Preliminary Results of the 2015 Archaeological Survey and Test Excavations of the Duncan and York Valleys

by

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This report contains restricted site locational data and is not for public distribution.

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Overview

During 2014 and 2015, the University of Texas-San Antonio (UTSA) Archaeology Field School and Colinas Cultural Resource Consulting, Albuquerque, completed initial investigations at Round Mountain (AZ:CC:4:61 (ASM)), a BLM-managed cerro de trincheras located along the Gila River north of Duncan, Arizona. This research project also documented several Early Agricultural period features and recorded 15 new sites ranging from the Early Agricultural to the historic period during class III survey of 112 acres in the vicinity of Round Mountain. The 2015 work included limited test excavations at Round Mountain, DotMon, and the Duncan Donut sites. This report summarizes our 2015 work and our 2014 work was previously reported (Roney et al. 2015b). We have also presented results of the project at a number of conferences (Hard et al. 2016a; Hard et al. 2016b; Roney et al. 2015a; Roney et al. 2014). This report consists of sections on the following sections: archaeological survey, geomorphological study, obsidian sourcing, as well as excavations at Round Mountain, DotMon, and Duncan Donut sites. The final sections of the report discuss the rock rings, ethnobotanical results, and radiocarbon dating.

Cerros de trincheras are complexes of walls, terraces, and other features of dry-laid stones and cobbles located on the upper slopes of isolated hills. times. However, recent and ongoing research contradicts this perception. Instead, cerros de trincheras are emerging as a widespread element of Early Agricultural period settlement systems. AMS radiocarbon dating has shown that at least four such sites in northwestern Chihuahua date to the Early Agricultural period (Hard and Roney 1998; Roney and Hard 2004) and recent work on Tumamoc Hill in the Tucson Basin is corroborating a substantial Early Agricultural period occupation on that hilltop as well (Cajigas et al. 2016; Fish et al. 1986; Fish et al. 2013).

The research presented here documents two additional Early Agricultural period cerros de trincheras located along the Gila River in eastern Arizona. These expand the distribution of the trincheras phenomenon to a third major river valley, implying that cerros de trincheras are part of a broad regional pattern during the pivotal Early Agricultural period. Round Mountain, the largest of the cerro de trincheras found thus far on the Gila River, contains 1.9 km of berm walls and terraces and 18 rock rings and was constructed on a 640-foot hill during the Early Cienega phase (ca. 800 – 400 BC). The DotMon cerro de trincheras is situated on a 400-foot ridge above the Gila River and includes 250 meters of walls and six rock rings. Early Agricultural period cerros de trincheras have also been previously documented in the Rio Cases Grandes and in the Tucson Basin. The upper Gila River sites expand the trincheras phenomenon to a third major river valley, implying that cerros de trincheras are part of a broad regional pattern during the pivotal Early Agricultural period.

A third Early Agricultural period site, Duncan Donut, lies in a valley setting below Round Mountain. The site, dated from the Late Cienega phase (400 BC – AD 50),

contains a midden, evidence of maize use, and at least two pithouses. Three other small settlements found along the Gila River may also be Early Agricultural period sites, based on the virtual absence of ceramics, projectile point forms, and the character of the chipped stone assemblage. Survey conducted near Round Mountain revealed sites ranging from the Early Agricultural to historic periods, all of which were mapped and recorded. The broad chronological distribution of features suggests the Duncan Valley was an ideal agricultural setting which was heavily utilized throughout the prehistoric period.

This report documents an archaeological research project in Arizona's Duncan Valley conducted between June 1 to July 4, 2015 by Robert J. Hard (University of Texas at San Antonio), John R. Roney (Colinas Cultural Resource Consulting), and Art MacWilliams. UTSA graduate student participants included Lori Barkwill-Love, Ashley Jones, Andrea Thomas, Kristina Solis, and Mary Whisenhunt. Undergraduate field school student participants included Ian Bates, Megan Brown, Rosa Compean – Molina, Hayley Fishbeck, Robert Gardner, Overton Lesley, Kimberly Martin, Stephanie Martin, Stephanie Denys Dooley, and Gabriella Zaragosa. David Barron served as a field crewmember.

This was our second consecutive field season in the Duncan Valley. Work done as part of the 2015 University of Texas at San Antonio Archaeological Field School involved survey, mapping, geomorphological reconnaissance, limited surface collection, and excavation on private property, Bureau of Land Management lands, and Arizona state property. This effort was facilitated by Dan McGrew, BLM Safford Field Office Archeologist and by Matthew Basham, Acting Deputy Preservation Officer, BLM Arizona State Office. Work on BLM lands was done under Permit No. AZ-000591. Access to Arizona state lands was authorized under ASM permit 2015-001bl, and we thank Todd Pitzel for his assistance with this aspect of the project. Crystal Carrando and Steve Rusiecki helped us obtain a Temporary Right of Entry (dated May 11, 2015) for State lands. As always, we gratefully acknowledge the assistance of Mr. Dick Kaler, who provided access to several sites on his property and extended many other courtesies. Ray Tyler was also very generous is allowing us access to his land. Bob Bigando, Sean Wenham, and Emily Muteb of Freeport-McMorRan Corporation provided support for the project. Deborah and Clayton Mendelsohn provided wonderful project headquarters at the Simpson Hotel in Duncan. We also thank our many colleagues who supported this educational initiative by visiting the field school and offering their expertise, including Karen Adams, Paul and Suzanne Fish, Gary Huckleberry, Jon Sandor, Fred Nials, Jeffrey Clark, Leonard Kemp, Jacob Freeman, Paul Minnis, Pat Gilman, Mark Sechrist, William Walker, and Karen Schollmeyer. The project received financial support from the UTSA Vice President of Research and the Department of Anthropology. The logistical support provided by Raymond Mauldin and the UTSA Center for Archaeological Research was also critical. Mark Willis generously conducted aerial survey to map Round Mountain, the North Site and the DotMon site. Geomorphologists Gary Huckleberry, Jon andor, and Fred Nials conducted geomorphological reconnaissance of the Gila River in the Duncan Valley. They

excavated and described the alluvial deposits and soils from four backhoe trenches on the Kaler and Tyler Ranches. Kayla Torres assisted with editing this report.

Archaeological Survey

The 2015 UTSA Field School project completed class III survey of approximately 112 acres in the vicinity of Round Mountain and recorded 15 new archeological sites. The purposes of the survey were: 1.) To train students in archeological survey and recording methods. 2.) To discover additional sites, features, and artifacts potentially associated with the Early Agricultural period occupation on Round Mountain. 3.) To develop a broader, diachronic understanding of prehistoric and early historic land use in the vicinity of Round Mountain. The survey targeted landforms which seemed most likely to yield archeological evidence from prehistoric times, based on information provided by local informants, prior experience, and geomorphic considerations. The survey areas consisted primarily of alluvial terraces above the Gila River floodplain, and the lower slopes of Peloncillo Mountains near Round Mountain.

The survey employed standard BLM Class III inventory protocols. Except as noted below, surveyors walked systematic pedestrian transects spaced at 15 meter intervals. All cultural prehistoric and early historic materials were recorded, including isolated occurrences. Surveyors used recreation-grade GPS units to maintain transect spacing and orientation. Crews were supervised by senior project members and/or graduate students, and ranged in size from 3 to 6 members, including the supervisor. Many of the students had no prior experience in survey and artifact recognition. This factor should be taken into account when evaluating the survey results. However, inexperienced crew members were closely supervised at all times, and we have good confidence in the overall results.

The individual survey parcels were assigned sequential numbers (preceded by the last two digits of the year in which the survey was conducted), and these are indicated in Figure 1. Survey acreage is tabulated by land ownership in Table 1, and the newly recorded or updated sites are tabulated in Table 2. Site locations are indicated in Figure 2. The archeological findings for each parcel, including sites and isolated occurrences are detailed below, accompanied by more detailed maps where appropriate.

Table 1. Survey Acreage by Land Ownership

Dick Kaler	55.8 acres
BLM	49.7 acres
State of Arizona	7.4 acres
TOTAL	111.9 acres

Table 2. Summary of Newly Recorded Sites

Site Number	*Parcel No.*	*Major Feature*	*Age*
North Site	15-01	C. de Trincheras	Early Ceramic
FS-02 (Apache Well)	15-06	Pithouses, Roomblocks	Preceramic/Ceramic Transition Middle Ceramic (post-Mimbres)
FS-03	15-06	Rock ring	Preceramic
FS-04	15-05	Pithouse	Early Ceramic
FS-05	15-03	Lithic scatter	Prehistoric
FS-06	15-05	Lithic scatter	Prehistoric
FS-07	15-05	Artifact scatter	Mid to Late Historic (1880-1910)
FS-08	15-09	Pithouses	Early Ceramic
FS-09	15-08	Rock ring	Mid to Late Archaic
FS-10	15-11	Roomblock/Pueblo	Late Ceramic (Salado)
FS-11	15-11	Artifact scatter	Ceramic
FS-12	15-07	Lithic procurement	Prehistoric/Protohistoric
FS-13	15-07	Roomblock, Lithic	Middle Ceramic
FS-14	15-07	Roomblock, Lithic	Middle Ceramic
FS-15	15-07	Rock ring	Late Archaic

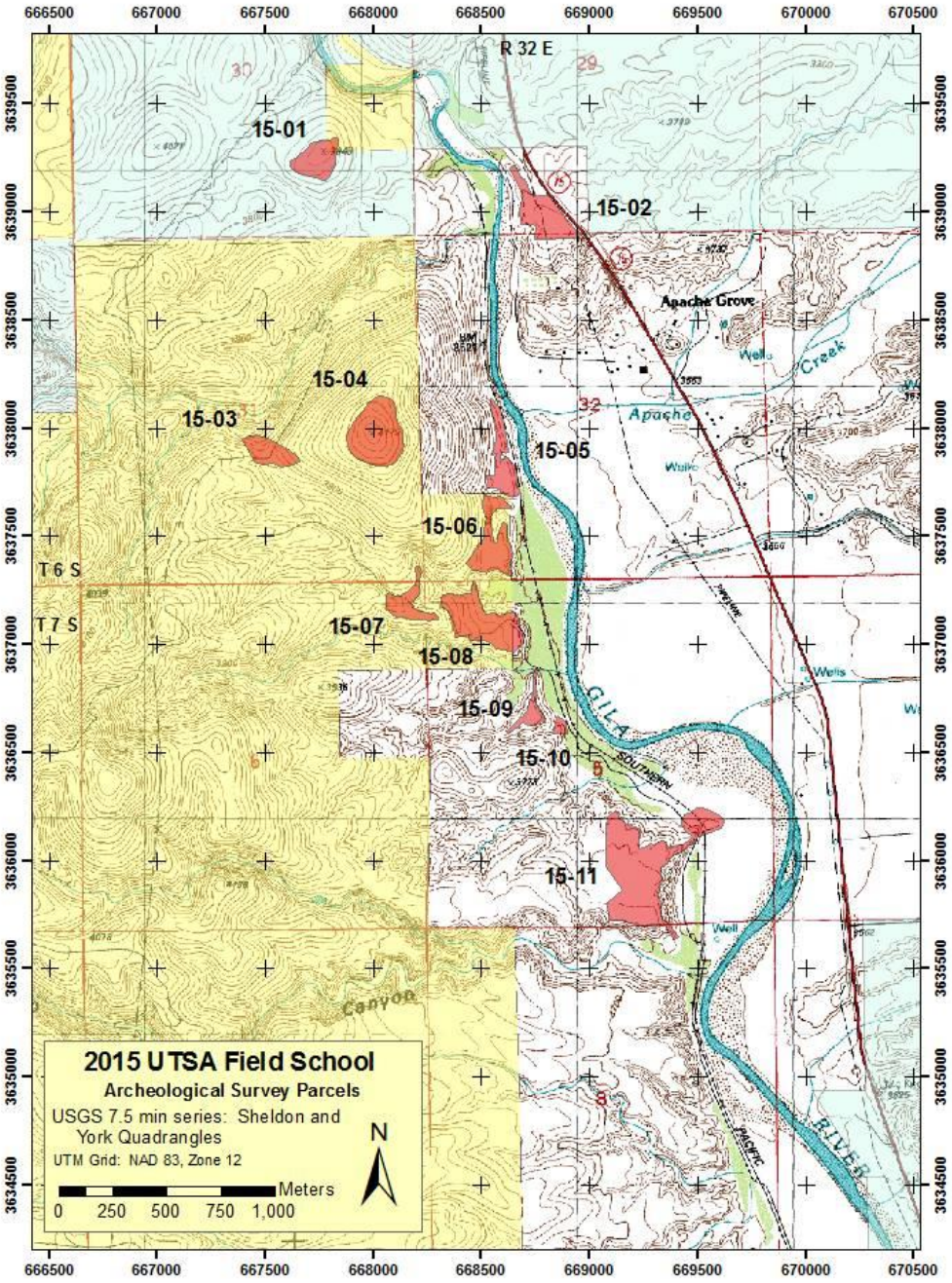


Figure 1. Survey Parcels

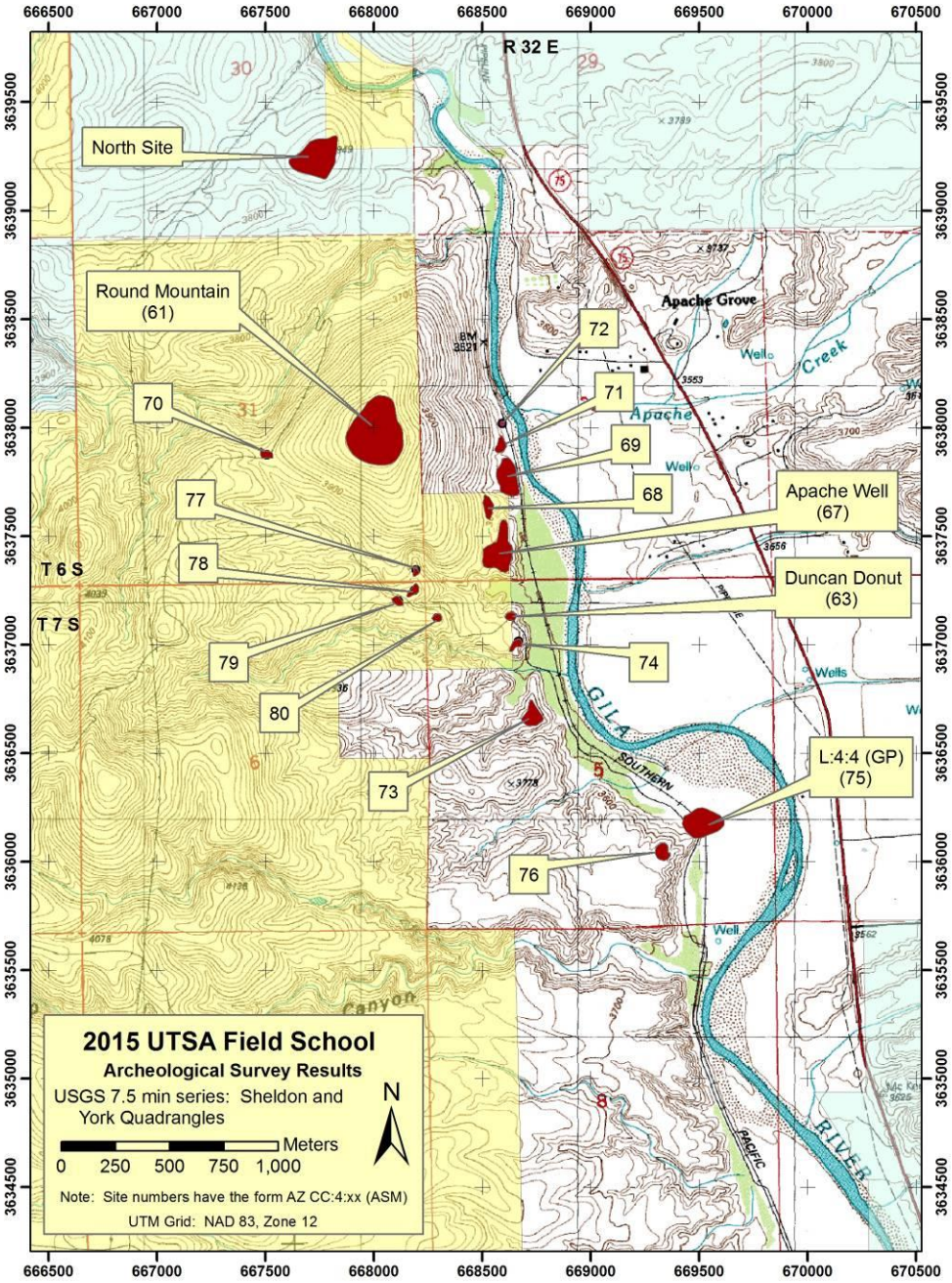


Figure 2. Site Locations

Parcel 15-01. State, BLM (7.1 acres)

This parcel consists entirely of the North Site and was surveyed intensively during recording of the site, rather than through systematic pedestrian transects. The North Site is a large cerro de trincheras with walls, terraces, and rock rings likely dating to the Early Pithouse period. Boundaries of the survey parcel correspond to boundaries of the site.

North Site (AZ CC:4:81 (ASM)). The North Site is a major cerro de trincheras site overlooking a constriction along the Gila River. Ceramic evidence suggests that its principal occupation was during the Pithouse period, AD 200 to 1000. The site is triangular in shape, and is approximately 200 meters by 140 meters in size. It is located about 1.3 kilometers north of Round Mountain, but is only about half as high as Round Mountain.

The North Site is located on a volcanic hill that rises over 400 feet above the Gila River, overlooking a box canyon. It is bounded on the northeast by the Gila River, and on the south and northwest by short, deep canyons. On the northeast it is also separated from another mass of volcanic hills by a 150 foot deep saddle.

The site is bounded by a 450 meter long perimeter wall on two sides, the northwest and northeast. Other walls within the complex amount to another 200 meters, making a total of about 650 meters of rubble berm wall. The perimiter wall often incorporates natural scarps and outcrops. While significant sections exhibit massive construction, there are also many areas where definition of the perimeter is limited to little more than a row of cobbles on the edge of a cliff. Although there are a series of natural cliffs on the southern side of the hill, we were not able to define any constructed wall along the southern edge of the complex.

In addition to the rubble berm walls, there are about 20 short terrace walls, with a total combined length of 114 meters. These are generally on the south face of the hill, and seem intended to create small crescent shaped areas with flat surfaces. Often they are built upon or incorporate natural bedrock ledges. There are 22 well defined rock rings within the cerro de trincheras complex, ranging from 1.6 to an impressive 8.8 meters in diameter (mean = 5.17, sd = 1.66; as measured from site map).

Artifacts are very sparse, suggesting only limited use of this site. There were few lithics, and the most common lithic artifacts were large cores of coarse material. No projectile points, bifaces, scrapers or other formal artifactswere found. Ground stone artifacts included a few lightly used manos and one large slab metate with moderate wear. Ninety nine sherds were tabulated. Most of these were plain brownwares, but there was one sherd of true San Francisco Red, two more nondescript red slipped sherds, a single Mimbres B/W (probably transitional) sherd, and one white slipped brownware lacking decoration. No artifacts were collected.

Site condition was good. There was no obvious evidence of looting or surface collection and we noted no particular problems with natural erosion. Livestock and game

use the hill, but there was no evidence of particularly concentrated use. Due to lack of soil, rodent activity is also minimal.

Parcel 15-02 Private (10.2 acres)

This parcel consists of relatively level land on the summit of a volcanic ridge overlooking a constriction along the Gila River. It was surveyed by systematic pedestrian transects. No sites were found, but there were 17 isolated occurrences (Table 3). One of these was a US Soil Conservation Service (now NRCS) bench mark. The remainder were all prehistoric lithic artifacts, including four cores and a dozen or more flakes and pieces of angular debris. Raw material types included both white chert and basalt (dark, glassy macrocrystaline volcanic rock). Both raw material types occur in the local bedrock, and it is likely that these isolated artifacts reflect casual procurement of lithic raw materials (Figure 3).

Table 3. Isolated Occurrences in Survey Parcel 15-02

IO#	*Northing*	*Easting*	*Description*
94	3638988 N	668780 E	Lithic
95	3638997 N	668747 E	Lithic
96	3638999 N.	668748 E	Lithic
97	3639003 N	668747 E	Lithic
100	3639046 N	668774 E	White chert flake
101	3639048 N	668768 E	White chert core
102	3639053 N	668767 E	White chert flake
103	3639009 N	668724 E	White chert flake
106	3638998 N	668753 E	Core
107	3639007 N	668742 E	Flake
108	3639005 N	668739 E	Core
109	3639003 N	668733 E	Flake
110	3638931 N	668850 E	Flake
118	3639022 N	668796 E	White chert flakes
121	3639019 N	668755 E	Basalt core
122	3639059 N	668731 E	Basalt flake
123	3639027 N	668688 E	Bench Mark: "US Soil Conservation , Service, Department of Agriculture, Triangulation, 19 G68 35."

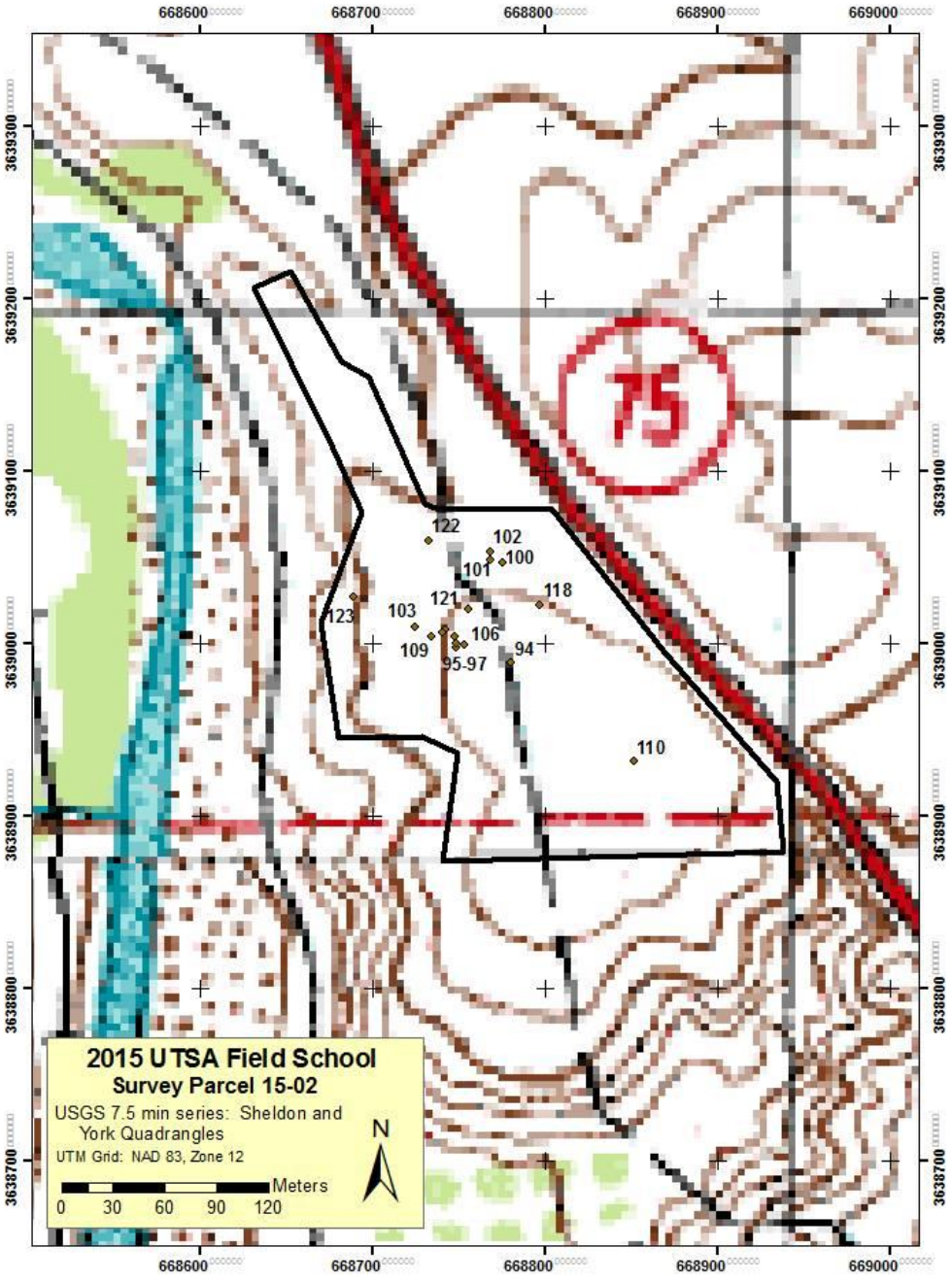


Figure 3. Survey Parcel 15-02

Parcel 15-03 BLM (5.7 acres)

Parcel 15-03 is located in the saddle between Round Mountain to the east and the main body of the Peloncillo Mountains to the west (Figure 4). Much of the parcel consists of FS-05 a light lithic scatter which at least partly represents lithic procurement. Aside from the site, five isolates were recorded, including a projectile point collected in 2014 (Table 4).

FS-05 (AZ C:4:70 (ASM)). FS 5 consists of about 20 lithic artifacts found within an area 56 meters by 46 meters in size. There were no features. The scatter is found just below (towards the north) of a saddle connecting Round Mountain to the main body of the Peloncillo Mountains (which are to the west of Round Mountain).

A total of 23 lithic artifacts were tabulated here, including five cores, a hammerstone, and an edge modified cobble. Four of the five cores and about half of the debitage were local igneous rock (perhaps andesite), and the remaining items were of white chert/chalcedony. The preponderance of cores suggests that lithic procurement was likely an important activity here. In prior years a deep basin metate was also observed in this vicinity, although it was not relocated during this recording of the site. No artifacts were collected from this site.

Pseudoartifacts found in the vicinity of the road may be the product of heavy equipment operation disruption in the area. Possible lithic items in the vicinity of this disturbance were not tabulated. Because the saddle itself has been almost completely bladed, it is hard to say what may have originally been present there. Artifacts described here were located on a moderate to relatively steep north-facing slope, where buried deposits are unlikely.

Table 4. Isolated Occurrences in Survey Parcel 15-03

IO#	*Northing*	*Easting*	*Description*
93	3637855 N	667642 E	Two white chert flakes
128	3637933 N	667454 E	Core of fine grained, vesicular black basalt
129	3637870 N	667595 E	Two small cleared areas 7 m apart. Each ca. 3 m diameter. Could be animal beds
130	3637902 N	667593 E	Projectile point, Tularosa Corner-notched. SC #42 (Bag 32).

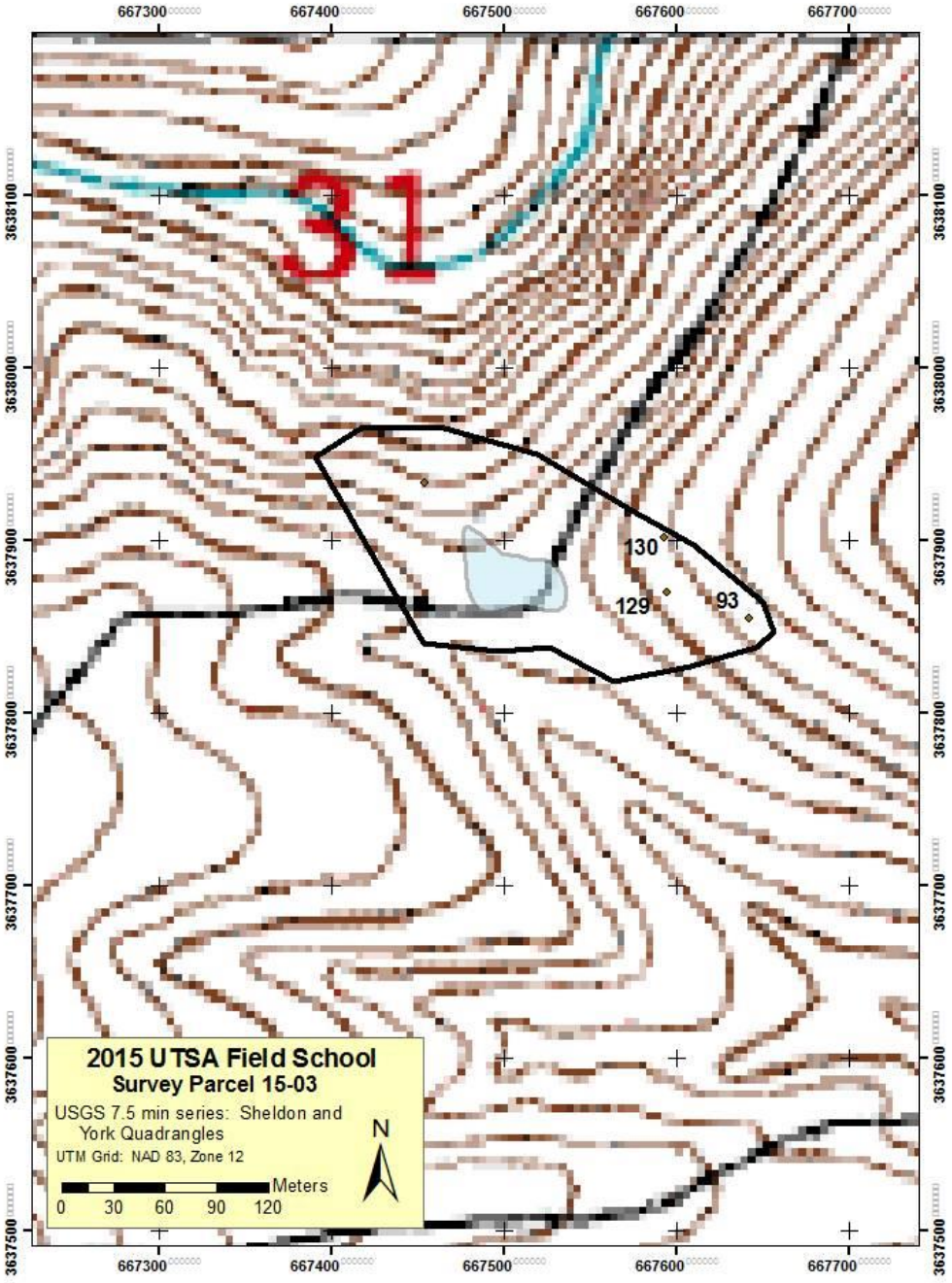


Figure 4. Survey Parcel 15-03

Parcel 15-04 BLM (15.3 acres)

This parcel consists entirely of the Round Mountain site (AZ CC:4:61 (ASM)), a major Early Agricultural period cerro de trincheras. It was surveyed intensively during recording of the site in 2013 and 2014. Boundaries of the survey parcel correspond to boundaries of the site. Surface collection and excavation results from 2015 are discussed elsewhere in this report.

Parcel 15-05 Private (6.9 acres)

This parcel consists of a narrow alluvial/colluvial terrace at the eastern base of Round Mountain, about 40 feet above the bed of the Gila River. Much of the terrace is occupied by two archeological sites, FS-04 and FS-06. In addition there is a small historic site associated with the railroad, FS-07. The parcel was surveyed primarily through recording the three sites, rather than by systematic transects. No isolated artifacts were recorded in this parcel; all artifacts were subsumed within one of the three sites.

FS-04 (AZ CC:4:69 (ASM)). This large pithouse site is 174 m in length and 60 m in width with approximately 12 pithouses visible. Ceramics and architecture suggest that the site dates to the Early and/or Late Pithouse periods.

The site is located about 600 meters above a distinct constriction in the Gila River floodplain, a location where local informants report that bedrock often forces groundwater flow to the surface. It is situated on an alluvial terrace remnant which is about 40 feet above the floodplain, bounded on the north and south by drainages which come off of the slopes of Round Mountain and have dissected the terrace remnant. The western edge of the site corresponds to the edge of talus at the base of Round Mountain, and on the east artifacts extend down the terrace slope towards the Gila River floodplain.

The 12 pithouses are indicated by subtle and sometimes not-so-subtle depressions surrounded by circular or semicircular concentrations of lag gravels. Measured from the inner edge of the lag gravel deposit these features range from 5.8 to 10.5 m in diameter. They occur in two clusters. Five of the pithouses occur towards the southern tip of the terrace, while seven are located in the northern half. In addition to the pithouses, there is an anomalous grouping of small boulders near the middle of the terrace. Soil on the terrace surface and terrace slopes is noticeably darker in color, reflecting higher than normal organic content.

