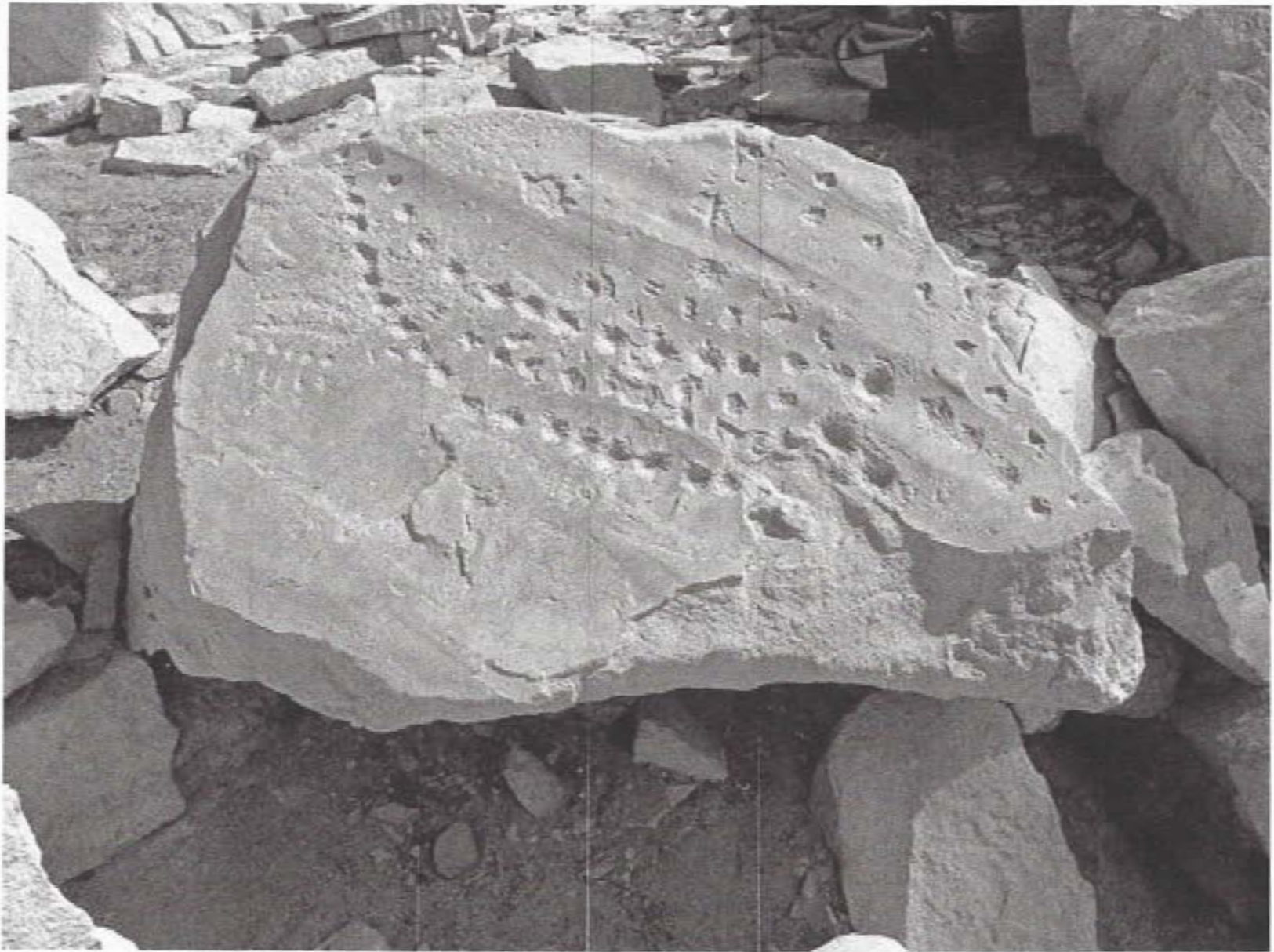
5MN519 Panel 4 detail



5MN519 Panel 4 details



5MN519, locations of Panels 4, 5, 6, 7 (view NE)



Panel 5 overview (infrared)



5MN519 Panel 5, edge detail



5MN519 Panel 5 detail



5MN519 Panel 6, at left on ceiling of overhanging cliff [northeast section of Panel 4 on cliff to right]

Cottonwood Cave

5MN 519

L. Larz

7-14-2012

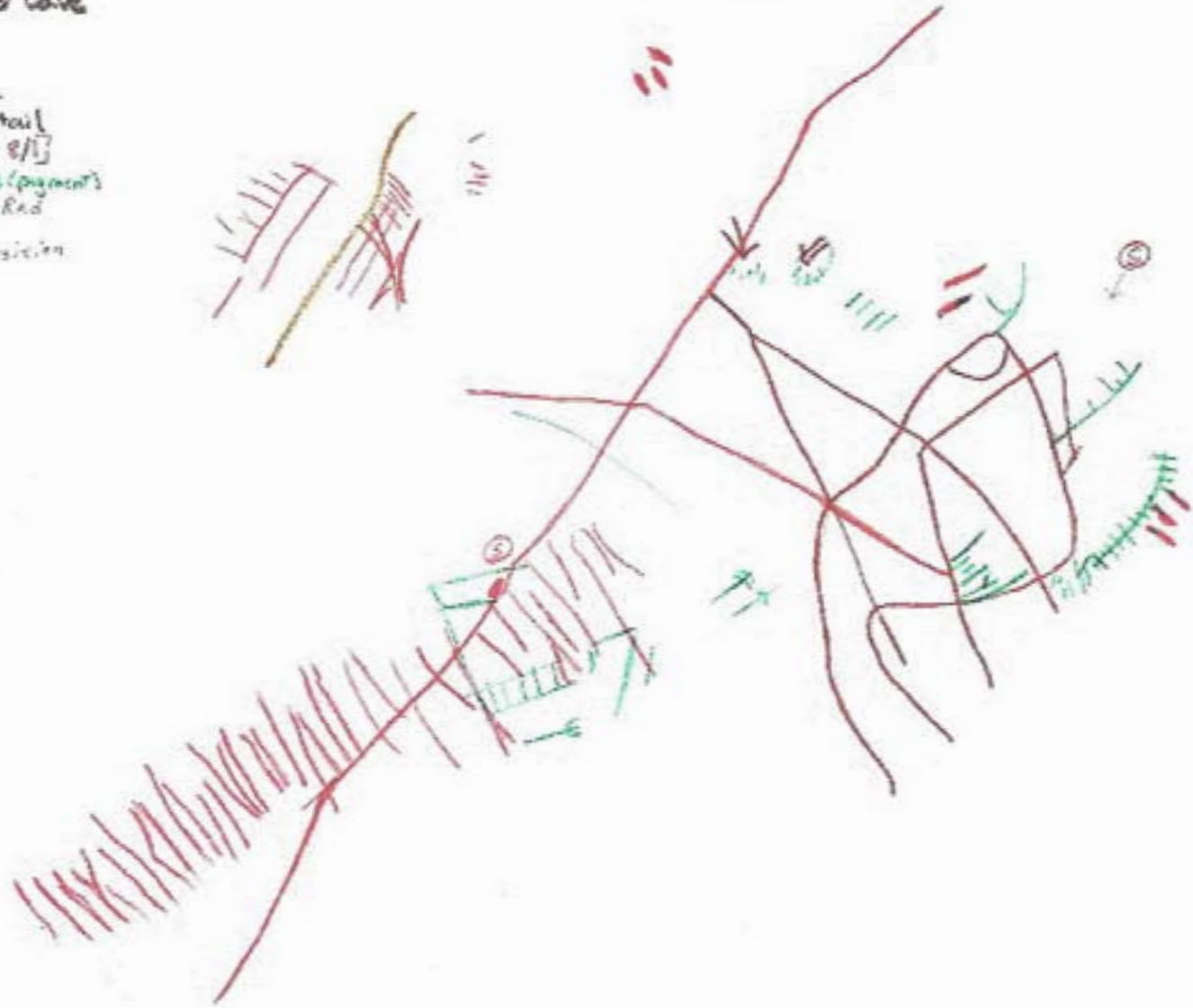
Panel 6 Detail

• White [5/1]

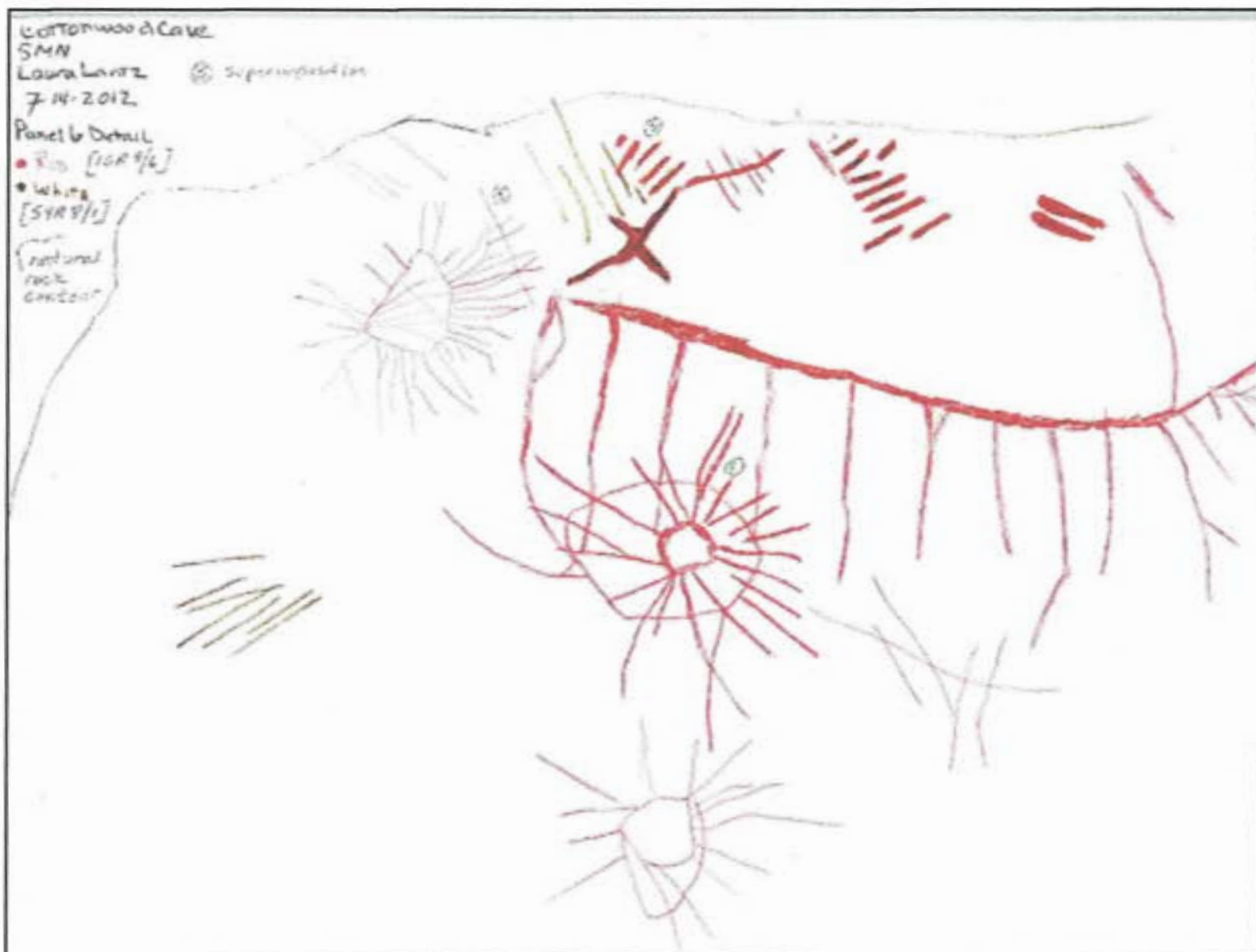
• Fairway (pigment)