There is a relatively light scatter of sherds and lithics across the terrace surface, and a somewhat higher concentration on the terrace slope. Two deep basin metates were found at the northern end of the site. Projectile points included a San Pedro point (Fig. 9c), a dart point (Fig. 9g), and indeterminate form (Fig. 9d), two arrow points (Figs. 9f and h), and another possible arrow point tip (Fig. 9j). There were also a number of cores, an unnotched biface (Fig. 9e) and a biface fragment (Fig. 10i).

Two power or communications line poles are located on the site, and an access road has been bladed discontinuously along this line. However, this disturbance is minor and is limited to the western edge of the site. The railroad bed has been cut into the slope below the site, but this construction also does not seem to have seriously impacted this site. Overall the site is in excellent condition, with no evidence of looting and no serious erosion problems.

FS-06 (AZ CC:4:71 (ASM)). This probable Archaic site includes an undefined rock feature and a large artifact scatter which covers an area approximately 100 meters by 40 meters in size. A hundred or more pieces of debitage may be present.

The site is located on a narrow alluvial/colluvial terrace at the eastern base of Round Mountain, about 45 feet above the Gila River. It is bounded on the south by an arroyo. Its northern boundary was defined by the distribution of artifacts across the terrace surface.

The most distinct feature on this site is a 2.6 meter diameter concentration of cobbles, with vestiges of a circular alignment. The feature seems too small for habitation and may have been the base of a granary, or perhaps an agricultural feature focused on a specific plant. Adjacent to this feature is a roughly "D" shaped area 3 or 4 meters long from which cobbles have been removed and tossed downslope. This feature resembles terraces found on steeper slopes, but because of the gentle slope on the terrace surface a retaining wall was unnecessary. These two features are located on the very northern edge of the lithic scatter, and are not necessarily related to the lithic scatter.

Virtually no ceramics are present with the exception of one clapboard corrugated brownware sherd. The assemblage also included one complete mano, a biface (Fig. 9k) and an expedient point of probable Archaic origin (Fig. 9l).

FS-07 (AZ CC:4:72 (ASM)). This historic campsite or trash dump likely dates to the late 19th century or early 20th century. It lies approximately 30 meters west of the Arizona Eastern Railway, which was constructed between 1885 and 1889. Presumably it resulted from railroad construction or maintenance activities.

The site is entirely within the railroad right-of-way. However, it is on the shoulder of a terrace, separated from the railroad bed by a three or four meter high, near vertical scarp. It is most concentrated in a 10 meter diameter area, but additional, clearly related items are found up to 17 meters to the south of the main concentration.

Historic artifacts found include 15 or so soldered hole-in-the-top meat cans, as well as a smaller number of round cans, and soldered cans that open with a key (sardine type). There were fragments of amber, pale blue and clear glass, some of it embossed. Bottle necks had lips created in spin molds. Several sizes of round-headed wire nails were also found, as well as five shell casings from a 45 caliber firearm and a wire handle, perhaps from a lard bucket. Also present were five or six old, heavily decayed railroad

ties. These, along with the inconvenient access to the railroad bed, suggest the possibility that these remains relate to fencing the railroad right-of-way.

Two bottles were embossed "M B & G Co." According to the on-line Encyclopedia of Manufacturers' Marks on Glass Containers maintained on Society for Historic Archaeology web site (accessed Dec. 31, 2015) this is a mark used between 1900 and 1904 by the Massillion Bottle and Glass Company of Massillion, Ohio. Nothing was collected.

Parcel 15-06 BLM (9.3 acres)

Like Parcel 15-04, Parcel 15-06 consists of an alluvial/colluvial terrace at the eastern base of Round Mountain, about 60 feet above the floodplain. The terrace is divided into two areas by a short, deep drainage, and each of these areas is largely covered by an archeological site, the Apache Well Site (FS-02) to the south and FS-03 to the north. The parcel was surveyed primarily through recording the two sites, rather than by systematic transects. No isolated artifacts were recorded in this parcel.

FS-02. Apache Well (AZ CC:4:67 (ASM)). This site includes at least two components. The most conspicuous is a cohesive group of six or seven masonry and adobe room blocks ranging from one to twelve rooms in size. Altogether as many as 50 rooms may be present. Four or five of the room blocks are more or less contiguous to one another and define a plaza which is enclosed on three sides. The room blocks all seem to be at least ceramicly contemporaneous, dating to the early to mid 13th century. The second component on this site consists of four circular pithouse depressions, and it is possible that others are present beneath the masonry and adobe room blocks. No artifacts could be conclusively associated with these features (as opposed to the later occupation), and they may date to either late preceramic times or to the Ceramic period.

The site is situated about a kilometer upstream from a distinct constriction in the Gila River floodplain, a location where local informants report that bedrock often forces groundwater flow to the surface. It is situated on a narrow alluvial terrace remnant about 80 feet above the floodplain, bounded on the south by a major arroyo and on the north by a smaller drainage which has cut into the terrace deposits. Its eastern boundary is the terrace edge, and its western boundary is the base of Round Mountain itself.

The pithouses are subtle depressions surrounded by circular or semicircular concentrations of lag gravels. All four are about 6 m in diameter (measured from the inner edge of the lag gravels—or 8 m measured from the center of the lag gravel deposits. Three are well defined and we are confident that they are prehistoric pithouses, the fourth is more speculative but still considered likely.

The largest of the room blocks is "U"-shaped, 24 m by 14 m in size. Its rubble mound is about a meter in height, suggesting full height masonry walls, and some of the masonry elements appear to have been shaped. A second, smaller room block is also masonry while three others are a mixture of masonry and adobe with cobble footings.

These five room blocks are distinct from one another but are positioned in such a way as to define a plaza 35 m by 25 m in size, enclosed on the north, west and south by roomblocks and defined on the east by the terrace edge. Two additional roomblocks stand apart from this complex. Both are of masonry and each includes about five rooms. Three other small cobble features of presumed prehistoric origin are found on this site. One is a small isolated rectangular room. Another is a circular arrangement of cobbles and small boulders, and the third is an anomalous grouping of cobbles.

A tally of sherds found in the plaza area included 257 sherds. The dominant sorting categories were plain brown (51% of total), corrugated indented brownware (19%) and Maverick Mountain black-on-red (21%). Distinctive ceramic types recognized but not included in the tally are St. John's Polychrome, Tularosa Black-on-white, Tularosa Fillet Rim, and Maverick Mountain Polychrome, each represented by one or two sherds. There also was a single sherd of Mimbres Black-on-white. The near complete absence of Mimbres B/W suggests occupation after AD 1150; the presence of St. John's Polychrome, Tularosa B/W, and Tularosa Fillet Rim suggest dates between AD 1150 and 1300. The near complete absence of Roosevelt redwares corroborates a date prior to AD 1300. This evidence implies that the site was occupied during some part of the interval between AD 1150 and 1300.

Other artifacts include several metate fragments, a stone pipe (Fig. 8w), one small arrow point, and two small dart points, both probably Tularosa Corner-notched forms (e.g. Fig. 8v).

Except for possible disturbance during the later pueblo occupation, the pithouses are in very good condition. The roomblocks and outlying cobble features have been looted extensively (and recently) by hand excavation. While we were working in the area, new looter holes began to appear in the plaza area. A very old bulldozer track (F 15) crosses the site from southeast to northwest, but mostly avoids cultural features. In the western portion of the site a causeway-like feature has been built along this track (which was at first mistaken for a prehistoric feature). We speculate that this disturbance resulted from a long-forgotten livestock watering system associated with Apache Well. Natural erosion along a short, steep drainage is beginning to affect the southern edge of the largest roomblock.

FS-03 (AZ CC:4:68 (ASM)). The site consists of a rock ring and a large lithic scatter, covering an area approximately 110 by 50 meters in size. Based on an apparent absence of pottery and on characteristics of the lithic assemblage this site is assumed to be Archaic in age.

The site lies at the east-southeastern base of Round Mountain, at the juncture of the talus slope and the surface of an alluvial terrace associated with the Gila River. Today the river itself is about 200 meters to the northeast, and the terrace is about 60 feet above the floodplain. Unlike other nearby terraces, the surface here is covered with fine sediments, and there is a good possibility of buried materials. The principal feature found

on this site is a three meter diameter rock ring built into talus about a meter above the terrace surface. Superficially, at least, this feature seems identical to those found on the summit of Round Mountain. Adjacent to this structure is a mortar ground into a large boulder.

Lithic debitage on the site consists primarily of relatively small flakes of fine-grained chert with some obsidian. The maximum lithic density is approximately 6 artifacts per square meter. Two projectile points were found. One appears to be a Dolores Expanding-stem arrow point (Fig. 9a); the other resembles a dart point of possible Archaic origin (Fig. 9b). Other artifacts included at least two metate fragments, one of which is from a very deep basin metate (a type informally termed a "bathtub" metate).

The lack of ceramics, number of lithic flakes, and presence of a deep basin metate suggest that this is an Archaic site.

Parcel 15-07 BLM (5.1 acres)

This parcel consists of relatively level ground on the summit and upper slopes of a bedrock ridge near the southern base of Round Mountain (Figure 5). The area was targeted for survey because of two small rubble mounds initially reported to us by Dick Kaler. It was surveyed primarily through systematic pedestrian transects. Four archeological sites were found, FS-12, FS-13, FS-14, and FS-15. In addition, seven isolated artifacts were noted (Table 5).

FS-12 (AZ CC:4:77 (ASM)). This site is an artifact scatter that included about 30 lithic items distributed across an area 45 m by 36 m in size. The site also included a concentration of large cobbles and small boulders which does clearly seem to be a cultural feature.

The site is located on the south side of a small drainage which forms the southern base of Round Mountain. Over the eons this drainage has meandered around a particularly resiliant outcrop, leaving the outcrop exposed as a knob connected to the adjacent hillslope by a small saddle which is 20 to 60 vertical feet above the bed of the drainage. The artifact scatter is located in this saddle, just south of the outcrop. This setting is essentially in a canyon bounded by Round Mountain to the north and a rocky bedrock ridge to the south.

The lithic artifacts consist mostly of basalt cores and large or medium-sized flakes. There was one flake of white chert. The only definite cultural feature on the site was a three meter diameter concentration of about 50 large cobbles or small boulders. Although there was no clear arrangement or organization, the cobble concentration is definitely anomalous. There was also a three meter diameter area where cobbles had been cleared away. Cattle congregate on the saddle, and this clearing is most likely a result of livestock activity. No artifacts were collected here.

Aside from the livestock activity noted above, there are no obvious sources of disturbance on this site. It is likely in very good condition.

FS-13 (AZ CC:4:78 (ASM)). This site consists of an apparent two room structure associated with about 60 lithic artifacts and two small sherds. Based on tentative identification of one of the sherds, the site is dated to between AD 1100 and 1300.

The site is located on the brow of a bedrock ridge overlooking a small drainage which defines the southern base of Round Mountain. The location is about 700 m west of the current course of the Gila River, as is about 250 vertical feet above the floodplain. There is little obvious agricultural potential in the immediate vicinity of this site.

There are about 60 lithic artifacts on this site. Artifacts included core/choppers, expedient tools, and scrapers. These materials were primarily made of local basalt, although 3 or 4 white chert flakes and 3 or 4 obsidian flakes were also noted. Two tiny sherds were found. One of these was tentatively identified as Tularosa Black-on-white; the other was a white slipped grayware. No collection was made at this site.

The principal feature was a masonry structure which included two small rooms, each about 2 m by 1.5 m in size. The volume of rubble suggests that the masonry component of these walls was not full height, perhaps as little as 30 cm. In addition there were two small (1.4 to 1.5 m diameter), vaguely defined circular clearings. These two features could be of either natural or cultural origin.

This site appears to be in stable condition. Aside from livestock, there are few obvious sources of disturbance.

FS-14 (AZ CC:4:79 (ASM)). This site consists of two one room structures located on a ridge to the south of Round Mountain. The setting is a barren, rocky hill slope with little obvious agricultural potential. A scatter of lithic artifacts consisting primarily of local stone, and including a large number of cores is spatially associated with the two structures.

The northern structure is rectangular with distinct wall alignments defining an area approximately 2.5m by 1.75 m in size. The amount of rubble suggests something less than full height walls. About 2.5 meters to the south is a second structure. The second structure is larger, but more amorphous, 2.5 to 3 m in diameter with no obvious alignments. However, this structure includes quite a bit more rubble than the first one.

A 55 m by 30 m scatter of 40 to 50 lithic artifacts appears to be roughly centered on these two structures. Because fine-grained, knappable igneous stone occurs naturally at this location we were very conservative in recognizing cultural items. Generally, lithic items were identified as cultural only if clear flake morphology was present. An overwhelming majority of the lithic artifacts were made of local material, and almost half were cores. About five items of non-local chert were observed. The only clear tool noted was a uniface. Three sherds were found. One was identified as a Classic Mimbres B/W

bowl sherd, although the paste was gray. Another was a polished brownware. The third was a sherd from a thin, mineral painted, white-slipped grayware, perhaps from the Cibola series. No artifacts were collected.

Construction of a bulldozer track and a small pipeline have slightly disturbed the southern roomblock and have affected artifacts on the southern periphery of the site. There may have been minor looting in the northern room.

FS-15 (AZ CC:4:80 (ASM)). This site consists of a rock ring and a terrace-like feature surrounded by a 30 meter diameter lithic scatter. It is situated at the end of a bedrock ridge, about 80 feet above the highest riverine terraces and 220 feet above the floodplain. This setting overlooks the river valley, and the Gila River itself is about 600 meters to the east.

Features on the site include a rock ring adjacent to a small terrace-like feature. The rock ring is circular in shape, about 3 meters in diameter, and has an opening on its eastern side. Just to the south is a 3 meter long segment of a cobble berm terrace-like feature which retains a small amount of fill. Unfortunately a bulldozer swath passes between the rock ring and the terrace remnant, leaving some uncertainty about the relationship between the rock ring and the terrace. However, it seems likely that the terrace berm was originally about 9 m in length, and that the rock ring was built immediately above it. These two features are very reminiscent of features found on Round Mountain, which is located a little to the north.

The two features are surrounded by a relatively concentrated lithic scatter composed almost exclusively of local basalt. The assemblage included 28 basalt cores, and over 150 basalt flakes, as well as four white chert flakes. None of these artifacts were formal tools, although several basalt flakes may have been used. There was no pottery and no obsidian. We did not collect any artifacts from this site.

There has been no deliberate damage to this site, but a bulldozer swath passes directly through it and has destroyed part ot the terrace-like feature. There is also a water pipeline laid on the surface along the northern edge of the site, part of a livestock watering system associated with Apache Well.

Table 5. Isolated Occurrences in Survey Parcel 15-07

IO#	*Northing*	*Easting*	*Description*
131	3637223 N	668127 E	Massive core 15cm diameter, Basalt flake
132	3637177 N	668085 E	White chert flake, Basalt flake
133	3637146 N	668211 E	Large basalt flake
134	3637116 N	668251 E	Basalt core
135	3637125 N	668243 E	Basalt core medium
136	3637126 N	668258 E	Basalt flake

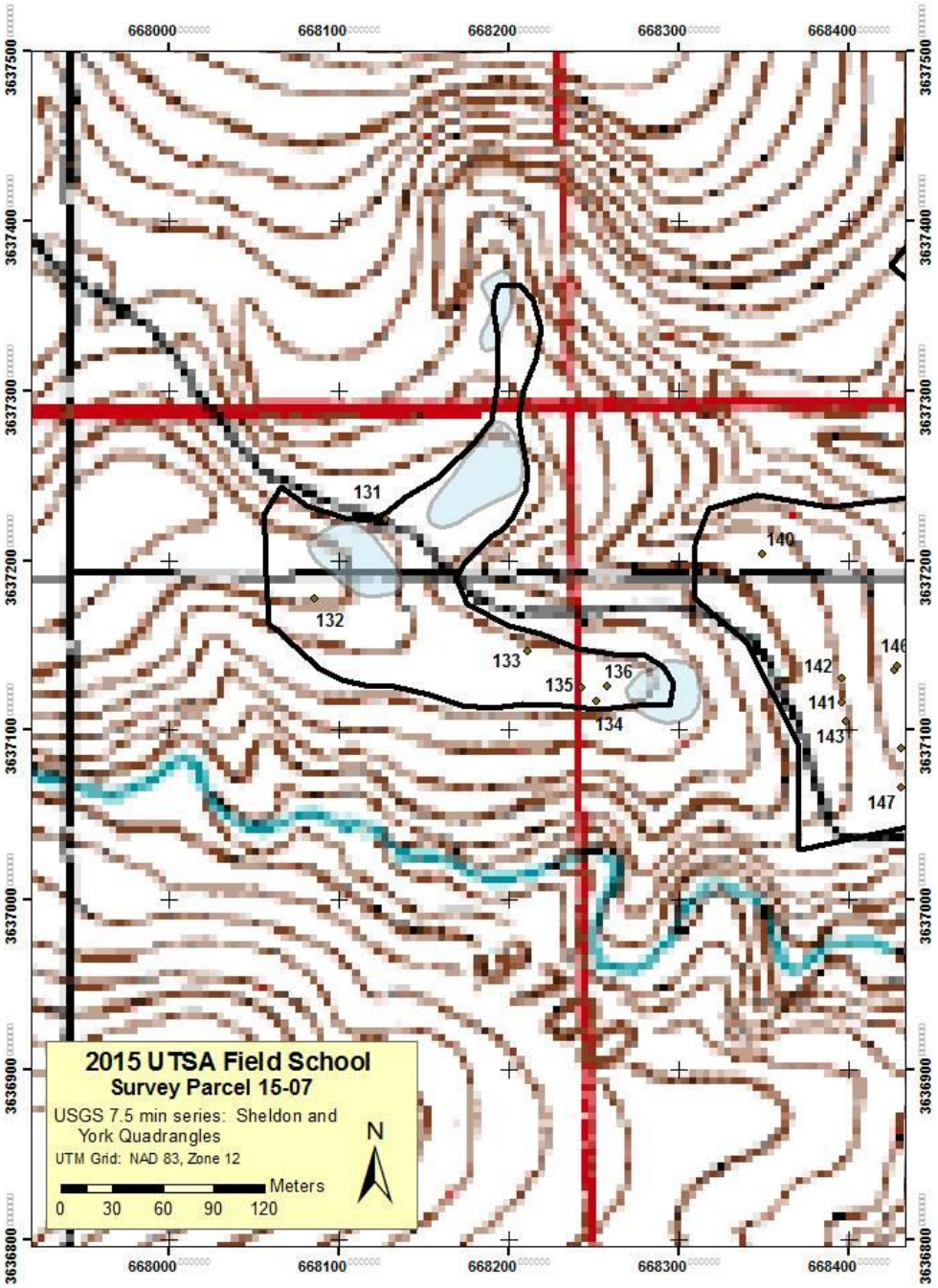


Figure 5. Survey Parcel 15-07

Parcel 15-08 BLM & Private (15.1 acres)

This relatively large parcel includes the Duncan Donut Site, as well as one additonal site (FS-09). Results of the 2015 test excavation at the Duncan Donut Site are described in another section of this report. The parcel includes a narrow alluvial/colluvial terrace which is about 60 feet above the floodplain, but it consists primarily of the lower slopes of a bedrock ridge near the southern base of Round Mountain (Figure 6). It was surveyed by systematic pedestrian transects. In addition to the two sites, 29 isolated artifacts were recorded (Table 6). These included a possible cairn (IO 137), a possible rock ring (IO 140), and three bone fragments (IO 113, IO 139, IO 141). The remaining IOs were all lithic artifacts, including several cores, a uniface, and an expedient tool fragment, as well as flakes and pieces of angular debris.

FS-09 (AZ CC:4:74 (ASM)). This site included a rock ring and an extensive scatter of over 100 chipped stone items over an area 75 meters by 40 meters in size. The site is located on the edge of an ancient alluvial terrace which is about 70 feet above the floodplain of the Gila River. It is situated on a narrow bench-like area just below the brow of the terrace, and as a result is somewhat protected from the north.

The rock ring is circular, and is about 3.5 meters in diameter with an opening towards the east. In comparison to other rock rings such those on Round Mountain, FS-03, and FS-15 the rock ring here is much less substantial and more difficult to see. However, it is clearly a cultural feature. There are a couple of possible cobble alignments on the terrace edge directly in front on the rock ring. Although these may be natural, there is a possibility that they are deliberately constructed features intended to retard erosion of the terrace edge.

The lithic scatter includes about 100 individual items and includes three cores as well as the base of an Archaic dart point. A single Salado polychrome sherd was also found, but is assumed to be intrusive. This site is coded as Archaic based on the projectile point, the character of the lithic assemblage, and the overall appearance of the rock ring. However, it is not impossible that the rock ring is protohistoric, rather than Archaic in age. Nothing was collected.

Table 6. Isolated Occurrences in Survey Parcel 15-08

IO#	*Northing*	*Easting*	*Description*
97	3637106 N	668590 E	Lithic
98	3637067 N	668591 E	Lithic
99	3636986 N	668595 E	Core
104	3637082 N	668619 E	White chert flake
105	3637079 N	668618 E	White chert flake
111	3637118 N	668608 E	Chert flake
112	3637067 N	668601 E	Chert flake
113	3637010 N	668607 E	Bone
114	3637045 N	668498 E	Core
115	3636993 N	668575 E	Brown chert flake
116	3637041 N	668530 E	Brown chert flake
117	3637046 N	668530 E	White and pink chert flake
119	3637005 N	668553 E	White chert core
120	3637036 N	668546 E	Unknown material flakes
124	3637102 N	668631 E	White chert flake
125	3637078 N	668663 E	Basalt flake
126	3637143 N	668457 E	White chert uniface
127	3637229 N	668462 E	White chert angular debris
137	3637276 N	668464 E	Possible cairn. Ca. 20 river cobbles
138	3637089 N	668430 E	Flaked stone
139	3637135 N	668427 E	Bone fragment
140	3637203 N	668349 E	Possible rock ring
141	3637116 N	668396 E	Bone, possibly modern
142	3637130 N	668395 E	Gray basalt flake
143	3637105 N	668397 E	White chert flake
144	3637225 N	668446 E	White chert flake
145	3637072 N	668436 E	Expedient tool fragment
146	3637137 N	668428 E	Retouched flake
147	3637065 N	668431 E	Tool

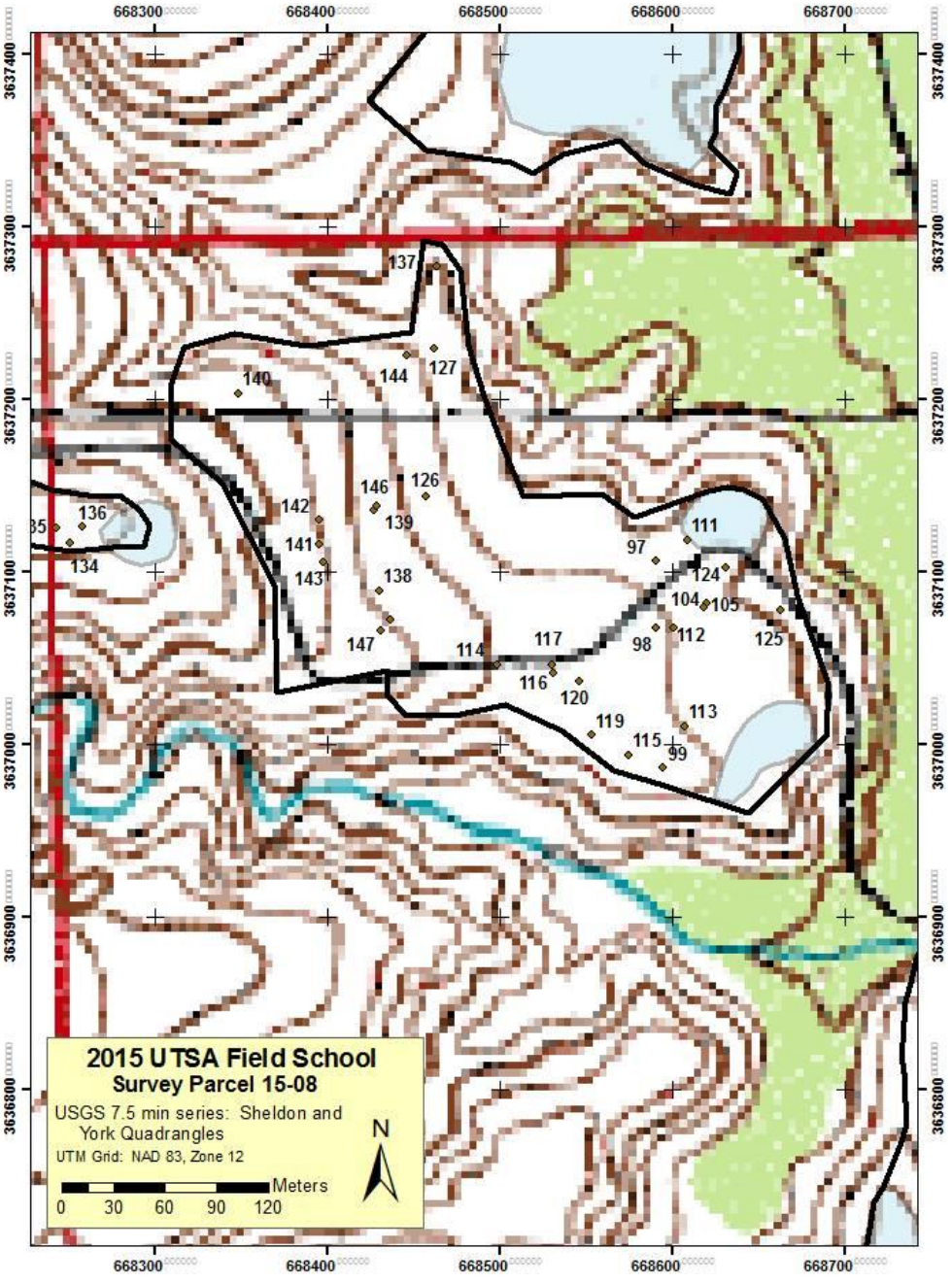


Figure 6. Survey Parcel 15-08

Parcel 15-09 Private (2.9 acres)

Parcel 15-09 consists of an isolated remnant of an alluvial terrace about 80 feet above the floodplain. The core of the parcel is a flat-topped mesa-like feature about two acres in size, which is covered with artifacts and cultural features, FS-08. The parcel was surveyed primarily in the course of recording the site, rather by use of transects.

FS-08 (AZ CC:4:73 (ASM)). This large pithouse site is about 115 m by 90 m in size, occupying the entire surface of a flat mesa-like terrace remnant. There are at least 12 pithouses, a mound of cobbles, an anomalous grouping of small boulders, two boulders covered with cupules, and two rock alignments which may be vestiges of a perimeter defense. Sherd tallys suggest Early and Late Pithouse Period occupations, but an apparent structural mound and a few sherds might indicate that use of this location extended into the Three Circle Phase as well.

Site occupies most of the top of a small mesa-like alluvial terrace remnant which rises about 80 feet above the Gila River floodplain. The terrace remnant is triangular in shape, bounded on the east by the floodplain and on the northwest and south by deep arroyos. Towards the southwest the site in connected to the main series of alluvial terraces by a narrow, eroded fin of alluvium.

The pithouses are indicated by circular depressions surrounded by circular or semicircular concentrations of lag gravels. Most are about six meters in diameter, measured from the inner edge of the encircling lag gravel deposit, but one is over eight meters in diameter. In addition to the pithouses, there is a four or five meter diameter mound of cobbles, perhaps a meter in height located near the center of the mesa top. Presumably this feature represents a surface structure, although no clear wall alignments were noted. Elsewhere on the site was a loose grouping of cobbles and small boulders, resembling features found on other pithouse sites recorded during the 2015 survey. Near the periphery of the mesa top were two small boulders covered with cupules. Finally, there was a clear 15 meter long cobble alignment along the northern edge of the mesa top, and a 20 meter long cobble berm wall at the southwestern corner of the mesa top. In places the soil was clearly ashy, implying midden deposits.

The artifact assemblage included hundreds of sherds and an estimated 1000 pieces of lithic debitage, as well as numerous fragments of manos and metates. Lithic raw materials included chert and fine-grained dark volcanic rock, as well as some obsidian. Three sherds, nine pieces of obsidian, and two retouched flakes were collected here.

There is a large, deep looters hole adjacent to the cobble mound, and a likely pit structure near the mesa edge at its southeastern corner has suffered some erosion. The looting is not fresh. Otherwise this important site appears to be in near pristine condition.

Parcel 15-10 Private (1.0 acres)

Parcel 15-10 was a point of bedrock on the edge of the floodplain which has been massively disturbed by heavy equipment. This was rumored to have been the location of a Mimbres site, and we spent several hours combing backdirt piles and other disturbed areas looking for any evidence of cultural activity. We found no such evidence, and later learned that this was a quarry area where fill and basalt was mined in order to make emergency repairs to the railroad grade after a particularly serious flood.

Parcel 15-11 Private (29.9 acres)

Most of this parcel is an extensive terrace about 100 feet above the floodplain (Figure 7). Its surface is covered with cobbles and pebbles which comprise a loose desert pavement. There is also a light, but more or less continuous scatter of lithic artifacts across this surface. This scatter seems to represent more than just casual lithic procurement, since it includes non-local raw materials, as well as occasional chipped and ground stone tools. More careful recording might show that some of the locations recorded here as isolated occurrences are actually small lithic scatters. The only portion of this scatter recorded as a site was FS-11 (Table 7).

Off the northeastern corner of this parcel a ridge of alluvium projects into the floodplain. The tip of this projection is FS-10, a large Salado site.

FS-10 (AZ CC:4:75 (ASM); AZ L:4:4 (GP)). Based on a Gila Pueblo site form we believe that this is the previously recorded site AZ L:4:4 (GP). The Gila Pueblo site form is dated January 2, 1937, and was completed by W.H. and Dorothea Kelly. They describe the site as "Very compact pueblo of about 30 ground floor rooms. Walls would support second story. Debris and perhaps burials and few more rooms down north slope. Pottery abundant. Three or four rooms, dug out and pot hunted, balance of ruin undisturbed. Land owned by George Cosper." The ruin was a pueblo type, with heavy stone masonry walls; and the mound was six feet or more deep, confined to the top of narrow point and projecting out into farm land. The site is known locally as Matice Ruin.

This is a large Salado pueblo, we estimate 50 rooms or more in size . Although severely damaged by mechanical looting, some architecture remains intact. Today the ruin and associated artifact scatter cover an area approximately 190 m by 140 m in size.

The site occupies a distinctive topographic location on the edge of the Gila River floodplain. Immediately to the west of the pueblo an alluvial terrace rises 100 to 120 feet above the floodplain. Ancient meanders of the Gila River appear to have cut against the edge of this terrace just to the north of the site, and again just to the south, leaving a ridge of alluvium which projects out into the floodplain. The main part of the pueblo was built on the eastern tip of this ridge, and is only 3 or 4 meters above the modern floodplain. The crest of the ridge slopes upward to the west, forming a ramp leading to the top of the alluvial terrace. A separate block of cimientos was built on the crest of this ridge, about 50 meters to the west of the main pueblo.

Because of mechanical looting the original configuration of the main pueblo is difficult to reconstruct. However, it appears to have been built on the north-facing slope of the ridge, extending from the crest of the ridge northwards for perhaps 15 to 25 meters. Mechanical disturbance was focused on this northern slope. We believe that the looters began blading the lower portion of the slope, moving their backdirt northwards and creating a 30 m wide terrace about 1.5 m above the floodplain. They then moved further upslope, again spreading their backdirt northwards onto the newly created artificial terrace, creating a second terrace level about 1.5 m above the first one. They appear not to have mechanically looted the uppermost rooms, those built along the crest of the ridge. In this area shovel looting has exposed several masonry walls which are still intact.