• [OR 4/6] Red

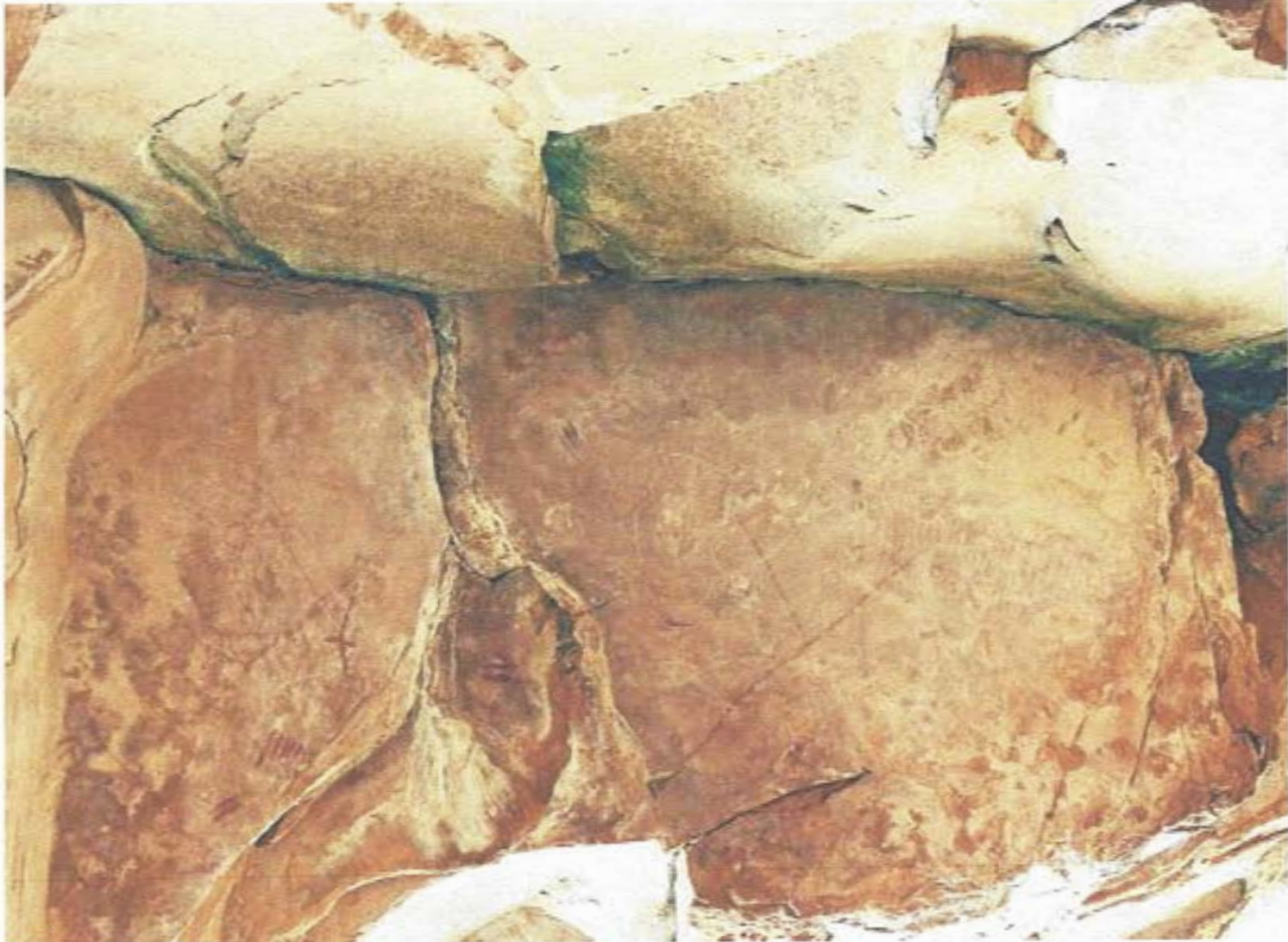
⑤ Superimposition



5MN519 Panel 6 detail



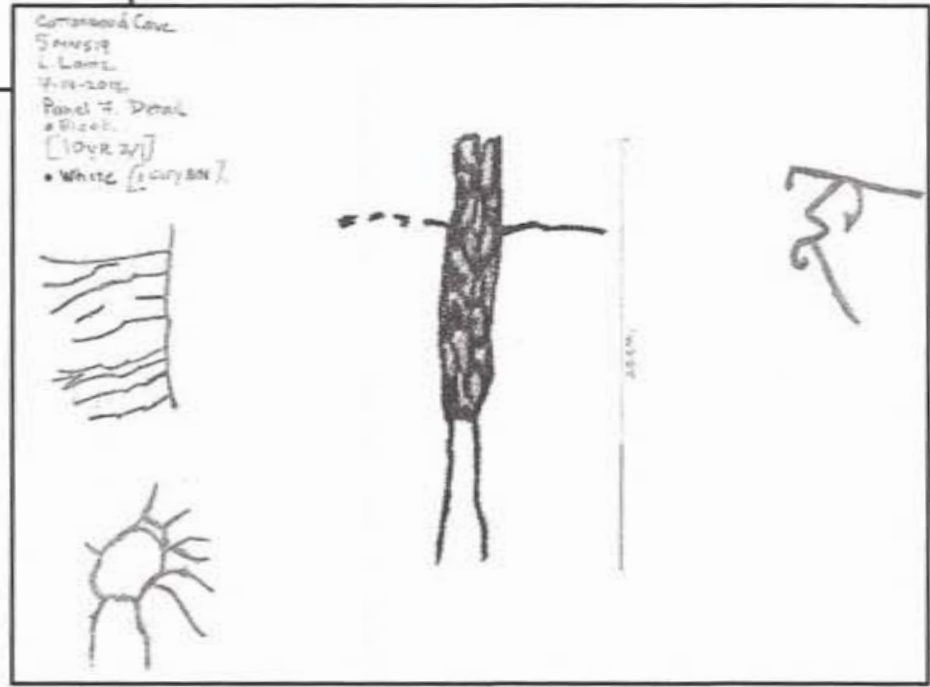
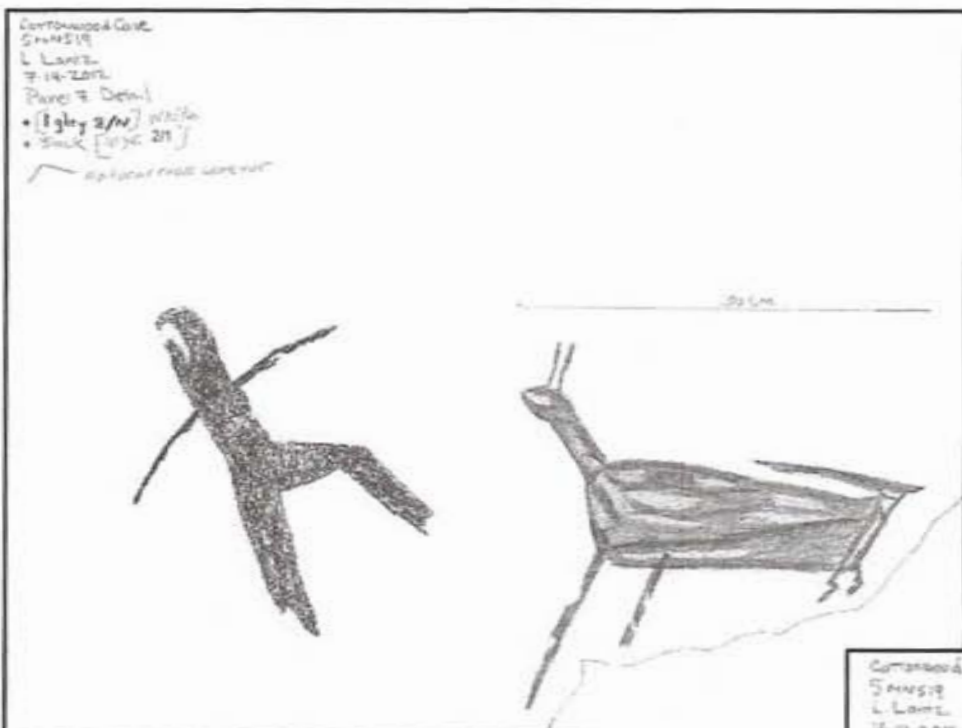
5MN519 Panel 6 detail



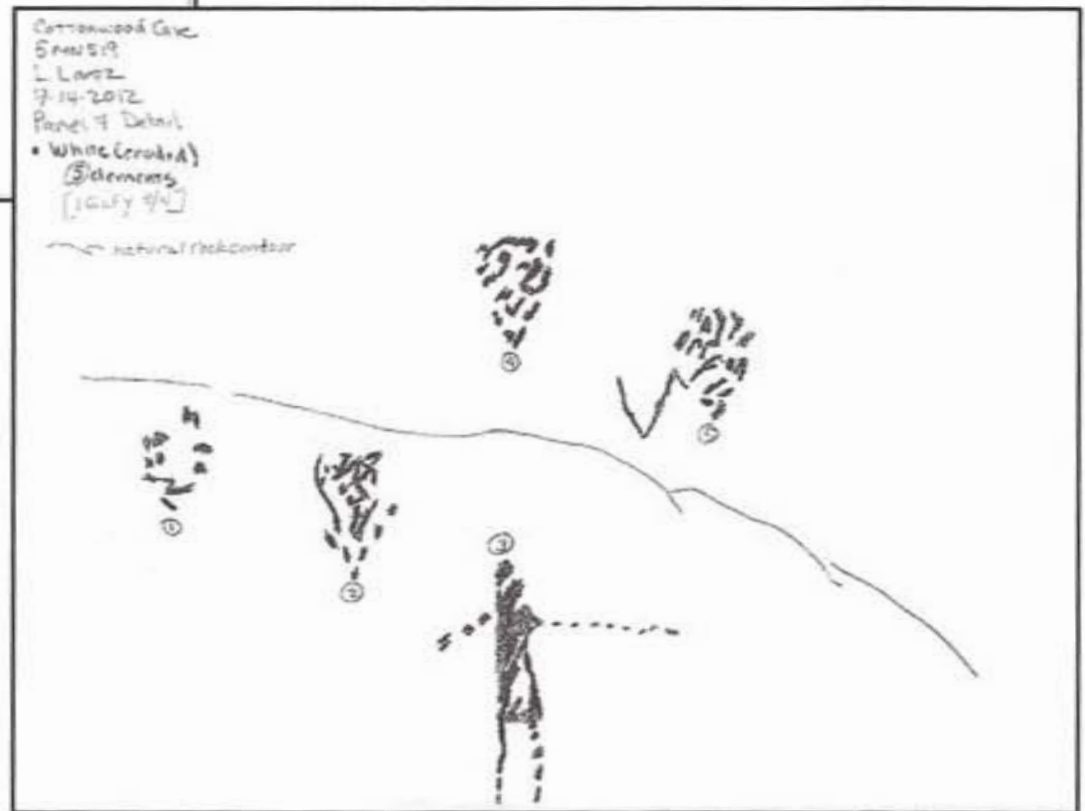
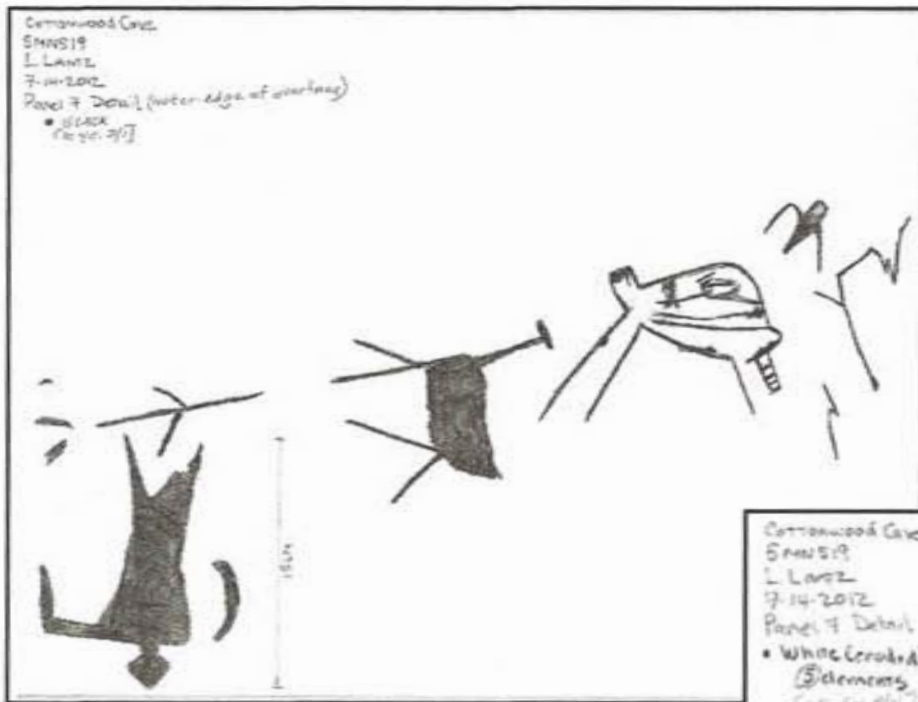
5MN519 Panel 6 overview



5MN519 Panel 6 detail



5MN519 Panel 7 details



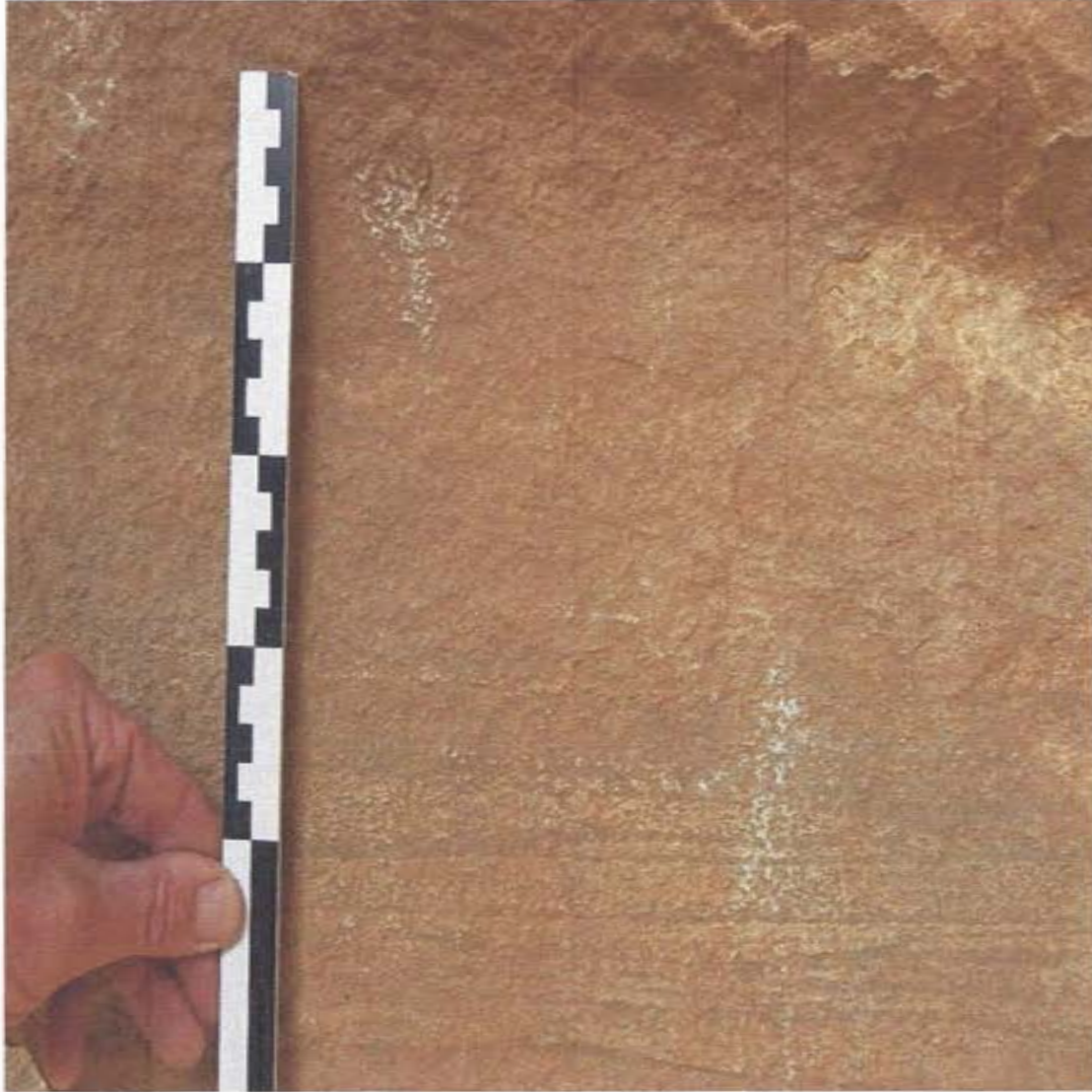
5MN519 Panel 7 details



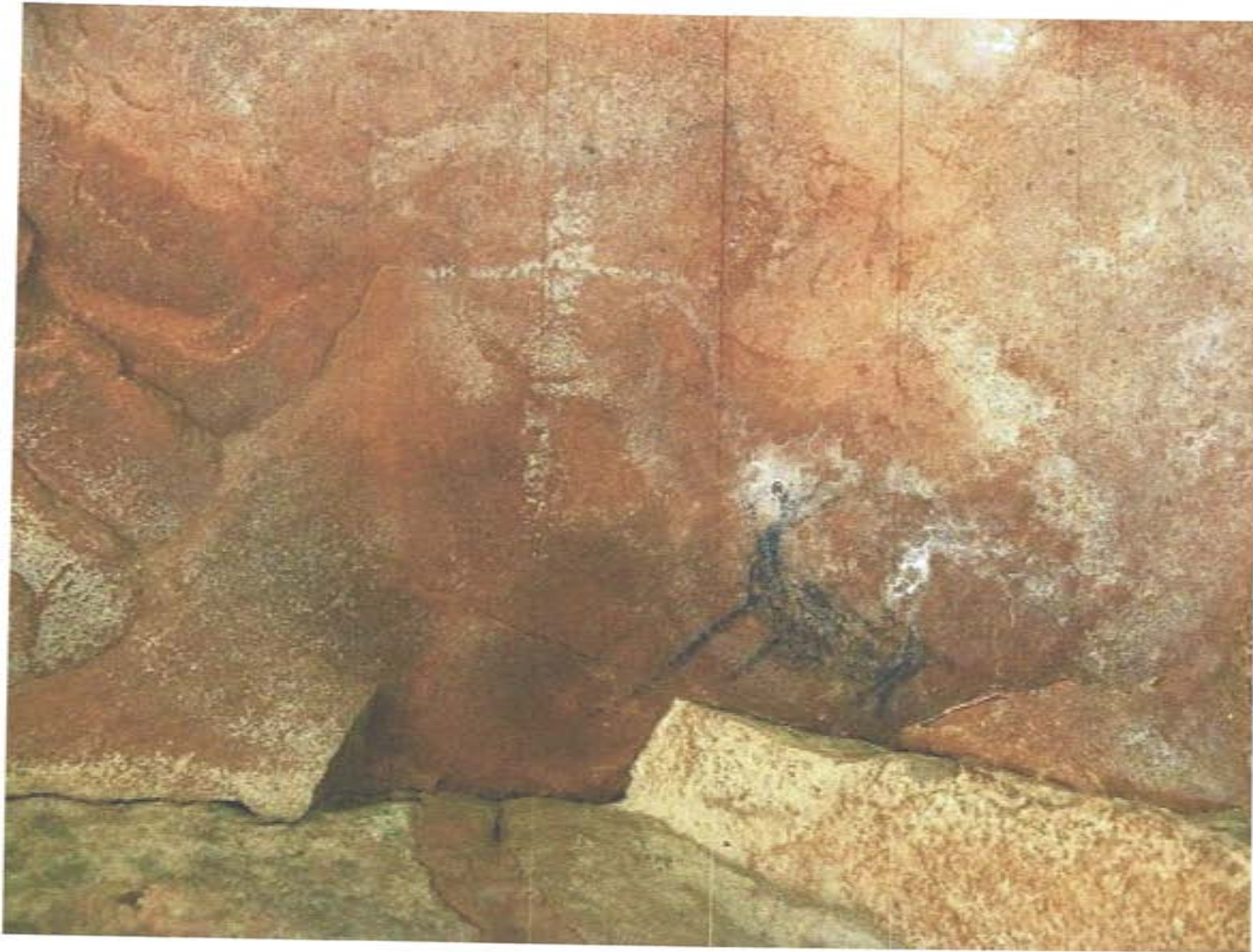
5MN519 Panel 7 location (view NE)