Based on this reconstruction, the spine of the main pueblo, built along the crest of the ridge, was about 40 meters long. Intact walls extend about eight meters to the north, and the original pueblo extended an unknown distance beyond that. Cobble alignments can be seen on the uppermost artificial terrace (created by looters), but it is not clear whether these are walls or alignments made by mechanized equipment. We also cannot tell if the main pueblo was a solid block of rooms, or it comprised a more complex arrangement with or without a plaza. Based mostly on the volume and configuration of the looters backdirt we estimate the width of the original pueblo to have been about 20 meters. The exposed masonry is made of subangular cobbles from the alluvium set in adobe mortar. It is possible that other parts of the pueblo were built of adobe.

The second, smaller roomblock was also built on the crest of the ridge, and is about 50 meters to the west, overlooking the main pueblo. It is represented by half a dozen or so cobble alignments, remnants of cimientos which define a block of small (2 m by 3 m) rooms. The roomblock was about 20 m long and 4 to 6 meters wide, implying perhaps 15 small rooms. Its preservation is fragmentary, because of erosion on the slopes of the ridge, and there is no structural relief—only the footing stones remain.

Also on the ridge crest, between the two buildings was a relatively recent hand-dug looters pit with a human tooth and several bone fragments adjacent to it, undoubtedly a looted burial. We did not make a formal ceramic tabulation at this site. However, key diagnostic ceramic types observed here included Maverick Mountain polychromes, Salado polychromes, and Cliff Red. We also found pieces of at least two perforated plates on this site.

Local informants tell us that a famous polychrome duck effigy ceramic pot was found in the railroad cut at this site. Another told us of finding a perforated plate on this site which had basketry still attached to the perforations, the plate forming the bottom of the basket. No artifacts were collected from this site in 2015.

Informants confirm that the site was looted using a bulldozer, and we believe that this took place in the 1980s, when many other privately owned sites in this valley were looted commercially. In addition to the looting, a deep railroad cut passes through the site, as does an old historic road paralleling the railroad. More recently the ranch road currently in use was bladed across the site. Two fences also cross the site, one along the

railroad right-of-way and the other along the edge of the floodplain. West of the modern road, outside the area of mechanical disturbance, natural erosion of the slopes of the ridge have also destroyed some architecture. However, by far (and obviously) the most serious source of disturbance has been commercial looting. Despite all of these impacts, we believe that much could be learned from systematic investigation of this site. Because looters have targeted sites of this time period, we suspect that this site is among the best preserved sites of its time period which still remain in the Virden/Duncan Valley.

FS-11 (AZ CC:4:76 (ASM)). This site consists of a diffuse artifact scatter on the edge of a
large alluvial terrace some 100 feet above the Gila River floodplain. The site covers an area approximately 85 m by 50 m in size.

This site is located on the terrace edge above a large Salado site (AZ L:4:4 (GP)). At this location an erosional remnant of the terrace forms a knife-like ridge rising from the Salado site to the top of the terrace, 100 feet above. This site is situated on the edge of the terrace where the ridge joins the terrace surface.

The site includes a hundred or more pieces of chipped stone, as well as a handful of ceramics. Ground stone fragments also occur on the site. The most notable artifact found here was a large piece of unworked turquoise (Fig. 9o). In addition to the artifact scatter, there were two oval shaped areas where larger rocks may have been cleared. One of these was 2.5 m by 2 m in size, the other 4.8 m by 4.2 m. However, we could not be certain that these were prehistoric cultural features, especially given the amount of recent historic disturbance at this location. No formal tally of the pottery was made.

A communications or power line descends off of the terrace here, taking advantage of the ridge of alluvium to reach the floodplain below. A track has been bladed across the terrace surface to this location and continues on down the alluvial ridge. The location was apparently used as a staging area during construction, and as a result there is a much larger area of disturbance on the terrace surface in the vicinity of the alluvial ridge.

Table 7. Isolated Occurrences in Survey Parcel 15-11

IO#	*Northing*	*Easting*	*Description*
1	3635731 N	669237 E	Lithic scatter
5	3635948 N	669270 E	White flake
6	3635932 N	669273 E	White flake
7	3635884 N	669272 E	White flake
8	3635856 N	669269 E	White shatter
9	3635793 N	669270 E	Lithic, possible edge modification
10	3635789 N	669268 E	Small white chert flake
11	3635787 N	669269 E	White flake
12	3635785 N	669268 E	White flake
13	3635754 N	669269 E	White flake
14	3635735 N	669273 E	White flake
15	3635724 N	669275 E	White flake
16	3635746 N	669208 E	Chert flake
17	3635753 N	669206 E	Three clusters of flakes
18	3635754 N	669205 E	Three white flakes
19	3635835 N	669212 E	Shatter
20	3635970 N	669213 E	White flake
21	3636055 N	669206 E	White flake
22	3636150 N	669117 E	White flake
23	3636011 N	669120 E	White flake
30	3635927 N	669314 E	Lithic
31	3635889 N	669238 E	Lithic
32	3635858 N	669240 E	Lithic
33	3635852 N	669240 E	Lithic
34	3635844 N	669239 E	Lithic
35	3635838 N	669239 E	Lithic
36	3635751 N	669242 E	Lithic scatter, including obsidian
39	3635738 N	669242 E	Lithic
40	3635731 N	669239 E	Lithic
41	3635725 N	669181 E	Core
42	3635769 N	669185 E	Lithic
43	3635827 N	669179 E	Lithic
44	3635950 N	669181 E	Lithic
45	3636051 N	669182 E	Lithic

Table 7 (continued). Isolated Occurrences in Survey Parcel 15-11

IO#	*Northing*	*Easting*	*Description*
46	3636104 N	669105 E	Lithic scatter
47	3636096 N	669110 E	Lithic
48	3636076 N	669110 E	Lithic
51	3635968 N	669287 E	White chert flake
52	3635939 N	669286 E	Two white chert flakes
53	3635865 N	669285 E	White chert flake
54	3635785 N	669284 E	White chert flake
55	3635782 N	669286 E	Large, well worn metate
56	3635776 N	669285 E	Gray chert flake
57	3635736 N	669285 E	White chert flake
58	3635746 N	669196 E	White flake
59	3635775 N	669195 E	White flake
60	3635777 N	669196 E	Lithic scatter
61	3635786 N	669196 E	White flake
62	3635812 N	669197 E	White flake
63	3635835 N	669195 E	White flake
64	3635844 N	669195 E	Two white flakes
65	3635864 N	669194 E	Two white flakes
66	3636092 N	669193 E	White chert core
67	3636164 N	669137 E	White chert core w/flake
68	3635956 N	669136 E	White chert flake
69	3635791 N	669135 E	White chert flake
70	3635739 N	669138 E	White chert flake
71	3635733 N	669236 E	White chert flake
74	3635718 N	669302 E	White chert flake
75	3635715 N	669225 E	White chert flake
76	3635803 N	669226 E	White chert flake
77	3636004 N	669225 E	White chert flake
78	3636129 N	669151 E	White chert flake
79	3636117 N	669147 E	White chert flake
80	3635960 N	669239 E	Ground stone fragment
81	3635932 N	669237 E	Chert hammerstone
82	3635771 N	669317 E	White chert flake
83	3635760 N	669318 E	White chert angular debris
85	3635921 N	669256 E	Two chert flakes
86	3635902 N	669257 E	Gray stone core
87	3635912 N	669163 E	Scatter, white chert flakes
88	3636190 N	669092 E	White chert shatter
89	3636177 N	669089 E	Core, white chert scatter
90	3636089 N	669102 E	Large gray stone flakes

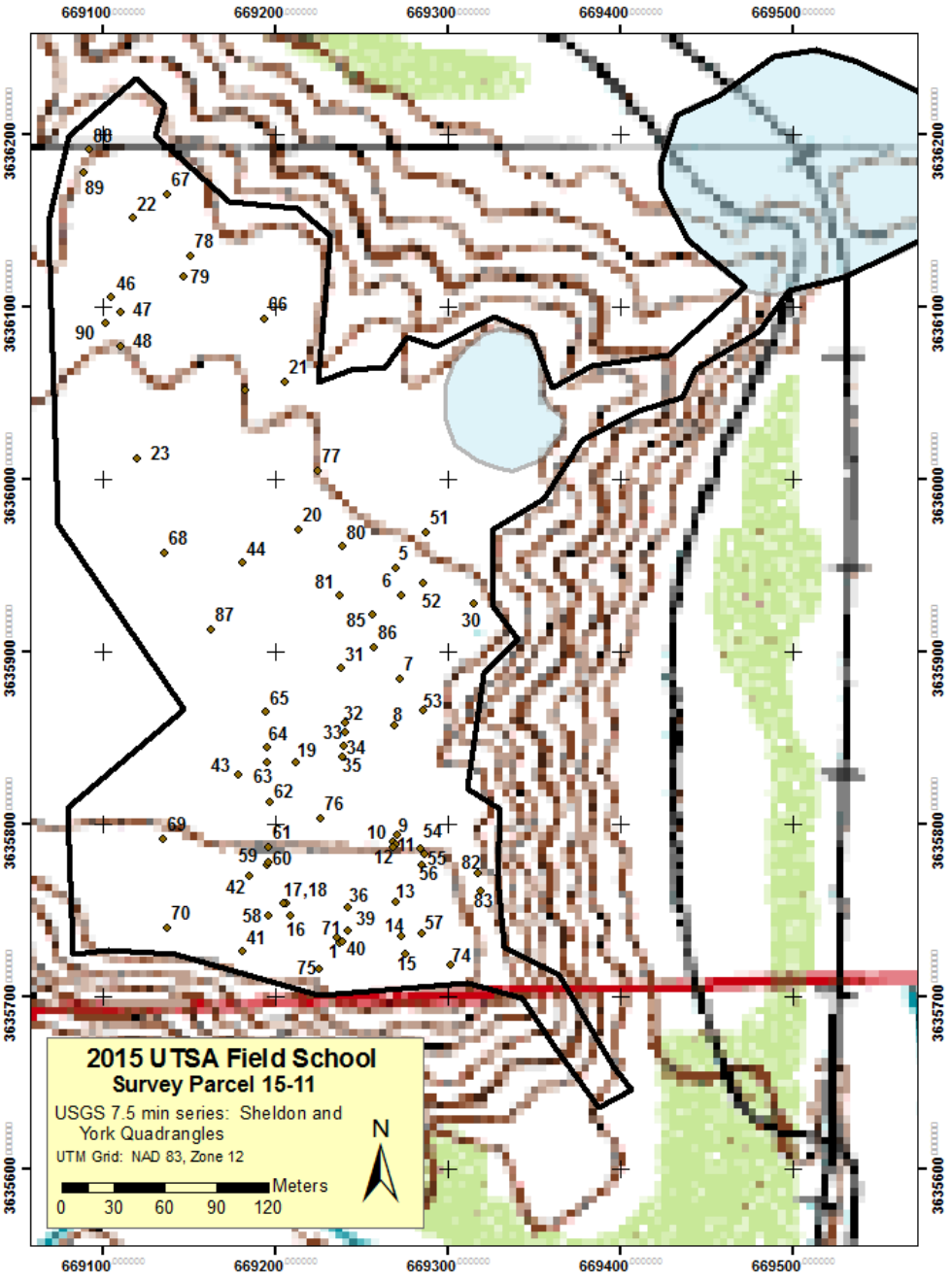


Figure 7. Survey Parcel 15-11

Surface Collections

In 2015 specific artifacts were collected from the surface of several sites. Artifacts were collected only if they were needed for further typoglogical or compositional analysis. These included sherds and formal lithic artifacts, as well as pieces of obsidian debitage and obsidian cores. UTM coordinates were recorded for each collected item using recreation grade GPS units with a nominal accuracy of +/- 3 meters. Table 8 lists all formal artifacts collected in 2015 and provides a count of all additional obsidian samples. Formal artifacts are illustrated in Figures 8 and 9, and more detailed information about these artifacts is provided in Tables 9 and 10. Finally, results of the obsidian source analysis are included here as aaa.

Table 8. Surface Collections in 2015

Round Mountain, AZ CC:4:61 (ASM)

SC#	*Bag#*	*Coordinates*		*Description*
Ceramic				
52	318	668006	3637973	White slipped brownware, indeterminate vessel form
54	320	668006	3637973	White slipped brownware, jar
55	321	668013	3637966	Three Circle Red-on-white, bowl
56	322	668013	3637966	Mimbres B/W, Style I, bowl
57	323	668013	3637966	Mimbres B/W, Style I, bowl
58	324	668016	3637967	Mimbres B/W, Style I, bowl
67	333	667989	3637986	White slipped brownware, indeterminate vessel form
70	336	668006	3637991	White slipped brownware, bowl
71	337	668006	3637992	White slipped brownware, bowl
75	341	667985	3637992	Unidentified Mimbres B/W, bowl
76	342	667990	3637996	Unidentified Mimbres B/W, bowl
78	344	667988	3637968	Unidentified Mimbres B/W, bowl
79	345	667988	3637968	Unidentified Mimbres B/W, bowl
Chipped Stone				
44	310	667976	3637875	Tularosa Corner-notched projectile point, white chert
46	312	667551	3637886	Tularosa Corner-notched projectile point, bornw chert
47	313	668051	3637963	Tularosa Corner-notched projectile point, obsidian
48	314	667898	3637821	Tularosa Corner-notched projectile point, chalcedony
49	315	668033	3637932	Tularosa Corner-notched projectile point, obsidian
74	340	667840	3638001	Biface fragment, obsidian
82	348	668040	3637983	Drill? Obsidian

93	359	668053	3637941	Projectile point base? obsidian
96	362	668067	3637928	Tularosa Corner-notched? projectile point base, obsidian
111	377	667994	3637913	Tularosa Corner-notched? projectile point base, obsidian
118	384	667979	3637915	Tularosa Corner-notched projectile point, white chert/chalc.
119	385	667944	3637925	Tip of pointed biface, obsidian
Ground Stone				
45	311	668044	3637969	Stone ballß
120	309			Metate with hole, 2 pieces

Obsidian
8 formal artifacts listed above
6 obsidian core/nodules
45 pieces of debitage

DotMon, AZ CC:4:62 (ASM)

Ceramic				
4	39	670823	3628517	Unidentified Mimbres B/W, bowl
Chipped Stone				
1	36	670811	3628623	Likely projectile point blade, opaque white chert
2	37	670819	3628581	Pointed ovoid biface, basalt
3	38	670825	3628585	Tip of large pointed biface, vitriphere?
5	40	670851	3628595	Biface blade, tip, probably projectile point, obsidian
6	41	670835	3628660	Projectile point-fragment, opaque cream-colored chert
7	42	670851	3628595	Projectile point blade, obsidian
8	43	670825	3628598	Biface, low quality white chert
9	44	670832	3628581	Tularosa Corner-notched projectile point, obsidian
Ground Stone				
25	35	670846	3628596	Ground stone pipe

Obsidian
1 formal artifact listed above
15 pieces of debitage

Table 8 (continued). Surface Collections in 2015

SC#	*Bag#*	*Coordinates*		*Description*
Duncan Donut, AZ CC:4:63 (ASM)				
Chipped Stone				
3	--			Tularosa Corner-notched? projectile point, obsidian
Obsidian				
1 formal artifact listed above				
7 pieces of debitage				
AZ CC:4:67, Apache Well, FS-02				
Chipped Stone				
1	--	668555	3637456	Tularosa Corner-notched projectile point, opaque white chert
Ground Stone				
2	--	668613	3637458	Stone pipe-fragment
AZ CC:4:68, FS-03				
Chipped Stone				
1	--	668515	3637653	Dolores Expanding-stem projectile point, obsidian
17	--	668533	3637580	Untyped corner-notched dart point, light gray rhyolite
Obsidian				
1 formal artifact listed above				
1 obsidian core/nodules				
14 pieces of debitage				
AZ CC:4:69, FS-04				
Chipped Stone				
1	--	668643	3637718	San Pedro projectile point, white translucent chert
2	--	668636	3637802	Untyped dart or arrow point, obsidian
3	--	668636	3637802	Biface, obsidian
5	--	668619	3637751	Untyped arrow point, obsidian
6	--	668618	3637755	Dart point midsection, obsidian
12	--	668617	3637803	Small, expedient arrow point, obsidian
17	--	668620	3637760	Biface fragment? obsidian
31	--	668635	3637765	Projectile point tip
Other				
4	--	668629	3637853	Crustacean claw?
Obsidian				
7 formal artifacts listed above				
1 obsidian core/nodule				
24 pieces of debitage				

Table 8 (continued). Surface Collections in 2015

AZ CC:4:71, FS-06

Chipped Stone

1	--	0668593	3637913	Large, thick biface, opaque white chert
2	--	0668589	3637923	Expedient dart point, opaque dirty white chert

AZ CC:4:73, FS-08

Ceramic

3	--	668738	3636678	Ceramic
6	--	668738	3636661	Ceramic
11	--	668708	3636658	Ceramic

Chipped Stone

8	--	668751	3636655	Flake retouched to form pointed tip, obsidian
12	--	668715	3636676	Flake retouched to form pointed tip, obsidian

Obsidian

2 formal artifacts listed above
3 obsidian core/nodules
6 pieces of debitage

AZ CC:4:76, FS-11

Other

1	--	3636020	669334	Turquoise

Sanchez, AZ CC:2:452 (ASM)

Ceramic

6	--	636552	3638855	Ceramic
7	--	636552	3638855	Ceramic

Obsidian

5 pieces of debitage

Table 9. Artifacts Illustrated in Figure 8.

	Site	*SC#*	*Item*	*L*	*W*	*T*	*Stem*	
a.	Round Mountain	44	Projectile point	3.75*	2.11	.59	.97	Tularosa Corner-notched
b.	Round Mountain	46	Projectile point	3.5*	2.45	.53	1.06	Tularosa Corner-notched
c.	Round Mountain	47	Projectile point	2.5*	1.80	.47	.80	Tularosa Corner-notched
d.	Round Mountain	48	Projectile point	3.75*	2.75*	.48	.80*	Tularosa Corner-notched
e.	Round Mountain	49	Projectile point	2.25*	1.8*	.39	.84	Tularosa Corner-notched
f.	Round Mountain	74	Projectile point blade fragment.					
g.	Round Mountain	82	Drill	2.75*	1.25	.48	n.a.	Heavy rounding, crushing, hinge fractures.
h.	Round Mountain	93	Projectile point base?	--	--	.40	.98	
i.	Round Mountain	96	Projectile point base	--	--	.45	.92	Tularosa Corner-notched?
j.	Round Mountain	111	Projectile point	2.25*	1.75*	.44	.87	Tularosa Corner-notched?
k.	Round Mountain	118	Projectile point	3.0*	2.0*	.66	.94	Tularosa Corner-notched
l.	Round Mountain	119	Biface tip	--	--	.45*	--	
m.	DotMon	1	Biface tip	--	--	.42*	--	
n.	DotMon	2	Ovoid biface	3.11	2.79	.69	--	
o.	DotMon	3	Pointed biface tip	4.25+	2.5+	.50	--	
p.	DotMon	5	Pointed biface tip	3+	1.57*	.61	--	Several weak serrations on edges.
q.	DotMon	6	Projectile point	4.5*	--	.91	--	Heat treated.
r.	DotMon	7	Projectile point blade	--	--	.53	--	
s.	DotMon	8	Biface	4.75*	2.70	.79	--	
t.	DotMon	9	Projectile point	2.22	1.45	.43	.79	Tularosa Corner-notched
u.	Duncan Donut	3	Projectile point	2.5*	--	.38	--	Tularosa Corner-notched?
v.	Apache Well	1	Projectile point	2.5*	1.8*	.69	.76	Tularosa Corner-notched
w.	Apache Well	2	Pipe made of vesicular basalt. Diameter ca. 3.2 cm					

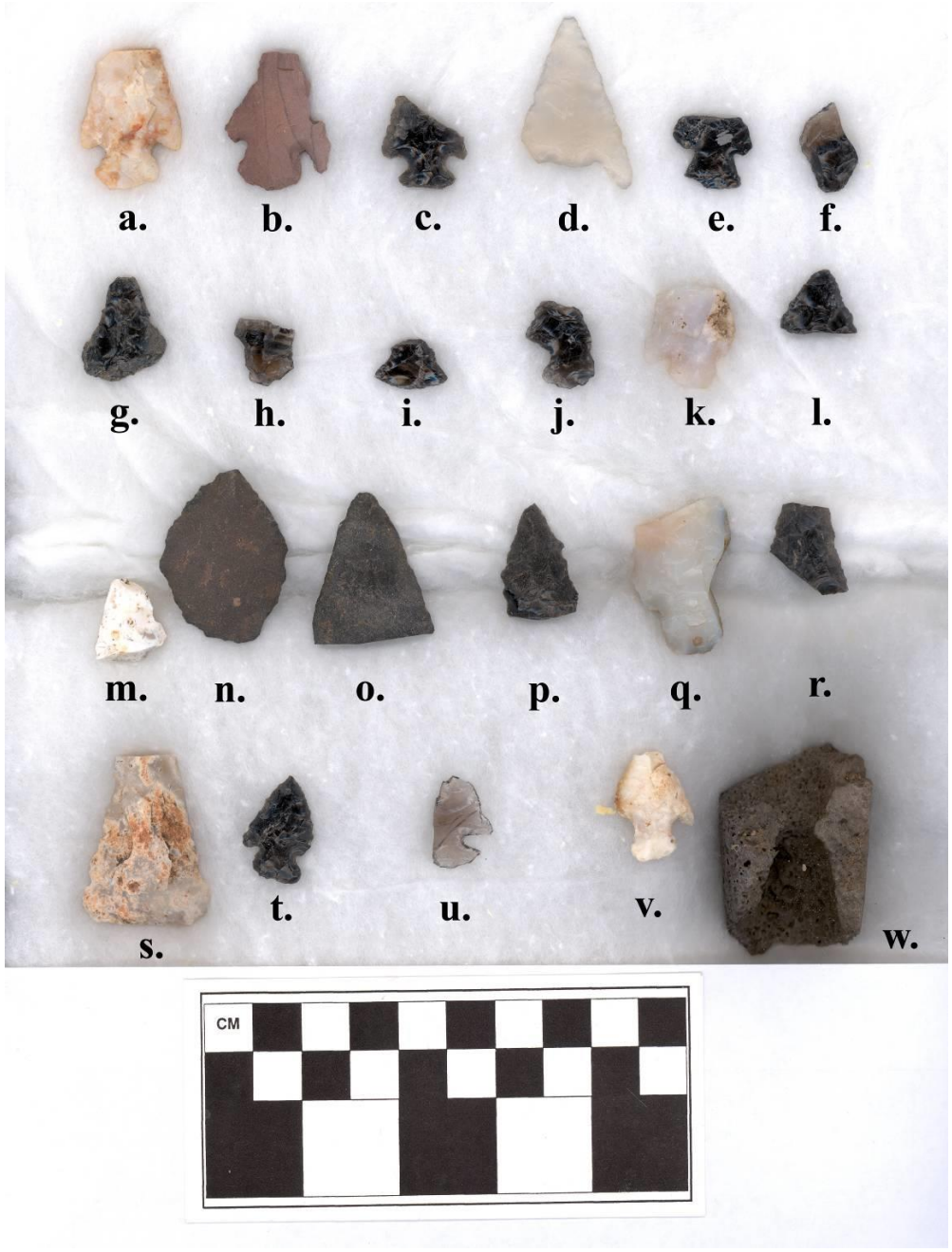


Figure 8. Formal Artifact (1 of 2)

Table 10. Artifacts Illustrated in Figure 9

	Site	*SC#*	*Item*	*L*	*W*	*T*	*Stem*	
a.	AZ CC:4:68 (ASM)	1	Projectile point	1.5*	1.7*	.34	.70	Dolores Expanding-stem arrow point
b.	AZ CC:4:68 (ASM)	17	Projectile point	2.90	1.84	.55	.88	Blade edges lightly serrated.
c.	AZ CC:4:69 (ASM)	1	Projectile point	3.25*	2.25	.73	1.48	San Pedro dart point
d.	AZ CC:4:69 (ASM)	2	Projectile point	2.65	1.32	.45	.72*	
e.	AZ CC:4:69 (ASM)	3	Unnotched biface	2.5*	1.71	.52	--	
f.	AZ CC:4:69 (ASM)	5	Untyped arrow point	1.56	.84	.28	.46	
g.	AZ CC:4:69 (ASM)	6	Dart point blade	3+	2+	.52	--	
h.	AZ CC:4:69 (ASM)	12	Arrow point	2.08	1.0	.25	.61	
i.	AZ CC:4:69 (ASM)	17	Possible biface fragment					
j.	AZ CC:4:69 (ASM)	31	Projectile point tip, possibly from arrow point					
k.	AZ CC:4:71 (ASM)	1	Biface	4.74	2.89	1.56	--	
l.	AZ CC:4:71 (ASM)	2	Projectile point	3.06	2.13	.35	1.27	Dart point. Expediently retouched flake.
m.	AZ CC:4:73 (ASM)	8	Retouched flake, perhaps a graver or perforator.					
n.	AZ CC:4:73 (ASM)	12	Retouched flake, perhaps a graver or perforator.					
o.	AZ CC:4:76 (ASM)	1	Piece of raw turquoise.					

* = estimated measurement
+ = minimum estimated measurement



Figure 9. Formal Artifacts (2 of 2)

Summary

Archaeological survey in 2015 focused on lands near a constriction in the Gila River floodplain, an area predicted to be favorable for prehistoric agriculture. Survey results begin to outline the occupational history of this section of the Duncan Valley. The survey also revealed a surprising variety of site and feature types.

Cerros de Trincheras. Most impressive are the three cerros de trincheras. Round Mountain (AZ CC:4:61 (ASM)), the largest of these, has been dated chronometrically to around 400 BC. The DotMon Site (AZ CC:4:62 (ASM)), located about five miles to the south is smaller, but based on material culture may be at least roughly contemporaneous with Round Mountain. Just to the north of Round Mountain is the North Site (AZ CC:4:81 (ASM)), another large cerro de trincheras which appears to have been built and used during Early Ceramic times.

Rock Ring/Isolated Terraces in Non-Hilltop Settings. Three much smaller aceramic sites include features reminiscent of those found on the cerros de trincheras, but are located on non-hilltop settings near the floodplain. AZ CC:4:68 (ASM) includes a single rock ring built into talus a meter or so above an alluvial terrace. The rock ring closely resembles those found on Round Mountain, and is associated with a relatively dense scatter of lithic artifacts on the alluvial terrace. AZ CC:4:80 (ASM) consists of a rock ring associated with small constructed terrace and a scatter of lithic artifacts situated on a rocky hill slope. AZ CC:4:71 (ASM) includes a small terrace-like clearing and a circular rock feature located near the juncture of a talus slope and an alluvial river terrace. These three sites raise the possibility that distinctive classes of Archaic or Early Agricultural period features may exist in unusual settings.

Pithouses. Clusters of pithouses found during the survey are also especially interesting. All were built on ancient alluvial terraces 60 to 80 feet above the modern floodplain. The pithouses are represented by circular concentrations of lag gravels, sometimes surrounding shallow depressions. The lag gravels presumably reflect deflated mounds of backdirt from the pithouse excavation. Measured from the inner edge of the lag gravel concentrations, they are most often about six meters in diameter. One group of two such pithouses, the Duncan Donut Site (AZ CC:4:63 (ASM)) has now yielded an AMS date from a maize cupule of about 250 BC. Two other tight groupings of multiple pithouses appear to date to Early Ceramic times, AD 200 to 700, based on their ceramic assemblages. AZ CC:4:69 (ASM) consists of a dozen closely grouped pithouses, while AZ CC:4:73 (ASM) includes 12 pithouses covering the top of an isolated alluvial terrace remnant. The final pithouse site recorded in 2015 is Apache Well, AZ CC:4:67 (ASM). Here three or four pithouses were recognized, but this site also includes an extensive 13th century occupation (see below), making interpretation of the pithouse component problematic.

Large Late Prehistoric Pueblos. Late prehistoric times are represented by two large sites. The earliest of these is Apache Well (AZ CC:4:67 (ASM)), a grouping of six or seven separate roomblocks, associated with abundant pottery suggesting that it was occupied sometime between AD 1100 and 1300. Several of the roomblocks are arranged to define an informal plaza, enclosed on three sides, bounded on the fourth side by the terrace edge. Altogether we estimate that the complex includes about 50 rooms.

The second late prehistoric site is AZ CC:4: 75 (ASM) is a large, compact Salado pueblo which may also have included about 50 rooms. Although badly damaged by mechanical disturbance, several intact walls constructed of cobbles and adobe were visible. Given the fact that industrial-scale looting has targeted sites of this time period, the observation that some architecture remains intact is significant.

Rock Rings/Clearings. Several sites included circular areas where surface rock has been cleared away, with a few larger cobbles arranged informally around their circumference. Typically these clearings are about three meters in diameter. These are much less substantial than the rock rings described above, and some of them may not be cultural features at all. Instead, some may result from wildlife or livestock activities. The rock ring found on AZ CC:4:74 (ASM) has an opening on its eastern side, and does seem to be clearly cultural. It is associated with a substantial scatter of lithic artifacts (plus one sherd of Salado Polychrome). Several other examples are plausible as cultural features, but are less convincing, including those at AZ CC:4:76, AZ CC:4:77, and AZ CC:4:78.

"Field Houses". Two puzzling sites were initially thought to be field houses and were interpreted as one to two room masonry structures (AZ CC:4:78 and 79 (ASM)). A third site, AZ CC:4:77 (ASM) also includes a cobble feature which may be comparable. Field houses are usually interpreted as temporary habitation or storage structures associated with agricultural fields and occupied on a seasonal basis. However, all three of these sites are situated on rocky bedrock ridges where traditional agriculture would be all but impossible. Nor do economically important wild plants such as agave grow in the area today. This observation makes interpretation of these sites as traditional field houses problematic.

All three sites are associated with relatively dense scatters of cores and debitage reflecting acquisition of the local glassy basalt/andesite, but the sites all include a small amount of non-local chert as well. This implies that acquisition of lithic raw materials was not the only activity that took place on the sites. One of the sites was aceramic, the other two included a total of four sherds, including Mimbres Black-on-white and possible Tularosa Black-on-white. If the sherds are truly associated with the structures, they imply construction and occupation between ca. AD 1000 and 1200.

Other Sites. The remaining two sites not yet discussed in this summary are both relatively minor. AZ CC:4:70 (ASM) is a small scatter of 20 lithic artifacts located in a saddle on the western side of Round Mountain. AZ CC:4:72 is an historic campsite dating to the very early 1900s. It is within the Arizona Eastern Railroad right-of-way and could pertain to initial fencing of the right-of-way.

Culture Historical Summary

The Early Agricultural period is represented by two cerros de trincheras (Round Mountain and DotMon) and by at least one pithouse site (Duncan Donut). Several other sites can be attributed to the Archaic or Early Agricultural periods, based primarily on absence of pottery. These include a rock ring and lithic scatter site (AZ CC:4:68), two terrace and rock ring sites (AZ CC:4:71 and 80), and one site consisting of an ephemeral rock ring and lithic scatter

(AZ CC:4:74). One additional site includes pithouses that could date to either Early Agricultural times or to the Early Ceramic period (Apache Well, AZ CC:4:67).

Early Ceramic Period period remains include another major cerro de trincheras, the North Site, and two pithouse sites, each with about a dozen pithouses (AZ CC:69 and 73). We did not find any red-on-brown pottery, although sites yielding these wares do occur nearby (Barney Farms). In the Mimbres sequence, the Three Circle Phase is represented by a cluster of mostly decorated sherds found on the very summit of Round Mountain. Because utility sherds are drastically underrepresented in this assemblage, we assume that the artifacts reflect specialized use of the mountain top, perhaps as a shrine. Also, a single Mimbres Black-on-white sherd was found on AZ CC:4:79.

Apache Well (AZ CC:4:67) is a major post-Mimbres residential site with six or seven roomblocks, an informal plaza, and perhaps 50 rooms altogether. Decorated ceramics here suggest a date between AD 1150 and 1300. In addition a single sherd of possible Tularosa Black-on-white was found at AZ CC:4:78. The interval between the distinctive Mimbres and Salado occupations is poorly understood, and for this reason Apache Well is an especially important site.

This survey recorded one major Salado Pueblo, AZ CC:4:75, a site which is probably the same as the old Gila Pueblo L:4:4. It is a compact pueblo which may have originally included 50 rooms or so. The site has been heavily damaged by mechanical looting, but some intact cobble masonry and adobe walls remain.

No protohistoric remains were recognized during the survey. The only historic era site recorded was AZ CC:4:72, an apparent campsite occupied around AD 1900, perhaps in connection with fencing the railroad right-of-way.

Geomorphology

Geomorphologists Drs. Gary Huckleberry, Jon Sandor, and Fred Nials conducted geomorphological reconnaissance of the Gila River in the Duncan Valley from June 8 – 11, 2015. The reconnaissance included excavation of four backhoe trenches and descriptions of alluvial deposits and soils on Holocene Gila River terraces upstream from Round Mountain, on the Kaler and Tyler Ranches (Figure 10). We summarize and quote extensively from Huckleberry's letter report which is included here as Appendix A.

The Gila River channel constricts immediately north of the Kaler Ranch, forming a river reach boundary. Reach boundaries force subsurface flow closer to the surface and slow surface flow, creating a more dependable source of moisture and deep alluvial sediments that would have been ideal for ancient farmers. The resultant geomorphological work demonstrated that the buried alluvial deposits are intact and have not been destroyed by the massive land modification that characterize much of the Gila River floodplain in the area.

The investigation "also confirmed that the Gila River segment located between Sheldon and Apache Grove contains fine-grained alluvial deposits formed by overbank deposition. These deposits have potential for providing insight into late Holocene floodplain environments and indigenous water control" (Huckleberry, Appendix A).

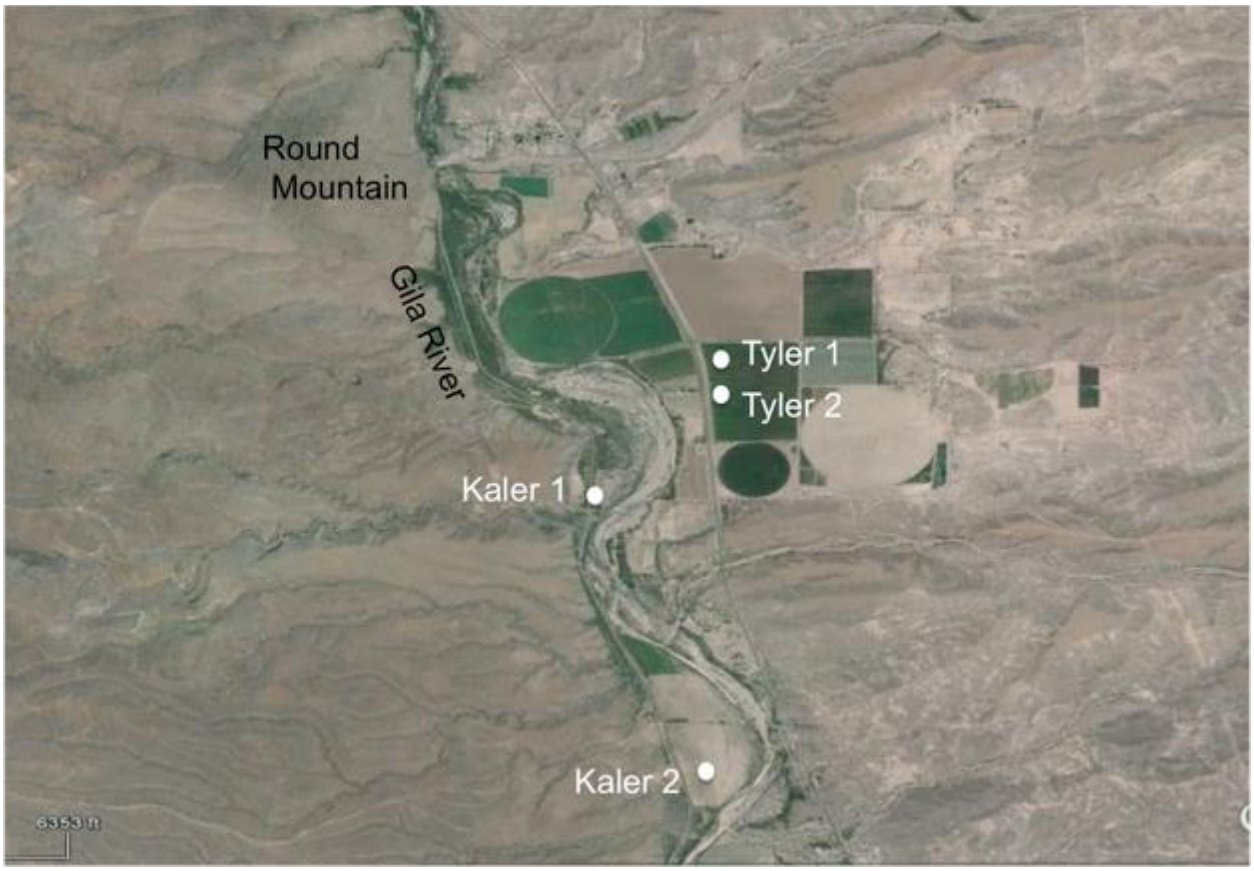


Figure 10. Trench Locations in Gila River Floodplain (Image courtesy of Google Earth), Huckleberry, Appendix A.

"Two backhoe trenches were excavated in the Gila River Holocene floodplain.." on the Kaler property. "Well-preserved alluvial bedding" in Trench 1 suggested minimal soil formation and implied "a relatively young (historic) age for the deposits. Trench Kaler 2 was placed on a higher terrace (probably t2) and exposed more than 2.8 meters of fine-grained, weakly bedded alluvium.. Slow rates of overbank deposition have resulted in an over-thickened, cumulic soil.. Based on soil formation and topographic position, I estimate the soils to date within the last 3000 years" (Huckleberry, Appendix A).

"Two additional backhoe trenches were excavated on the eastern edge of the Gila River Holocene floodplain… This area has been significantly modified by historic leveling... Trench Tyler 2 revealed mostly disturbed deposits… Trench Tyler 1 exposed fine-grained, horizontally bedded alluvium interpreted as overbank Gila River flood deposits. A burned layer (Unit 9) containing very fine charcoal was sampled for ^{14}C dating… These deposits likely also date within the **last** 3000 years" (Huckleberry, Appendix A). The radiocarbon date reported below confirms this assessment.

We submitted this sediment sample from the burned layer (Unit 9) in Tyler Trench 1, to Direct AMS Radiocarbon Dating Service. The deposit was approximately 1.6 meters below modern surface. Direct AMS (D-AMS 015753) extracted the fine charred plant fragments by first picking out the largest pieces and then by using a flotation procedure with a solution of

lithium metatungstate. The sample yielded a result of 1177±21 BP radiocarbon years. Using Oxcal 4.2 (Bronk Ramsey 2016), this age calibrates to AD 770 – 940 at 2 sigmas. Buried Early Agricultural features, if present, are likely to be several hundred meters away from the modern channel and at least 1.5 meters deep (Fred Nials, personal communication).

The results from Direct AMS are in Table 11. Direct AMS states that "All results have been corrected for isotopic fractionation with □13C values measured on the prepared graphite using the accelerator mass spectrometer. These □13C values provide the most accurate radiocarbon ages, but cannot be used to investigate environmental conditions, or for trophic and nutritional interpretations."

Table 11 Direct AMS radiocarbon date on charred plant fragments from geomorphic Tyler Trench 1, Unit 9.

DirectAMS	Sample ID	$\delta^{13}C$ ‰	Fraction of modern			
			pMC	1□□error	BP	1□□error
D-AMS 015753	TT-1	-12.2	86.4	0.23	1177	21

"These preliminary excavations and stratigraphic observations suggest that this reach of the Gila River upstream from the bedrock constriction at Round Mountain contains abundant, fine-grained, late Holocene (<3000 BP) overbank flood deposits. Such a depositional environment is conducive for burial and preservation of prehistoric surfaces.. and possible archaeological features such as canals. Soils developed into this fine-grained alluvium have high water-holding capacities and receive periodic deposition of organic detritus conducive for supporting long-term agriculture" (Huckleberry, Appendix A).

Source Provenance of Obsidian Artifacts

Geoarchaeological XRF Laboratory Director M. Steven Shackley examined 149 obsidian artifacts recovered from the surface of seven sites mapped or excavated during the 2015 Field School and his report is included as Appendix B. Shackley's analysis indicated "procurement of four of the regional obsidian sources from the Mogollon-Datil Volcanic Province in western New Mexico and eastern Arizona. The assemblage is dominated by obsidian from the Antelope Creek West locality at Mule Creek, New Mexico, followed by the North Sawmill Creek Group at Mule Creek (Table 12 and Figure 11). All of the four sources are present in San Francisco and Gila River Quaternary alluvium, but there are reasons to infer that at least some of the artifacts were produced from obsidian procured from primary sources to the north and east of the study area." (Shackley, Appendix B). "The presence of angular cortex on bipolar cores and debitage, and the frequency of North Sawmill Creek obsidian in the assemblage, a source rare in river alluvial contexts, suggests that at least some of the artifacts were produced from obsidian procured from the Mule Creek and Cow Canyon primary sources" (Shackley Appendix B) rather than secondary deposits from riverine alluvium.

Shackley (Appendix B) notes it is typical "to see local procurement of secondary deposit obsidian from the San Francisco and Gila River alluvium contexts in sites in this area. However, the presence of angular cortex on bipolar cores and debitage, and the frequency of North Sawmill Creek obsidian in the assemblage, a source rare in river alluvial contexts, suggests that at least some of the artifacts were produced from obsidian procured from Mule Creek and Cow Canyon primary sources.." The primary source of Cow Canyon nodules which funnel into the Cow Canyon Creek/Turkey Creek system is located in the Apache National Forest, central Greenlee County, Arizona—a relatively small, primary source along and east of Arizona Highway 191. Shackley suggests "the source provenance study indicates both a regional procurement pattern and the frequent use of the uplands both north and east of research area sites."

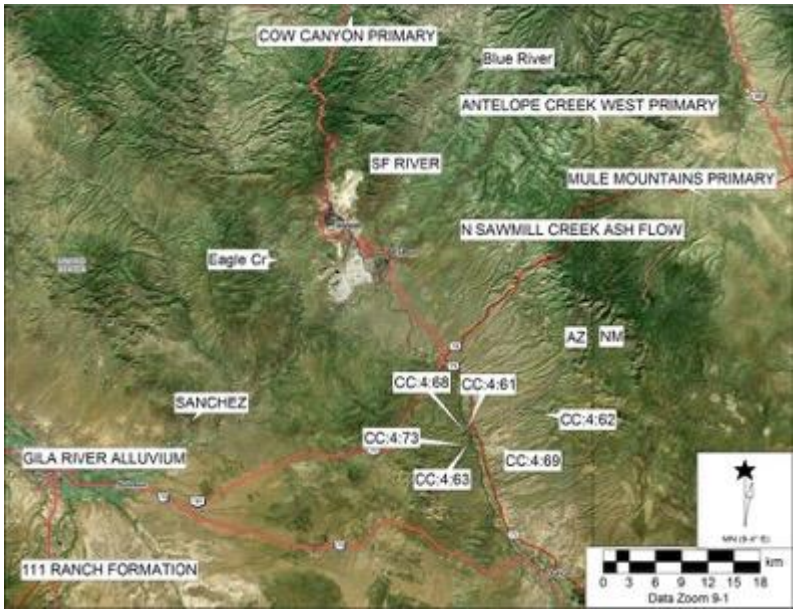


Figure 11. Source Provenance of 2015 UTSA Archaeological Field School Obsidian Artifacts (Shackley Appendix B)

Table 12. Cross-tabulation of Obsidian Source by Archaeological Site (Shackley, Appendix B)

			Source				
			Antelope Cr-Mule Creek	N Sawmill Cr-Mule Creek	Mule Mtns-Mule Creek	Cow Canyon/111 Ranch	Total
SITE	AZ CC:4:61	Count	37	12	1	8	58
		% within SITE	63.8%	20.7%	1.7%	13.8%	100.0%
		% within Source	40.2%	34.3%	25.0%	44.4%	38.9%
		% of Total	24.8%	8.1%	0.7%	5.4%	38.9%
	AZ CC:4:62	Count	10	9	0	0	19
		% within SITE	52.6%	47.4%	0.0%	0.0%	100.0%
		% within Source	10.9%	25.7%	0.0%	0.0%	12.8%
		% of Total	6.7%	6.0%	0.0%	0.0%	12.8%
	AZ CC:4:63	Count	5	2	0	1	8
		% within SITE	62.5%	25.0%	0.0%	12.5%	100.0%
		% within Source	5.4%	5.7%	0.0%	5.6%	5.4%
		% of Total	3.4%	1.3%	0.0%	0.7%	5.4%
	AZ CC:4:68	Count	9	5	0	2	16
		% within SITE	56.3%	31.3%	0.0%	12.5%	100.0%
		% within Source	9.8%	14.3%	0.0%	11.1%	10.7%
		% of Total	6.0%	3.4%	0.0%	1.3%	10.7%
	AZ CC:4:69	Count	23	4	1	4	32
		% within SITE	71.9%	12.5%	3.1%	12.5%	100.0%
		% within Source	25.0%	11.4%	25.0%	22.2%	21.5%
		% of Total	15.4%	2.7%	0.7%	2.7%	21.5%
	AZ CC:4:73	Count	7	2	2	0	11
		% within SITE	63.6%	18.2%	18.2%	0.0%	100.0%
		% within Source	7.6%	5.7%	50.0%	0.0%	7.4%
		% of Total	4.7%	1.3%	1.3%	0.0%	7.4%
	SANCHEZ	Count	1	1	0	3	5
		% within SITE	20.0%	20.0%	0.0%	60.0%	100.0%
		% within Source	1.1%	2.9%	0.0%	16.7%	3.4%
		% of Total	0.7%	0.7%	0.0%	2.0%	3.4%
Total		Count	92	35	4	18	149
		% within SITE	61.7%	23.5%	2.7%	12.1%	100.0%
		% within Source	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	61.7%	23.5%	2.7%	12.1%	100.0%

AZ CC:4:61 (ASM), Round Mountain Site Excavation

Our primary excavation focus in 2015 was to investigate several houses at the summit of Round Mountain, as we hoped to recover further macrobotanical and radiocarbon samples to help us understand whether the chronology of the site, architectural detailsm and subsistence evidence. We set up excavation units in three structures. One of our key questions in this process was the location of occupational surfaces within the structures. The 2014 excavation of Test Unit 1, also in a structure, showed the interface of terrace fill and overburden to be the best candidate for an occupational surface. We excavated multiple units in two structures, designated Feature E (northeast and southeast quadrants), Feature F, as well as Test Units 4 and 5. We conducted surface documentation of the rock ring structures using photography, mapping, and taking systematic measurements on 16 of the 17 structures, designated as Features A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, and Test Trench 1. Data from all structures is in Appendix C. Eight of the rock rings were also documented with a large number of overlapping digital images so they could be rendered into 3D images using Agisoft Photoscan software.

Field Methods

All units were excavated by hand using trowels, with all sediment passed through a 1/8 inch mesh screen and all artifacts were retained. Soil textures and colors were described using the USDA Soils Texture and Color Chart and the Munsell Soil Color Chart. Sediment samples were taken from each level, starting with the second level in each unit for flotation purposes.

Feature E Northeast Quadrant

Feature E is a rock ring structure located on a small terraced area on the eastern flank of Round Mountain. Its walls are 5.5 meter in length by 5.45 meters in width (outside measurements). The structure is oval in shape, with a one-meter opening in the northeast quadrant. Surface artifacts found at or near the feature included an expedient tool, flakes, a vesicular basalt metate in the northwest wall, and a metate fragment outside the eastern wall. The heaviest concentrations of flakes were found within the feature. The western wall is composed of cobbles sitting on a bedrock outcrop, creating a relatively high western wall.

We first excavated the northeast, then the southeast, quadrant of the feature. Each quadrant initially had its own vertical datum. The northeast quadrant vertical datum is a metal stake with the string tied 40 cm above the modern surface while the southeast vertical datum is 35 cm above the modern surface. The absolute elevations of the two datums are equivalent (see Figure 12, Figure E Profile Map). Vertical control was measured using line levels on string tied to these two datum stakes measured as below datum (bd) and/or with negative numbers. The levels in both units are equivalent in terms of real space.

Table 13. Feature E Northeast and Southeast Provenience Levels

Northeast Quadrant Surface	Datum	Depth	Southeast Quadrant Surface	Datum	Depth
L-1	E1*	-29 to -40	L-1	E2**	-31 to -51
L-2	E1	-40 to -50	L-2	E2	-40 to -50
L-3	E1	-50 to -60	L-3	E1	50 to 60
L-4	E1	-60 to -70	L-4	E1	60 to 70

* E1 datum height 40 cm above modern surface
** E2 datum height 35 cm above modern surface

We first took a series of pre-excavation photos of the Feature E northeast quadrant, (Feature E/NE) and then drew a profile and plan drawing. We set out strings to define the excavation quadrants. We used the string down the long axis of the feature as a baseline. The unit was set up as a wedge shape within the rock ring feature, and initially had a maximum length of 144 cm and a maximum width of 107 cm. However, while excavating Level 2, we expanded the unit by 20 cm to the north in order to try to locate the feature's edge (see Level 2 discussion below).

*Stratigraphy***.**

Level 1 (surface to 40 cm below datum). In general, this level consisted of a thin drape of post-occupation colluvium; its color is 10YR 4/3 dry. The sediment was largely compact silty overburden with unsorted rock derived from bedrock. By volume, the level was approximately 20 percent rock. Within 2-4 cm from the surface, the soil began to look less like modern overburden and more like fill. The loose overburden disappeared at 39 – 40 cm below datum (cmbd) and was followed by cultural deposits. There were signs of ant colony and rodent disturbances.

Almost all lithics found in Level 1 were found either on the surface or within 0 – 3 cm of the surface. Cultural deposits included a metate found at the top right on the northern end of the unit and several obsidian flakes. The metate sat generally horizontally, dipping north-northwest at about 10 degrees. An expedient tool was found on the surface. Additional flaked stones, including debitage, were found on the surface and through the screening process.

Level 2 (40 to 50 cmbd). Trying to locate an edge to the feature, we expanded the unit by approximately 20 cm to the north. A line of rocks emerged that may be the feature edge along the north side of the unit. The line of rocks did not extend into the northwest corner of the unit. In the northwest corner, many small, flat rocks were packed into a space approximately 15 by 15 cm. The rocks were generally 5 to 10 cm across and less than 4 cm thick. The fill through most of the unit is dark, clearly contrasting with hillslope alluvium.

This level consisted of compact upper terrace cultural fill; however, we were unsure whether it reflected post-abandonment processes or reflected an occupational surface. Level 2 included the top of the fill, which is roughly horizontal around -48 to -52 cmbd. The fill was

compact and silty; its color is 10YR 4/2 dry. It faded to alluvium in the northernmost 10 cm of the unit. No carbonates were observed at this level. We continued to see signs of ant and rodent disturbance.

A second broken metate (Bag 269) appeared in the bottom of level 2, resting horizontally across the two open quadrants.

We noted the steady presence of flaked stone throughout Level 2. Artifacts included a mano fragment, a white stone point found at the southwest corner of the unit, a bone fragment, and a mineral sample that may be pigment. We also took two modern plant samples for Dr Karen Adams, the field school's ethnobotanist. Additional flaked stones were found while cleaning up the west wall, from levels 1 through 3.

Level 3 (50 to 60 cmbd). Level 3 consisted of silty, compact, pebbly sediment. At -54 cmbd, in the south section of the unit, and at 52 cmbd in the north section of the unit, we hit rocks or bedrock. Sediment color was 10 YR 3/2 dry. No carbonates were observed. We continued to observe rodent and insect holes in the southern end of the unit.

While we continued to see cultural material, there appeared to be fewer artifacts than in the preceding level. We removed the broken metate originally noted in Level 1 (Bag 224). Cultural material recovered included one obsidian projectile point and a possible core or retouched flake, both found in the southwest corner of the unit; and an edge-modified tool and bone fragment obtained during the screening process. Three flotation samples were taken; one from under the metate lifted out from level 2, and one each from the southern and northwest sides of the unit.

Level 4 (60 to 70 cmbd). Level four was focused on excavation in the southwest corner of unit, as we hit bedrock at approximately -60 cmbd elsewhere. This was the soil located directly under the metate removed in Level 2. Level 4 appeared to be eroded bedrock, and was located on top of bedrock. The sediment color was 10 YR 3/2 dry, and appeared to be darker under the metate. We also removed wall fall from the northeast side that included material from -30 to -60 cmbd. Bedrock was hit at approximately -70 cmbd. This level appeared to have experienced only low levels of ant and rodent activity. Only one float sample was taken from this small corner. One flaked stone each was recovered from Level 4 and from the wall fall.

Feature E Southeast Quadrant, Round Mountain

We began excavating the southeast quadrant of Feature E simultaneously with our excavation of Level 2 of the northeast quadrant. The unit had a maximum length of 163 cm (north-south, and a maximum width of 89 cm (east-west).

Stratigraphy.

Level 1 (31 to 43 cmbd). In excavating Level 1, we removed the overburden, exposing the top of the cultural fill, replicating the approach used in the northeast quadrant work. The soil was silty and compact; its color was 10YR 4/3 dry. Approximately 10 percent of the sediment

was small rocks by volume. No carbonates were noted. Portions of the top of the feature fill were removed.

Cultural material in Level 1 included a projectile point fragment of off-white chert found in the overburden in the northeast edge of the unit, and a fragment of calcined bone and flaked stone found during screening.

Level 2 (40 to 50 cmbd). Level 2 was composed of feature fill, with no apparent stratigraphic, color, or texture changes. By volume, Level 2 was composed of approximately 40 percent rocks. We believe the rocks were largely deposited as fill and do not constitute wall fall. Level 2 appears to be below the occupational surface. Signs of rodent and insect disturbance were noted.

We continued excavation despite the rockiness, hoping to better understand wall construction. The wall appeared to include as many as three courses, and no less than two, plus the slope wall. Our intent was to extend the profile, in order to more precisely identify the feature occupational surface.

This level included a sizable number of artifacts, including several flaked stones, a ground stone pebble, a cobble chopper, a projectile point tip, a retouched flake, possible charcoal, and a bone fragment. Additional flaked stones were found in the west wall cleanup (levels 1 through 3). Four flotation samples were taken.

Level 3 (50 to 60 cmbd). The sediments in Level 3 were soft and silty, with no carbonates observed. Small rodent and insect disturbance continued to be noted. Level 3 includes many rocks, varying in size and shape but largely 20 cm or less in diameter. The rocks are spread out across bedrock and seem to form a discontinuous rock layer distinct from the underlying bedrock. In the south part of the unit, the level bottomed out at bedrock.

The east feature wall began to be more visible from inside the structure during Level 3 excavation. The most visible, and largest, stones are approximately 35 to 40 cm in diameter, and are securely supported and balanced by rocks only 15 to 20 cm in diameter. Rock placements appeared to be intentional and careful; in fact, many of the rocks were difficult to move because they had been so carefully set in place.

We also expanded the unit south by several centimeters into rocks that appeared to define the south wall. The rocks along this southern edge were not large as compared to those on the east side of the feature, with one exception, but formed an arc and appeared to be carefully fit together. There appeared to be a rapid horizontal transition from dark sub-transition fill to browner sediment in the rocks.

We removed a metate fragment (Bag 269) and an adjoining groundstone fragment (Bag 272) that appeared to be part of the same metate, both located in the northwest corner of the unit and the southwest corner of the northeast quadrant. There was substantial fill beneath the fragments that continued down at least one level. One flotation sample was taken from underneath each metate piece, while two more were taken from the south and north halves of the

unit respectively. Flakes were still present, but appeared to be smaller than those from Level 2. Possible charcoal fragments from the south side of the unit and a piece of bone were discovered in screening. The charcoal would have been located close to bedrock. One biface tool fragment was discovered in screening. A possible stone hoe (Bag 282) was found in the south edge of the feature wall. A small mano (Bag 275) was discovered under a large boulder in the northeast corner, lying on very dark fill over bedrock.

Level 4 (60 to 70 cmbd). Level 4 was confined to the northwest corner of the quadrant, as the rest of the unit was largely exposed bedrock. The sediment was silty and soft; its color was 10 YR 3/2 dry. No carbonates were visible. There appeared to be a light amount of rodent bioturbation (including one live mouse). The soil at this level appears to be darker than that of Level 3.

At the western edge of the unit next to the metate depression, five rocks appeared to be intentionally emplaced. The rocks were recorded (drawn), photographed, and removed before excavating down to bedrock. Five flotation samples were taken from the sediment under the rocks, in addition to one taken in the northwest corner of the unit. Flaked stones and one bone fragment were found in screening.

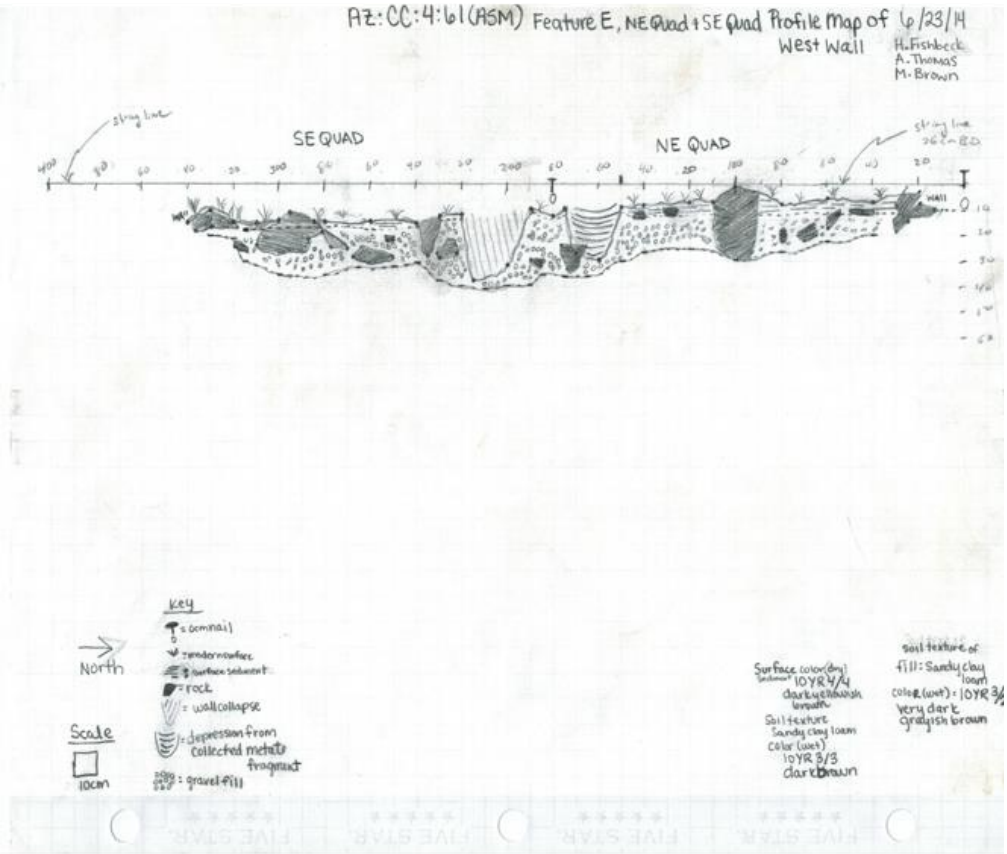


Figure 12. AZ CC:4:61 (ASM) Feature E Profile Map

Feature E radiocarbon results. A charred unknown fruit fragment recovered from flotation and identified by Karen Adams was recovered from the SE Quadrant, Level 4, 60-70 cm BD and was dated by Direct AMS (D-AMS 014969) to 2610±29 radiocarbon years. This calibrates to 770-825 B.C. (median 800 B.C.) at two standard errors, placing the features in the Early Cienega phase (see Table 20).

Feature F Unit 1, Round Mountain

Feature F is a 6.2 by 6.7 m (outer diameter) circular structure, with a one-meter opening in the southeast quarter and it lies west of Feature E. One metate was found in the southeast wall, while three manos were discovered in or near the wall. Feature F was constructed on a natural surface, unrelated to any other terrace or other wall. Its floor is elevated 70 cm above the natural grade on the downslope (southeast) side. Its walls consist largely of collapsed basalt cobbles, and are approximately 70 to 130 cm wide (Figure 13).

Unit 1 is 1 meter by 1 meter excavation unit, with the datum stake located outside the unit to the northwest. The unit was set up just north of a centerline bisecting the structure. Datum string height was set at 20 cm above the modern surface. Several ground stone artifacts were noted and recorded on the surface in or within the walls of Feature F. A 50 cm by 40 cm basalt metate with heavy grinding wear on both sides was found in the southeast corner of the feature. A complete 10 cm by 7 cm rhyolite mano was discovered in the northeast corner of Feature F. Two rhyolite mano fragments were also recorded, one at the southeast margin, and the other on the southwest out edge of the feature. A hammerstone 8 cm in diameter was found approximately two meters outside the southwest quadrant of the structure.

Stratigraphy.

Level 1 (36 to 50 cmbd). The unit surface was grassy, with a significant number of roots. Soils on the west side of the unit were ashy and slightly darker (10 YR 4/2) than those on the east side (10 YR 4/3). Those darker soils appeared at 46 cmbd. Sediments were compact and sandy, with low gravel levels. There were several tabular rocks in the unit that were quarter-sized or larger. Possible bioturbation from grass roots or ant colonies may have occurred. Flaked stones (5 – 10 pieces) were scattered in the feature fill.

Level 2 (50 to 60 cmbd). Darker soils were noted in the southeast corner of the unit at 53 cmbd, and in the northeast corner at 51 cmbd. Regolith, or weathered bedrock, were identified in the center of the unit but pieces of regolith were found throughout the level. Soils near regolith were much darker. Soil composition and colors changed significantly in Level 2, to a silty clay with a greasy appearance and feel. Its color was 10 YR 3/2. The presence of tabular rocks and gravel increased. No carbonates were noted. Bedrock emerged on the western side of the unit. Roots disturb the unit to some degree.

The number of flaked stones increased to between 21 to 50 pieces. Most were microflakes, and were found before reaching 55 cmbd. The darker soils noted above appear to be noncultural, and are instead likely associated with eroding bedrock. Two flotation samples were taken from Level 2, one from the east, and one from the west, side of the unit.

Level 3 (60 to 69 cmbd). This level was very rocky, with little soil. Many of the rocks were very soft, and consistently broke into tabular pieces. We hit bedrock at approximately 63 cmbd. Soils were compact and composed of silty clay, with high levels of gravel. The dark, greasy soils were still present near the eroding bedrock. As in Level 2, its color was 10 YR 3/2.

Carbonate nodules were present. We were unable to take flotation samples due to the lack of soil at this level.

The number of flaked stones decreased to 5 – 10 pieces.