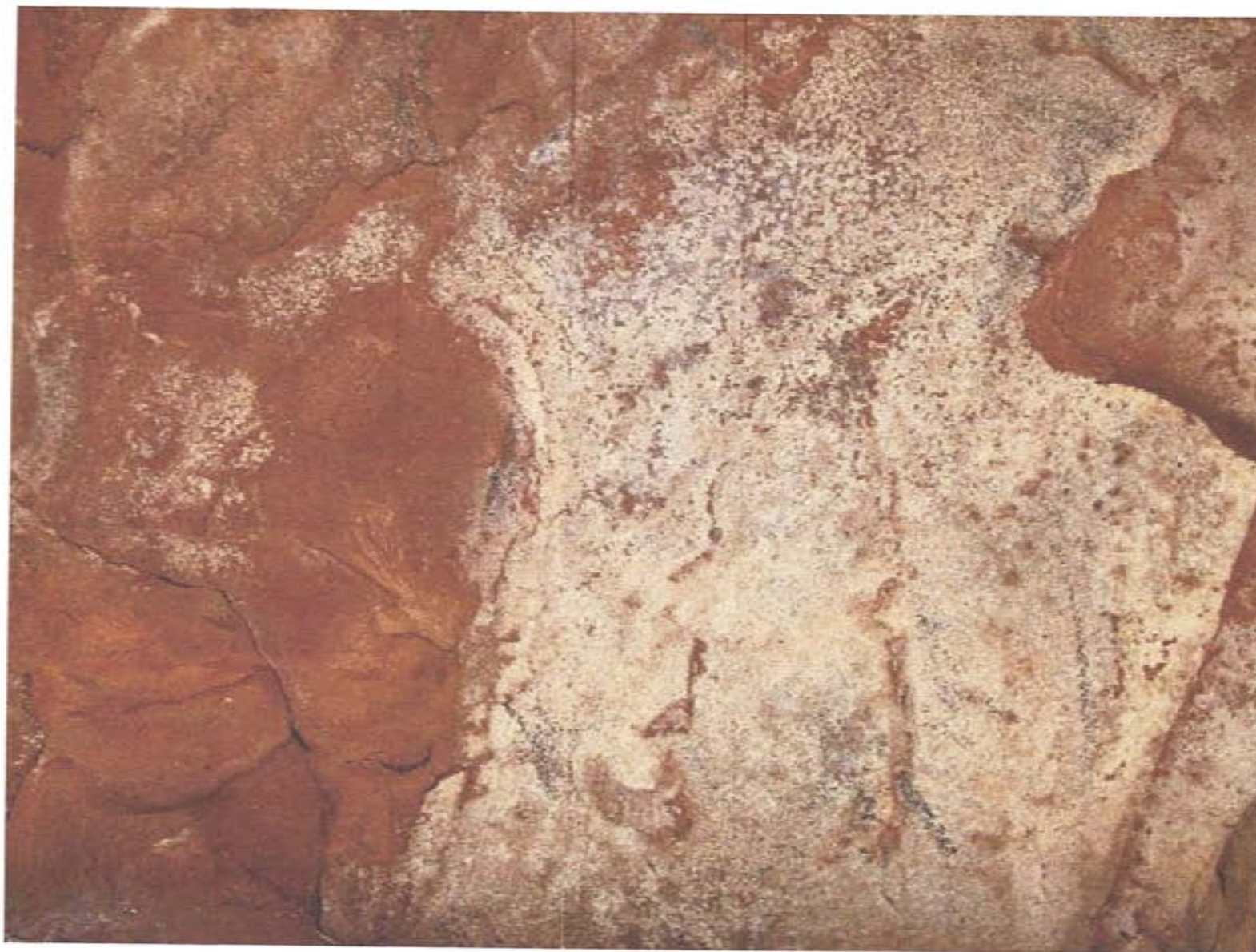
5MN519 Panel 7 detail



5MN519 Panel 7 detail



5MN519 Panel 7 detail



5MN519 Panel 7 detail

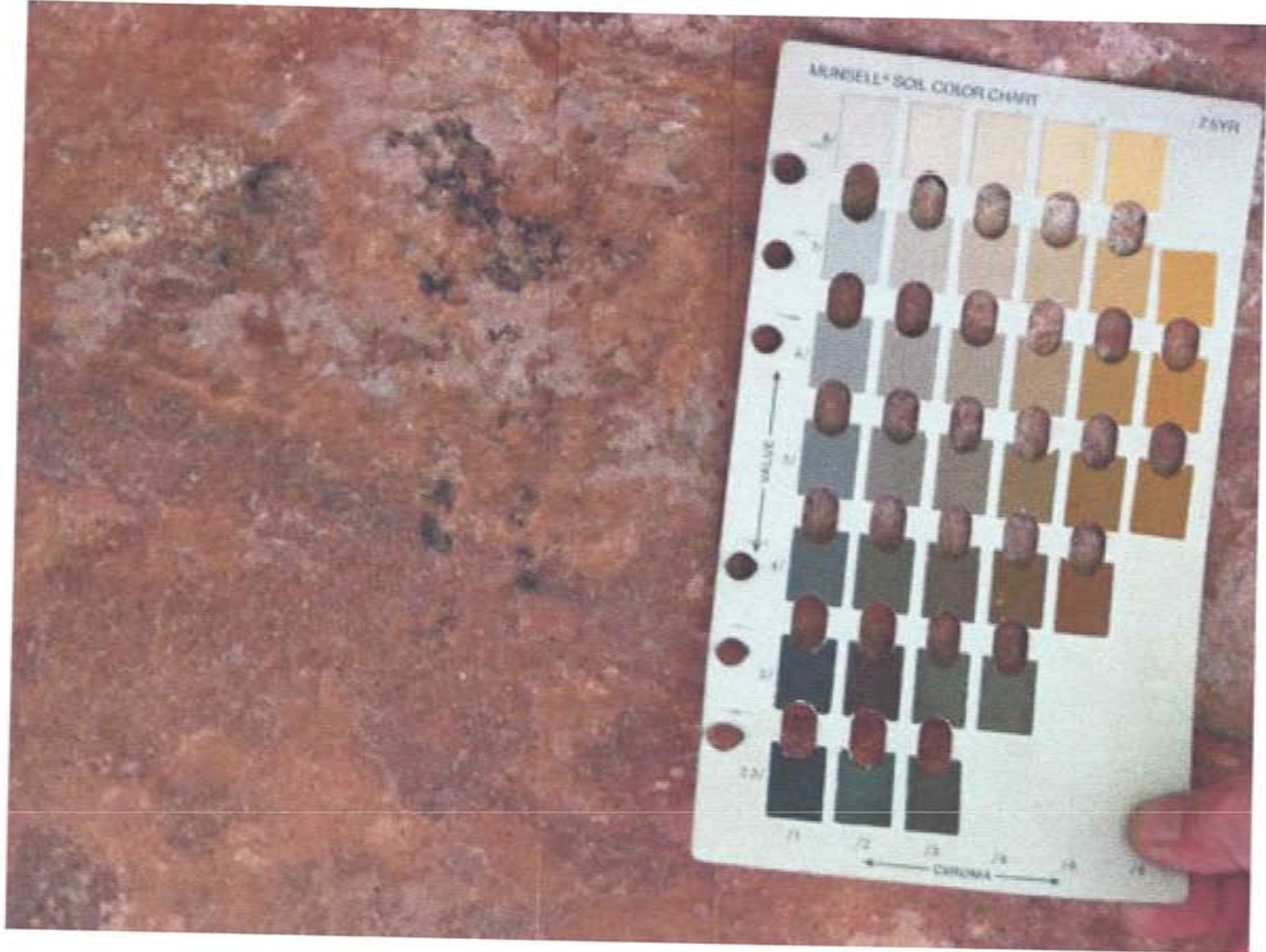


Black, Munsell No. 10YR2/1

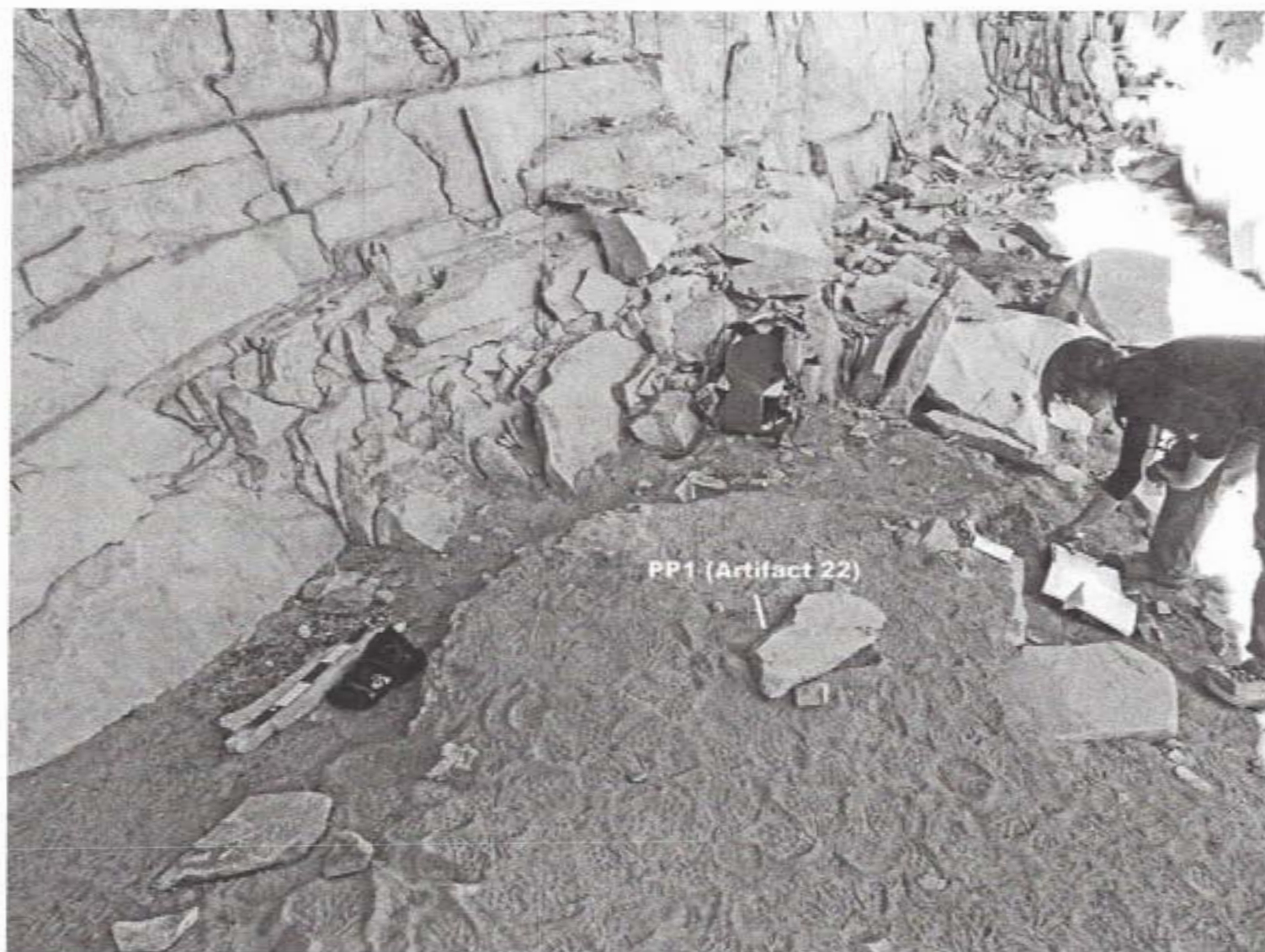
5MN519 Panel 7 detail



5MN519 Panel 7 detail



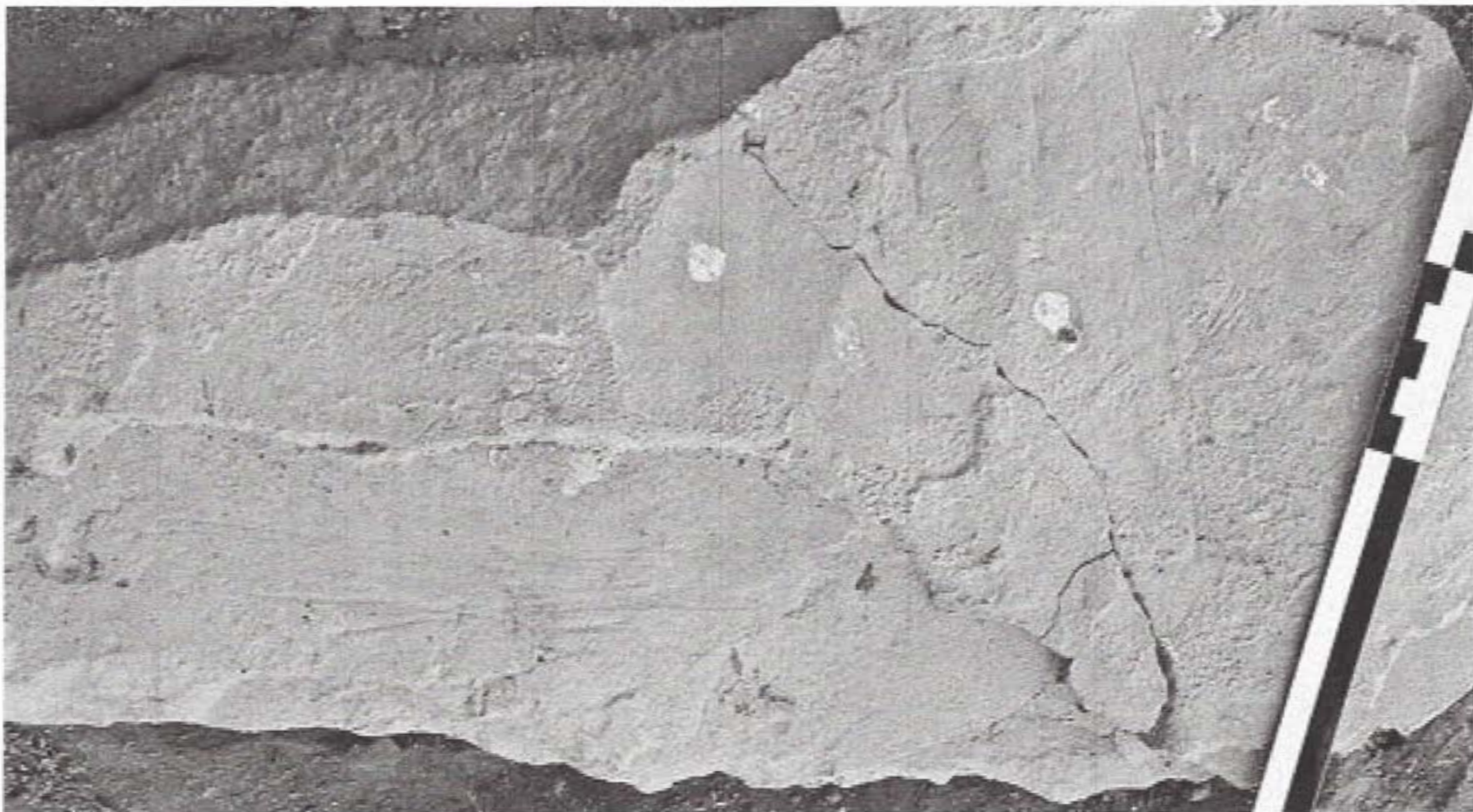
5MN519 Panel 7 detail



5MN519 Portable Panel 1 (Artifact 22) location in Artifact Scatter 2



5MN519 Portable Panel 1



5MN519 Portable Panel 1 detail (infrared)



5MN519 Portable Panel 1
detail

Appendix C: Rock Art Descriptive Data

Panel I.D. [keyed to map]	Physical location	Motifs	Petroglyphs	Pictographs (Monochrome/Polychrome)
P1	southwest rear wall	streak, splotch, incised/grooved marks or indentations	incised, etched or scraped indentations [possibly unintentional]	painted (monochrome)[possibly natural]
P2	southwest-central boulder	human form with sticklike item-possible atlatl; animal form; indistinct black pigment-possible linear motif		painted (monochrome)
P3	southwestern-central rear wall	humans (2 with ducklike headdresses); quadrupeds including striped; unidentified paint		painted (monochrome)
P4	center-north rear wall [various facets]	humans [holding rabbitlike figure, rope or snake, loop], animals (quadrupeds including striped; turtlelike; froglike), lines, finger-swipes, dots		painted (monochrome and polychrome); quadrupeds are black and white (black superimposes white)
P5	center, tilted boulder	cupules, stylized-segmented bear paw-print, U-form, parallel and other lines, possible human form, wavy line with scallops on boulder edge, notches on boulder edge, ground surface areas, stipple-pecked area	pecked, incised, chipped/etched	
P6	central overhead, on ceiling of interior overhang ~5.5 m above floor	cross-motif, straight and curved lines, rows of lines, fanlike forms, rakelike forms, sunburst forms, and finger-swipes		painted (monochrome)
P7	northeastern rear rockshelter wall and ceiling of cliff overhang above ledge	human forms, linear-geometric forms (sunburst, rakelike), quadrupeds		painted (monochrome)
PP1 (Artifact-22)	north-central, on floor in Panel 4 area	etched/grooved lines, one incised bird-track motif and one partial-track, incised flag or pennant-like form, smoothed area	incised, ground/abraded, gouged	

Panel I.D. [keyed to map]	Color	Dimensions (WxH)	Direction faces /Angle of rock	Condition	Estimated Age
P1	Red, Munsell 10R 4/8 or 5/8	4.5m X 2.0m	SE @ 130°/vertical	moderate; eroded; graffiti	Basketmaker II–Pueblo II-III
P2	Very dark gray, Munsell 10YR 3/1	1.90m X 35cm	W @ 324°/vertical	poor; eroded, rubbed	Basketmaker II
P3	White, Munsell 1Gley 8/N; White, 7.5YR 8/1; Gray, 5YR 5/1	7.1m X 2.60m	E @ 127° / vertical	poor and moderate; eroded; graffiti	Archaic(?); Basketmaker II-III
P4	White, Munsell 1Gley 8/N; Very dark gray, Munsell 10YR 3/1; Red, Munsell 2.5YR 4/4 or 10R 3/4 or 4/4	15.70 m X ~7.5m	SE @ 143° /vertical; vertical-sloping, horizontal-overhead	poor and moderate; eroded; mineral deposits; broken rock	Archaic(?); Basketmaker II-III; possible Pueblo I-II
P5	General background, Gray, Munsell 7.5YR 5/1; Cupule interior, Light brown, Munsell 7.5YR 6/4	1.20m X 1m	Up and SW @ 218° /sloping horizontal	good; some scratches and rubbing	Basketmaker II-III to Pueblo II-III
P6	White, Munsell 5YR8/1; Red, Munsell 10R4/6	~3.30m X ~1.50m	Down and NE; overhead, horizontal-sloping	good, moderate; eroded, mineral deposits	Archaic(?); Pueblo II-III(?)
P7	White, Munsell No. 1 Gley 8/N; Black, Munsell No. 10YR2/1	9.15m X 85cm	down and SE @ 163° /vertical and horizontal-sloping-overhead	good, moderate; eroded	Archaic(?); Basketmaker II-III
PP1 (Artifact-22)	Munsell 5YR7/2	48cm X 25cm	NA	moderate; eroded, rubbed/handled/stepped upon	Basketmaker II-III to Pueblo II-III range

Appendix D: Illustrations of Comparative Rock Art

1



Figure 1. Glen Canyon Style 5 quadruped, Sand Island, Utah. Horizontal stripes occur on some quadrupeds in the style (Turner 1963, 1971).



a



b

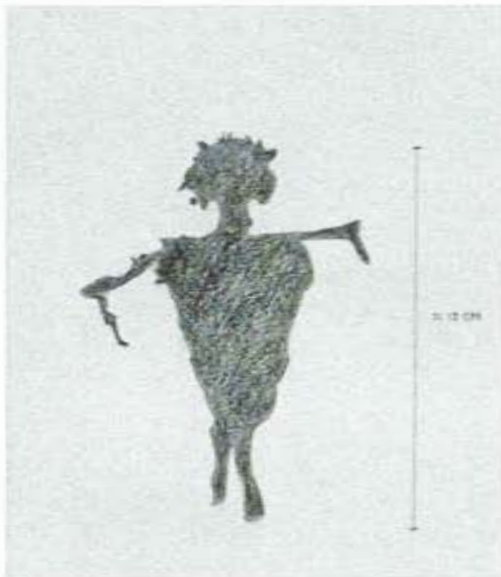


c

Figure 2. Ducklike and other bird headdresses in the greater San Juan culture area (a) Cedar Mesa, Utah, (b) Canyon de Chelly National Monument, Arizona, and (c) Falls Creek Shelters (5LP1434), Colorado. Drawing by J. Pfertsh.



a



b



c

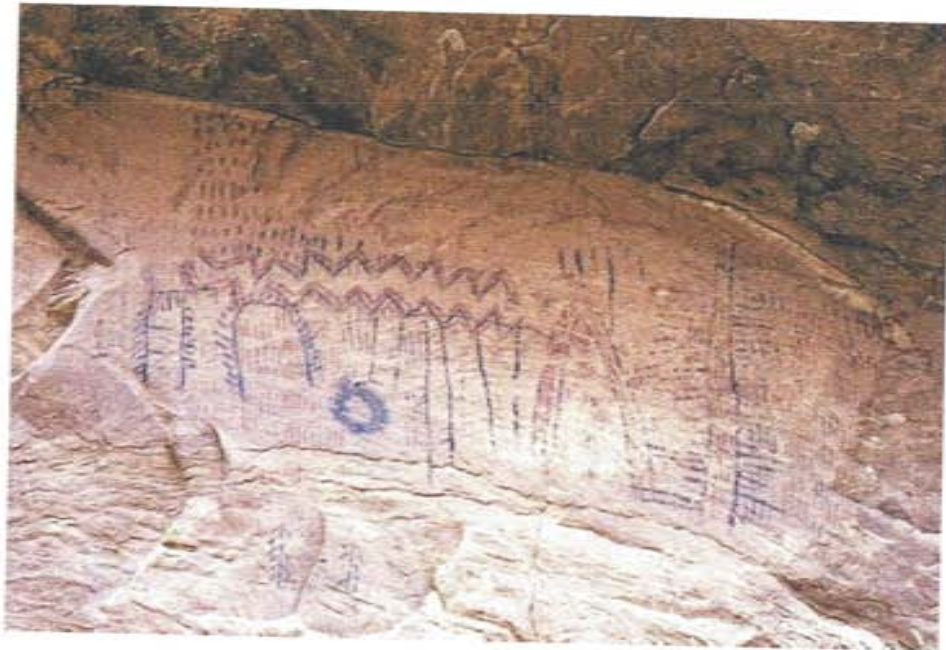
Figure 3. Falls Creek Shelters (5LP1434) imagery (a, c) active and broad-shouldered white anthropomorphs and a quadruped, (b) a black broad-shouldered anthropomorph, and (c) red finger-swipes near masklike forms. Drawings by C. Graham.



a



b



c

Figure 4. Abstract-Geometric Tradition rock paintings in eastern Utah (a) Escalante River, (b) Cedar Mesa, and (c) San Rafael Swell

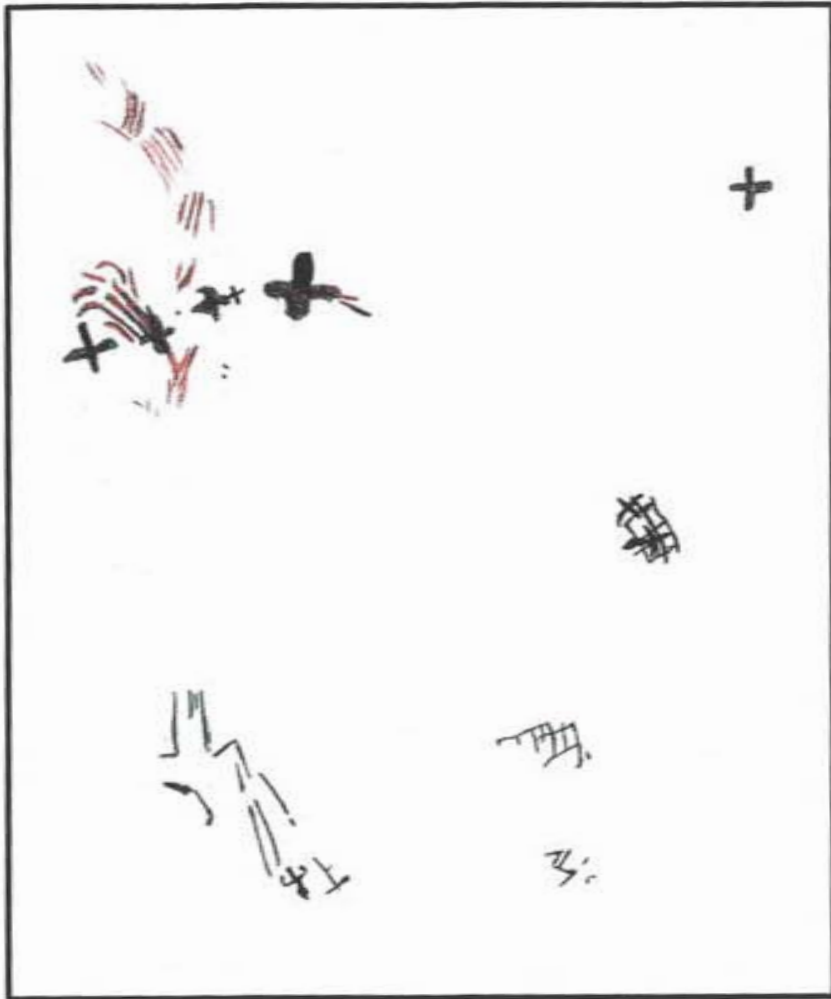
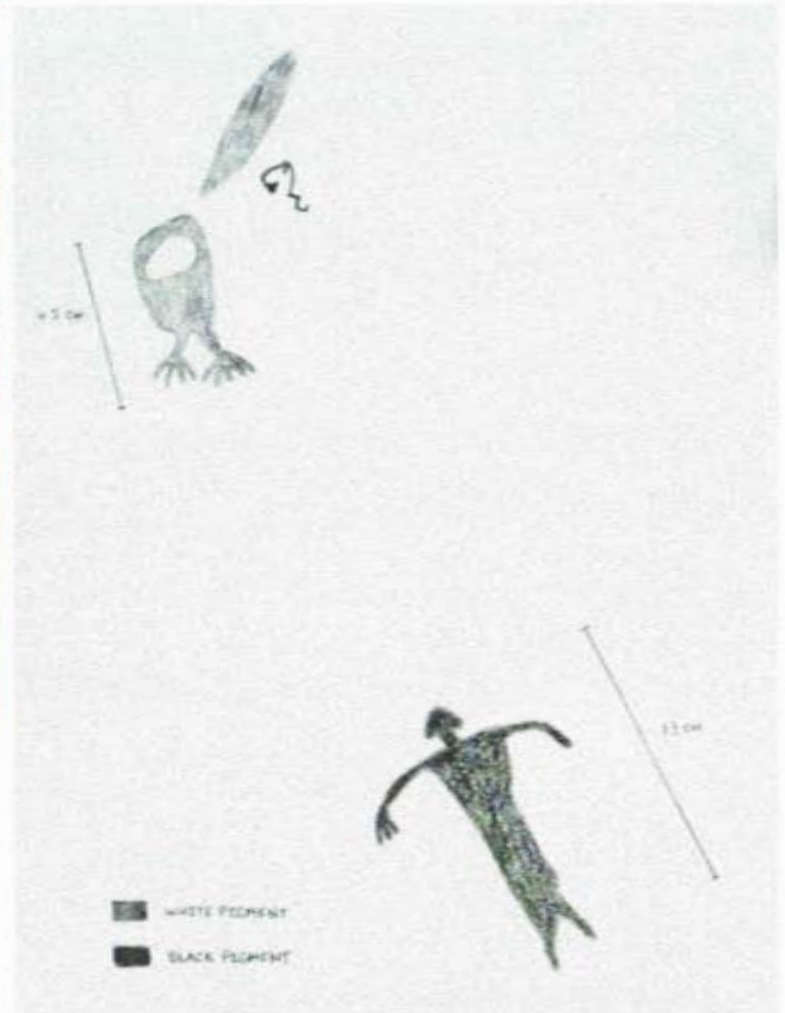