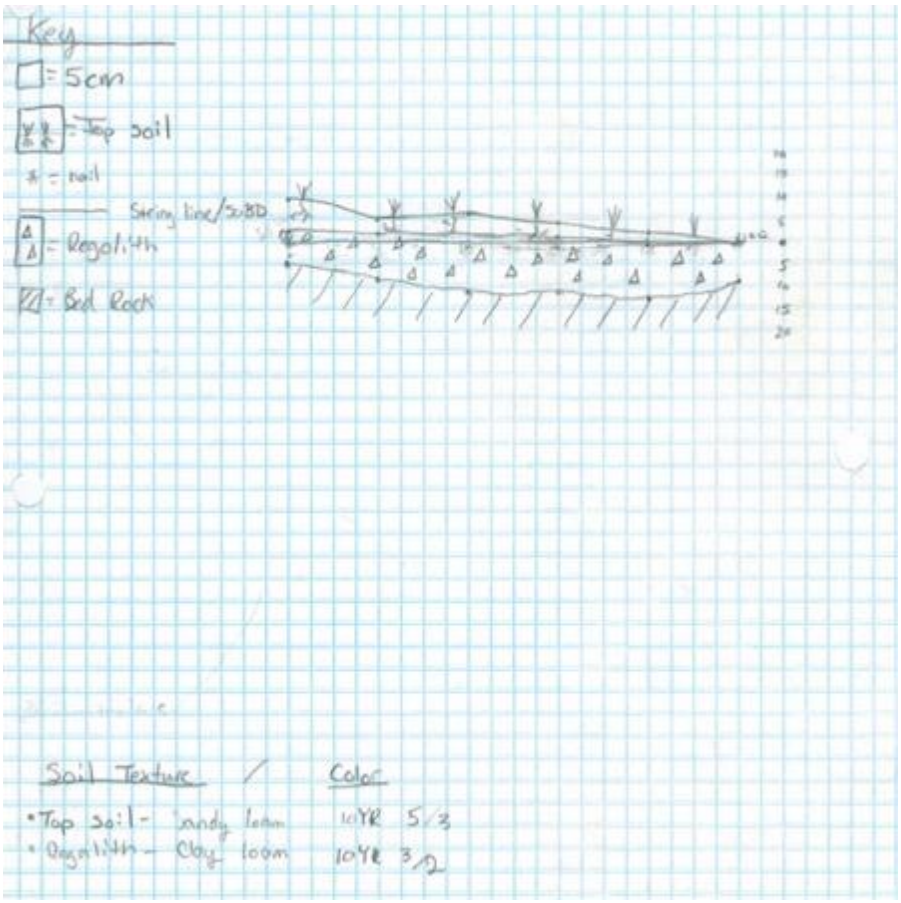


Figure 13. AZ CC:4:61 (ASM) Feature F Profile Map

Test Unit 4 and 5, Round Mountain

Test Unit 4

Test Unit 4, a one-meter by one-meter unit, located about 10 m east of Test Unit 1 that was excavated during the 2014 field season (Figure 14). Test Unit 4 was placed on the edge of a terrace with the hope of locating deep deposits with macrobotanical preservation as found in Test Unit 1. The datum stake of Test Unit 4 was located 12 cm north and 42 cm west of the southwest corner of the unit. The string height is set at 20 cm above the modern surface. Test Unit 5 is a 40 cm by 40 cm expansion of Test Unit 4 placed at its southwest corner to recover a possible buried metate that was in both Test Units 4 and 5. Test Unit 4 is presented first followed by Test Unit 5.

Stratigraphy.

Level 1 (33 to 40 cmbd). Level 1 consists of loose, sandy soil, with several large rocks lying at the bottom of the level. Soil is slightly darker in the southwest corner of the unit (10 YR 4/2) than in the southeast side (10 YR 4/3). No carbonates were noted. Potential sources of bioturbation included roots and onion growth.

A substantial number of flaked stones appeared (20 + pieces). A metate fragment was noted on the surface in the northeast corner of the unit. A mano fragment was also found. A piece of tooth enamel was also discovered on the surface of Level 1. One flotation sample was taken.

Level 2 (40 to 50 cmbd). Level 2's sediment was compact, dark silty clay on bedrock. Bedrock emerged at 42 cmbd at the western half of the unit. This dark (10 YR 3/2) soil had a greasy appearance and texture. The dark soil was likely associated with decaying roots and eroding bedrock. This level included a high proportion of rocks, including several large (20 cm by 25 cm) rocks. No carbonates were present. Bioturbation sources included roots, wild onion, and tubers.

Approximately 20 – 50 chipped stones were collected. Two flotation samples were taken, one at the southwest corner, and one on the east side of the unit.

Level 3 (50 to 60 cmbd). Level 3 consisted of mostly bedrock, protruding out of the west and southern half of the unit. Dark soil in this level appears to be associated with eroding bedrock. Sediments were compact silty clay; color was 10 YR 3/2. There was a high proportion of gravel and large rocks. Carbonate nodules were present. Bioturbation sources included roots, wild onion, and tubers.

We continued to find flaked stone (21 – 50 pieces). A mano fragment and piece of bone were also collected, as was a mineral sample. One core tool was discovered at the northern edge of the unit. Two flotation samples were extracted, one from the east side and one from the northeast side.

Level 4 (60 to 70 cmbd). Gravels and bedrock dominated Level 4, with soil rapidly disappearing. The remaining soil was similar to that found in Level 3, silty and greasy (10 YR 3/2). By the end of the level, bedrock was visible throughout the unit, except for the northeast corner. Carbonate nodules continued to be present, as were roots, wild onions, and tubers.

A greater variety of cultural material was found in Level 4, including a core, bone fragment, flaked stones, and a white chert arrow point. It is unknown whether the presence of the arrow point indicates a later occupation or if the point fell through the sediment into Level 4. One flotation sample was taken.

Level 5 (70 to 80 cmbd). Excavation of Level 5 was focused in the northeast corner of the unit; elsewhere, bedrock constrained further work. The little soil remaining was located on top of bedrock, and contained small flecks of carbonate material. The unit bottomed out at bedrock throughout. Roots and a possible rodent hole were possible sources of bioturbation.

Only a few (1 – 5 pieces) small flakes were found in this level. Due to the lack of soil, only one flotation sample was taken.

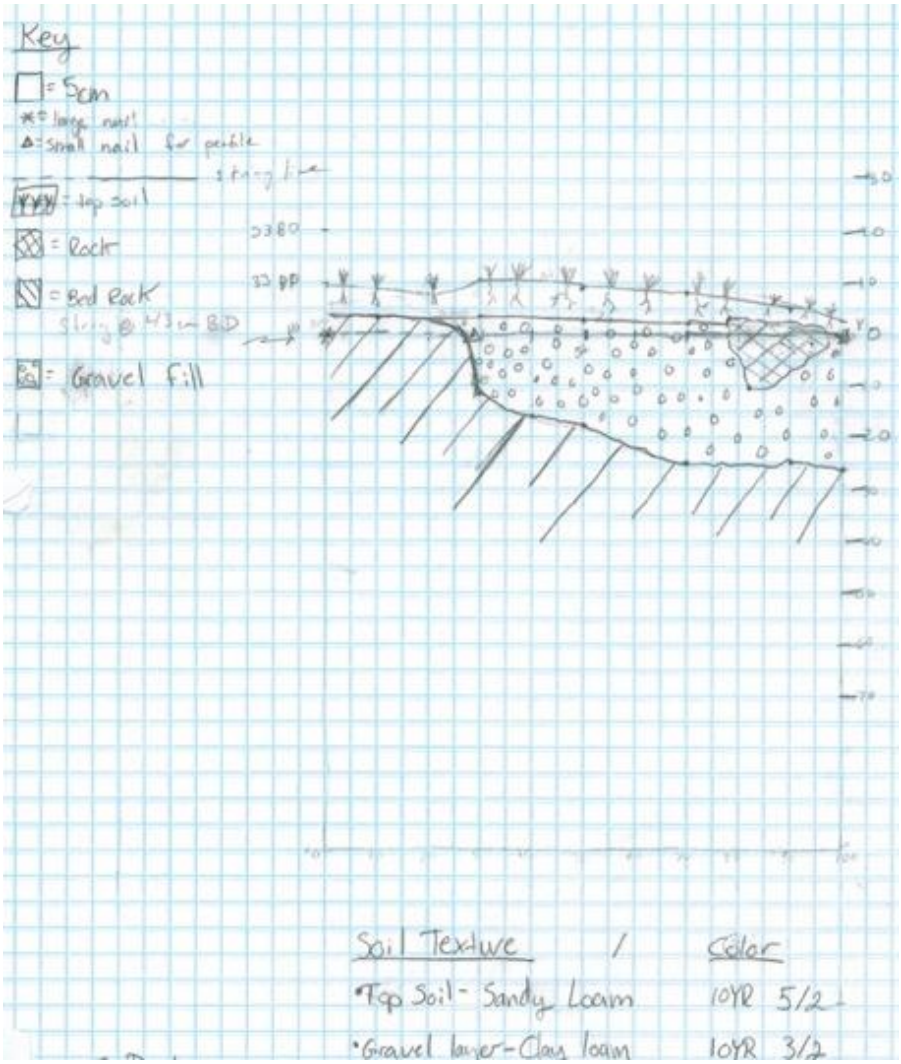


Figure 14. AZ CC:4:61 Test Unit 4 Profile Map

Test Unit 5

Test Unit 5 was a small 40 by 40 cm unit located adjacent to the southwest edge of Test Unit 4. The same datum string was used for Test Unit 5 as for Test Unit 4. Test Unit 5 was emplaced to remove a flat rock—possibly a ground stone (Bag 292)--from the southwest corner of Test Unit 4. As this rock is 37 cm in length, we limited test unit 5 to 40 by 40 cm. The possible groundstone's surface showed evidence of smoothing, with the center slightly raised.

Stratigraphy.

Level 1 (30 to 38 cmbd). Soils in this level were compact and sandy, with no evidence of carbonates. A few (5 – 10 pieces) of flaked stone were noted.

Level 2 (38 to 46 cmbd). We extracted a 39 by 28 cm ground stone at 38 – 46 cmbd. The ground stone's thickness is approximately 5 – 6 cm. An additional 11 – 20 pieces of chipped

stone were also found in this level. One mineral sample was removed. No further excavation was accomplished once the ground stone was removed.

Radiocarbon results. One piece of charred, unknown plant tissue from the flotation samples from Test Unit 4 was identified by Karen Adams as the best potential short-lived sample available from the unit for radiocarbon dating. It was from Level 5, 70-80 cm BD and was submitted to Direct AMS for radiocarbon dating. The sample (D-AMS 014970) yielded a date of 2480±26 radiocarbon years BP which calibrates to 490 - 775 BC at two standard errors with a median of 635 BC. The large error range is due to the reversals on this segment of the calibration curve.

AZ CC:4:62 (ASM), DOTMON Site Excavation

DotMon is an Early Agriculture period *cerro de trincheras* site smaller than Round Mountain. On BLM land, DotMon lies about 10 kilometers south of Round Mountain and is situated on the northern crest of a long ridge that rises 410 feet above the Gila River. An Arizona Department of Transportation survey monument is on the site and is the basis for the site name. The site's perimeter is defined by a combination of constructed walls of basalt cobbles and large rocks, and natural bedrock ledges, which enclose an area of approximately 0.53 ha., or 1.3 acres. Constructed walls at this site total about 250 meters in length, and the complex includes seven rock rings, at least six of which are likely habitation structures. These were labeled Features A-G. In a cursory look, there appeared to be approximately 400 flakes at the site, most of which were white chert. As many as a dozen mano fragments, one partially-buried slab metate, and a complete pestle were also noted. Based on pinflag probing, most of the cultural deposits seem to be on the north side of the site, as do the site's artifacts. We also discovered one possible pipe on the site's surface.

We were particularly interested in understanding DotMon's occupational history, and whether it was contemporaneous with Round Mountain. No ceramics were found at the site, indicating a likely EAP origin. A single test unit was excavated, emplaced in Rock Ring A.

The largest of the stone circles (Rock Ring B) is located near the center of the site, with an outer length and width of 6.4 and 7.05 meters, respectively, and an inner length and width of 4.55 and 4.2 meters, respectively. This feature is in better condition than the others with more smaller rocks forming the upper part of the wall. Surface artifacts found in Rock Ring B include a cylindrical tool, possibly a pipe, a mano fragment, and 15 white cert flakes. It shows signs of refurbishing, with fresh breaks observed on several rocks located on the top of the walls, suggesting they were emplaced within the past few decades. Larger stones, with a height of 50 cm, are embedded in the soil and are likely part of the original, ancient wall.

Rock Ring C is the most southerly of the rock rings, and is C-shaped, with an outer length and width of 3.1 and 3.65, respectively. Its inner length and width are 2.2 and 1.8 meters, respectively. It is approximately three-fourth complete, with an opening to the north. Surface artifacts found in the ring include an obsidian scatter, and 13 pieces of white chert flakes.

Rock Ring D is located on a natural bedrock terrace approximately ten meters east and below (outside) of the east wall of the site. This circular ring has an outer length and width of five and 4.8 meters, respectively, and an inner length and width of 2 and 3.3 meters, respectively. It has a small (70 cm) opening to the northeast. Surface artifacts found include two core fragments and 16 chert flakes.

Rock Ring E lies on the north-central side of Dotmon. It has a circular shape and is complete, with no opening. Its outer length and width are 5.3 and 4.4 meters, respectively; its inner length and width are 3.6 and 2.7 meters, respectively. It includes one vertical, upright stone on the west side of the wall fall. Surface artifacts include seven white chert flakes, and, three meters north of the circle, a bedrock mortar.

Rock Ring F lies approximately three meters west of Rock Ring E. It has a circular shape and is considered complete. It has no apparent associations with visible walls, terrace or bedrock. The circle includes one vertical, upright stone on the south side of the ring. The ring's outer length and width are five and 3.9 meters respectively; its inner length and width are 2.2 and 2.2 meters respectively. Surface artifacts include two chert flakes.

Rock Ring G is poorly defined, with a C shape. It lies in the northwest quadrant of the site. Its outer length and width are 3.9 and 4.8 meters, respectively; its inner length and width are 2.3 and 2.3 meters. Surface artifacts include one green, and three white, chert flakes.

Field Methods

We excavated a single one-meter by one-meter unit in Rock Ring A, which lies roughly in the center of the site's walled area. We selected this feature for excavation because it appeared to have 25 cm of deposits, based on probes. Our hope was to discover charred botanical and/or faunal remains. Rock ring A is constructed of large basalt cobbles and stones, with a small opening to the east; otherwise, the ring is complete (360 degrees). The ring has an outer length and width of 7.2 and 5.8 meters respectively; its inner length and width are 2.6 and 2.7 meters respectively. It conjoins with Rock Ring B to the south, sharing wall fall. The northern edge of the ring is demarcated by bedrock. String height is 15 cm above ground. The unit was excavated by hand using trowels, with all sediment passed through a 1/8 inch mesh screen. At a minimum, a one-liter flotation sample was taken at each level. Soil textures and colors were described using the USDA Soils Texture and Color Chart and the Munsell Soil Color Chart. Soil color was determined for each sediment type, both when wet and dry.

Stratigraphy.

Level 1 ((surface (14 to 20) to 20 cm bd)). Beginning elevations range from 14 cm to 20 cm below datum. Level 1 sediment is very loose and dry. Munsell charts indicated the soil was 10 YR 5/4 (yellowish brown) dry, and 10 YR 3/3 (dark brown) wet. The soil was silty loam, with small caliche gravels mixed with dry grass and basalt gravels. Carbonates included caliche nodules approximately one to two cm in diameter. The presence of burrows and caliche gravels indicate rodent activity. Cultural material included six pieces of flaked stone and shatter, including one obsidian tertiary flake, and a very small possible shell with some etching.

Level 2 (20 to 30 cm bd). Level 2 sediment was loose in the upper part of the level, but grew more compact toward the end of the level. The soil was silty loam with very dense caliche gravels and basalt cobbles in the upper right and lower central portion of the unit. The sediment color was yellow-brown, the same as level 1. Carbonate caliche gravels were present in the soil. Rodent burrows were present, some found under large rocks. Artifact levels were slightly higher (17) in level 2, and included an obsidian projectile point, two obsidian and chert tertiary flakes, and various obsidian, chert, quartz, and basalt flakes and shatter.

Level 3 (30 to 40 cm bd). Level 3 silty loam sediment included dense deposits of basalt and carbonate gravels. Bedrock was visible at variable depths throughout the unit, but

approximately 40 cm bd. Carbonates encrusted much of the bedrock. Munsell charts indicated the soil was 10 YR 4/3 (brown) dry, and 10 YR 3/3 (dark brown) wet. Relative hardness of the sediments ranged from loose to compact at this level. We removed a large rock from the northeast corner of the unit; the bottom of the rock was 32 to 38 cmbd. The rock appeared to be part of a post-occupation wall collapse. Rodent disturbances continued to be visible. There was no sign of a floor or living surface, but it was likely at this level, as it was the last to contain cultural material. Artifacts included a quartz core, three pressure-flaked obsidian artifacts, an additional obsidian flake, a chert flake, and four pieces of shatter.

Level 4 (40-45 cm bd). Level 4 silty loam sediment was similar in appearance to level 3 sediment, but included decaying tabular carbonate and basalt on bedrock. This level consisted of removing only a few centimeters (one to three) of sediment from the unit's surface and crevices of undulating bedrock. The bedrock's depth varied from 31 to 45 cmbd. Soils grew more dry, compact and increasingly hard at this level, with a high density of gravel. The soil's color was similar to level 3's (10YR 4/3). New rodent activity was visible. No cultural material was discovered in level 4. This was the last level of excavation.

Radiocarbon results. We submitted a piece of charred *Quercus* sp (oak) wood from Level 4, 40-467 cm bd for AMS radiocarbon dating and Direct AMS determined it was modern (D-AMS 014971). This was likely a product of recent fire activity that was introduced into Level 4 by bioturbation.

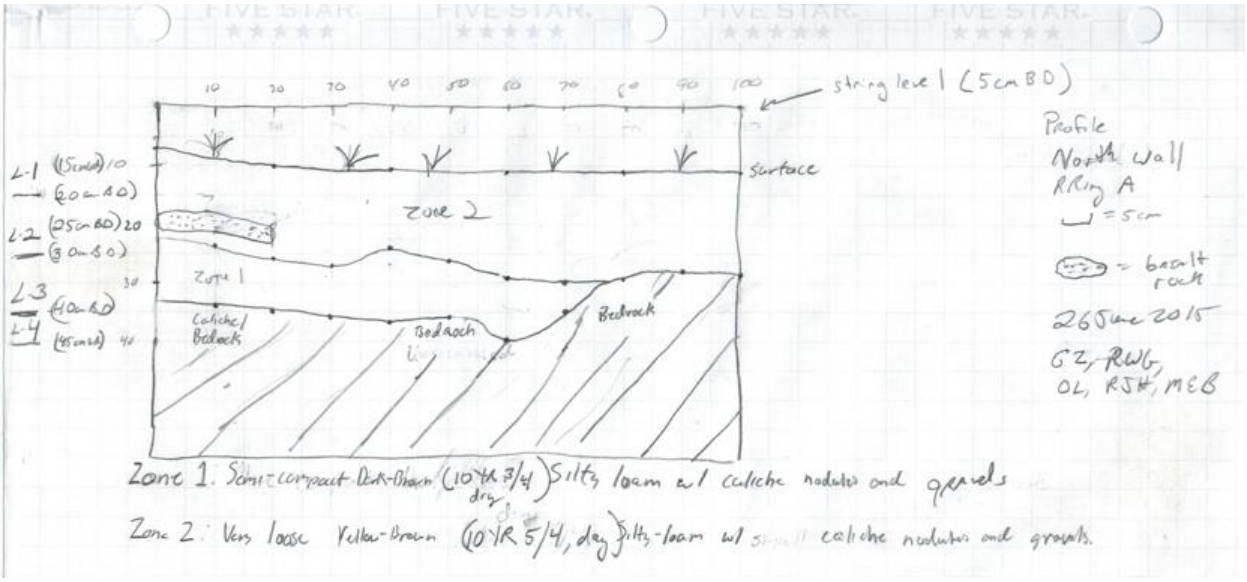


Figure 15. AZ CC:4:62 (AMS) DotMon Rock Ring A Profile Map

AZ CC:4:63 (ASM), Duncan Donut Site Excavation

This small (30 meters in diameter) site is located on a Pleistocene terrace overlooking the Gila River. The site is in excellent condition, with a substantial record of artifacts, including charred bone and plant material. At least two pithouse depressions are present.

Surface examination and test excavations indicate this is an Early Agricultural period occupation, given the types of artifacts present. Two AMS dates of charred *Zea mays* cupules found in the site's ashy midden yielded yielded statistically identical results placing the site in the Late Cienega phase (400 B.C.-A.D. 50). The presence of maize demonstrates that early inhabitants of the Duncan Valley invested in the labor necessary to maintain fields and tend crops.

Field Methods

The stratigraphy, depth of cultural deposits, and integrity of the site were explored through the excavation of two units along the southern edge of the site. The southern edge is demarcated by a cut bank. The maximum height of the site along this slope is 1 meter, and the slope extends south for a total length of 2.4 meters. This area was chosen for excavation in order to minimize site disturbance.

In order to choose a location for the units, an area approximately 1.5 meters wide (running northeast to southwest) and 4 meters long (running southeast to northwest) was lightly swept to remove aeolian sediments. The removal of this thin layer of sediment revealed the presence of ashy grey soil. The location of the initial unit (Unit 1) was chosen to profile the road cut bank which revealed an ashy midden and high artifact density.

Unit 1 is located at the highest point of the bank and is laid out to be perpendicular to the road cut. Level 1 represents a 50 centimeter by 50 centimeter unit and was excavated at a natural level. All depths were recorded as centimeters below datum (cm bd), and the datum was set at 10 centimeters above the surface. All measurements were determined using a string, line level, and measuring tape. Each subsequent level in Unit 1 pushed the unit further south, down the cut bank, extending the initial length of the unit from 50 centimeters to 120 centimeters. At this point, the unit was subdivided into two units, Unit 1 North and Unit 1 South. Unit 1 South, level 7 was excavated first, creating a stepped trench into the slope. Second, level 7 was excavated in Unit 1 North. The maximum length of the entire unit at the end of level 7 was 140 centimeters (N-S) by 50 cm (E-W). Unit 2 represents a southward extension of Unit 1. Unit 2 is 100 cm (N-S) by 50 cm (E-W) and is designed to excavate the remaining slope of the cut bank using arbitrary levels. This area of the cut-bank represents a change in slope and possible disturbed soils. Both Unit 1 and Unit 2 were excavated until gravelly, riverine sands emerged. The maximum depth for Unit 1 is 90 cm bd, while Unit 2 was excavated to 100 cm bd. The resulting two units combined revealed a 240 cm long profile of the cutbank (Figure 16).

The units were excavated by hand using trowels and brushes. All sediment was passed through 1/8th inch mesh. All lithics, ground stone, carbonized plant material, bone, and daub were recorded and collected for further study. Fire-cracked rock was analyzed in the field. In

addition, at minimum, a one-liter flotation sample was taken per level. Flotation samples were separated into light and heavy fraction samples for further analysis in the lab. Soil textures and colors were described using the USDA Soils Texture and Color Chart and the Munsell Soil Color Chart. Soil color was determined for each sediment type both when wet and dry.

Unit 1

Unit 1 is located on a relatively flat area at the top of the cut-bank. As the unit increased in depth, and moved along the slope, the southern edge of the unit was extended to the south. The initial measurement of the unit, at level 1, was 50 centimeters by 50 centimeters. By level 9, the unit was 50 centimeters by 140 centimeters. The area was first lightly swept in order to remove windblown soils and artifacts, and to reveal the underlying sediments. Creosote bushes and rodent burrows were located nearby the unit. A few flakes were located in the surrounding area, but otherwise, there were relatively few artifacts on the surface in this particular section of the site.

Stratigraphy.

Level 1 (7 cm to 14 cmbd). Due to the slope of the cut bank, Level 1 was excavated as a natural level. The 50 centimeter by 50 centimeter unit was oriented to profile the cut bank. The soil is loam, and is predominately yellowish brown (see *Site Stratigraphy* for more information). Water-worn gravels were identified in the screen. Only two flakes were recovered from this initial level.

Level 2 (14 to 20 cmbd). Dimensions: 50 centimeters by 60 centimeters. This arbitrarily excavated level transitioned from yellowish-brown soils into ashy grey deposits. The gravels in this level ranged from pea sized to 3 centimeters in size. Two flotation samples were taken from this level: one from the transitional zone along the center and eastern edge of the unit, and the second from near the bottom of the level in an area dominated by darker, grey sediments. Despite the increase in gravel density and the soil color change, only six flakes and one piece of shatter were recovered from this level.

Level 3 (20 to 30 cm bd). Dimensions: 50 centimeters x 70 centimeters. At 20 centimeters, the soil transitioned to a darker grey color and became much looser, perhaps due to the higher density of gravels in this level. The larger pebbles recovered from this level ranged in size from 1 centimeter to 7 centimeters. The pebbles were lightly coated on their bottom surfaces with carbonate. Along with the transition to darker soils, the number of artifacts recovered from the unit increased. Bone, daub, and debitage were collected from this level. Debitage materials included quartz, chert, and basalt. Six pieces of fire-cracked rock were analyzed in the field.

Level 4 (30 to 40 cmbd). Dimensions: 50 centimeters x 80 centimeters. The sediments continued to be soft and ashy grey in color. Starting in this level, fire-cracked rock resting on gravels emerged from the north wall. This intrusion into the unit had a length of 20 centimeters (north to south) and a width of 40 centimeters (east to west). The natural basalt pebbles and cobbles underlying the fire-cracked rock ranged from 4 centimeters to 11 centimeters in diameter. Both the fire-cracked rock and the cobbles had a light coating of carbonate on their surfaces. Bone, including a deer mandible, was found in proximity to the fire-cracked rock. One

small piece of daub was recovered from the screen. Obsidian, basalt, rhyolite, and chert debitage was collected from the unit.

Level 5 (40 to 50 cmbd). Dimensions: 50 centimeters x 100 centimeters. The excavation of this level focused on exploring the extent of the fire-cracked intrusion in order to determine if it was a component of a feature. The soil in the unit remained loose, loamy, and ashy grey. After the unit was fully excavated, it was determined that fire-cracked rock was resting on the top of a gravel stringer, running roughly northeast to southwest. In all, 29 pieces of basalt fire-cracked rock, ranging in size between 3 and 7 centimeters in diameter, were removed from the northern 40 centimeters of the unit. The pebbles composing the stringer were smaller in size distribution than those in the nearby drainage. Both the fire-cracked rock and gravel had a light carbonate coating on their surfaces. This level contained more bone than any other level. Forty-two percent of the total amount of bone from Units 1 and 2 were recovered from this level. One obsidian flake was identified among the basalt, chert, and quartz debitage collected.

Level 6 (50 to 60 cmbd). Dimensions: 50 centimeters x 120 centimeters. The excavation of this level revealed the continuing depth of the stringer, as well as its orientation northeast to southwest, sloping towards the nearby drainage. Fire-cracked rock continued to be recovered from the unit, and was concentrated towards the approximate center and southern portion of the unit (60 to 100 centimeters). Fire-cracked rock ranged in size from 3.5 to 14 centimeters in diameter, however, only 11 of the 49 pieces fell within the larger size range. Carbonate coated all sides of the gravels within the stringer, whereas the fire-cracked rock only had a light coating. Artifacts and ecofacts from this level include chert, obsidian, and basalt debitage, bone, and charcoal. Based on the sloping nature of the stringer, and the placement of the fire-cracked rock, it is hypothesized that this area was a sloped surface during the site's occupation, and can be seen in the sloped "dumped" pattern of the fire-cracked rock. The soils, while still ashy grey and loose, with high gravel content, displayed a slight color change between the northern and southern portions of the unit.

Level 8 (70 to 80 cmbd). Dimensions: 50 centimeters by 140 centimeters. After Level 7 of Unit 1 South and North were excavated, the unit was subdivided again. –Since the trench-like unit was long and difficult to excavate, the decision was made to leave Unit 1 as the northernmost 140 centimeters, and allow the remaining 100 centimeters to become Unit 2. Unit 1 was 50 centimeters by 140 centimeters. Unit 2, levels 1 and 2 were fully excavated before this level was started. The soils continued to be soft and ashy grey in this level. However, at the bottom of the level, loamy soils gave way to a coarse gravely river sand. Sand mainly concentrated in the northern most 40 centimeters of the unit. Only one large flake and one core were collected from this level. Two relatively small pieces of fire-cracked rock, under 4 centimeters in diameter, were recorded from this level.

Level 9 (80 to 90 cmbd). The last level of Unit 1 ended when sandy soil, filled with small and medium riverine rock emerged from the soft grey soils. Carbonates were present on the rocks. No cultural material was collected from this level

Unit 1 South and Unit 1 North.

Once the unit reached 1.2 meters in length, it was subdivided into two portions. Unit 1 South followed the slight soil color change and slope of the cut bank. The maximum length of this unit is 90 centimeters. Unit 1 North was excavated second, and represents a 50 centimeter by 50 centimeter unit.

Unit 1 South.

Level 7 (60 to 70 cmbd). This level was composed of soft, loamy, and ashy grey soil. At this depth, gravels were covered in carbonate. Artifacts recovered from this unit include small fragments of bone, charcoal and debitage. Fire-cracked rock continued to overlay riverine gravels. The 20 pieces of fire-cracked rock recovered from this level ranged between 5 and 15 centimeters in diameter.

Unit 1 North.

Level 7 (60 to 70 cmbd). Dimensions: 50 centimeters x 50 centimeters. This level reflects the change in soil color and artifact distribution between the higher, northern part of the site, and the slope. Gravels remained heavy in the western half of the unit, and are composed of small, pea-sized grains intermixed with cobbles greater than 12 centimeters in diameter. However, the density of these gravels does decrease with depth. Very few artifacts were found in this loose and loamy soil. However, bone fragments and debitage were collected. In addition to the decrease in artifacts and gravels, only three pieces of fire-cracked rock were recovered from the level. The gravels were lightly coated in carbonate on all surfaces, however, the underlying surface had a heavier carbonate coating.

Unit 2

As Unit 1 extended in length downslope and towards the south, it became necessary to subdivide the trench into two distinct units. The northernmost 140 centimeters remained Unit 1, while a new, 50 centimeter by 50 centimeter unit was created to the south. This unit, Unit 2, was fully excavated to sterile soil and reached 100 cm in length (N-S) x 50 cm (E-W) as it expanded downslope. Once both Units 1 and 2 were excavated to sterile subsoil, the trench was 50 centimeters wide by 240 centimeters long (N-S).

Stratigraphy.

Level 1 (70 to 80 cmbd). As with previous levels to the north, the soils continued to be very loose, loamy, and ashy grey in color. When compared to other excavated levels in Unit 1, there is a comparatively low density of riverine gravels in this soil. Well-preserved bone, a fragment of groundstone and fire-cracked rock were recovered from this level. One utilized flake, made of basalt, and a quartz cobble expedient tool were identified and collected. This unit was opened in order to continue the trench towards the south, downslope; the soils are similar to those found in Unit 1, however, gravel densities are lower.

Level 2 (80 to 100 cmbd). Dimensions: 52 centimeters by 100 centimeters. The last level of Unit 2 was excavated at a natural level. Two intrusive soils appeared in the unit. The first were a reddish soil, which upon further excavation, disappeared. The intrusion of this soil may be attributed to trampling or weathering. In the southern two-thirds of the unit, patches of brown

sediment appeared around 90 cmbd. By 100 cmbd, gravely river sand replaced the ashy grey soil. When compared to Unit 1, gravels were relatively low in this level. One groundstone fragment, debitage, and bone fragments were collected from this level.

Unit 1 and 2 Stratigraphy

There are four soil strata defined in the profile of Units 1 and 2. The soil textures were determined using the USDA Soil Textures and Colors chart and the color was determined using both wet and dry soil against the Munsell Soil Color Chart. Starting with the deepest strata (as seen in Figure 16), the textures and colors are as follows:



1 . Gravelly Sand
Dry: 10YR4/2 Grayish Brown
Wet: 10YR4/4 Dark Yellowish Brown
Grain texture: Gravelly

2. Very Gravelly Loamy Sand
Dry: 10YR4/1 Dark Grey
Wet: 10YR3/3 Dark Brown
Grain texture: Gravelly

3. Loamy Sand
Dry: 10YR5/1 Grey
Wet: 10YR2/2 Very Dark Brown
Grain Texture: Less than 15% gravels

4. Loam
Dry: 10YR5/4 Yellowish Brown
Wet: 10YR4/4 Dark Yellowish Brown
Grain Texture: Less than 15% gravels

Figure 16. AZ CC:4:63 (AMS) Duncan Donut Profile of east wall of Units 1 and 2.

*Radiocarbon results.*Two AMS radiocarbon samples of maize cupules were submitted from Unit 1. The results were statistically indentical, placing the occupation between 350-50 B.C. which falls in the Late Cienega phase. The first sample (Beta 422949) is a maize cupule identified by Karen Adams from Level 7, Unit 1, 60-70 cm bd yielded a radiocarbon age of 2150±30 (delta ^{13}C -11.1 per mil). This date calibrates with two sigmas at 350-105 B.C. with a median of 195 B.C. The second sample (D-AMS 014979) is also a maize cupule from Unit 1, Level 6, 50-60-70 cm bd from flotation. It yielded a radiocarbon age of 2130 ± 27 bp. The delta

13C value was taken on graphite and is not comparable to typical values measured on whole samples. The date calibrates to 350-50 B.C. at two sigmas with a median of 160 B.C. The two samples are statistically equivalent indicating the deposit and the site dates to the Late Cienega phase.