Figure 5. Celestial ceilings: (left) at Step House, Mesa Verde National Park, Colorado (L. DeTar drawing) and (right) Chaco Cultural National Historical Park, New Mexico



Figure 6. Black and white anthropomorphs on shelter ceilings at Falls Creek Shelters (5LP1434). Two have peaked heads or headdresses; one is a white owl-like form with toes or claws (photo images ~10 cm tall). Drawings by C. Graham.



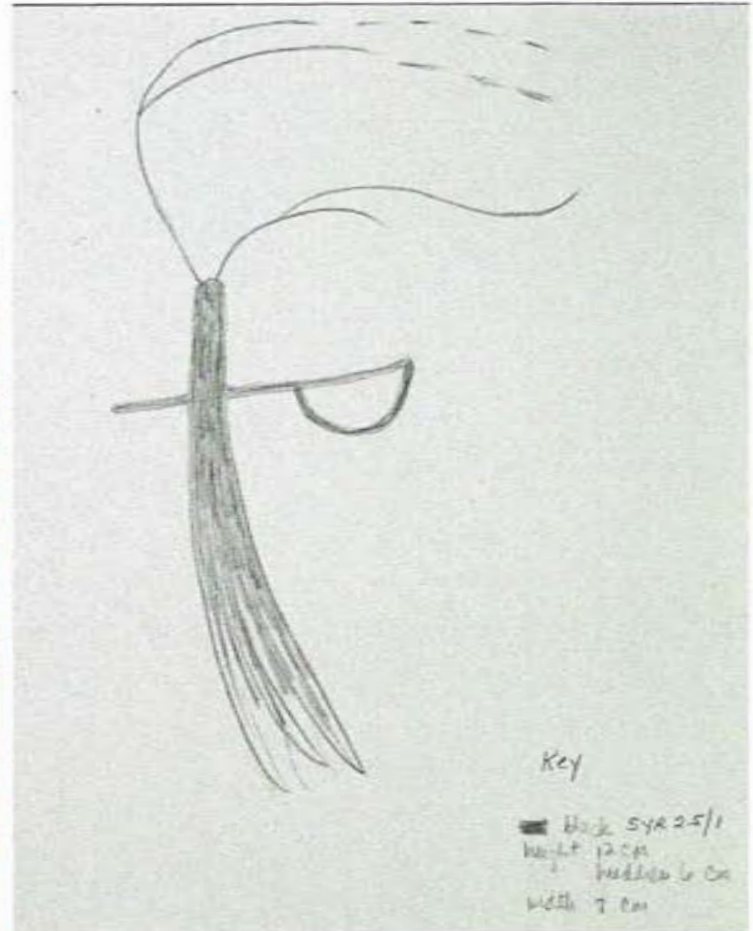


Figure 7. Slender figure with spread arms on an overhang ceiling, Falls Creek Shelters (5LP1434). Drawing by S. Hubbard

Appendix E: Field Work Illustrations

Appendix F: Analysis Data

TU	Stratum	Level	Feature	Point Plot	FS	SG	Material	Cortex	Burned	Count	Grams	Comment
1	1				4	2	1	0	0	1	1.3	biface thinning
						3	4	0	0	2	0.3	
							10	1	0	2	1.5	
							9	0	0	1	0.4	possible biface edge
							8	1	0	1	0.1	
							1	0	0	3	0.5	
							1	1	0	5	1.5	
							4	2	0	0	3	0.2
						5		0	0	7	0.4	
						7		0	0	0	0.0	
						8		1	0	2	0.0	
						8		0	0	1	0.0	
						1		0	0	23	0.9	
						1		1	0	4	0.2	
						5	6	0	0	1	0.0	
							5	0	0	2	0.0	
							3	0	0	1	0.0	
							1	0	0	1	0.0	
							1	1	0	1	0.0	
						Totals:						

TU	Stratum	Level	Feature	Point Plot	FS	SG	Material	Cortex	Burned	Count	Grams	Comment
1	2	1			10	2	11	1	0	1	9.1	
						3	5	0	0	2	0.5	
							10	1	0	1	0.5	
						4	6	0	0	1	0.0	
							2	0	0	2	0.0	
							8	0	0	1	0.0	
							1	0	0	3	0.1	
							5	0	0	3	0.1	
							10	0	0	2	0.1	
							9	1	0	1	0.0	
						5	2	1	0	1	0.0	
							5	0	0	2	0.0	
Totals:						4	0	20	10.4			
1	2	2			14	3	8	1	0	1	0.1	
						4	4	0	0	1	0.0	Possible biface tip
							8	0	0	2	0.1	
Totals:						1	0	4	0.2			
1	2	4			21	1	11	1	0	1	10.3	
						3	10	0	0	1	0.6	
						4	10	0	0	1	0.1	
							1	0	0	1	0.1	
						5	8	0	0	1	0.0	
Totals:						1	0	5	11.1			

TU	Stratum	Level	Feature	Point Plot	FS	SG	Material	Cortex	Burned	Count	Grams	Comment
2	1				30	2	11	1	0	1	8.7	
							5	0	0	1	1.3	
							1	0	1	1	1.3	Mat ID tentative, burned.
						3	11	1	0	1	0.1	
							4	0	1	1	0.4	
							5	0	0	3	0.5	
							3	0	0	1	0.1	
							1	0	0	13	5.0	
							1	1	0	3	1.8	
						4	6	0	0	2	0.1	
							8	0	0	4	0.1	
							5	0	0	9	0.3	
							7	1	0	1	0.1	
							1	0	0	33	2.3	
							1	1	0	1	0.1	
						5	6	0	0	1	0.0	
							8	0	0	1	0.0	
							5	0	0	2	0.0	
							1	0	0	10	0.1	
						Totals:						

TU	Stratum	Level	Feature	Point Plot	FS	SG	Material	Cortex	Burned	Count	Grams	Comment
2	2	1			32	2	5	0	0	1	1.2	
						3	4	0	0	3	0.8	Very smooth
							12	0	0	1	0.3	
							3	1	0	1	0.5	
							1	0	0	2	0.6	
							5	1	0	1	0.5	
							5	0	0	3	0.3	
						4	10	0	0	2	0.2	
							11	0	0	1	0.1	
							3	0	0	1	0.0	
							1	0	0	11	0.4	
							8	0	0	1	0.0	
							5	1	0	1	0.1	
												5
Totals:							3	0	38	5.3		
2	2	2		10	43	2	5	1	0	1	3.8	
Totals:							1	0	1	3.8		
2	2	2			46	2	5	0	0	1	0.6	
						3	1	0	0	1	0.2	
							5	0	0	2	1.7	
						4	11	1	0	1	0.1	
							3	0	0	1	0.1	
							10	1	0	1	0.0	Could be tan Morrison
							8	0	0	1	0.0	
							1	0	0	4	0.1	
							5	0	0	3	0.2	
						5	5	0	0	3	0.0	
Totals:							2	0	18	3.0		

TU	Stratum	Level	Feature	Point Plot	FS	SG	Material	Cortex	Burned	Count	Grams	Comment
2	2	2		9	47	2	13	0	0	1	4.1	
Totals:								0	0	1	4.1	
1			1		54	4	2	0	0	1	0.1	
							5	0	0	1	0.0	
Totals:								0	0	2	0.1	
1			1		56	4	3	1	0	0	1	0.4
							5	0	0	1	0.0	
							8	0	0	1	0.1	
							1	0	0	2	0.1	
Totals:								0	0	5	0.6	
Grand Totals:								23	2	244	68.2	
% Grand Total:								9.43%	0.82%			

Cottonwood Cave (5MN519)
Lithic Material Types - Flaking Debris Analysis

Material

Code	Material
1	Semi-translucent light brown/tan chert
2	White chalcedony
3	Brown silicified wood
4	White chert
5	Dakota-Burro silicified sediment
6	Burro Canyon chert
7	Coarse greenish chert
8	Coarse brown chert
9	Brown chert with large cherty inclusions
10	Metaquartzite
11	Morrison silicified sandstone
12	Tan/brown siltstone
13	Morrison mudstone

FS	TU	Stratum	Level	Feature	Point Plot	Type	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Material	Surface Modification	Description
5	1	1				indeterminate ground stone	55.5	25.4	47.2	98.2	sandstone	ground	If this is a grinding tool, it was only lightly used, no planes present; thermally fractured and oxidized on interior.
17	1	2	2		5	mano	128.5	91.2	21.9	242.4	sandstone	ground and pecked	One-hand mano fragment; probably ovoid in outline; only one side of tool present; probably thermally fractured, charcoal staining present.
24	2	1				mano	61.9	54.6	29.8	111.6	sandstone	ground and pecked	Fragment of probable mano; only one side of tool present; probably thermally fractured, charcoal staining and oxidation evident.
61	1	1				indeterminate ground stone	39.5	16.5	23.8	14.1	sandstone	ground	Small fragment of ground slab; probably ground on both surfaces.
62	1	1				indeterminate ground stone	43.1	41.3	14.8	20.7	sandstone	ground	Small fragment of ground slab; probably ground on both surfaces.
63	1	1				indeterminate ground stone	22.2	20.6	6.3	2.1	sandstone	ground	Very small fragment; ground on remaining surface.
64	1	2	1			indeterminate ground stone	49.9	44.7	21	50.3	sandstone	ground	Small fragment of ground slab; probably ground on both surfaces; possible peck mark on one surface.
65	1	2	1			indeterminate ground stone	28.9	28.6	12.3	10.7	sandstone	ground	Small fragment of ground slab; definitely ground on one surface, possibly ground on other surface.
66	1			1		indeterminate ground stone	17.6	14.8	10.4	2.7	sandstone	ground	Very small fragment; ground on remaining surface; thermally fractured; ground surface very smooth.
68	2	1				metate	72.1	51.2	21.8	97	sandstone	ground and pecked	Fragment of probable metate; pecked and ground on one surface, ground on other surface; thermally fractured; charcoal staining present on pecked and ground surface.
69	2	1				indeterminate ground stone	58.7	51.5	25	78.5	sandstone	ground	Fragment of ground slab; irregular outline; thermally fractured; charcoal staining present on one surface and adjacent edges
70	2	2	1			mano				195.4	sandstone	ground and pecked	Fragment; ground and pecked on existing surface; thermally fractured; oxidized; lichen present

FS	TU	Stratum	Level	Feature	Point Plot	Type	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Material	Surface Modification	Description
71	2	2	1			metate	70.8	51.5	36.3	210	sandstone	ground and pecked	Fragment; ground and pecked on one surface only; thermally fractured; oxidation on interior, charcoal staining on multiple surfaces
72	2	2	1			mano	32.8	34.4	9.7	12.8	sandstone	ground	Fragment of probable mano; very smooth.
75	1	2	2			indeterminate ground stone	14.2	7.1	2.8	0.3	diorite?	ground	Very tiny fragment; ground on existing surface; part of ax or maul?

Samp. No.	Site	Test Unit	PD	PO	FS	PL	Strat	Level	Feat.	Taxon	ID Level	Part	Condition	No.	Length	Width	Thick-ness	Object Description	Analyst	Date Analyzed	Photo?
1	Cottonwood Cave	1	5		20	6	2	4		<i>Zea mays</i> AMS UG No. 12487		cob segment	uncharred	1	1.7 cm	1.2 cm	1.2 cm	8 rows, round, yellow, glumes hard, cupule mean width 7 mm	Adams	8/11/2012	yes
2	Cottonwood Cave	2	6	1	27		1			<i>Zea mays</i>		cob segment	uncharred	1	4 cm	1.5 cm	1.2 cm	12 rows, elliptical, glumes hard, paleas and lemmas soft, cupule mean width 5 mm	Adams	8/11/2012	yes
3	Cottonwood Cave	1	1		1		1			<i>Yucca baccata</i>	type	seed	uncharred	2				one is missing the interior and one side	Adams	8/11/2012	yes
4	Cottonwood Cave	1			13		2	2	east of Feat. 1	<i>Quercus</i>	type	twig	uncharred	1	6.5 cm	.5 cm	.5 cm	broken into 2 pieces; one end appears sharpened and fire-blackened; ring porous, wide rays; ~ 4-5 years old	Adams	8/11/2012	yes
5	Cottonwood Cave	2	8		45		2	2		<i>Pinus edulis</i>	type	wood	charred	1				cross section view of a conifer with many large resin canals	Adams	8/11/2012	yes
5	Cottonwood Cave	2	8		45		2	2		<i>Juniperus osteosperma</i>	type	seed	uncharred	2				rodent gnawed on proximal end	Adams	8/11/2012	yes
5	Cottonwood Cave	2	8		45		2	2		<i>Juniperus osteosperma</i>	type	seed	uncharred	2				not damaged by rodents	Adams	8/11/2012	yes
5	Cottonwood Cave	2	8		45		2	2		Unknown	type	rodent pellet	uncharred	1					Adams	8/11/2012	
5	Cottonwood Cave	2	8		45		2	2		<i>Yucca baccata</i>	type	seed	uncharred	1					Adams	8/11/2012	

5	Cottonwood Cave	2	8		45		2	2		<i>Zea mays</i> AMS UG No. 12488		kernel	uncharred	1					lacking interior	Adams	8/11/2012	
5	Cottonwood Cave	2	8		45		2	2		<i>Zea mays</i>		kernel	uncharred	1	5 mm	7 mm	6 mm	complete; striations visible across top; pop/flint type; yellow; Chapalote?	Adams	8/11/2012	yes	
6	Cottonwood Cave	1			23		2	4		<i>Zea mays</i>		kernel	uncharred	1				immature, deflated	Adams	8/11/2012		
7	Cottonwood Cave	1	9	58	58				Feat. 1 fill	<i>Yucca baccata</i>	type	seed fragment	uncharred	2					Adams	8/11/2012		
8	Cottonwood Cave	2					1			<i>Yucca baccata</i> AMS UG No. 12489	type	leaf fragment	uncharred	1	18 cm	2 cm (base)	< 5 mm	parallel fibro-vascular bundles evident; split down the middle, leaving one natural surface (with epidermis) and one view of the interior; distal end has slight charring and appears evenly cut or burned	Adams	8/11/2012	yes	

② face view

② x-section

①



FS 20

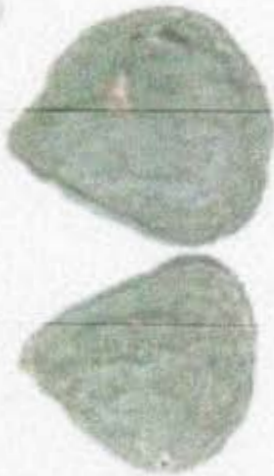


FS 27



FS 27

③



FS 1

④



FS 13

④ x-section view



FS 13

⑤



FS 45

⑤



FS 45

⑤



FS 45

2nd dorsal
embryo view

④ 200x scanned
top view of striations



FS 45

③ epidermis

③ interior



FS 25

⑤ end cut and/or
burned



FS 25

5MN519 - Cottonwood Cave

Faunal Analysis
Cottonwood Cave (5MN519)
D. Hencmann

For this analysis, I separated the contents of each bag into various groups on a large piece of clean, white cardboard paper. To aid in sorting, I used a magnifying light, a hand lens, and a pair of tweezers. I examined each group piece by piece, separating specimens into the various analysis categories. Then each group was counted and placed in bags labeled according to the categorized contents. Any unique specimens were placed in an individual bag and labeled.

The primary reference for the analysis is Beisaw (2013). Categories used for classification of the bones consisted of bone type (i.e., flat, long, short, or irregular), burned vs. unburned, number of bone fragments, worked vs. unworked, large mammal vs. small mammal, side (if applicable), and any comments about the specimens.

The various types used in the bone type category consisted of long, short, flat irregular, cortical, cancellous and fragments. These classifications are in reference to the various types of bone that are found throughout the bodies of all mammals. Long bone refers to hind and fore limbs as well as any other bones that may be involved with locomotion. Short bone refers to any of the bones that make up the fore and hind paws, such as metacarpals, metatarsals, carpals, tarsals. Irregular bone refers to the vertebral column and all of the bones present in the pelvic girdle. Flat bone consists of the ribs, sternum, and cranial bones. The categories of cortical and cancellous bone are in reference to fragments of bone that could not be identified as being any of the above types. Cortical or compact bone is the solid outer layer of bone present on most bones throughout the skeleton. Cancellous or spongy bone refers to the layer of bone directly below the compact bone. The category fragments refers primarily to small pieces of bone too small for any other classification.

The large mammal and small mammal categories were used to distinguish between size classes. The large mammal category is for remains likely to be from mule deer, elk or any other type of large game. The small mammal category is used for rodents or birds. While bones from large mammals are likely to be archaeological in context, small unburned mammal remains are likely from non-archaeological contexts. While I did not identify any bird bones in this analysis, it is my opinion that a majority of the small burned mammal bones are likely those of birds.

References Cited

Beisaw, April M.

2013 *Identifying and Interpreting Animal Bones: A Manual*. Texas A & M University, College Station.

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	23	23 pieces of large mammal long bone. There is no evidence of processing that I can see in any of these segments. One piece appears to be the cannon bone of what is likely a mule deer.
						Long	N	Y	Y	N	N/A	1	1 piece of processed large mammal bone. It appears to have small cut marks on its exterior.
						Long	Y	N	Y	N	N/A	20	20 fragments of burned large mammal long bone. No signs of processing.
2	1	1				Long	N	N	N	Y	N/A	40	40 pieces of rodent long bone. One complete right humerus from what is likely a mouse.
						Short	N	N	N	Y	N/A	7	7 pieces of rodent short bone, consisting of phalanges, carpals and tarsals.
						Teeth	N	N	N	Y	N/A	4	4 pieces of what appear to be rodent teeth.
						Long	Y	N	N	Y	N/A	10	10 pieces of what appear to be burned rodent long bone, however it is possible that some fragments could be bird bone.
						Irregular/ Flat	N	N	N	Y	N/A	47	47 pieces of what appear to be rodent flat and irregular bone. Including several innominates, some maxillary bone and a few vertebra.
Total:												152	
7	1	2	1		1	Long	Y/N	N	Y	N	N/A	2	2 pieces of cannon bone. Larger piece is both burned and unburned. Small fragment likely resulted from breeding in captivity.
Total:												2	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Flat	N	Y	Y	N	N/A	1	1 segment of large mammal flat bone. Bone has evidence of processing on its exterior.
						Fragments	N	N	Y	N	N/A	7	7 fragments of what I believe to be large mammal long bone. They have no evidence of processing or modification.
						Long	Y	N	Y	N	N/A	5	5 fragments of burned large mammal long bone. There is no evidence of processing. 1 fragment appears to be a segment of cannon bone from a mule deer.
						Long	Y	Y	Y	N	N/A	1	1 fragment of processed large mammal long bone. The bone appears to be the cannon bone of a mule deer with processing evident on the exterior of the bone. This fragment is also burned on its interior.
8	1	2	1			Long/ Fragments	Y	N	Y	N	N/A	29	29 fragments of burned large mammal long bone. These fragments consist of segments of cortical and cancellous bone which have been burned. They appear to have come from large mammals.
						Long/ Fragments	N	N	N	Y	N/A	16	16 fragments of small mammal long bone. No evidence of processing or modification.
						Irregular	N	N	N	Y	N/A	5	5 fragments of small mammal irregular bone. No evidence of processing or modification.
						Long	Y	N	N	Y	N/A	7	7 fragments of burned small mammal long bone. No evidence of processing or modification beyond burning.
Total:												71	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	5	5 pieces of large mammal long bone, with no signs of processing.
						Long	N	Y	Y	N	N/A	1	1 piece of processed large mammal long bone. Appears to have several cut marks and unnatural striations on its exterior.
						Long	Y	N	Y	N	N/A	16	16 fragments of burned large mammal long bone. There is no evidence of processing or modification beyond burning.
15	1	2	2			Flat	Y	Y	Y	N	N/A	1	1 segment of flat bone which appears to have several layers of cortical bone removed from tool use. Meaning that thin layers of compound bone were removed during processing. The bone segment is also burned on its interior. It is likely this piece was utilized for marrow consumption.
						Long	N	N	N	Y	N/A	2	2 segments of small mammal long bones. No evidence of modifications or processing.
						Cranial	N	N	N	Y	N/A	3	3 segments of small mammal cranial bone. 2 pieces of flat bone as well as a section of zygomatic arch.
						Long	Y	N	N	Y	N/A	8	8 pieces of burned small mammal long bone. No evidence of processing.
Total:												36	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Flat	N	N	Y	N	N/A	2	2 fragments of large mammal flat bone. No signs of processing or modification.
						Long	N	N	Y	N	N/A	1	1 large mammal long bone fragment. Likely cannon bone fragment.
18	1	2	3			Fragments	N	N	Y	N	N/A	2	2 large mammal bone fragments. No spongy bone. But they appear to be compact bone of large mammal long or flat bone.
						Fragments	Y	N	Y	N	N/A	1	
						Long	Y	N	N	Y	N/A	1	1 fragment of small mammal bone. Likely rodent long bone.
						Fragments	Y	N	N	Y	N/A	2	
												Total:	9
						Long	N	N	N	Y	N/A	8	8 fragments of small mammal long bone. There is no evidence of processing or modification.
22	1	2	4			Mandibular/Teeth	N	N	N	Y	N/A	19	19 fragments of small mammal mandibular bone and teeth. No evidence of processing or modification.
												Total:	27
28	2	1			2	Long	N	N	Y	N	N/A	1	1 large mammal long bone fragment with what appears to be healed breakage trauma or pathology.
												Total:	1