Artifact Inventory

A preliminary artifact inventory was made and the results are tabulated below. Note the two spikes in artifact frequency in Table 14. Level 3 contains 37 items and and Level 5 contains 76 items. Given the sloping stratigraphy of the cut bank and the arbitrary levels a number of interpretations of this pattern are possible. Table 15 provides further detail of these artifacts.

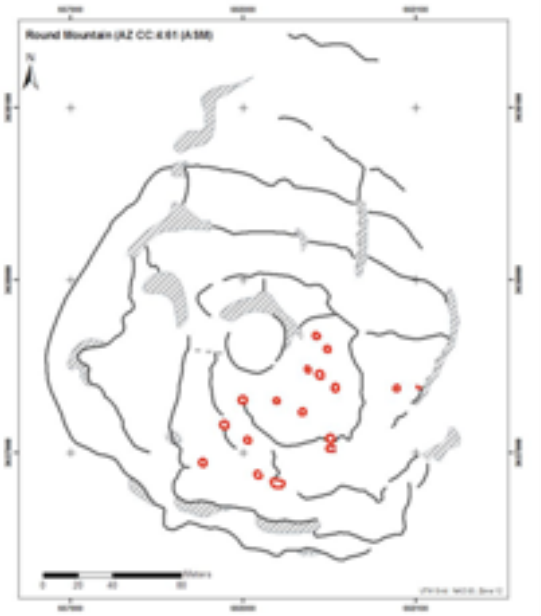
Test Unit Depth (below datum),	Flakes	Shatter	Core	Utilized Flake	Expedient Tool	Bone	Charcoal	Daub	Ground Stone	Total by Level
Unit 1										
0-14 cm, Level 1	2									2
14-20 cm, Level 2	2	3								5
20-30 cm, Level 3	10	15				6		6		37
30-40 cm, Level 4	3	6				6		1		16
40-50 cm, Level 5	3	25				48				76
50-60 cm, Level 6	1	16				11	1			29
70-80 cm, Level 8	1		1							2
80-90 cm, Level 9						1				1
0-40 cm, Wall Collapse		4								4
70 cm, Level 7 Clean-up	1									1
Unit 1 South										
60-70 cm, Level 7	6	11				17	1			35
Unit 1 North										
60-70 cm, Level 7	1					7				8
Unit 2										
70-80 cm, Level 1	4	1		1	1	2			1	10
80-100 cm, Level 2	23					16			1	40
Total for all Units	57	81	1	1		114	2	7	2	**265**

Table 14. Duncan Donut Artifacts by Level

Bag#	Unit	Level	Depth	N	Description
10	1	1	0-14 cmbd	2	1 white quartz tertiary flake (medial and distal end only) 1 red (or dark maroon) rhyolite tertiary flake
13	1	2		5 to 7	1 large basalt shatter 1 brown quartz shatter 1 tan chert shatter 2 tertiary flakes, crystal quartz? *2 basalt flakes (1 may be a heat spall)*
16	1	3		6	Daub?
18	1	3		25	1 secondary white quartz flake 4 tertiary white quartz flakes/small shatter *(1 quartz shatter may be a calcium carbonate crystal)* 1 pink/red toned distal end of a tertiary chert flake 1 distal end of a tan chert flake with a black inclusion 3 (several colors) chert shatter (heat treated? Some have pink undertones) 15 basalt flakes and shatter (some with reddish tones)
19	1	4		1	1 small piece of daub
20	1	4		9	1 tertiary obsidian flake 1 distal end of a basalt flake 1 red rhyolite (?) shatter 1 pinky-white secondary quartz flake 5 chert shatter (1 heat treated?)
15	1	5		27-29	1 obsidian tertiary flake 2 grey quartzite/large grained chert shatter 16 basalt flakes/shatter 6 chert flakes/shatter 2 tertiary chert flakes 2 vesicular basalt, unknown
27	1	1-5		4	Wall fall 3 chert shatter 1 basalt shatter
29	1	6		17	1 large red chert shatter 2 obsidian tertiary flakes 5 basalt shatter 9 chert shatter (one with a strange waxy luster)
35	1S	7		17	1 large secondary reddish-pink chert flake 1 obsidian shatter 2 red/maroon rhyolite shatter

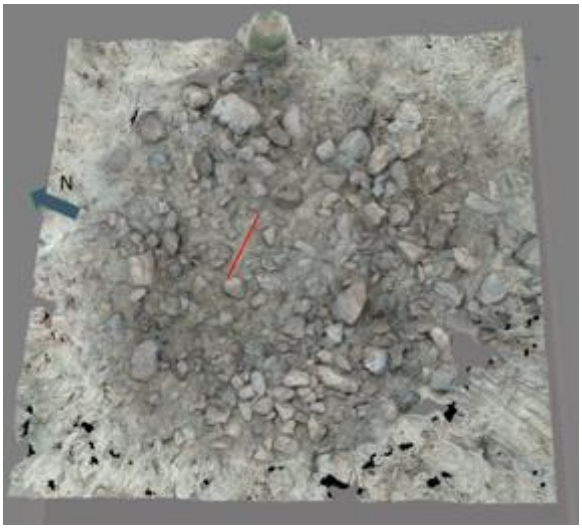
Table 15. Preliminary Lithic Descriptions: Duncan Donut Site

Rock Rings



The rock rings, most of which we interpret to be houses, are of particular interest due to their substantial and patterned nature. A total of 28 rings were found on five sites. They are of a consistent size with a mean inner diameter of 3.1 meters and an outer diameter of 5.5 meters, with a low standard deviation (see Appendix 2, Rock Ring Documentation, for more information). The shapes are circular, ovoid, semicircular, and irregular. Limited excavations show floors are shallow, located on bedrock, and not prepared. Openings are present on more than half of the rock rings. The openings tend to face in an easterly direction. Thus far, we have not located postholes in the shallow, rocky sediments.

Figure 17. Map of Round Mountain and the red circles represent rock rings.



Almost all of the structures have a large amount of wall rubble, creating a ring of stone about 1 meter-thick, suggesting foundational walls perhaps 0.5-1.0 meter high with perhaps 3 to 6 courses of stone. Virtually all of the the rock rings have chipped stone associated with them and 42% have associated metates or manos visible on the surface. Clearly these rock rings are residences. The 3D image shown in Figure 18 was produced from multiple digital images processed using Agisoft Photoscan software.

Figure 18. Ring C, Round Mountain

Ethnobotanical Collection and Analysis

During the excavation process, normally, at least two flotation samples were collected within each stratigraphic level. Fewer samples were collected from upper levels and more samples were collected from levels that appeared to be particularly productive. Dr. Karen Adams examined the light fraction from all samples as well as all samples of charred plant remains recovered in the excavation screens, known as "macrobotanical samples" to evaluate the range of plant species found at the site and to identify radiocarbon samples. Float samples were uniformly collected in one-liter volumes. Soil samples were also collected underneath metates or other locations that appeared to be particularly productive. The decanting method was used to process light fractions at the field lab in Duncan, Arizona. Because only minimally useful data was acquired from heavy fraction collection in the 2014 field season, we analyzed only the light fractions. However we did retain the heavy fractions from Duncan Donut site, since bone preservation was good at that site. Our priorities for processing and evaluation were to identify samples suitable for radiocarbon dating, possible cultigens, and the site's range of subsistence resources.

Before initiating the decanting process, we filled out entries in the flotation log and on labels for the light fractions. We poured one one-liter flotation sample into a large bucketful of clean water, gently agitated it with a wooden or plastic spoon or stick, and allowed the heavier sediments to settle for one minute. We then slowly decanted the water, which contained floating botanical materials, into a square of chiffon fabric tied over a colander. We continued to pour until the heavier sediments in the bucket threated to spill over into the chiffon cloth. We then repeated the process after slowly pouring more clean water into the bucket with the sample. The light fraction was then tied with its associated label, hung on a clothesline, and dried in the shade.

Karen Adams then scanned all 83 light fractions and found that 64 contained charred remains, including all three sites where excavations were conducted including: AZ CC:4:61 (ASM) (Round Mountain), AZ CC:4:62 (ASM) (DotMon Site), and AZ CC:4:63 (ASM) (Duncan Donut). She identified all charred pieces in the flotation light fractions. She particularly sought potential radiocarbon dating material, preferably reproductive tissue with other sort lived pieces such as stems or twigs that would eliminate the problem of dating old wood.

Site	Total float samples examined	No of float samples with charred specimens	No of float samples with no charred specimens
Round Mtn	59	41	18
DotMon	5	4	1
Duncan Donut	19	19	0
Total	83	64	19

Table 16. Floation samples examined by Karen Adams from 2014 and 2015 field seasons.

Site	Total float samples	Juniperus	Prosopis	Quercus	Rosacea	Populus/Salix	Poaceae stem	Fabaceae	Larrea	Unknown stem	Unknown wood
Round Mtn	41	33	8	3	1		6			3	
DotMon	4	1		2*		1					3
Duncan Donut	19	15	9				2	1	1		1

*^{14}C date by Direct AMS on Quercus from DotMon indicated it was of modern origin.

Table 17. Ubiquity of charred wood and stems from productive flotation samples, identifications by Karen Adams. Ubiquity refers to the number of flotation samples that contain a taxon. Samples from 2014 and 2015 field seasons.

Site	Total float samples	Poaceae caryopsis	Monocot tissue	Unknown tissue/seed	Euphorbia seed	Unknown pith possible Zea mays	Zea mays
Round Mtn	41	1	1	8	1		
DotMon	4			1		1	
Duncan Donut	19						4*

* 4 float samples each contained one maize cupule

Table 18. Ubiquity of charred reproductive tissue from floatation samples from 2014-2015 seasons. Identifications by Karen Adams.

Site	No of macrobotanical samples	Juniperus	Prosopis	Atriplex	Populus/Salix
Round Mtn	8	3	3	1	
DotMon	0				
Duncan Donut	2	2	1		1

Table 19. Taxa of macrobotanical samples which are charred specimans collected during excavation

Tables 16-19 summarize the results and include samples from both the 2014 as well as the 2015 seasons. Sixty-four out of 83 light fractions produced charred remains, despite the shallow sediments (Table 16). The samples were dominated by charred wood, with low representation of reproductive tissue (Table 17 and 18). Juniper wood was more common than mesquite. Juniper is present in 76.5% (49/64) of the productive samples from the three sites, while mesquite is in only 26.6% of samples (17/64) (Table 17). Today mesquite is far more common on and near the sites than juniper. Grass stems and oak along with a few other taxa are also present in the samples. Oak is not found on the sites today. The recovery of charred reproductive tissue, including seeds, was sparse. *Zea mays* (corn) was only recovered from the Duncan Donut site and there 4 out of 19 samples contained maize cupules. DotMon yielded a pith fragment which may be maize (Figure 20). The charred specimens found in the screen and during excavation are known as "macrobotanical samples" and they are described in Table 19. They are are all charred wood and represent the same range of taxa found in the flotation samples, with the addition of one piece of Atriplex. Uncharred items are not listed in the tables as they are considered to be of modern origin and they included Echinocereus and Sphaeralcea seeds from Round Mountain.



Figure 19. AZ CC:4:63 (ASM) (Duncan Donut) Charred Juniperus Twig with <20 Rings. Photo by Karen Adams.

Figure 20. AZ CC:4:62 (ASM) (DotMon Site), Charred Unknown Pith Fragment. Photo by Karen Adams.



Radiocarbon Dating

We prioritized the AMS radiocarbon dating of annual seeds or other short-lived material, and were limited in our choices of potential radiocarbon samples. During the 2014 and 2015 seasons we submitted six samples that were large enough to date and these are listed in Table 20. Several additional samples were submitted but returned because they were too small to date. We obtained three dates from Round Mountain on annuals or other short lived material from terraces or rock rings. Two dates on maize were obtained from the Duncan Donut site (Figure 21). One sample of oak from the DotMon site turned out to be modern. The Round Mountain and Duncan Donut probability calibration curves are plotted in Figure 22. It shows two of the Round Mountain dates do not overlap while the third falls in the middle and overlaps the first two as it has a large calibrated date range because it falls on a fluctuating segment of calibration curve. All three Round Mountain dates however cluster nicely within the Early Cienega phase, 800-400 BC. The two maize dates from Duncan Donut are statistically identical and fall in the Late Cienega phase, 400 BC – AD 50 indicating it was occupied subsequently to Round Mountain.

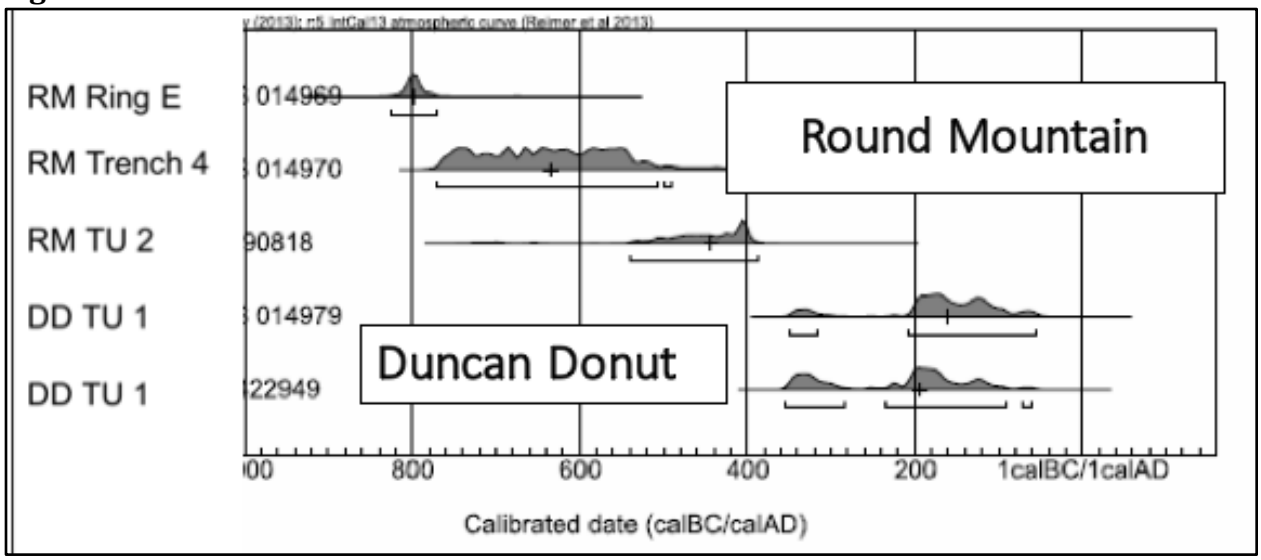


Figure 21. AZ CC:4:63 (ASM) (Duncan Donut) Charred *Zea mays* cupule. Photo by Karen Adams.

Site No	Location	Level	Depth cm BD	Bag No	Taxon	Plant tissue	Report Date	Lab No	Radiocarbon Age BP	One sigma error	OxCal calibration From-To (95.4%)	Median	d13C per mil
AZ CC:4:61 (ASM) Round Mtn	Rock Ring E, SE Quad	4	60-70	302	Unknown	1 fruit fragment	2/22/16	D-AMS 014969	2610	29	825-770 BC	800 BC	-2.7*
AZ CC:4:61 (ASM) Round Mtn	Test Unit 4	5	70-80	289	Unknown	1 plant tissue fragment	2/22/16	D-AMS 014970	2480	26	775-490 BC	635 BC	-27.1*
AZ CC:4:61 (ASM) Round Mtn	Test Unit 2	6	60-70	66	Atriplex	wood	9/29/14	Beta-390818	2370	30	540-385 BC	445 BC	-11.3
AZ CC:4:63 (ASM) Duncan Donut	Test Unit 1	6	50-60	028	Zea mays (tentative ID)	1 cupule	2/22/16	D-AMS 014979	2130	27	350-50 BC	160 BC	-5.9*
AZ CC:4:63 (ASM) Duncan Donut	Test Unit 1 South	7	60-70	38	Zea mays	cupule	11/13/15	Beta-422949	2150	30	360-60 BC	195 BC	-11.1
AZ CC:4:62 (ASM) DotMon	Rock Ring A	4	40-46	019	Quercus	1 wood fragment	2/22/16	D-AMS 014971	Modern				-25.7*

Table 20. Radiocarbon Dates from 2014 and 2015 field seasons.

Figure 22. Calibrated radiocarbon dates



Summary

The substantial prehistoric occupations in, and geomorphological investigation of, the Upper Gila River Valley suggest that the valley was ideally suited for ancient farmers. The river reach boundary formed by the constriction of the Gila River channel near Round Mountain created a dependable source of moisture and deep alluvial sediments. Early Cienega phase radiocarbon dating of botanical samples discovered at Round Mountain, and the presence and dating of Late Cienega phase *Zea mays* from the Duncan Donut site, imply that maize agriculture was part of the local Early Agriculture period subsistence base. Round Mountain AMS dates indicate two separate occupations occurred in this important site. The presence of maize suggests that the early inhabitants of the Duncan Valley invested in the labor necessary to maintain fields and tend crops. The presence of two Early Agriculture period cerros de trincheras in the Gila River Valley suggests cerro de trincheras are part of a broad regional pattern during the pivotal transition to the adoption of agriculture.

The 2015 UTSA Archaeological Field School project surveyed approximately 112 acres in the area around Round Mountain and recorded 15 new archaeological sites. The survey identified several Early Agricultural period sites, and enabled a broader understanding of prehistoric and early historic land use in the Duncan Valley along the Gila River. The early ceramic period cerro de trincheras North site, early ceramic period pithouse site AZ CC:4:69 (ASM) (FS-4), the Middle Ceramic (post-Mimbres) Apache Well [AZ CC:4:67 (ASM)] site, and the Late Ceramic (Salado) site L:4:4 (GP) (75) are among the most significant of the locations surveyed.

The archaeological sites that were identified, recorded, and excavated provide an extraordinary record of long-standing human habitation in the Duncan Valley, and in southeastern Arizona.

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June 23, 2015

Robert J. Hard, Ph.D.
Department of Anthropology

Subject: Observations of the Gila River Floodplain at Round Mountain, Arizona

Dear Robert,

This letter report summarizes observations and preliminary interpretations related to a geomorphological reconnaissance of the Gila River in the Duncan Valley conducted June 8-11, 2015. I was assisted in the field by Fred Nials and Jon Sandor. The reconnaissance included excavation of four backhoe trenches and description of alluvial deposits and soils on Holocene Gila River terraces upstream from Round Mountain (Figure 1). The investigation confirmed that the Gila River segment located between Sheldon and Apache Grove contains fine-grained alluvial deposits formed by overbank deposition. These deposits have potential for providing insight into late Holocene floodplain environments and indigenous water control.

The Gila River within the Duncan Valley flows NNW within an alluvial floodplain inset below older fluvial terraces and pediments dating to the Pliocene and Pleistocene (Morrison 1965). Immediately below the mouth of Apache Creek adjacent to Round Mountain, the Gila River floodplain narrows and is confined by volcanic bedrock. The geological (Holocene) floodplain upstream from this constriction is ~500 to 1000 m wide and contains at least two low terraces (t1 and t2) above a meandering active channel (t0; Figure 2; Table 1). Historically, the active channel has widened and narrowed during periods of enhanced and reduced flooding, respectively (Klawon 2001). The t1 terrace is prone to frequent flooding and contains higher energy, sand and gravel deposits. The higher t2 terrace appears to contain more fine-grained (fine sand, silt, and clay) alluvium near the surface that likely formed through overbank Gila River flooding and vertical accretion. Most of the floodplain soils along this reach of the Gila River are mapped as Pima silty clay loam (DeWall 1981; Figure 3). Recent mapping of the Upper Gila River by the U.S. Bureau of Reclamation (Klawon et al. 2004) defines a geomorphic floodplain (Figure 3) prone to lateral channel migration for at least the past 1000 years; this boundary includes the t1 terrace and parts of the t2 terrace.

Two older Pleistocene fluvial terraces (Qt1 and Qt2) have been mapped along the Gila River at Duncan (Morrison 1965). Although the surficial geology has not been mapped farther downstream within the Sheldon 7.5' quadrangle, cursory observations of higher terraces on the west side of the Gila River upstream from Round Mountain suggest that the Qt1 and Qt2 terraces are present in the study area (Figure 2).

Two backhoe trenches were excavated in the Gila River Holocene floodplain located on Dick Kaler's property (Figure 1). Trench Kaler 1 was placed on the t1 terrace and exposed sandy/cobble channel and finer overbank deposits (Figure 4). Well preserved alluvial bedding indicates minimal soil formation and implies a relatively young (historic) age for the deposits. Trench Kaler 2 was placed on a higher (probably t2) terrace and exposed > 2.8 m of fine grained, weakly bedded alluvium. These deposits have been more affected by pedogenesis as evidenced by strong prismatic to angular blocky structure and calcium carbonate enrichment. Consequently, a soil profile (Table 2) was described following USDA guidelines (Schoeneberger et al. 2012) at Trench Kaler 2 in place of a stratigraphic profile. Slow rates of overbank deposition have resulted in an over-thickened, cumulic soil (see Holliday 2004:91-95). Based on soil formation

and topographic position, I estimate these deposits to date within the last 3000 years.

Two backhoe trenches were excavated on the eastern edge of the Gila River Holocene floodplain, east of State Route 75 on Ray Tyler's property (Figure 1). This area has been significantly modified by historic leveling, and prior to trenching it was unclear whether deposits would be disturbed or dominated by tributary alluvium from the east (see Fred Nial's comments in Table 3). The original surface likely correlates with the t2 terrace. Whereas Trench Tyler 2 revealed mostly disturbed deposits, Trench Tyler 1 exposed fine-grained, horizontally bedded alluvium interpreted as overbank Gila River flood deposits (Figure 5; Table 3). A burned layer (Unit 9) containing very fine charcoal was sampled for ^{14}C dating. These deposits contained minimal evidence for pedogenesis. However, the original soil capping this landform has likely been removed by leveling and/or plowing. These deposits likely date within the last 3000 years.

These preliminary excavations and stratigraphic observations suggest that this reach of the Gila River upstream from the bedrock constriction at Round Mountain contains abundant, fine grained, late Holocene (<3000 yr BP) overbank flood deposits. Such deposits are mainly associated with the t2 terrace that is best preserved on the margins of the Holocene floodplain. The relatively fine-textured sediments exposed in Trenches Kaler 2 and Tyler 1 imply a low energy depositional environment conducive for burial and preservation of prehistoric surfaces (e.g., Stratum 9 in Trench Tyler 1) and possible archaeological features such as canals. Soils developed into this fine grained alluvium have high water-holding capacities and receive periodic deposition of organic detritus conducive for supporting long-term agriculture. Such deposits are also conducive for building an alluvial chronology for this reach of the Gila River provided that t2 terrace deposits can be exposed through excavation.

Future geoarchaeological studies of the Gila River in the vicinity of Round Mountain should include the reach located downstream from the bedrock constriction (near the community of York). This represents a zone of expanding Gila River flow where fine-grained alluvial deposits are likely to be preserved. Moreover, the boundary between bedrock canyon and alluvial floodplain would have been preferred for the construction of prehistoric canals (see Nials et al. 2011).

In sum, there is high potential to obtain geoarchaeological information from the Gila River floodplain in the Round Mountain area. Possible research themes include reconstructing late Holocene floodplain formation through alluvial stratigraphy, identification of prehistoric canals, and assessment of soil fertility. Such information would help define the environmental context and subsistence strategies of ancient communities located along this reach of the Gila.

Sincerely,

Gary Huckleberry, Ph.D.

Tuscon, Arizona

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Table 1. Preliminary list of Gila River fluvial surfaces upstream from Round Mountain; correlations with Morrison (1965) based on topographic relationships.

This study	Morrison (1965)	Notes
t0	Qay	Modern channel
t1	Qay	Historic low terrace; see Trench Kaler 1
t2	Qa	Late Holocene terrace; see Trenches Kaler 2 & Tyler 1
t3	Qt1	Late Pleistocene terrace
t4	Qt2	Mid-to-late Pleistocene terrace

Table 2. Soil Profile at Trench Kaler 2 on Gila River (t2?) Terrace.

Soil Profile: Trench Kaler 2
Location: NW 1/4, NW 1/4, Sec. 16, T. 7 S., R. 31 E. (Salt River Baseline and Meridian); UTM 12S 0670054; 3633780 (WGS 84 datum)
Elevation: 1082 m (3550 ft) above sea level.
Potential vegetation: Mesquite (Prosopsis sp.),
Mapped soil series: Pima silty clay (DeWall, 1981)
Mapped soil classification: Torrifluvent
Observed soil classification : Haplocambid
Parent material: mixed alluvium Landform: fluvial (Gila River) terrace
Topography: <1 % slope; north aspect
Described by: Gary Huckleberry and Jon Sandor
Date recorded: June 10, 2015
Notes: Ped from Bk1 horizon containing single fine charcoal fleck sampled at west end of trench for 14C dating; calcium carbonate morphological stage based on Machette (1985).

Ap 0-62 cm. Brown to grayish brown (10YR 5/2.5, dry) and dark grayish brown (10YR 4/2, moist) silt loam; strong, very coarse, angular blocky structure; clods are strong, very coarse subangular blocky; extremely hard (dry), sticky and plastic (wet); slightly effervescent; very few, very fine, carbonate filaments (Stage I); clear, wavy boundary.

Bw 62-137 cm. Brown to grayish brown (10YR 5/2.5, dry) and dark grayish brown (10YR 4/2, moist) silt loam; moderate, medium, prismatic and strong, very coarse, platy (62-80 cm); hard to very hard (dry), sticky and plastic to very plastic (wet); slightly effervescent; very few, very fine, carbonate filaments (Stage I); many fine roots; gradual, wavy boundary.

Bk1 137-166 cm. Brown (10YR 5/3, dry) and brown to dark brown (10YR 4/3) silt loam; moderate, medium, prismatic structure; hard to very hard (dry); sticky and plastic (wet); moderately effervescent; few, very fine to fine carbonate filaments (Stage I); clear, wavy boundary.

Bk2 166-209 cm. Brown (10YR 5/3, dry) and brown to dark brown (10YR 4/3) silt loam; moderate, coarse to medium, prismatic structure grading to moderate, medium, angular blocky structure; very hard (dry); sticky and plastic (wet); strongly effervescent; common, very fine to fine carbonate filaments and almost continuous, thin coating on base of pebble (Stage I); abrupt, smooth boundary.

CBk 209-280+ cm. Brown/dark brown to dark yellowish brown (10YR 4/3.5, moist) loam; sand fraction is very fine; massive; friable (moist); slightly sticky, slightly plastic (wet); strongly effervescent; very few, very fine carbonate filaments (Stage I).

Table 3. Detailed stratigraphic descriptions and interpretations for Trench Tyler 1 (courtesy of Fred Nials). See Figure 5 for profile.

Location: The trench is at an elevation of approximately 3548 feet, is approximately 10 m long at the downslope end of a leveled field, and is near the distal end of an alluvial fan deposited by Stove Wash and an unnamed tributary to the south. The trench is dug approximately perpendicular to the trend of the unnamed tributary. Because of agricultural and constructional manipulation of the land surface, it is impossible to determine a precise boundary between the alluvial fan and prehistoric floodplain surface (t2). The trench size and orientation did not favor recognition of interfingering of fan and floodplain deposits and no such relationship was observed. The trench location is approximately 25 feet (8 m) above the present stream bed of the Gila River.

Descriptions: With the exception of Stratum 1, all deposits are alluvial in origin, and unless otherwise noted all contacts are geologic. Isolated pieces of charcoal were present in numerous strata, but with the exception of Stratum 9 did not appear to be in situ. Although minor calcium carbonate filaments were noted locally, no significant pedogenesis was observed.

Stratum	Notes
1	Artificially emplaced leveling spoil. Locally contains crushed gravel and recognizable exotic blocks. The texture is basically a slightly gravelly sandy loam. The lower boundary is clear to abrupt, and smooth.
2	Thinly bedded, fine and medium sand; water deposited; boundary abrupt, smooth; thickens slightly to the west.
3	Very fine sandy loam at top, grading downward in most areas to a massive silty clay loam/clay loam; lower boundary abrupt, smooth.
4	Bedded fine and medium sand, silty fine sand, deposited by slightly higher-velocity water. Lower boundary mostly abrupt, wavy.
5	Localized lens of silty fine sand. Lower boundary abrupt, irregular, erosional.
6	Localized lens (?) of fine sandy silt. Lower boundary smooth, abrupt.
7	Lens of relatively dark silt loam, unit grades into obscurity near center of profile, where it grades into lighter-colored, slightly coarser sediments of Unit 8. Lower boundary obscure.
8	Light-colored, massive, very fine sandy loam. Localized Patchy areas of very fine carbonate filaments were locally present, but obvious. Lower boundary obscure.
9	Discontinuous bed of dark-colored loamy silt/loamy fine sand; contains very finely disseminated charcoal. Appears to have been a low temperature fire (e.g., grass?), burned in place. Samples collected for possible dating. Lower boundary clear to gradual, non-depositional.
10	Thick deposit of loamy very fine sand to very fine sandy loam appears to have been a single depositional event.

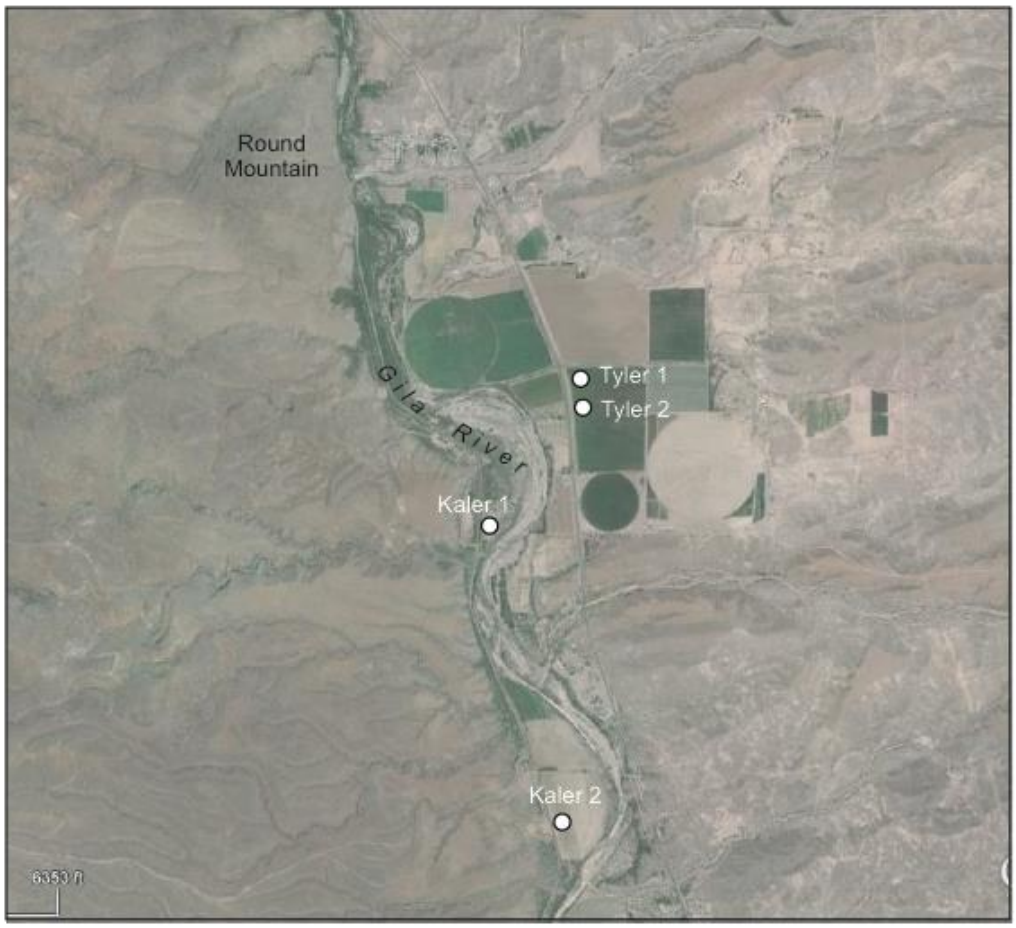


Figure 1. Trench location in Gila River floodplain. Image courtesy of Google Earth.

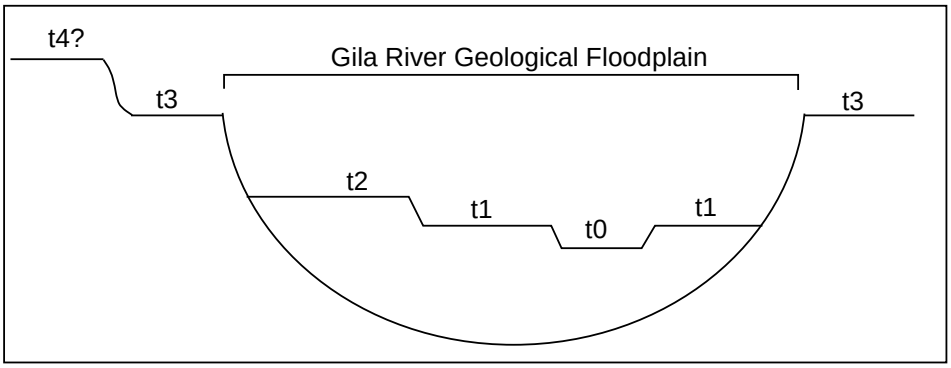


Figure 2. Preliminary schematic cross-section of Gila River terraces upstream from Round Mountain.

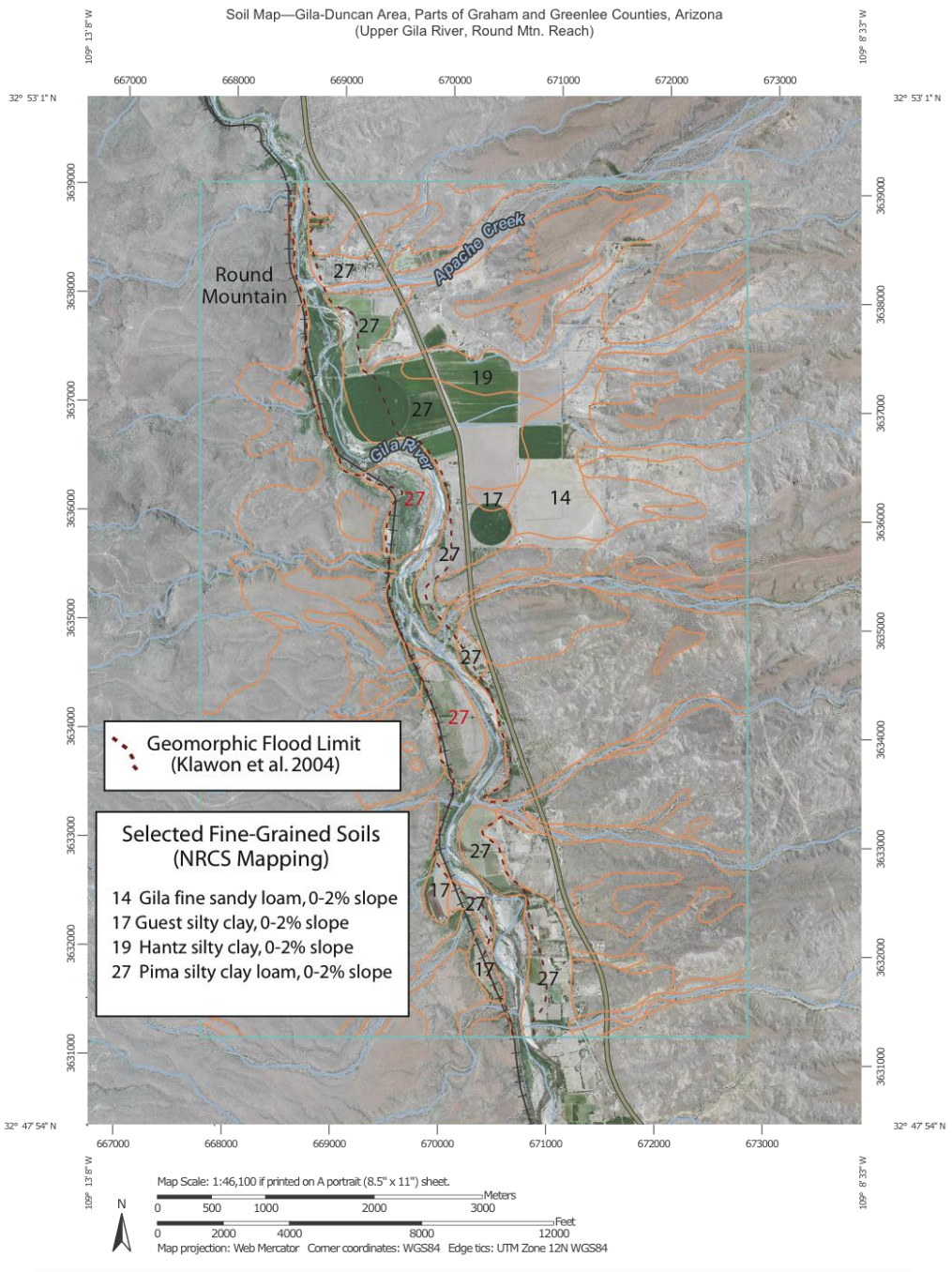
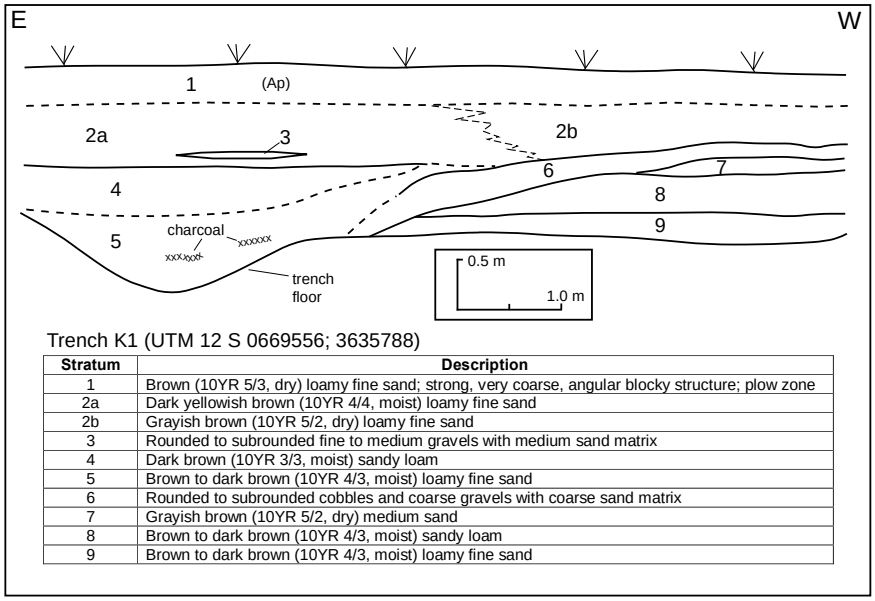


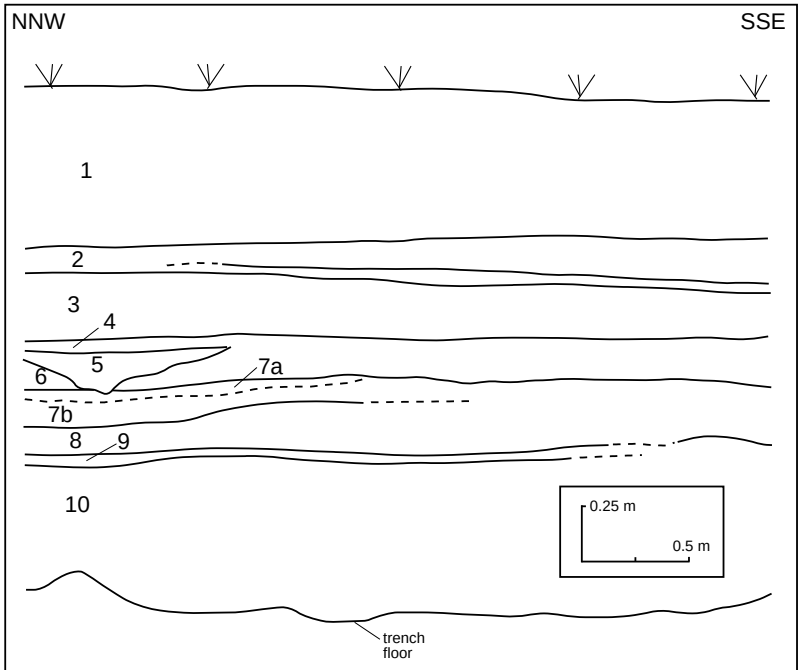
Figure 3. Soil map (courtesy of the NRCS Web Soil Survey) with geomorphic floodplain boundaries (Lawon et al. 2004).



Trench K1 (UTM 12 S 0669556; 3635788)

Stratum	Description
1	Brown (10YR 5/3, dry) loamy fine sand; strong, very coarse, angular blocky structure; plow zone
2a	Dark yellowish brown (10YR 4/4, moist) loamy fine sand
2b	Grayish brown (10YR 5/2, dry) loamy fine sand
3	Rounded to subrounded fine to medium gravels with medium sand matrix
4	Dark brown (10YR 3/3, moist) sandy loam
5	Brown to dark brown (10YR 4/3, moist) loamy fine sand
6	Rounded to subrounded cobbles and coarse gravels with coarse sand matrix
7	Grayish brown (10YR 5/2, dry) medium sand
8	Brown to dark brown (10YR 4/3, moist) sandy loam
9	Brown to dark brown (10YR 4/3, moist) loamy fine sand

Figure 4. Stratigraphic profile, Trench Kaler 1.

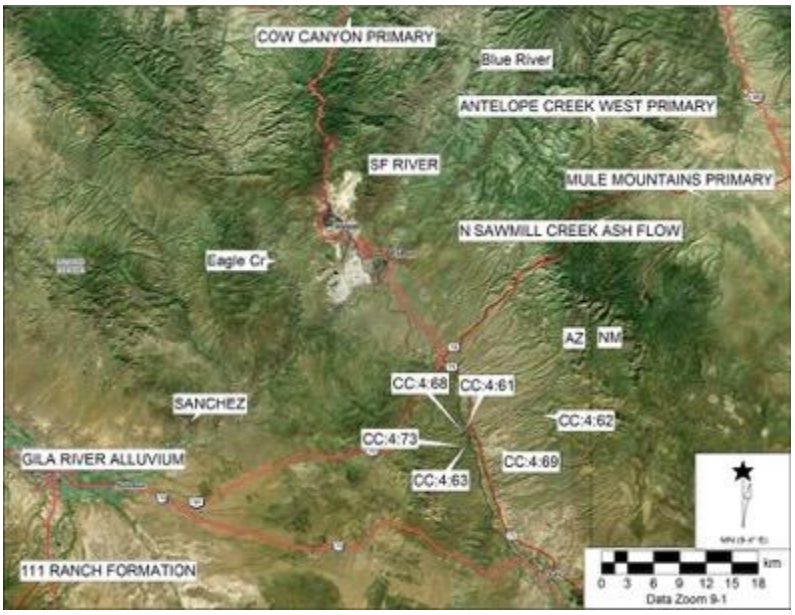


Trench T1 (UTM 12S 0670097; 3636782)

Stratum	Description
1	Brown to dark brown (7.5YR 4/4, moist) ; sandy loam with some gravel; disturbed fill
2	Brown to dark brown (7.5YR 4/4 to 10YR 4/3, moist) fine to medium sand
3	Brown to dark brown (7.5YR 4/3, moist) fine sandy loam grading downward to silty clay loam
4	Brown to dark brown (10YR 4/3, moist) bedded fine and medium sand and silty fine sand
5	Dark brown (7.5YR 3/4, moist) silty fine sand
6	Brown to dark brown (7.5YR 4/4 to 10YR 4/3, moist) fine sandy silt
7	Dark yellowish brown (10YR 4/4, moist) silt loam
8	Brown to dark brown (7.5YR 4/4 to 10YR 4/3, moist) very fine sandy loam
9	Brown to dark brown (10YR 4/3, moist) loamy silt and loamy fine sand; very fine charcoal
10	Dark yellowish brown (10YR 4/4, moist) loamy very fine sand to very fine sandy loam

Figure 5. Stratigraphic profile of Trench Tyler 1.

SOURCE PROVENANCE OF OBSIDIAN ARTIFACTS FROM SEVEN ARCHAEOLOGICAL SITES IN EASTERN ARIZONA



by
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Report Prepared for

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University of Texas, San Antonio

25 April 2016

Introduction

The analysis here of 149 artifacts from seven sites from the University of Texas, San Antonio field school, indicates procurement of four of the regional obsidian sources from the Mogollon-Datil Volcanic Province in western New Mexico and eastern Arizona (see Shackley 2015; Shackley et al. 2016a). The assemblage overall is dominated by obsidian from the Antelope Creek West locality at Mule Creek, New Mexico, followed by the North Sawmill Creek group at Mule Creek. All of the four sources are present in San Francisco and Gila River Quaternary alluvium, but there are reasons to infer that at least some of the artifacts were produced from obsidian procured from the primary sources to the north and east (see discussion).

Laboratory Sampling, Analysis and Instrumentation

All archaeological samples are analyzed whole. The results presented here are quantitative in that they are derived from "filtered" intensity values ratioed to the appropriate x-ray continuum regions through a least squares fitting formula rather than plotting the proportions of the net intensities in a ternary system (McCarthy and Schamber 1981; Schamber 1977). Or more essentially, these data through the analysis of international rock standards, allow for inter-instrument comparison with a predictable degree of certainty (Hampel 1984; Shackley 2011).

All analyses for this study were conducted on a ThermoScientific *Quant'X* EDXRF spectrometer, located at the University of California, Berkeley. It is equipped with a thermoelectrically Peltier cooled solid-state Si(Li) X-ray detector, with a 50 kV, 50 W, ultra-high-flux end window bremsstrahlung, Rh target X-ray tube and a 76 µm (3 mil) beryllium (Be) window (air cooled), that runs on a power supply operating 4-50 kV/0.02-1.0 mA at 0.02 increments. The spectrometer is equipped with a 200 l min^{-1} Edwards vacuum pump, allowing for the analysis of lower-atomic-weight elements between sodium (Na) and titanium (Ti). Data acquisition is accomplished with a pulse processor and an analogue-to-digital converter. Elemental composition is identified with digital filter background removal, least squares empirical peak deconvolution, gross peak intensities and net peak intensities above background.

For the analysis of mid Zb condition elements Ti-Nb, Pb, Th, the x-ray tube is operated at 30 kV, using a 0.05 mm (medium) Pd primary beam filter in an air path at 100 seconds livetime to generate x-ray intensity Ka-line data for elements titanium (Ti), manganese (Mn), iron (as $Fe_2O_3^T$), cobalt (Co), nickel (Ni), copper, (Cu), zinc, (Zn), gallium (Ga), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), niobium (Nb), lead (Pb), and thorium (Th). Not all these elements are reported since their values in many volcanic rocks are very low. Trace element intensities were converted to concentration estimates by employing a linear calibration line ratioed to the Compton scatter established for each element from the analysis of international rock standards certified by the National Institute of Standards and Technology (NIST), the US. Geological Survey (USGS), Canadian Centre for Mineral and Energy Technology, and the Centre de Recherches Pétrographiques et Géochimiques in France (Govindaraju 1994). Line fitting is linear (XML) for all elements but Fe where a derivative fitting is used to improve the fit for iron and thus for all the other elements. Further details concerning the petrological choice of these elements in Southwest obsidians is available in Shackley (1995, 2005; also Mahood and Stimac 1991; and Hughes and Smith 1993). Nineteen specific pressed powder standards are used for the best fit regression calibration for elements Ti-Nb, Pb, Th, and Ba, include G-2 (basalt), AGV-2 (andesite), GSP-2 (granodiorite), SY-2 (syenite), BHVO-2 (hawaiite), STM-1 (syenite), QLO-1 (quartz latite), RGM-1 (obsidian), W-2 (diabase), BIR-1 (basalt), SDC-1 (mica schist), TLM-1 (tonalite), SCO-1 (shale), NOD-A-1 and NOD-P-1 (manganese) all US Geological Survey standards, NIST-278 (obsidian), U.S. National Institute of Standards and Technology, BE-N (basalt) from the Centre de Recherches Pétrographiques et Géochimiques in France, and JR-1 and JR-2 (obsidian) from the Geological Survey of Japan (Govindaraju 1994). RGM-1 a USGS obsidian standard from Glass Mountain, Medicine Lake Highlands is analyzed during each sample run of 20 to check stability of machine calibration (Table 1). Source assignments were made by comparison to source

standards in the laboratory (Shackley 1995, 2005, http://swxrflab.net/swobsrcs.htm; see Tables 2 and 3 and Figures 1 and 2 here; see also Shackley et al. 2016a).

Discussion

While it is typical to see local procurement of secondary deposit obsidian from the San Francisco and Gila River alluvium contexts in sites in this area, the presence of angular cortex on bipolar cores and debitage, and the frequency of North Sawmill Creek obsidian in the assemblage, a source rare in river alluvial contexts, suggests that at least some of the artifacts were produced from obsidian procured from the Mule Creek and Cow Canyon primary sources (see Shackley 1998, 2005). Additionally, a source provenance study of a nearby Middle Archaic site (AZ CC:3:76 ASM) further suggests primary raw material procurement for the field school sites, since North Sawmill Creek obsidian was absent in this relatively large Middle Archaic assemblage (see Shackley 2005:131-133).

Sources in the Assemblage

A discussion of sources is offered in the way of understanding procurement. See also (Shackley 1988, 1989, 1995, 1998, 2005; Shackley et al. 2016a).

Cow Canyon/111 Ranch

The secondary depositional extent of this source is much greater than originally mapped (Shackley 1988). This Tertiary source is eroding east into the Blue River, south into the San Francisco River and west into the Gila River as originally noted, but also erodes in much higher density west into Eagle Creek west of the Blue River, and on south into the Gila River and up to 20 km south into the San Simon River Valley (Figures 3 and 4). A number of "pockets" of Cow Canyon glass have been located in the San Simon River Valley in Pliocene/Pleistocene sediments of the 111 Ranch Formation the result of considerably higher sedimentation rates in these periods than currently (Figure 3). The density of nodules at Eagle Creek approximately 15 km west of the primary contexts at Cow Canyon is up to 1 per $10m^2$, and less than 100 times lower in the Gila River (Shackley 1998). These nodules are mixed with the Mule Creek marekanites in the San Francisco and Gila River alluvium. Nodules up to 5 cm in diameter have been recovered in the 111 Ranch Formation, as large as those at the primary source to the north, suggesting that the sediment load during the Plio-Pleistocene was very great.

Unpublished analyses by the Berkeley Geoarchaeological XRF Lab of over 300 obsidian samples from McEuen Cave (AZ W:13:6 ASM) in the Gila Mountains about 30 km north of the Gila River at Geronimo, indicates that Cow Canyon obsidian comprises over 80% of the assemblage. Most, if not all of the raw nodules were likely procured from the Gila River alluvium in the Safford and San Carlos Valleys (Shackley et al. 2016b).

Cow Canyon obsidian was also the only obsidian source known from the Murray Springs Clovis site in southern Arizona. Two of the fluted points were produced from this glass, likely from nodules around 5 cm in diameter, and probably through bipolar reduction. This is the earliest indication of both obsidian procurement and bipolar technology in the southern Southwest (Shackley 1989:374-388, 2007).

The "primary source" is located in Apache National Forest, central Greenlee County, Arizona. This is a relatively small primary source along and east of Arizona Hwy 191 located in a Tertiary rhyolite body. The nodules are found within an eroded rhyolite/ash unit that appears to be a remnant dome structure. Perlite or vitrophyre was not evident. The nodules are common in a rhyolite regolith on top of the dome as well as the rhyolite/ash alluvium at the base of the slopes. Nodules up to 5 cm in diameter are available, but most of the nodules are near or less than 4 cm. The density of nodules is fairly high in places, up to 5 per m^2. Cortex is mainly a thin gray-black. The interior glass is aphyric and the color is as variable as the mid-Tertiary marekanite sources. The most common color/opacity is a near transparent brown-green sometimes with thin banding. A few specimens exhibit a nearly opaque aphyric gray-green banded megascopic character.

The nodules are eroding and funneled into the Cow Canyon Creek/Turkey Creek system reaching the Blue River 15 km east. Reduced nodules and flakes occur everywhere on the regolith and in the alluvium. The pattern of reduction is similar to Vulture with sporadic bipolar reduction throughout the source area. These specific areas may reach 10-20 per m^2. Overall the rejected core/flake density is less than 1 per $5m^2$. Published sources on this locality other than the county geology map (Wilson and Moore 1958), include Shackley (1988, 1995, 1998, 2005).

The Mule Creek Lava and Ash Flow Obsidian Complex

Including secondary deposition, the Mule Creek sources are some of the geographically largest obsidian sources in the Southwest (Figure 4). Recent research into the Mogollon-Datil Volcanic Province obsidian sources has considerably expanded our understanding of the geochronology and geochemistry of these important sources in prehistory (Mills et al. 2013a, 2013b; Shackley 2015; Shackley et al. 2016a).

The obsidian is, in part, found in a very extensive late Tertiary ash-flow sheet that covers portions of Greenlee County, Arizona, and Catron and Grants Counties, New Mexico (Ratté, 2004; Figure 3 here). The 10+ cm nodule size density at the Antelope Creek West locality reaches 100s per $5m^2$, especially on the top of the ash hills. Erosion into the San Francisco and Gila River systems has been occurring from the Mule Creek sources for 21.98 ± 0.02 Ma with the Mule Mountains event, and even more so with the volumetrically and numerically superior 19.433 ± 0.013 Ma Antelope Creek West event that is located just above the San Francisco River Canyon (Shackley, 1998, 2005; Shackley et al. 2016a; see Figures3 and 4).

Fieldwork and chemical analyses by Ratté and Brooks (1989) lead them to conclude that the Mule Creek Caldera is actually just a graben, although the typical succession from intermediate to silicic volcanism apparently holds. The caldera structure seen originally by Rhodes and Smith (1972) does seem sensible on first blush, with a central graben surrounded by what could be interpreted as post-collapse ring eruptions including the structures discussed here; the Mule Mountains dome complex, North Sawmill Creek ash flow, and the Antelope Creek dome complex and ash flows (Figure 4). Elston has discussed the different definitions of calderas and cauldrons, and defined a cauldron from Smith and Bailey (1968) "as a structural term for 'all volcanic subsidence structures'" (Elston, 2001:51). He further observes that "in southwestern New Mexico we see faulted and eroded mid-Tertiary cauldron substructures and at best remnants of original caldera topography" (Elston, 2001:51). Using these criteria, Mule Creek could be considered a cauldron.

The obsidian was originally directly dated at the Antelope Creek locality (Antelope Creek East locality herein) to 17.7±0.6 Ma by K-Ar, and at the Mule Mountain locality at the same statistical age (17.7±1 Ma by K-Ar; Ratté and Brooks, 1983, 1989). $^{40}Ar/^{39}Ar$ results in the Shackley et al. (2016a) study suggest that the K-Ar dating of obsidian at the Antelope Creek locality (Antelope Creek East here) were inaccurate, with the Antelope Creek locality now dated at 19.56 ± 0.04 Ma and Mule Mountains considerably older at 21.98 ± 0.02 Ma. A single obsidian marekanite sampled from the perlitic lava at the Antelope Creek East locality by Ratté was used in the original K-Ar dating, as was the marekanite in this study (Jim Ratté, personal communication 2003, and Ratté, 2004; Shackley et al. 2016a). Unusual for geological descriptions of the time, the obsidian proper was discussed as an integral part of the regional geology by Ratté and Brooks in 1989:

> Rhyolite of Mule Creek (Miocene). Aphyric, high-silica, alkali-rhyolite domal flows from the Harden Cienega eruptive center along southwestern border of quadrangle [Wilson Mountain 1:24,000 Quad, New Mexico; Antelope Creek East locality herein]. Unit **ob**, commonly at the base of the flows, consists of brown, pumiceous glass that grades upward into gray to black perlitic obsidian and obsidian breccia. Extensive ledges of partly hydrated, perlitic obsidian contain nonhydrated obsidian nodules (marekenites) which, when released by weathering [termed marekanites here], become the Apache tears that are widespread on the surface and within the Gila Conglomerate in this region. Age shown in Correlation is from locality about 1 km south of tank in Antelope Creek in Big Lue Mountains quadrangle adjacent to west edge of Wilson Mountain quadrangle. Thickness of flows is as much as 60 m and unit **ob** as much as 25 m (Ratté and Brooks, 1989:map text, bold as in original, bracketed comments by Shackley).

Shackley's (1995, 2005) study of Ratté's original locality (now Antelope Creek East) indicated that all of the marekanites exhibit perlitic cracking, and are generally poor media for chipped stone tool production, even though Ratté and Brooks characterized them as "non-hydrated" (see above). Shackley has experimented using bipolar reduction on hundreds of marekanites from this locality since the 1980s and has found only perlitic marekanites, none of them artifact quality (Shackley, 1988, 2005). Furthermore, there are virtually no bipolar cores or flakes present over the large perlitic dome complex at this locality, suggesting as well, that it was not a major toolstone quarry in prehistory (see Shackley, 2005:53-55). Given the poor quality of Antelope Creek obsidian, why were so many Antelope Creek artifacts occurring in prehistoric sites in the region for 14,000 years of prehistory? It was a conundrum for decades with no apparent resolution until the Antelope Creek West locality was discovered in 2013, an ash flow tuff deposit with abundant high artifact quality obsidian marekanites up to 100 mm in largest dimension and plentiful reduced cores and flakes throughout the deposit (Figure 4).

Additionally, the location at the head of Cienega Creek and Antelope Creek flowing directly into the San Francisco River explained the relatively abundant secondary deposits of Antelope Creek obsidian flowing into the Gila River system as much as 100 stream km to the west, and relevant for sites in this study (Shackley 1992, 1998, 2005; Figure 4 here). None of the Antelope Creek obsidian recovered in Gila River alluvium downstream were of the perlitic

character seen at Antelope Creek East, indeed recent research indicates that they would not survive stream transport for any distance (Shackley 1992, 1998, 2005, 2012). The elemental composition of the two Antelope Creek localities overlaps significantly, and both differ considerably from the other Mule Creek Complex obsidian sources (Shackley et al. 2016a; Figures 1 and 2 here).

At least four distinct chemical groups are evident in Mule Creek area sources, distinguished by Rb, Sr, Y, Nb, Zr, and Ba, concentration values, and are named after the localities where marekanites have been found in perlitic lava and ignimbrites, originally named by Ratté: Antelope Creek (East and West localities 19+ Ma); Mule Mountains (ca. 22 Ma); and North Sawmill Creek (17+ Ma) all in New Mexico (Ratté 2004, Shackley, 2005). Additionally, during the 1994 field season, a fourth sub-group was discovered as secondary deposits in the San Francisco River alluvium near Clifton, Arizona and in older alluvium between Highway 191 and Eagle Creek in eastern Arizona north of Clifton (Shackley 2005). This 'low zirconium' sub-group was discovered in alluvium upstream from the juncture of the Blue and San Francisco Rivers, but the primary source has not been discovered. It is rare in archaeological contexts in the region, and not present in this assemblage.

The Antelope Creek locality after Government Mountain, Arizona, and the Jemez Mountains sources in northern New Mexico was the most significant source of obsidian in prehistory from Paleoindian through historic times, recovered in sites in the region in much greater frequency than any other of the Mogollon-Datil obsidians. Indeed, Antelope Creek obsidian has been recovered as artifacts from western Arizona into Texas, Oklahoma, Kansas, and south well into Mexico (Duff et al. 2012; Hamilton et al., 2013; Mills et al., 2013a, 2013b; Taliafero et al., 2010). The Late Classic inhabitants of the Mule Creek area as well as the Classic Mimbres appear to have seen this obsidian as a commodity. Clovis knappers during the late Pleistocene in New Mexico often used the obsidian for point production, pointing to the Late Pleistocene significance of the area. Mule Creek, in part due to the abundant water, high water table and relatively low elevation, was an important area for human occupation for 14,000 years as it remains today, particularly in the Late Classic of the late 13th and early 14th centuries (Mills et al. 2013a, 2013b).

Conclusion

The obsidian source provenance study here, while indicating a regional procurement pattern, nevertheless points to frequent use of the uplands both north and east of these sites. We know that the Mule Creek area was relatively densely populated during the Late Classic, and drew people to the Mule Creek graben from points throughout the Southwest (Mills et al. 2013a, 2013b). Research for the last decade or more also indicates the prominence of these source throughout prehistory from Paleoindian to at least the Late Classic (Hamilton et al. 2013; Mills et al. 2013a, 2013b; Shackley 1989, 1998, 2005; 2015; Shackley et al. 2016a). It appears that the inhabitants of the UTSA field school sites were just as involved in the region as in all other time periods, the details of which will be left to others.

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Table 1. Recommended values for USGS RGM-1 obsidian standard and mean and central tendency data from this study. ± = 1st standard deviation.

SAMPLE	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb
RGM-1 (Govindaraju 1994)	279	12998	32	149	108	25	219	8.9
RGM-1 (USGS recommended)[1]	279±50	13010±210	32[2]	150±8	110±10	25[2]	220±20	8.9±0.6
RGM-1, pressed powder standard (this study, n=10)	309±14	13715±38	39±4	148±2	106±2	24±2	220±3	9±2.7

[1] Mn, Fe calculated to ppm from wt. percent from USGS data.
[2] information value

Table 2. Elemental concentrations and source assignments for the archaeological specimens and USGS RGM-1 obsidian standard. All measurements in parts per million (ppm).