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	39	39 fragments of large mammal long bone. These fragments have no evidence of processing or burning.
						Long	N	Y	Y	N	N/A	1	1 fragment of processed large mammal bone. This segment of long bone appears to have large pieces of cortical bone removed as if it were struck by a blade. Also shows evidence of the same bone degradation found on bones in FS:48, PD: 8.
						Long	Y	N	Y	N	N/A	8	8 pieces of burned large mammal long bone. No evidence of processing.
						Long	N	N	N	Y	N/A	37	37 pieces of small rodent long bone. None appear to be burned or modified.
						Short	N	N	N	Y	N/A	11	11 pieces of small rodent short bone. None appear to be modified or burned.
29	2	1				Irregular	N	N	N	Y	N/A	20	20 pieces of small rodent irregular bone, consisting primarily of vertebra, innominate and segments of cortical bone.
						Mandibular/Teeth	N	N	N	Y	N/A	16	16 pieces of what appear to be rodent mandibular bones and teeth.
						Fragments	N	N	N	Y	N/A	40	40 small fragments of what appear to be small mammal bone. It appears that these fragments are rodent bone. There is no evidence of modification or processing.
						Long	Y	N	N	Y	N/A	9	9 fragments of burnt small mammal long bone. None of these bones appear to be modified or processed.
						Short	Y	N	N	Y	N/A	1	1 fragment of burnt small mammal short bone. Appears to be the calcaneus of a rodent.
						Teeth	N	N	N	Y	N/A	9	9 fragments of what appear to be small rodent teeth.
						Mandibular/Teeth	N	N	N/A	N/A	N/A	1	1 small lizard mandible with a complete row of teeth.
Total:												192	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	29	29 pieces of large mammal long bone. There are no signs of processing. I would guess that a majority of these bone fragments come from mule deer.
						Long	N	Y	Y	N	N/A	2	2 pieces of processed large mammal bone. Likely mule deer long bone.
						Irregular	N	N	Y	N	N/A	1	1 piece of irregular bone from a large mammal. It is the spinus process of a vertebra.
						Long	Y	N	Y	N	N/A	6	6 pieces of burned large mammal bone.
33	2	2	1			Long	N	N	N	Y	N/A	9	9 pieces of rodent long bone.
						Teeth/ Mandibular/ Maxillary	N	N	N	Y	N/A	5	5 pieces of rodent mandibular, maxillary bone and teeth.
						Irregular/ Flat/ Short	N	N	N	Y	N/A	7	7 pieces of rodent bone consisting of 4 pieces of irregular bone, 2 pieces of short bone and 1 piece of flat bone.
						Long/ Cortical	N	N	N	Y	N/A	55	55 fragments of what appear to be portions of cortical bone. All fragments appear to have come from small mammals, most likely rodents.
						Long	Y	N	N	Y	N/A	6	6 fragments of burned small mammal long bone.
												Total:	120
37	2	2	1		6	Flat	N	Y	Y	N	R	1	1 fragment of large mammal flat bone. More specifically this is the right rib from a large quadrupedal animal, most likely a large mule deer or small elk. It has some evidence of processing as there is a small notch taken out of the anterior portion of the rib.
												Total:	1

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
38	2	2	1		8	Flat	N	Y	Y	N	L	1	1 fragment of large mammal flat bone. More specifically this is the left rib of a mule deer. It has several cut and scratch marks on the bone indicative of food processing.
39	2	2	1		4	Long	N	Y	Y	N	N/A	1	1 fragment of large mammal long bone. More specifically this is a segment of cannon bone from a mule deer. It has evidence of processing on its anterior face with several cuts and scratch marks.
Total:												2	
40	2	2	1		3	Long	N	N	Y	N	N/A	1	1 fragment of large mammal long bone. There is no sign of processing or modification. There is also a high level of damage to the cortical bone which makes it difficult to determine its actual thickness.
Total:												1	
41	2	2	1		7	Long	N	N	Y	N	N/A	1	1 fragment of large mammal long bone. There is no sign of processing or modification. However my assessment is the same as that for FS 40. The same bone degradation present in other samples from this site is present on this bone.
Total:												1	
42	2	2	1		5	Cranial	N	N	Y	N	N/A	1	antler, in multiple fragments
Total:												1	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	7	7 fragments of large mammal long bone; 1 fragment submitted for AMS dating (UG No. 15840)
						Cancellous	N	N	Y	N	N/A	3	3 fragments of cancellous, large mammal bone. Two of the bone fragments are completely unidentifiable while the third appears to be a process. However due to the small size of the fragment, the process cannot be identified.
						Cortical	N	N	Y	N	N/A	12	12 fragments of large mammal cortical bone. A majority of these fragments are likely from long bones, however they are too small to identify.
48	2	2	2			Processed long	N	Y	Y	N	N/A	1	1 large piece processed mammal bone with bone degradation that I cannot identify. It appears to have processing marks located on both sides of the bone, surrounding the mysterious bone degradation.
						Short	N	N	N	Y	N/A	2	2 pieces of short bone from two small mammals.
						Long	N	N	N	Y	N/A	1	1 distal segment of rodent long bone. Appears to be a humerus.
						Flat	N	N	N	Y	N/A	1	1 segment of what appears to be rodent flat bone.
						Teeth	N	N	N	Y	N/A	2	2 segments of large rodent incisors.
						Long	Y	N	N	Y	N/A	2	2 large segments of burned rodent long bone.
						Cortical/ Cancellous	N	N	N	Y	N/A	14	14 fragments of what appear to be small mammal cortical and cancellous bone. None appear to be processed.
						Irregular	N	N	N	Y	N/A	3	3 segments of rodent irregular bone.
Total:												48	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	Y	N	N/A	1	1 fragment of large mammal long bone. There is no sign of processing or modification.
						Long/ Fragments	N	N	Y	N	N/A	2	2 fragments of large mammal long bone. They appear to be epiphyseal growth plates of long bones. There is no sign of processing or modification.
						Long	Y	N	Y	N	N/A	3	3 fragments of burned large mammal long bone. There is no sign of processing or modification beyond burning.
55	1			1		Long	Y	Y	Y	N	N/A	1	1 fragment of burned, processed large mammal long bone. This bone has a high level of processing and has an almost ceramic texture from oxidation.
						Flat/Cranial	Y	N	Y	N	N/A	5	5 fragments of burned large mammal flat/cranial bone.
						Long	N	N	N	Y	N/A	9	9 fragments of small mammal long bone. There is no evidence of processing or modification.
						Cranial	N	N	N	Y	N/A	5	5 fragments of small mammal cranial bone. There is no evidence of processing or modification.
						Long	Y	N	N	Y	N/A	2	2 fragments of burned small mammal long bone. No other signs of processing or modification beyond burning.
Total:												28	

FS	TU	Stratum	Level	Feature	Point Plot	Bone Type	Burned	Worked	Large Mammal	Small Mammal	Side	N	Comments
						Long	N	N	N	Y	N/A	6	6 fragments include 5 pieces of long bone and one epiphyseal growth plate.
						Short	N	N	N	Y	N/A	2	2 pieces of short bone from small rodent.
						Irregular	N	N	N	Y	N/A	1	1 fragment of small mammal irregular bone. Likely rodent vertebra.
60	1			rodent burrow		Long	N	N	Y	N	N/A	3	3 long bone fragments. Small gnaw marks present on curvature of on fragment.
						Long	Y	N	Y	N	N/A	3	3 pieces of burned long bone consisting of 2 large pieces and one small fragment. One large piece of long bone shaft, another large piece of what appears to be a proximal long bone.
												Total:	15
												Grand Total:	707

Appendix G: AMS Results



The University of Georgia

Center for Applied Isotope Studies

RADIOCARBON ANALYSIS REPORT

November 19, 2012

Mrs. Carole Graham
Crow Canyon Archaeological Center
23390 County Rd. K
Cortez, CO 81321

Dear Mrs. Graham

Enclosed please find the results of ^{14}C Radiocarbon analyses and Stable Isotope Ratio $\delta^{13}\text{C}$ analyses for the samples received by our laboratory on October 26, 2012.

UGAMS#	Sample ID	Material	$\delta^{13}\text{C}, \text{‰}$	^{14}C age, years BP	\pm	pMC	\pm
12487	1	maize cob	-13.3	1960	20	78.30	0.22
12488	2	maize kernel	-11.5	1280	20	85.22	0.23
12489	3	yucca leaf	-12.2	1960	20	78.35	0.22

The plant fragment sample was treated with 5% HCl at the temperature 80°C for 1 hour, then it was washed with deionized water on the fiberglass filter and rinsed with diluted NaOH to remove possible contamination by humic acids. After that the sample was treated with diluted HCL again, washed with deionized water and dried at 60°C. For accelerator mass spectrometry analysis the cleaned sample was combusted at 900°C in evacuated / sealed ampoules in the presence of CuO. The resulting carbon dioxide was cryogenically purified from the other reaction products and catalytically converted to graphite using the method of Vogel *et al.* (1984) Nuclear Instruments and Methods in Physics Research B5, 289-293. Graphite $^{14}\text{C}/^{13}\text{C}$ ratios were measured using the CAIS 0.5 MeV accelerator mass spectrometer. The sample ratios were compared to the ratio measured from the Oxalic Acid I (NBS SRM 4990). The sample $^{13}\text{C}/^{12}\text{C}$ ratios were measured separately using a stable isotope ratio mass spectrometer and expressed as $\delta^{13}\text{C}$ with respect to PDB, with an error of less than 0.1‰.

Sincerely,

Dr. Alexander Cherkinsky



The University of Georgia

Center for Applied Isotope Studies

RADIOCARBON ANALYSIS REPORT

November 18, 2013

Mrs. Carole Graham
312 N. Washington
Cortez, CO 81321

Dear Mrs. Graham

Enclosed please find the results of ^{14}C Radiocarbon analyses and Stable Isotope Ratio $\delta^{13}\text{C}$ analyses for the samples received by our laboratory on October 28, 2013.

UGAMS#	Sample ID	$\delta^{13}\text{C}, \text{‰}$	^{14}C age, years BP	\pm	pMC	\pm
15840	5MN519 FS 48	-27.0	1980	25	78.11	0.23

The Burned bone sample was treated with 5% HCl at the temperature 80°C for 1 hour, then it was washed and with deionized water on the fiberglass filter and rinsed with diluted NaOH to remove possible contamination by humic acids. After that the sample was treated with diluted HCL again, washed with deionized water and dried at 60°C. For accelerator mass spectrometry analysis the cleaned sample was combusted at 900°C in evacuated / sealed ampoules in the presence of CuO. The resulting carbon dioxide was cryogenically purified from the other reaction products and catalytically converted to graphite using the method of Vogel *et al.* (1984) Nuclear Instruments and Methods in Physics Research B5, 289-293. Graphite $^{14}\text{C}/^{13}\text{C}$ ratios were measured using the CAIS 0.5 MeV accelerator mass spectrometer. The sample ratios were compared to the ratio measured from the Oxalic Acid I (NBS SRM 4990). The sample $^{13}\text{C}/^{12}\text{C}$ ratios were measured separately using a stable isotope ratio mass spectrometer and expressed as $\delta^{13}\text{C}$ with respect to PDB, with an error of less than 0.1‰.

Sincerely,

Dr. Alexander Cherkinsky

Appendix H: 5MN519 - Site Form

Appendix I: Data CDs