BAG#	SITE	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Source
313	AZ CC:4:61	418	12572	94	255	23	42	116	26	Antelope Cr-Mule Creek
315	AZ CC:4:61	646	11468	105	452	13	78	111	124	N Sawmill Cr-Mule Creek
316	AZ CC:4:61	392	12783	117	251	34	41	126	22	Antelope Cr-Mule Creek
317	AZ CC:4:61	430	13030	144	263	26	42	117	21	Antelope Cr-Mule Creek
319	AZ CC:4:61	341	11414	70	231	21	38	117	25	Antelope Cr-Mule Creek
325	AZ CC:4:61	634	11210	96	459	10	76	119	123	N Sawmill Cr-Mule Creek
326	AZ CC:4:61	402	11264	70	130	128	24	114	6	Cow Canyon/111 Ranch
327	AZ CC:4:61	568	10947	86	436	10	81	119	123	N Sawmill Cr-Mule Creek
328	AZ CC:4:61	425	11698	112	135	125	19	123	11	Cow Canyon/111 Ranch
329	AZ CC:4:61	389	11970	72	253	24	46	121	21	Antelope Cr-Mule Creek
330	AZ CC:4:61	497	11810	75	146	140	22	127	15	Cow Canyon/111 Ranch
331	AZ CC:4:61	346	11732	51	248	24	38	114	23	Antelope Cr-Mule Creek
332	AZ CC:4:61	353	11595	83	239	25	42	117	25	Antelope Cr-Mule Creek
334	AZ CC:4:61	415	12009	66	258	21	46	116	27	Antelope Cr-Mule Creek
335	AZ CC:4:61	686	11842	188	479	14	73	118	121	N Sawmill Cr-Mule Creek
338	AZ CC:4:61	433	12379	152	263	24	38	111	27	Antelope Cr-Mule Creek
339	AZ CC:4:61	492	11228	89	202	17	26	122	26	Mule Mtns-Mule Creek
340	AZ CC:4:61	471	11590	63	143	134	25	128	13	Cow Canyon/111 Ranch
343	AZ CC:4:61	414	12372	88	261	25	40	116	30	Antelope Cr-Mule Creek
346	AZ CC:4:61	531	10748	65	400	10	69	109	122	N Sawmill Cr-Mule Creek
347	AZ CC:4:61	379	12013	66	250	26	44	117	25	Antelope Cr-Mule Creek
348	AZ CC:4:61	376	11433	50	234	21	44	112	29	Antelope Cr-Mule Creek
349	AZ CC:4:61	392	11819	62	252	22	46	115	29	Antelope Cr-Mule Creek
350	AZ CC:4:61	387	11621	80	228	21	42	113	20	Antelope Cr-Mule Creek
351	AZ CC:4:61	520	13065	59	280	25	49	125	34	Antelope Cr-Mule Creek
352	AZ CC:4:61	392	11978	142	254	23	44	112	24	Antelope Cr-Mule Creek
353	AZ CC:4:61	440	12159	110	266	22	43	113	24	Antelope Cr-Mule Creek
354	AZ CC:4:61	383	11923	74	251	20	39	119	24	Antelope Cr-Mule Creek
355	AZ CC:4:61	481	11750	53	150	142	19	132	10	Cow Canyon/111 Ranch

356	AZ CC:4:61	399	11998	66	250	19	42	122	28	Antelope Cr-Mule Creek
BAG#	**SITE**	**Mn**	**Fe**	**Zn**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Source**
357	AZ CC:4:61	547	10736	84	397	12	72	110	117	N Sawmill Cr-Mule Creek
358	AZ CC:4:61	394	12060	79	253	26	39	119	27	Antelope Cr-Mule Creek
359	AZ CC:4:61	465	12313	68	135	137	22	134	15	Cow Canyon/111 Ranch
360	AZ CC:4:61	370	11874	49	248	22	44	115	23	Antelope Cr-Mule Creek
361	AZ CC:4:61	519	10873	67	403	11	77	110	121	N Sawmill Cr-Mule Creek
362	AZ CC:4:61	365	11796	80	233	21	41	117	24	Antelope Cr-Mule Creek
363	AZ CC:4:61	395	11950	53	240	23	38	115	22	Antelope Cr-Mule Creek
364	AZ CC:4:61	634	11233	107	447	15	77	111	122	N Sawmill Cr-Mule Creek
365	AZ CC:4:61	436	11642	98	142	132	22	125	16	Cow Canyon/111 Ranch
366	AZ CC:4:61	395	11715	69	253	24	41	119	24	Antelope Cr-Mule Creek
367	AZ CC:4:61	589	11131	104	435	13	82	115	129	N Sawmill Cr-Mule Creek
368	AZ CC:4:61	406	12513	71	283	21	42	129	33	Antelope Cr-Mule Creek
369	AZ CC:4:61	336	11676	70	240	22	42	117	26	Antelope Cr-Mule Creek
370	AZ CC:4:61	398	11966	88	256	23	42	118	25	Antelope Cr-Mule Creek
371	AZ CC:4:61	399	12070	95	237	34	42	122	28	Antelope Cr-Mule Creek
372	AZ CC:4:61	541	10959	90	445	15	80	125	120	N Sawmill Cr-Mule Creek
373	AZ CC:4:61	355	11402	75	233	22	41	119	19	Antelope Cr-Mule Creek
374	AZ CC:4:61	351	11303	52	231	25	40	114	23	Antelope Cr-Mule Creek
375	AZ CC:4:61	389	12086	54	252	24	38	120	26	Antelope Cr-Mule Creek
376	AZ CC:4:61	378	11413	51	229	25	40	115	32	Antelope Cr-Mule Creek
377	AZ CC:4:61	600	11116	89	443	14	75	109	121	N Sawmill Cr-Mule Creek
378	AZ CC:4:61	430	12348	83	262	25	47	120	27	Antelope Cr-Mule Creek
379	AZ CC:4:61	632	12875	64	155	120	20	137	16	Cow Canyon/111 Ranch
380	AZ CC:4:61	397	11942	63	254	22	50	117	26	Antelope Cr-Mule Creek
381	AZ CC:4:61	570	11218	107	430	17	74	108	122	N Sawmill Cr-Mule Creek
382	AZ CC:4:61	367	11504	50	244	21	43	117	26	Antelope Cr-Mule Creek
383	AZ CC:4:61	384	12076	129	244	20	40	111	25	Antelope Cr-Mule Creek
385	AZ CC:4:61	373	11698	63	232	22	45	112	28	Antelope Cr-Mule Creek
5-40	AZ CC:4:62	372	11852	53	236	23	42	115	26	Antelope Cr-Mule Creek
7-42	AZ CC:4:62	500	11022	73	406	11	72	113	117	N Sawmill Cr-Mule Creek
9-44	AZ CC:4:62	645	11514	96	430	12	71	116	123	N Sawmill Cr-Mule Creek

10-20	AZ CC:4:62	618	11328	94	452	11	78	113	120	N Sawmill Cr-Mule Creek
11-21	AZ CC:4:62	378	11678	44	229	21	43	109	29	Antelope Cr-Mule Creek
12-22	AZ CC:4:62	392	11799	63	246	20	43	109	29	Antelope Cr-Mule Creek
13-23	AZ CC:4:62	591	11129	90	440	12	80	112	120	N Sawmill Cr-Mule Creek
14-24	AZ CC:4:62	575	10891	84	430	14	73	107	112	N Sawmill Cr-Mule Creek
15-25	AZ CC:4:62	365	11436	61	236	20	40	112	32	Antelope Cr-Mule Creek
16-26	AZ CC:4:62	573	11136	84	429	11	77	106	121	N Sawmill Cr-Mule Creek
17-27	AZ CC:4:62	483	10596	63	378	12	67	105	112	N Sawmill Cr-Mule Creek
18-28	AZ CC:4:62	365	11642	101	221	25	42	110	23	Antelope Cr-Mule Creek
19-29-1	AZ CC:4:62	674	11598	128	472	12	80	111	126	N Sawmill Cr-Mule Creek
19-29-2	AZ CC:4:62	376	12087	88	248	23	40	115	28	Antelope Cr-Mule Creek
20-30	AZ CC:4:62	381	11615	70	242	18	49	118	28	Antelope Cr-Mule Creek
21-31	AZ CC:4:62	529	11045	146	417	12	70	101	117	N Sawmill Cr-Mule Creek
22-32	AZ CC:4:62	358	11782	60	248	20	43	120	24	Antelope Cr-Mule Creek
23-33	AZ CC:4:62	397	11790	75	245	25	44	120	30	Antelope Cr-Mule Creek
24-34	AZ CC:4:62	368	11627	81	243	22	46	119	31	Antelope Cr-Mule Creek
3-34	AZ CC:4:63	483	10994	80	157	94	24	93	24	Cow Canyon/111 Ranch
BAG#	**SITE**	**Mn**	**Fe**	**Zn**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Source**
4-57	AZ CC:4:63	381	11801	85	244	22	41	121	24	Antelope Cr-Mule Creek
5-58	AZ CC:4:63	561	10965	95	436	14	77	114	124	N Sawmill Cr-Mule Creek
6-59	AZ CC:4:63	357	11505	101	235	19	44	114	22	Antelope Cr-Mule Creek
7-60	AZ CC:4:63	404	12247	146	264	26	44	111	24	Antelope Cr-Mule Creek
8-61	AZ CC:4:63	380	11820	95	250	22	39	121	29	Antelope Cr-Mule Creek
9-62	AZ CC:4:63	396	11425	106	231	19	43	107	22	Antelope Cr-Mule Creek
10-63	AZ CC:4:63	569	10956	83	440	15	78	107	121	N Sawmill Cr-Mule Creek
1	AZ CC:4:68	566	11306	114	450	9	78	111	119	N Sawmill Cr-Mule Creek
2	AZ CC:4:68	374	11749	55	242	22	46	116	31	Antelope Cr-Mule Creek
3	AZ CC:4:68	590	11316	99	453	10	73	110	115	N Sawmill Cr-Mule Creek
4	AZ CC:4:68	417	12350	95	244	25	38	118	27	Antelope Cr-Mule Creek
5	AZ CC:4:68	411	12104	86	265	22	45	116	29	Antelope Cr-Mule Creek
6	AZ CC:4:68	387	11605	61	241	22	43	111	25	Antelope Cr-Mule Creek
7	AZ CC:4:68	373	11373	77	231	23	41	113	26	Antelope Cr-Mule Creek
8	AZ CC:4:68	591	10955	77	429	14	74	112	126	N Sawmill Cr-Mule Creek

9	AZ CC:4:68	343	11087	48	221	22	39	110	24	Antelope Cr-Mule Creek
10	AZ CC:4:68	431	11315	60	140	127	20	123	15	Cow Canyon/111 Ranch
11	AZ CC:4:68	592	11054	153	419	12	76	108	123	N Sawmill Cr-Mule Creek
12	AZ CC:4:68	352	11619	75	219	23	39	109	26	Antelope Cr-Mule Creek
13	AZ CC:4:68	431	12195	129	257	29	40	116	30	Antelope Cr-Mule Creek
14	AZ CC:4:68	447	10700	55	148	87	19	89	17	Cow Canyon/111 Ranch
15	AZ CC:4:68	602	11115	87	446	9	74	117	117	N Sawmill Cr-Mule Creek
16	AZ CC:4:68	425	11805	49	253	20	46	116	33	Antelope Cr-Mule Creek
2	AZ CC:4:69	373	10800	63	123	125	18	122	13	Cow Canyon/111 Ranch
3	AZ CC:4:69	448	10741	48	187	16	24	122	31	Mule Mtns-Mule Creek
5	AZ CC:4:69	380	11562	86	244	27	38	116	27	Antelope Cr-Mule Creek
6	AZ CC:4:69	383	11612	69	238	25	43	118	30	Antelope Cr-Mule Creek
7	AZ CC:4:69	425	11206	65	135	132	17	122	13	Cow Canyon/111 Ranch
8	AZ CC:4:69	348	11576	75	244	19	48	115	24	Antelope Cr-Mule Creek
9	AZ CC:4:69	383	11705	126	243	19	38	119	28	Antelope Cr-Mule Creek
10	AZ CC:4:69	611	11187	217	421	14	69	106	104	N Sawmill Cr-Mule Creek
11	AZ CC:4:69	455	12463	104	286	26	47	116	29	Antelope Cr-Mule Creek
12	AZ CC:4:69	366	11609	144	248	21	43	114	26	Antelope Cr-Mule Creek
13	AZ CC:4:69	382	11574	87	241	22	42	112	24	Antelope Cr-Mule Creek
14	AZ CC:4:69	413	11673	74	251	21	40	114	32	Antelope Cr-Mule Creek
15	AZ CC:4:69	439	12514	138	277	23	47	117	26	Antelope Cr-Mule Creek
16	AZ CC:4:69	722	11870	159	497	15	79	127	121	N Sawmill Cr-Mule Creek
17	AZ CC:4:69	441	10568	47	144	85	23	87	17	Cow Canyon/111 Ranch
18	AZ CC:4:69	408	11964	113	268	24	44	123	28	Antelope Cr-Mule Creek
19	AZ CC:4:69	420	11949	103	253	24	44	121	30	Antelope Cr-Mule Creek
20	AZ CC:4:69	563	10925	137	420	12	74	105	115	N Sawmill Cr-Mule Creek
21	AZ CC:4:69	396	12081	85	255	27	46	120	23	Antelope Cr-Mule Creek
22	AZ CC:4:69	387	12108	115	252	28	44	119	24	Antelope Cr-Mule Creek
23	AZ CC:4:69	384	11857	82	258	24	43	115	24	Antelope Cr-Mule Creek
24	AZ CC:4:69	403	11847	73	249	26	41	120	26	Antelope Cr-Mule Creek
25	AZ CC:4:69	643	11193	100	452	10	76	112	120	N Sawmill Cr-Mule Creek
26	AZ CC:4:69	447	12461	107	282	23	41	126	26	Antelope Cr-Mule Creek
27	AZ CC:4:69	390	11838	132	256	22	47	110	26	Antelope Cr-Mule Creek

Appendix B. Source Provenance of Obsidian Artifacts

BAG#	SITE	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Source
28	AZ CC:4:69	394	11792	80	253	22	45	121	26	Antelope Cr-Mule Creek
29	AZ CC:4:69	372	11873	95	252	21	45	110	27	Antelope Cr-Mule Creek
30	AZ CC:4:69	389	11759	74	260	24	43	118	24	Antelope Cr-Mule Creek
31	AZ CC:4:69	524	11658	114	147	113	28	140	21	Cow Canyon/111 Ranch
32	AZ CC:4:69	389	12159	156	265	24	41	120	33	Antelope Cr-Mule Creek
33	AZ CC:4:69	355	11413	87	231	21	45	114	28	Antelope Cr-Mule Creek
34	AZ CC:4:69	446	12008	80	257	24	49	113	27	Antelope Cr-Mule Creek
1	AZ CC:4:73	363	11338	119	216	20	38	108	22	Antelope Cr-Mule Creek
2	AZ CC:4:73	604	11235	120	439	13	77	112	115	N Sawmill Cr-Mule Creek
4	AZ CC:4:73	407	12230	70	245	21	45	113	19	Antelope Cr-Mule Creek
5	AZ CC:4:73	371	11651	59	247	24	37	111	28	Antelope Cr-Mule Creek
7	AZ CC:4:73	387	11677	109	251	20	42	108	33	Antelope Cr-Mule Creek
8	AZ CC:4:73	449	10589	52	180	15	25	122	36	Mule Mtns-Mule Creek
9	AZ CC:4:73	304	10951	55	209	19	38	111	18	Antelope Cr-Mule Creek
10	AZ CC:4:73	398	12161	94	239	24	38	118	23	Antelope Cr-Mule Creek
12	AZ CC:4:73	615	11022	81	433	13	84	113	125	N Sawmill Cr-Mule Creek
13	AZ CC:4:73	358	11581	48	234	21	44	116	23	Antelope Cr-Mule Creek
14	AZ CC:4:73	431	10865	84	180	15	28	118	30	Mule Mtns-Mule Creek
S1	SANCHEZ	650	11395	232	450	14	71	107	114	N Sawmill Cr-Mule Creek
S2	SANCHEZ	410	11170	83	134	132	21	121	17	Cow Canyon/111 Ranch
S3	SANCHEZ	477	11297	63	140	113	19	130	23	Cow Canyon/111 Ranch
S4	SANCHEZ	523	11637	59	153	123	25	143	19	Cow Canyon/111 Ranch
S5	SANCHEZ	403	12062	86	252	26	44	121	25	Antelope Cr-Mule Creek

Table 3. Crosstabulation of source by archaeological site.

			Source				
			Antelope Cr-Mule Creek	N Sawmill Cr-Mule Creek	Mule Mtns-Mule Creek	Cow Canyon/111 Ranch	Total
SITE	AZ CC:4:61	Count	37	12	1	8	58
		% within SITE	63.8%	20.7%	1.7%	13.8%	100.0%
		% within Source	40.2%	34.3%	25.0%	44.4%	38.9%
		% of Total	24.8%	8.1%	0.7%	5.4%	38.9%
	AZ CC:4:62	Count	10	9	0	0	19
		% within SITE	52.6%	47.4%	0.0%	0.0%	100.0%
		% within Source	10.9%	25.7%	0.0%	0.0%	12.8%
		% of Total	6.7%	6.0%	0.0%	0.0%	12.8%
	AZ CC:4:63	Count	5	2	0	1	8
		% within SITE	62.5%	25.0%	0.0%	12.5%	100.0%
		% within Source	5.4%	5.7%	0.0%	5.6%	5.4%
		% of Total	3.4%	1.3%	0.0%	0.7%	5.4%
	AZ CC:4:68	Count	9	5	0	2	16
		% within SITE	56.3%	31.3%	0.0%	12.5%	100.0%
		% within Source	9.8%	14.3%	0.0%	11.1%	10.7%
		% of Total	6.0%	3.4%	0.0%	1.3%	10.7%
	AZ CC:4:69	Count	23	4	1	4	32
		% within SITE	71.9%	12.5%	3.1%	12.5%	100.0%
		% within Source	25.0%	11.4%	25.0%	22.2%	21.5%
		% of Total	15.4%	2.7%	0.7%	2.7%	21.5%
	AZ CC:4:73	Count	7	2	2	0	11
		% within SITE	63.6%	18.2%	18.2%	0.0%	100.0%
		% within Source	7.6%	5.7%	50.0%	0.0%	7.4%
		% of Total	4.7%	1.3%	1.3%	0.0%	7.4%
	SANCHEZ	Count	1	1	0	3	5
		% within SITE	20.0%	20.0%	0.0%	60.0%	100.0%
		% within Source	1.1%	2.9%	0.0%	16.7%	3.4%
		% of Total	0.7%	0.7%	0.0%	2.0%	3.4%
Total		Count	92	35	4	18	149
		% within SITE	61.7%	23.5%	2.7%	12.1%	100.0%
		% within Source	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	61.7%	23.5%	2.7%	12.1%	100.0%

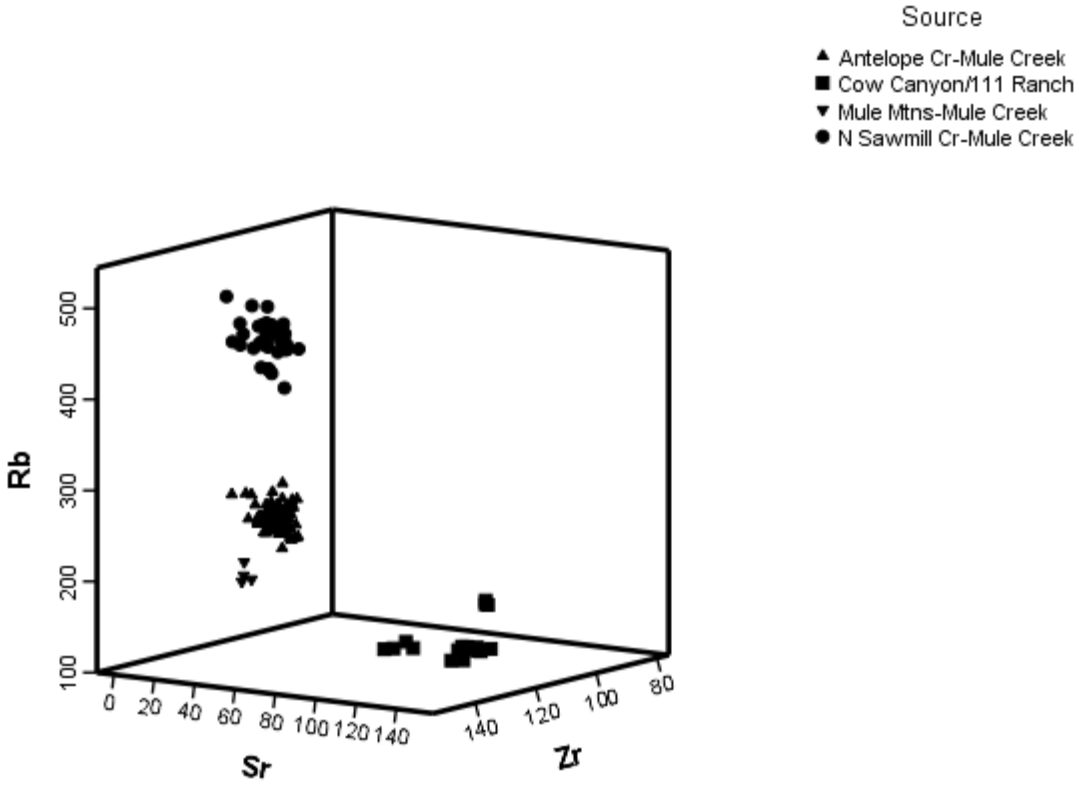


Figure 1. Three-dimensional plot of Sr, Rb, Zr concentrations for all the archaeological specimens from all sites.

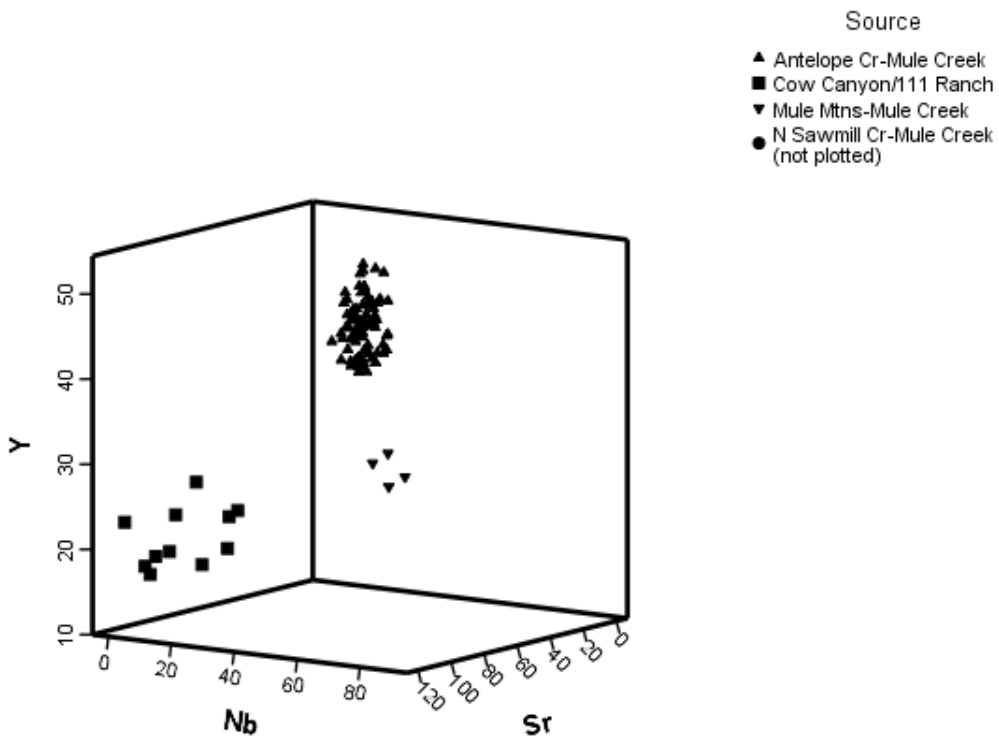


Figure 2. Three-dimensional plot of Nb, Y, Sr elemental concentrations with North Sawmill Creek samples removed to provide greater discrimination.

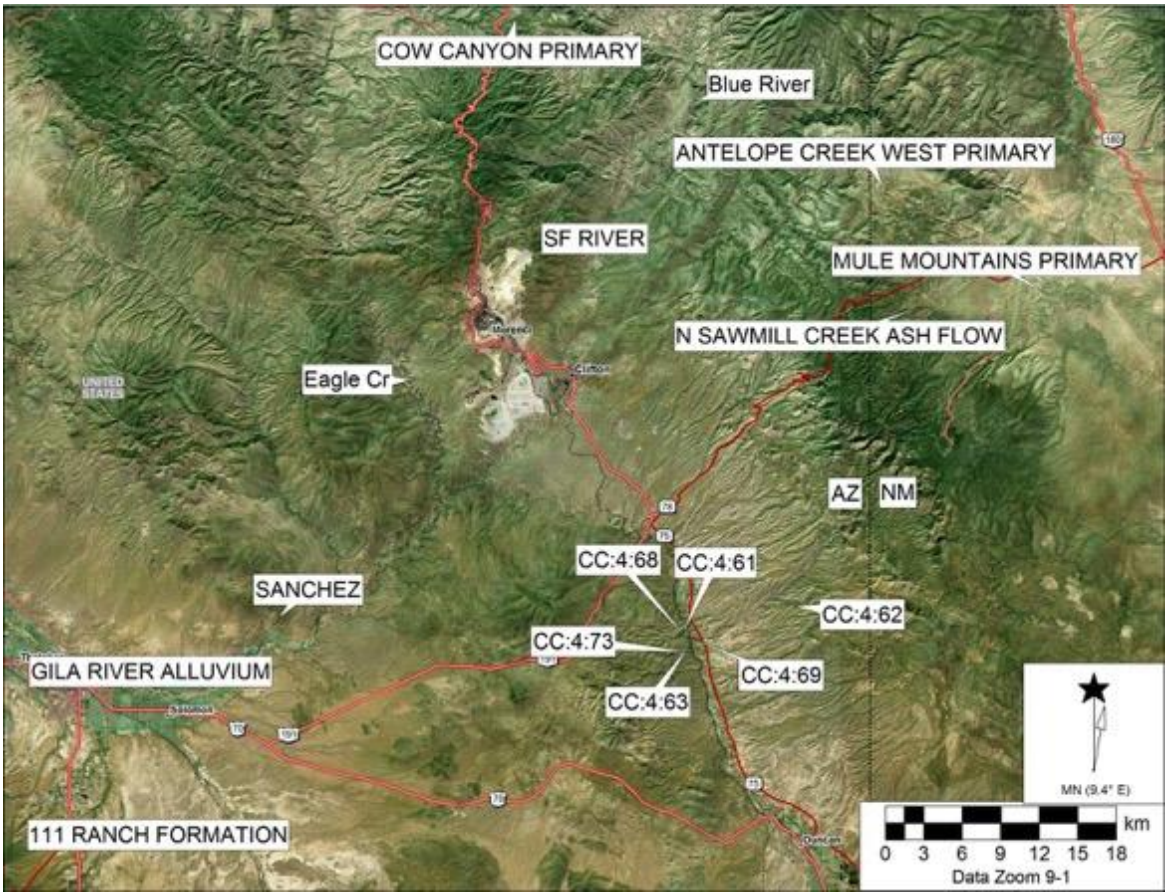


Figure 3. Digital elevation model of site locations, obsidian sources in the assemblage, and relevant features.

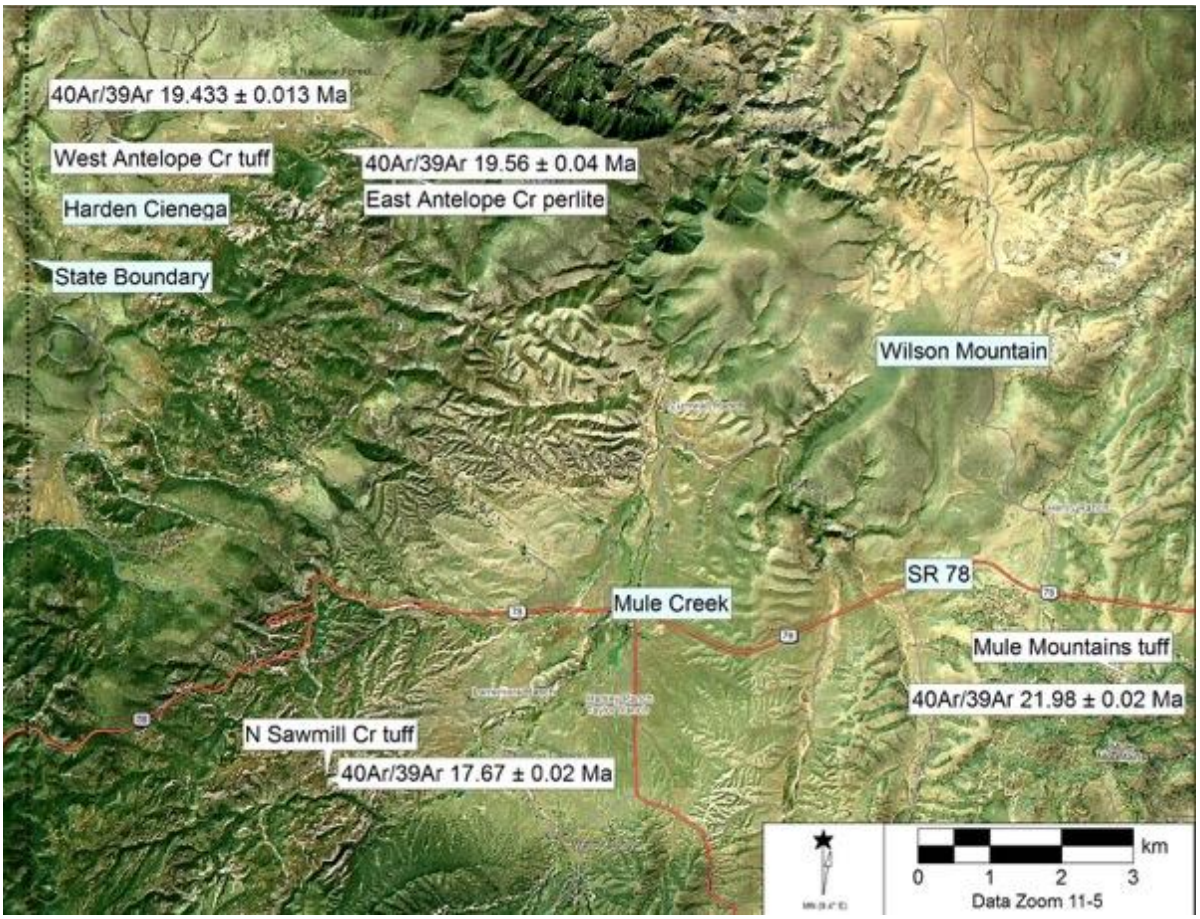


Figure 4. Mule Creek source localities (from Shackley et al. 2016a).

Site	Feature (Rock Ring) Designation	Outer Length (m)	Outer Width (m)	Inner Length (m)	Inner Width (m)	Plan	Opening	Direction of opening	Completeness	Ground Stone Present	Chipped stone
DotMon	A	7.20	5.80	2.60	2.7	Circular	Yes	E	360°	No	Yes
DotMon	B	6.40	7.05	4.55	4.2	Circular	Yes	S	360°	Yes	Yes
DotMon	C	3.10	3.65	2.20	1.8	Semi-circular	Yes	NE	270°	No	Yes
DotMon	D	5.00	4.80	2.90	3.3	Circular	Yes	NE	360°	No	Yes
DotMon	E	5.30	4.40	3.60	2.7	Circular	Yes	N	360°	No	Yes
DotMon	F	5.00	3.90	2.20	2.2	Circular	Unknown		360°	No	Yes
DotMon	G	3.90	4.80	2.30	2.3	Semi-circular	Unknown		360°	No	Yes
FS 15	A	4.00	5.00	2.20	2	Circular	Yes	SE	360°	No	Yes
FS 3				3.00		Circular	No		360°	No	Yes
FS 9				3.50		Circular	Yes	E	270°	No	No
Round Mtn	A	6.55	6.72	3.20	3.6	Semi-circular	Yes	W	200°	No	Yes
Round Mtn	B	6.20	5.42	2.96	2.9	Circular	No		360°	No	Yes
Round Mtn	C	5.60	5.30	3.10	3	Circular	No		360°	Yes	Yes
Round Mtn	D	6.60	5.67	3.15	2.7	Circular	No		360°	Yes	Yes
Round Mtn	E	5.50	5.45	2.57	2.38	Ovoid	Unknown		360°	Yes	Yes
Round Mtn	F	6.20	6.70	3.40	3.15	Irregular	Yes	SE	360°	Yes	No
Round Mtn	G	5.29	6.16	3.16	3	Circular	Unknown		360°	Yes	No
Round Mtn	H	6.40	6.70	3.40	3.3	Circular	Yes	E	360°	Yes	Yes
Round Mtn	I										
Round Mtn	J	3.80	5.03	2.50	2.7	Ovoid	Yes	E	360°	No	Yes
Round Mtn	K	5.75	6.00	3.00	4	Irregular	Yes	E	complete	Yes	Yes
Round Mtn	L	5.73	5.90	3.10	2.9	Ovoid	Unknown		360°	Yes	No
Round Mtn	M	7.40	7.50	5.20	5.7	Irregular	Yes	W	270°	No	Yes
Round Mtn	N	4.70	4.90	3.00	3.2	Circular	Unknown		360°	No	Yes
Round Mtn	O	4.60	3.40	2.90	2.5	Semi-circular	Yes	W	180°	No	Yes
Round Mtn	P	5.20	4.90	3.20	3.2	Semi-circular	Yes	E	180°	Yes	Yes

Appendix C. Rock Ring Data

Round Mtn	Test Trech 1/Q (excavated May 2014)	5.00	6.10	3.00	3.6	Semi-circular	Yes	W	180°	Yes	Yes

Outer Length m		**Inner Length m**		**Plan**		**Opening present**		**Ground Stone Present**		**Chipped Stone present**
mean	5.46	mean	3.07	Circular	14	Yes	16	Yes	11	Yes
std dev	1.09	std dev	0.67	Semi-Circular	6	No	4	No	15	No
n	24	n	26	Irregular	3	Unknown	6	Total	26	Total
maximum	7.40	maximum	5.20	Ovoid	3					
minimum	3.10	minimum	2.20	Total	26					